

# Stillwater Lift Bridge Management Plan

**Mn/DOT Bridge 4654**

Report prepared for

**Minnesota Department of  
Transportation**

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# Minnesota Department of Transportation (Mn/DOT)

## Historic Bridge Management Plan

Bridge Number: 4654

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### Executive Summary

The Stillwater Lift Bridge (Bridge No. 4654), completed in 1931, is a 10-span, two-lane highway crossing of the St. Croix River, between Stillwater, Minnesota, on the west and Houlton, Wisconsin, on the east. It is owned by the Minnesota Department of Transportation (Mn/DOT). The bridge currently carries Minnesota Trunk Highway (TH) 36 and Wisconsin State Trunk Highway (STH) 64, in addition to pedestrian traffic. The bridge includes a counterweighted, tower-and-cable, vertical-lift span of the Waddell and Harrington type. The total structure length is about 1,050 feet. The bridge has seven, 140-foot, steel, riveted, Parker truss spans, including the vertical lift span. There are two reinforced-concrete approach spans on the west and a rolled-beam jump span on the east. At the west approach to the bridge is a reinforced-concrete circular concourse, about 94 feet in diameter, designed with Classical Revival architectural treatment. The concourse is integrated with the west approach spans in materials and design, including a continuous, open-balustrade railing.

The bridge, including the concourse, is listed in the National Register of Historic Places (National Register). The concourse is included in the Stillwater Commercial Historic District (also listed in the National Register). The bridge and concourse are within the Stillwater Cultural Landscape District (determined eligible for the National Register).

In 2006 Mn/DOT and other agencies signed an *Amended Section 106 Memorandum of Agreement (MOA) for the St. Croix River Crossing Project*, involving the construction of a new St. Croix River bridge that will carry Minnesota TH 36 and Wisconsin STH 64. The MOA is presented in Appendix A. MOA Stipulation III states that the Stillwater Lift Bridge will continue to be used for Trunk Highway purposes until a new river crossing has been constructed and opened to vehicular traffic, at which time the historic bridge will be converted to pedestrian and bicycle use on a new trail system. If new federal funding for the St. Croix River Crossing Project becomes available in 2010, the new St. Croix River Crossing will be constructed in 2010-2013 and the Stillwater Lift Bridge rehabilitation and conversion project will commence in 2013. Otherwise, Minnesota will make state funding available for constructing the St. Croix River Crossing to commence in 2013 (or an alternate date), depending on funding coordination with Wisconsin, followed by the rehabilitation and conversion of the Stillwater Lift Bridge.

The MOA directs Mn/DOT to develop a Stillwater Lift Bridge Management Plan that “will identify those actions needed to preserve the structural and historical integrity of the Stillwater Lift Bridge for continued safe use,” as well as directing the management of the bridge before and after its conversion. The Management Plan is considered integral to the successful implementation of Mn/DOT’s *Management Plan for Historic Bridges in Minnesota*, in which Mn/DOT commits to preserving the structural integrity of 24 state-owned historic bridges.

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### Executive Summary

This Stillwater Lift Bridge Management Plan is prepared pursuant to the MOA and includes the following sections:

- Section 1.0: Project Introduction – Provides an introduction to the Stillwater Lift Bridge Management Plan.
- Section 2.0: Bridge Data – Lists pertinent information about the bridge and provides a narrative description of the bridge and concourse.
- Section 3.0: Historical Data – Provides narrative history of the bridge and identification of its character-defining features.
- Section 4.0: Engineering Data – Lists engineering data specific to the Stillwater Lift Bridge.
- Section 5.0: Existing Conditions – Details the bridge's existing conditions, including a description of the current structural, mechanical, and electrical conditions, as well as the needs of the bridge.
- Section 6.0: Recommendations – Provides detailed recommendations for the bridge, including the recommended treatments of the bridge for stabilization (vehicular use prior to conversion to pedestrian/bicycle use), preservation (conversion to trail use and rehabilitation and repair of structural, mechanical, and electrical components), and maintenance and operations following preservation.
- Section 7.0: Projected Agency Costs – Provides a summary of estimated costs for recommended treatments.
- Section 8.0: Endowment Fund – Provides a summary recommendation for development of an endowment fund for future operation and maintenance costs.
- Section 9.0: Long-Term Considerations – Presents a discussion of long-term considerations for the Stillwater Lift Bridge, including repair and improvement issues that may arise in the future. This section includes emergency situations.

Related documents are in the appendices, including the *Stillwater Lift Bridge Endowment Fund Analysis Report* and cost details for recommendations with estimates for future work extended to 2055.

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As required by the MOA, preservation work on the bridge, including activities that occur before conversion and during subsequent maintenance, will be in compliance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (SOIS). Mn/DOT will continue to own, operate, and maintain the bridge according to the recommendations in this Management Plan and in accordance with Mn/DOT's Historic Bridge Management Program.



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### Section 1 – Project Introduction

## 1.0 Project Introduction

### 1.1 Introduction to the Stillwater Lift Bridge Management Plan

In 2006 the Minnesota Department of Transportation (Mn/DOT) and other agencies signed an *Amended Section 106 Memorandum of Agreement (MOA) for the St. Croix River Crossing Project*. The St. Croix River Crossing Project involves the construction of a new bridge over the St. Croix River between the city of Oak Park Heights in Washington County, Minnesota, and the town of St. Joseph in St. Croix County, Wisconsin. The bridge will carry Minnesota Trunk Highway (TH) 36 and Wisconsin State Trunk Highway (STH) 64. The entire project is described in the 2006 *St. Croix River Crossing Project Supplemental Final Environmental Impact Statement (EIS)*.

Included in the MOA is a stipulation regarding the future of the historic Stillwater Lift Bridge (Mn/DOT Bridge No. 4654), located within the vicinity of the St. Croix River Crossing Project. The Federal Highway Administration (FHWA) has determined that the St. Croix River Crossing Project will have an adverse effect on the bridge, which is listed in the National Register of Historic Places (National Register). MOA Stipulation III states that the historic bridge will continue to be used for Trunk Highway purposes until a new river crossing has been constructed and opened to vehicular traffic. According to MOA Stipulation III.E.1, Mn/DOT commits to completing a rehabilitation project for the Stillwater Lift Bridge within one year after opening of the new bridge. At that time, the Stillwater Lift Bridge will be converted to pedestrian/bicycle use on a new trail system. The trail system, to be completed by Mn/DOT and the Wisconsin Department of Transportation (WisDOT), will create a loop joining Minnesota and Wisconsin. The trail system is identified as the Loop Trail in the MOA, EIS, and other project documents.

If new federal funding for the St. Croix River Crossing Project becomes available in 2010, the new St. Croix River Crossing will be constructed in 2010-2013 and the Stillwater Lift Bridge rehabilitation and conversion project will commence in 2013. Otherwise, Minnesota will make state funding available for constructing the St. Croix River Crossing to commence in 2013 (or an alternate date), depending on funding coordination with Wisconsin.

MOA Stipulation III.C directs Mn/DOT to develop a Stillwater Lift Bridge Management Plan that “will identify those actions needed to preserve the structural and historical integrity of the Stillwater Lift Bridge for continued safe use.” The plan will also “describe how the Stillwater Lift Bridge is to be managed during its interim vehicular use and after its conversion to pedestrian/bicycle use.” The stipulation states that the Management Plan “is integral to the successful implementation” of Mn/DOT’s *Management Plan for Historic Bridges in Minnesota*, in which Mn/DOT commits to preserving the structural integrity of 24 state-owned historic bridges “beyond its normal practice.” Mn/DOT’s historic bridge management program is discussed in Section 1.2 below. The MOA further states that the “FHWA will not obligate

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### Section 1 – Project Introduction

funding for the [St. Croix River Crossing] Project until it is in receipt of the final Stillwater Lift Bridge Management Plan from Mn/DOT.”

According to the MOA, the plan should have multiple components, including, but not limited to: current analysis of the bridge's condition; maintenance and improvement needs and priorities; a process to establish an endowment fund; a process for response to emergencies; a process to update the Management Plan as appropriate; review of ownership and long-term maintenance of the bridge; and priorities for the capital repair, rehabilitation, and improvement project that will allow the bridge to function as an integral part of the new Loop Trail upon conversion from vehicular to pedestrian/bicycle use.

Finally, the MOA states that all activities involving the Stillwater Lift Bridge will be in compliance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (SOIS). This includes “any maintenance, repair, rehabilitation, and treatment proposed by Mn/DOT” until the new river crossing bridge is opened, as well as all actions identified in the Management Plan.

The Stillwater Lift Bridge, built in 1931, is a 10-span, 2-lane crossing of the St. Croix River between Stillwater, Minnesota, and Houlton, Wisconsin. The bridge includes a Waddell & Harrington type, vertical-lift movable span, constructed in a steel Parker through-truss configuration, which allows river navigation access in compliance with federal regulations. The remaining spans are fixed; two are reinforced-concrete beam spans and the others are steel Parker through-trusses. The property includes a reinforced-concrete concourse at the west (Stillwater) approach.

This Stillwater Lift Bridge Management Plan is based on information obtained from Mn/DOT in 2007, field examinations conducted in 2007 and 2008 by professional engineers, historians, and landscape architects, and current bridge design standards and other codes and standards (see Section 6.2 and Appendix F). Design exceptions are recommended where appropriate and are based on safety and traffic volume. Because the condition of the bridge and applicable standards may change prior to plan implementation, a review of the plan may be required. The Glossary in Appendix B explains historic preservation and engineering terms used in this plan.

Finally, Stipulation III.A of the MOA states that Mn/DOT will continue to own and operate the Stillwater Lift Bridge with the intent to preserve and protect it beyond the opening of the new St. Croix River bridge. If, after the repair and conversion project, Mn/DOT decides to transfer ownership, it must be done pursuant to Stipulation III.F.2 of the MOA.

Mn/DOT will also continue to conduct routine maintenance of the bridge. The City of Stillwater will assume operation and maintenance responsibilities for the Loop Trail to the center of the bridge (state line) after the conversion project. Plans and responsibility for the operation and maintenance of the Loop

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Trail on the east, or Wisconsin, side of the bridge were in process, but not resolved, when this Management Plan was completed. It is anticipated that the trail on the Stillwater Lift Bridge will be open year-round. Following a snow event, the City of Stillwater will clear a single path to the center of the bridge.

Currently, the northern and southern portions of the concourse are outside the existing state-owned right-of-way through the concourse. In order to obtain ownership of all elements of the historic concrete concourse, Mn/DOT would need to expand right-of-way ownership to these portions.

### 1.2 Minnesota's Historic Bridge Management Program

Mn/DOT, in cooperation with the Minnesota State Historic Preservation Office (SHPO) and the FHWA, has committed to preserve selected historic bridges in Minnesota that are owned by the state and managed by Mn/DOT. In consultation with SHPO and the FHWA, Mn/DOT identified 24 bridges (including the Stillwater Lift Bridge) as candidates for long-term preservation in the *Management Plan for Historic Bridges in Minnesota* (2006). Mn/DOT's objective is to preserve the structural and historic integrity while maintaining the serviceability of these bridges. All activities will comply with the SOIS [36 CFR Part 68] and their adaptation for historic bridges by the Virginia Transportation Research Council in its *Guidelines for Bridge Maintenance and Rehabilitation Based on the Secretary of the Interior's Standards*.

Mn/DOT's ongoing efforts to manage historic bridges are intended to comply with Section 106 of the National Historic Preservation Act of 1966, as amended, and Section 4(f) of the U.S. Department of Transportation Act of 1966. Mn/DOT historic bridge management efforts began in 1985 with Robert M. Frame's study and list of significant and endangered bridges in Minnesota and incorporates Jeffrey A. Hess's 1995 survey and inventory of historic bridges in Minnesota that were built before 1956. Hess's inventory identified Bridge No. 4654 (Stillwater Lift Bridge) and others as eligible for listing in the National Register. Using the results of the 1995 study, Mn/DOT selected the 24 historic bridges for long-term preservation. Mn/DOT completed management plans for 23 of the 24 selected bridges in 2004-2006, one of which (Bridge No. 5557) was later excluded due to serious structural issues. The Stillwater Lift Bridge is one of two remaining bridges that are addressed through separate projects. The management plan for the Faribault Viaduct, the other remaining bridge, will be completed by 2009 and will replace the plan for Bridge No. 5557.

The *Management Plan for Historic Bridges in Minnesota* describes a process for completing individual management plans for historic bridges, including the 24 historic bridges identified by Mn/DOT. That process has been followed for this Management Plan for the Stillwater Lift Bridge, with some modifications related to the particular circumstances of the St. Croix River Crossing Project. For example,

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### Section 1 – Project Introduction

the overall St. Croix River Crossing Project and related MOA already identify a preservation option for the Lift Bridge (conversion to less-demanding pedestrian/bicycle use), eliminating that substantial step in the individual management plan development process. The MOA also adds elements not found in other individual plans, such as the incorporation of an endowment fund component. The remainder of the Stillwater plan essentially follows the process as described in the statewide management plan and incorporates the key element of collaboration between bridge engineers and bridge historians. In the collaborative process, recommendations for treatment of the historic bridge are developed collaboratively by professional engineers and professional historians.

This Stillwater Lift Bridge Management Plan includes the following components:

1. Introduction to the management plan
2. Bridge data: a narrative description of the bridge
3. Historical data: a narrative history of the bridge that explains its significance and identifies its character-defining features
4. Engineering data: technical information specific to the bridge
5. Existing conditions: a description of the current structural, mechanical, and electrical conditions, as well as the needs of the bridge
6. Recommendations: the recommended treatments of the bridge for stabilization (vehicular use prior to conversion to pedestrian/bicycle use), preservation (conversion, rehabilitation, and repair), and maintenance and operations (ongoing efforts following preservation)
7. Project costs: summary of estimated costs for recommended treatments
8. Endowment fund: recommendation for development of an endowment fund
9. Long-term considerations: repair and improvement issues that may arise in the future, including emergency situations

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### Section 2 – Bridge Data

## 2.0 Bridge Data

### 2.1 Data

Date of Construction:	1930-1931
SHPO Inventory Number:	WA-SWC-322
Common Name (if any):	Stillwater Lift Bridge
Descriptive Location:	State border between Stillwater, Minnesota, and Houlton, Wisconsin
Feature Carried:	TH 36
Feature Crossed:	St. Croix River
UTM Zone:	15
NAD:	1983
Easting:	4989254
Northing:	515529
USGS Quad Name:	Stillwater
Town or City:	Stillwater
County:	Washington
Roadway Function:	Mainline
Ownership:	State
Custodian/Maint. Agency:	State

### Structure Data

Main Span Type:	315 (Steel, Movable – Lift)
Total Length:	1,053 feet

## 2.2 Narrative description

The Stillwater Lift Bridge components contained in this management plan include the seven steel truss spans, two reinforced-concrete approach spans on the west end of the bridge, one metal-beam approach span on the east end, and the concourse. The boundaries extend from the east abutment to the west edge of the concourse. The concourse is a circular, concrete entry area that serves as a transitional element between the bridge and downtown Stillwater.

The bridge structure is a 10-span, two-lane highway crossing of the St. Croix River, between Stillwater, Minnesota, on the west and Houlton, Wisconsin, on the east. The bridge currently carries Minnesota TH 36 and Wisconsin STH 64, in addition to pedestrian traffic. The bridge includes a counterweighted, tower-and-cable, vertical-lift span of the Waddell and Harrington type.

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### Section 2 – Bridge Data

At the site of the Stillwater Lift Bridge, the St. Croix River is approximately 1,800 feet wide. The total structure length is about 1,050 feet. The remaining distance is covered by an earthen causeway, which was built out from the Wisconsin shore to reduce the grade difference between the opposing banks, as well as to lower the fabrication costs of the bridge. Resting on reinforced-concrete piers and abutments, the bridge superstructure includes, from west to east, the following sequence of spans:

- Spans 1 & 2: Continuous, cast-in-place, reinforced-concrete slab approach spans over Lowell Park Drive
- Span 3: Fixed steel-truss span with west lift tower
- Span 4: Vertical-lift span
- Span 5: Fixed steel-truss span with east lift tower
- Spans 6-9: Fixed steel-truss spans
- Span 10: Rolled-beam jump span

The six fixed truss spans are of similar size and configuration. Each span employs the Parker through-truss design (essentially a Pratt truss with polygonal top chord) that was widely used by the 1930s for larger, longer-span, metal truss bridges. Most Parker trusses used riveted connections. Measuring approximately 140 feet in length, each span is a seven-panel, riveted, Parker through-truss with angle-iron portal, top-lateral, and sway bracing. The webs are further stiffened by horizontal, angle-iron bracing across the four center panels. Except for the top chord, which consists of heavy paired channels tied with cover plate above and X-lacing below, the web members are built of paired, back-to-back angles tied with batten plates (as in the bottom chord and diagonals) or V-lacing (as in the verticals). The truss members were originally painted green but were painted gray in 1942. The gray paint has been used on the bridge from 1942 until the present. The only exception to green or gray paint is the aluminum paint on the tender house roof and south railing panels, which has been used from original construction to the present.

Spans 3 and 5 each include an 82-foot tower to accommodate the lift span and counterweight. These spans include traffic safety gates to control vehicular and pedestrian traffic approaching the lift span. The gate system has warning lights and bells. The first safety-gate system was installed in 1940 and has been subsequently upgraded.

The vertical-lift span (span 4) is also a 140-foot, seven-panel, Parker through-truss. In its method of operation, the span embodies a design originally developed by John Alexander Low (J.A.L.) Waddell (1854-1938) in 1892 and subsequently refined in partnership with John Lyle Harrington (1868-1942). The general type is customarily known as a "Waddell and Harrington vertical lift." The span is raised and lowered by up-haul and down-haul steel ropes. To ensure easy movement, the span is counterweighted by concrete blocks that travel up and down within the tower framework. The span is connected to the counterweights with steel ropes carried on steel sheaves at the tops of the towers. The power for the up-



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### Section 2 – Bridge Data

and down-haul ropes was originally supplied by a gasoline engine, which was replaced by a 25-horsepower electric motor in 1980 and subsequently replaced by the present motor in 2005. With the span in raised position, vertical navigational clearance is 57 feet above normal pool elevation. The span itself is engineered for a rise of 48 feet, although an additional three feet of lift are available for emergency situations. The vertical lift span remains in operation during the May-October navigation season, with an average of 1,925 lifts per season.

The control machinery for lift operations is sheltered in a welded, plate-steel, gable-roofed tender's house. The house is mounted at roadway level on a steel framework at mid-span on the north (upstream) side of span 4. Adjacent to the tender's house is a similar, but slightly larger, electrical house that was built to contain electrical control equipment. Reduction gears and winding drums for the ropes are located beneath span 4.

The bridge's 23-foot-wide concrete deck has an angle-iron rub rail on the north and a cantilevered, concrete sidewalk with an ornamental metal railing on the south. The railing includes original, cast metal, newel posts and curved-lattice panels, which have been replicated to match the original. The railing panels were originally finished with aluminum paint, while the newel posts were originally painted green. Aluminum paint was originally used on the railing panel braces above the sidewalk, and green paint used below the sidewalk. These green areas were later re-painted gray. Original ornamental light standards that matched those on the concourse were removed at an unknown date from their newel posts above each pier along the south sidewalk. Bethel-type luminaire ("cobra head") fixtures that are mounted on truss members were added in the 1980 electrical project to provide roadway lighting.

According to recent engineering studies, the bridge has been repaired and retrofitted several times in its history. The following projects involved changes to physical features:

- 1931 – Bridge is completed and opened to traffic
- 1940 – First traffic gates installed; manually operated
- 1942 – Cable guard rail installed on inside of south trusses
- 1942 – Original green paint on truss spans changed to gray due to wartime paint shortages
- 1946 – First generation navigation lights installed
- 1954 – Electrical service installed, including remotely-operated traffic gates, warning lights, and controls

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### Section 2 – Bridge Data

- 1973 – Deck replaced
- 1980 – Gasoline engine replaced with electric motor and power distribution system replaced the existing 1954 system (power system included new roadway lighting, conduit mounted on trusses, and festoon cables and cable boxes installed on lift towers)
- 1981 – Span 10 replaced
- 1998 – Sidewalk deck replaced
- 2005 – Major project that included the following:
  - Electrical house added adjacent to tender's house
  - Ornamental sidewalk railing replaced
  - Deck replaced
  - Electrical system largely replaced

#### ***Stillwater Lift Bridge Concourse***

Located between span 1 of the bridge and the east end of Chestnut Street is the reinforced-concrete concourse. The materials and Classical Revival architectural treatment of the concourse are integrated with the materials and treatment of approach spans 1 and 2. In fact, the east one-third of the concourse roadway, between the expansion joint and the approach span, is identified on the 1931 plans as "approach slab."

The concourse is approximately 94 feet in outside diameter. Around the outside edge are four reinforced-concrete retaining-wall segments topped with concrete open-balustrade railings, sidewalks, and curbs. Openings between wall and balustrade segments provide roadway access on the east and west for vehicular through-traffic between Chestnut Street and the bridge, on the south for vehicular access to Lowell Park Drive, and steps on the north provide pedestrian access to Lowell Park. The eight concrete endposts flanking the four openings have original metal light standards. Each light consists of a Union Metal Company fluted metal shaft with a scroll-casting base and acanthus-leaf capital, topped with a No. 127 alabaster globe and No. 1127 alabaster rippled canopy. The light standards and globes match those depicted in the original 1930 plan sheet entitled "Bridge Lighting." Two additional light standards, which were originally mounted on the span 2 east endposts adjacent to span 3, are currently missing.

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### Section 3 – Historical Data

## 3.0 Historical Data

### 3.1 Contractor

Peppard & Fulton – builder

American Bridge Company (Minneapolis & Gary Plant) – fabricator

### 3.2 Designer/engineer

Minnesota Department of Highways (fixed span)

Ash, Howard, Needles, and Tammen (vertical-lift span) – engineer

### 3.3 National Register status

The Stillwater Lift Bridge was listed in the National Register in 1989 under *Criterion C* for engineering. The concourse is included in the Stillwater Commercial Historic District (listed in the National Register in 1992 under *Criterion C*) and is a transitional element between the bridge structure and downtown Stillwater. The entire bridge and concourse is located within the Stillwater Cultural Landscape District, which was determined eligible for the National Register in 1999.

### 3.4 Statement of significance

#### 3.4.1 Stillwater Lift Bridge

The Stillwater Lift Bridge, featuring a counterweighted, cable-and-tower design, embodies engineering significance as an important example of vertical-lift highway bridge construction of the Waddell and Harrington type in Minnesota and Wisconsin. It is one of two surviving, pre-World War II, vertical-lift, vehicular bridges in Minnesota and Wisconsin, where only six were built between 1913 and 1931.

The significance of the Stillwater Lift Bridge is best understood within the general context of Minnesota and Wisconsin movable highway bridges. Movable bridges, also known as drawbridges, are constructed over navigable waterways when it is impractical or uneconomical to build fixed bridges of sufficient height to permit the passage of vessels. Numerous systems have been devised for lifting, dropping, folding, rotating, and retracting a span to provide temporary clearance. By the early twentieth century, however, engineers had focused their attention on three basic drawbridge categories: swing, bascule, and vertical lift.

Briefly defined, a swing span revolves in a horizontal plane around a vertical axis, a bascule span rotates in a vertical plane around a horizontal axis and a vertical-lift span rises and descends in a

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### Section 3 – Historical Data

vertical plane. In Minnesota and Wisconsin, as well as elsewhere in the nation, virtually all nineteenth-century movable bridges were of the swing-span variety, and the type continued to be constructed during the early twentieth century. As late as 1935, a total of 51 highway swing spans were in operation in Minnesota and Wisconsin. None of these structures have survived. The demise of the highway swing span was nationwide, reflecting its incompatibility with an urban setting. There were two basic problems with swing spans. First, the central pivot pier increasingly became an obstruction to navigation for the ever-larger vessels of the late nineteenth and early twentieth centuries. Second, the swing span itself squandered valuable space. By requiring a clear turning radius, it prohibited the development of docking facilities adjacent to the bridge site. These shortcomings were especially onerous along highly industrialized urban waterways, where shipping channels tended to be narrow, highway crossings numerous, and real estate prices high. For less crowded sites, the swing span remained a viable form of technology well into the twentieth century. Most surviving swing spans are railroad bridges in rural regions or relatively uncongested urban areas. In the downtown waterfronts of late twentieth-century American cities, however, the swing span was marked for extinction. Its major adversary was the federal government.

No matter how loudly shipping and real-estate interests denounced the swing span, there was no effective means of regulating movable-bridge design until the early 1890s, when Congress authorized the War Department to approve plans for all new bridges over navigable waterways and to seek the alteration of any existing bridge that interfered with "reasonably free, easy and unobstructed" navigation. In 1892 the War Department sent a clear message of future policy by way of Chicago, demanding the removal of a two-year-old swing span from one crossing of the Chicago River and denying permission to build a new swing span at another. The search for an alternate drawbridge technology began in earnest. Not surprisingly, Chicago was in the vanguard. In 1894 the city erected the world's first modern, vertical-lift bridge across the Chicago River at South Halsted Street.

During the middle decades of the nineteenth century, an occasional vertical-lift span was constructed in Europe and the United States. Although their engineering was often ingenious, the bridges themselves were quite modest as they were designed mainly for canals and small navigable streams in cases where it was only necessary to lift the spans a few feet to clear traffic in the channels. The modern, long-span, high-rise, vertical-lift bridge dates from the last decade of the nineteenth century. In 1892 the city of Duluth, Minnesota, hosted a design competition for constructing a drawbridge over the 250-foot-wide ship canal at its harbor entrance on Lake Superior. Under the rules of the competition, the successful design would leave the entire width of the canal open for navigation, which effectively eliminated the traditional, center-pier, swing span.

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### Section 3 – Historical Data

Most responses to the Duluth competition employed some form of retractable or "sliding draw" mechanism, whereby the span moved back and forth on rollers. A striking exception was a design submitted, and later patented, by Waddell. Waddell was a consulting engineer based in Kansas City, Missouri, who, during the next 40 years, would become one of the best-known bridge engineers in the United States. Waddell proposed to build a vertical-lift bridge consisting of a simple truss span 260 feet long that could be raised 140 feet above the surface of the canal. *The Engineering News*, October 27, 1892, reported on the Waddell entry in the design competition:

At each end of the movable span is a tower 170 ft. high, carrying at its top built steel pulleys about 15 ft. in diameter. Over these pulleys steel wire ropes, or chain cables, pass. One end of each cable is attached to the end piers of the trusses, and end to counter-weights which exactly balance the dead weight of the span. Therefore, the only work left for the operating machinery is to overcome the weight due to dirt, water, snow, etc. The power for operating the bridge is supplied by two electric motors placed at mid-span; the upward and downward motion being regulated by racks and pinions communicating with the power by means of steel shafting and spur and mitre wheels.

The Duluth authorities selected Waddell's design, but the War Department vetoed the construction of any drawbridge at the site. Nevertheless, Waddell's design was a seemingly practical solution to the drawbridge problem. His vertical-lift span did not obstruct navigation and dockage like a swing span, nor did it clutter the shore approaches like a sliding-draw span. A few months after the cancellation of the Duluth project, the City of Chicago commissioned Waddell to modify his original design for a 130-foot span capable of 150-foot clearance over the Chicago River at South Halsted Street. This structure was completed in 1894 as the world's first modern, vertical-lift bridge.

The South Halsted Street Vertical-Lift Bridge remained the only example of its kind for over a decade. Waddell commented in the May 1924 *Journal of the Western Society of Engineers* that the long delay in constructing another vertical lift was due not to technological issues, but to the corruption of those in charge of subsequent bridge projects, who, as he put it, "demanded boodle...a condition with which [I] never did and never will comply." There were other reasons as well. From 1895 to 1905, engineers in Chicago and Milwaukee perfected several bascule designs that were widely believed to be more economical for narrow waterways than Waddell's vertical lift. The new type received early and strong endorsement from the City of Milwaukee, which built 10 bascule spans between 1902 and 1910. It was subsequently adopted as the preferred movable-bridge type by the Wisconsin State Highway Commission. The greatest obstacle to the initial acceptance of the vertical-lift span, however, was the fact that the South

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### Section 3 – Historical Data

Halstead Street Bridge was expensive to build and operate because of mechanical flaws, giving the vertical-lift design a reputation for high costs.

In 1907 Waddell formed a partnership with Harrington, a skilled civil and mechanical engineer who was largely responsible for reworking Waddell's invention into a rational, well-integrated design. In its essential form and dynamics, the "Waddell and Harrington type" remained true to the original 1892 Duluth design. It was a simple span equipped with machinery for operation, suspended at each end by wire ropes that pass over sheaves on towers and connect to counterweights about equal to the span weight. Before the partnership dissolved in 1914, Waddell and Harrington designed approximately 30 vertical-lift spans for highway and railroad crossings. Both men continued to work in the field after parting company, and Harrington's new office (Harrington, Howard, and Ash) became particularly well known, as did its successor (Ash, Howard, Needles, and Tammen).

Six vertical-lift highway bridges were constructed in Minnesota and Wisconsin before World War II. At least five were designed by Waddell and Harrington or successor firms. All were of the standard Waddell and Harrington type. The 1931 Stillwater Lift Bridge was the last of this group to be completed and is one of two that survive. The other is the Duluth Aerial Lift Bridge, built in 1905 as a transporter bridge and converted to a vertical lift in 1930.

The predecessor to the Stillwater Lift Bridge was a timber bridge, built in 1910, with a pontoon section that swung open for navigation. Owned and maintained by the City of Stillwater, the bridge was taken over by the Minnesota Department of Highways (MHD) in 1925. By that time the structure was deteriorating, prompting calls for a new bridge. When the pontoon bridge was closed to heavy traffic in 1928, MHD prepared preliminary plans for its replacement. The plans called for a series of fixed concrete-slab and steel-truss spans to be designed by MHD engineers, and a single vertical-lift span to be designed by an engineering firm specializing in such work. In November 1929 a design contract for \$3,150 was awarded, on a competitive basis, to Ash, Howard, Needles and Tammen of Kansas City, Missouri. Construction on the bridge proper began the following summer, with the Minneapolis firm of Peppard and Fulton serving as general contractor and the American Bridge Company (Minneapolis and Gary plants) serving as fabricator. The project was completed in August 1931 for a total cost of \$460,174, shared equally by the states of Minnesota and Wisconsin.

At the time of the bridge's completion, navigation on the St. Croix River was minimal. Since most of the traffic was small craft, there were few occasions to operate the lift span. As the MHD noted in a 1938 letter: "...for several years not a single request for its opening was received."

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### Section 3 – Historical Data

Contemporary newspaper accounts indicate that there was great interest in having increased highway traffic from a new bridge that would facilitate development and growth of a market for Stillwater businesses across the river in Wisconsin. Governors of both states commented on the importance of the new interstate bridge at the dedication on July 1, 1931. Then as now, the vehicular use of the bridge was more significant than river navigation for Stillwater residents. Because the St. Croix was (and remains) a navigable waterway, the vertical lift span has been an essential and significant component of the bridge regardless of the amount of river traffic.

#### 3.4.2 Stillwater Lift Bridge concourse

Located at the west end of the bridge, between the west abutment and Chestnut Street, is the circular concrete concourse, as it is named on the bridge plans prepared in 1930 by Minneapolis landscape architects Morell & Nichols, and in 1931 by the MHD. The concourse is a transitional element between the bridge structure and downtown Stillwater. The concourse itself is included within the boundaries of two National Register districts: the Stillwater Commercial Historic District (listed in 1992 under *Criterion C*), and the Stillwater Cultural Landscape District (determined eligible in 1999). The concept of a focal point at the downtown Stillwater end of a St. Croix River bridge was discussed in detail as early as 1888 in a *Stillwater Daily Gazette* article, “Bridge Square: Its Past History and Prospective Greatness” (May 7, 1888). At that time, the location known as Bridge Square at the intersection of Chestnut Street and the bridge had become a commercial and railroad hub for the city, even though, as the article pointed out, there had been no physical “square” there.

In 1916 “Bridge Square” is clearly drawn and named on the map of “Stillwater, Minn., Grading Plan for Sunken Gardens,” prepared by Morell & Nichols. In the plan, Bridge Square is in the same location as both the 1888 Bridge Square and the present concourse, and consists of a circle within a diamond-shaped intersection where Chestnut Street meets the bridge. The Sunken Gardens were part of adjacent Lowell Park. Two years later, in 1918, Morell & Nichols published their extensive Plan of Stillwater, which presented a comprehensive City Beautiful design in narrative and map format. Central to the plan is the proposed widening of Chestnut Street into a major east-west civic axis. At the west end, on the hill, would be the public buildings of “Stillwater’s civic center,” including the city hall, armory, and community hall. The buildings look out from their “commanding situation” on the hill toward the river and bridge at Chestnut’s east end. Running north-south along the river are Lowell Park and Park Drive. At the approach to the bridge, where Chestnut crosses Lowell Park and Park Drive, is a circular intersection that is very similar to the Bridge Square on the 1916 map. In this plan, Morell & Nichols write, “Chestnut Street would be transformed into an attractive and important main thoroughfare.” The entire arrangement is conceptualized in a symmetrical City Beautiful manner. This element of the 1918 Plan of Stillwater still survived in the two ends of the Chestnut Street axis at the time this report



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was prepared. On the hill at the west end is the armory, the only one of the three proposed civic buildings to be located there. At the east end are the concourse and the bridge.

In February 1930 Morell & Nichols produced a plan titled “Study for Concourse as Terminal Feature to Chestnut Street & to Proposed New Wisconsin-Minnesota Highway Bridge.” Subtitled “Rearrangement of Lowell Park and Park Driveways,” the drawing presents the concourse as it would be built in 1930-31, including its relationship with the adjacent areas of Lowell Park, Park Drive, and the bridge. The details of the concourse include the four curved balustrade segments with light standards, north steps, and south entry to Park Drive. Drawn on the plan are both the “center line of Chestnut Street” and the “center line of highway bridge,” each on a slightly different alignment. The two meet at the center of the concourse circle. The plan also shows the continuity between the concourse and approach spans 1 and 2.

The Morell & Nichols plan corresponds with the 1930 construction drawings of the MHD, as well as with historic photographs of the new concourse in 1931 and concourse elements extant at the time of this report. The extant concourse exhibits the Classical Revival architectural style in its open balustrade railing and light standards, as well as in its circular design with openings at the four compass points. Functionally, it still serves as a gateway to the city at the bridge and provides pedestrian access to Lowell Park and vehicular access to Park Drive.

Appendix H presents references for the historical sources used to prepare Section 3.4. The sources presented in Appendix H are also included in the National Register documentation of the Stillwater Lift Bridge.

### 3.5 Character-defining features

Character-defining features are prominent or distinctive aspects, qualities, or characteristics of a historic property that contribute significantly to its physical character. Generally, the character-defining features represent the physical manifestation of the significant elements of the property. Features may include materials, engineering design, and structural and decorative details.

#### 3.5.1. Feature 1 – Vertical lift, design and construction

The Stillwater Lift Bridge is one of two surviving vertical-lift highway bridges in Minnesota and Wisconsin. The Waddell & Harrington-type, vertical-lift configuration is the central character-defining feature. This feature includes the general configuration of span 4 for vertical movement and the lift towers on spans 3 and 5, with associated original components (counterweights, sheaves and shafts, rope drums, span guides and counterweight guides, uphaul and downhaul



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deflector sheaves, original tender's house, and original builder's plate identifying the patents used in the lift design).

#### Photo CDF-1

Feature 1. General view of span 4, including lift towers of spans 3 and 5.



#### Photo CDF-2

Feature 1. Detail of sheave on lift tower.



#### Photo CDF-3

Feature 1. Detail of bridge-tender's house.



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#### Photo CDF-4

Feature 1. Detail of builder's plate with list of patents.



#### 3.5.2 Feature 2 – Parker truss, design and construction

The Parker truss design, with riveted connections, is used in the seven main spans of the bridge (spans 3-9). By 1930 the Parker configuration had become widely used for larger, longer-span trusses. Its polygonal upper chord, repeated in each span, gives the overall appearance of the bridge a distinctive, rhythmic profile. This feature includes the polygonal top chord, built-up members, and riveted connections.

#### Photo CDF-5

Feature 2. Parker truss span.



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#### Photo CDF-6

Feature 2. Detail of riveted built-up member.



#### 3.5.3 Feature 3 – Concourse and approach spans 1 and 2, design and construction

The concourse represents the bridge's functional and symbolic connection with downtown Stillwater and the city's cultural and historic landscapes. This feature includes the City Beautiful gateway concept of a circular intersection with its four compass-point openings for the bridge, Chestnut Street, Lowell Park, and Park Drive. It also includes the Classical Revival architectural treatment of the open balustrade, light standards, and other concrete elements, and their seamless integration with the design of the reinforced-concrete approach spans 1 and 2. The concourse's relationship to the surrounding setting of Lowell Park, Park Drive, and the levee is an important extension of this feature.

#### Photo CDF-7

Feature 3. General view of concourse.



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#### Photo CDF-8

Feature 3. Detail of open balustrade railing.



#### Photo CDF-9

Feature 3. Detail of light standard.



#### Photo CDF-10

Feature 3. Continuity of design and construction between concourse and spans 1 and 2.





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### Section 4 – Engineering Data

#### 4.0 Engineering Data

Inspection Date	5/17/2007
Sufficiency Rating	42.8
Operating Rating *	19.996 tons
Inventory Rating*	12.996 tons
Posted Load*	Two axles – 28 tons; three or more axles – 40 tons.
Design Load*	2.2046 tons
Deficiency Rating Status	S

#### Condition Codes

Deck:	8
Superstructure:	6
Substructure:	6
Channel and Prot.:	7
Culvert:	N

#### Appraisal Ratings

Struct. Eval.:	5
Deck Geometry:	2
Underclearances:	2
Waterway Adequacy:	2
Appr. Alignment:	8

**Smart Flag Data** ☐ (A check indicates data items are listed on the Bridge Inspection Report)

**Fracture Critical** Y

**Previous Inspection Date** 5/23/2003

#### Waterway Data

Scour Code: N-STBL; Limited Scour

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\* This term is defined in the glossary in Appendix A

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### Section 4 – Engineering Data

#### Roadway Data

ADT Total:	18,000
Truck ADT Percentage:	3%
Bypass Detour Length:	14 miles

#### Roadway Clearance

Roadway Width:	23 feet
Vert. Clearance Over Rdwy:	13.9 feet
Vert. Clearance Under Rdwy	9.5 feet
Lat. Under Clearance Right:	.5 feet
Lat. Under Clearance Left:	

#### Geometric Characteristics

Skew:	0
Structure Flared:	0

#### Roadway Characteristics

#### Floodplain Data

#### Accident Data

Crash data from Mn/DOT Metro Traffic for the years 1997 through 2007 indicates only one fatal crash and no other crashes on the bridge during this period.

#### Location of Plans

Minnesota Department of Transportation, Bridge Office

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### Section 5 – Existing Conditions

## 5.0 Existing Conditions

### 5.1 Introduction

URS Corporation (URS) performed a thorough field inspection of the Stillwater Lift Bridge during the week of August 27, 2007. The inspection included the examination of all structural, mechanical, and electrical components of the bridge. The results of the inspection initially were detailed in the *URS Report of Findings* (September 2007). Following the *Report of Findings* and a review of the previous condition assessment by HNTB Corporation in 2003, *Stillwater Lift Bridge Repair Needs*, URS prepared a *Condition Assessment Report* in 2008.

The Condition Assessment Report is based on the 2007 field inspection and is certified by a Minnesota Registered Professional Engineer. It lists stabilization, preservation, and maintenance needs with associated costs for structural, mechanical, and electrical components and the concourse. To establish the needs and costs, the Condition Assessment Report first summarizes existing conditions of the bridge and concourse at the time of the field inspection and thus reflects work completed in the 2005-2006 rehabilitation project.

The existing conditions as presented in the Condition Assessment Report are included below. The complete Condition Assessment Report is on file in the Mn/DOT Bridge Office.

### 5.2 Structural conditions

#### ***Rehabilitation project in 2005-2006***

The 2005 rehabilitation included construction of a new 5 3/8-inch-thick, reinforced concrete deck made composite to the stringers of the truss spans. Aside from minor cracking, the bridge deck and corresponding expansion joint system are in very good condition. The decorative metal sidewalk railing along the south side of the bridge, also replaced in 2005, is in very good condition except for scattered locations of peeling paint. All elements of this railing and the associated rail brackets and steel plates above the support system, except the newel posts, were finished in aluminum paint (Federal Standard 595 B No. 37200) as part of the 2005 rehabilitation. The rehabilitation also included several repairs to the truss superstructure. Stringers were replaced at the end bays of each truss span, and floor beams were strengthened by adding cover plates to the flanges. Floorbeam ends exhibiting heavy section loss from corrosion received new connection plates at the truss panel points. Several truss lower chord members suffering section loss were plated across the inside face at panel point locations, and truss vertical members bent from collision damage were heat-straightened in Spans 8 & 9. Other recent repairs include replacing the original roller bearings with elastomeric bearings in 2002 and replacement of the sidewalk deck and stringer system in 1998.

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### Section 5 – Existing Conditions

#### *West approach spans 1 and 2*

The western-most bridge spans 1 and 2 consist of two reinforced concrete slab spans supported by the west abutment and piers 1 and 2. Both spans are in fair-to-good condition. In 2005 the roadway top of the slab received a low slump concrete overlay while the slab underside received a minimal amount of crack patching. The concrete overlay already has light, intersecting longitudinal and transverse cracks (Photo S-1). Previous repairs of an unknown date included patching along the concrete balustrade railings and sidewalk, and mortar patching or crack sealing on the slab underside and substructure units. The concrete patching repairs appear to be more superficial in nature, and the repaired surface does not match the original concrete finish. The repaired areas on the railings are map cracked and severely spalled in several locations (Photo S-2). The south sidewalk and curb has light-to-moderate spalling that was not previously repaired (Photo S-3).

Extending north and south from the west abutment are concrete retaining walls with ornamental iron railing mounted along the top. The walls are in good condition except for settlement issues affecting appearance at construction joints. The iron railings on the top of the walls are deformed somewhat due to the wall settlement. Many of the vertical pickets are bent and a separation in the railing (at a wall joint location) of several inches was previously repaired with welded bars. At least one tubular steel post is split on a corner and a few posts are missing their ornamental cast iron knob on top.

#### *Truss Spans 3-9*

The truss spans are generally in fair condition, with the most serious deficiency being active corrosion with measurable section loss on vertical hangers U1-L1 and U6-L6, and on several lower chord members near the truss panel points. On span 4, brackets hung from the sidewalk framing that support the operating ropes are inappropriately welded to the lower chord. On all of the spans, several truss primary and secondary members suffer minor-to-significant collision damage. Random areas of heavy corrosion with section loss and/or small holes are present on plates and sections of the truss built-up members. Generally, there is extensive surface rust and corrosion on the truss in the “splash zone” area extending several feet up from the roadway deck.

Extensive pack rust exists between the truss verticals and the inside gusset plates that connect to the floorbeams at panels L1 and L6. The resulting spread between the plate and two angles of the vertical member is typically ¾- to 1-inch thick, which has caused deformation in the vertical angles. Heavy pitting is also typical on the face of the gusset plates (Photos S-4 thru S-6). The aforementioned deficiencies are a result of the excessive overspray from the roadway above.

At U1-L1 on spans 3, 4, and 9, and at U6-L6 on spans 3 and 8, moisture is being trapped behind the clip angle that attaches the north side rub rail to the truss vertical member, resulting in pack rust with



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### Section 5 – Existing Conditions

significant section loss in the hanger angles (Photo S-7). Similar deficiencies exist on the inside web of the north truss end portal diagonals (Photo S-8). These diagonal members are large, built-up sections. At U6-L7 on span 4 and at L0-U1 on span 5, the corrosion has resulted in holes in the member webs.

Extensive corrosion deterioration from roadway overspray exists on the truss lower chord members at panel points. Generally, the outside vertical edges of the chord angle sections suffer section loss along the panel gusset plate. The horizontal legs of the angles are corroded and thin. The lacing bars that tie the angle sections together are heavily corroded or missing at many panel points (Photos S-9 and S-10). Resulting section loss percentages in the lower chord are generally higher at the end three panels (L0 thru L2 and L5 thru L7) where the members are lighter in weight (smaller cross sectional area). Plating repairs were made to the lower chord at 18 locations during the 2005 rehabilitation, and three other locations prior to 2005.

The cantilevered sidewalk brackets and adjacent vertical hanging brackets support the lift span operating ropes along the south side of span 4. The sidewalk brackets are located at the truss panel points, and the hanging brackets are located five feet on either side of the sidewalk brackets. The operating ropes pass through these supporting brackets (Photo S-11). Modifications over the years to the sidewalk framing have resulted in the vertical brackets being field welded to the truss lower chord, creating a poor fatigue detail on these fracture critical members (Photo S-12). No visible cracking was found during the inspection.

The truss bearings are generally in good condition, though all of the original steel components suffer light-to-heavy surface corrosion (Photo S-13). The original anchor bolts of the fixed and expansion assemblies are either missing or in varying states of deterioration. In 2002 elastomeric pads were installed to replace the original roller nest at the expansion bearings. In 2005 side retainers were added to each of the expansion bearings to provide lateral restraint (Photos S-14 and S-15).

Other steel truss deficiencies include pack rust between the lower panel gusset plates or heavy corrosion on the gusset plates at locations where several truss members frame into the panels. This is especially true at the end panel points, where the large portal diagonals, lower chords, and end transverse floorbeams connect. At these locations the members create tightly spaced areas, which tend to trap moisture and debris. Past leakage from the transverse expansion joints above, as well as roadway overspray, has advanced the corrosion over the years. Despite painting in this area in 2002, heavy corrosion has resumed and has caused section loss and severe deterioration on the steel members (Photo S-16). Several secondary members, including closure plates above the panel points and on the portal undersides, exhibit holes from corrosion or loss of section of rivet heads (Photos S-17 and S-18). These deficiencies are not considered critical, and the rebuilt expansion joints are keeping the affected areas free from additional moisture penetration. The 2002 paint coat on the remaining truss areas below

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### Section 5 – Existing Conditions

the roadway deck is generally in fair condition, though light-to-moderate surface rust has broken through at several locations. As previously noted, extensive surface rust exists on the truss members in the “splash zone” above the roadway and the paint on the upper truss steel is generally faded (Photo S-19).

Two channel members of the lift span operator house support suffer major section loss or holes from corrosion (Photo S-20). In 2005 the lower lateral bracing was removed from the underside of spans 3, 5, 6, 7, 8, and 9. The horizontal gusset plates connecting the bracing to the trusses were cut flush with the floorbeam bottom flange and lower chord connection angle. The cuts are rough and some rust pack areas remain, which has promoted moderate to heavy corrosion along the cut edges (Photo S-21).

Overspray from the deck drains has also contributed to corrosion and pitting on the side of the lower chord members and the north fascia stringers (Photo S-22). Earlier reports recommended installation of drainage deflection devices along the truss web members below the roadway level to protect the lower truss steel. The deflectors were not included in the 2005 rehabilitation due to budgetary constraints.

Several of the truss web members along the eastbound lane have minor-to-significant damage from vehicular collision. Most of the damage is in the form of minor bends or gouges in the angles of the built-up members, though three members (U2-L2 of span 3, U5-L5 of span 4, and L3-U4 of span 5) are significantly out of alignment (Photos S-24 and S-25). These are full compression members or force reversal under live load members. As a result, their load carrying capability may be reduced. Additionally, the exposed south truss members will continue to be at risk for collision damage as long as vehicular traffic is using the roadway. (Note: These members were heat-straightened by Mn/DOT in August 2008 after a vehicle collision on the upper truss closed the bridge for several days.)

Along the westbound lane, the rub rail attached to the north truss provides protection to the side members from vehicular impact. The majority of the collision damage is to the overhead truss portal and sway bracing. Numerous repairs have been made over the years to individual sections of the damaged members. In 2005 bent truss verticals (resulting from severe collision damage to the attached sway frames) on spans 8 and 9 were heat-straightened to a plumb position. The remaining overhead collision damage is generally minor and the condition is stable. However, as long as vehicular traffic is using the roadway, the risk of collision damage from over-height vehicles will continue to exist. Several sections of damaged rub rail were replaced in the 2005 rehabilitation. These replacements were generally at the end sections in front of the truss portals. An additional 127 sections of rail (approximately 847 feet of length) have significant collision damage. Additionally, 26 rail connection angles and seven intermediate support post are bent or damaged from vehicular impacts (Photos S-26 and S-27).

One deficiency resulting from movement of lift span 4 involves damage to the southwest corner curb of the span. The closure plate over the curb and joint has torn off, likely from interference with the tower leg

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during span movement. Scuffmarks on the leg guide indicate that the plate was rubbing on the leg, which was likely a result of being longer than required. The concrete curb section that anchored the plate has also broken off. The missing section has exposed the lower truss steel to harmful roadway moisture runoff (Photos S-28 and S-29).

#### ***Concrete bridge piers***

The concrete piers of the truss spans are in fair condition. The most severe deterioration visible above the waterline is at the west face and south end of pier 8, where deep spalls with exposed rebar extend for five feet above the waterline (Photo S-30). The remaining piers have light-to-heavy scaling and/or spalling visible at the waterline level. Previous underwater inspections indicate extensive scaling and spalling on the piers below the waterline. The 2005 rehabilitation included surface concrete repair to the top portions of the piers and a limited amount of crack sealing on the sides of the piers. Past underwater inspections have also indicated minor local scour and partial footing exposure at all piers, and partial sealcoat exposure at piers 5, 7, and 8. Scour does not appear to be progressive.

#### ***East approach span and east abutment***

The east approach span (span 10) is a short span built over the open vaulted east abutment. The span itself is in good condition. However, the entire abutment structure has suffered significant settlement and rotation in the north and west direction, and consequently has undergone major modifications over the years. In 2005 a new concrete railing was installed on the north side of the span that replicates the railing on the concourse and spans 1 and 2. Concurrently, the deck was milled and received a new low slump concrete overlay. The east abutment concrete is in fair condition. A limited amount of concrete surface repair was performed on the abutment in 2005. Over the years several shim plates have been placed under the north bearing supporting truss span 9. There is currently a 3.25-inch difference in elevation between the north and south side of spans 9 and 10 over the west end of the abutment structure. Currently, the abutment appears stable with no signs of recent settlement.

#### ***Sidewalk support system***

The sidewalk support system runs along the south side of spans 3-10 and consists of the sidewalk deck with decorative railing, supporting stringers, and cantilevered brackets. The deck and stringers were replaced in 1998 and the railing and fascia stringer were replaced in 2005. These elements are in very good condition. The cantilevered truss brackets that support the sidewalk from the truss panel points are in poor condition. Likewise, the intermediate bracket angles, which help support the railing, are also in poor condition. There is heavy corrosion with holes in the angle sections, which make up the brackets, and heavy rust and pitting in the bracket connection plates (Photos S-31 – S-34).

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#### *Concourse and approach pavement*

The west approach to the bridge consists of approach pavement or fill supported by concrete retaining walls. It is configured in a circular concourse, with the north and south approach retaining walls laid out in a half-circle plan. The walls have the same concrete, open-balustrade railing as approach spans 1 and 2. The concourse retaining walls are generally in good condition, except at the locations where they transition from pile-supported footings to spread footings. The spread footing walls have obviously settled and rotated, causing a visible gap between the panels of the concrete railing. In addition, the pile-supported, retaining-wall sections between the spread footing sections and west abutment have rotated slightly (approximately 1.25 inches out at the top of the south wall and 1 inch out at the top of the north wall). Past formed concrete and patching repair at these locations has had limited success. Cracks have reappeared through the poured and patched concrete and, as with the concrete work on spans 1 and 2, the repaired surface does not match the original concrete appearance.

The concourse pavement has a bituminous surface that is in fair condition with slight rutting in the wheel paths and some reflective cracking. It can be seen from old photographs and design plans that the original concrete pavement had a decorative geometric joint pattern with an octagonal slab centered in the circular area. It is unknown whether this concrete pavement still remains underneath the bituminous surface. The sidewalks and curbs around the concourse are not original construction. Settlement, recent curb cuts for handicap ramps, and vegetation growing through the joints have left an uneven and discontinuous appearance.

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## Historic Bridge Management Plan

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### Section 5 – Existing Conditions

**Photo S-1**

Hairline intersecting cracks in new low slump concrete overlay of spans 1 and 2.



**Photo S-2**

Spalling and map cracking in previously repaired areas on the north concrete railing of spans 1 and 2 (view looking northwest).



**Photo S-3**

Scaling and spalling in the south sidewalk of spans 1 and 2 (view looking east).





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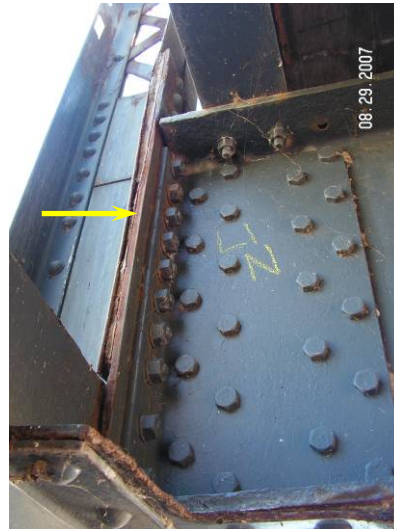
## Historic Bridge Management Plan

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### Section 5 – Existing Conditions

#### Photo S-4

Pack rust between the truss hanger vertical and inside gusset plate connecting the vertical to the floorbeam at panel L1 on north side of span 1.



#### Photo S-5

Pack rust between the truss hanger vertical and inside gusset plate connecting the vertical to the floorbeam at panel L1 on south side of span 8.



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**Photo S-6**

Close-up view of pack rust and visible gap between the truss hanger vertical and inside gusset plate connecting the vertical to the floorbeam at panel L1 on north side of span 1.



**Photo S-7**

Area of heavy corrosion with section loss behind rub rail connection on truss vertical member U1-L1 of span 3 (view looking north).



**Photo S-8**

Areas of heavy corrosion behind rub rail connection on truss portal L0-U1 of span 6 (view looking north).



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### Section 5 – Existing Conditions

**Photo S-9**

View east of lower chord near panel L7, north side of span 4, showing heavy corrosion, deterioration of lacing, and debris build-up.



**Photo S-10**

Lower chord near panel L5, north side of span 8, showing thin angle leg and deteriorated lacing bars.



**Photo S-11**

View looking west towards sidewalk bracket at L2 on south side of span 4, showing operating rope support bracket improperly attached to truss lower chord.





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### Section 5 – Existing Conditions

**Photo S-12**

Close-up of operating rope support bracket improperly welded to truss lower chord east of panel L2, south side of span 4.



**Photo S-13**

View looking south showing typical corrosion of truss bearing assemblies. Location shown is at pier 6 (span 6 at right, span 7 at left).



**Photo S-14**

Anchor bolt deterioration and construction debris around elastomeric expansion bearing at L0, north side of span 3.



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#### Photo S-15

View looking east of truss bearings at north end of pier 8 showing deteriorated anchor bolt in expansion anchor slot (span 8 bearing in foreground).



#### Photo S-16

Typical corrosion, rust scale on inside gusset plate (panel L7 at north side of span 4).



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### Section 5 – Existing Conditions

**Photo S-17**

Typical corrosion with rust holes in cover plate above truss end panel point (panel L0 at south side of span 7).



**Photo S-18**

Corrosion hole in bottom batten plate of portal U6-L7 near panel L7 (south side of span 7).



**Photo S-19**

Typical surface rust at roadway level of truss spans (looking west at north side of span 7 from pier 7).





# Minnesota Department of Transportation (Mn/DOT)

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### Section 5 – Existing Conditions

#### Photo S-20

Corroded steel channel supporting bridge tender operating house on span 4 (view looking northeast).



#### Photo S-21

Typical condition at truss panel points showing surface rust and rough edge along cut lateral bracing connection plate (panel L5 on north truss of span 1).



# Minnesota Department of Transportation (Mn/DOT)

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### Section 5 – Existing Conditions

**Photo S-22**

Typical damage from deck drain overspray: corrosion and/or pitted areas on fascia stringer and truss lower chord (north truss of span 7, looking east)



**Photo S-23**

Open rivet/bolt holes at former utility attachment locations (south truss of span 3).



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### Section 5 – Existing Conditions

#### Photo S-24

Vertical U5-L5 on south truss of lift span 4, bent and out of plumb from vehicular collision (view looking north).



#### Photo S-25

Vertical U5-L5 on south truss of lift span 4, bent and out of plumb from vehicular collision. Two individual angles of member also have localized bends from impact (view looking southeast).



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**Photo S-26**

Typical collision damage of north rub rail on truss spans (span 8, looking northeast).



**Photo S-27**

Damaged north rub rail connection angle to truss vertical member (span 9, looking northeast)



**Photo S-28**

Intact closure plate at northwest corner of lift span 4. The tower leg is to the left; span 4 support member L0-U0 is to the right.





# Minnesota Department of Transportation (Mn/DOT)

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### Section 5 – Existing Conditions

#### Photo S-29

Missing closure plate at southeast corner of lift span 4. Compare with Photo S-26. Interference with tower leg (at right) during span closing has caused plate and adjacent concrete curb section to break off.



#### Photo S-30

West face of pier 8 (looking east) showing deep concrete spalling near pier waterline and repaired concrete at pier cap.



#### Photo S-31

Typical truss brackets supporting south sidewalk (pier 7, looking east).





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### Section 5 – Existing Conditions

**Photo S-32**

Typical truss brackets supporting south sidewalk (pier 7, looking west). Note heavy corrosion on horizontal and diagonal angle components and connection plates



**Photo S-33**

Sidewalk bracket connection to truss panel cover plate (span 7 at pier 7). Note corrosion with pack rust on connection angle.



**Photo S-34**

Typical condition of sidewalk intermediate bracket angles, which support sidewalk railing. Notice heavy corrosion and holes in angle legs (span 4).



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### Section 5 – Existing Conditions

#### 5.3 Mechanical conditions

##### ***Rehabilitation project in 2005-2006***

The main drive system was completely replaced during the 2005 rehabilitation, with the exception of the down-haul cable take-ups, which were reconfigured. Records indicate that the counterweight wire ropes were last replaced in 1971. The remainder of the counterweight system, including the counterweight sheave assemblies, is original equipment.

##### ***Main drive system***

The drive machinery is relatively new and operates as designed. See Figure M-1 at the end of this section for layout of machinery. The gears and shafts of the speed reducers and open gearing operate smoothly. There is no binding or vibration evident at the bearings. Lubrication of the speed reducers, bearings, and couplings is appropriate. Speed reducer and bearing shaft seals work properly. The shafts and couplings are unpainted and exhibit surface corrosion throughout (Photo M-1). The paint system of other machinery components is scratched and marred, most likely due to handling and installation, and corrosion is forming on the unprotected portions. The connecting fasteners and shaft extensions of the four main drive speed reducers, the bearings, and the auxiliary drive speed reducer exhibit surface corrosion due to lack of paint.

The most significant finding related to the condition and life expectancy of the machinery is the lack of protective coating on the shafts, couplings, and fasteners. As surface corrosion forms on these items, it is very likely to intrude on seal areas and damage seals. Corrosive particles will eventually enter bearings and create additional friction, damaging the bearing and shortening its life. Section loss of the fasteners could eventually lead to significant loss of fastener clamping ability and allow movement of machinery components. Misalignment of machinery components would drastically shorten the life of seals and couplings.

##### ***Operating cable system***

Two wire-rope operating drums contain and control the operating cables. Each drum operates two up-haul and two down-haul cables, with one of each type of cable terminated at each tower. The operating drums are in good condition. The grooves of the drums are in fair condition and are reasonably clean; however, they do exhibit impression markings and minor evidence of friction damage from the wire ropes. The operating wire ropes are in fair condition, with evidence of flattened wires and distressed strands (Photo M-2). Rope take-up and pay-out is consistent and does not cause twisting of the operating ropes. Upper and lower timber wear plates are used at the opening to the machinery room and exhibit similar grooves. All wear plates in the general location of the machinery room are in fair condition (Photo M-3). Wear plates are used for the vertical runs of operating rope at the top chord of the truss at all four corners. These plates exhibit similar wear and are severely weathered and in poor condition.

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### Section 5 – Existing Conditions

Tension in the operating cables is not properly balanced. Lowering of the lift span is completed by pulling it down onto the live load shoes with the downhaul cables. The up-haul cables go slack during the seating of the lift span, while the downhaul cables pull the four corners down. During this process, the lift span is pulled down tightly against the live load shoes at three of the four corners of the span. The southeast live load shoe does not fully seat as it should during the lowering operation, indicating either that the up-haul cable is too restrictive or the downhaul cable is not sufficiently tensioned (Photo M-4). This live load shoe consistently seats only after the weight of traffic has crossed the span following a closure.

The downhaul cable take-ups are a modified version of the original system (Photo M-5). The original worm gear and reel remain. These components exhibit light surface corrosion throughout. The system has been modified to include a hand-operated speed reducer to drive the worm gear set. The system is locked up through high friction and corrosive adhesion and cannot be operated by hand. Attempts to operate the system exceeded the intended capacity of the coupling used to mate the speed reducer with the worm gear unit.

#### ***Counterweight system machinery***

The counterweight sheaves appear to be in good condition. The locations on the sheaves where fatigue cracks are historically known to form do not contain cracks. The sheave rims and webs are intact and corrosive losses are minimal. The wire rope grooves are relatively smooth. The crowns between the wire rope grooves have good remaining section and knife-edging has not formed. However, the sheaves have provided extensive service and may have exceeded their anticipated life. The counterweight sheave trunnion journals exhibit heavy circumferential scoring (Photo M-6). Though not visible, the bushings will be similarly scored and worn. The fillet radius of a sheave trunnion typically develops fatigue-related cracking after long-term service of the bridge. This area is not accessible for viewing. It is anticipated that the life expectancy of the sheave trunnions has been exceeded and fatigue related fractures may soon develop.

The counterweight ropes terminate at anchorages that are embedded into the counterweights at the north and south ends of the counterweights. The opposite end of each rope terminates at castings bolted into the ends of the lift girders of the lift span. End blocks that are spelt-connected to the counterweight ropes fit into sockets formed into the anchorages and castings. Several outer wire strands of the counterweight ropes have flattened and are distressed (Photo M-7). The strands exhibit additional friction-related damage due to the debris collected on the cable. The counterweight ropes have reached the end of their anticipated service life.

The most significant finding related to the condition and life expectancy of the counterweight rope system is the limited remaining life of the counterweight ropes and trunnion bearing bushings.

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### Section 5 – Existing Conditions

#### ***Counterweight guides***

The counterweight guides bolt into built-up members of the counterweight steel frame that are partially encased in the counterweight concrete. The exposed portions of the framing members are in good condition. The counterweight guides are generally in good condition (Photo M-8). The lower counterweight guide on the south end of the west counterweight is significantly bent. The guide rides properly on the rail; however, the leg bolted to the framing has a gap from the prying that allows moisture and debris to collect between the two surfaces. This will accelerate corrosive losses.

#### ***Span locks***

An item that could be considered a deficiency is the lack of span locks on the vertical lift span. These devices provide a mechanical system that locks the span down to the piers when in the closed position. This condition has been noted in previous reports. The 1988 American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Movable Highway Bridges states: "Vertical Lift Span Bridges shall preferably be equipped with locking devices at each end to prevent the span from rising after it has been seated by the operating machinery." This preference primarily applies to newly constructed bridges, but could also be applied to rehabilitated bridges. The 2000 version of the code has similar verbiage, making it the owner's option to provide span locks.

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### Section 5 – Existing Conditions

**Photo M-1**

General condition of machinery with unpainted surfaces exhibiting minor-to-moderate surface corrosion.



**Photo M-2**

Beginning stages of wear on haul cable. Debris collected on haul cable.



**Photo M-3**

Grooves worn into timber wear plates. The horizontal wear plates are at the edge of the machinery platform. The vertical wear plates are at the end panel points of the upper chords of the lift span truss.





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### Section 5 – Existing Conditions

**Photo M-4**

Southeast corner of lift span does not seat properly.



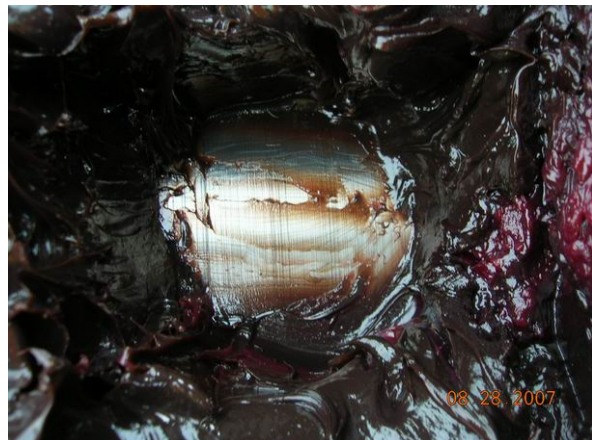
**Photo M-5**

Seized down-haul cable take-up assembly.



**Photo M-6**

Heavy radial scoring on counterweight sheave trunnion journal. Note that grease is in good condition.



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#### Photo M-7

Worn counterweight cables, with flattened strands and a few broken wires.



#### Photo M-8

Bent counterweight guide.



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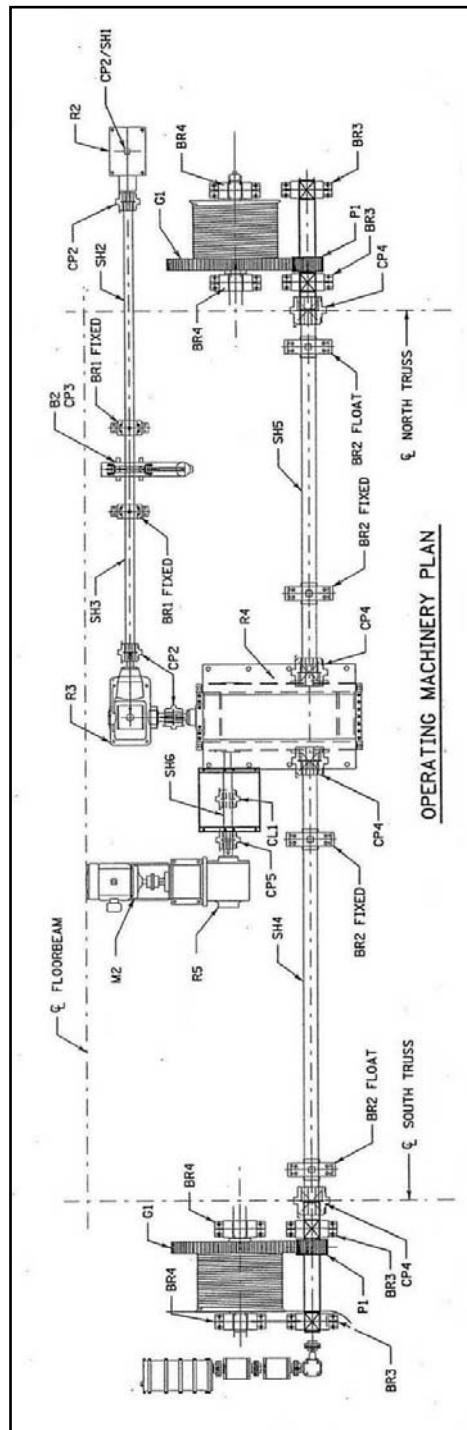


Figure M-1. Operating machinery layout.



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### Section 5 – Existing Conditions

#### 5.4 Electrical conditions

##### *Rehabilitation project in 2005-2006*

The electrical system was completely replaced during the 2005 rehabilitation, with the exception of the overhead roadway lights and some of the existing conduit and junction boxes. The majority of the electrical equipment on the bridge is used for controlling the movement of the vertical lift span and for stopping traffic during a bridge opening.

##### *Vertical span lift control conditions*

The existing traffic control devices are in good condition. Some minor repairs are needed to the conduit for the traffic signals and the advanced warning lights. A visor is missing from the northeast traffic signal.

The lack of an energy absorbing roadway traffic barrier is a condition of concern and is discussed in more detail in later sections. Barriers are incorporated into modern movable bridge systems to prevent errant vehicles from entering the waterway when the lift span is in the open position. For this report, when the term “barrier” is used, it refers to an energy absorbing traffic barrier that will stop a vehicle of a designated mass traveling up to a designated speed. A “traffic gate” is a warning device only. It provides visual indication for motorists to stop. It will not physically stop a vehicle if hit. The bridge currently has traffic gates only. The current AASHTO Standard Specifications for Movable Bridges states that both warning gates and physical barriers “should” be used on both approaches to a movable bridge (Photo E-1).

The navigational aides such as the navigation lights, air horn, and marine radio were all replaced during the 2005 repair. The lights are equipped with long lasting light-emitting diode (LED) style fixtures.

The conduit installed to transition electrical circuits between spans 5-10 is in poor condition. The support system does not adequately support the conduit expansion couplings.

The electrical controls and drives for the vertical lift span were replaced in 2005 with new equipment. The overall control system is in very good condition. The lift span moves quietly and smoothly in both directions. A meter on the control console and the diagnostic reports are not working properly, but have no effect on the operation and the reliability of the bridge.

The sightlines for the operator to adequately view all pedestrians and stopped vehicles are poor. The bridge’s overhead steel truss structure distorts and blocks the operator’s view of the sidewalk and traffic gate areas.

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### Section 5 – Existing Conditions

#### *Lighting*

Lighting on the bridge includes maintenance and roadway lights. Maintenance lights are located in the operator's house and equipment areas for operation and maintenance of the bridge. These were all replaced in 2005. The deck of the bridge is illuminated with cobra-head type roadway lights. Each truss span has three fixtures attached to the overhead top chords of the trusses (Photo E-4).

The ornamental lights and poles mounted to the sidewalk railing newel posts were previously removed. Plates have been welded to the tops of the cast iron newel posts to cover openings where anchor bolts and wiring previously passed through.

The lights on the concourse balustrade are in very poor condition. None of the lights are currently working and significant corrosion exists on some of the fluted metal poles. Two of the fixtures are missing the acorn globe on the top. Embedded conduit has been replaced with externally run conduit on the outside of the concourse retaining walls.

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**Photo E-1**

View of an open roadway when bridge is open. No traffic barrier to prevent an errant vehicle from entering waterway.



**Photo E-2**

New console, main drive motor, and new amenities in refurbished operator house.



**Photo E-3**

Motor control center, cable tray, and other equipment installed in new electrical room.



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**Photo E-4**

Cobra-head roadway lights mounted to the top truss chords.



**Photo E-5**

Cast iron newel post that ornamental light poles were originally mounted on. Top of post has a welded plate.



**Photo E-6**

Typical conduit and expansion joint between spans. Angle brackets do not adequately support the expansion joint.



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### Section 6 – Recommendations

## 6.0 Recommendations

### 6.1 Introduction

As stated in MOA Stipulation III, the Stillwater Lift Bridge Management Plan will identify those actions needed to preserve the structural and historical integrity of the bridge for continued safe use. This includes the following:

- Stabilization: ongoing maintenance and repair during the period of continued trunk highway vehicular use.
- Preservation: capital repair, rehabilitation, and improvement during the period of conversion to pedestrian/bicycle trail use.
- Maintenance: ongoing maintenance and operations following conversion.

Recommended actions for stabilization, preservation, and maintenance are described below. The recommendations are intended to address issues and conditions identified in Section 5.0, as well as any requirements for converting the bridge from vehicular use to pedestrian/bicycle trail use. Like the existing conditions, the recommendations were presented in the Condition Assessment Report that was prepared by URS in 2008. The Condition Assessment Report lists stabilization, preservation, and maintenance recommendations with associated costs for structural, mechanical, and electrical components and the concourse.

All recommended actions in this management plan have been reviewed for compliance with the SOIS as required in MOA Stipulation III and in the *Management Plan for Historic Bridges in Minnesota*. In general, the SOIS require maximum retention of historic fabric of the bridge and concourse, with particular attention to character-defining features (see Section 3.6). In particular, recommended actions for the concourse and spans 1 and 2 have been reviewed for compliance with the SOIS for restoration, and recommended actions for spans 3-10 have been reviewed for compliance with the SOIS for rehabilitation. In general, renderings and plans included herein are conceptual. Final plans will also be reviewed for compliance with the SOIS.

Recommended actions have also been reviewed for compliance with other applicable standards, codes, and guidelines (see Section 6.2 and Appendix F).

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### Section 6 – Recommendations

## 6.2 Guidelines and standards

### 6.2.1 Guidelines, standards, and regulations

Mn/DOT is responsible for providing a safe and accessible structure, and must work to incorporate various standards and guidelines into the repair and conversion plan to the fullest extent possible without compromising the historic integrity of the structure, including the *Revised Draft Guidelines for Accessible Public Rights-of-Way*, and *Mn/DOT Bikeway Facility Design Manual* (see Appendix F for a comprehensive list of applicable standards).

### 6.2.2 Guidelines for steel repair and fastener considerations

Over time, steel repairs to the Stillwater Lift Bridge have required the replacement or addition of steel components. As is typical with older riveted structures, these repairs have involved removal of existing rivets and reuse of their holes for new connections using standard, high strength, hex-head bolts. Additionally, some repairs have required additional field drilling for new bolts in existing steel where no rivet holes existed. The 2005 rehabilitation project added approximately 4000 high strength bolts to the structure. It has become common engineering practice to utilize high strength bolts when rehabilitating older steel bridges, even when the bridge is considered historic. Riveting is rarely done due to the lack of riveting technology in the industry, high costs, and the superior strength and performance of high strength bolts. Extensive rivet installation by skilled riveters is sometimes done on smaller bridge restoration projects where truss bridges are rehabilitated or restored. A list of skilled riveters is presented in Appendix K.

A more common practice used on historic bridge projects is to utilize button-head bolts where there is a desire to maintain the appearance of rivets in highly visible areas. These fasteners have a threaded shank with a rounded head in lieu of a hex shaped head, but still use a washer and hex shaped nut. When installed, the bolt resembles a rivet on one side and a standard bolt-with-nut on the other. A special installation tool is required that holds the threaded end of the bolt while simultaneously tightening the nut from the same side. Because of the single-side tightening and the use of the special tool, installation requires more clearance than a standard bolt. Due to the restricted installation requirements and the fact that the button-head bolt resembles a rivet on one side only, the use of the button-head bolt to replace and resemble a rivet has a limited range of applications.

Because the treatment of the metal trusses is reviewed for compliance with the SOIS for Rehabilitation, a compromise solution was achieved between the universal replacement of rivets with rivets and the universal replacement of rivets with high-strength, hex-head bolts. The solution involves an evaluation of the truss locations and applications involved in rehabilitation recommendations. The compromise also includes the utilization of four types of fastener: rivets,



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### Section 6 – Recommendations

hex-head high-strength bolts, button-head bolts with tension control, and button-head bolts with acorn nuts. The evaluation determined which fastener would be appropriate for a particular location. In general, locations with high visibility from the bridge deck will use rivets and areas not visible will use hex-head bolts. Areas of limited visibility will use button-head bolts where feasible.

A matrix indicating the recommended use of specific fasteners in particular locations and applications is presented in *Figure R-1. Rivet/Bolt Connection Matrix*. The matrix is recommended for all work on the bridge to maintain compliance with the SOIS. In the case of unusual circumstances or new information regarding the use of rivets and bolts on a historic bridge, Mn/DOT will employ the decision-making process outlined in Section 1.4. Emergency repairs do not require use of the matrix.



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### Section 6 – Recommendations

Figure R-1. Rivet/Bolt Connection Matrix					
Item/Location	Rivet	HHB	BHB	BHB/AN	Comment
Bottom chord repairs and gusset connections		X			All are below the deck
Floorbeam and stringer connections		X			All are below the deck
Top chord member (Shop-riveted with top plate and bottom lacing)			X		Button head facing down
Top chord gusset plate connections		X			
Truss vertical and diagonal members, above deck level (Shop-riveted lacing bars and batten plates to flange angles)	X				
Truss vertical and diagonal members, above deck level, gusset plate connections		X			
Truss verticals and diagonals below deck level		X			All are below deck
Portal diagonals (L0-U1) above deck. (Shop-riveted with top plate and bottom lacing)	X				
Portal diagonals (L0-U1) above deck, gusset plate connections		X			
South pedestrian railing panels				X	In-kind replacement
Sway frames: lower horizontal strut	X				
Sway frames: diagonal members and top struts		X			
Portal frames at ends of truss spans: lower horizontal strut	X				
Portal frames at ends of truss spans: diagonal members and top struts		X			
Top lateral bracing		X			
North bridge railing		X			In-kind replacement
Lifting towers, between deck and top chord	X				
Lifting towers, top chord and above		X			
Sidewalk cantilever brackets, not including top horizontal angles: full bracket replacement or repair	X				
Sidewalk cantilever brackets: replacement of top horizontal angles		X			
Sidewalk cantilever brackets: connection of bracket to truss		X			
Intermediate sidewalk brackets (paired back-to-back angles)		X			

HHB = Hex Head High Strength Bolt

BHB = Button Head Bolt (Tension Control)

BHB/AN = Button Head Bolt with Acorn Nut

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### Section 6 – Recommendations

#### 6.2.3 Guidelines for treatment and repair of concrete

This section recommends separate treatment guidelines for concrete in two areas of the bridge.

##### ***River piers, bridge decks, sidewalks on the truss spans, and the east abutment***

Repair work on these components shall conform to the standard Mn/DOT specifications for concrete surface repair and concrete mortar patch. The recommended repairs require thoroughly removing the deteriorated material down to sound concrete, cleaning or replacing corroded reinforcement bars, and forming for the pouring of a new, high-quality concrete mix.

##### ***Concourse and spans 1 and 2***

The concourse and spans 1 and 2 are character-defining features and subject to the SOIS for restoration as indicated in Section 6.1. Concrete elements in these areas include the open-balustrade railings, circular retaining walls, pavements, and sidewalks. Restoration work required includes a combination of replacements, patching, and crack repair. It is important that this work be performed in a manner consistent with current best practices for the treatment of historic concrete. To achieve this, specifications based on the current version of the National Park Service's *Preservation Bulletin 15 – Preservation of Historic Concrete* will be used in the design and preparation of plans for new concrete, including the concourse pavement, curbs, and sidewalks, and for the restoration of historic concrete, including the balustrades and retaining walls. These specifications call attention to, and provide guidance on, the following:

- Concrete mix design requirements
- Quality control
- Qualifications of contractor and workers
- Sampling and testing of existing and new concrete
- Sample panels (mock-ups) for color and texture matching
- Acceptance criteria and approval requirements
- Weather limitations
- Limitations on concrete cleaning methods to avoid damage
- Concrete removal and excavation methods

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### Section 6 – Recommendations

#### 6.3 Recommended stabilization activities

Stabilization activities are those that will be required prior to the implementation of preservation activities (repair and conversion). They are minor repairs needed to maintain the Stillwater Lift Bridge's structural, mechanical, and electrical systems until a permanent repair or rehabilitation can be completed.

##### 6.3.1 Structural

Spot clean and touch-up paint the pedestrian sidewalk railing using the existing railing color. Remove areas of peeling paint and clean galvanized surface before over-coating.

The most heavily deteriorated portions of the concrete balustrade occur on the north side of spans 1 and 2 where the rail is just behind the curb line and is directly impacted by plowed snow and water splash. Deterioration of these elements is rapidly progressing. It is important that repairs be made to this section as soon as possible to avoid complete replacement of the railing in the future. It is recommended that this portion of the concrete balustrade be repaired within the next two years, utilizing the treatment method in Section 6.2.3.

##### 6.3.2 Mechanical

The recommended mechanical repairs for stabilization include minor machinery repairs and some adjustments to the operating cables to maintain bridge serviceability under vehicular traffic prior to conversion. Additional and substantial stabilization work will be required prior to conversion if the project is delayed beyond 2013.

##### *Drive machinery system*

It is recommended that the drive machinery components be painted. The items that are unpainted, such as shafts and coupling housings, should be fully cleaned and painted with appropriate protection at all penetrations where seals are used. The prime coating should be compatible with the finished surface of these components. Due to the existing corrosion, the anchor pattern on these items, after appropriate cleaning, should accommodate several types of primers. Primer-type coatings now exist that perform well with minimal surface preparation of machine-finished surfaces. Components such as speed reducers and bearing housings, which were painted but have lost much of their coatings through handling and installation damage, should be cleaned and painted with an epoxy mastic system in accordance with the provisions of Mn/DOT Standard 2478. The shafts and couplings should be painted safety orange or red to clearly identify that they are moving components. Since these elements are located below deck within the machinery enclosure and are not readily visible, painting operating components with safety colors is acceptable treatment in terms of the SOIS.

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#### ***Operating cable system***

Balancing of the tension in the up-haul and down-haul cables is required, particularly those of the southeast corner of the lift span, so the span is pulled down tightly on all four live-load shoes during the span-lowering operation.

The down-haul cable take-up assemblies should be mechanically freed for operation. The unpainted, contact surfaces of the worm gear assemblies should be coated with a dry lubricant containing molybdenum disulfide or graphite. The oil in the speed reducers of the take-up assemblies should be checked and topped off as necessary to prevent portions of the gears from getting exposed and developing corrosion.

The worn timber wear plates that support the operating cables on span 4 should be replaced in-kind at all locations. These items typically do not endure the time interval between rehabilitations and will be a maintenance item even after being replaced in the upcoming rehabilitation.

#### ***Counterweight system***

Non-destructive testing of the counterweight sheave shafts should be performed. Due to the known occurrence of failures of similar counterweight trunnions, attempts should be made to determine if any fatigue damage exists on the shafts. The primary location of potential fatigue failure is in the fillet radii between the bearing journal and the portion of the trunnion fitted into the counterweight sheave. Ultrasonic testing should be used as part of this testing to determine if internal flaws exist within the trunnion. However, ultrasonic testing from the end of the trunnion would likely not reveal cracks in the fillet location, due to the change in section of the trunnion at this same location. Proper inspection of each fillet radius should be performed utilizing magnetic particle or dye-penetrant testing. The following sequence is recommended:

1. Removal of the grease in the trunnion bearing
2. Removal of the trunnion bearing cap
3. Installation of a temporary trunnion journal strap to allow rotation of the sheave
4. Cleaning of the grease on the trunnion at the radius and sheave
5. Magnetic particle and/or dye-penetrant testing
6. Reassembly and re-lubrication of the bearing assembly

If fatigue related cracks are found, proactive measures as described in Section 6.4.3: Counterweight system, will be required immediately. This could potentially include the complex and costly work of trunnion replacement, which includes bridge closure, counterweight shoring, and sheave removal.

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#### 6.3.3 Electrical

The condition of the electrical and control system on the movable portion of the bridge is in excellent condition and very few repairs are required for stabilization. Only routine maintenance-type repairs are needed, such as replacement of broken supports and conduits at the traffic and advance warning signals. The northeast traffic signal should have its visor replaced.

#### 6.4 Recommended preservation activities

Preservation activities will occur within one year of the completion of the new St. Croix River Crossing, as per the terms of the MOA. These include activities required for conversion of the Stillwater Lift Bridge from a vehicular highway bridge to a pedestrian/bicycle bridge, and repairs to the truss spans (including the lift span), approach spans, and concourse in structural, mechanical, and electrical areas.

##### 6.4.1 Pedestrian/bicycle trail conversion

This section identifies work necessary to convert the bridge from vehicular highway use to pedestrian/bicycle use in conjunction with the new Loop Trail. The recommendations include items required for trail use, necessary access by emergency vehicles, and continued safe operation of the lift span. The recommendations are in compliance with the SOIS as well as other applicable codes, standards, and guidelines. Engineering design and construction details for some conversion recommendations are in sections 6.3.1, 6.3.2, and 6.3.3. Cross-references to such details are included in the text below.

##### *Lane alignments and bridge deck*

Pedestrian/bicycle use requires two bicycle lanes and two pedestrian lanes on the bridge deck, designed in compliance with Mn/DOT trail standards. In order to provide an appropriate historical alignment for maintaining circulation patterns in compliance with the SOIS for rehabilitation of cultural landscapes, the centerline of the bike trail will follow the existing centerline of the vehicular roadway (Figure R-2). Bike lanes will be delineated by three-inch edge striping only and not by different pavement treatment. A single three-inch dashed stripe will delineate the centerline separating the two bike lanes. Each bike lane width will be five feet, six inches clear between the three-inch stripes. The remainder of the width of the roadway between curb lines will be divided equally into two pedestrian access lanes. The lanes will not be delineated by using any additive to the concrete deck surface at the time of conversion. If subsequent use indicates that the deck should receive a surface treatment, it will be considered at that time. During the conversion process, the deck joints between spans will be retrofitted to accommodate bicycle use (see Section 6.4.2: Truss spans for details).

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#### ***Pedestrian crosswalks***

To facilitate safe north-south pedestrian access across the bicycle lanes, three striped crosswalks will be provided on the bridge deck (Figure R-2). One will be located at the western end of the bridge above pier 1, and two toward the center of the bridge above piers 5 and 7. Crossings will be six feet wide and will be delineated with stripes. The crossing stripes will be 6 feet long, perpendicular to the crossing, and 1.5 feet wide, with 1.25 feet of space between stripes and a minimum of 1.5 feet of clear distance to the curb. The stripes will be reflectorized white polymer preformed tape. Tactile strips will be installed at the base of each crossing as a detectable warning for visually impaired users.

A fourth crossing is recommended for the trail area immediately east of the east abutment. The location is outside the scope of this management plan but still within the historically sensitive setting of the bridge. See Appendix J for recommendations regarding this crossing.

#### ***Truss openings***

Two truss openings (above piers 6 and 8) will not have crosswalks. Paired bollards, one on each side of the expansion joint, will be installed at these openings to warn visually impaired persons and persons in wheelchairs that the area is not an accessible point on the trail (Figure R-3). At the eastern end of the bridge, between the end of the truss on span 10 and the transition to grade, the existing guardrail will be removed and replaced by bollards identical to those used at the truss openings.

#### ***Pedestrian ramps on south sidewalk***

To comply with the Americans with Disabilities Act (ADA), ramps are required to provide access from the bridge deck to the south sidewalk. In order to avoid potential congestion and pedestrian/bicycle conflict associated with adding built-up ramps adjacent to the sidewalk on the bridge deck, and to minimize the visual impact to the historic character of the bridge, the south sidewalk will be modified. At each of the north-south pedestrian crossings, modifications will be made to ramp down the sidewalk to the level of the main deck. The sidewalk will ramp down in both directions to create accessible ramps within the sidewalk alignment. At the bottom of these ramps will be a five-foot landing opening onto the pedestrian crossing (Figure R-4). For crosswalk locations above piers 5 and 7, structural modifications will be made to the stringer and bracket system beneath the sidewalk to create two-stage, stepped ramps at each location (Figure R-5). For design and construction details, see section 6.4.2: Sidewalk support system.

#### ***Pedestrian gates***

A physical barrier is required across the roadway to prevent access to moving portions of the bridge during a lift and to the unguarded waterway when the bridge is open. A full-depth swing

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gate is recommended to prevent pedestrian access to restricted danger zones near the counterweights and lift span. The recommended new gate (Figure R-6) will reflect the materials, design, and operation of the original 1940 gate, which has since been removed. The 1940 gate was manually operated, while the new gate will be operated by electric motor. For design and construction details, see Section 6.4.4: Pedestrian gates.

#### ***South truss cable addition***

To provide a detectable barrier for handicapped users on the sidewalk, offer protection from diagonal members that protrude into truss openings, and direct pedestrian traffic to the designated crossings, two steel cables will be installed along the sidewalk side of the south truss at 12 and 36 inches above the curb. The cables will extend the length of each truss between endposts, but will not extend across the space between trusses (Figure R-3). The cables will be attached in a manner that will prevent contact with and damage to the paint on the trusses. The cable diameter will be sufficient to serve as a simple, detectable barrier with minimal visual impact on the truss design and configuration. The upper cable is not required to function as a hand rail.

#### ***North rail treatment***

The existing north rail, also known as the vehicular rub rail, has openings between horizontal members that are not in code compliance because they allow the passage of a four-inch sphere. To reduce the openings to an acceptable dimension, a series of horizontal tensioned cables will be installed. Four cables will extend through the bottom and middle openings, and three cables will extend through the top opening (Figures R-7 and R-15). A gate through the railing will provide access to the bridge tender's house.

#### ***Concourse***

As noted in Sections 6.1 and 6.2.3, the concourse and spans 1 and 2 are subject to SOIS standards for restoration. The original Stillwater Lift Bridge plans from 1930 will serve as the basic reference documents for restoration work. Repair and restoration of historic concrete will follow the treatment specifications in Section 6.2.3. The following recommendations for treatment of the specific concourse elements are based on the analysis of the URS survey of the concourse, conducted in 2007.

#### ***Pavement***

Pavement on the concourse will be restored to the original design from 1930 plans, including scoring and expansion joints in a geometric pattern as depicted in the original design. Color and texture of the new concrete will utilize the guidelines in Section 6.2.3 and will respect the original concrete of the balustrade railing. The surface elevation of the pavement will be established in



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coordination with the elevation of the sidewalks in order to achieve a curb height of six inches or less. Bike lanes on the concourse will not be delineated by different pavement treatment.

#### *Sidewalks and curb*

The existing concourse sidewalks and curbs will be removed and replaced with concrete sidewalks based on original 1930 plans, including design and location of expansion joints and scoring as depicted in the original design. Color and texture of the new concrete will utilize the guidelines in Section 6.2.3 and will respect the original concrete of the balustrade railing. The elevation of the sidewalk and curb will be established relative to the new elevation of the restored pavement so that the new curb height is six inches or less in all locations. Every effort will be made to minimize the lowering of the sidewalk in relation to the balustrade, while still addressing the drainage needs.

Historic ramps on the west end of the north and south sidewalks will be reconstructed according to the design in the original 1930 plans. ADA-compliant ramps will be added to the south sidewalks at the south drive and only these ramps will require the installation of detectable warnings. The color for the south driveway ramps will be determined at the time of construction with the following method: (1) the contractor or a historic concrete consultant will prepare several panels of contrasting gray color concrete, and (2) Mn/DOT and SHPO will identify the most appropriate color that is visually distinct but not contrasting beyond ADA needs at the location.

The national ADA Access Board has determined that a ramp is not required at the east end of the north sidewalk. A sign alerting sidewalk users to the lack of an east ramp will be posted at the west end of the north sidewalk.

ADA accessibility to Lowell Park from the north side of the concourse will be met through the Stillwater Flood and Retaining Wall Project (see Appendix J for details on the Flood and Retaining Wall Project).

#### *North staircase*

No repair work will be undertaken on the north concourse steps because the steps are outside the scope of the project. If future repairs or modifications to the stairs trigger a need to bring the area into compliance with standards, then Mn/DOT has indicated that the agency will seek an exemption to railing standards to achieve compliance with the SOIS.

#### *Concourse walls and balustrade*

Cracked, spalled, and otherwise damaged concrete will be repaired as specified in Section 6.2.3. Areas requiring repair will be indicated on the relevant repair plan sheets.

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#### *West abutment retaining wall and metal railing*

The north and south concrete retaining walls at the west abutment will be repaired where spalling or other damage has occurred. Repairs will follow the specifications for historic concrete repair in Section 6.2.3. Bent, broken, or otherwise damaged metal fences located on top of the retaining walls will be repaired and restored following original 1930 plans. The railing height will remain unchanged because the retaining wall area is not a pedestrian-designated area and the 42-inch height standard is not applicable to the railing.

#### *Traffic restriction devices*

Bollards will be placed at the end of Chestnut Street to restrict automobile access to the bridge. Signage will indicate a dead end.

#### ***Signage***

##### *Regulatory and warning signing*

Regulatory signs for motor vehicles will be removed in the approach areas leading up to the bridge. These will include TH 36, STH 64, Speed Limit 30, and load restriction signs. The existing signs, flashing lights, and overhead cobra-head fixture on the portals will also be removed. Navigational signs will remain. For location, content, and design of original signage, with sign removals upon conversion indicated, see Figure R-8.

All new signs will follow the regulations established in the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), 2003. Signs will be manufactured following prescriptive colors and sizes for their respective functions as indicated in the manual and as required by Minnesota Statute Section 169.06. Signs indicating the new use of the bridge will be added to inform motorists that the bridge is a pedestrian/bicycle facility. These signs will be placed near the entrance to the concourse from the west and the entrance to the bridge from the east and will prohibit all motor vehicles from entering the bridge, with the exception of emergency use vehicles. Pavement markings will be added at the beginning of the bridge from both directions delineating the bicycle lanes and the pedestrian areas. These will be painted onto the pavement at spans 1 and 10 and at pier 5. A 10 mile-per-hour pavement marking will also be painted on the bike lanes at spans 1 and 10. A crosswalk indicator sign will be placed near the crosswalks informing bicyclists to stop for pedestrians in the crosswalk. These signs may be removed after a period of time as pedestrians and bicyclists become familiar with the location and use of the crosswalks. For location, content, and design of signs on the bridge following conversions, see Figures R-9 and R-10.

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#### *Other regulatory signing*

Signing will be added to spans 3 and 5 to inform pedestrians and bicyclists that they are prohibited from being in the area of the lift span (span 4) and the counterweight area (end of span 3 and beginning of span 5) during operation of the lift span. A 12-inch-wide stop-bar will be painted on the deck five feet to the outside of the closed pedestrian gate location, indicating a safe area for pedestrians and bicyclists to queue during a bridge raise. A “STOP HERE ON RED” sign will be added near the stop-bar and a stop sign added to the pedestrian gate (Figure R-9). Two pairs of flashing red lights will be added to the truss members above the stop-bar on spans 3 and 5.

#### *Directional signage*

Since no ramp is required at the northeastern corner of the concourse (existing curb to be retained), signage is needed to warn users that the ramp ends and a turnaround is necessary.

#### *Interpretive signage*

No interpretive signage will be developed as part of the repair and conversion project. Rather, it will be developed through a separate mitigation item with Mn/DOT and the National Park Service.

### **6.4.2 Structural**

#### ***West approach spans 1 and 2***

To accommodate wheel chair access on and off the roadway deck, removal and replacement of the sidewalk in spans 1 and 2 is required as a trail conversion item (See Section 6.4.1: Pedestrian crosswalks and Pedestrian ramps on south sidewalk). The sidewalk will be reconstructed in a ramped configuration with a landing at the base of the ramps centered over pier 1. The sidewalk deck will be saw-cut along the curb line and north face of balustrade for removal. Ramps will slope down to the landing with tops of the ramps at the west abutment and pier 2. New steel reinforcing bars will be doweled into the saw-cut faces of the bridge deck and south concrete fascia beam to lap with new ramp reinforcement prior to pouring concrete. Concrete work will follow guidelines in Section 6.2.3.

Settlement issues with the retaining walls north and south of the west abutment are mostly cosmetic in nature and corrective action is not a requirement. The ornamental railing on top of the walls should be restored and painted. Bent vertical pickets should be heat-straightened and splits in tubular posts should be sealed with weld metal. Posts with missing ornamental spherical knobs on top should have new knobs fabricated and welded back onto the existing posts.

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#### ***Pier and abutment concrete***

Formed concrete repairs are required on deteriorated concrete surfaces of the bridge piers and east abutment. Originally, the 2005 rehabilitation called for more extensive concrete repair to the bridge piers above and below the waterline. The repairs below the waterline required installation of a dewatering system around each pier. Due to budget constraints at that time, all repairs below the waterline and a sizeable amount of repair work above the waterline were eliminated from the 2005 rehabilitation. These areas remain in need of repair.

The east face of the west abutment and the west face of pier 1 have decorative formed insets that were painted at some point in the past. This paint should be removed to return the concrete to its original intended appearance, adhering to any applicable guidelines in Section 6.2.3. Paint removal methods require special attention to ensure the concrete is not damaged. Small test areas in the least visible locations should be cleaned initially to determine the final agreed-upon method for the process.

Repairs of the main substructure elements should conform to the standard Mn/DOT specifications for Concrete Surface Repair and Concrete Mortar Patch. The recommended repairs require thoroughly removing the deteriorated material down to sound concrete, cleaning or replacing corroded reinforcement bars, and preparing the form for the pouring of a new high quality concrete mix.

#### ***Concourse concrete walls and pavement***

The pavement, sidewalks, and curbs within the concourse should be replaced to reestablish the historic geometric joint pattern in the roadway and to correct for settlements that have resulted in varying curb heights, irregular walkways, and non-compliant handicap ramps at the south driveway entrance. The original 1930 design drawings should be used as the basis for recreating the original geometry. The 12-foot-long portions of sidewalks extending westward from the west limit of the balustrade should also be reconstructed to its original 10 foot width and include a seven-foot ramped end section where it terminates. The original 1930 drawings will be a design guide for the restoration of the west ramps.

The displacement of the concourse walls and balustrades is an indication of past settlement of spread footings. It is likely that this settlement has stopped. Mortar patches made at construction joints between walls and balustrade panels in recent years have cracked but do not show signs of significant recent horizontal or vertical displacement. Underpinning the walls could be performed but is not warranted based on the apparent lack of ongoing movement. Since the deficiencies associated with the settlement are mostly cosmetic in nature, a more practical course of action is

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recommended. It is recommended that cracks be sealed and concrete surfaces be repaired on walls and balustrades.

It is important that any concrete work at the concourse be performed in a manner consistent with the SOIS. Similar to recommended repairs on the balustrades (see Section 6.3.1), concrete work in the concourse area will follow guidelines in Section 6.2.3.

#### ***Truss spans***

A fully intact and functional paint system offers the single most crucial component of steel bridge preservation. The paint system protects the steel superstructure from the harsh effects of moisture and other environmental conditions that can promote steel corrosion. The truss spans were last fully painted in 1982. Spot painting was performed on the lower chord areas of the trusses in 2002, and a limited amount was done during the 2005 rehabilitation. The structure should receive a full blast cleaning to near white metal (SSPC-SP10) and a three-coat paint system. In compliance with the SOIS, it was determined that green paint (Federal Standard 595B No. 34097) will be used for the truss spans and ornamental lights because historic research indicated these features were originally painted green, according to original plans and state specifications. The entire painting process should conform to standard Mn/DOT specifications for collection and disposal of existing paint and field applied paint procedures.

It is recommended to replace the inside gusset plate and adjacent section of vertical angles on the truss hanger verticals U1-L1 and U6-L6 at the lower panel floor beam connections. The splice for the two new sections of angles should be on the inside of the member at approximately deck level, and would not be readily visible. A suggested detail for this repair is shown in Figures R-11 and R-12. A temporary support will be required for the floor beam end at each repair location during construction. A concept schematic for this shoring is shown in Figure R-13.

On the north trusses, heavy corrosion and section loss on the roadway side faces of the portal end posts (L0-U1 and L7-U6) should be repaired. Ten out of 14 north end posts are in need of repair to address section loss and deep pitting that has taken place at the traffic rub rail connection locations. It is recommended that bolted patch plates be installed extending from the top of the bridge rail down to the top of the curb. These plates should be installed on the exterior face of the box-shaped member web with bolts around the perimeter for sealing. Standard hex head bolts with nuts on the inside of the box are recommended.

Approximately 40 lower chord panel points on the seven truss spans require strengthening to repair section loss from corrosion. Similar to the 2005 rehabilitation, the repairs consist of plates bolted horizontally inside the lower chord across the panel location (Figure R-14). One previous

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(pre-2005) repair located on the south side lower chord of span 6 should be replaced to remove the existing cover plate from the outside of the panel.

The operating rope support brackets below the sidewalk of lift span 4 should be removed and the welded areas on the lower chord of the south truss ground smooth. The vertical brackets should be reattached to the sidewalk stringer system through the placement of new transverse channel sections.

The bearing assemblies require complete cleaning and painting, including removal of all previous construction debris. New anchor bolts are required to replace the deteriorated original bolts, especially at the slotted hole locations at the expansion bearing sole plates.

The remaining portions of the lower lateral bracing system that was eliminated in 2005 should be ground smooth and painted to prevent progression of deterioration in the areas where these pieces are connected to the truss and floor beams. This includes portions of gusset plates and the horizontal connection angles below the floor beam flanges.

Damaged sections of the north rub rail should be replaced, as should damaged intermediate support post and connection angles. Modification to the railing is required to meet current pedestrian railing standards by narrowing the openings between the horizontal elements. This will be accomplished by adding horizontal stainless steel cables as in-fill to the existing rails (See Section 6.4.1). The cables will pass through holes drilled into the existing posts and will be anchored for tensioning at steel angle sections to be bolted to the face of vertical truss members (Figures R-7 and R-15).

The existing strip seal expansion joint system on spans 3-10 is not appropriate for bicycle and pedestrian use, as the depressed seal of the expansion opening will provide an excessive bump for bicycle tires, roller blades, and other types of wheels/tires. Modification to a sliding plate-type detail similar to what is currently on the south sidewalk will be required. Conversion should be possible without full-depth removal of the entire deck section at the expansion joint location. The watertight strip seal joint will remain in place under the sliding plate. Modifications should conform to Mn/DOT standard details and specifications.

Other truss member repairs recommended at various isolated locations include:

- Replacement of the closure plates over the truss end panels
- Replacement of deteriorated truss member batten plates
- Repair of the deteriorated steel members under the lift span operator house



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- Rebuild the damaged concrete curb at the southeast corner of lift span 4 and replace the associated steel closure plate

#### ***Tender's house and electrical house***

The roofs of the tender's house and electrical house (added in 2005) will be finished in aluminum paint (Federal Standard 595 B No. 37200) in compliance with the SOIS. This paint was used on the south (ornamental) pedestrian railing when reconstructed in 2005, and is the original paint specified for the roof of the tender's house. When added, the electrical house was built to match the original tender's house.

#### ***Sidewalk support system***

It is recommended that all intermediate horizontal brackets that support the ornamental pedestrian railing posts be replaced in-kind with similar-sized members. These are located midway between the triangular-shaped sidewalk brackets that cantilever from each panel point of the south truss. The members basically consist of double, back-to-back steel angles and will be bolted to the underside of the sidewalk stingers.

A combination of full and partial replacement of the triangular cantilevered brackets is recommended. The brackets are constructed in a truss arrangement of steel angles, gusset plates, and rivets. Several brackets near ends of spans require full replacement due to advanced corrosion from runoff at the expansion joints. With the lower portions of these brackets being highly visible from the shoreline, it is recommended that they be shop fabricated, in-kind replacements. It is recommended that rivets be used (per the original detail) in assembling the individual bracket elements, following guidelines in Section 6.2.2. The brackets will be bolted to the truss where they attach to the lower chords and vertical members. All brackets not requiring complete replacement should still have their top, horizontal, double-angle portions replaced in-kind because of deterioration. These top members are not readily visible and should be bolted replacements, similar to the intermediate brackets.

For pedestrian/bicycle trail conversion, two locations of sidewalks east of the lift span will be removed and reconstructed in a ramped configuration to provide handicap access on and off the main deck area. The existing filled steel grid in these locations will be replaced with cast-in-place concrete. The landing at the base of the ramps will be centered over piers 5 and 7 (see Section 6.4.1: Pedestrian crosswalks and Pedestrian ramps on south sidewalk). To accommodate these ramps, approximately 50 feet of sidewalk and the supporting steel beams and brackets will require removal and replacement at each location (Figures R-4 and R-5). New cantilevered brackets and sloping longitudinal beams are required for this modification. Since the new longitudinal beams will be lower than existing beams, they will need to frame into the side of the

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support brackets instead of passing over their tops. New cantilevered brackets will be fabricated with solid web plates to accommodate the new sloping beam connection. Double angles will be used for the horizontal top flanges and diagonal bottom flanges in keeping with the original bracket detail.

#### 6.4.3 Mechanical

The recommended mechanical repairs for preservation include major counterweight system repairs required to maintain lift-bridge serviceability for an indefinite period. These needs are related to navigational requirements and are unrelated to the type of traffic on the bridge. As a pedestrian/bicycle facility, the bridge will require at least the same number of openings for marine vessels that it currently does. These mechanical recommendations assume that the non-destructive testing performed during the stabilization phase does not reveal deficiencies that require replacement of components, particularly the counterweight sheave trunnions, prior to the preservation phase.

##### *Operating cable system*

It is recommended that the operating cables be replaced. Typically, the wire ropes of haul cable systems are replaced as they break, except for times when failure is predicted to be imminent. With systems only using one wire rope in each direction of travel per corner, wire rope wear varies drastically between the haul cables, making it impractical to predict simultaneous replacement of all of ropes.

##### *Counterweight system*

The counterweight cables are old and worn and should be replaced in-kind for safe operation of the bridge. The counterweight sheave trunnion bearing bushings should also be replaced to provide reliable operation. Both of these items were noted in previous reports but were unable to be included in the 2005 rehabilitation. Because the lift span will be operated at least as frequently after vehicular traffic is removed, further rehabilitation beyond the cables and bushings should be made to the counterweight system to provide safe operation for the long term. Considering the age of this structure, rehabilitation should include the replacement of the counterweight trunnions and counterweight sheaves. These major components of vertical lift bridges are historically known to develop fatigue-related failures in older bridges. In compliance with the SOIS, the new sheaves should be designed and constructed similar to the original in shape and size. However, it is recommended they be fabricated from rolled steel plates and steel-ring forgings instead of castings. Fabrication can be performed to create a component that is identical in appearance, but with higher grade materials while being more economical than steel castings.

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#### ***Counterweight guides***

The counterweight guides should be removed. After removal, all pack rust should be removed and the exposed portions of the embedded steel counterweight frame, and the counterweight guides themselves, should be cleaned and prime coated. The counterweight guides should then be reattached, replacing all accessible fasteners.

#### ***Span locks***

Installation of span locks could provide additional safety on the vertical lift span by reducing the probability of unwanted span movement when in the closed position. Span locks use mechanical actuators mounted to the piers to latch the span down. They are not a requirement of the AASHTO Specifications. They are commonly used for lift spans carrying vehicular traffic. With no known incidents related to the absence of span locks on the bridge, and with vehicular traffic being permanently removed at the time of conversion to a pedestrian/bicycle facility, span locks would provide little benefit compared to their cost. The installation of span locks would require modifications to the trusses that would not be in compliance with the SOIS. They are not included in the recommendations.

#### **6.4.4 Electrical**

The electrical items required for preservation deal primarily with lighting and traffic safety systems intended to prevent injury during lift span operation.

#### ***Pedestrian/bicycle traffic safety system***

At conversion, bridge traffic will change from vehicular to pedestrians and bicycles. Safety features will require modification for the new use. Pedestrians and bicyclists can exhibit unpredictable behavior. A protection system is needed that is easily understood and safe for public use. The existing traffic signals and traffic warning gates will no longer be needed and will be removed. A new system is recommended to warn pedestrians and to isolate them from the potential hazards of bridge operation.

When an opening is pending, all pedestrians and bicyclists must leave the lift span (span 4) and the area around the counterweight on the adjacent fixed spans (spans 3 and 5). Visual and audio aids are recommended to alert the public and direct them where to go. A new barrier gate will cordon-off pedestrians and bicyclists.

#### ***Pedestrian gates***

A physical barrier is required across the roadway to prevent access to moving portions of the bridge and the unguarded waterway when the lift span is in operation. A full-depth swing gate is recommended to prevent pedestrian access to restricted danger zones near the counterweights

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and lift span (Figure R-6). A gate of similar material and design as the original 1940 style-swing gate is recommended. An electrical/mechanical operating mechanism for the gate is recommended, rather than the original manual-style mechanism that required the bridge tender to walk to each location before and after each operation.

The recommended horizontal swing barrier pivots an arm 90 degrees in the horizontal plane to block both the roadway and the south sidewalk in the same operation. When not in use, the barrier arm will be stored along the curb line, parallel to the roadway. The recommended location for the gates is just outside the counterweight areas on spans 3 and 5. In adapting the original swing gate plans, it is recommended that the gate be constructed of aluminum tubing welded in the same truss configuration and a chain link mesh should be used as in-fill on the frame. The mechanical operator housing should be as unobtrusive as possible and mounted overhead to the south truss such that it can rotate a single vertical gate capstan.

#### ***Audio aids***

A public address (PA) system should be installed to warn and direct the public to a safe area. Other audio aids should include a gong and emergency call boxes. The PA system should have a pre-recorded message directing the public to the safety zone. In addition to a pre-recorded message, the bridge operator needs the ability to direct the public over the PA system. Speakers should be installed overhead and directed toward the roadway on spans 3, 4, and 5. The speakers should be located near the top chords in locations partially hidden from view.

#### ***Visual aids***

Current traffic signals will be removed to conform to standards for pedestrian and bicycle trails. Two pairs of flashing red lights will be added above each painted stop-bar, near the pedestrian gates, to visually alert the public that a bridge opening is pending. These warning lights will be activated only by the bridge operator. It is recommended that yellow rotating beacons (“Mars lights”) be placed along both the north and south sides of the roadway, mounted to truss members approximately 10 feet above the curb. Six lights would be evenly spaced in span 4 and two lights placed in advance of the pedestrian gate in spans 3 and 5. In addition, flashing alternating dual signals will be placed on the north and south ends of the pedestrian gates in spans 3 and 5.

Signs for directing the public to safety zones prior to the opening sequence are also required. The safety zones should be clearly identified by signage and pavement markings. Signing will be added to spans 3, 4, and 5 to inform pedestrians and bicyclists that they are prohibited from being in the area of the lift span (span 4) and the counterweight areas of spans 3 and 5 during a bridge raise. A 12-inch-wide stop-bar will be painted on the deck five feet to the outside of the closed

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pedestrian gate location, indicating a safe area for pedestrians and bicyclists to queue during bridge operations. A “STOP HERE ON RED” sign will be added near the stop-bar and a stop sign mounted on the pedestrian gate as indicated in Figure R-9.

#### *Lighting*

Light fixtures must meet SOIS as well as standards for safety lighting included in the Mn/DOT Bikeway Facility Design Manual. The preferred light source for all fixtures is LED units, as this technology uses less energy than conventional light sources, requires less maintenance, and allows greater flexibility for managing light levels and directing light.

#### *Ornamental lighting*

The original ornamental lights at the concourse are made up of four primary components: the pole, the globe, the lamp holder, and the fixture. The pole is the decorative support for the lamp holder, globe, and fixture. The lamp holder is the decorative cast iron portion at the top of the pole on which the globe and fixture are mounted. The globe protects the fixture and lamp holder and provides glare control. The fixture includes the socket for the lamp and the ballast. Ornamental lights similar to those at the concourse were previously mounted to the newel posts along the bridge sidewalk railing. These were removed in the past, and plates were welded over the tops of the newel posts where the light poles were previously bolted.

The original components of the ornamental lights were manufactured by Union Metal Corporation of Canton, Ohio. These poles and lamp holders are still manufactured by this company. The original light fixture and alabaster globe are no longer available, but the style is a common “Acorn” fixture that has been re-created by multiple manufacturers and is readily available. Current globes are typically made of polycarbonate or acrylic, which are resistant to breakage and vandalism, although some glass models are still available. The acrylic types are available in a frosted, smoked, or white model. For either the acrylic or polycarbonate globes, a hand-painted faux finish would be applied to suggest the appearance of the original alabaster.

Incandescent lamps were used in the original fixtures. At the time this report was prepared, incandescent lamps were used in limited applications, primarily indoors, due to their short life span and inefficiency. Most current outdoor lighting applications utilize high pressure sodium or metal halide lamps for illumination. Both types are much more efficient and provide a much longer life than incandescent lamps. The primary difference between the two is the color of the light. High pressure sodium lamps last slightly longer but have a yellowish tint and do not render most colors well. Metal halide lamps produce a whiter light and have a high color rendering index, which makes objects appear more natural looking. The most current lamp technology available is LED. This source is available in a variety of white light color temperatures and is an

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“instant on” type of lamp, with the capability for dimming. Manufacturers are now making retrofit/inserts for acorn-style, post-top fixtures. This type of fixture would provide the most flexibility in control and is recommended for use on this project. Modern fixtures are designed with better optics to distribute the light more accurately to the area to be illuminated, and can also eliminate uplight and stray light to meet dark sky and light trespass objectives.

The ornamental lights, including those at the concourse, contribute to the overall historic character of the bridge. However, due to their deteriorated condition, the original light standards must be replaced. It is recommended that new poles, lamp holders, fixtures, and globes replace the ornamental lights on the concourse and also be provided for mounting on the existing concrete railing at Pier 2 and on the existing newel posts along the bridge sidewalk. Any new poles and lamp holders will use original materials and details by using the original manufacturer and original molds. Fixtures and globes will be similar to the originals but use modern materials. New poles will be mounted to the original newel posts on the bridge by drilling and tapping into the welded top plates for anchor bolts. The top plates will also require a central field-drilled hole to accommodate internal wiring passing up through the newel post and into the light pole.

Prior to reinstallation on the concourse, new conductors will be installed internal to the concrete balustrade rail posts to reinstate the original method of hidden wiring. This will be accommodated by either “rodding out” the original embedded conduit or by core-drilling new holes down from the top of the concrete posts within the “footprint” of the light pole to create a wire chase that extends down below the sidewalk elevation. New conduit will be buried beneath the concourse sidewalks such that the existing external conduit (installed in 1980) on the face of the concourse walls can be removed.

#### *Functional lighting*

The existing three cobra-head-type fixtures mounted along the top chords in each of the seven truss spans will be removed. The lighting requirements will change after conversion to a pedestrian/bicycle facility. Replacement ornamental lights along the sidewalk will not provide enough light to illuminate the trail at night. LED area lights with the capability of multi-level control are recommended to replace the cobra heads. The LED area lights will allow for varying light levels for the various activities along the bridge. Unlike high intensity discharge (HID) sources, LED fixtures are “instant on” fixtures that do not require a warm-up period to full light output. These fixtures would also supplement the light provided by the ornamental lights along the bridge sidewalk. During periods of no pedestrian or bike traffic, the LED area lights could be partially or totally turned off, leaving a minimal ambient light level.



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At night, lighting requirements increase during the period of a lift-span operation. During a bridge lift, the roadway and sidewalk must be adequately illuminated for the bridge tender to clearly view pedestrians in the vicinity of the lift span. For safety, the bridge tender must know that everyone is in the safe areas behind barriers before proceeding with an operation. To accomplish this, additional area lighting will be directed toward the roadway. These lights will only be turned on prior to and during an opening by the operator. LED fixtures are also recommended for this application due to their “instant on” capability. The additional fixtures will be placed near the lift span and pedestrian gate area. When the lift span is not in operation, the additional LEDs would be turned off. The remaining light output will be adequate for pedestrians and bicyclists.

The new area light fixtures will be mounted at the upper chord cross bracing intersection point, directly over the trail. The fixtures will be directed down toward the roadway deck. Each span will have three fixtures mounted at panel point locations U1.5, U3.5 and U5.5. Additionally, spans 3 and 5 will have two fixtures near their ends abutting span 4: one on the south side and one on the north side.

#### **Conduit**

In the 1980s electrical conduit was installed on the south face of the truss spans. It is approximately 10 feet above the sidewalk and obscures the configuration of the Parker trusses, which are character-defining features. The original conduits from the earliest electrification were installed underneath the sidewalk, where they were only visible from below the bridge. In 1953, as electric traffic gates and signals were installed, additional conduits were introduced. In 1980 the bridge was completely rewired and new controls were installed. At that time the conduit above the sidewalk was installed and the cobra head roadway lighting was put in place. Less visible conduit also exists on the top of the truss spans, used for the roadway lights and controls on the vertical lift span. During the 2005 rehabilitation, cabinets and elevated platforms were removed from the traffic gate areas on both sides of the lift span. However, most of the conduit was reused with new conductors pulled through them. Conduit that passes between trusses on the west side of the vertical lift span was part of later installations. This conduit is not adequately supported by an expedient rigging (Photo E-6 in Section 5).

In compliance with SOIS, it is recommended that the conduit along the south face of the truss spans be relocated below the sidewalk deck as much as possible. Where conduit is required on the spans, attempts should be made to conceal it from view within the truss elements.

#### **Closed circuit television system**

A closed circuit television system (CCTV) with video cameras is a recommended safety improvement to aid the bridge operator in locating pedestrians and verifying their locations behind

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warning gates and away from the moving components of the bridge. Blind spots in the overhead truss structure, depth perception issues, and reduced visibility at night for the operator indicate the need for cameras. Thermal imaging cameras detect thermal (heat) images that are easily viewed in daylight or darkness. The images remain visible when individuals are partially obstructed by steel column members.

Two cameras should be installed on span 3 and two cameras on span 5. The cameras near the lift span end of the approach trusses will be pointed toward the lift span for viewing the lift span's deck area when the bridge is closed and the waterway when the bridge is open. The cameras on the far ends of spans 3 and 5 should also be directed towards the lift span to provide a view of the deck areas of spans 3 and 5, particularly the area around the pedestrian swing gates.

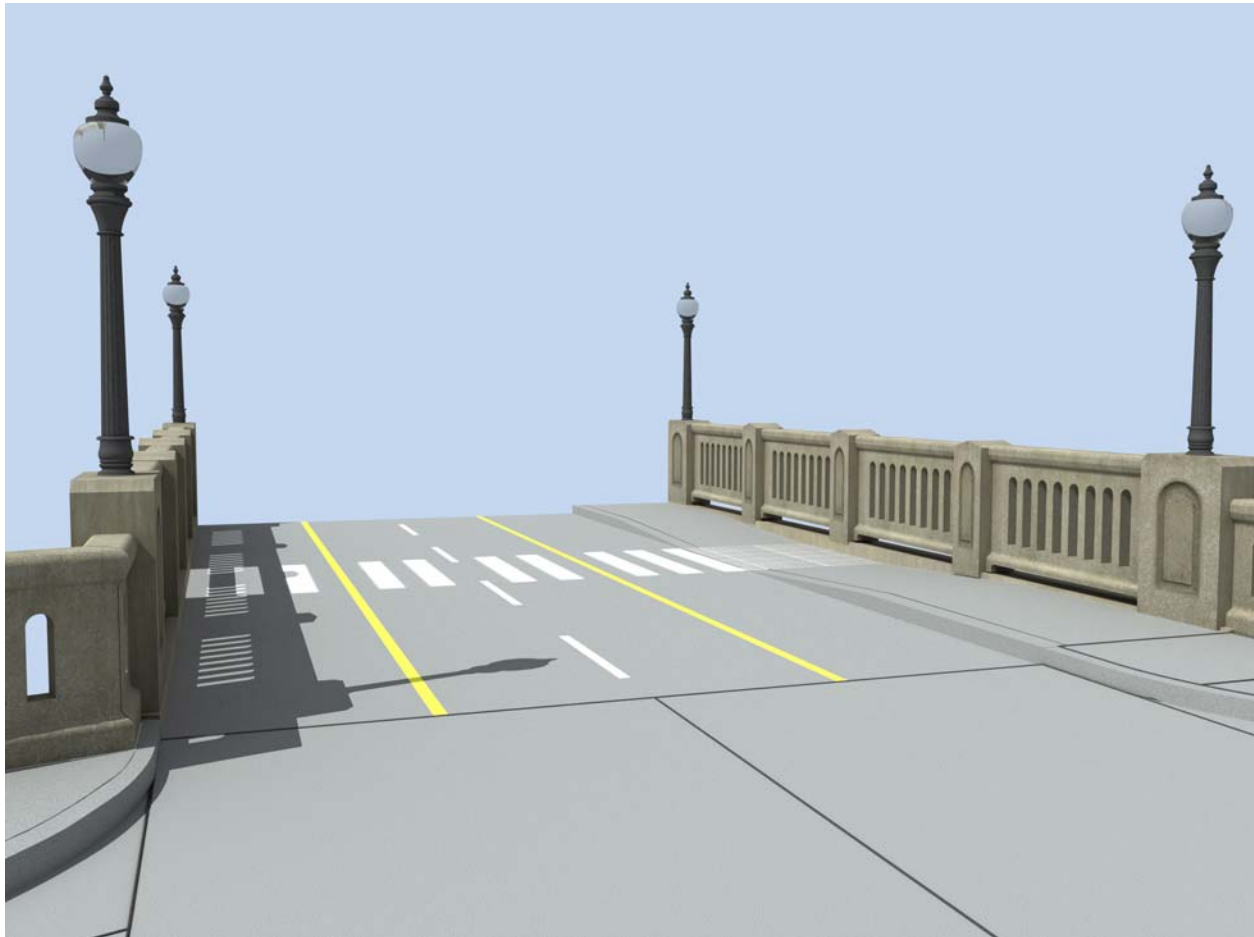
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*The following renderings are not intended to show all features, but only specific features as indicated in captions.*



**Figure R-2.** URS rendering showing pedestrian and bicycle lane markings and crosswalk markings on bridge. The centerline of the bike trail will follow the existing centerline of the vehicular roadway.

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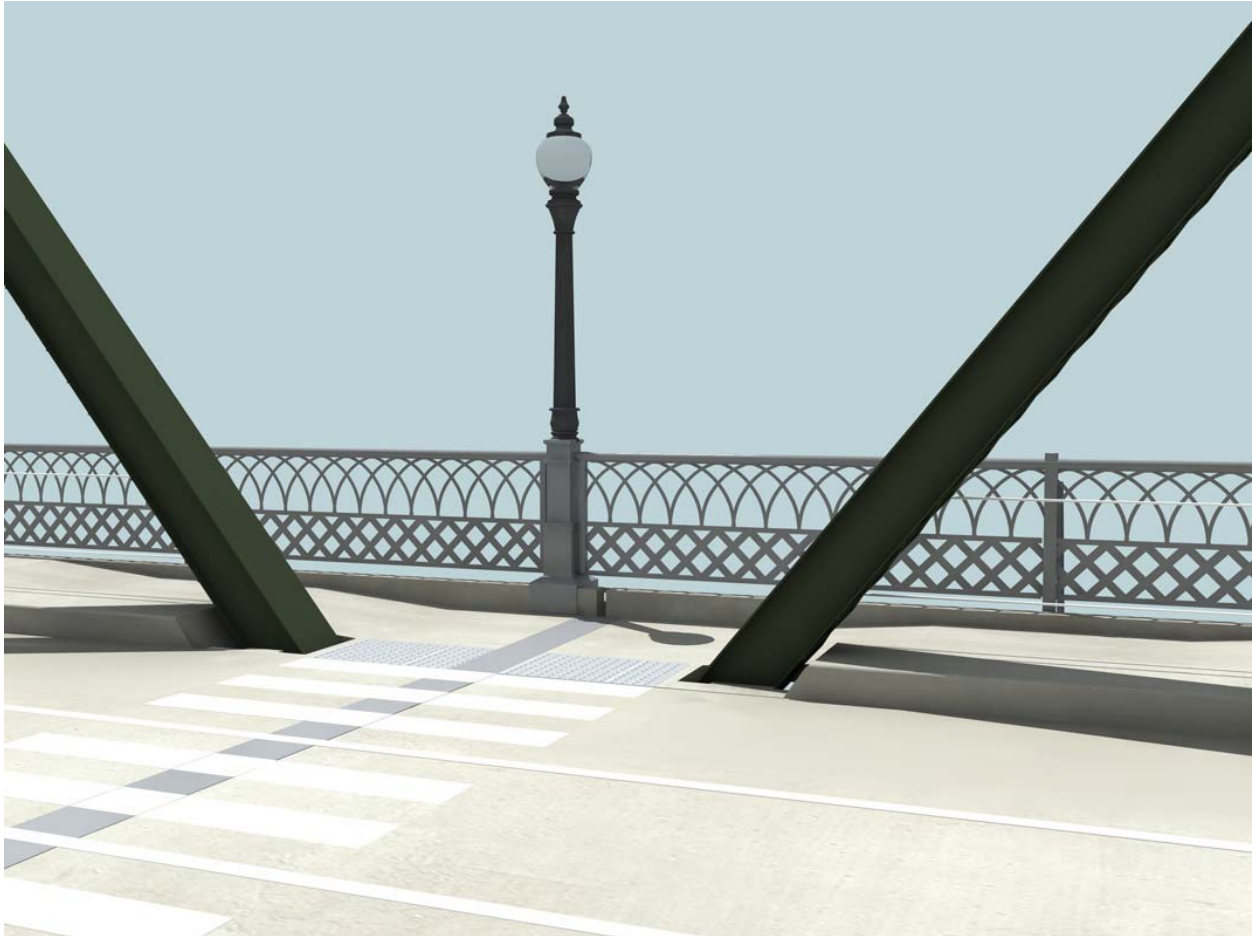
**Figure R-3.** URS rendering showing plan for bollards and cables at truss openings where no crosswalks are planned.

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**Figure R-4.** URS rendering showing plan for lowering of sidewalk to provide access to main deck at pedestrian crosswalks.

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**Figure R-5.** URS rendering showing plan for structural modifications to the stringer and bracket system beneath the sidewalk required to create ramps at two of the pedestrian crosswalks.



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**Figure R-6.** URS rendering of proposed swing gate to prevent access to restricted danger zones near the counterweights and lift span.

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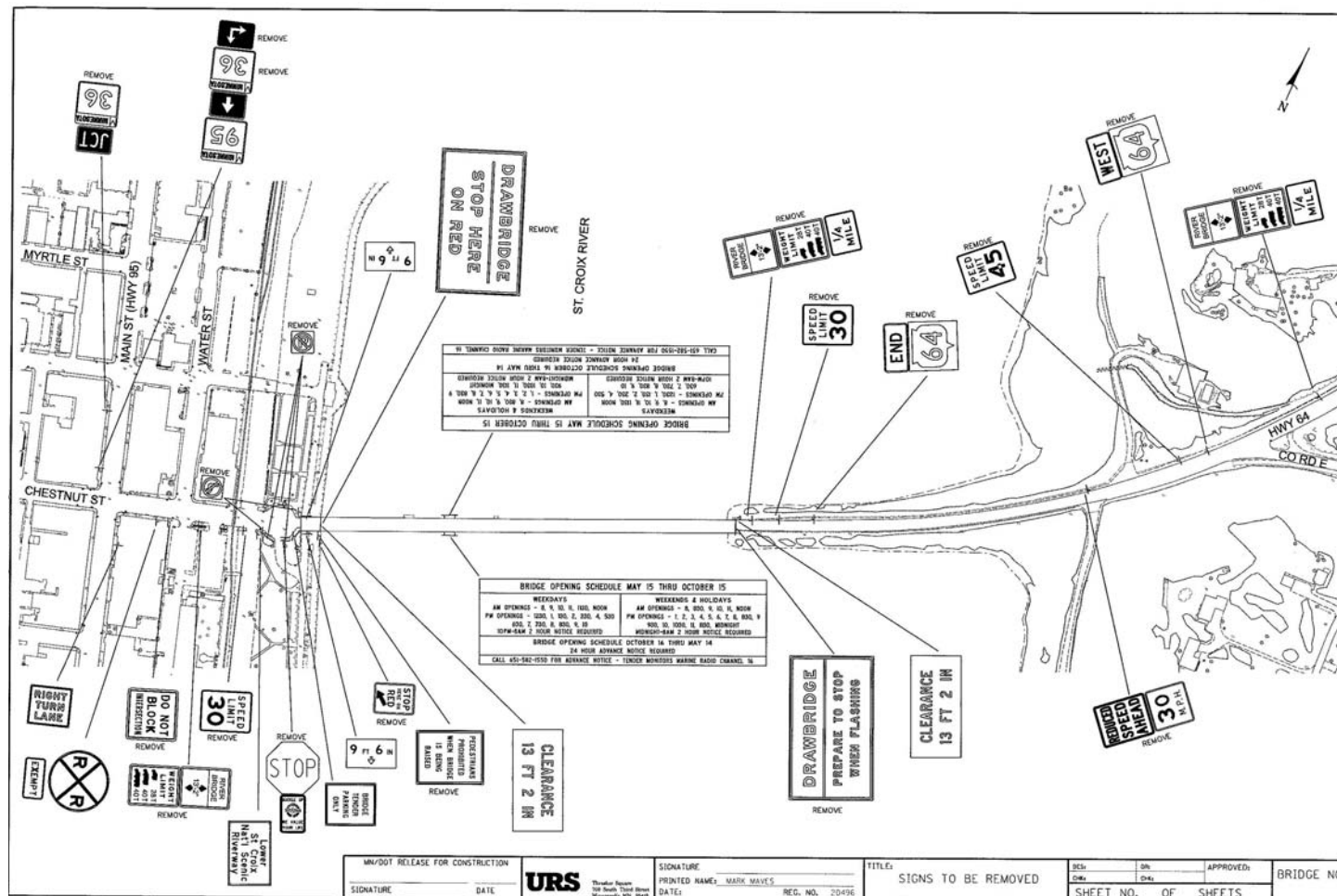
**Figure R-7.** URS rendering showing plan for cable barrier along north rail of bridge.



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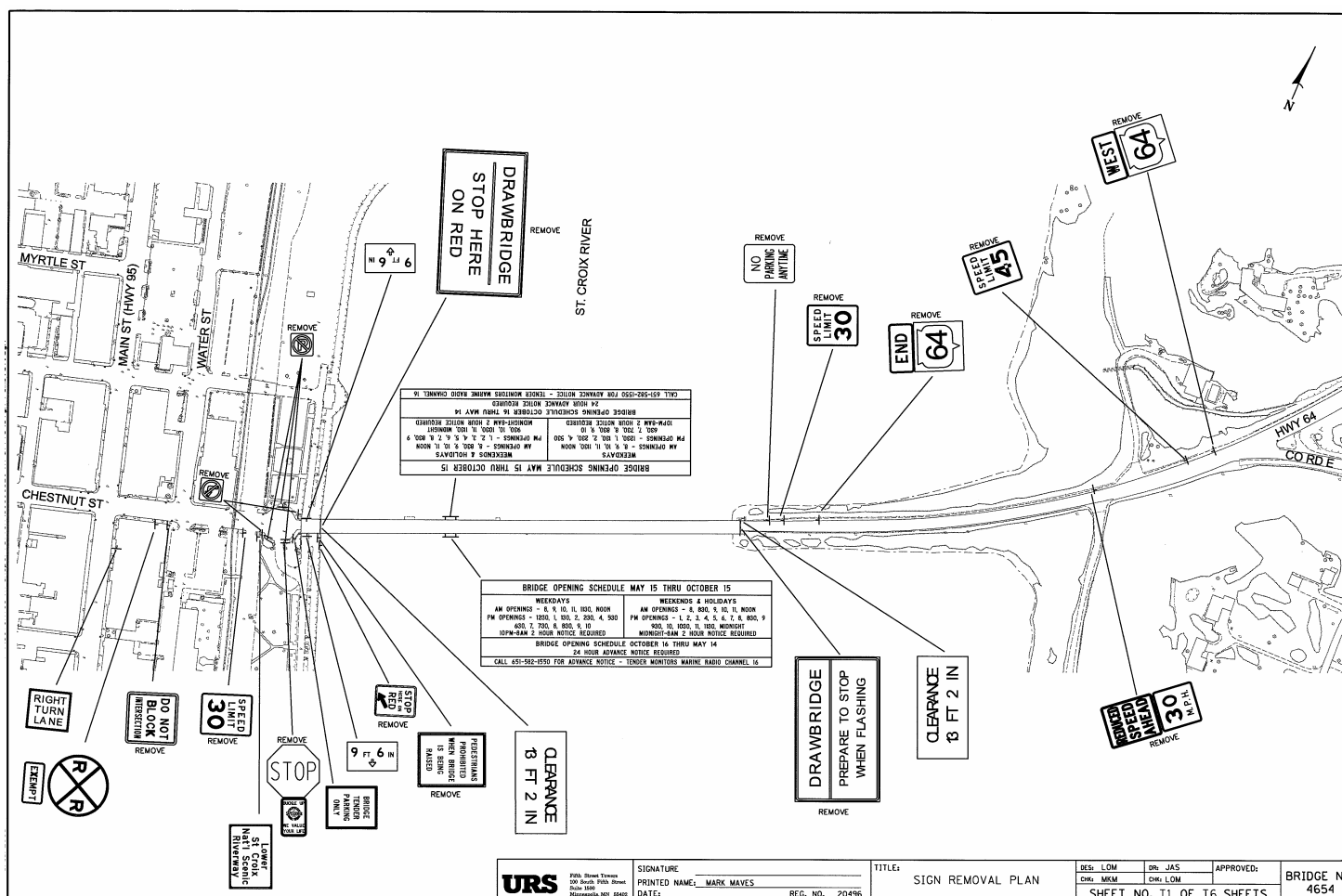


**Figure R-8.** Existing signage on and approaching bridge. Signs that are proposed for removal during the conversion are noted.

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**Figure R-9.** Proposed plan for signage on concourse and bridge following conversion (sheet 1 of 2).

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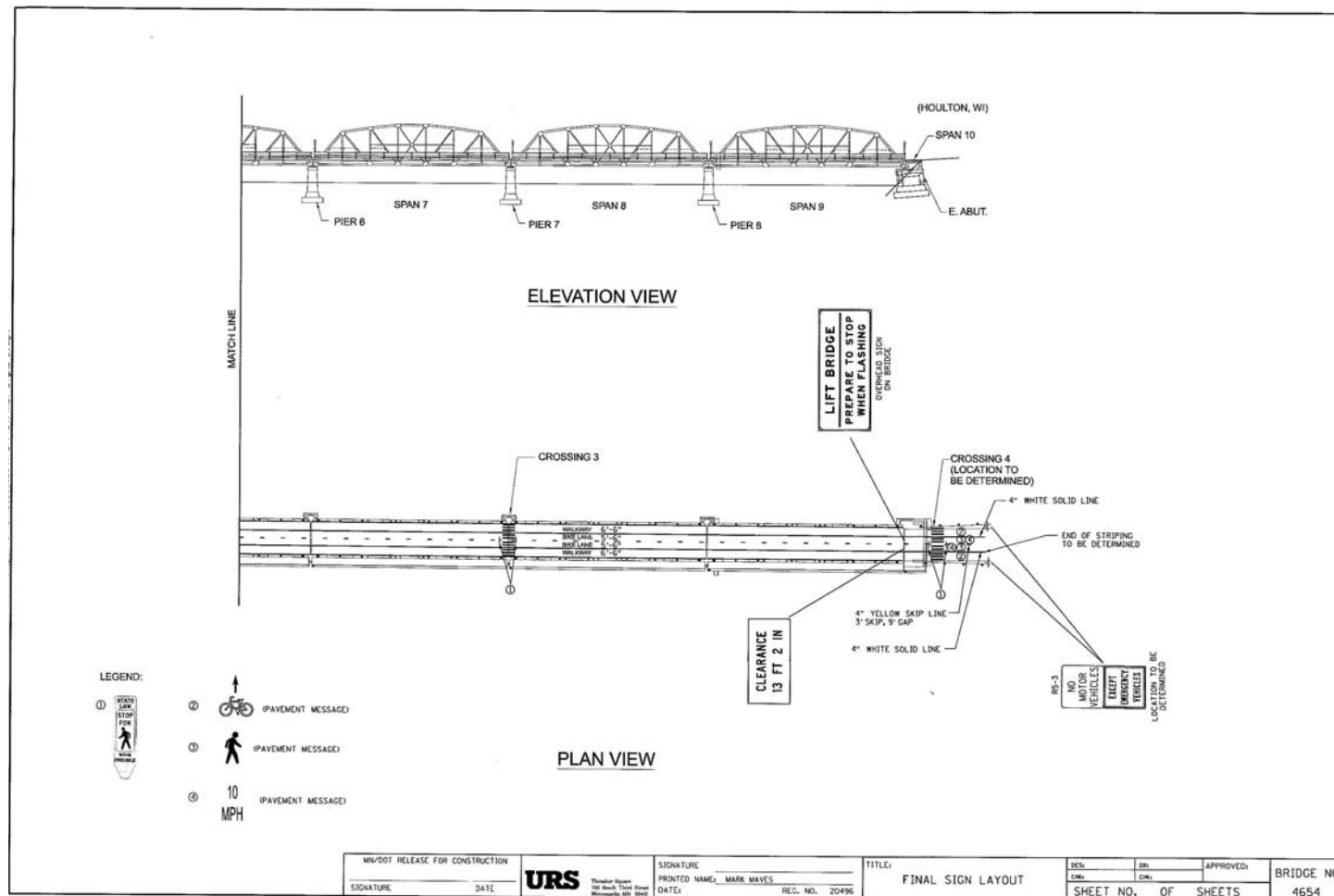


Figure R-10. Proposed plan for signage on concourse and bridge following conversion (sheet 2 of 2).

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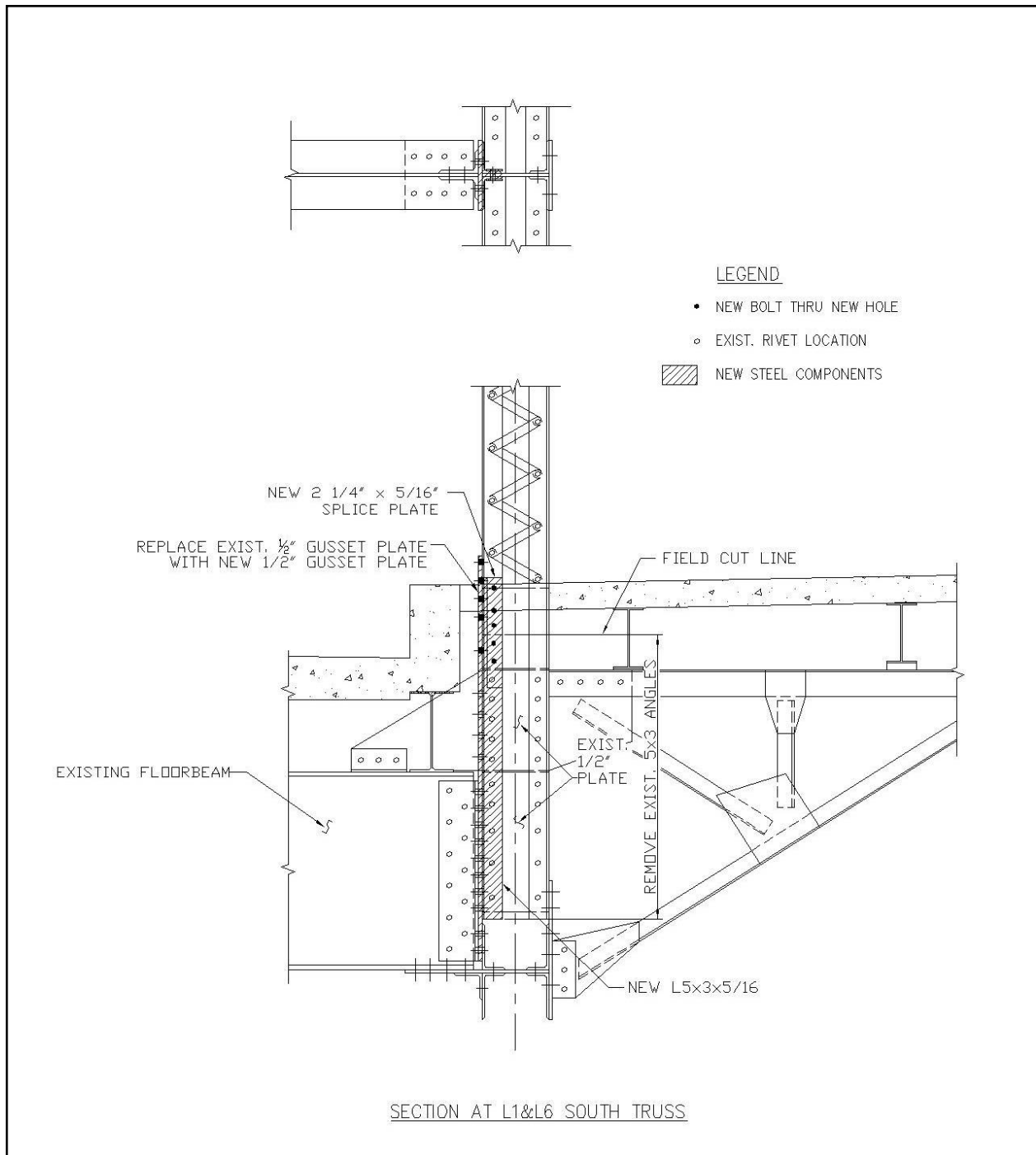


Figure R-11. Detail of suggested repair at L1 and L6 on the south truss.



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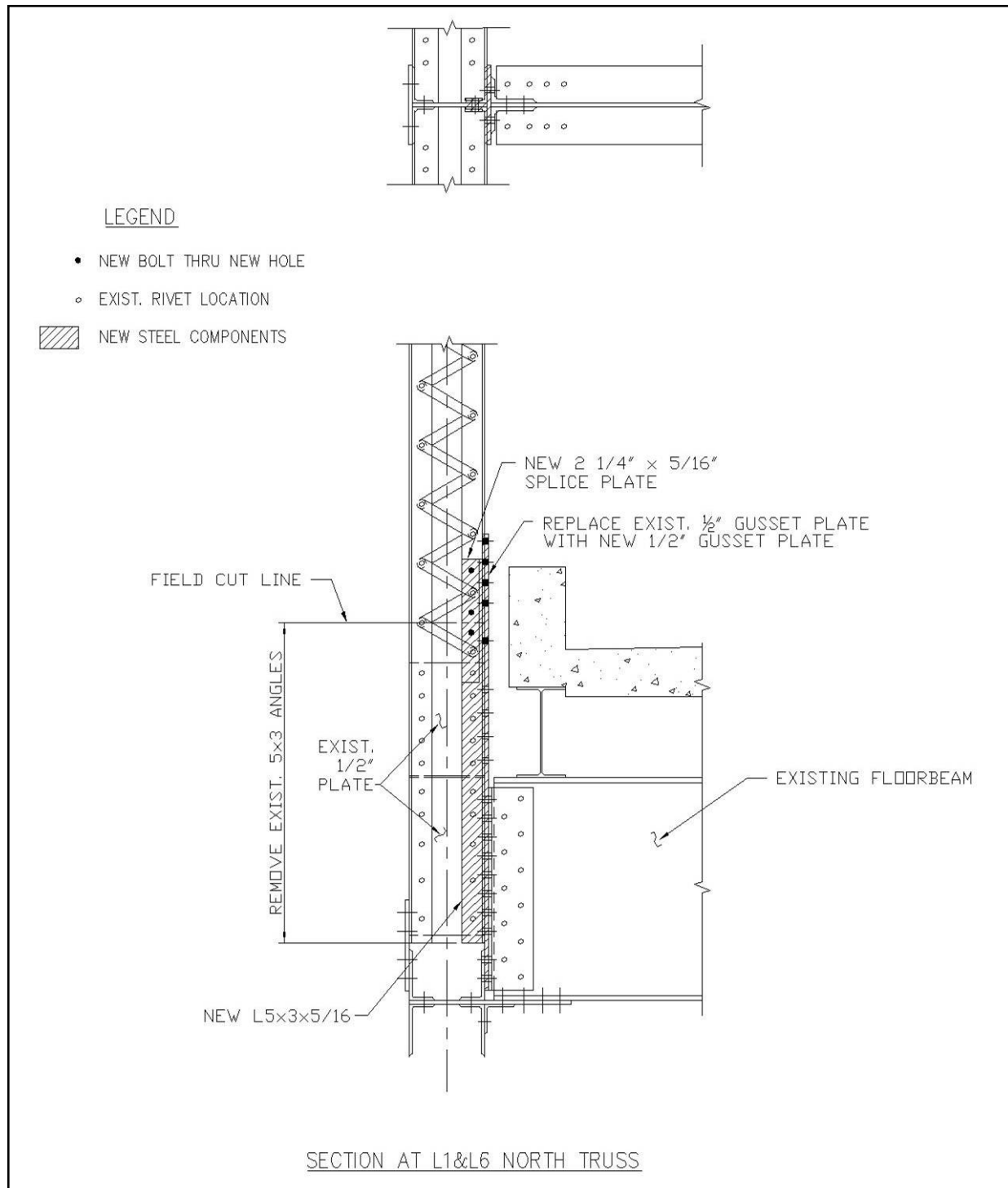
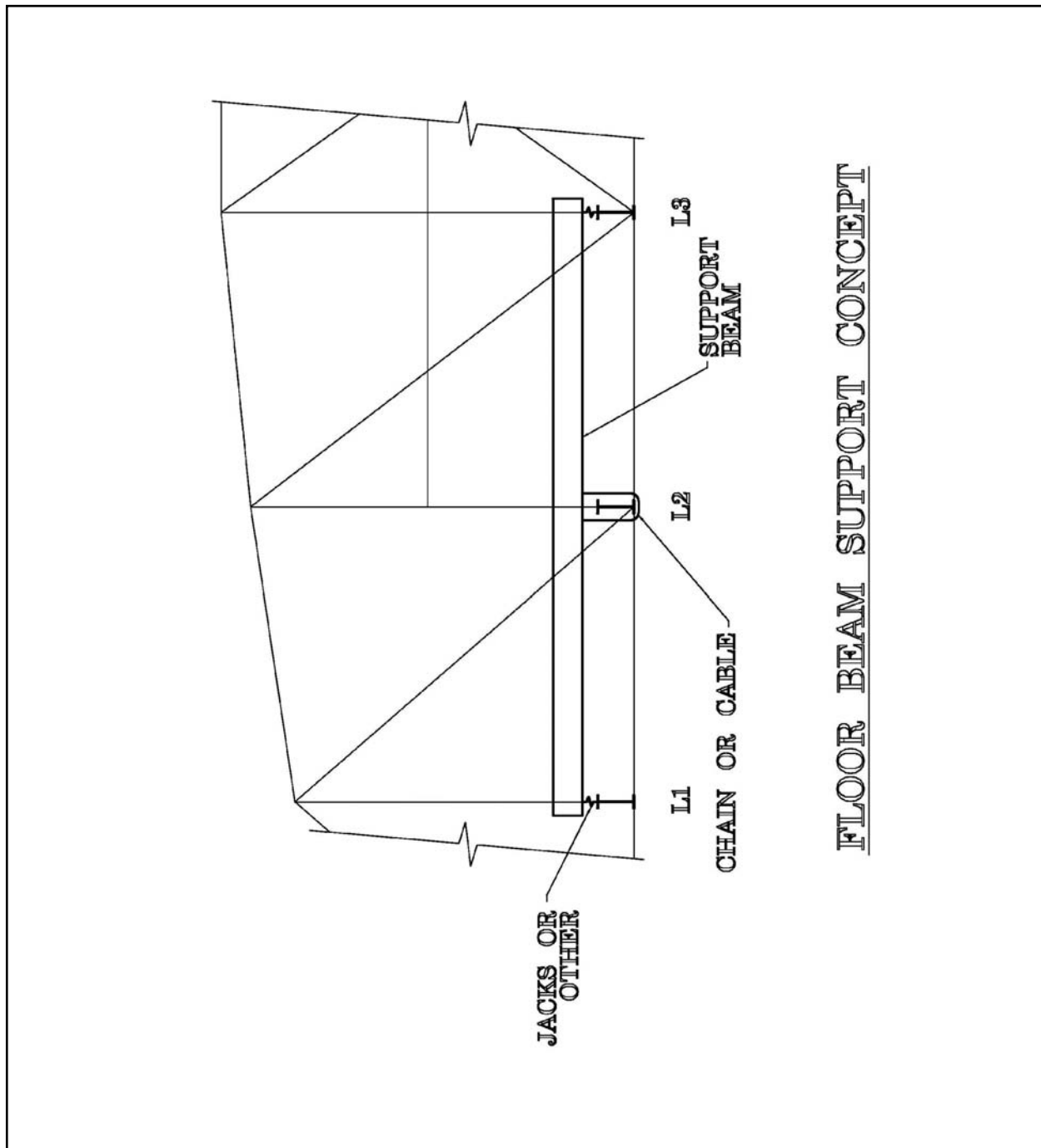


Figure R-12. Detail of suggested repair at L1 and L6 on the north truss.

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**Figure R-13.** Concept for temporary support of floor beam during repair of gusset plates and vertical angles.

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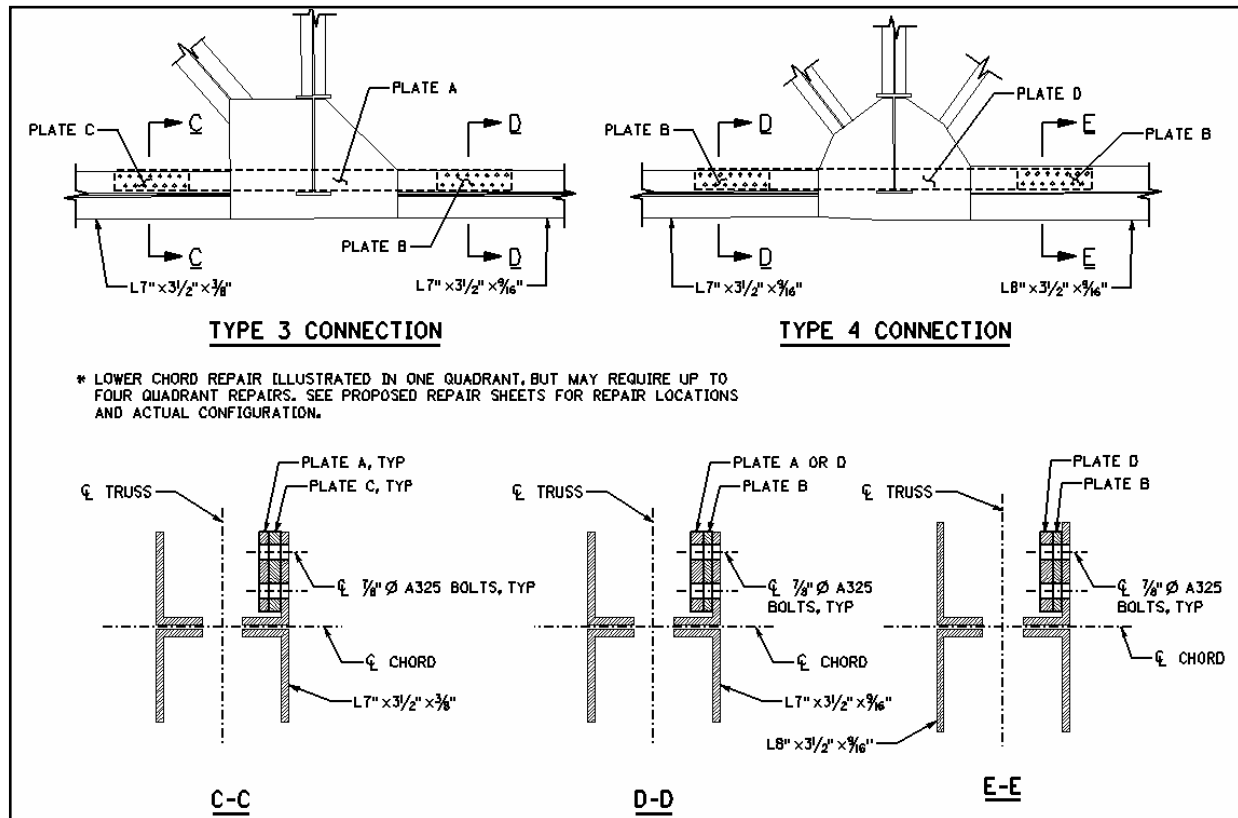


Figure R-14. Detail of repairs to lower chord.

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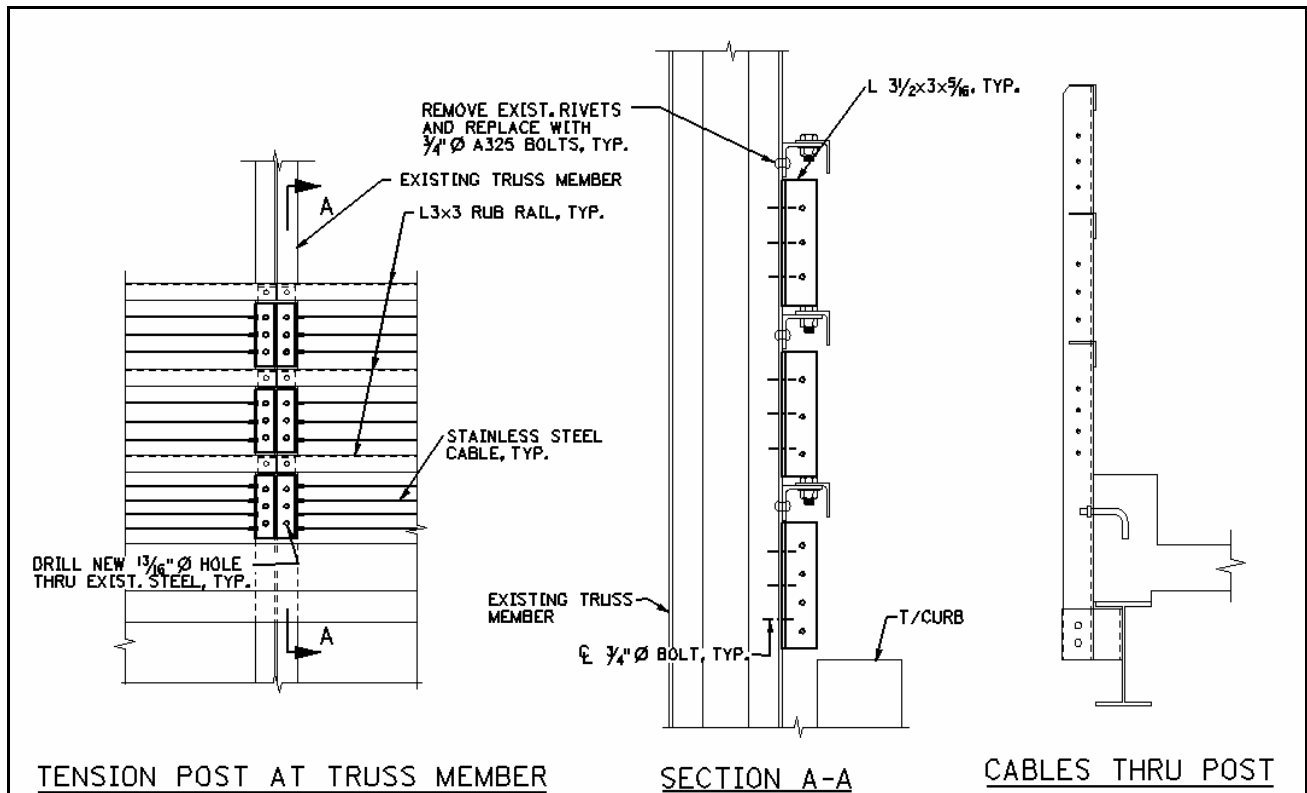


Figure R-15. Elevation view of cable arrangement on north rub rail.

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#### 6.5 Recommended maintenance activities

Routine maintenance is the ongoing work required to prevent and control the deterioration of the bridge components. Because the Stillwater Lift Bridge is movable, and includes complex structural, mechanical, and electrical elements, maintenance is more involved and plays a more critical role than for bridges with fixed spans. Lack of maintenance on moving parts and electrical components can lead to sudden failures in operation, disruption to river navigation, dangerous conditions, and very costly repairs. Routine maintenance activities will be conducted as per the MOA.

Maintenance activities are identified as part of a Mn/DOT Maintenance Implementation Program for selected historic bridges and as part of Mn/DOT's general program for historic bridges owned by the state. As such, the Maintenance Implementation Program includes any special maintenance requirements for historic bridges, particularly recommendations prepared in compliance with the SOIS. To effectively carry out the Mn/DOT Maintenance Implementation Program, a maintenance checklist has been prepared for the Stillwater Lift Bridge and is included in Appendix C. This checklist includes the routine maintenance tasks identified below along with the agency responsible for each task, and lists the tasks to be performed in each of the first seven years following preservation efforts. This constitutes a seven-year maintenance cycle, which will be repeated throughout the 42 years following preservation.

Mn/DOT anticipates that the boxes on the checklist will be marked by the appropriate agency as tasks are completed and the list submitted to the Mn/DOT Cultural Resources Unit (CRU) for review. It is anticipated that the maintenance tasks and checklist will be evaluated by Mn/DOT CRU at the end of the each seven-year cycle to assure that the tasks and list are appropriate for the ongoing needs of the bridge.

##### 6.5.1 Structural maintenance

Structural bridge maintenance includes routine maintenance and minor component repairs. Routine maintenance includes activities that are regularly scheduled regardless of bridge condition. Minor component repairs include repairs or replacements of individual components due to normal wear, or from damage caused by normal bridge operations, such as vehicular impact to bridge railing or bridge members. A routine maintenance schedule that is rigidly adhered to offers the greatest amount of protection over time against any potential component failure.

##### ***Structural routine maintenance schedule***

Routine maintenance involves all routine bridge inspections and preventive-type, recurring maintenance procedures.

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#### Structural Routine Maintenance Schedule

Item	Frequency
Annual structure inspection	Annually
In-depth inspection	Every 4 <sup>th</sup> year
Underwater inspection	Every 5 <sup>th</sup> year
Sweep cleaning bridge decks	Annually
Flushing and power-washing bridge deck, drains, and joints	Annually
Lubricate bearing assemblies	Annually

#### ***Structural component repair***

Component repair involves non-recurring preventive maintenance procedures and potential minor repairs or replacements, such as the following:

- Sealing bridge deck cracks
- Spot cleaning and painting of structural steel components.
- Bridge railing repairs
- Settlement adjustment of spans 9 and 10 at east abutment
- Channel debris removal or slope/streambed repairs
- Concrete surface repairs
- Miscellaneous structural steel repairs
- Replace expansion joint strip seals

#### **6.5.2 Mechanical maintenance**

##### ***Drive machinery***

Frequent preventive maintenance activities for the drive machinery include lubricating the bearings, lubricating the open gearing, and routine cleaning of the operating ropes. Less frequent preventive maintenance activities for the drive machinery include: cleaning, flushing and refilling the speed reducers, cleaning internally and re-lubricating the sleeve bearings, application of wire rope dressing to the operating wire ropes, testing and adjusting the brakes, and maintenance spot painting of the drive machinery components.



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#### ***Counterweight system***

Preventive maintenance activities related to the counterweight system include: exchanging the lubrication in the trunnion bearings, applying lubrication (wire rope dressing) to the counterweight cables, and inspecting the counterweight cables, trunnions, bearings and sheaves, and cable connections for damage.

#### ***Mechanical routine maintenance schedule***

This involves all routine bridge inspections and preventive type recurring maintenance procedures.

**Mechanical Routine Maintenance Schedule**

<b>Item</b>	<b>Frequency</b>
In-depth inspection (all drive machinery and counterweight system machinery, including wire rope connections)	Annually
Lubricate drive machinery bearings	Monthly
Open drive machinery sleeve bearings, clean old dried lubricant and re-lubricate.	Annually
Lubricate open gearing	Monthly
Remove all lubricant and debris from open gearing and re-lubricate.	Annually
Wipe operating ropes clean to remove debris and apply wire rope dressing/lubricant to operating ropes	Semi-annually
Replace operating ropes	As-necessary, or predictive every 7+/- years
Remove coupling covers, wipe clean and replace lubricant	Every 5 <sup>th</sup> year
Flush and replace lubrication in speed reducers	Every 5 <sup>th</sup> year
Remove and replace lubricant in counterweight sheave bearings. Clean and remove debris when empty.	Annually
Wipe counterweight cables clean to remove debris and apply wire rope dressing/lubricant to counterweight cables	Semi-annually
Clean, remove standing water, spot-paint and inspect the general surfaces and potential fracture points of the counterweight sheaves and other machinery components.	Annually

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#### Mechanical Routine Maintenance Schedule

Item	Frequency
Apply protective coatings to haul cable take-ups, free and lubricate as required for use. Maintain the take-up assemblies in a condition where they can be used when needed.	Semi-annually
Spot paint machinery where steel surfaces have been exposed.	Annually

#### ***Mechanical component failure***

Operating wire ropes, haul cables, and wear plates should be replaced when they fail or when it is noted that failure is imminent.

#### **6.5.3 Electrical maintenance**

Electrical maintenance on a movable bridge is divided into routine maintenance, component failure, and component obsolescence. Routine maintenance is used to identify and predict potential problems and to repair and maintain equipment at regular intervals to extend its life. Component failure occurs when a device fails from a manufacturing defect, age, or a lack of routine maintenance. Much of the electrical equipment used to control a movable bridge requires no maintenance and is not repairable, so it must be replaced. Component obsolescence occurs when a component is no longer available or cannot be maintained or repaired.

#### ***Electrical routine maintenance schedule***

Most electrical equipment requires little-to-no maintenance. Motors and brakes will require some lubrications and inspection, but most of the other electrical equipment works until failure. The electrical maintenance will consist of predictive maintenance through inspections, testing, and maintaining accurate records. For electrical equipment, maintenance should only be performed by qualified electricians.

#### Electrical Routine Maintenance Schedule

Item	Frequency
Megger and record insulation resistances of all motors	Annually
Inspect armature brushes on DC motor and DC tachometer. Replace as needed.	Annually
Lubricate main drive and auxiliary drive motor bearings	Annually
Inspect festoon cables and sheaves. Lubricate sheaves	Annually

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#### Electrical Routine Maintenance Schedule

Item	Frequency
Control console & PLC cabinet – Inspect and clean. Inspect wiring and tighten all connections.	Every 3 months during operational season
Motor control center – Inspect and clean.	Annually
Main drive controller – Inspect and clean.	Annually
Warning and navigation lighting – Inspect once a month, re-lamp/repair as needed.	Monthly during operational season
Bridge roadway & sidewalk lighting - Inspect once a month, re-lamp/repair as needed.	Monthly during operational season
Spring start-up – Inspect all equipment and test for proper operation. Verify all interlocks are working properly	Annual - Spring, Prior to May 15 <sup>th</sup>
Fall shutdown – Inspect all equipment and test for proper operation. Verify all interlocks are working properly. Prepare equipment for very limited operations prior to winter.	Annual - Every Fall
Pedestrian gates (when installed at conversion)- Inspect and check oil levels, brakes, lights, and general condition of the equipment	Monthly
Traffic gates (before removal at conversion) – Change transmission oil and lubricate flange bearings.	Annually

#### **Electrical component failure**

Many electrical components are non-repairable or are not cost effective to repair. When a component fails, it must be replaced. Commercially available electrical devices such as relays and starters are designed for more operations than a movable bridge system would typically require in a 50-year lifetime. However, these components usually fail due to abnormal conditions such as excess loading from lightning, surges, heat, or other defective devices. Electronic devices are very similar in that their operations will more than exceed the life of the bridge, but they are subject to the same abnormal conditions and it is difficult to predict their failure.

#### **Electrical component obsolescence**

Motors, brakes, circuit breakers, fuses, starters, and relays are a proven technology required to move, control, and interface to equipment that will likely never become obsolete. Other technologies used on the bridge, such as the PLC and main drive, are subject to change rapidly and could become obsolete in a matter of years. Fortunately, most electrical suppliers continue

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to support their older technology or provide a migration path for their equipment as it becomes obsolete. Items such as a PLC and a DC motor drive typically become obsolete within 10-30 years and, once spare parts are no longer available, they will require replacement.

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### Section 7 – Projected Agency Costs

## 7.0 Projected Agency Costs

### *Qualifier statement*

The opinions of probable costs provided below are in 2008 dollars. The costs were developed based on preliminary (60 percent) plans and are based on the tasks recommended in Section 6.0 using engineering judgment and/or gross estimates of quantities and historic unit prices, and are intended to provide a programming level of estimated costs (actual costs may vary significantly from those opinions of cost provided herein). Probable costs may be refined upon completion of final plans. The estimated preservation costs include a 20 percent contingency and five percent mobilization allowance of the preservation activities, excluding soft costs.

For itemized activity listing and costs, see Appendix G.

### 7.1 Summarized costs

#### Stabilization activities:

Superstructure	\$4,000
Substructure	\$0
Railings	\$25,000
Deck	\$0
Other	\$0
Mechanical	\$51,000
Electrical	\$5,000
TOTAL	\$85,000

#### Preservation activities (at time of conversion<sup>†</sup>):

Superstructure	\$3,207,225
Substructure	\$558,920
Railings	\$128,007
Deck	\$79,903
Other	\$718,463
Mechanical	\$1,870,500
Electrical	\$707,395
TOTAL	\$7,270,413

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<sup>†</sup> Some preservation activities may occur prior to conversion, if deemed necessary by Mn/DOT.

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### Section 7 – Projected Agency Costs

Operations costs: \$95,600 annualized, through 2055

Routine maintenance costs: \$71,128 annualized, through 2055

Future preservation activities (annualized, through 2055)

Substructure	\$27,845
Superstructure – truss spans	\$73,671
Superstructure – span 10	\$257
Sidewalk support system	\$786
Deck	\$8,395
Railing	\$2,571
Support system	\$843
Balance system	\$11,024
Distribution/control system	\$5,357
Traffic control system	\$214
Machinery/tender's house	\$243
Bridge lighting	\$400

Component failure \$51,488 annualized, through 2055

### 7.2 Applicable funding

Stabilization activities will be performed by Mn/DOT as owner and operator of the bridge (see MOA Stipulation III.A). Funding provisions for preservation activities are outlined in MOA Stipulation III.E.1: “Mn/DOT will cover the cost of rehabilitation up to \$7 million. Mn/DOT expects to secure funding for this rehabilitation project from a combination of eligible state and federal funding sources. If rehabilitation costs exceed \$7 million, Mn/DOT, in consultation with the SLBAC, will seek the additional funds required.” MOA Stipulation III.C. states: “FHWA will not obligate funding for the Project until it is in receipt of the final Stillwater Lift Bridge Management Plan from Mn/DOT.” Funding for operations and routine maintenance will be provided through the endowment fund (see MOA Stipulation III.D. and Section 8).

Mn/DOT's Draft Statewide Bridge Program identifies that construction of the new St. Croix River Crossing will begin in 2013. The previous Mn/DOT plan stated that construction would begin on the new crossing on or after 2024. The new crossing is expected to take three years to complete. Per the MOA, the Stillwater Lift Bridge will be converted to pedestrian/bicycle use following completion of the new crossing. Mn/DOT's Draft Statewide Bridge Program also notes that the St. Croix River Crossing, as a border bridge, is a shared responsibility with Wisconsin. Because Wisconsin has a role in the new project, the 2013 construction date is a starting point of Minnesota's discussions with Wisconsin. The new 2013 date, while preliminary, demonstrates Mn/DOT's ability to fund the new crossing in this timeframe.



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### Section 7 – Projected Agency Costs

#### 7.3 Special funding note

As stated in MOA Stipulation III.D.4, “Revenues from the operations and maintenance account [i.e. the endowment fund] are not eligible for use in major repairs/rehabilitation or other capital improvements to the Stillwater Lift Bridge.” To provide funding from the endowment fund for the future preservation and component failure activities (see Section 7.1 and Appendix G), MOA Stipulation III.D.4 could be amended as suggested in the *Stillwater Lift Bridge Endowment Fund Analysis Report* (see also Section 8.0 and Appendix I).



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### Section 8 – Endowment Fund

## 8.0 Endowment Fund

The *Amended Section 106 MOA for the St. Croix River Crossing Project* requires the establishment of an endowment to fund operations and routine maintenance for the Stillwater Lift Bridge after its conversion to pedestrian and bicycle use. The endowment will also fund the demolition of the bridge once its service life is over. Mn/DOT will retain ownership of the bridge after the conversion, preserving it according to the SOIS.

To proceed with the development of the Stillwater Lift Bridge Endowment Fund, Mn/DOT officials should first develop a preferred arrangement for ownership and management of the Stillwater Lift Bridge. This should address near- and long-term expectations of ownership and should anticipate potential shifts in management responsibilities.

Mn/DOT should then draft preferences for the structure of the endowment based on the discussion in the *Stillwater Lift Bridge Endowment Fund Analysis Report*, which is presented in its entirety in Appendix I. Preferences should be based on Minnesota statutory requirements and restrictions identified in consultation with Mn/DOT legal counsel and a Certified Public Accountant.

Based on the expected ownership arrangement and preferences for the structure of the endowment, Mn/DOT should work with the Legislative Liaison and legal counsel to develop enabling legislation that addresses those expectations and preferences.

#### ***Summary of steps toward drafting enabling legislation:***

- Introduce the project to the Mn/DOT Legislative Liaison
- Introduce the project to the Mn/DOT legal counsel
- The Legislative Liaison and legal counsel draft a bill that stipulates the structure of the endowment
- Identify legislator(s) who will sponsor the legislation and introduce it in the state legislature
- The legislative sponsor(s) will introduce the bill during 2009 legislative session

The table below summarizes key features of the three trustee options based on research conducted to complete the *Stillwater Lift Bridge Endowment Fund Analysis Report*. Mn/DOT's preferred option for a trustee for the endowment fund is the State Board of Investment. It may still be helpful to solicit examples of endowment agreements from each of the potential trustees discussed in the *Stillwater Lift Bridge Endowment Fund Analysis Report*. Legal research should be conducted to fully understand the potential cost and benefits of all the discussed alternatives.

# Minnesota Department of Transportation (Mn/DOT)

## Historic Bridge Management Plan

Bridge Number: 4654

### Section 8 – Endowment Fund

#### *Summary of costs and disbursement rates of potential trustees:*

	National Trust for Historic Preservation	Minnesota Community Foundation	State Board of Investment
<i>Administrative costs</i>	<1% of principal, fluctuates	"Minimal," negotiated in an endowment agreement	.005% of principal
<i>Disbursements</i>	5% of previous three-year average	5%	Undetermined, presumed to be approximately 5% of principal
<i>Location</i>	Washington, D.C.	St. Paul, MN	St. Paul, MN

Income from the endowment fund is intended to support operation and routine maintenance of the Stillwater Lift Bridge. As the owner of the bridge, Mn/DOT will decide how the income from the fund will be spent. Mn/DOT will make decisions in consultation with an advisory committee that consists of representatives from the City of Stillwater, the Minnesota SHPO, and the National Park Service.

The MOA restricts the use of endowment income to "operation and routine maintenance" because these activities "are usually predictable, repetitive, and conducive to the establishment of reasonable and accurate annual budget projections." Endowment income is "not eligible for use in major repairs, rehabilitation, or other capital improvements to the Stillwater Lift Bridge."

The *Stillwater Lift Bridge Endowment Fund Analysis Report* presents a full discussion of how to establish the endowment fund. The report is presented in its entirety in Appendix I.

# Minnesota Department of Transportation (Mn/DOT)

## Historic Bridge Management Plan

Bridge Number: 4654

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### Section 9 – Long-Term Considerations

## 9.0 Long-Term Considerations

### 9.1 Projected life expectancy

The recommendations for stabilization, preservation, and maintenance of the bridge include varying life expectancies and life cycles for components and service (see Cost Details in Appendix G). Preservation work items have life expectancies ranging from 5 to 50 years. Subsequent work involving these items, beyond the conversion and repair project, is not included in the cost estimates for preservation or routine maintenance. Other items not included involve non-routine repairs whose frequency is unpredictable, but which are not emergencies. This would include such work items as concrete pier repairs, bridge painting, deck repairs, counterweight rope replacement, and repairs to the bridge tender's house.

To estimate the costs of these items, the spreadsheet of Future Preservation Costs considers a 42-year timeframe from the 2013 rehabilitation to the year 2055. This period of time was used for consistency with the previous 2003 HNTB report "Maintenance Projections and Annualized Costs," where it was logically projected that the new operating system installed in 2005 would be good for 50 years. The 42 years between 2013 and 2055 are organized in three, 14-year increments for purposes of projecting maintenance and preservation activities and their associated costs.

### 9.2 Potential component failure and appropriate remedial measures

The Component Failure subsection of Future Preservation Costs (Appendix G) identifies major components that may require repair or replacement at some point before 2055. The estimate of costs for these major work items is necessary for long-term planning for funding purposes. Included in the category of Component Failure are: east abutment foundation stabilization, pier replacement (two estimated), bearing replacement, lower chord gusset plate replacement, vehicular and transition deck replacement, pedestrian deck replacement, and operating drum replacement (two estimated).

### 9.3 Process for addressing emergencies

Emergency situations with the bridge will be addressed with standard Mn/DOT procedures, with the stipulation that Section 106 requirements, as well as applicable MOA requirements, remain in effect. Depending on the nature and urgency of the emergency, the Mn/DOT Metro engineer, Bridge Office, and Mn/DOT Metro Maintenance will assess the situation and determine whether the bridge needs to be closed. The Mn/DOT CRU will participate in the review and assessment of the work required to meet the emergency situation. At that point, or as soon as is feasible, the decision-making process outlined in Section 1.4 will be in effect.

# Minnesota Department of Transportation (Mn/DOT)

## Historic Bridge Management Plan

Bridge Number: 4654

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### Section 9 – Long-Term Considerations

#### 9.4 Future decision-making

Because the Stillwater Lift Bridge Management Plan is intended to provide guidance many years into the future, it is expected that new situations will emerge, new information will become available, and unanticipated decisions will need to be made. To accommodate future decision making, the following process is recommended. This process parallels the one used to prepare this management plan.

1. An issue is identified that is not covered by the management plan, conflicts with the management plan, or cannot be resolved by information in the management plan.
2. If a recommendation from an engineer or other professional is required to resolve the issue, that recommendation is requested from the appropriate party and brought to the Mn/DOT Cultural Resource Unit (CRU) and Mn/DOT Bridge Office for review and comment. If the issue requires review under the SOIS, that review will be part of the recommendation.
3. The Mn/DOT CRU will consult with SHPO for review and comment.
4. Following consultation with SHPO, the issue and recommendation will be presented to the Stillwater Lift Bridge Advisory Committee (SLBAC) or its successor (see discussion of Advisory Committee in *Stillwater Lift Bridge Endowment Fund Analysis Report*) for comment before being accepted by Mn/DOT.
5. Mn/DOT will make a decision on the issue following the above review and comment, and will then implement that decision.



**Minnesota Department of Transportation (Mn/DOT)**  
**Historic Bridge Management Plan**

**Bridge Number: 4654**

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**Appendices**

**Appendix A. Amended Section 106 Memorandum of Agreement for  
the St. Croix River Crossing Project**



**AMENDED SECTION 106 MEMORANDUM OF AGREEMENT  
BETWEEN  
THE FEDERAL HIGHWAY ADMINISTRATION,  
THE U.S. ARMY CORPS OF ENGINEERS,  
THE ADVISORY COUNCIL ON HISTORIC PRESERVATION,  
AND THE  
MINNESOTA AND WISCONSIN  
STATE HISTORIC PRESERVATION OFFICERS  
REGARDING  
THE ST. CROIX RIVER CROSSING PROJECT  
WASHINGTON COUNTY, MINNESOTA AND  
ST. CROIX COUNTY, WISCONSIN**

**WHEREAS**, the Minnesota Department of Transportation (Mn/DOT) and Wisconsin Department of Transportation (WisDOT) plan to construct a new crossing of the St. Croix River between the City of Oak Park Heights in Washington County, Minnesota and the Town of St. Joseph in St. Croix County, Wisconsin, along Trunk Highway (TH) 36 and State TH (STH) 64 on Alignment B-1, the Preferred Alternative (Project), as described in the 2006 St. Croix River Crossing Supplemental Final Environmental Impact Statement (EIS). The Project also includes construction in the Cities of Stillwater and Bayport; and

**WHEREAS**, the Federal Highway Administration (FHWA) plans to provide assistance to the Project pursuant to the Federal Aid Highway Program, 23 U.S.C., thereby making the Project an undertaking subject to review under Section 106 of the National Historic Preservation Act (NHPA), 16 U.S.C. § 470f, and its implementing regulations, 36 C.F.R. Part 800; and

**WHEREAS**, the United States Army Corps of Engineers (Corps) has determined that this Project, due to its authorization under Section 10 and Section 404 permits, is an undertaking that requires review in accordance with 36 CFR Part 800; and

**WHEREAS**, in accordance with 36 CFR § 800.2(a)(2), FHWA and the Corps have agreed that FHWA is the lead Federal agency for the purposes of Section 106 review; and

**WHEREAS**, on December 8, 1994, FHWA, the Advisory Council on Historic Preservation (ACHP), the Minnesota and Wisconsin State Historic Preservation Offices (SHPOs), Mn/DOT and WisDOT executed a Memorandum of Agreement (MOA) (Attachment A) for a new crossing of the St. Croix River; and

**WHEREAS**, in compliance with Stipulation I of the 1994 MOA, FHWA completed an historical documentation study of the Bergstein House and Shoddy Mill prior to demolishing the Bergstein House; and

**WHEREAS**, FHWA and the Minnesota SHPO agree that the Shoddy Mill is individually eligible for listing in the National Register of Historic Places (NRHP); and

**WHEREAS**, in 1996 consideration of a new crossing of the St. Croix River did not proceed because the National Park Service (NPS) determined, pursuant to Section 7(a) of the Wild and Scenic Rivers Act, that the proposed new crossing would have a direct and adverse effect on the scenic and recreational values for which the Lower St. Croix River was designated a Wild and Scenic River; and

**WHEREAS**, FHWA suspended the proposed new crossing of the St. Croix River and implemented none of the remaining stipulations of the 1994 MOA; and

**WHEREAS**, in February 1999, FHWA resumed consideration of a new crossing of the St. Croix River when it began development of a Supplemental Draft EIS; and

**WHEREAS**, in January 2001, FHWA again suspended consideration of a new crossing of the St. Croix River because the consulting parties could not agree on the future of the Stillwater Lift Bridge, a property that is listed on the NRHP; and on appropriate and fundable mitigation for the project; and

**WHEREAS**, in June 2003, FHWA initiated a facilitated stakeholder process to identify and analyze a new set of alternatives for a new crossing of the St. Croix River; and

**WHEREAS**, changes in the nature and scope of the proposed new crossing of the St. Croix River and its effects, and the passage of time dictate amendment of the 1994 MOA; and

**WHEREAS**, execution and implementation of this Amended MOA satisfies the responsibilities of FHWA and the Corps under Section 106 of NHPA and 36 CFR Part 800; and

**WHEREAS**, FHWA has determined that the Project may have an adverse effect on the Stillwater Lift Bridge, Log Cabin Restaurant (Club Tara), Bergstein Shoddy Mill and Warehouse, St. Croix Overlook-South, Stillwater Commercial Historic District, Stillwater Cultural Landscape District, South Main Archaeological District, Nicholas Thelen Farmstead, and Louis Kriesel Farmstead, all of which are properties included in or eligible for inclusion in the NRHP, and has consulted with the ACHP and the Minnesota and Wisconsin SHPOs, pursuant to 36 CFR Part 800, the regulations implementing Section 106 of the NHPA, 16 U.S.C. 470f; and

**WHEREAS**, the Project's area of potential effects (APE), as determined by FHWA pursuant to 36 CFR § 800.4(a)(1), is described in Attachment B; and

**WHEREAS**, FHWA, the Minnesota and Wisconsin SHPOs, the Corps and the ACHP as signatories have sole authority to execute, amend or terminate this Amended MOA in accordance with 36 CFR § 800.6(c)(1); and

**WHEREAS**, FHWA has consulted with Mn/DOT and WisDOT, and has invited those State agencies to execute this Amended MOA as invited signatories; and

**WHEREAS**, in accordance with 36 CFR § 800.6(c)(2)(i) invited signatories have the same rights with regard to seeking amendment or termination of the Amended MOA as the signatories; and

**WHEREAS**, FHWA has consulted with the United States Environmental Protection Agency, the U.S. Fish and Wildlife Service, the NPS, United States Coast Guard, the Minnesota and Wisconsin Departments of Natural Resources (DNR's), City of Oak Park Heights, Town of St. Joseph, City of Stillwater (a "Preserve America Community"), Preservation Alliance of Minnesota, Stillwater Heritage Preservation Commission (HPC), Friends of the St. Croix, New St. Croix Bridge Coalition, Stillwater Area Chamber of Commerce, Sierra Club, St. Croix Alliance for an Interstate Bridge, St. Croix County, St. Croix River Association, Stillwater Lift Bridge Association, Western Wisconsin Realtors Association, Minnesota Center for Environmental Advocacy, and the National Trust for Historic Preservation, and has invited them to concur in this Amended MOA; and

**WHEREAS**, in accordance with 36 CFR § 800.6(c)(3) concurring parties may elect to concur in the Amended MOA but their refusal to sign does not invalidate this Amended MOA; and

**WHEREAS**, FHWA has invited the Lower Sioux Indian Community, Mille Lacs Band of Ojibwe, Upper Sioux Indian Community, Prairie Island Indian Community (Welch, Minnesota), Shakopee Mdewakanton Sioux Community, Leech Lake Band of Ojibwe, Prairie Island Indian Community (Tama, Iowa), White Earth Reservation, Red Cliff Band of Lake Superior Chippewa Indians, Sac and Fox Nation of Oklahoma, Sokaogon Chippewa Community Mole Lake Band, St. Croix Chippewa Indians of Wisconsin, Stockbridge Munsee Community of Wisconsin, Sac and Fox Nation of Missouri, Bad River Band of Lake Superior Chippewa Indians of Wisconsin, Forest County Potawatomi, Ho-Chunk Nation, Iowa Tribe of Oklahoma, Lac Courte Oreilles Band of Lake Superior Chippewa Indians of Wisconsin, Lac Du Flambeau Band of Lake Superior Chippewa Indians of Wisconsin, Menominee Indian Tribe of Wisconsin, Oneida Nation, Great Lake Inter-Tribal Council, Inc., Prairie Band Potawatomi Nation, Sac and Fox Nation of Missouri in Kansas and Nebraska, and Sac and Fox of the Mississippi in Iowa to participate in consultation; and

**WHEREAS**, the terms used in this Amended MOA are defined in 36 CFR § 800.16; and

NOW, THEREFORE, FHWA, ACHP, Corps, Minnesota and Wisconsin DOT's, and the Minnesota and Wisconsin SHPOs agree that the Project will be implemented in accordance with the following stipulations in order to take into account the effect of the Project on historic properties.

### STIPULATIONS

FHWA will ensure that the following stipulations (I – XV) are carried out:

#### **I. OVERSIGHT AND COORDINATION**

- A. FHWA authorizes Mn/DOT and WisDOT to carryout the terms of this Amended MOA on its behalf.
- B. FHWA will ensure that all historic preservation work carried out pursuant to the terms of this Amended MOA is conducted by or under the direct supervision of a person or persons meeting the *Secretary of the Interior's (SOI) Professional Qualification Standards* (62 Fed. Reg. 33,719).
- C. Mn/DOT and WisDOT will maintain the professional staff (as defined in Stipulation I.B) needed to implement the terms of this Amended MOA.
- D. In carrying out the terms of this Amended MOA, FHWA will utilize the comprehensive educational and interpretive information on the Lower St. Croix Riverway's natural, cultural and historic resources as recommended in the *Lower St. Croix Cooperative Management Plan* (NPS, 2002) and coordinate with the NPS in implementing mutual interpretive goals.
- E. FHWA will implement the terms of this Amended MOA in a manner that is consistent with the principles established by the *ACHP's Policy Statement on Balancing Cultural and Natural Values on Federal Land* (2001), a document that has been endorsed by the Chairman of the ACHP and the Director of the NPS.

#### **II. PROJECT DESIGN DEVELOPMENT**

- A. Context Sensitive Design: FHWA recognizes the significance and inter-relatedness of natural resources and historic properties to the outstanding scenic and recreational qualities of the Lower St. Croix National Scenic Riverway. The importance of these resources is affirmed in the *Lower St. Croix Cooperative Management Plan* (NPS, 2002). In developing the Project design, FHWA will ensure that the DOT's apply context sensitive design principles in order to protect these defining natural and historic qualities.
- B. Design Principles: FHWA will develop the overall Project design - including the new bridge structure, approach roadways, and aesthetic treatments to surfaces, structures, portals, appurtenances, and land contours and landscaping - and a Visual Quality Manual (VQM) consistent with the following principles:



1. A controlling vision, developed as part of the VQM process (Stipulation II.C), which identifies and reinforces the links between the historic properties and natural resources that make up the landscape of the Lower St. Croix National Scenic Riverway, will guide the Project design development and implementation.
2. The Project design will effectively meet the Project purpose and need, as defined in the Supplemental Final EIS, while avoiding, minimizing, and/or mitigating adverse impacts to the environment, including adverse effects to historic properties. Avoidance of adverse effects is preferable.
3. The Project design will minimize the impact of the new bridge on the Lower St. Croix National Scenic Riverway and, in particular, on vistas from the St. Croix Overlook-South and the Stillwater Cultural Landscape District. The overall scale of the new bridge structure and the number of its piers in the river will be minimized to the maximum extent possible. Where appropriate, the new bridge design will incorporate opportunities to enhance scenic and historic vistas for pedestrians, bicyclists, and river and vehicle travelers.
4. The Project design will minimize the impact of Project lighting on the St. Croix Valley and on historic properties. Roadway and navigational lighting will be designed and constructed to minimize the dispersion of light ("spillover") beyond the roadway right-of-way and the Lower St. Croix National Scenic Riverway.
5. The Project design will minimize the visual impact of signage on the Lower St. Croix Valley and on historic properties. Roadway signage in the Lower St. Croix National Scenic Riverway area will be strategically located to minimize impacts to important vistas.
6. The Project design will incorporate opportunities to provide comprehensive educational and interpretive information about the Lower St. Croix National Scenic Riverway's natural resources and historic properties, consistent with the *Lower St. Croix Cooperative Management Plan* (NPS, 2002).

C. Visual Quality Manual

1. **Prior to commencing Project design**, Mn/DOT and WisDOT are developing a VQM to provide for corridor continuity in all aspects of the Project design, while enhancing the diverse environments within the limits of the overall Project. The Final VQM will be consistent with the design principles identified in Stipulations II.A and II.B.

2. The VQM Project consultant team includes professionals who meet the *Secretary of the Interior's Professional Qualification Standards* (62 Fed. Reg. 33,719) for architectural historians, historical architects, or historians.
3. Mn/DOT established a Design Review Committee to work with the consultant team throughout the development of the VQM. The Design Review Committee includes the SHPOs, and Mn/DOT and WisDOT historic preservation professionals. Mn/DOT invited the City of Stillwater, the Stillwater HPC and other consulting parties to become members of the Design Review Committee.
4. All Project design elements presented in the VQM - include, but are not limited to, bridge and ramp design, loop trail (including the Stillwater Lift Bridge), landscape alteration, landscape design, surface treatments, lighting, signage, corridor enhancements, and permanent erosion control - will be:
  - a. consistent with FHWA's Context Sensitive Design principles, the *Secretary of the Interior's Standards and Guidelines for the Treatment of Historic Properties* (SOI Standards) and the *Lower St. Croix Cooperative Management Plan* (NPS, 2002), and
  - b. compatible with the historic qualities of the Stillwater Lift Bridge, Log Cabin Restaurant (Club Tara), Bergstein Shoddy Mill and Warehouse, St. Croix Overlook-South, Stillwater Commercial Historic District, Stillwater Cultural Landscape District, South Main Archaeological District, Nicholas Thelen Farmstead, and Louis Kriesel Farmstead.
5. Mn/DOT held public informational meetings in both Minnesota and Wisconsin during the Fall of 2005 to gather public comments on the draft VQM.
6. Mn/DOT has submitted a copy of the draft VQM to the SHPOs and the Visual Quality Review Committee for review. The SHPOs and the Visual Quality Review Committee had thirty (30) days from receipt of the draft to submit their respective reviews. Mn/DOT will take into account the SHPOs' and Visual Quality Review Committee's review comments in the preparation of the final draft VQM.
7. Mn/DOT will submit a copy of the final draft VQM to the SHPOs for review and concurrence. The SHPOs will have thirty (30) days from receipt of the final draft VQM to provide their review and concurrence. Mn/DOT will take into account the review comments in the preparation of the final VQM. If Mn/DOT and the SHPOs cannot reach concurrence on the final VQM, Mn/DOT will submit the matter to FHWA for resolution in accordance with Stipulation XIII.

8. Mn/DOT will hold a public open house to disseminate the information contained in the final VQM to the general public.

D. Design Review: Mn/DOT and WisDOT will submit the preliminary bridge plan for the new bridge structure to the SHPOs for review and concurrence. The SHPOs will have thirty (30) days from the date of receipt of the preliminary bridge plan to provide their review and concurrence. Design plans for other sections of the Project are subject to SHPO review pursuant to Stipulation IV of this Amended MOA.

E. Construction Review

1. **Before Project construction begins**, Mn/DOT and WisDOT will meet with the construction contractor to ensure that construction plans are consistent with the VQM and the Project design as approved by the SHPOs.
2. **During construction**, Mn/DOT and WisDOT will monitor Project construction and will provide a record of those monitoring activities in the Annual Report prepared pursuant to Stipulation IX.
3. Mn/DOT and WisDOT will identify a point of contact who will be responsible for responding to inquiries and complaints from the public regarding historic preservation issues that arise during the implementation of the terms of this Amended MOA.

### III. STILLWATER LIFT BRIDGE

A. Interim Vehicular Use of the Stillwater Lift Bridge -- The historic Stillwater Lift Bridge will be used for Trunk Highway purposes in accordance with Federal, State and local law, and safety standards until a new river crossing has been constructed and opened to vehicular traffic. Mn/DOT will continue to own and operate the Stillwater Lift Bridge with the intent to preserve and protect it beyond the opening of the new bridge for conversion to pedestrian/bicycle use.

Mn/DOT will continue to conduct annual structural inspections, perform routine maintenance, perform necessary repairs, and perform appropriate emergency measures, as it has done in the past, in a manner that will minimize the structural deterioration of the historic bridge, to the extent practicable, until such time as the new bridge is open for vehicular use.

B. Stillwater Lift Bridge Advisory Committee - **Following approval of the Record of Decision (ROD)**, Mn/DOT will invite the U.S. Coast Guard, SHPOs, the NPS, MnDNR, WisDNR, the City of Stillwater, the Stillwater HPC, the Stillwater Lift Bridge Association, the Minnesota Historical Society, St. Croix County, and the Town of St. Joseph and others who seek to participate to serve on the Stillwater Lift Bridge Advisory Committee (SLBAC).

1. The SLBAC will provide Mn/DOT with advice and recommendations regarding the maintenance, repair, rehabilitation, treatment and management of the Stillwater Lift Bridge during its interim vehicular use and will oversee development of the Stillwater Lift Bridge Management Plan prepared in accordance with Stipulation III.C.
  2. The recommendations of the SLBAC will support Mn/DOT's efforts to incorporate Riverway, historical/cultural, and local perspectives in its decision-making process regarding planning and repair decisions for the Stillwater Lift Bridge.
  3. Mn/DOT will seek the advice of the SLBAC until the final Stillwater Lift Bridge Management Plan has been approved by the SHPOs in accordance with Stipulation III.C.
  4. Mn/DOT will convene meetings of the SLBAC, including the first meeting, and provide staff support to the SLBAC, as appropriate. The SLBAC will establish the procedures through which it will operate and develop its recommendations for Mn/DOT.
  5. Until the new bridge opens, when Mn/DOT, the SHPOs and the SLBAC agree that any maintenance, repair, rehabilitation, and treatment proposed by Mn/DOT meets the SOI's *Standards*, then Mn/DOT may implement the proposed work. If they do not agree and FHWA will provide assistance for the proposed work, then the matter will be resolved by FHWA in accordance with 36 CFR §§800.5, 800.6 and 800.7.
- C. Stillwater Lift Bridge Management Plan - The Stillwater Lift Bridge Management Plan, which will be consistent with Mn/DOT's Statewide Historic Bridge Management Plan, will identify those actions needed to preserve the structural and historical integrity of the Stillwater Lift Bridge for continued safe use. All actions identified will be consistent with the SOI's *Standards*.

**After completion of the Stillwater Lift Bridge Repair Project**, Mn/DOT and WisDOT, in consultation with the SLBAC, will update the existing condition assessment of the Stillwater Lift Bridge that was developed from the reports listed in Attachment C using information obtained during the Stillwater Lift Bridge rehabilitation project in 2005. In consultation with the SHPOs and SLBAC, Mn/DOT will use this information as the basis for developing an Operations and Maintenance Manual for the Stillwater Lift Bridge that includes estimated funding needs. Mn/DOT will submit the Manual to the SHPOs and SLBAC for review. The SHPOs and SLBAC will have thirty (30) days from receipt of the draft Manual to submit their review comments. In preparing the final draft Manual, Mn/DOT will take into account timely comments received on the draft Manual. Mn/DOT will submit the final draft Manual to the SHPOs for their review and concurrence. The SHPOs will have thirty (30) days from receipt of the final draft

Manual to provide their review and concurrence. Mn/DOT will then use the approved Operations and Maintenance Manual to develop the Stillwater Lift Bridge Management Plan.

The Stillwater Lift Bridge Management Plan will describe how the Stillwater Lift Bridge is to be managed during its interim vehicular use and after its conversion to pedestrian/bicycle use, but the latter use will receive primary emphasis.

In consultation with the MnSHPO, Mn/DOT is developing a Statewide Historic Bridge Management Plan, including individual plans, for twenty-four (24) historic bridges, including the Stillwater Lift Bridge. The long-term preservation of the Stillwater Lift Bridge is integral to the successful implementation of this Statewide Plan. In accepting statewide planning for historic bridges, Mn/DOT committed to preserving the structural integrity of the twenty-four (24) historic bridges beyond its normal practice.

The Stillwater Lift Bridge Management Plan will include but is not limited to, components that establish a process and procedures:

- to update and analyze the condition of the Stillwater Lift Bridge;
- to establish maintenance and improvement needs and priorities;
- to identify criteria for decision-making and priority setting;
- to use and expand the endowment fund;
- to acquire capital improvement funding predictably and when needed;
- to respond to emergencies;
- to involve other parties in an advisory capacity in decision-making;
- to revise and update the Stillwater Lift Bridge Management Plan, as appropriate;
- to integrate with the development, ownership and operation of the Loop Trail; and
- for ownership and long-term maintenance of the Stillwater Lift Bridge.

Mn/DOT will submit a draft of the Stillwater Lift Bridge Management Plan to the SHPOs and the SLBAC for their review. The SHPOs and the SLBAC will have thirty (30) days from receipt of the draft Stillwater Lift Bridge Management Plan to submit their review comments. In preparing the final draft Stillwater Lift Bridge Management Plan, Mn/DOT will take into account timely comments received on the draft Stillwater Lift Bridge Management Plan. Mn/DOT will submit the final draft Stillwater Lift Bridge Management Plan to the SHPOs and SLBAC for their review and concurrence. The SHPOs and SLBAC will have thirty (30) days from receipt of the final draft Stillwater Lift Bridge Management Plan to provide their review and concurrence.

When the SHPOs and the SLBAC have concurred pursuant to Stipulation III.C., Mn/DOT will implement the Stillwater Lift Bridge Management Plan. Mn/DOT will provide a copy of the final Stillwater Lift Bridge Management Plan to

FHWA, the SHPOs and the SLBAC. The Plan will be incorporated as part of the Statewide Bridge Management Plan. **FHWA will not obligate funding for the Project until it is in receipt of the final Stillwater Lift Bridge Management Plan from Mn/DOT.**

- D. Endowment Fund - The establishment of an endowment fund account by Mn/DOT will generate revenue to support the operation and routine maintenance of the Stillwater Lift Bridge after it is converted to pedestrian/bicycle use.
1. **Upon approval of the ROD by FHWA and the appropriation of funding for the Project, Mn/DOT, in cooperation with the State of Minnesota, will establish an endowment account for the Stillwater Lift Bridge.**
  2. In setting up this fund, Mn/DOT will
    - a. Support any enabling legislation that may be determined by the State of Minnesota to be necessary for the establishment of such an account, and develop and execute agreements, as needed, with other elements of the State, including the MnSHPO, **prior to the opening of the new river crossing;**
    - b. Consult with the SHPOs to develop the structure of the fund; and
    - c. Consult with a person or persons with established credentials in establishing and managing endowment funds.
  3. **Prior to the opening of the new river crossing, Mn/DOT and WisDOT will deposit no less than \$3 million in the endowment fund.**
  4. Mn/DOT will set up an operations and maintenance account that will be funded from the investment revenues derived from the endowment fund. This account may be used only to support Stillwater Lift Bridge operation and routine maintenance from abutment to abutment because these activities are usually predictable, repetitive, and conducive to the establishment of reasonable and accurate annual budget projections. Revenues from the operations and maintenance account are not eligible for use in major repairs/rehabilitation or other capital improvements to the Stillwater Lift Bridge.
  5. Mn/DOT will establish the endowment fund in order to receive funds and disburse revenues sufficient to support the operation and routine maintenance of the Stillwater Lift Bridge. Mn/DOT will ensure that adequate legal controls are in place to ensure that the endowment, and operations and maintenance funds are managed effectively, in the public interest and to support the protection and preservation of the Stillwater Lift Bridge.



**E. Capital Improvement Upon Conversion - Upon approval of the ROD and appropriation of funding for the Project**, Mn/DOT will convene the SLBAC to advise Mn/DOT regarding the proper scope of the Stillwater Lift Bridge capital improvement/repair work that will be pursued by Mn/DOT when the Stillwater Lift Bridge is to be converted to a pedestrian/bicycle use in conjunction with the new Loop Trail.

1. As part of the Statewide Historic Bridge Management Plan (III. C.), Mn/DOT commits to completing a rehabilitation project for the Stillwater Lift Bridge, **within one year after opening of the new bridge**. The Stillwater Lift Bridge Management Plan will establish the priorities for the rehabilitation project in order to allow the Stillwater Lift Bridge to function with the Loop Trail. Mn/DOT will cover the cost of rehabilitation up to \$7 million. Mn/DOT expects to secure funding for this rehabilitation project from a combination of eligible state and federal funding sources. If rehabilitation costs exceed \$7 million, Mn/DOT, in consultation with the SLBAC, will seek the additional funds required.
2. Mn/DOT will submit the draft design plan for the rehabilitation of the Stillwater Lift Bridge to the SHPOs and SLBAC for review. The SHPOs and SLBAC will have thirty (30) days from receipt of the draft design plan to submit their review comments. Mn/DOT will take into account any timely comments submitted in preparing the final design plan. Mn/DOT will submit the final design plan to the SHPOs for their review and concurrence. The SHPOs will have thirty (30) days from receipt of the final plan to provide their review and concurrence. Mn/DOT will implement the approved design plan for the rehabilitation of the Stillwater Lift Bridge.
3. If Mn/DOT and the SHPOs agree that the rehabilitation project meets the SOI's *Standards*, then Mn/DOT may implement the work. If they do not agree and FHWA or another federal agency will provide assistance for the proposed work, then the matter will be resolved by the federal agency in accordance with 36 CFR §§800.5, 800.6 and 800.7.

**F. Conversion of the Lift Bridge to Pedestrian/Bicycle Use - Once the Project has been constructed and opened to traffic**, Mn/DOT will remove the Stillwater Lift Bridge from the Trunk Highway system and close it to vehicular traffic.

1. Mn/DOT will retain ownership and maintenance of the Stillwater Lift Bridge, unless Mn/DOT decides to transfer the historic property pursuant to Stipulation III.F.2.
2. If Mn/DOT proposes to transfer ownership of the Stillwater Lift Bridge, Mn/DOT will consult with the SHPOs, the ACHP, the City of Stillwater, Town of St. Joseph, Preservation Alliance of Minnesota, Stillwater HPC, NPS, Stillwater Area Chamber of Commerce, Stillwater Lift Bridge

Association, National Trust for Historic Preservation, SLBAC, and other consulting parties regarding the proposed transfer.

- a. Mn/DOT will ensure that the transferee will conform to the terms of the Stillwater Lift Bridge Management Plan and any additional legal restrictions deemed appropriate by Mn/DOT to ensure its continued protection and preservation.
  - b. Mn/DOT will take into account the recommendations of the consulting parties identified in Stipulation III. F. 2. in reaching a final decision about any proposed transfer.
  - c. If they cannot agree on legal restrictions, Mn/DOT will seek the advice of the ACHP. Mn/DOT will notify FHWA and all consulting parties that it is seeking the advice of the ACHP. Upon receipt of adequate documentation, the ACHP will review and advise Mn/DOT on the resolution of the dispute within thirty (30) days.
  - d. Prior to reaching a final decision on the dispute, Mn/DOT will prepare a written response that takes into account any timely advice from the ACHP and provide all consulting parties with a copy of this written response. Mn/DOT may then proceed according to its final decision.
  - e. If the ACHP does not respond within thirty (30) days after receipt of adequate documentation, Mn/DOT may render a decision regarding the dispute.
3. Mn/DOT may, at its discretion and in consultation with the SHPOs, the City of Stillwater and the Stillwater HPC enter into an agreement with a federal, state or local agency for management of the operation and routine maintenance of the Stillwater Lift Bridge. Mn/DOT will ensure that management of the Stillwater Lift Bridge by the other agency adheres to the final Stillwater Lift Bridge Management Plan developed pursuant to Stipulation III.C.

#### **IV. SITE SPECIFIC MITIGATION MEASURES**

##### **A. Log Cabin Restaurant (Club Tara)**

1. Design: In consultation with the MnSHPO and the owner of this historic property, Mn/DOT will design Project elements, including the frontage road, access, landscaping, and other site improvements in the vicinity of this historic property, to be compatible with the qualifying characteristics and setting of the Log Cabin Restaurant. The design will be consistent with the design principles listed in Stipulations II.A and B and the VQM. Mn/DOT will submit design plans to the MnSHPO for review and concurrence **prior to**

**FHWA authorization to obligate funds for the Project.**

2. Parking: In consultation with the MnSHPO and the owner of this historic property, Mn/DOT has developed a design plan to provide adequate parking for the Log Cabin Restaurant. In the plan, Mn/DOT has specified that the existing lot will remain gravel and that an additional lot will be constructed, east and adjacent to the Log Cabin Restaurant property. The design plan will comply with municipal standards and will not diminish the qualifying characteristics of the historic property. Mn/DOT will implement the design plan in cooperation with the City of Oak Park Heights and Xcel Energy. Mn/DOT will submit the design plan to the MnSHPO for review and concurrence **prior to FHWA authorization to obligate funds for the Project.**
3. Construction: Mn/DOT will ensure access and temporary directional signage to the Log Cabin Restaurant during construction.
4. City of Oak Park Heights Memorandum of Understanding (MOU): Mn/DOT will ensure that the terms of the MOU that will be executed with the City of Oak Park Heights will be consistent with this Amended MOA. The function of the MOU is to document the terms of municipal consent from the City which is required under Minnesota statutes.

**B. Bergstein Shoddy Mill and Warehouse**

1. **Prior to letting the Project for construction**, Mn/DOT will complete photo documentation of the Shoddy Mill and Warehouse in accordance with the standards and guidelines of the MnSHPO. Mn/DOT will submit two (2) copies of the completed documentation to the MnSHPO and one (1) copy each to the City of Oak Park Heights and City of Stillwater.

In consultation with the MnSHPO, Mn/DOT has determined that it is cost effective to move and stabilize the Shoddy Mill and the Warehouse, and upon identification of a suitable site, Mn/DOT will move and secure the buildings on a new foundation at the new location.

2. Mn/DOT has consulted with the MnSHPO; Cities of Oak Park Heights, Stillwater, and Bayport; Washington County Historical Society; Stillwater HPC; the Jewish Historical Society of the Upper Midwest; and other parties to identify a new owner, a new site and a suitable use for this historic property. The new site and use for the buildings must maintain, and not detract from the National Register character-defining features of the property and will include an appropriate setting.
3. Mn/DOT marketed the historic property for two (2) months during the spring of 2005. Two interest offers were received during that period and one party

remains interested. Review of a potential site is occurring in consultation with the MnSHPO and other consulting parties.

4. If Mn/DOT and the MnSHPO agree on an acceptable site and use, Mn/DOT will move the historic property to its new site and then transfer it with a legal restriction that ensures it will be maintained in accordance with the SOI's *Standards*.
5. If Mn/DOT determines, in consultation with MnSHPO, that there is no acceptable offer (that is, a new owner, new site, and a suitable use for the historic property have not been identified and approved by agencies with jurisdiction over the new site), Mn/DOT may authorize its demolition. In the event that Mn/DOT determines that it should proceed with demolition, Mn/DOT will consult with the MnSHPO to determine if any further mitigation is needed prior to demolition. If Mn/DOT and the MnSHPO cannot agree, Mn/DOT will submit the matter to FHWA for resolution in accordance with Stipulation XIII.
6. City of Oak Park Heights and City of Stillwater MOU's: Mn/DOT will ensure that the terms of the MOU's that will be executed with the City of Oak Park Heights and City of Stillwater will be consistent with this Amended MOA. The function of the MOU's is to document the terms of municipal consent from the Cities which are required under Minnesota statutes.

#### C. St Croix Overlook-South

1. Design: Mn/DOT will design the Project within the viewshed of the St. Croix Overlook-South, including the new bridge and other improvements, in accordance with the design principles found in Stipulations II.A and B, and the VQM. The Project design will take into account the setting, feeling and viewshed of the St. Croix Overlook-South.
2. Restoration: Mn/DOT will restore the St. Croix Overlook-South in accordance with the *Mn/DOT-Historic Roadside Development Structures Preservation and Restoration Report (2005)* **during construction of the proposed Project**. Despite diminished vehicular access, the scenic and historic view from this site has high value and the restoration of this property provides viewing opportunities described within II.B.3 of this Amended MOA. Providing access from the Loop Trail and other city streets to the St. Croix Overlook-South is being studied.
3. Management: Mn/DOT will develop a Management Plan for the St. Croix Overlook-South that addresses the maintenance and rehabilitation of structural and landscape elements of the historic property **prior to restoration**. Mn/DOT will submit the Plan to the MnSHPO for review and concurrence. Mn/DOT will continue ownership of the St. Croix Overlook-South, unless

Mn/DOT elects to transfer ownership to a federal, state or local agency with appropriate restrictions developed in consultation with the MnSHPO.

4. Construction Access: Mn/DOT will ensure access to the St. Croix Overlook-South during construction.
5. City of Oak Park Heights MOU: Mn/DOT will ensure that the terms of the MOU that will be executed with the City of Oak Park Heights will be consistent with this Amended MOA. The function of the MOU is to document the terms of municipal consent from the City which is required under Minnesota statutes.

#### D. Stillwater Commercial Historic District

1. Signage:
  - a. According to standard practice, primary guide signs for STILLWATER will be installed, **as part of the project**, in both westbound and eastbound directions on TH 36 approaching the TH 36/TH 95 interchange. **Provided that adequate signing space is available**, as determined by Mn/DOT, a supplemental guide sign for "Downtown Stillwater" (white lettering on green background) will be installed, as part of the project, on both eastbound and westbound approaches to the TH 36/TH 95 interchange. **If it is determined that not enough space is available for this supplemental guide sign, FHWA and Mn/DOT will consult with the signatories and other consulting parties, including the downtown Stillwater business owners, to develop additional mitigation for the Stillwater Commercial Historic District.**
  - b. **Provided that adequate space is available**, as determined by Mn/DOT, the City of Stillwater will install a municipal identification entrance sign for the City on northbound TH 95 at the Stillwater city limit in accordance with the VQM. The municipal identification entrance sign will include a reference to the Stillwater Commercial Historic District. Mn/DOT will determine if sufficient property is available outside the clear zone for installation and maintenance of the municipal identification entrance sign by the City.

As an alternative, Mn/DOT will consider, **during the development of the Project's signing plan** and if allowable by policy, a "recreational and cultural interest area sign" (white lettering on brown background) for the Stillwater Commercial Historic District.

2. Construction Communication Plan:

As part of its overall Project design process, Mn/DOT will develop a plan to ensure access to the Stillwater Commercial Historic District during Project construction. The plan will be developed in consultation with MnSHPO, the City of Stillwater, and the Stillwater Area Chamber of Commerce. The plan will consider the sequencing of Project construction, the location of construction staging areas, street closures, parking changes and the traffic flow during construction. Mn/DOT and WisDOT will provide signage and public notice for efficient access to the Stillwater Commercial Historic District during construction.

3. Mn/DOT will work with the City of Stillwater to give full consideration to maximizing parking on Chestnut Street from Main Street to the Stillwater Lift Bridge.
4. As part of the Project, WisDOT will provide parking in the immediate vicinity of the Loop Trail in Wisconsin at the connection of the Loop Trail and existing STH 64 with a direct pedestrian access to the Stillwater Lift Bridge and the Commercial Historic District. And, a trailhead parking area will be provided at the new interchange of STH 64 and STH35/CTH E in Wisconsin.

E. **Stillwater Cultural Landscape District (SCLD)**

1. Design: In consultation with the MnSHPO, Mn/DOT will design the Project elements within the viewshed of the SCLD, including the new bridge structure, the Loop Trail, Chestnut St. from Main St. to the Stillwater Lift Bridge, landscaping and other improvements, in accordance with Stipulations II.A and B and the VQM, taking into account the historic property's qualifying characteristics, setting and feeling. Mn/DOT will submit the draft design plans to the MnSHPO for review. MnSHPO will have thirty (30) days from receipt of the draft design plans to submit their review comments. Mn/DOT will take into account any timely comments submitted in preparing the final design plan. Mn/DOT will submit the final design plan to the MnSHPO for their review and concurrence **prior to FHWA authorization to obligate funds for the Project.** The MnSHPO will have thirty (30) days from receipt of the final plan to provide their review and concurrence.
2. Study: Mn/DOT will complete a study of the SCLD, in consultation with the SHPOs, Stillwater HPC and NPS (St. Croix National Scenic Riverway Office) to illustrate the significant features and essential characteristics of the SCLD and its setting, as described in *Cultural Resource Investigation St. Croix River Bridge* (by Barbara Henning for Rivercrest Associates, Inc., August 1999). The study is intended to reinforce an understanding of the historic relationship

between the natural and built features in the SCLD, identify and illustrate important views to, from and within the SCLD, and promote understanding of the SCLD and its significant features to a wide audience. **The study will begin at the time of FHWA authorization of funding for the Project.**

- a. The study will utilize historic and contemporary images, maps, and text to illustrate the defining characteristics and features of the landscape, their interrelationships, and the associated viewsheds. This product will include existing pre-construction views of the Riverway from the SCLD and views from the Riverway to the district **prior to construction.**
- b. Mn/DOT will submit a draft study to the SHPOs, NPS and Stillwater HPC for review and comment. The parties will have thirty (30) days from the date of receipt of the draft to provide their review comments. Mn/DOT will take into account the comments received in developing the final study.
- c. Mn/DOT will submit the final study to the SHPOs for review and concurrence. Mn/DOT will ensure that the approved final study is completed **prior to opening of the new bridge.**
- d. The final study documentation will be formatted for easy reference and use, and for Internet application. Mn/DOT will present the completed final study to the public at a meeting of the Stillwater HPC.

#### **F. South Main Archaeological District**

1. **Prior to initiating Project construction**, Mn/DOT, in consultation with the MnSHPO, the Stillwater HPC, and the City of Stillwater, will complete a condition and stabilization report identifying those measures needed to stabilize and protect the Hersey and Bean Saw Mill and Hersey and Bean Planing Mill archeological sites in such a way as to avoid adversely affecting the historic properties' above and below-ground qualifying characteristics. Mn/DOT will use the report to develop the stabilization needed in order to construct the Loop Trail. The report will be made available to the City of Stillwater for future park planning. Mn/DOT will ensure that the protective measures that have been identified are implemented by **inclusion in the Project special provisions and plans.**
2. If Mn/DOT determines that an adverse effect to this historic property cannot be avoided, then Mn/DOT will consult with the MnSHPO, Stillwater HPC and City of Stillwater to develop mitigation measures. If the parties can reach agreement on mitigation, Mn/DOT will record those measures through a letter agreement with the MnSHPO and then implement the measures. If the parties cannot agree, Mn/DOT will submit the matter to FHWA for resolution in accordance with Stipulation XIII.



3. If Mn/DOT proposes to use any area of the Hersey and Bean Archaeological Site as a staging area, Mn/DOT will consult with the MnSHPO to ensure that the use will not result in adverse effects to the historic archaeological site and its setting.
4. City of Stillwater MOU: Mn/DOT will ensure that the terms of the MOU that will be executed with the City of Stillwater will be consistent with this Amended MOA. The function of the MOU is to document the terms of municipal consent from the City which is required under Minnesota statutes.

#### **G. Louis Kriesel Farmstead**

1. WisDOT will construct a berm on land currently owned by Dennis and Georgeann Kilbane in order to screen the Kriesel Farmstead from the Project. WisDOT will design this berm in consultation with Dennis and Georgeann Kilbane. But it will accommodate, to the maximum extent possible, the continued use for agricultural purposes, the land to the south of the Kriesel Farmstead farm buildings. This berm will be based on the concepts presented in "Highway Profile Options at Kriesel Farm" in the VQM.
2. **Before completion of the final Project design in Wisconsin**, WisDOT will submit a draft plan for applying the general concepts set forth in the VQM (see Stipulation II. C.) to the WisSHPO for review and concurrence. As part of the plan, WisDOT will consider installing landscape elements along a line near the south boundary, within 500 feet on either side of the current driveway access to the Kriesel Farmstead, and roughly parallel to the centerline of the proposed new frontage road as shown for Alternative B1 in the Supplemental Final EIS for the Project. WisDOT will use text, photographs and other exhibits, as appropriate, to develop this plan. WisDOT will consider the cost effectiveness in reaching a final decision on any proposed landscaping.

#### **V. NATIONAL REGISTER NOMINATIONS**

- A. Minnesota Properties: In consultation with the MnSHPO, Mn/DOT will prepare National Register nomination forms for the Log Cabin Restaurant; the Bergstein Shoddy Mill and Warehouse, if it is not demolished pursuant to Stipulation IV.B.5 and if it remains eligible on its new site per concurrence from the MnSHPO; the St. Croix Overlook - South and the South Main Archaeological District **prior to authorization of funding by FHWA for the Project.**
- B. Wisconsin Properties: **Within one year of the signing of the Record of Decision for the Project**, WisDOT will submit the required completed National Register nomination forms to the WisSHPO for final nomination of the Nicholas Thelen Farmstead and Louis Kriesel Farmstead to the NRHP.

## VI. INTERPRETATION AND PUBLIC EDUCATION

- A. Stillwater Lift Bridge Publication: Mn/DOT will contract with the Washington County Historical Society (WCHS) or another responsible party if the WCHS declines, in consultation with the SHPOs, to publish an illustrated book tracing the history of the Stillwater Lift Bridge in narrative and photographs. The narrative will include the complete story of the Stillwater Lift Bridge, and its relationship to the community and the cultural landscape. Mn/DOT and WisDOT will provide a total of \$50,000 for publication of the book. The book will be completed **following authorization of funding by FHWA but prior to opening of the new bridge.**
- B. Field Guide: In consultation with the SHPOs, Mn/DOT will develop an educational Field Guide to direct visitors, students and others to locations where they may experience and understand the relationships between the cultural, natural and physical features in and adjacent to the SCLD.
  1. The Field Guide will be based on the SCLD study, produced pursuant to Stipulation IV.E.2., and information related to the Boom Site and St. Croix Overlook-South. The Field Guide will highlight the role of historic properties within the SCLD, including the St. Croix Overlook - South, in the development of nearby roadways.
  2. The Field Guide will include a map showing the scope and significant features of the SCLD, the St. Croix Overlook-South, and the Boom Site.
  3. The Field Guide also will include a map that clearly shows how to access the St. Croix Overlook-South and other affected historic properties identified in this Amended MOA.
  4. Mn/DOT will make the Field Guide widely available in rest areas, tourism distribution centers and local businesses along the Lower St. Croix National Scenic Riverway, and through the Greater Stillwater Area Chamber of Commerce.
  5. Mn/DOT will complete the Field Guide **prior to the opening of the new bridge.**
  6. Mn/DOT will submit the draft Field Guide to the SHPOs and Stillwater HPC for review. The SHPOs and Stillwater HPC will have thirty (30) days from the receipt of the draft Field Guide to submit their review comments. Mn/DOT will take into account any timely comments submitted in preparing the final Field Guide. Mn/DOT will submit the final Field Guide to the SHPOs for their review and concurrence. The SHPOs will have thirty (30) days from receipt of the final Field Guide to provide their review and concurrence. The completed Field Guide will be presented to the SHPOs and Stillwater HPC in

both hard copy and electronic format. The Field Guide will also be posted on Mn/DOT's Project website.

- C. Riverway Research and Interpretation: In developing the Riverway interpretation mitigation measure described in the Supplemental Final EIS, NPS will consult with the SHPOs to ensure that pertinent information about historic properties and their relationship to the Lower St. Croix National Scenic Riverway is incorporated into interpretative efforts, including signage, kiosk and mobile outreach. These agencies should also consult on the broad Riverway research carried out by NPS on archaeological sites and National Register nomination preparation.

In particular, in accordance with the St. Croix National Scenic Riverway mitigation measures identified in the Supplemental Final EIS, in order to raise awareness among river users and researchers of how man has changed the river in the past, the NPS, in consultation with the SHPOs, will document the river changes implemented by Corps activities (i.e., decisions; proposed and implemented plans; photographs and drawings). The NPS will also document, including photographs, the history of the Boomsite and its effect on the Riverway and the logging industry. The results of these efforts will be a scholarly document and an overview of the research on the NPS website.

## VII. GROWTH MANAGEMENT

- A. The WisDNR will invite the WisSHPO to participate as a member of the Wisconsin Growth Management Advisory Team. This Team will be created to promote natural, cultural and historic resource protection by providing advice and guidance in the administration of the "St. Croix River Crossing Project Growth Management Fund" as described in the Supplemental Final EIS.
- B. In accordance with the growth management mitigation measures identified in the Supplemental Final EIS, funds will be provided (\$200,000 to the Town of St. Joseph and \$750,000 to St. Croix County) to hire or contract for staff and consultant services to assist in revising and/or developing local comprehensive plans, neighborhood plans, ordinances and other planning tools that will result in natural resource enhancement, pollution prevention, protection for historic properties, or other environmental protection.
- C. In accordance with the growth management mitigation measures identified in the Supplemental Final EIS, funds (\$50,000) will be provided to the University of Wisconsin (UW) - River Falls to help establish and implement natural resources and historic properties protection efforts of the Western Wisconsin Intergovernmental Collaborative (WWIC). The funding will supplement, but not replace, local government member financial support for the WWIC. The purpose of this organization is to enhance the quality of life in Pierce, Polk and St. Croix Counties of Wisconsin by providing a long-term collaborative forum for its governmental jurisdictions, including villages, towns, cities and counties.

WWIC will share information, experiences and best practices on key issues and problems; serve as an "Issues Clearinghouse"; engage in regional problem-solving; develop a more visible regional identity; serve as a voice for the three-county region to influence public policy; help to provide advice and sharing of technical expertise from resources available at UW-River Falls, UW-Extension and other sources; and explore opportunities for potential governmental cost-savings through shared resources.

WWIC planned actions include organizing and sponsoring quarterly programs/workshops used to bring in experts, facilitate focused problem solving and to disseminate targeted and region-specific educational materials on water quality, natural resources, historic properties, and other issues.

WWIC will share information with the Wisconsin SHPO and invite their participation in efforts related to historic preservation.

#### **VIII. ADDITIONAL HISTORIC PROPERTIES AND EFFECTS TO BE CONSIDERED**

- A. Before granting approval of sites for construction staging, wetland mitigation, borrow or waste, dredge disposal, or other construction activities associated with the Project or bluffland restoration, the DOT's will consult with FHWA, the SHPOs, and other consulting parties, including Indian tribes, as appropriate, in accordance with 36 CFR §§ 800.3 - 800.5 to determine if historic properties will be affected by the Project.
- B. In accordance with the St. Croix Riverway mitigation measures identified in the Supplemental Final EIS, the Riverway agencies (NPS, MnDNR, WisDNR) have proposed to restore native vegetation and develop campsites along the Lower St. Croix National Scenic Riverway in order to enhance the camping experience while protecting the Riverway's resources. Prior to implementing any management activities to remove exotic species and restore natural species (e.g., burning or other treatment plans) or prior to any campsite expansion, the NPS will comply with Section 106 requirements.
- C. In accordance with the St. Croix Riverway mitigation measures identified in the Supplemental Final EIS, funding in the amount of \$2.0 million will be provided to WisDNR and \$2.5 million will be provided to St. Croix County for the protection of replacement lands to offset the impacts of a new crossing on the Wisconsin bluff. Protection could include the purchase of fee title, the purchase or transfer of development rights or the purchase of conservation easements from willing sellers of land located in St. Croix County, Wisconsin. Protected lands would be perpetually maintained for land and water conservation purposes, scenic protection and other compatible uses, including low-impact public recreation.

1. For any property purchased under this mitigation item, WisDNR, St. Croix County and the Town of St. Joseph will consult with WisSHPO, MnSHPO, and other consulting parties, including Indian tribes as appropriate, in accordance with 36 CFR §§ 800.3 - 800.5 to determine if historic properties in addition to those identified in Stipulation II.C.4.b. will be affected.
  2. The WisDNR, St. Croix County and the Town of St. Joseph will confer with the WisSHPO on possible sites to acquire in order to provide protection for historic properties in conjunction with land and water conservation goals.
- D. Pursuant to 36 CFR § 800.5(a), if FHWA determines that the proposed activity will adversely affect a historic property, then FHWA will consult with Mn/DOT, and/or WisDOT, the respective SHPO, and other consulting parties, including Indian tribes, to seek ways to avoid, minimize or mitigate the adverse effect.
- E. If the parties can agree on measures to mitigate the adverse effect, FHWA will ensure that those measures are recorded in a letter agreement and then implemented. If the parties cannot agree, FHWA will resolve the dispute in accordance with Stipulation XIII.

## **IX. MONITORING AND REPORTING**

- A. **On March 1 of every year beginning after issuance of the ROD**, Mn/DOT will submit a summary annual report to the signatories describing the measures carried out pursuant to the terms of this Amended MOA. The annual report will describe all actions taken by FHWA, Mn/DOT and WisDOT during the preceding year to implement the terms of this Amended MOA, identifying any problems or unexpected issues encountered during the year, any disputes and objections submitted or resolved, any changes recommended in implementation of this Amended MOA, and any scheduling changes. The annual report will also include a timetable of activities proposed for implementation within the following year. Attachment D portrays a summary of specific actions with their scheduled implementation based on Project milestones.
- B. The signatories will review the annual report and provide their written comments to Mn/DOT within thirty (30) days of receipt of the report. At the same time, Mn/DOT will also make the annual report available to concurring parties and the public for their inspection and review. Mn/DOT will share with the signatories any comments it receives from concurring parties and the public.
- C. At its own discretion or at the request of any signatory to this Amended MOA, Mn/DOT will convene a meeting to facilitate review and comment of the annual report, to address any questions about its content, and to resolve adverse comments.

- D. The signatories may use the annual report as a basis for recommendations prepared pursuant to Stipulations XII, XIII, XIV and XV.
- E. Mn/DOT will submit an annual report every year until this Amended MOA expires pursuant to Stipulation XV or is terminated pursuant to Stipulation XIV.

## **X. POST-REVIEW DISCOVERIES**

- A. In the event that historic properties are discovered or unanticipated effects on historic properties found **during Project construction**, the DOTs shall ensure that the following steps are carried out.
  - 1. During Project construction, the contractor shall cease all ground-disturbing activities in the area where any unidentified archeological resources are discovered as well as in the immediately adjacent area.
  - 2. The contractor shall notify the respective DOT of the discovery within twenty-four (24) hours.
  - 3. Within forty-eight (48 hours) from receipt of the notice in Stipulation X.A.2, the respective DOT shall notify FHWA, the respective SHPO and other parties, as appropriate, of the discovery. The notice shall describe the archeological resources encountered, the circumstances of their discovery, make an assessment of NRHP eligibility, and propose actions to resolve the adverse effect.
  - 4. In accordance with 36 CFR § 800.13(c), the respective DOT, in consultation with FHWA, and the respective SHPO, may assume the archeological property to be eligible for listing in the NRHP.
  - 5. FHWA, SHPO and other consulting parties shall have forty-eight (48) hours from receipt of the notice, to provide their recommendations to the DOT on the proposed actions contained in the notice. The DOT shall take into account these recommendations before implementing appropriate actions to resolve the adverse effect.
- B. The DOTs shall ensure that if any human remains are encountered **during the Project**, all ground-disturbing activities will cease in the area where such remains are discovered as well as in the immediately adjacent area. The contractor is legally required within twenty-four (24) hours to notify the respective DOT of this discovery of human remains. Upon receipt of this notice from the contractor, the responsible DOT shall notify FHWA within twenty-four (24) hours.
  - 1. In Minnesota, if human remains are encountered during the Project, all ground-disturbing activities will cease in the area where any site is discovered as well as in the immediately adjacent area. The contractor will immediately

notify local law enforcement authorities and the Mn/DOT Cultural Resources Unit (CRU) of the discovery. FHWA (with the assistance of the Mn/DOT CRU) will work with the Office of the State Archaeologist (OSA) to perform any necessary tribal consultation in order to meet FHWA's responsibilities under Section 106. The Mn/DOT CRU will develop a reburial plan in consultation with the FHWA, the OSA, the SHPO, and, if appropriate, the Minnesota Indian Affairs Council (MIAC), prior to ground-disturbing work being allowed to proceed in the area of discovery. The FHWA will ensure that the terms of any reburial plan are fully implemented. The Mn/DOT CRU will record, document and evaluate the National Register eligibility of sites in accordance with 36 CFR 800. If eligible sites are identified, the Mn/DOT CRU, in consultation with the SHPO and the FHWA, will design a plan for avoiding or mitigating any adverse effects prior to resuming ground-disturbing work in the area of discovery.

2. In Wisconsin, if human bone is discovered during any activities directly associated with the construction of this project, work will stop immediately and the SHPO, Burial Sites Preservation Office (BSPO), WisDOT Bureau of Equity and Environmental Services (BEES), and Consulting Tribes will be notified immediately in accordance with Wis. Stats. 157.70. Work may proceed only after authorization from the BSPO.

The WisDOT will ensure that protective steps are taken to safeguard the human remains after working hours. Measures will include one or more of the following--fencing, signage, temporary hand backfilling of the area to conceal the location, and notification of local authorities to include the area in their patrol. If, in the opinion of the archaeologist, human remains may be in jeopardy and cannot be protected, WisDOT will consult with the Consulting Tribes, and the BSPO. Permission of the Director of the Wisconsin Historical Society (WHS) will be obtained prior to moving remains to a safe location.

### Burials

WisDOT will ensure that all construction activity will be stopped immediately in the area of the discovery of human remains. The project construction manager will notify BEES immediately. BEES will notify BSPO, SHPO, and Consulting Tribes.

The WisDOT shall ensure that construction in areas adjacent to the archaeological site and/or mortuary areas where human remains are located during construction activity are monitored by a qualified archaeologist, as defined in HS2, 157.70(1)(I)(1991) Wis.Stats.

WisDOT shall ensure that one Tribal Monitor will be available on site if requested by consulting tribes. The Tribal Monitor will work directly with and under the supervision of the WisDOT archaeologist in those areas to be



monitored. WisDOT will reimburse the tribe at the state per diem rate for travel, food and lodging for services rendered.

WisDOT will comply with 157.70, Wis.Stats., regarding treatment of human remains and final disposition protocol, if necessary, when human remains are encountered.

WisDOT will ensure that encountered human remains (and associated grave goods) undergo analysis by a qualified skeletal analyst in compliance with 157.70 Wis.Stats. and as defined in Chapter HS2.02 (12) and .04(6).

WisDOT will take into account the requests of Consulting Tribes on treatment of human remains in accordance with provisions reached between WisDOT and the Wisconsin Intertribal Repatriation Committee on burial treatment.

WisDOT will ensure that when possible, human remains will remain in the same place as discovery. When it is not possible to leave human remains in situ, WisDOT will consult on a case-by-case basis with the Consulting Tribes, the SHPO, and the BSPO, on the disturbance of a burial site. In compliance with 157.70 Wis.Stats. burials will not be disturbed until permission from the Director of the WHS is obtained.

The reinterment of human remains at a different location will be as near as possible to the original location. Human remains that must be removed and reinterred in accordance with 157.70 Wis. Stats. will be placed in an agreed upon plot established by Consulting Tribes, WisDOT, and FHWA. WisDOT will provide land, or a cemetery plot, for reburial if requested by the descendants or consulting parties.

WisDOT will ensure that the location(s) of reinterment, if needed, is surveyed by a registered Land Surveyor to provide a metes and bounds description to the BSPO who will file the necessary forms to ensure that the site is catalogued.

## **XI. EMERGENCIES**

- A. If during Project construction, Mn/DOT or WisDOT propose an action in response to an immediate threat to life or property, the responsible DOT will notify the signatories to this Amended MOA with a description of the proposed action and its likely affects on historic properties. The DOT will invite the signatories to provide their views within the time available.
- B. To the extent practicable given the circumstances of the threat, the responsible DOT will document any adverse effect to a historic property and provide that documentation to the signatories.

- C. In the event that Mn/DOT decides to demolish and remove the Stillwater Lift Bridge in response to an immediate threat to life or property, the expenses incurred from that demolition and removal may be charged to the Stillwater Lift Bridge endowment fund established in accordance with Stipulation III. D. Mn/DOT, in consultation with the SHPOs, will consider using any remaining funds in this account to support implementation of the Statewide Historic Bridge Management Plan.
- D. This section applies only to actions taken in response to an immediate threat to life or property that will be implemented within thirty (30) days or less of a formal designation of the threat to life or property.
- E. Closure of the Stillwater Lift Bridge to conduct repairs does not, in and of itself, constitute a threat to life and property.

## **XII. AMENDMENT**

- A. If any signatory to this Amended MOA, including any invited signatory, determines that its terms will not or cannot be carried out or that an amendment to its terms must be made, that party will immediately consult with the signatories and concurring parties to develop an amendment. The amendment will be effective on the date a copy signed by all of the original signatories is filed with the ACHP.
- B. If the signatories cannot agree to appropriate terms to amend the Amended MOA, any signatory, including any invited signatory, may terminate the agreement in accordance with Stipulation XIV, below.

## **XIII. DISPUTE RESOLUTION**

- A. Should any signatory, including any invited signatory, to this Amended MOA object at any time to any actions proposed or the manner in which the terms of this Amended MOA are implemented, FHWA will consult with the objecting party(ies) to resolve the objection. If FHWA determines that such objection(s) cannot be resolved, FHWA will:
  - 1. Forward all documentation, including the FHWA's proposed resolution, relevant to the dispute to the ACHP in accordance with 36 CFR § 800.2(b)(2). Upon receipt of adequate documentation, the ACHP will review and advise FHWA on the resolution of the objection within thirty (30) days. Prior to reaching a final decision on the dispute, FHWA will prepare a written response that takes into account any timely advice or comments regarding the dispute from the ACHP, signatories and concurring parties, and provide them with a copy of this written response. FHWA will then proceed according to its final decision.

2. If the ACHP does not provide comments regarding the dispute within thirty (30) days after receipt of adequate documentation, FHWA may implement its proposed resolution or render a decision regarding the dispute. In reaching its decision, FHWA will take into account all comments regarding the dispute from the parties to the Amended MOA.
- B. FHWA's responsibility to carry out all other actions subject to the terms of this Amended MOA that are not the subject of the dispute remain unchanged.
  - C. FHWA will notify all parties of its decision in writing before implementing that portion of the Project subject to dispute under this stipulation. FHWA's decision will be final.

#### **XIV. TERMINATION**

- A. If the Amended MOA is not amended following the consultation set out in Stipulation XII, it may be terminated by any signatory or invited signatory. The ACHP may be asked by any signatory, including any invited signatory, to the Amended MOA to review the terms of the agreement and its implementation by the FHWA. If the ACHP determines that the terms of the Amended MOA are not being carried out, the Amended MOA will be terminated.
- B. If the Amended MOA is terminated for any reason, FHWA will either develop a new agreement in accordance with 36 CFR § 800.6 or seek the comments of the ACHP in accordance with 36 CFR § 800.7.

#### **XV. DURATION**

This Amended MOA will terminate twenty (20) years from the date of its execution or upon mutual agreement of the signatories. Prior to such time, FHWA may consult with the other signatories to reconsider the terms of this Amended MOA and revise or amend it in accordance with Stipulation XII.

EXECUTION of this Amended MOA by FHWA, the ACHP, the Corps, the Minnesota and Wisconsin SHPOs, the Minnesota and Wisconsin DOTs, and implementation of its terms evidence that FHWA has taken into account the effects of the undertaking on historic properties and afforded the ACHP an opportunity to comment.

**SIGNATORIES:**

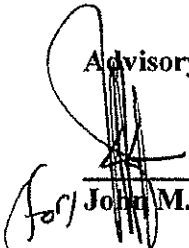
**Federal Highway Administration**

 Date 5/11/06  
Thomas K. Sorel, Division Administrator

**U.S. Army Corps of Engineers**

 Date 5/10/06  
Col. Michael F. Pfennig, District Engineer and Commander

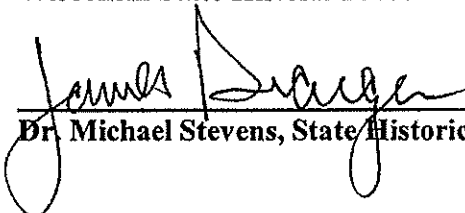
**Advisory Council on Historic Preservation**

 Date 5/15/06  
for John M. Fowler, Executive Director

**Minnesota State Historic Preservation Officer**

 Date 5/11/06  
Dr. Nina Archabal, State Historic Preservation Officer

**Wisconsin State Historic Preservation Officer**

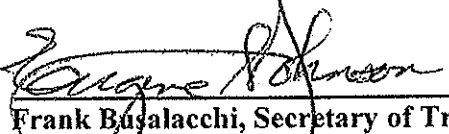
 Date 4/28/06  
Dr. Michael Stevens, State Historic Preservation Officer

INVITED SIGNATORIES:

Minnesota Department of Transportation

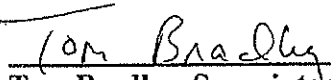
 Date 5-11-06  
Carol Molnau, Lt. Governor/Commissioner of Transportation

Wisconsin Department of Transportation

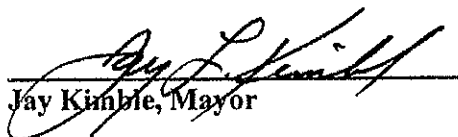
 Date 5/8/06  
Frank Busalacchi, Secretary of Transportation

CONCURRING PARTIES:

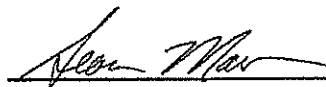
National Park Service

 Date 4/19/06  
Tom Bradley, Superintendent  
St. Croix National Scenic Riverway

City of Stillwater

 Date 4-19-06  
Jay Kinble, Mayor

U.S. Fish and Wildlife Service

 Date 4/19/06  
Sean Marsan, Acting Field Supervisor

St. Croix County

Tim Ramberg Date 04/19/06  
Tim Ramberg, St. Croix County Highway Commissioner

St. Croix County

Clarence W. Malick Date 4/19/06  
Clarence W. "Buck" Malick, St. Croix County

Town of St. Joseph

Theresa Johnson Date 4/19/06  
Theresa Johnson, Chair Town of St. Joseph

Stillwater Heritage Preservation Commission

Howard Lieberman Date 4/21/06  
Howard Lieberman, Chair

Greater Stillwater Area Chamber of Commerce

James Laskin Date 4/19/06  
James Laskin

St. Croix Alliance for an Interstate Bridge

John D. Soderberg Date 4/18/06  
John D. Soderberg, Chairman

St. Croix River Association

Larry Kennedy 4/19/06 Date  
Larry Kennedy, Past President

Stillwater Lift Bridge Association

Donald Empson 4/19/06 Date  
Donald Empson, Director

Western Wisconsin Realtors Association

William F. Berndt Date 4/21/06  
William F. Berndt, Government Affairs Director

National Trust for Historic Preservation

Royce Yeater 4-26-06 Date  
Royce Yeater, Director, Midwest Office



## MEMORANDUM OF AGREEMENT

WHEREAS, the Federal Highway Administration (FHWA) has determined that the Trunk Highway 36/State Trunk Highway 64 New St. Croix River Crossing Project will have an effect on the Bergstein House and Shoddy Mill, the Log Cabin, and the Stillwater Overlook, Minnesota properties which are eligible for the National Register of Historic Places, and has consulted with the Minnesota State Historic Preservation Officer (MnSHPO), the Wisconsin State Historic Preservation Officer (WisSHPO), and the Advisory Council on Historic Preservation (COUNCIL) pursuant to 36 CFR 800, regulations implementing Section 106 of the National Historic Preservation Act (16 U.S.C. 470f); and

WHEREAS, the Minnesota Department of Transportation (MnDOT) and the Wisconsin Department of Transportation (WisDOT) participated in the consultation and have been invited to concur in this Memorandum of Agreement;

WHEREAS, MnDOT and WisDOT have indicated that the Stillwater Lift Bridge, a property listed on the National Register of Historic Places and located in both Minnesota and Wisconsin, will remain on the states' respective trunk highway systems, will not be affected by this project, and will be subject to further review pursuant to 36 CFR 800 for future changes in jurisdiction or disposition;

NOW, THEREFORE, FHWA, MnSHPO, WisSHPO, and the COUNCIL agree that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the undertaking on historic properties.

## STIPULATIONS

FHWA will ensure that the following measures are carried out:

1. MnDOT will complete a historical documentation study on the Bergstein House and Shoddy Mill, in accordance with the Secretary of the Interior's Standards for Historical Documentation. The Research Design will be developed in consultation with and be approved by the

Attachment A

MnSHPO, and a draft of the documentation will be submitted to MnSHPO for review and comment before final submittal to MnSHPO. While the emphasis of this documentation should be historical, historic archaeology and architecture/engineering documentation will be considered for incorporation into the research design, as appropriate. No alteration or demolition of the property will occur until MnSHPO has approved the final documentation.

2. MnDOT will develop design plans for project elements in the vicinity of the Log Cabin in consultation with MnSHPO and will submit these design plans to MnSHPO for review and concurrence. This review will include the frontage road, access points to parking areas, landscaping, and any other project-related changes to the setting of the Log Cabin.

3. MnDOT will develop and implement a plan for the Stillwater Overlook in consultation with MnSHPO, and will submit this plan to MnSHPO for review and concurrence. This plan will address identity and access for the area, rehabilitation of the structural and landscape elements of the overlook, interpretation at the site, and a long range maintenance program.

4. The design for the new bridge will be developed in consultation with MnSHPO, and will be submitted to MnSHPO for review and concurrence. The design will take into account the qualities of the historic vista of the St. Croix Valley as seen from the Stillwater Overlook.

5. Should the MnSHPO object within 45 days to any plans, designs, or specifications provided pursuant to this agreement, FHWA shall consult with the MnSHPO to resolve the objection. If the FHWA determines that the objection cannot be resolved, FHWA shall request the further comments of the Council pursuant to 36 CFR 800.6(b). Any Council comment provided in response to such a request will be taken into account by FHWA in accordance with 36 CFR 800.6(c)(2) with reference only to the subject of the dispute; FHWA's responsibility to carry out all actions under this agreement that are not the subjects of the dispute will remain unchanged.

Execution of this Memorandum of Agreement and implementation of its terms evidence the FHWA has afforded the COUNCIL an opportunity to comment on the Trunk Highway 36/State Trunk Highway 64 New St. Croix River Crossing Project and its effects on historic properties, and that FHWA has taken into account the effects of the undertaking on historic properties.

ADVISORY COUNCIL ON HISTORIC PRESERVATION

By: Robert D. Bush Date: 12/8/94  
Name and Title of Signer: Executive Director

FEDERAL HIGHWAY ADMINISTRATION

By: Alan Friesen Date: 11/29/94  
Alan M. Archibald 11/20/94  
Name and Title of Signer: ALAN Friesen  
Program Operations Engineer

MINNESOTA STATE HISTORIC PRESERVATION OFFICER

By: Nina M. Archibald Date: 11/23/94  
Name and Title of Signer:

WISCONSIN STATE HISTORIC PRESERVATION OFFICER

By: Jeff D. Date: 11/18/94

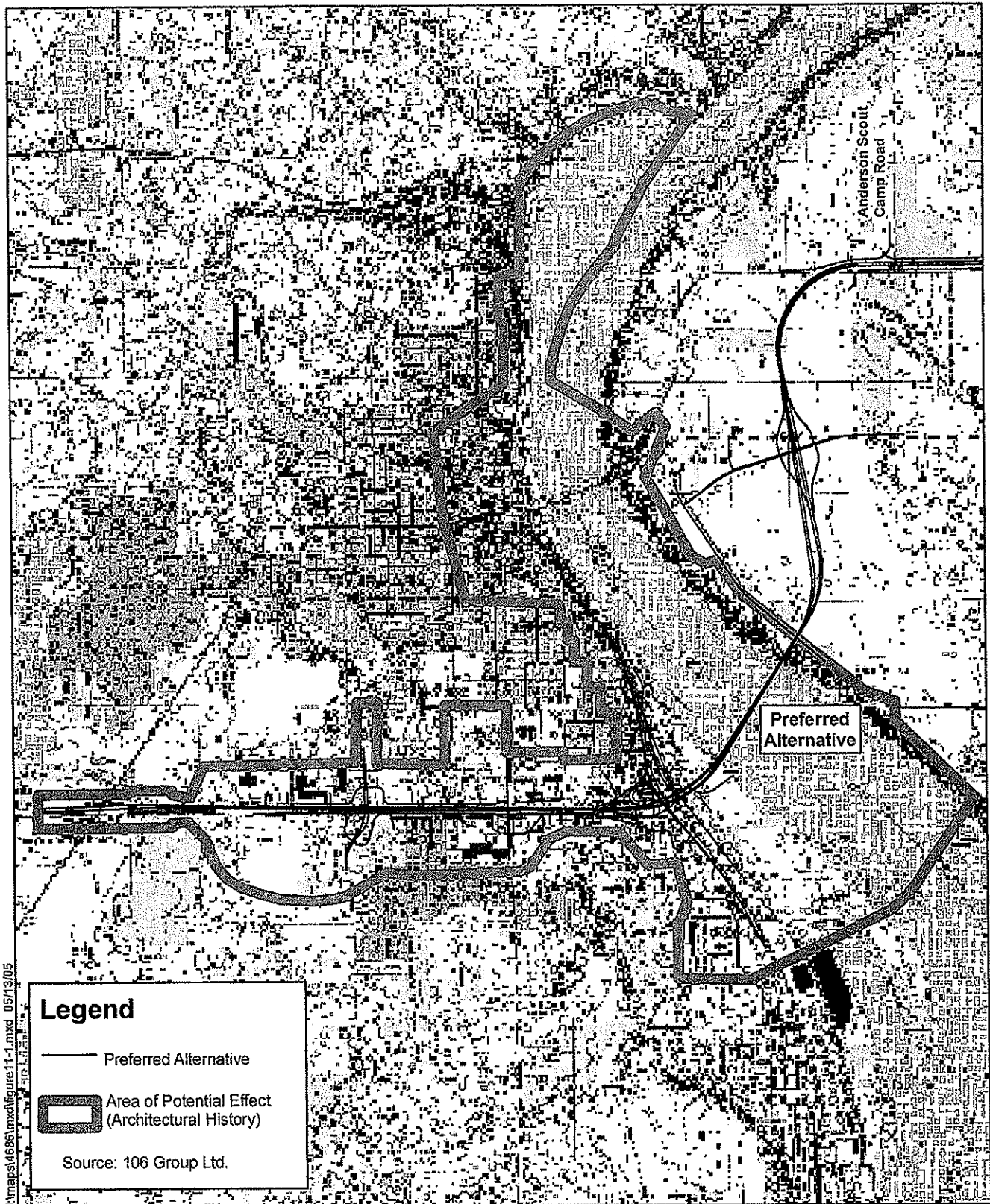
Concur:

MINNESOTA DEPARTMENT OF TRANSPORTATION

By: Paul E. Surgen Dep Commissioner/Chief Engr. Date: 11/16/94  
Name and Title of Signer:

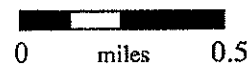
WISCONSIN DEPARTMENT OF TRANSPORTATION

By: Paul R. Gotsch Date: 11/17/94  
Name and Title of Signer:



**Area of Potential Effect - Minnesota**

*Figure 11-1*



**CORRESPONDENCE/MEMORANDUM** ----- **State of Wisconsin**  
*Bureau of Equity and Environmental Services/Division of Transportation Infrastructure Development*

**Date:** March 25, 2004

**To:** File

**From:** Robert S. Newbery  
Bureau of Environment (ENVIRONMENT)  
Rm. 451 HFSTB

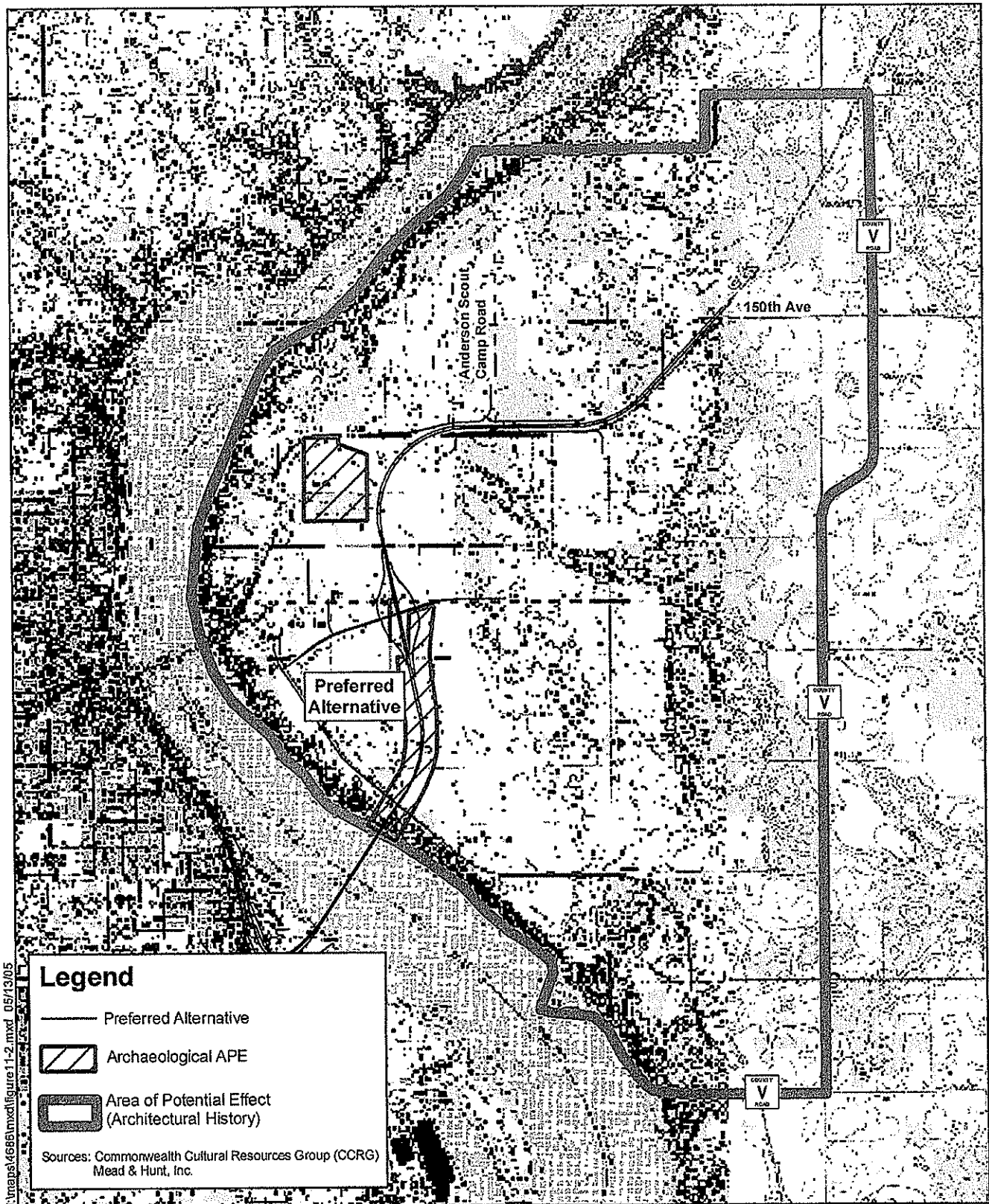
**Subject:** Project ID 1550-00-02  
Stillwater Bridge  
Washington County, MN to St. Croix County, WI

I have reviewed the previous windshield study and reconnaissance survey for this project and recently drove from the St. Croix River along STH 64 to CTH "V" and from STH 35 along CTH "E" to CTH "V" and then (south) along CTH "V" to STH 35. I believe a useful Area of Potential Effects for historical structures on the Wisconsin side of the river for this project would be roughly CTH "V" to the St. Croix River, with the addition of the strip north of STH 35/64 to the town line for the Town of St. Joseph. On the south, just extend CTH "V" westerly from its intersection with STH 35 to the St. Croix River. The total area encompassed may be excessive but it yields a simple and easy delineation of an area within which to begin a windshield search. The following concerns should be well within this area and justify the determination to establish this area as the starting APE:

1. What will be the differential impacts of one build alternative versus another?
2. What indirect commercial and retail effects might be related to this project?
3. Where will one be most likely be able to attribute the secondary effects of the increase in the intensity of development pressure to this project?
4. Where are noise impacts likely to occur?
5. Where will light impacts occur? (Except for cloudy, night time, general light pollution.)
6. Where will visual impacts be noticeable? (Note the topography here: a hill or line of several hills obscure the proposed approaches to the Stillwater Bridge from any house near CTH "V".

I believe that it is not necessary to construct or conduct elaborate methodologies to determine more precise boundaries because doing a windshield survey of CTH "V" to the River will not be that onerous. It is likely to cost less and take less time than to develop more precise measures to use to estimate the APE, which is, after all, an intermediate step in the conduct of the identification step of the Section 106 process.





**Area of Potential Effect - Wisconsin**

*Figure 11-2*

Attachment C

St. Croix River Crossing Project --- Amended Section 106 MOA

**Stillwater Lift Bridge over the St. Croix River: HNTB Corporation's Condition Assessment/Needs Reports:**

- 1) **Tender's House Repair Report**, dated January 21, 2003 found at  
<http://www.dot.state.mn.us/metro/projects/liftbridge/pdfs/tenderhouse-repair.pdf>
- 2) **Structural Inspection and Preliminary Condition Evaluation, Volume 1 of 2**, dated March 17, 2003 found at  
<http://www.dot.state.mn.us/metro/projects/liftbridge/pdfs/struct-report-v1r1.pdf>
- 3) **Structural Inspection and Preliminary Condition Evaluation, Volume 2 of 2**, dated March 17, 2003 found at  
<http://www.dot.state.mn.us/metro/projects/liftbridge/pdfs/struct-report-v2r1.pdf>
- 4) **Mechanical and Electrical Inspection and Evaluation, Volume 1 of 2**, dated March 18, 2003, found at  
<http://www.dot.state.mn.us/metro/projects/liftbridge/pdfs/mechanical-elec-v1r1.pdf>
- 5) **Mechanical and Electrical Inspection and Evaluation, Volume 2 of 2**, dated March 18, 2003, found at  
<http://www.dot.state.mn.us/metro/projects/liftbridge/pdfs/mechanical-elec-v2r1.pdf>
- 6) **Pedestrian Railing Repair Study**, dated March 20, 2003 found at  
<http://www.dot.state.mn.us/metro/projects/liftbridge/pdfs/railing-repair-study.pdf>
- 7) **Deck Replacement Study**, dated March 21, 2003 found at  
<http://www.dot.state.mn.us/metro/projects/liftbridge/pdfs/deck-replace-study.pdf>
- 8) **Maintenance Projections and Annualized Costs**, dated August 6, 2003, found at  
<http://www.dot.state.mn.us/metro/projects/liftbridge/pdfs/maintenance-projections.pdf>
- 9) **Stillwater Lift Bridge Repair Needs**, dated September 3, 2003, found at  
<http://www.dot.state.mn.us/metro/projects/liftbridge/pdfs/repair-needs-rev1.pdf>
- 10) **Repair Methods, Schedules, and Probable Repair Costs**, dated December 2, 2003, found at  
<http://www.dot.state.mn.us/metro/projects/liftbridge/pdfs/Fin%20Rep%20Meth.pdf>

Attachment C

# ST. CROIX RIVER CROSSING PROJECT

## SECTION 106 MEMORANDUM OF AGREEMENT

### Summary Of Specific Properties Info

### With Implementation Based on Project Milestones

	Record Of Decision July 2006	Lift Bridge Repair Project Ends Summer 2006	FHWA Authorization Of Funding	Letting Of Project	Begin Construction	End Construction	One Year After Construction
Visual Quality Manual, Section II							
Overall Project Design w/Controlling Vision			Implement Overall Vision-Roadway & Bridge				Implement Overall Vision-Landscaping
Stillwater Lift Bridge, Section III		Stillwater Lift Bridge Advisory Committee					
		Condition Assessment for Operations & Maintenance Manual					
		Lift Bridge Management Plan					
		Minnesota Legislation for Endowment Fund, setting up Endowment Fund, Depositing \$3M into Endowment Fund					
						\$7M Capital Improvement Repair Project	
							Conversion to Bike/Ped Facility
Log Cabin, Section IV. A			Parking Design Plan To SHPO		Construct Parking Lot		
Bergstein Shoddy Mill & Warehouse, Section IV. B			Photo Documentation		Relocation or Demolition		
St. Croix Overlook -South, Section IV. C			Overlook Management Plan				
			Restoration: Design & Construction				
Stillwater Commercial Historic District, Section IV. D			Supplemental Signing in Plans			Communication Plan	
						Parking Opportunities On Chestnut	
Stillwater Cultural Landscape District, Section IV. E			Design of Project Elements within Viewshed to SHPO				
			Illustrative Study - Preconstruction Views				
			- Defining Characteristics				
			- HPC Presentation				
South Main Archaeological District, Section IV. F			Avoidance Protective Measures in Plans & Special Provisions				
			Develop Condition and Stabilization Report for Hersey & Bean Archaeological Site				
Louis Kriesel Farmstead, Section IV. G			Beem design in plans with Landscaping			Construct Beem	
National Register Documentation/ Nominations, Section V							
- Log Cabin							
- Shoddy Mill & Warehouse							
- Overlook - South							
- South Main Archaeological District							
- Thelen Farmstead							
- Kriesel Farmstead							
	Documentation/Prepare Nominations for Minnesota Properties						
	Documentation/Prepare Nominations for Wisconsin Properties						
Lift Bridge Publication, Section VI. A			Develop & Publish Book				
Field Guide of Stillwater Cultural Landscape District, Section VI. B					Field Guide w/Maps, HPC Presentation & Distribution		
Riverway Research, Section VI. C					Interpretation & Research by NPS		
Growth Management			Planning, Protection, Support				
Annual Report, Section IX	Report & Presentation On March 1st	Report & Presentation On March 1st	Report & Presentation On March 1st	Report & Presentation On March 1st	Report & Presentation On March 1st	Report & Presentation On March 1st	Report & Presentation On March 1st

#### TIME LINE DEFINITIONS

Record Of Decision: FHWA's Environmental Decision Document

FHWA Authorization: Normally 5 weeks prior to letting

LETTING: DOT's Advertise for bids, hiring construction contractors, typically 4-6 weeks prior to construction

03/16/06

Attachment D



**Minnesota Department of Transportation (Mn/DOT)**  
**Historic Bridge Management Plan**

**Bridge Number: 4654**

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**Appendices**

**Appendix B. Glossary of Preservation and Engineering Terms**



## Glossary of Preservation and Engineering Terms

**Appraisal ratings** – Five National Bridge Inventory (NBI) inspection ratings (structural evaluation, deck geometry, under-clearances, waterway adequacy, and approach alignment, as defined below), collectively called appraisal ratings, are used to evaluate a bridge's overall structural condition and load carrying capacity. The evaluated bridge is compared with a new bridge built to current design standards. Ratings range from a low of 0 (closed bridge) to a high of 9 (superior). Any appraisal item not applicable to a specific bridge is coded N.

**Approach alignment** – One of five NBI inspection ratings. This rating appraises a bridge's functionality based on the alignment of its approaches. It incorporates a typical motorist's speed reduction because of the horizontal or vertical alignment of the approach.

**Character-defining features** – Prominent or distinctive aspects, qualities, or characteristics of a historic property that contribute significantly to its physical character. Features may include structural or decorative details and materials.

**Condition rating** – Level of deterioration of bridge components and elements expressed on a numerical scale according to the NBI system. Components include the substructure, superstructure, deck, channel, and culvert. Elements are subsets of components (e.g. piers and abutments are elements of the component substructure). The evaluated bridge is compared with a new bridge built to current design standards. Component ratings range from 0 (failure) to 9 (new); element ratings range from 1 (poor) to 3 (good). In rating a bridge's condition, Mn/DOT pairs the NBI system with the newer and more sophisticated Pontis element inspection information, which quantifies bridge elements in different condition states and is the basis for subsequent economic analysis.

**Deck geometry** – One of five NBI inspection ratings. This rating appraises the functionality of a bridge's roadway width and vertical clearance, taking into account the type of roadway, number of lanes, and Average Daily Traffic (ADT).

**Deficiency** – The inadequacy of a bridge in terms of structure, serviceability, and/or function. Structural deficiency is determined through periodic inspections and is reflected in the ratings that are assigned to a bridge. Service deficiency is determined by comparing the facilities a bridge provides for vehicular, bicycle, and pedestrian traffic with those that are desired. Functional deficiency is another term for functionally obsolete (see below). Remedial activities may be needed to address any or all of these deficiencies.

**Deficiency rating** – A nonnumeric code indicating a bridge's status as structurally deficient (SD) or functionally obsolete (FO). See below for the definitions of SD and FO. The deficiency rating status may be used as a basis for establishing a bridge's eligibility and priority for replacement or rehabilitation.

**Design exception** – A deviation from standard bridge design practices that takes into account environmental, scenic, aesthetic, historic, and community factors that may have bearing upon a



transportation project. A design exception is used for federally funded projects where federal standards are not met. Approval requires appropriate justification and documentation showing that concerns for safety, durability, and economy of maintenance have been met.

**Design load** – The usable live-load capacity that a bridge was designed to carry, expressed in metric tons according to the allowable stress, load factor, or load resistance factor rating methods. An additional code was recently added to assess design load by a rating factor instead of tons. This code is used to determine if a bridge has sufficient strength to accommodate traffic demands. A bridge that is posted for load restrictions may not be adequate to accommodate present or expected truck traffic.

**Fracture critical** – Classification of a bridge having primary superstructure or substructure components subject to tension stresses and which are non-redundant. A failure of one of these components could lead to collapse of a span or the bridge. Tension members of truss bridges are often fracture critical. The associated inspection date is a numerical code that includes frequency of inspection in months, followed by year, and month of last inspection.

**Functionally obsolete (FO)** – The FHWA classification of a bridge that cannot meet current or projected traffic needs because of inadequate horizontal or vertical clearance, inadequate load-carrying capacity, and/or insufficient opening to accommodate water flow under the bridge.

**Historic fabric** – The material in a bridge that was part of original construction or a subsequent alteration within the historic period (e.g. more than 50 years old) that has significance in and of itself. Historic fabric includes both character-defining and minor features. Minor features have less importance and may be replaced more readily.

**Historic bridge** – A bridge that is listed in, or eligible for listing in, the National Register of Historic Places.

**Historic integrity** – The authenticity of a bridge's historic identity, evidenced by the survival and/or restoration of physical characteristics that existed during the bridge's historic period. A bridge may have integrity of location, design, setting, materials, workmanship, feeling, and association.

**Inspections** – Periodic field assessments and subsequent consideration of the fitness of a structure and the associated approaches and amenities to continue to function safely.

**Inventory rating** – The load level a bridge can safely carry for an indefinite amount of time expressed in metric tons or by the rating factor described in design load (see above). Inventory rating values typically correspond to the original design load for a bridge without deterioration.

**Maintenance** – Work of a routine nature to prevent or control the process of deterioration of a bridge.

**Minnesota Historical Property Record (MHPR)** – A documentary record of an important architectural, engineering, or industrial site, maintained by the MHS as part of the state's commitment to historic

preservation. MHPR typically includes large-format photographs and written history, and may also include historic photographs, drawings, and/or plans. This state-level documentation program is modeled after a federal program known as the Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER).

**National Bridge Inventory** – Bridge inventory and appraisal data collected by the FHWA to fulfill the requirements of the National Bridge Inspection Standards (NBIS). Each state maintains an inventory of its bridges subject to NBIS and sends an annual update to the FHWA.

**National Bridge Inspection Standards** (NBIS) – Federal requirements for procedures and frequency of inspections, qualifications of personnel, inspection reports, and preparation and maintenance of state bridge inventories. NBIS applies to bridges located on public roads.

**National Register of Historic Places** – The official inventory of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, and culture, which is maintained by the Secretary of the Interior under the authority of the National Historic Preservation Act of 1966 (as amended).

**Non-vehicular traffic** – Pedestrians, non-motorized recreational vehicles, and small motorized recreational vehicles moving along a transportation route that does not serve automobiles and trucks. Includes bicycles and snowmobiles.

**Operating rating** – Maximum permissible load level to which a bridge may be subjected based on a specific vehicle type, expressed in metric tons or by the rating factor described in design load (see above).

**Posted load** – Legal live-load capacity for a bridge usually associated with the operating or inventory ratings as determined by a state transportation agency. A bridge posted for load restrictions may be inadequate for truck traffic.

**Pontis** – Computer-based bridge management system to store inventory and inspection data and assist in other bridge data management tasks.

**Preservation** – Preservation, as used in this report, refers to historic preservation that is consistent with the Secretary of the Interior's *Standards for the Treatment of Historic Properties*. Historic preservation means saving from destruction or deterioration old and historic buildings, sites, structures, and objects, and providing for their continued use by means of restoration, rehabilitation, or adaptive reuse. It is the act or process of applying measures to sustain the existing form, integrity, and material of a historic building or structure, and its site and setting. Mn/DOT's *Bridge Preservation, Improvement and Replacement Guidelines* (BPIRG) describe preservation differently, focusing on repairing or delaying the deterioration of a bridge without significantly improving its function and without considerations for its historic integrity.

**Preventive maintenance** – The planned strategy of cost-effective treatments that preserve a bridge, retard future deterioration, and maintain or improve its functional condition without increasing structural capacity.

**Reconstruction** – The act or process of depicting, by means of new construction, the form, features, and detailing of a non-surviving site, landscape, building, structure, or object for the purpose of replicating its appearance at a specific period of time and in its historic location. Activities should be consistent with the Secretary of the Interior's *Standards for the Treatment of Historic Properties*.

**Rehabilitation** – The act or process of returning a historic property to a state of utility through repair or alteration that makes possible an efficient contemporary use, while preserving those portions or features of the property that are significant to its historical, architectural, and cultural values. Historic rehabilitation, as used in this report, refers to implementing activities that are consistent with the Secretary of the Interior's *Standards for the Treatment of Historic Properties*. As such, rehabilitation retains historic fabric and is different from replacement. However, Mn/DOT's *Bridge Preservation, Improvement and Replacement Guidelines* (BPIRG) describe rehabilitation and replacement in similar terms.

**Restoration** – The act or process of accurately depicting the form, features, and character of a property as it appeared at a particular period of time. Activities should be consistent with the Secretary of the Interior's *Standards for the Treatment of Historic Properties*.

**Scour** – Removal of material from a river's bed or bank by flowing water, compromising the strength, stability, and serviceability of a bridge.

**Scour critical rating** – A measure of bridge's vulnerability to scour (see above), ranging from 0 (scour critical, failed, and closed to traffic) to 9 (foundations are on dry land well above flood water elevations). This code can also be expressed as U (unknown), N (bridge is not over a waterway), or T (bridge is over tidal waters and considered low risk).

**Serviceability** – Level of facilities a bridge provides for vehicular, bicycle, and pedestrian traffic, compared with current design standards.

**Smart flag** – Special Pontis inspection element used to report the condition assessment of a deficiency that cannot be modeled, such as cracks, section loss, and steel fatigue.

**Stabilization** – The act or process of sustaining a bridge by means of making minor repairs until a more permanent repair or rehabilitation can be completed.

**Structurally deficient** – Classification indicating NBI condition rating of 4 or less for any of the following: deck condition, superstructure condition, substructure condition, or culvert condition. A structurally deficient bridge is restricted to lightweight vehicles; requires immediate rehabilitation to remain open to traffic; or requires maintenance, rehabilitation, or replacement.

**Structural evaluation** – Condition of a bridge designed to carry vehicular loads, expressed as a numeric value and based on the condition of the superstructure and substructure, the inventory load rating, and the ADT.

**Sufficiency rating** – Rating of a bridge's structural adequacy and safety for public use, and its serviceability and function, expressed on a numeric scale ranging from a low of 0 to a high of 100. It is a relative measure of a bridge's deterioration, load capacity deficiency, or functional obsolescence. Mn/DOT may use the rating as a basis for establishing eligibility and priority for replacement or rehabilitation. Typically, bridges rated between 50 and 80 are eligible for rehabilitation and those rated 50 and below are eligible for replacement.

**Under-clearances** – One of five NBI inspection ratings. This rating appraises the suitability of the horizontal and vertical clearances of a grade-separation structure, taking into account whether traffic beneath the structure is one- or two-way.

**Variance** – A deviation from standard bridge design practices that takes into account environmental, scenic, aesthetic, historic, and community factors that may have bearing upon a transportation project. A design variance is used for projects using state aid funds. Approval requires appropriate justification and documentation that concerns for safety, durability and economy of maintenance have been met.

**Vehicular traffic** – The passage of automobiles and trucks along a transportation route.

**Waterway adequacy** – One of five NBI inspection ratings. This rating appraises a bridge's waterway opening and passage of flow through the bridge, frequency of roadway overtopping, and typical duration of an overtopping event.



**Minnesota Department of Transportation (Mn/DOT)**  
**Historic Bridge Management Plan**

**Bridge Number: 4654**

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**Appendices**

**Appendix C.      Stillwater Lift Bridge Maintenance Checklist**





**Maintenance Implementation Program**  
**Bridge No. 4654 (Stillwater Lift Bridge)**

TO: Mn/DOT Maintenance Staff

Date: 2006

RE: Special maintenance requirements for historic bridges

Mn/DOT has prepared individual management plans for selected historic bridges that are listed in the National Register of Historic Places. These plans are the result of historical and engineering evaluations. Each plan includes recommended activities, customized for that bridge, that comply with state and federal laws and regulations for historic preservation. In particular, the recommendations are prepared in compliance with the Secretary of Interior's Standards for Rehabilitation [36 CFR Part 67] and Guidelines for Bridge Maintenance and Rehabilitation based on the Secretary of the Interior's Standards.

Each plan includes a list of Recommended Maintenance Activities. The Historic Bridge Management Plan for Bridge 4654 (Stillwater Lift Bridge) includes the Recommended Maintenance Activities listed on the maintenance checklist on the follow pages. The checklist provides maintenance activities for the Stillwater Lift Bridge for the first seven years, which make up the first maintenance cycle.

Mn/DOT anticipates that the boxes on the checklist will be marked by the appropriate agency as tasks are completed and the list submitted to the Mn/DOT Cultural Resources Unit (CRU) for review. It is anticipated that the maintenance tasks and checklist will be evaluated by Mn/DOT CRU at the end of the each seven-year cycle to assure that the tasks and list are appropriate for the ongoing needs of the bridge.

The individual management plan, including the Recommended Maintenance Activities, is subject to periodic review and revision by Mn/DOT.



# Stillwater Lift Bridge (Bridge 4654) Maintenance Checklist

## First Cycle

Maintenance Activity		Responsible Party	Year							Comments (reference year)
			2014	2015	2016	2017	2018	2019	2020	
	Flush deck, drains, exp. joints, sub structure	City of Stillwater	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Graffiti removal and vandalism repair (if found)	City of Stillwater	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Structural Inspection – Base inspection	Mn/DOT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	In-depth structural inspection – 4-year inspection	Mn/DOT				<input type="checkbox"/>				
	Mechanical and electrical inspection	Mn/DOT		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		
	Underwater inspection – 5-year inspection	Mn/DOT					<input type="checkbox"/>			
	Sweep clean deck	City of Stillwater	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Clean and lubricate counterweight wire ropes	Mn/DOT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Clean and lubricate gears/bearing/shaft	Mn/DOT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

# Stillwater Lift Bridge (Bridge 4654) Maintenance Checklist

## First Cycle

Maintenance Activity		Responsible Party	Year							Comments (reference year)
			2014	2015	2016	2017	2018	2019	2020	
	Clean and lubricate couplings	Mn/DOT					<input type="checkbox"/>			
	Clean, lubricate, and adjust operating wire ropes and take-up devices (2x per year)	Mn/DOT	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	
	Inspect, clean, and lubricate main drive motor	Mn/DOT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Clean and lubricate gear reducers	Mn/DOT					<input type="checkbox"/>			
	Inspect, clean, and lubricate auxiliary drive motor	Mn/DOT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	General annual control system maintenance	Mn/DOT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Clean and lubricate pedestrian barriers (gates)	Mn/DOT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Replace aerial cables (festoon cables)	Mn/DOT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Maintain pavement markings/signage	City of Stillwater								

**Minnesota Department of Transportation (Mn/DOT)**  
**Historic Bridge Management Plan**

**Bridge Number: 4654**

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**Appendices**

**Appendix D. Secretary of the Interior's Standards for the  
Treatment of Historic Properties, as Adapted for  
Historic Bridges**



# **Secretary of the Interior's Standards for the Treatment of Historic Properties, as Adapted for Historic Bridges**

## **Adapted from:**

**Clark, Kenneth M., Grimes, Mathew C., and Ann B. Miller, *Final Report, A Management Plan for Historic Bridges in Virginia*, Virginia Transportation Research Council, 2001.**

The Secretary of the Interior's Standards for the Treatment of Historic Properties, first codified in 1979 and revised in 1992, have been interpreted and applied largely to buildings rather than engineering structures. In this document, the differences between buildings and structures are recognized and the language of the Standards has been adapted to the special requirements of historic bridges.

1. Every reasonable effort shall be made to continue an historic bridge in useful transportation service. Primary consideration shall be given to rehabilitation of the bridge on site. Only when this option has been fully exhausted shall other alternatives be explored.
2. The original character-defining qualities or elements of a bridge, its site, and its environment should be respected. The removal, concealment, or alteration of any historic material or distinctive engineering or architectural feature should be avoided.
3. All bridges shall be recognized as products of their own time. Alterations that have no historical basis and that seek to create a false historical appearance shall not be undertaken.
4. Most properties change over time; those changes that have acquired historic significance in their own right shall be retained and preserved.
5. Distinctive engineering and stylistic features, finishes, and construction techniques or examples of craftsmanship that characterize an historic property shall be preserved.
6. Deteriorated structural members and architectural features shall be retained and repaired, rather than replaced. Where the severity of deterioration requires replacement of a distinctive element, the new element should match the old in design, texture, and other visual qualities and where possible, materials. Replacement of missing features shall be substantiated by documentary, physical, or pictorial evidence.
7. Chemical and physical treatments that cause damage to historic materials shall not be used. The surface cleaning of structures, if appropriate, shall be undertaken using the most environmentally sensitive means possible.
8. Significant archaeological and cultural resources affected by a project shall be protected and preserved. If such resources must be disturbed, mitigation measures shall be undertaken.

9. New additions, exterior alterations, structural reinforcements, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.
10. New additions and adjacent or related new construction shall be undertaken in such a manner that if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.



# **Minnesota Department of Transportation (Mn/DOT)**

## **Historic Bridge Management Plan**

**Bridge Number: 4654**

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### **Appendices**

#### **Appendix E.      Current Mn/DOT Structure Inventory Report**

[Appendix E includes copies of current and past Mn/DOT inspection reports, as available, and selected other reports and documents on the bridge.]

#### **Current Mn/DOT Bridge Inspection Report**

#### **Past Maintenance Reports (as available)**

#### **Other Reports (as available)**



# Mn/DOT Structure Inventory Report

Bridge ID: 4654

TH 36 over ST CROIX RIVER

Date: 10/08/2008

+ GENERAL +			+ ROADWAY +			+ INSPECTION +		
Agency Br. No.	Crew	7648	Bridge Match ID (TIS)	1		Deficient Status	S.D.	
District	METRO	Maint. Area METRO	Roadway O/U Key	1-ON		Sufficiency Rating	32.8	
County	82 - WASHINGTON		Route Sys/Nbr	MNTH 36		Last Inspection Date	05-23-2008	
City	STILLWATER		Roadway Name or Description			Inspection Frequency	12	
Township			MUN STREET			Inspector Name	METRO	
Desc. Loc.	AT WISCONSIN STATE LINE		Roadway Function	MAINLINE		Structure	P-LOAD POSTED	
Sect., Twp., Range	27 - 030N - 20W		Roadway Type	2 WAY TRAF		+ CONDITION CODES +		
Latitude	45d 03m 24.00s		Control Section (TH Only)	8217		Deck	5 % UNSOUND	8
Longitude	92d 48m 06.00s		Ref. Point (TH Only)	205+00.354		Superstructure	6	
Custodian	STATE HWY		Date Opened to Traffic	07-01-1931		Substructure	5	
Owner	STATE HWY		Detour Length	14 mi.		Channel	7	
Inspection By	METRO DISTRICT		Lanes	2 Lanes ON Bridge		Culvert	N	
BMU Agreement			ADT (YEAR)	18,000 (2004)		+ APPRAISAL RATINGS +		
Year Built	1930		HCA DT	540		Structure Evaluation	5	
Year Fed Rehab			Functional Class.	URB/OTH PR ART		Deck Geometry	2	
Year Remodeled			+ RDWY DIMENSIONS +			Underclearances	2	
Temp			If Divided	NB-EB	SB-WB	Waterway Adequacy	2	
Plan Avail.	CENTRAL		Roadway Width	23.0 ft		Approach Alignment	8	
+ STRUCTURE +			Vertical Clearance	13.2 ft		+ SAFETY FEATURES +		
Service On	HWY;PED		Max. Vert. Clear.	13.9 ft		Bridge Railing	0-SUBSTANDARD	
Service Under	HWY;STREAM		Horizontal Clear.	23.0 ft		GR Transition	1-MEETS STANDARDS	
Main Span Type	STEEL MOVEABLE		Lateral Clr. - Lt/Rt			Appr. Guardrail	1-MEETS STANDARDS	
Main Span Detail	PRATT		Appr. Surface Width	42.0 ft		GR Termini	0-SUBSTANDARD	
Appr. Span Type	CONC DECK GIRD		Roadway Width	23.0 ft		+ IN DEPTH INSP. +		
Appr. Span Detail			Median Width			Frac. Critical	Y	24 mo 05/2007
Skew			+ MISC. BRIDGE DATA +			Underwater	Y	60 mo 08/2004
Culvert Type			Structure Flared	NO		Pinned Asbly.		
Barrel Length			Parallel Structure	NONE		Spec. Feat.		
Number of Spans			Field Conn. ID	RIVETED		+ WATERWAY +		
MAIN: 7 APPR: 3 TOTAL: 10			Cantilever ID			Drainage Area	6,730.0 sq mi	
Main Span Length	143.6 ft		Foundations			Waterway Opening	25000 sq ft	
Structure Length	1,053.0 ft		Abut.	CONC - FTG PILE		Navigation Control	PERMIT REQD	
Deck Width	24.0 ft		Pier	CONC - FTG PILE		Pier Protection	NOT REQUIRED	
Deck Material	C-I-P CONCRETE		On - Off System	YES		Nav. Vert./Horz. Clr.	63 ft	98.0 ft
Wear Surf Type	MONOLITHIC CONC		+ PAINT +			Nav. Vert. Lift Bridge Clear.	15.0 ft	
Wear Surf Install Year			Year Painted	2002	Pct. Unsound 30 %	MN Scour Code	N-STBL;LIM SCOUR	
Wear Course/Fill Depth			Painted Area	36,100 sf		Scour Evaluation Year	1996	
Deck Membrane	NONE		Primer Type	ORGANIC ZINC		+ CAPACITY RATINGS +		
Deck Rebars	EPOXY COATED REBAR		Finish Type	URETHANE		Design Load	H 15	
Deck Rebars Install Year	2005		+ BRIDGE SIGNS +			Operating Rating	HS 20.0	
Structure Area	25,272 sq ft		Posted Load	VEHICLE & SEMI		Inventory Rating	HS 13.0	
Roadway Area	24,219 sq ft		Traffic	NOT REQUIRED		Posting	VEH: 28 SEMI: 40 DBL: 40	
Sidewalk Width - L/R	7.5 ft		Horizontal	NOT REQUIRED		Rating Date	07-22-2008	
Curb Height - L/R	0.75 ft	0.75 ft	Vertical	ROADWAY RESTRICTION		Mn/DOT Permit Codes		
Rail Codes - L/R	02	02				A: X	B: X	C: X

# Mn/DOT Structure Inventory Report

Bridge ID: 4654

TH 36 over ST CROIX RIVER

Date: 10/08/2008

+ GENERAL +			+ ROADWAY +			+ INSPECTION +		
Agency Br. No.	Crew	7648	Bridge Match ID (TIS)	2		Deficient Status	S.D.	
District	METRO	Maint. Area METRO	Roadway O/U Key	2-UNDER		Sufficiency Rating	32.8	
County	82 - WASHINGTON		Route Sys/Nbr	MUN 181		Last Inspection Date	05-23-2008	
City	STILLWATER		Roadway Name or Description			Inspection Frequency	12	
Township			MUN 181			Inspector Name	METRO	
Desc. Loc.	AT WISCONSIN STATE LINE		Roadway Function	MAINLINE		Structure	P-LOAD POSTED	
Sect., Twp., Range	27 - 030N - 20W		Roadway Type	2 WAY TRAF		+ CONDITION CODES +		
Latitude	45d 03m 24.00s		Control Section (TH Only)			Deck	5 % UNSOUND	8
Longitude	92d 48m 06.00s		Ref. Point (TH Only)			Superstructure		6
Custodian	STATE HWY		Date Opened to Traffic	07-01-1931		Substructure		5
Owner	STATE HWY		Detour Length	14 mi.		Channel		7
Inspection By	METRO DISTRICT		Lanes	2 Lanes UNDER Bridge		Culvert		N
BMU Agreement			ADT (YEAR)	50 (1974)		+ APPRAISAL RATINGS +		
Year Built	1930		HCA DT			Structure Evaluation		5
Year Fed Rehab			Functional Class.	URBAN LOCAL		Deck Geometry		2
Year Remodeled			+ RDWY DIMENSIONS +			Underclearances		2
Temp			If Divided	NB-EB	SB-WB	Waterway Adequacy		2
Plan Avail.	CENTRAL		Roadway Width	18.0 ft		Approach Alignment		8
+ STRUCTURE +			Vertical Clearance	9.5 ft		+ SAFETY FEATURES +		
Service On	HWY;PED		Max. Vert. Clear.	9.5 ft		Bridge Railing	0-SUBSTANDARD	
Service Under	HWY;STREAM		Horizontal Clear.	18.0 ft		GR Transition	1-MEETS STANDARDS	
Main Span Type	STEEL MOVEABLE		Lateral Clr. - Lt/Rt	0.5 ft		Appr. Guardrail	1-MEETS STANDARDS	
Main Span Detail	PRATT		Appr. Surface Width	18.0 ft		GR Termini	0-SUBSTANDARD	
Appr. Span Type	CONC DECK GIRD		Roadway Width	18.0 ft		+ IN DEPTH INSP. +		
Appr. Span Detail			Median Width			Frac. Critical	Y	24 mo 05/2007
Skew			+ MISC. BRIDGE DATA +			Underwater	Y	60 mo 08/2004
Culvert Type			Structure Flared	NO		Pinned Asbly.		
Barrel Length			Parallel Structure	NONE		Spec. Feat.		
Number of Spans			Field Conn. ID	RIVETED		+ WATERWAY +		
MAIN: 7 APPR: 3 TOTAL: 10			Cantilever ID			Drainage Area	6,730.0 sq mi	
Main Span Length	143.6 ft		Foundations			Waterway Opening	25000 sq ft	
Structure Length	1,053.0 ft		Abut.	CONC - FTG PILE		Navigation Control	PERMIT REQD	
Deck Width	24.0 ft		Pier	CONC - FTG PILE		Pier Protection	NOT REQUIRED	
Deck Material	C-I-P CONCRETE		On - Off System	YES		Nav. Vert./Horz. Clr.	63 ft	98.0 ft
Wear Surf Type	MONOLITHIC CONC		+ PAINT +			Nav. Vert. Lift Bridge Clear.	15.0 ft	
Wear Surf Install Year			Year Painted	2002	Pct. Unsound 30 %	MN Scour Code	N-STBL;LIM SCOUR	
Wear Course/Fill Depth			Painted Area	36,100 sf		Scour Evaluation Year	1996	
Deck Membrane	NONE		Primer Type	ORGANIC ZINC		+ CAPACITY RATINGS +		
Deck Rebars	EPOXY COATED REBAR		Finish Type	URETHANE		Design Load	H 15	
Deck Rebars Install Year	2005		+ BRIDGE SIGNS +			Operating Rating	HS 20.0	
Structure Area	25,272 sq ft		Posted Load	VEHICLE & SEMI		Inventory Rating	HS 13.0	
Roadway Area	24,219 sq ft		Traffic	NOT REQUIRED		Posting	VEH: 28 SEMI: 40 DBL: 40	
Sidewalk Width - L/R	7.5 ft		Horizontal	NOT REQUIRED		Rating Date	07-22-2008	
Curb Height - L/R	0.75 ft	0.75 ft	Vertical	ROADWAY RESTRICTION		Mn/DOT Permit Codes		
Rail Codes - L/R	02	02				A: X	B: X	C: X

# Mn/DOT BRIDGE INSPECTION REPORT

## BRIDGE 4654

# TH 36 OVER ST CROIX RIVER

INSP. DATE: 05-23-2008

County: WASHINGTON

Location: AT WISCONSIN STATE LINE

Length: 1,053.0 ft

City: STILLWATER

Route: MNTH 36      Ref. Pt.: 205+00.354

Deck Width: 24.0 ft

Township:

Control Section: 8217 Maint. Area: METRO

Rdwy. Area / Pct. Unsnd: 24,219 sq ft 5 %

Section: 27 Township: 030N Range: 20W

Local Agency Bridge Nbr:

Paint Area/ Pct. Unsnd: 36,100 sq ft 30 %

Span Type: STEEL MOVEABLE

Culvert	N/A
---------	-----

NBI Deck: 8 Super: 6 Sub: 5 Chan: 7 Culv: N

Open, Posted, Closed:      LOAD POSTED

Postings: 28 - 40 - 40

Appraisal Ratings - Approach: 8    Waterway: 2

MN Scour Code: N-STBL;LIM SCOUR

Def. Stat: S.D. Suff. Rate: 32.8

Required Bridge Signs - Load Posting: VEHICLE &amp; SEMI      Traffic: NOT REQUIRED

Horizontal: NOT REQUIRED      Vertical: ROADWAY RESTRICTION

**STRUCTURE UNIT: 0**

[illegible]

INSP. DATE: 05-23-2008

ELEM NBR	ELEMENT NAME	ENV	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4	QTY CS 5
126	P/STL THRU TRUSS/TOP	2	05-23-2008	1,986 LF	1,278	410	248	50	0
			05-17-2007	1,986 LF	1,390	298	248	50	0
	Notes: [95/2008] Upper truss members have salt film, bubbled & peeled paint, flaking & surface rust, (pitting 1/16" deep) (bottom 10 FT), with flaking paint on the interior of many connections.								
146	STEEL CABLE - BARE	2	05-23-2008	40 EA	0	40	0	0	N/A
			05-17-2007	40 EA	0	40	0	0	N/A
	Notes: The lift span is supported by 32 counterweight cables (1 1/2" diameter) and 8 "uphaul/downhaul" cables (3/4" diameter). [1970/71] Counterweight cables replaced. [1995] Northeast "uphaul" cable replaced. [2002] SW Uphaul and downhaul cable replaced.								
152	PAINT STL FLOORBEAM	2	05-23-2008	2,800 LF	1,848	532	280	140	0
			05-17-2007	2,800 LF	1,960	420	280	140	0
	Notes: 30" deep rolled floorbeams (8 in each span). [1996] Span 4: panel point 0 (west end of lift span): both ends of floorbeam has a hole in the web at the bottom corner. [2001] Hole plated over & bolted. [2002] [2003] Surface rust showing. Several holes found through web. Floorbeam 0' at pier 6 (south end) have bolted plates added to web. [2005] 19 each repair floorbeam connection, 56 each repair floorbeam. [2008] (Up to 1/8" deep) pitting web ends floorbeams.								
310	ELASTOMERIC BEARING	2	05-23-2008	16 EA	16	0	0	N/A	N/A
			05-17-2007	16 EA	16	0	0	N/A	N/A
	Notes: [2002] Elastomeric bearings replaced roller nests.								
313	FIXED BEARING	2	05-23-2008	12 EA	0	12	0	N/A	N/A
			05-17-2007	12 EA	0	12	0	N/A	N/A
	Notes: Truss spans are "simple span". Fixed bearing at one end, elastomeric at the other. Salt film, flaking & surface rust.								
210	CONCRETE PIER WALL	2	05-23-2008	268 LF	134	134	0	0	N/A
			05-17-2007	268 LF	134	134	0	0	N/A
	Notes: The "pierwalls" have two columns connected by a web - most deterioration is below water surface. Underwater inspections in 1991 & 1995 found a 1 FT band of scale (typically 4-6" deep with exposed rebar, some at 12" deep) at the waterline of each river pier. Pier 1: cap has vertical cracks. Pier 2: east face has 50 LF of horizontal cracks. Pier 3: upstream nose has a horizontal crack. [2005] Concrete repair to delaminated & spall areas: pier 2 thru pier 8. 171 LF repair strucural cracks.								
215	CONCRETE ABUTMENT	2	05-23-2008	70 LF	35	35	0	0	N/A
			05-17-2007	70 LF	35	35	0	0	N/A
	Notes: [1985/95] East abutment: 30 LF horizontal & vertical cracks. West abutment face has 2 vertical leaching cracks. [2005] Concrete repairs at east abutment.								
387	CONCRETE WINGWALL	2	05-23-2008	4 EA	4	0	0	0	N/A
			05-17-2007	4 EA	4	0	0	0	N/A
	Notes: [2005] Concrete patches.								
357	PACK RUST	2	05-23-2008	1 EA	0	0	1	0	N/A
			05-17-2007	1 EA	0	0	1	0	N/A
	Notes: [1995] Truss bottom chord/vertical member connection plates have severe pack rust (up to 1" spread between plates: panel points 1 & 1' span 3 thru 9) at many locations.								
358	CONC DECK CRACKING	2	05-23-2008	1 EA	1	0	0	0	N/A
			05-17-2007	1 EA	1	0	0	0	N/A
	Notes: [2006] Random cracks.								
359	CONC DECK UNDERSIDE	2	05-23-2008	1 EA	0	1	0	0	0
			05-17-2007	1 EA	0	1	0	0	0
	Notes: [2006] Leaching cracks below floorbeams.								

# Mn/DOT BRIDGE INSPECTION REPORT

## BRIDGE 4654

# TH 36 OVER ST CROIX RIVER

**INSP. DATE: 05-23-2008**

## STRUCTURE UNIT: 0

[illegible]

## Mn/DOT BRIDGE INSPECTION REPORT

**BRIDGE 4654**

**TH 36 OVER ST CROIX RIVER**

**INSP. DATE: 05-23-2008**

**STRUCTURE UNIT: 0**

ELEM NBR	ELEMENT NAME	ENV	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4	QTY CS 5
988	MISCELLANEOUS	2	05-23-2008 05-17-2007	1 EA 1 EA	1 1	0 0	0 0	N/A N/A	N/A N/A
Notes: [2005] Tender house repaired, electrical house constructed, lift tower lateral bracing modified, mechanical improvements (all in span 4). Lower St. Croix National Scenic Riverway.									
422	PAINTED BEAM ENDS	2	05-23-2008 05-17-2007	6 EA 6 EA	6 6	0 0	0 0	0 0	0 0
Notes:									

General Notes: Bridge #4654, Year 2008  
"Stillwater" Vertical Lift Bridge constructed in 1930-31. Replace sidewalk contract in 1998. Spot painting contract in 2002. Bridge repair contract in 2005. MnDOT is considered the "Lead Agency" for scheduled contract work, inspections and maintenance of this bridge.

[2001, 03, 04, 05, 06] Photos.

See "Fracture Critical" inspection report for additional information. [1994] Note: Due to the extensive structural deterioration, Mn/DOT posted the bridge with a load restriction of 28 tons (40 tons for truck/trailer combinations) - overweight permits are no longer being issued.

The Forest Lake bridge crew completed numerous structural repairs after the 2002 inspection. [2002] Bridge vertical clearance signed at 13 feet 2 inches, semi tractor trailer should be restricted.

Inspectors: K Fuhrman, V Desens

\_\_\_\_\_  
Inspector's Signature

\_\_\_\_\_  
Reviewer's Signature / Date



# **Minnesota Department of Transportation (Mn/DOT)**

## **Historic Bridge Management Plan**

**Bridge Number: 4654**

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### **Appendices**

## **Appendix F.      Applicable Standards**



## Applicable Standards

### Bridge Specifications and Standards

- AASHTO Standard Specifications for Moveable Bridges, 1988
- AASHTO Standard Specifications for Highway Bridges, 2002 (17<sup>th</sup> Edition)
- Mn/DOT LRFD Bridge Design Manual
- Bridge Preservation, Improvement, and Replacement Guidelines

### Mechanical Specifications and Standards

- AGMA 2001 – C95 and AGMA 390.03

### Electrical Specifications and Standards

- National Electric Code (NFPA 70)
- Electrical Standard for Industry Machinery (NFPA 79)
- Manual on Uniform Traffic Control Devices (MUTCD)
- National Electrical Manufacturers Association (NEMA)
- Institute for Electrical and Electronic Engineers (IEEE)
- Underwriters Laboratories

### Pedestrian/Bicycle Specifications, Standards, and Guidelines

- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities, July 2004
- AASHTO Policy on Geometric Design of Highways and Streets, 2001
- The ADA Standards for Accessible Design, September 2002
- FHWA Designing Sidewalks and Trails, Part II, Best Practices Design Guide, September 2001
- Mn/DOT Bikeway Facility Design Manual, 2007
- Secretary of the Interior's Standards for the Treatment of Historic Properties
- Revised Draft Guidelines for Accessible Public Rights-of-Way 2005
- Public Rights-of-Way ADA Guidelines, 2005
- Mn/DOT LRFD Bridge Design Manual



# **Minnesota Department of Transportation (Mn/DOT)**

## **Historic Bridge Management Plan**

**Bridge Number: 4654**

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### **Appendices**

#### **Appendix G. Cost Details**



# **Mn/DOT Historic Bridge Management Plan**

BRIDGE No. 4654 MAINTENANCE/STABILIZATION/PRESERVATION Activity Listing and Costs

## **STABILIZATION COST SUMMARY**

Ref. No.	Item/Description of Work	Costs
1.00	Superstructure	\$ 4,000
2.00	Substructure	\$ -
3.00	Railings	\$ 25,000
4.00	Deck	\$ -
5.00	Other	\$ -
6.00	Mechanical	\$ 51,000
7.00	Electrical	\$ 5,000
	<b>Total:</b>	<b>\$ 85,000</b>

### **1.00 Superstructure**

Ref. No.	Item/Description of Work	Expected Life Cycle - Years	Item Qty	Qty Unit	Unit Cost	Item Total
1.00	Spot Clean & Paint Pedestrian Railing	5	1	LS	\$ 4,000	\$ 4,000
1.05						\$ -
	<b>Total:</b>				<b>\$</b>	<b>4,000</b>

### **2.00 Substructure**

Ref. No.	Item/Description of Work	Expected Life Cycle - Years	Item Qty	Qty Unit	Unit Cost	Item Total
2.00						\$ -
2.05						\$ -
	<b>Total:</b>				<b>\$</b>	<b>-</b>

### **3.00 Railings**

Ref. No.	Item/Description of Work	Expected Life Cycle - Years	Item Qty	Qty Unit	Unit Cost	Item Total
3.00	Concourse Balustrade Repairs (ASAP)		1	LS	\$ 25,000	\$ 25,000
3.05						\$ -
	<b>Total:</b>				<b>\$</b>	<b>25,000</b>

### **4.00 Deck**

Ref. No.	Item/Description of Work	Expected Life Cycle - Years	Item Qty	Qty Unit	Unit Cost	Item Total
4.00						\$0
4.05						\$0
	<b>Total:</b>				<b>\$</b>	<b>-</b>

### **5.00 Other**

Ref. No.	Item/Description of Work	Expected Life Cycle - Years	Item Qty	Qty Unit	Unit Cost	Item Total
5.00						\$ -
5.05						\$ -
	<b>Total:</b>				<b>\$</b>	<b>-</b>

### **6.00 Mechanical**

Ref. No.	Item/Description of Work	Expected Life Cycle - Years	Item Qty	Qty Unit	Unit Cost	Item Total
6.00	Paint Machinery	20	1	LS	\$ 11,000	\$ 11,000
6.05	Balance Up-haul/Down-haul Cables	20	1	LS	\$ 3,500	\$ 3,500
6.10	Repair Down-haul take-up Assemblies	50	1	LS	\$ 2,000	\$ 2,000
6.15	Replace Wear Plates	5	1	LS	\$ 7,500	\$ 7,500
6.20	Perform Non-destructive testing on trunnions	NA	1	LS	\$ 27,000	\$ 27,000
6.25						\$ -
	<b>Total:</b>				<b>\$</b>	<b>51,000</b>

### **7.00 Electrical**

Ref. No.	Item/Description of Work	Expected Life Cycle - Years	Item Qty	Qty Unit	Unit Cost	Item Total
7.00	Misc. Routine Repairs		1	L Sum	\$ 5,000	\$ 5,000
7.05						\$ -
7.10						\$ -
7.15						\$ -
7.20						\$ -
7.25						\$ -
	<b>Total:</b>				<b>\$</b>	<b>5,000</b>

# Mn/DOT Historic Bridge Management Plan

## Bridge No. 4654 Stabilization/Preservation/Maintenance Activity Listing and Costs

### PRESERVATION COST SUMMARY

Costs are in YR 2009 Dollars

Ref. No.	Item/Description of Work	Costs
1.00	1.00 Superstructure	\$ 3,207,225
2.00	2.00 Substructure	\$ 558,920
3.00	3.00 Railings	\$ 128,007
4.00	4.00 Deck	\$ 79,903
5.00	5.00 Other	\$ 718,463
6.00	6.00 Mechanical	\$ 1,870,500
7.00	7.00 Electrical	\$ 707,395
<b>Total:</b>		<b>\$ 7,270,413</b>

#### 1.00 Superstructure

Ref. No.	Item/Description of Work	Recommended Completion Year	Expected Life Cycle - Years	Item Qty	Qty Unit	Unit Cost	Item Total
1.00	Repair Truss Vertical at Floorbeam Connection	2013	30	28	EA	\$ 10,000	\$ 280,000
1.05	Repair Lower Chord Type 1	2013	30	5	EA	\$ 2,000	\$ 10,000
1.10	Repair Lower Chord Type 2	2013	30	31	EA	\$ 2,000	\$ 62,000
1.15	Repair Lower Chord Type 3	2013	30	39	EA	\$ 2,000	\$ 78,000
1.20	Repair Lower Chord Type 4	2013	30	10	EA	\$ 2,000	\$ 20,000
1.25	Replace Rivet with Bolt	2013	50	100	EA	\$ 50	\$ 5,000
1.30	Replace Rivet with Rivet	2013	50	100	EA	\$ 125	\$ 12,500
1.35	Miscellaneous Metal	2013	50	32,435	LB	\$ 15	\$ 486,525
1.40	Waste Collection and Disposal	2013	25	1	LS	\$ 1,500,000	\$ 1,500,000
1.45	Organic Zinc-Rich Paint System (old)	2013	25	150,000	SF	\$ 5	\$ 750,000
1.50	Grouted Anchorages	2013	50	16	EA	\$ 200	\$ 3,200
<b>Total:</b>						<b>\$</b>	<b>3,207,225</b>

#### 2.00 Substructure

Ref. No.	Item/Description of Work	Recommended Completion Year	Expected Life Cycle - Years	Item Qty	Qty Unit	Unit Cost	Item Total
2.00	Reinforcement Bars (Epoxy Coated)	2013	30	2225	LB	\$ 2	\$ 4,450
2.05	Steel Fabric	2013	30	1280	LB	\$ 2	\$ 2,560
2.10	Dewatering System	2013	NA	1	LS	\$ 360,000	\$ 360,000
2.15	Grouted Reinforcement Bars	2013	30	95	EA	\$ 30	\$ 2,850
2.20	Repair Structural Cracks	2013	30	31	LF	\$ 60	\$ 1,860
2.25	Concrete Surface Repair	2013	30	2080	SF	\$ 90	\$ 187,200
<b>Total:</b>						<b>\$</b>	<b>558,920</b>

#### 3.00 Railings

Ref. No.	Item/Description of Work	Recommended Completion Year	Expected Life Cycle - Years	Item Qty	Qty Unit	Unit Cost	Item Total
3.00	Repair Ornamental Metal Railing	2013	20	1	LS	\$ 6,000	\$ 6,000
3.05	Stainless Steel Cable North Railing	2013	45	995	LF	\$ 80	\$ 79,600
3.10	Stainless Steel Cable South Railing	2013	45	860	LF	\$ 16	\$ 13,760
3.15	Concrete Surface Repair - Historic	2013	30	155	SF	\$ 165	\$ 25,575
3.20	Concrete Surface Cleaning - Historic	2013	30	384	SF	\$ 8	\$ 3,072
<b>Total:</b>						<b>\$</b>	<b>128,007</b>

#### 4.00 Deck

Ref. No.	Item/Description of Work	Recommended Completion Year	Expected Life Cycle - Years	Item Qty	Qty Unit	Unit Cost	Item Total
4.00	Sawing Concrete Pavement	2013	NA	242	LF	\$ 14	\$ 3,388
4.05	Bridge Approach Panels	2013	45	1	LS	\$ 7,800	\$ 7,800
4.10	Bridge Slab Concrete (3Y33)	2013	45	890	SF	\$ 30	\$ 26,700
4.15	Reconstruct Expansion Joint Device	2013	45	153	LF	\$ 215	\$ 32,895
4.20	Remove Sidewalk Deck	2013	NA	912	SF	\$ 10	\$ 9,120
<b>Total:</b>						<b>\$</b>	<b>79,903</b>

#### 5.00 Other

Ref. No.	Item/Description of Work	Recommended Completion Year	Expected Life Cycle - Years	Item Qty	Qty Unit	Unit Cost	Item Total
5.00	Remove Miscellaneous Structures	2013	NA	1	LS	\$ 10,000	\$ 10,000
5.01	Remove Overhead Lights	2013	NA	29	EA	\$ 200	\$ 5,800
5.02	Access Hatch	2013	30	6	EA	\$ 1,000	\$ 6,000
5.03	Mobilization	2013	NA	1	LS	\$ 400,000	\$ 400,000
5.04	Clearing	2013	NA	5	TREE	\$ 200	\$ 1,000
5.05	Grubbing	2013	NA	6	TREE	\$ 200	\$ 1,200
5.06	Pavement Marking Removal - Permanent	2013	NA	770	SF	\$ 80	\$ 61,600
5.07	Remove Curb and Gutter	2013	NA	480	LF	\$ 10	\$ 4,800
5.08	Remove Storm Sewer Pipe	2013	NA	220	LF	\$ 10	\$ 2,200
5.09	Remove Concrete Walk	2013	NA	1400	SF	\$ 2	\$ 2,100
5.10	Remove Concrete Driveway	2013	NA	370	SF	\$ 2	\$ 648
5.11	Remove Pavement	2013	NA	8560	SF	\$ 2	\$ 17,120
5.12	Remove Casting (Storm)	2013	NA	6	EA	\$ 150	\$ 900



Ref. No.	Item/Description of Work	Recommended Completion Year	Expected Life Cycle - Years	Item Qty	Qty Unit	Unit Cost	Item Total
7.00	Conduit System (Lighting)	2013	50	1	LS	\$ 32,000	\$ 32,000
7.05	Conduit System (Power)	2013	50	1	LS	\$ 75,000	\$ 75,000
7.10	Conduit System (Surveillance)	2013	50	1	LS	\$ 16,000	\$ 16,000
7.15	Conduit System (Telephone)	2013	50	1	LS	\$ 6,500	\$ 6,500
7.20	Conduit System (Navigation)	2013	50	1	LS	\$ 6,200	\$ 6,200
7.25	Lighting Unit Type AA1	2013	50	10	EA	\$ 13,475	\$ 134,750
7.30	Lighting Unit Type AA2	2013	50	21	EA	\$ 2,800	\$ 58,800
7.35	Lighting Unit Type AA3	2013	50	4	EA	\$ 3,800	\$ 15,200
7.40	Lighting Unit Type AA4	2013	50	6	EA	\$ 13,475	\$ 80,850
7.45	Lighting Unit Type AA5	2013	50	2	EA	\$ 14,210	\$ 28,420
7.50	Lighting Unit Type AA6	2013	50	1	EA	\$ 13,475	\$ 13,475
7.55	Lighting Unit Type AA8	2013	50	2	EA	\$ 800	\$ 1,600
7.60	Lighting Unit Type AA9	2013	50	2	EA	\$ 800	\$ 1,600
7.65	Control System Modifications	2013	25	1	LS	\$ 40,000	\$ 40,000
7.70	PA System	2013	25	1	LS	\$ 23,000	\$ 23,000
7.75	CCTV System	2013	10	1	LS	\$ 37,000	\$ 37,000
7.80	Pedestrian Gate Design Special	2013	50	2	EA	\$ 60,000	\$ 120,000
7.85	Revise Signal System	2013	10	1	SYS	\$ 17,000	\$ 17,000
<b>Total:</b>						<b>\$</b>	<b>707,395</b>

# **Mn/DOT Historic Bridge Management Plan**

## **BRIDGE No. 4654 MAINTENANCE/STABILIZATION/PRESERVATION Activity Listing and Costs**

### **OPERATIONS**

Ref. No.	Item	Action	Cost Per Event (2008 US\$)	Occurrences Years 2014 to 2027	Occurrences Years 2028 to 2041	Occurrences Years 2042 to 2055	42 Yr. Cost (2008 US \$)
1	Bridge Tender	Operate Br.	\$84,000	14	14	14	\$3,528,000
2	Electricity & Phone	Provide Service	\$5,600	14	14	14	\$235,200
3	Admin, Coord, Training, & Misc	Main. Records	\$6,000	14	14	14	\$252,000
4	Not Used		\$0				\$0
			Projected Costs:	\$1,338,400	\$1,338,400	\$1,338,400	\$4,015,200
			Annualized Cost:	\$95,600			

### **ROUTINE MAINTENANCE**

Ref. No.	Item	Action	Cost Per Event (2008 US\$)	Occurrences Years 2014 to 2027	Occurrences Years 2028 to 2041	Occurrences Years 2042 to 2055	42 Yr. Cost (2008 US \$)
5	Flush Deck, drains, exp. Joints, sub-struct.	Power Wash	\$3,000	14	14	14	\$126,000
6	Graffiti Removal & Vandalism Repair	Clean & Repair	\$800	14	14	14	\$33,600
7	Structural Inspection	Base Inspection	\$16,000	11	10	10	\$496,000
8	In-Depth Structural Inspection	4-Year Inspection	\$30,000	3	4	4	\$330,000
9	Structural Analysis & Rating	Struct. Rating	\$60,000		1		\$60,000
10	Mech. & Elect. Inspection	Base Inspection	\$5,900	6	7	7	\$118,000
11	Underwater Inspection	5-year Inspection	\$20,000	2	3	3	\$160,000
12	Lamp Replacement - NAV LED (10 each, 10 yr life)	Replace Lamps	\$4,000	1	1	1	\$12,000
13	Lamp Replacement - Rdwy LED (25 each, 10yr life)	Replace Lamps	\$20,000	1	1	1	\$60,000
14	Lamp Replacement - Om Walkway LED (16 each, 10 yr)	Replace Lamps	\$11,200	1	1	2	\$44,800
15	Sweep Clean Deck	Sweep	\$700	14	14	14	\$29,400
16	Counterweight Wire Ropes	Clean & lubricate	\$9,400	14	14	14	\$394,800
17	Gears/Bearing/Shaft	Clean & lubricate	\$5,300	14	14	14	\$222,600
18	Couplings	Clean & lubricate	\$2,650	2	3	3	\$21,200
19	Operating Wire Ropes & Take-Up Devices	Clean / Lub / Adj.	\$3,150	14	14	14	\$132,300
20	Operating Wire Ropes	Replace	\$20,000	1	2	2	\$100,000
21	Operating Rope Wear Plates	Replace	\$7,500	2	3	2	\$52,500
22	Main Drive Motor	Insp/clean/Lub	\$780	14	14	14	\$32,760
23	Gear Reducers	Clean & lubricate	\$4,900	2	3	3	\$39,200
24	Auxiliary Drive Motor	Insp/clean/Lub	\$465	14	14	14	\$19,530
25	General annual control syst maintenance	Clean, test adjust	\$5,700	14	14	14	\$239,400
26	Pedestrian Barriers (Gates)	Clean & lubricate	\$1,850	14	14	14	\$77,700
27	Aerial Cables (Festoon Cables)	Replace	\$23,200	2	3	3	\$185,600
28	Not Used		\$0				\$0
29	Not Used		\$0				\$0
			Projected Costs:	\$882,930	\$1,033,580	\$984,780	\$2,987,390
			Annualized Cost:	\$71,128			

# **Mn/DOT Historic Bridge Management Plan**

## **BRIDGE No. 4654 MAINTENANCE/STABILIZATION/PRESERVATION Activity Listing and Costs**

### **Future Preservation - Substructure**

Ref. No.	Item	Action	Cost Per Event (2008 US\$)	Occurrences Years 2014 to 2027	Occurrences Years 2028 to 2041	Occurrences Years 2042 to 2055	42 Yr. Cost (2008 US \$)
1	Scour Repair	Aggregate on ice	\$6,000	2	2	2	\$36,000
2	W. Concourse Concrete Patching & Surf. Treat.	Repair	\$30,000		1		\$30,000
3	West Abut. Concrete Patching & Surf. Treat.	Repair	\$10,000		1		\$10,000
4	Piers 3 to 7 Concrete Repair Above Waterline	Sup Br. - Repl	\$400,000			1	\$400,000
5	Pier 8 Concrete Repair Above Waterline	Sup Br. - Repl	\$80,000			1	\$80,000
6	Pier 1 to 7 Concrete Repair Below Waterline	Repair	\$480,000			1	\$480,000
7	Pier 8 Concrete Repair Below Waterline	Repair	\$80,000			1	\$80,000
8	E. Abut Concrete Surface Repair	Repair	\$27,000		1		\$27,000
9	E. Abut Settlement Adjustments	Jack & Fill Pedestal	\$23,000		1		\$23,000
10	E. Abut. Slope Protection	Repair	\$3,500		1		\$3,500
Projected Costs:				\$12,000	\$105,500	\$1,052,000	\$1,169,500
Annualized Cost:				\$27,845			

### **Future Preservation - Superstructure - Truss Spans**

Ref. No.	Item	Action	Cost Per Event (2008 US\$)	Occurrences Years 2014 to 2027	Occurrences Years 2028 to 2041	Occurrences Years 2042 to 2055	42 Yr. Cost (2008 US \$)
11	Remove Flood Water Debris	Remove & Discard	\$10,100	3	3	3	\$90,900
12	Bridge Painting - Below Deck Spot	Paint Bridge	\$20,000	2	2	1	\$100,000
13	Bridge Painting - Full Structure	Paint Bridge	\$2,300,000			1	\$2,300,000
14	Bridge Painting - Above Deck Spot	Paint Bridge	\$15,000		1		\$15,000
15	Bearings	Clean & lubricate	\$3,000	2	2	2	\$18,000
16	Stringers	Struct. Repair	\$28,500		1		\$28,500
17	Floor Beams	Struct. Repair	\$46,800		1		\$46,800
18	Lower Chord Members	Struct. Repair	\$140,000		1		\$140,000
19	Truss Webs (Vertical & Diagonals)	Repair	\$300,000		1		\$300,000
20	Truss Lower Lateral Bracing	Lft. Span Only	\$5,000		1		\$5,000
21	Truss - Portal Frames	Misc. Repair	\$25,000		1		\$25,000
22	Truss - Interior Sway Bracing	Misc. Repair	\$25,000		1		\$25,000
Projected Costs:				\$76,300	\$661,600	\$2,356,300	\$3,094,200
Annualized Cost:				\$73,671			

### **Future Preservation - Superstructure - Span 10**

Ref. No.	Item	Action	Cost Per Event (2008 US\$)	Occurrences Years 2014 to 2027	Occurrences Years 2028 to 2041	Occurrences Years 2042 to 2055	42 Yr. Cost (2008 US \$)
23	Deck	Patch/Crack Rep.	\$6,500		1		\$6,500
24	Strip Seal	Rem. & Replace	\$4,300		1		\$4,300
Projected Costs:				\$0	\$10,800	\$0	\$10,800
Annualized Cost:				\$257			

### **Future Preservation - Sidewalk Support System**

Ref. No.	Item	Action	Cost Per Event (2008 US\$)	Occurrences Years 2014 to 2027	Occurrences Years 2028 to 2041	Occurrences Years 2042 to 2055	42 Yr. Cost (2008 US \$)
25	Standard Support Brackets	Repair	\$8,000			1	\$8,000
26	Lift-Span Support Brackets	Repair	\$8,000			1	\$8,000
27	Fascia Stringer	Repair	\$8,000			1	\$8,000
28	Stringers	Repair	\$9,000			1	\$9,000
Projected Costs:				\$0	\$0	\$33,000	\$33,000
Annualized Cost:				\$786			

### **Future Preservation - Deck**

Ref. No.	Item	Action	Cost Per Event (2008 US\$)	Occurrences Years 2014 to 2027	Occurrences Years 2028 to 2041	Occurrences Years 2042 to 2055	42 Yr. Cost (2008 US \$)
29	Roadway & Transition Deck	Patch	\$13,000		1	2	\$39,000
30	Roadway & Transition Deck	Sealing	\$207,000		1		\$207,000
31	Span 9 to 10 Expansion Joints	Replace Gland	\$9,000	1	1	1	\$27,000
32	Drainage System	Repair	\$1,500		1		\$1,500
33	Sidewalk Deck	Seal	\$52,000		1		\$52,000
34	Sidewalk Deck	Patch	\$4,500		1	1	\$9,000
35	Sidewalk Deck Expansion Joints	Clean & Adjust	\$1,700	1	1	1	\$5,100
36	Sidewalk Deck Expansion Joints	Replace	\$12,000		1		\$12,000
Projected Costs:				\$10,700	\$300,700	\$41,200	\$352,600
Annualized Cost:				\$8,395			

### Future Preservation - Railing

Ref. No.	Item	Action	Cost Per Event (2008 US\$)	Occurrences Years 2014 to 2027	Occurrences Years 2028 to 2041	Occurrences Years 2042 to 2055	42 Yr. Cost (2008 US \$)
37	Concrete Railing (Balustrade)	Minor Repair	\$3,000	2	2	4	\$24,000
38	South Pedestrian Railing	Spot Paint	\$3,000	2	2	3	\$21,000
39	North Cable Railing	Spot Repair	\$6,000	2	2	2	\$36,000
40	Pedestrian Railing at South Side	Spot Repair	\$9,000		1	2	\$27,000
Projected Costs:				\$12,000	\$21,000	\$39,000	\$108,000
Annualized Cost:				\$2,571			

### Future Preservation - Support System

Ref. No.	Item	Action	Cost Per Event (2008 US\$)	Occurrences Years 2014 to 2027	Occurrences Years 2028 to 2041	Occurrences Years 2042 to 2055	42 Yr. Cost (2008 US \$)
41	Strike Plates & Live Load Shoes	Clean & adjust	\$2,800	1	1	1	\$8,400
42	Span & Counterweight Guides	Repair	\$22,000			1	\$22,000
43	Ladders/ Platforms	Repair	\$5,000		1		\$5,000
Projected Costs:				\$2,800	\$7,800	\$24,800	\$35,400
Annualized Cost:				\$843			

### Future Preservation - Balance System

Ref. No.	Item	Action	Cost Per Event (2008 US\$)	Occurrences Years 2014 to 2027	Occurrences Years 2028 to 2041	Occurrences Years 2042 to 2055	42 Yr. Cost (2008 US \$)
44	Counterweight Wire Ropes	Replace	\$445,000			1	\$445,000
45	Counterweights	Concrete Repair	\$18,000			1	\$18,000
Projected Costs:				\$0	\$0	\$463,000	\$463,000
Annualized Cost:				\$11,024			

### Future Preservation - Distribution/Control System

Ref. No.	Item	Action	Cost Per Event (2008 US\$)	Occurrences Years 2014 to 2027	Occurrences Years 2028 to 2041	Occurrences Years 2042 to 2055	42 Yr. Cost (2008 US \$)
46	DC Drive	Replace	\$50,000		1		\$50,000
47	PLC Control System	Replace	\$175,000		1		\$175,000
48	Not Used		\$0				\$0
Projected Costs:				\$0	\$225,000	\$0	\$225,000
Annualized Cost:				\$5,357			

### Future Preservation - Traffic Control System

Ref. No.	Item	Action	Cost Per Event (2008 US\$)	Occurrences Years 2014 to 2027	Occurrences Years 2028 to 2041	Occurrences Years 2042 to 2055	42 Yr. Cost (2008 US \$)
49	Pedestrian Barriers (Gate)	Misc. Repair	\$3,000	1	1	1	\$9,000
50	Not Used		\$0	1	1		\$0
51	Not Used		\$0				\$0
Projected Costs:				\$3,000	\$3,000	\$3,000	\$9,000
Annualized Cost:				\$214			

### Future Preservation - Machinery/Tender's House

Ref. No.	Item	Action	Cost Per Event (2008 US\$)	Occurrences Years 2014 to 2027	Occurrences Years 2028 to 2041	Occurrences Years 2042 to 2055	42 Yr. Cost (2008 US \$)
52	Deck & Grating	Misc. Repair	\$1,500		1	1	\$3,000
53	Windows / Door / Lock Set	Misc. Repair	\$600		1	1	\$1,200
54	Sheathing & Roof	Misc. Repair	\$3,000			1	\$3,000
55	AC / Heating / Telephone / Detection / Suppres.	Misc. Repair	\$500	1	2	3	\$3,000
Projected Costs:				\$500	\$3,100	\$6,600	\$10,200
Annualized Cost:				\$243			

### Future Preservation - Bridge Lighting

Ref. No.	Item	Action	Cost Per Event (2008 US\$)	Occurrences Years 2014 to 2027	Occurrences Years 2028 to 2041	Occurrences Years 2042 to 2055	42 Yr. Cost (2008 US \$)
56	Roadway Lighting	Misc. Repair	\$2,600	1	1	1	\$7,800
53	Ornamental Lighting	Misc. Repair	\$3,000	1	1	1	\$9,000
Projected Costs:				\$5,600	\$5,600	\$5,600	\$16,800
Annualized Cost:				\$400			

### Component Failure

Ref. No.	Item	Action	Cost Per Event (2003 US\$)				42 Yr. Cost (2008 US \$)
54	Substruct. E. Abut. Foundation Stabilization	Repair	\$350,000				\$350,000
55	Substructure - Pier Replacement (2 each)	Demo. & Replace	\$450,000				\$450,000
56	Superstructure Bearings	Rehab.	\$48,500				\$48,500
57	Low. Chrd. Gusset Plate Repair	Replace	\$650,000				\$650,000
58	Vehicular & Transition Deck	Replace	\$402,000				\$402,000
59	Pedestrian Deck	Replace	\$200,000				\$200,000
60	Operating Drums Replacement (2 each)	Replace	\$62,000				\$62,000
61							\$0
Annualized Cost:				\$51,488			\$2,162,500

**Minnesota Department of Transportation (Mn/DOT)**  
**Historic Bridge Management Plan**

**Bridge Number: 4654**

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**Appendices**

**Appendix H. Bibliographical References**



## Bibliographical References

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**Minnesota Department of Transportation (Mn/DOT)**  
**Historic Bridge Management Plan**

**Bridge Number: 4654**

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**Appendices**

**Appendix I.      Stillwater Lift Bridge Endowment Fund Analysis  
Report**



# Stillwater Lift Bridge Endowment Fund Analysis Report

**Mn/DOT SP# 8214-114F**

Report prepared for  
**The Minnesota Department of  
Transportation**

Report prepared by  
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January 2009



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## Executive Summary

The Amended Section 106 Memorandum of Agreement (MOA) for the St. Croix River Crossing Project requires the establishment of an endowment to fund operations and routine maintenance for the Stillwater Lift Bridge (Lift Bridge) after its conversion to pedestrian and bicycle use. Stipulation III of the MOA is attached and contains these commitments related to the Lift Bridge (see Appendix 1). The Minnesota Department of Transportation (Mn/DOT), a state agency, will retain ownership of the bridge after the conversion, preserving it according to the Secretary of the Interior's Standards (SOIS). The establishment of an endowment for the benefit of a state-owned property is subject to Minnesota statutory guidelines and requirements. Research was undertaken to determine the steps necessary to establish the endowment. Efforts were also made to identify similarly funded projects that could inform the development of the endowment, and appropriate methods for handling disbursements from the fund.

Listed below are the sections contained in this report and a brief summary of each section.

- **Methodology** summarizes research undertaken to provide this analysis.
- **Definitions** clarifies the terms used in this report.
- **Critical Issues** identifies considerations that need to be addressed during the development of the endowment.
- **Fiscal Structure of the Endowment** includes information about the original principal and income expectations of the endowment, and makes recommendations for arranging the fiscal structure of the fund.
- **Enabling Legislation** identifies considerations in the establishment of enabling legislation.
- **Endowment Agreement** makes recommendations about issues that need to be addressed in the agreement with the trustee of the endowment fund.
- **Potential Trustees** provides information on organizations that could potentially serve as the trustee of the endowment fund.
- **Potential Pass-Through Entity** highlights the potential need for an entity through which endowment income could be passed in order to get it to the operations manager.
- **Conclusion** outlines recommendations for Mn/DOT on how to proceed with the development of the endowment.

This report was prepared cooperatively by researchers at Jacobsen/Daniels Associates (JDA) and Mead & Hunt, Inc. Both firms have staff with expertise in planning and transportation project development. JDA staff also draws upon technical and professional experience in economics and finance. Nonetheless, it is recommended that legal counsel for Mn/DOT and the Wisconsin Department of Transportation (WisDOT)

perform a thorough review of all options prior to making any decisions concerning the establishment of the endowment. It may also be appropriate to solicit review by a Certified Public Accountant or financial advisor.



## **Methodology**

The methodology used to prepare this report included review of the MOA, discussions with current and potential stakeholders, outreach to other historic bridge owners throughout the country, and research on the structure and operations of endowment funds both in Minnesota and throughout the country. Stakeholders contacted during research for this report are employees with Mn/DOT, WisDOT, the Minnesota Community Foundation, the Minnesota Historical Society, or the National Trust for Historic Preservation (NTHP).

Research was undertaken to identify similar projects involving historic bridges or comparable state-owned facilities, with the expectation that information about these projects would inform the structure of the endowment fund for the Lift Bridge. Online research was conducted using keyword searches in Internet search engines. Several state DOT websites and bridge-oriented websites, such as those of the Historic Bridge Foundation and Historic Bridges of the United States, were searched for similar projects (see Appendix 2 for a summary of similar conversion projects).

Finally, a review of the Minnesota State Constitution and other state legislation pertaining to the establishment of enabling legislation was necessary to understand the function and allowed activities of an endowment fund and the process for creating necessary legislation. The next section provides definitions to assist in understanding aspects of this report.



## Definitions

**Advisory committee** is convened to provide guidance to the owner of the Lift Bridge regarding appropriate treatment and maintenance procedures, as well as appropriate use of income disbursements from the endowment. The Stillwater Lift Bridge Advisory Committee (SLBAC) currently serves this role and may be retained or restructured to fill the role after the conversion project is completed.

**Endowment agreement** is an agreement between the owner of the Lift Bridge and the trustee of the endowment that stipulates protocols for the disposition, management, and disbursal of the endowment funds. If the Minnesota State Board of Investment (SBI) serves as trustee of the fund, the enabling legislation serves this function.

**Income** includes all earnings, exclusive of capital appreciation, derived from the investment of the principal of the endowment fund.

**Operations manager** is the entity that is responsible for carrying out the operation and maintenance of the bridge using disbursements of income from the endowment. Mn/DOT currently owns and serves as the operations manager for the Lift Bridge. It is expected that Mn/DOT will continue in that role after the conversion. In the future, Mn/DOT may designate another entity to serve as operations manager. Mn/DOT or its designee may seek input from an advisory group regarding the operations and maintenance of the Lift Bridge. The operations manager may use disbursements to hire internal forces or contractors to complete the work.

**Pass-through entity** is an organization that would receive disbursements of income from the Trustee and subsequently pass them on to the operations manager. This option would be necessary only if the SBI is designated the trustee of the endowment and Mn/DOT conveys ownership of the bridge and/or no longer wants to receive income disbursements itself. Because the SBI may only disburse endowment funds to a Minnesota state agency, a pass-through entity would need to be a state agency.

**Principal** is defined as the original value of any contribution made to the endowment fund. As stipulated in the MOA, "Mn/DOT and WisDOT will deposit no less than \$3 million in the endowment fund." This initial contribution will become the fund's principal. Subsequent contributions to the fund would be added to the principal amount. Principal is also defined as the "historic dollar value," which refers to the original gift value of no less than \$3 million. Mn/DOT is pursuing a legislative request for an additional \$2.355 million to provide a total of \$5.355 million, which is the amount projected to create an endowment that will serve its purpose of funding routine maintenance and operations of the Lift Bridge through 2055 while leaving enough left for future demolition of the bridge after it reaches its maximum expected life.

**Trustee** is an entity who holds and manages the endowment fund. A trustee is empowered to make decisions about investments and routine distributions according to the stipulations of the endowment agreement. The trustee's responsibilities may include hiring appropriate professional services for record-keeping, observing donor restrictions, and administering the funds according to the enabling legislation and other established guidelines.



## Critical Issues

There are some significant issues that must be addressed before or during the preparation of the enabling legislation.

### ***Determine which organizations will act as the trustee, operations manager, and, if necessary, pass-through entity***

The management and disbursement of the endowment's principal and interest will require the cooperation of organizations in these designated roles. One entity will need to serve as the trustee, managing the fund's principal to generate an expected annual yield to be used as income for the operation and maintenance of the Lift Bridge. The trustee should be an institution with a record of managing funds for similar types of projects. In general, institutions that are willing to serve as the trustee are not willing, and do not have the expertise, to serve as the operations manager. Therefore, another institution will need serve as the operations manager, accepting the income disbursements from the endowment and overseeing the operation and routine maintenance of the bridge. If the entity serving as the operations manager is unable, for statutory reasons, to accept income disbursements directly from the trustee, then a pass-through entity must be designated that can receive disbursements and pass them on to the entity acting as operations manager. This situation is likely to arise only if the SBI is designated as the trustee. Mn/DOT may serve the role of either operations manager or pass-through entity in addition to their presumed role as owner of the property. Other organizations that may fill these roles are identified in *Potential Trustees* below.

Perhaps the most critical issue to be addressed is determining which organization will serve as operations manager to receive disbursements and make the decisions regarding routine operations and maintenance. There are a number of options that can be evaluated and pursued. The most obvious organization to serve this role in is Mn/DOT as the owner of the bridge. Mn/DOT has the background and expertise to retain management responsibilities. However, if Mn/DOT decides in the future to transfer the operations manager role to another entity there are options for doing so. The Governor may formally establish a commission to assume the responsibilities, or an agreement may be negotiated with the City of Stillwater to take on the role.

### ***The enabling legislation should not prevent institutions other than the SBI from acting as the trustee of the endowment***

If the SBI acts as the trustee of the endowment, then disbursements must be issued to a Minnesota state agency. While this is not a prohibitive situation, it may result in a process that requires an extra step to get the disbursement funds to the operations manager if the operations manager is not an agent of the state. This would be the case if Mn/DOT transferred ownership of the Lift Bridge to a non-state entity.

### ***The enabling legislation should allow for an institution located outside of Minnesota to act as the trustee of the endowment***

Providing for the possibility of a trustee located outside of Minnesota would allow an organization like the NTHP in Washington, D.C., to serve as the trustee.



## Fiscal Structure of the Endowment

The endowment is intended to support the routine operation and maintenance of the Lift Bridge in perpetuity, and is not intended to provide funding for major repairs/rehabilitation or other capital improvements. The most critical operational need that must be addressed is the legal requirement to raise the lift span according to an established schedule.

### ***Determining the length of the endowment***

The year 2055 was established as a reasonably foreseeable date in which accurate calculations could be completed. Periodic reviews on both the life expectancy of the structure and the performance of the endowment will need to be performed between the fund's establishment and the year 2055 to adjust the bridge's life expectancy and the fund's viability.

### ***Determining the principal investment needed for the endowment***

Calculations were performed in order to accurately determine the principal investment needed to meet anticipated costs for the Lift Bridge after its conversion. Anticipated costs were determined as part of Management Plan development (by URS Corporation and reviewed and accepted by Mn/DOT), with costs projected through the year 2055.

The principal investment for the endowment fund must also provide enough funding at the end of the life of the bridge for demolition, a cost previously determined by different sources to range from \$600,000 to \$1 million. Documentation used to determine costs of demolition is presented in Appendix 5, while the final cost of demolition is still to be determined. For the purposes of calculating the necessary principal investment, \$1 million was used as a demolition cost in this report.

As outlined in the MOA, it was established that Mn/DOT and WisDOT will deposit no less than \$3 million in the endowment fund (expected contribution is \$1.5 million for each agency). The \$3 million amount was based on original calculations that estimated the annual costs of routine maintenance and operation at approximately \$150,000 per year. These endowment costs were estimated as part of a memorandum in 2003 (see WisDOT correspondence/memorandum in Appendix 5). It was estimated that the investment of the \$3 million principal would produce an annual yield of at least five percent, or \$150,000, which would match the estimated costs of routine maintenance and operation. This figure was not adjusted for inflation.

In order for the endowment fund to serve its purpose of funding routine maintenance and operations through the year 2055, the initial investment into the endowment fund would need to be greater than \$3 million. This is due to two reasons: (1) the lack of an adjustment for inflation in the original calculations and (2) an annual amount of \$175,000 instead of \$150,000 used for routine maintenance and operations. The amount of \$175,000 is based on URS's calculations for the Management Plan, which has been approved by the Mn/DOT Bridge Office. An estimate of maintenance and operations costs is presented in Appendix 3.

Using calculations that assumed an annual interest rate of five percent, an inflation rate of three percent, and an administrative fee of 0.005 percent, as well as accounting for \$175,000 for routine maintenance and operations costs, four scenarios were presented for the initial investment of the endowment fund.

The scenarios reflected initial investments in 2009, 2010, 2011, or 2012 as the Section 106 MOA requires that the endowment fund be established prior to the opening of the new St. Croix River Crossing, which is currently estimated for 2016. A minimum of \$1 million (in 2008 dollars) should be available within the fund for demolition in the case it is determined in the future that the bridge must be removed for safety reasons. For purposes of calculating the principal required, the present value of this demolition cost was calculated in each scenario. The four scenarios are presented below, along with a scenario showing that with an initial investment of \$3 million, demolition funds would fall below \$1 million (2008 dollars) by 2028 and the endowment would be dissolved by 2034.

### **2009 Scenario**

2009 (year zero) – Principal investment required is \$5.361 million

2013 – First maintenance expenditure (\$175,000 in 2008 dollars, adjusted for inflation)

2055 – \$1 million (in 2008 dollars) remaining for demolition

### **2010 Scenario**

2009 (year zero) – Principal investment required is \$5.629 million

2013 – First maintenance expenditure (\$175,000 in 2008 dollars, adjusted for inflation)

2055 – \$1 million (in 2008 dollars) remaining for demolition

### **2011 Scenario**

2009 (year zero) – Principal investment required is \$5.910 million

2013 – First maintenance expenditure (\$175,000 in 2008 dollars, adjusted for inflation)

2055 – \$1 million (in 2008 dollars) remaining for demolition

### **2012 Scenario**

2009 (year zero) – Principal investment required is \$6.205 million

2013 – First maintenance expenditure (\$175,000 in 2008 dollars, adjusted for inflation)

2055 – \$1 million (in 2008 dollars) remaining for demolition

### **2009 Scenario with \$3 million endowment**

2009 (year zero) – \$3 million principal invested

2028 – Funds for demolition fall below \$1 million (2008 dollars)

2034 – Endowment fund dissolved

Of the four scenarios presented above, the Mn/DOT Bridge Office, CRU, Metro, and the Directors of the Operations and Technical Divisions agreed to pursue the 2009 scenario through the legislative request process. This scenario identifies the need of a principal investment of \$5.361 million, or \$2.361 million more than the initial Mn/DOT and WisDOT deposits. Mn/DOT management recently agreed to forward this legislative proposal to the Governor's office for their approval. If approved by the Governor's office, the request would go before the legislature in the 2009 session.



### ***Costs for non-annual preservation measures***

Costs for periodic (less frequent than annual) preservation measures required to keep structural elements in good condition were not included in this estimate. An example is below deck spot painting, which is estimated to be required every 10 years.

### ***Allocation of future contributions and disbursements from the endowment***

It should be specified in the endowment agreement that all future contributions to the endowment will be added to the principal. The principal amount, deriving from the original contributions of Mn/DOT and WisDOT and any subsequent contributions, should be maintained. Disbursements should derive only from gains made by investing the principal amount.

### ***Acceptance of private contributions of cash, stock, or personal tangible property***

It would be appropriate to have a mechanism in place to accept private contributions of cash, stock, or personal tangible property to the endowment. The bridge will continue to be a source of pride for the people of Stillwater and certain residents may want to provide legacy donation. Since these gifts may also carry liabilities, certain restrictions should also be considered for gifts to the endowment. It is also conceivable that certain benefactors may want to sponsor enhancements beyond operations and maintenance. The endowment agreement should clearly outline permitted activities and emphasize the constraints of the SOIS as they apply to the Lift Bridge.

### ***WisDOT assurance of the use of revenue generated by the endowment***

Although WisDOT's involvement in the Lift Bridge will conclude once their contribution is made, they will require some assurance that revenue generated by the endowment will only be used by Mn/DOT for the maintenance and operation of the Lift Bridge and no other Mn/DOT project or purpose. This stipulation should be addressed in the endowment agreement.

### ***Modifications to, or elimination of, the endowment fund***

There may come a point in time when the annual operating and maintenance costs exceed the available income. If needs exceed revenues, a fiscally constrained plan will need to be implemented, or additional principal would need to be added to the endowment fund. In addition, certain disasters may require demolition of the bridge and thus require the elimination of the endowment. Consequently, the dissolution of the fund, including the principal, must be addressed in the endowment agreement.



## Enabling Legislation

In order to establish an endowment fund that will pay income to a state agency, Minnesota law requires that enabling legislation be enacted by the Minnesota state legislature prescribing the structure and parameters of the endowment. Since other sections of the Minnesota Statutes will also be applicable to the endowment, the enabling legislation should be developed in consultation with Mn/DOT legal counsel and the Legislative Liaison. The legislation should include language that prescribes the purpose and appropriate use of endowment funds (see Appendix 6 for examples of enabling legislation).

It may be appropriate for the legislation to address the following considerations:

- Statement of the intended use of the endowment fund's income
- General rules for the principal amount of the endowment (e.g. whether it should be maintained, allowance for future contributions)
- To which entity disbursement funds may be issued
- Contingency plans for unanticipated occurrences, such as higher/lower than expected earnings
- Any special considerations regarding use, limits, earnings, and termination of the endowment fund

Mn/DOT should work with the Legislative Liaison to develop the enabling legislation that would establish the Stillwater Lift Bridge Endowment Fund. The Legislative Liaison is responsible for framing Mn/DOT legislative agenda and will provide a complete outline of the legislative process required to establish the endowment. The Legislative Liaison will also help in understanding the key deadlines during the legislative session (see Appendix 7 for a general outline of the Minnesota legislative process). The proposed timeline for establishing the fund is one year before the opening of the new bridge, which is projected to open in 2013. Consequently, the legislation should be in place and the endowment established no later than 2012. The enabling legislation should establish the endowment with committed contributions from both Minnesota and Wisconsin, and should stipulate the disposition of the endowment fund. The Legislative Liaison will help prepare the legislation and determine which other stipulations may need to be included.

Based on a projected opening date of 2016 for the converted bridge, the following is a suggested timeline for developing the enabling legislation:

- 2008 Begin drafting enabling legislation (by Mn/DOT Legislative Liaison and legal counsel).
- 2009 Identify legislator(s) who will sponsor the bill and introduce it in the state legislature. Finalize draft bill to be introduced to state legislature during 2009 legislative session. Legislation will work its way through committees and be adopted during the 2009 or 2011 legislative session.
- 2013 Work begins on bridge conversion.
- 2016 Bridge opens to pedestrian and bicycle traffic.



## Endowment Agreement

Once the trustee of the endowment is identified, an agreement must be developed between Mn/DOT and the institution acting as trustee. The endowment agreement should establish the structure of the endowment fund and should include stipulations on the method of calculating disbursement amounts (based on a fixed percentage or the performance of investments), the frequency and method of income disbursements, to which entity disbursements will be issued, how disbursements may be used, whether any amount of the principal may be spent or if it must be left inviolate, administrative costs, and other considerations determined by the owner and trustee. The agreement should also include some understanding of how funds will be segregated, if necessary, between maintenance activities and operational activities. It should also allow for the dissolution of the endowment fund in the event that it becomes necessary to demolish or discontinue use of the bridge. Reasonable administrative fees paid to the trustee of the fund should be stipulated in the agreement. Mn/DOT may request that the state legislature cover administrative costs.



## Potential Trustees

The organizations discussed below may provide trustee services for the endowment. However, none are prepared to own, operate, or maintain the bridge. As identified in the MOA, Mn/DOT will retain ownership of the Lift Bridge and responsibility for operations and maintenance of the bridge for the foreseeable future. In the event that Mn/DOT decides to transfer ownership or operational responsibility, there are alternatives that may be evaluated and pursued.

### The National Trust for Historic Preservation

Founded in 1949, the NTHP is a private, not-for-profit membership organization based in Washington, D.C., with six regional offices, 29 historic sites, and 270,000 members and member organizations in all states. Minnesota is covered by the Midwest regional office in Chicago. The mission of the NTHP is to save historic places and revitalize communities through leadership, education, advocacy, and resources.

The NTHP is the trustee for an endowment fund estimated to be over \$230 million. The organization's Business & Finance Department oversees the endowment that provides income support for several historic properties, including two in Washington, D.C., that the NTHP does not own: a congressional cemetery and residential property converted into an office. The endowment fund provides for these properties through sub-accounts that generate operating revenue distributed through annual disbursements established by an endowment agreement. The endowment agreement prescribes the use of the revenue and requires that the guidelines of the SOIS be met in maintaining and repairing the sites. The NTHP also owns and manages several historic properties using endowment income.

The NTHP has expressed interest in accepting endowment funds for the Lift Bridge and would commingle the funds with other endowment funds for investment purposes. The principal amount of the endowment would be preserved and would be the basis for income disbursements. The NTHP would only accept management or expenditure responsibility for the bridge if the organization was indemnified by the state. The NTHP would be receptive to managing the endowment but would not consider owning the bridge. Per NTHP policy, income from the endowment would be paid at a rate of five percent of the three-year average of the endowment (see Appendix 8).

If it is determined that the NTHP is a viable option as a trustee of the Lift Bridge endowment, a similar agreement could be the basis for management policies and procedures for the Lift Bridge endowment.

Advantages of the NTHP serving as the trustee of the Stillwater Lift Bridge Endowment Fund:

- The NTHP is willing to be the trustee.
- The NTHP has experience in managing similar endowments.
- The NTHP has experience in managing and preserving historic sites.
- The NTHP has familiarity with the SOIS.
- The NTHP's large endowment allows for more investment diversification.

Disadvantages:

- Funds would be invested as determined by the NTHP.
- The NTHP would become the owner of the endowment funds in perpetuity.

Neutral considerations:

- Endowment would be managed by entity outside of Minnesota and Wisconsin.
- Annual disbursement of five percent of a three-year average.
- Administrative fees paid to the NTHP.
- Mn/DOT would need to determine whether the state can disperse funds to the NTHP and allow those funds to be comingled with other NTHP investments.

Contact:        *Greg Coble, Vice President, Business & Finance*  
                      *The National Trust for Historic Preservation*  
                      *Greg\_Coble@nthp.org*  
                      *202.588.6000*

## **The Minnesota Community Foundation**

The Minnesota Community Foundation (MCF) is a statewide entity that partners with private and public organizations to fund charitable and civic efforts (see Appendix 9 for summary of services). It currently manages over \$800 million dollars in endowment funds ranging from \$20,000 to \$80 million. The MCF is not typically able to receive state assets for endowment purposes. However, there is one specific case where the MCF has been able to accept state assets for large institutional endowments. An endowment held by the MCF for Ironworld, a museum and library in northern Minnesota devoted to Minnesota's iron mining industry, was supported with public funds. Before the MCF is chosen as the trustee for the endowment, this potential impediment should be researched by Mn/DOT legal counsel. Appendix 10 presents a sample agreement form used by the MCF to act as the trustee for an endowment.

Similar to the NTHP, the MCF establishes endowment agreements that provide the terms of how endowment funds are invested and income disbursed, and outline associated administrative fees. The MCF would be receptive to managing the endowment but would not consider owning the Lift Bridge.

Advantages to designating the MCF as the trustee for the Stillwater Lift Bridge Endowment Fund:

- The MCF is willing to be the trustee.
- The MCF has extensive experience managing endowment funds within Minnesota.
- Endowment would be managed by an entity within Minnesota.
- The MCF also manages funds in Wisconsin.

Disadvantages:

- As a 501(c)(3) public charity, there may be a legal impediment that prevents the MCF from receiving state funds.

Neutral considerations:

- Annual disbursement of five percent
- Administrative fees paid to the MCF
- Funds are invested as determined by the MCF



Contact: Jaclyn D. Schroeder, Gift Planner  
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### State Board of Investment

The SBI is the state agency responsible for the management of various retirement funds, trust funds, and cash accounts for Minnesota state agencies. The duties and powers of the SBI are outlined in the state constitution and are summarized as Appendix 11. The SBI may only make disbursements to other state agencies. Consequently, the SBI could not make disbursements to an operations manager who was not a state agency. If management responsibilities are ever transferred to a non-state entity, then a pass-through entity may be established to accept disbursements from the endowment and pass them on to an appropriate operations manager. The enabling legislation should clarify whether the fund may be dissolved and reconstituted if ownership changes and it is no longer feasible for SBI to serve as trustee. The annual administrative fee associated with this option is estimated to be .005 percent of the principal. It is unknown whether or not the fund could be segregated from other investments of the SBI.

Advantages to designating the SBI as the trustee for the Stillwater Lift Bridge Endowment Fund:

- SBI has experience managing similar funds.
- Endowment would be managed by an entity within Minnesota.

Disadvantages:

- SBI may only disburse income from the endowment to Minnesota state agencies.

Neutral considerations:

- A state agency as trustee is an efficient arrangement while the bridge is owned by Mn/DOT.

Contact: Minnesota State Board of Investment  
Minn.Sbi@state.mn.us  
651-296-3328



## Potential Pass-Through Entity

A pass-through entity would be necessary only if the SBI is designated the trustee of the endowment *and* Mn/DOT conveys ownership of the bridge and/or no longer wants to receive income disbursements itself.

### The Minnesota Historical Society

The Minnesota Historical Society's (MHS) mission is to preserve and interpret Minnesota history. It was created by the Territorial Legislation in 1849 and is considered today to be a quasi-government agency. It has been preserving the stories and collecting artifacts related to Minnesota's history for more than 158 years and operates a state history museum, a library, and 26 historic sites and museums throughout the state. It also serves as the Minnesota State Historic Preservation Office (SHPO). The MHS does not invest funds for endowments for other organizations. It is presented here as a quasi-state agency that could accept income disbursements from the SBI. It is expected that if SBI is the trustee, disbursements would be directed to Mn/DOT. However, in the event that Mn/DOT transferred ownership of or operational responsibility for the bridge, the MHS could accept income from the endowment and then pass it on to an alternative entity serving as the operations manager. The MHS has not confirmed that they are willing to take on this role if asked. It is presented here as a quasi-state agency with potential interest in assisting with preservation of the historic bridge.

Advantages of the MHS serving as the operations manager or pass-through entity:

- As a quasi-state agency, the MHS could accept income disbursements from SBI
- The MHS has experience in preserving and managing historic sites

Contact:        *David Kelliher, Legislative Liaison*  
                     *External Relations*  
                     *david.kelliher@mnhs.org*  
                     *651.259.3103*



## Conclusion

To proceed with the development of the Stillwater Lift Bridge Endowment Fund, Mn/DOT officials should first develop a preferred arrangement for ownership and management of the Lift Bridge. This should address near- and long-term expectations of ownership and should anticipate potential shifts in management responsibilities.

Mn/DOT should then draft preferences for the structure of the endowment based on the discussion herein. Preferences should be based on Minnesota statutory requirements and restrictions identified in consultation with Mn/DOT legal counsel and a Certified Public Accountant.

Based on the expected ownership arrangement and preferences for the structure of the endowment, Mn/DOT should work with the Legislative Liaison and legal counsel to develop enabling legislation that addresses those expectations and preferences (see page 7).

### ***Summary of steps toward drafting enabling legislation:***

- Introduce the project to the Mn/DOT Legislative Liaison
- Introduce the project to the Mn/DOT legal counsel
- The Legislative Liaison and legal counsel draft a bill that stipulates the structure of the endowment (see page 7)
- Identify legislator(s) who will sponsor the legislation and introduce it in the state legislature.
- The legislative sponsor(s) will introduce the bill during 2009 legislative session

The table below summarizes key features of the three trustee options based on research conducted to complete this report. Mn/DOT's preferred option for a trustee for the endowment fund is the SBI. It may still be helpful to solicit examples of endowment agreements from each of the potential trustees discussed in this report. Legal research should be conducted to fully understand the potential cost and benefits of all the discussed alternatives.

### ***Summary of costs and disbursement rates of potential trustees:***

	<b>National Trust for Historic Preservation</b>	<b>Minnesota Community Foundation</b>	<b>State Board of Investment</b>
<i>Administrative costs</i>	<1% of principal, fluctuates	"Minimal," negotiated in an endowment agreement	.005% of principal
<i>Disbursements</i>	5% of previous three-year average	5%	Undetermined, presumed to be approximately 5% of principal
<i>Location</i>	Washington, D.C.	St. Paul, MN	St. Paul, MN

Income from the endowment fund is intended to support operation and routine maintenance of the Lift Bridge. As the owner of the bridge, Mn/DOT will decide how the income from the fund will be spent. Mn/DOT will make decisions in consultation with an advisory committee that consists of representatives from the City of Stillwater, the Minnesota SHPO, and the National Park Service.

The MOA restricts the use of endowment income to “operation and routine maintenance” because these activities “are usually predictable, repetitive, and conducive to the establishment of reasonable and accurate annual budget projections.” Endowment income is “not eligible for use in major repairs, rehabilitation, or other capital improvements to the Stillwater Lift Bridge.”

Mn/DOT is currently in the process of procuring the initial funds necessary to make the endowment fund self-sustaining. After adjusting for inflation and an amount of \$175,000 for routine maintenance and operations costs, the initial \$3 million investment by Mn/DOT and WisDOT would leave demolition funds below \$1 million (2008 dollars) by 2028 and the endowment dissolved by 2034. In order to pursue the additional funds needed, the Mn/DOT Bridge Office, CRU, Metro, and the Directors of the Operations and Technical Divisions were presented with four scenarios that reflected initial investments in 2009, 2010, 2011, and 2012. The four scenarios were:

### **2009 Scenario**

2009 (year zero) – Principal investment required is \$5.361 million

2013 – First maintenance expenditure (\$175,000 in 2008 dollars, adjusted for inflation)

2055 – \$1 million (in 2008 dollars) remaining for demolition

### **2010 Scenario**

2009 (year zero) – Principal investment required is \$5.629 million

2013 – First maintenance expenditure (\$175,000 in 2008 dollars, adjusted for inflation)

2055 – \$1 million (in 2008 dollars) remaining for demolition

### **2011 Scenario**

2009 (year zero) – Principal investment required is \$5.910 million

2013 – First maintenance expenditure (\$175,000 in 2008 dollars, adjusted for inflation)

2055 – \$1 million (in 2008 dollars) remaining for demolition

### **2012 Scenario**

2009 (year zero) – Principal investment required is \$6.205 million

2013 – First maintenance expenditure (\$175,000 in 2008 dollars, adjusted for inflation)

2055 – \$1 million (in 2008 dollars) remaining for demolition

The decision was made by the Mn/DOT project team to pursue the 2009 scenario through the legislative request process. This scenario requires an initial investment of \$5.361 million, an additional \$2.361 million more than the initial Mn/DOT and WisDOT investment. Mn/DOT management recently agreed to forward this legislative proposal to the Governor's office for their approval. If approved by the Governor's office, the request would go before the legislature in the 2009 session.

**Appendix 1.      Section III-D of the Amended Section 106  
Memorandum of Agreement**





D. Endowment Fund - The establishment of an endowment fund account by Mn/DOT will generate revenue to support the operation and routine maintenance of the Stillwater Lift Bridge after it is converted to pedestrian/bicycle use.

1. **Upon approval of the ROD by FHWA and the appropriation of funding for the Project**, Mn/DOT, in cooperation with the State of Minnesota, will establish an endowment account for the Stillwater Lift Bridge.
2. In setting up this fund, Mn/DOT will
  - a. Support any enabling legislation that may be determined by the State of Minnesota to be necessary for the establishment of such an account, and develop and execute agreements, as needed, with other elements of the State, including the MnSHPO, **prior to the opening of the new river crossing;**
  - b. Consult with the SHPOs to develop the structure of the fund; and
  - c. Consult with a person or persons with established credentials in establishing and managing endowment funds.
3. **Prior to the opening of the new river crossing**, Mn/DOT and WisDOT will deposit no less than \$3 million in the endowment fund.
4. Mn/DOT will set up an operations and maintenance account that will be funded from the investment revenues derived from the endowment fund. This account may be used only to support Stillwater Lift Bridge operation and routine maintenance from abutment to abutment because these activities are usually predictable, repetitive, and conducive to the establishment of reasonable and accurate annual budget projections. Revenues from the operations and maintenance account are not eligible for use in major repairs/rehabilitation or other capital improvements to the Stillwater Lift Bridge.
5. Mn/DOT will establish the endowment fund in order to receive funds and disburse revenues sufficient to support the operation and routine maintenance of the Stillwater Lift Bridge. Mn/DOT will ensure that adequate legal controls are in place to ensure that the endowment, and operations and maintenance funds are managed effectively, in the public interest and to support the protection and preservation of the Stillwater Lift Bridge.



## **Appendix 2.      Summary of Similar Bridge Conversion Projects**



## Summary of Similar Conversion Projects

The following is a summary of bridges that have been converted to pedestrian and bicycle use.

Name/Location/Website	Year built	Ownership	Maintenance Responsibilities	Funding
Old Chain of Rocks Bridge over Mississippi River St. Louis, Missouri <a href="http://www.trailnet.org/p_ocorb.php">http://www.trailnet.org/p_ocorb.php</a>	1929	City of Madison, Illinois	Trailnet (trailnet.org)	Coalition of private funders and partners
Walnut Street Bridge Chattanooga, Tennessee <a href="http://www.smartcommunities.ncat.org/success/walnut_street.shtml">http://www.smartcommunities.ncat.org/success/walnut_street.shtml</a>	1891	City of Chattanooga, Tennessee	Undetermined	Undetermined
Stone Arch Bridge Minneapolis, Minnesota <a href="http://www.ci.minneapolis.mn.us/about/stonearch.asp">http://www.ci.minneapolis.mn.us/about/stonearch.asp</a>	1883	City of Minneapolis, Minnesota	Minneapolis Park Board	<i>Conversion:</i> Partnership of public agencies. <i>Maintenance:</i> Minneapolis Park Board budget
Union Street Railroad Bridge over Willamette River Salem, Oregon <a href="http://www.cityofsalem.net/departments/urbandev/revitalization_rfdt_rr_bridge_conversion.htm">http://www.cityofsalem.net/departments/urbandev/revitalization_rfdt_rr_bridge_conversion.htm</a>	1913	City of Salem, Oregon	City of Salem, Oregon	<i>Conversion:</i> Partnership of public agencies. <i>Maintenance:</i> long-term maintenance fund
Faust Street Bridge New Braunfels, Texas	1887	City of New Braunfels, Texas	Undetermined	Undetermined
McKeowen Road Bridge (aka Sponable Bridge) over Thornapple River Barry County, Michigan	1903	Barry County, Michigan	Undetermined	Undetermined
Minnesota Slip Drawbridge Duluth Harbor, Minnesota <a href="http://www.bridgemeister.com/pic.php?pid=1635">http://www.bridgemeister.com/pic.php?pid=1635</a>	1991	City of Duluth, Minnesota	City of Duluth, Minnesota	Undetermined
Newport Southbank Bridge (Purple People Bridge) Newport, Kentucky to Cincinnati, Ohio <a href="http://www.enquirer.com/editions/2003/04/20/loc_purplebridge20.html">http://www.enquirer.com/editions/2003/04/20/loc_purplebridge20.html</a>	1872	Newport Southbank Bridge Co.	Newport Southbank Bridge Co.	<i>Conversion:</i> State of Kentucky. <i>Maintenance:</i> undetermined
Poughkeepsie Railroad Bridge (Walkway Over the Hudson) Dutchess County, New York <a href="http://www.walkway.org/">http://www.walkway.org/</a>	1887	Currently Walkway Over the Hudson (not-for-profit). Transferred to state agency after conversion	New York State Office of Parks, Recreation, and Historic Preservation and Walkway Over the Hudson	<i>Conversion:</i> Public and Private funds



### **Appendix 3.      Estimate of Maintenance and Operations Costs – 2008**





## Mn/DOT Historic Bridge Management Plan

### BRIDGE No. 4654 MAINTENANCE/STABILIZATION/PRESERVATION Activity Listing and Costs

#### OPERATIONS

Ref. No.	Item	Action	Cost Per Event (2008 US\$)	Occurrences Years 2014 to 2027	Occurrences Years 2028 to 2041	Occurrences Years 2042 to 2055	42 Yr. Cost (2008 US \$)
1	Bridge Tender	Operate Br.	\$84,000	14	14	14	\$3,528,000
2	Electricity & Phone	Provide Service	\$5,600	14	14	14	\$235,200
3	Admin, Coord, Training, & Misc	Main. Records	\$6,000	14	14	14	\$252,000
4	Not Used		\$0				\$0
Projected Costs:				\$1,338,400	\$1,338,400	\$1,338,400	\$4,015,200
Annualized Cost:				\$95,600			

#### ROUTINE MAINTENANCE

Ref. No.	Item	Action	Cost Per Event (2008 US\$)	Occurrences Years 2014 to 2027	Occurrences Years 2028 to 2041	Occurrences Years 2042 to 2055	42 Yr. Cost (2008 US \$)
5	Flush Deck, drains, exp. Joints, sub-struct.	Power Wash	\$3,000	14	14	14	\$126,000
6	Graffiti Removal & Vandalism Repair	Clean & Repair	\$800	14	14	14	\$33,600
7	Structural Inspection	Base Inspection	\$16,000	11	10	10	\$496,000
8	In-Depth Structural Inspection	4-Year Inspection	\$30,000	3	4	4	\$330,000
9	Structural Analysis & Rating	Struct. Rating	\$60,000		1		\$60,000
10	Mech. & Elect. Inspection	Base Inspection	\$5,900	6	7	7	\$118,000
11	Underwater Inspection	5-year Inspection	\$20,000	2	3	3	\$160,000
12	Lamp Replacement - NAV LED (10 each, 10 yr life)	Replace Lamps	\$4,000	1	1	1	\$12,000
13	Lamp Replacement - Rdwy LED (25 each, 10yr life)	Replace Lamps	\$20,000	1	1	1	\$60,000
14	Lamp Replacement - Orn Walkway LED (16 each, 10 yr)	Replace Lamps	\$11,200	1	1	2	\$44,800
15	Sweep Clean Deck	Sweep	\$700	14	14	14	\$29,400
16	Counterweight Wire Ropes	Clean & lubricate	\$9,400	14	14	14	\$394,800
17	Gears/Bearing/Shaft	Clean & lubricate	\$5,300	14	14	14	\$222,600
18	Couplings	Clean & lubricate	\$2,650	2	3	3	\$21,200
19	Operating Wire Ropes & Take-Up Devices	Clean / Lub / Adj.	\$3,150	14	14	14	\$132,300
20	Operating Wire Ropes	Replace	\$20,000	1	2	2	\$100,000
21	Operating Rope Wear Plates	Replace	\$7,500	2	3	2	\$52,500
22	Main Drive Motor	Insp/clean/Lub	\$780	14	14	14	\$32,760
23	Gear Reducers	Clean & lubricate	\$4,900	2	3	3	\$39,200
24	Auxiliary Drive Motor	Insp/clean/Lub	\$465	14	14	14	\$19,530
25	General annual control syst maintenance	Clean, test adjust	\$5,700	14	14	14	\$239,400
26	Pedestrian Barriers (Gates)	Clean & lubricate	\$1,850	14	14	14	\$77,700
27	Aerial Cables (Festoon Cables)	Replace	\$23,200	2	3	3	\$185,600
28	Not Used		\$0				\$0
29	Not Used		\$0				\$0
Projected Costs:				\$882,930	\$1,033,580	\$984,780	\$2,987,390
Annualized Cost:				\$71,128			



**Appendix 4. Principal Investment Calculations Presented with  
Four Scenarios that Reflect Initial Investments in  
2009, 2010, 2011, and 2012**



Initial Investment Required including administrative fee

2009 Scenario	\$5,361,286.43
2010 Scenario	\$5,629,082.68
2011 Scenario	\$5,910,255.36
2012 Scenario	\$6,205,472.62

Prior w/out

2009 Scenario	\$5,355,168.72
2010 Scenario	\$5,622,927.15
2011 Scenario	\$5,904,073.51
2012 Scenario	\$6,199,277.19

Net increase in initial investment

\$6,117.71
\$6,155.53
\$6,181.85
\$6,195.43

Assumptions Used in this Model

5% interest rate

3% inflation rate

.005% administrative fee



## Endowment Fund Calculations for Stillwater Lift Bridge

### 2009 Investment Scenario

#### Calculation of Present Value of Bridge Demolition Costs

\$4,011,895.03 FV  
 4.995% interest rate 5%, less .005% administrative fee  
 46 n  
 \$426,180.07 PV

#### Demolition Costs and Maintenance Costs (to calculate amount of initial total endowment)

YEAR	0	1	2	3	4	5	6	7	8	
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Demolition Costs	\$426,180.07	447,467.77	469,818.78	493,286.23	517,925.88	543,796.27	570,958.90	599,478.30	629,422.24	
Maintenance Costs Adjusted for Inflation	0	0.00	0.00	0.00	202,872.96	208,959.15	215,227.92	221,684.76	228,335.30	
	\$4,935,106.35	NPV of Maintenance Costs								
	<u>\$426,180.07</u>	PV of Demolition Costs								
INITIAL ENDOWMENT REQUIRED	\$5,361,286.43	Total Endowment								

#### Presentation of endowment, annual earnings, maintenance costs, and amount remaining for demolition (in dollars adjusted for inflation)

YEAR	0	1	2	3	4	5	6	7	8
Beginning	\$5,361,286.43	\$5,361,286.43	\$5,629,082.68	\$5,910,255.36	\$6,205,472.62	\$6,312,563.01	\$6,418,916.39	\$6,524,313.34	\$6,628,518.03
Earnings (based on 5% interest rate)		\$267,796.26	\$281,172.68	\$295,217.26	\$309,963.36	\$315,312.52	\$320,624.87	\$325,889.45	\$331,094.48
Maintenance Costs		0.00	0.00	0.00	202,872.96	208,959.15	215,227.92	221,684.76	228,335.30
Ending	\$5,361,286.43	\$5,629,082.68	\$5,910,255.36	\$6,205,472.62	\$6,312,563.01	\$6,418,916.39	\$6,524,313.34	\$6,628,518.03	\$6,731,277.20
Value in 2008 Dollars (Ending)	5,205,132.45	5,305,950.31	5,408,720.90	5,513,482.05	5,445,272.31	5,375,741.42	5,304,863.79	5,232,613.34	5,158,963.48

9 2018	10 2019	11 2020	12 2021	13 2022	14 2023	15 2024	16 2025	17 2026	18 2027	19 2028	20 2029	21 2030
660,861.88	693,871.93	728,530.83	764,920.95	803,128.75	843,245.03	885,365.12	929,589.10	976,022.08	1,024,774.38	1,075,961.86	1,129,706.16	1,186,134.98
235,185.36	242,240.92	249,508.15	256,993.40	264,703.20	272,644.29	280,823.62	289,248.33	297,925.78	306,863.55	316,069.46	325,551.55	335,318.09

9	10	11	12	13	14	15	16	17	18	19	20	21
\$6,731,277.20	\$6,832,319.13	\$6,931,352.55	\$7,028,065.46	\$7,122,123.93	\$7,213,170.83	\$7,300,824.41	\$7,384,676.97	\$7,464,293.26	\$7,539,208.92	\$7,608,928.85	\$7,672,925.39	\$7,730,636.47
\$336,227.30	\$341,274.34	\$346,221.06	\$351,051.87	\$355,750.09	\$360,297.88	\$364,676.18	\$368,864.61	\$372,841.45	\$376,583.49	\$380,066.00	\$383,262.62	\$386,145.29
235,185.36	242,240.92	249,508.15	256,993.40	264,703.20	272,644.29	280,823.62	289,248.33	297,925.78	306,863.55	316,069.46	325,551.55	335,318.09
\$6,832,319.13	\$6,931,352.55	\$7,028,065.46	\$7,122,123.93	\$7,213,170.83	\$7,300,824.41	\$7,384,676.97	\$7,464,293.26	\$7,539,208.92	\$7,608,928.85	\$7,672,925.39	\$7,730,636.47	\$7,781,463.67
5,083,887.09	5,007,356.56	4,929,343.71	4,849,819.84	4,768,755.67	4,686,121.38	4,601,886.55	4,516,020.18	4,428,490.67	4,339,265.80	4,248,312.75	4,155,598.03	4,061,087.53



22 2031	23 2032	24 2033	25 2034	26 2035	27 2036	28 2037	29 2038	30 2039	31 2040	32 2041	33 2042	34 2043
1,245,382.42	1,307,589.27	1,372,903.36	1,441,479.88	1,513,481.80	1,589,080.22	1,668,454.77	1,751,794.09	1,839,296.21	1,931,169.05	2,027,630.95	2,128,911.11	2,235,250.22
345,377.63	355,738.96	366,411.13	377,403.47	388,725.57	400,387.34	412,398.96	424,770.93	437,514.05	450,639.48	464,158.66	478,083.42	492,425.92

22	23	24	25	26	27	28	29	30	31	32	33	34
\$7,781,463.67	\$7,824,770.14	\$7,859,878.45	\$7,886,068.24	\$7,902,573.88	\$7,908,581.88	\$7,903,228.21	\$7,885,595.50	\$7,854,710.07	\$7,809,538.78	\$7,748,985.77	\$7,671,888.95	\$7,577,016.38
\$388,684.11	\$390,847.27	\$392,600.93	\$393,909.11	\$394,733.57	\$395,033.66	\$394,766.25	\$393,885.50	\$392,342.77	\$390,086.46	\$387,061.84	\$383,210.85	\$378,471.97
345,377.63	355,738.96	366,411.13	377,403.47	388,725.57	400,387.34	412,398.96	424,770.93	437,514.05	450,639.48	464,158.66	478,083.42	492,425.92
\$7,824,770.14	\$7,859,878.45	\$7,886,068.24	\$7,902,573.88	\$7,908,581.88	\$7,903,228.21	\$7,885,595.50	\$7,854,710.07	\$7,809,538.78	\$7,748,985.77	\$7,671,888.95	\$7,577,016.38	\$7,463,062.43
3,964,746.46	3,866,539.37	3,766,430.11	3,664,381.84	3,560,357.01	3,454,317.32	3,346,223.76	3,236,036.55	3,123,715.12	3,009,218.15	2,892,503.50	2,773,528.20	2,652,248.48

35 2044	36 2045	37 2046	38 2047	39 2048	40 2049	41 2050	42 2051	43 2052	44 2053	45 2054	46 2055
											1,000,000.00
2,346,900.97	2,464,128.67	2,587,211.90	2,716,443.13	2,852,129.47	2,994,593.34	3,144,173.27	3,301,224.73	3,466,120.90	3,639,253.64	3,821,034.36	4,011,895.03
507,198.70	522,414.66	538,087.10	554,229.71	570,856.61	587,982.30	605,621.77	623,790.43	642,504.14	661,779.26	681,632.64	702,081.62

35	36	37	38	39	40	41	42	43	44	45	46
\$7,463,062.43	\$7,328,643.70	\$7,172,294.79	\$6,992,463.81	\$6,787,507.67	\$6,555,687.07	\$6,295,161.33	\$6,003,982.87	\$5,680,091.39	\$5,321,307.82	\$4,925,327.88	\$4,489,715.37
\$372,779.97	\$366,065.75	\$358,256.12	\$349,273.57	\$339,036.01	\$327,456.57	\$314,443.31	\$299,898.94	\$283,720.56	\$265,799.33	\$246,020.13	\$224,261.28
507,198.70	522,414.66	538,087.10	554,229.71	570,856.61	587,982.30	605,621.77	623,790.43	642,504.14	661,779.26	681,632.64	702,081.62
\$7,328,643.70	\$7,172,294.79	\$6,992,463.81	\$6,787,507.67	\$6,555,687.07	\$6,295,161.33	\$6,003,982.87	\$5,680,091.39	\$5,321,307.82	\$4,925,327.88	\$4,489,715.37	\$4,011,895.03
2,528,619.71	2,402,596.37	2,274,132.10	2,143,179.61	2,009,690.72	1,873,616.28	1,734,906.23	1,593,509.51	1,449,374.09	1,302,446.93	1,152,673.93	1,000,000.00

## Endowment Fund Calculations for Stillwater Lift Bridge 2010 Investment Scenario

### Calculation of Present Value of Bridge Demolition Costs

\$4,011,895.03 FV  
4.995% interest rate 5%, less .005% administrative fee  
45 n  
\$447,467.77 PV

### Demolition Costs and Maintenance Costs (to calculate amount of initial total endowment)

YEAR	2008	2009	0 2010	1 2011	2 2012	3 2013	4 2014	5 2015	6 2016	7 2017
Demolition Costs			\$447,467.77	469,818.78	493,286.23	517,925.88	543,796.27	570,958.90	599,478.30	629,422.24
Maintenance Costs Adjusted for Inflation			0	0.00	0.00	202,872.96	208,959.15	215,227.92	221,684.76	228,335.30
			\$5,181,614.92 NPV of Maintenance Costs							
			<u>\$447,467.77</u> PV of Demolition Costs							
INITIAL ENDOWMENT REQUIRED			<u>\$5,629,082.68</u>	Total Endowment						

### Presentation of endowment, annual earnings, maintenance costs, and amount remaining for demolition (in dollars adjusted for inflation)

YEAR	0	1	2	3	4	5	6	7
Beginning	\$5,629,082.68	\$5,629,082.68	\$5,910,255.36	\$6,205,472.62	\$6,312,563.01	\$6,418,916.39	\$6,524,313.34	\$6,628,518.03
Earnings (based on 5% interest rate)		\$281,172.68	\$295,217.26	\$309,963.36	\$315,312.52	\$320,624.87	\$325,889.45	\$331,094.48
Maintenance Costs		0.00	0.00	202,872.96	208,959.15	215,227.92	221,684.76	228,335.30
Ending	\$5,629,082.68	\$5,910,255.36	\$6,205,472.62	\$6,312,563.01	\$6,418,916.39	\$6,524,313.34	\$6,628,518.03	\$6,731,277.20
Value in 2008 Dollars (Ending)	5,305,950.31	5,408,720.90	5,513,482.05	5,445,272.31	5,375,741.42	5,304,863.79	5,232,613.34	5,158,963.48

8 2018	9 2019	10 2020	11 2021	12 2022	13 2023	14 2024	15 2025	16 2026	17 2027	18 2028	19 2029	20 2030
660,861.88	693,871.93	728,530.83	764,920.95	803,128.75	843,245.03	885,365.12	929,589.10	976,022.08	1,024,774.38	1,075,961.86	1,129,706.16	1,186,134.98
235,185.36	242,240.92	249,508.15	256,993.40	264,703.20	272,644.29	280,823.62	289,248.33	297,925.78	306,863.55	316,069.46	325,551.55	335,318.09

8	9	10	11	12	13	14	15	16	17	18	19	20
\$6,731,277.20	\$6,832,319.13	\$6,931,352.55	\$7,028,065.46	\$7,122,123.93	\$7,213,170.83	\$7,300,824.41	\$7,384,676.97	\$7,464,293.26	\$7,539,208.92	\$7,608,928.85	\$7,672,925.39	\$7,730,636.47
\$336,227.30	\$341,274.34	\$346,221.06	\$351,051.87	\$355,750.09	\$360,297.88	\$364,676.18	\$368,864.61	\$372,841.45	\$376,583.49	\$380,066.00	\$383,262.62	\$386,145.29
235,185.36	242,240.92	249,508.15	256,993.40	264,703.20	272,644.29	280,823.62	289,248.33	297,925.78	306,863.55	316,069.46	325,551.55	335,318.09
\$6,832,319.13	\$6,931,352.55	\$7,028,065.46	\$7,122,123.93	\$7,213,170.83	\$7,300,824.41	\$7,384,676.97	\$7,464,293.26	\$7,539,208.92	\$7,608,928.85	\$7,672,925.39	\$7,730,636.47	\$7,781,463.67
5,083,887.09	5,007,356.56	4,929,343.71	4,849,819.84	4,768,755.67	4,686,121.38	4,601,886.55	4,516,020.18	4,428,490.67	4,339,265.80	4,248,312.75	4,155,598.03	4,061,087.53

21 2031	22 2032	23 2033	24 2034	25 2035	26 2036	27 2037	28 2038	29 2039	30 2040	31 2041	32 2042	33 2043
1,245,382.42	1,307,589.27	1,372,903.36	1,441,479.88	1,513,481.80	1,589,080.22	1,668,454.77	1,751,794.09	1,839,296.21	1,931,169.05	2,027,630.95	2,128,911.11	2,235,250.22
345,377.63	355,738.96	366,411.13	377,403.47	388,725.57	400,387.34	412,398.96	424,770.93	437,514.05	450,639.48	464,158.66	478,083.42	492,425.92

21	22	23	24	25	26	27	28	29	30	31	32	33
\$7,781,463.67	\$7,824,770.14	\$7,859,878.45	\$7,886,068.24	\$7,902,573.88	\$7,908,581.88	\$7,903,228.21	\$7,885,595.50	\$7,854,710.07	\$7,809,538.78	\$7,748,985.77	\$7,671,888.95	\$7,577,016.38
\$388,684.11	\$390,847.27	\$392,600.93	\$393,909.11	\$394,733.57	\$395,033.66	\$394,766.25	\$393,885.50	\$392,342.77	\$390,086.46	\$387,061.84	\$383,210.85	\$378,471.97
345,377.63	355,738.96	366,411.13	377,403.47	388,725.57	400,387.34	412,398.96	424,770.93	437,514.05	450,639.48	464,158.66	478,083.42	492,425.92
\$7,824,770.14	\$7,859,878.45	\$7,886,068.24	\$7,902,573.88	\$7,908,581.88	\$7,903,228.21	\$7,885,595.50	\$7,854,710.07	\$7,809,538.78	\$7,748,985.77	\$7,671,888.95	\$7,577,016.38	\$7,463,062.43
3,964,746.46	3,866,539.37	3,766,430.11	3,664,381.84	3,560,357.01	3,454,317.32	3,346,223.76	3,236,036.55	3,123,715.12	3,009,218.15	2,892,503.50	2,773,528.20	2,652,248.48

34 2044	35 2045	36 2046	37 2047	38 2048	39 2049	40 2050	41 2051	42 2052	43 2053	44 2054	45 2055
											1,000,000.00
2,346,900.97	2,464,128.67	2,587,211.90	2,716,443.13	2,852,129.47	2,994,593.34	3,144,173.27	3,301,224.73	3,466,120.90	3,639,253.64	3,821,034.36	4,011,895.03
507,198.70	522,414.66	538,087.10	554,229.71	570,856.61	587,982.30	605,621.77	623,790.43	642,504.14	661,779.26	681,632.64	702,081.62

34	35	36	37	38	39	40	41	42	43	44	45
\$7,463,062.43	\$7,328,643.70	\$7,172,294.79	\$6,992,463.81	\$6,787,507.67	\$6,555,687.07	\$6,295,161.33	\$6,003,982.87	\$5,680,091.39	\$5,321,307.82	\$4,925,327.88	\$4,489,715.37
\$372,779.97	\$366,065.75	\$358,256.12	\$349,273.57	\$339,036.01	\$327,456.57	\$314,443.31	\$299,898.94	\$283,720.56	\$265,799.33	\$246,020.13	\$224,261.28
507,198.70	522,414.66	538,087.10	554,229.71	570,856.61	587,982.30	605,621.77	623,790.43	642,504.14	661,779.26	681,632.64	702,081.62
\$7,328,643.70	\$7,172,294.79	\$6,992,463.81	\$6,787,507.67	\$6,555,687.07	\$6,295,161.33	\$6,003,982.87	\$5,680,091.39	\$5,321,307.82	\$4,925,327.88	\$4,489,715.37	\$4,011,895.03
2,528,619.71	2,402,596.37	2,274,132.10	2,143,179.61	2,009,690.72	1,873,616.28	1,734,906.23	1,593,509.51	1,449,374.09	1,302,446.93	1,152,673.93	1,000,000.00

## Endowment Fund Calculations for Stillwater Lift Bridge 2011 Investment Scenario

### Calculation of Present Value of Bridge Demolition Costs

\$4,011,895.03 FV  
4.995% interest rate 5%, less .005% administrative fee  
44 n  
\$469,818.78 PV

### Demolition Costs and Maintenance Costs (to calculate amount of initial total endowment)

YEAR	2008	2009	2010	0 2011	1 2012	2 2013	3 2014	4 2015	5 2016	6 2017
Demolition Costs				\$469,818.78	493,286.23	517,925.88	543,796.27	570,958.90	599,478.30	629,422.24
Maintenance Costs Adjusted for Inflation				0	0.00	202,872.96	208,959.15	215,227.92	221,684.76	228,335.30
				\$5,440,436.58	NPV of Maintenance Costs					
				<u>\$469,818.78</u>	PV of Demolition Costs					
INITIAL ENDOWMENT REQUIRED				<u>\$5,910,255.36</u>	Total Endowment					

### Presentation of endowment, annual earnings, maintenance costs, and amount remaining for demolition (in dollars adjusted for inflation)

YEAR	0	1	2	3	4	5	6
Beginning	\$5,910,255.36	\$5,910,255.36	\$6,205,472.62	\$6,312,563.01	\$6,418,916.39	\$6,524,313.34	\$6,628,518.03
Earnings (based on 5% interest rate)		\$295,217.26	\$309,963.36	\$315,312.52	\$320,624.87	\$325,889.45	\$331,094.48
Maintenance Costs		0.00	202,872.96	208,959.15	215,227.92	221,684.76	228,335.30
Ending	\$5,910,255.36	\$6,205,472.62	\$6,312,563.01	\$6,418,916.39	\$6,524,313.34	\$6,628,518.03	\$6,731,277.20
Value in 2008 Dollars (Ending)	5,408,720.90	5,513,482.05	5,445,272.31	5,375,741.42	5,304,863.79	5,232,613.34	5,158,963.48

7 2018	8 2019	9 2020	10 2021	11 2022	12 2023	13 2024	14 2025	15 2026	16 2027	17 2028	18 2029	19 2030
660,861.88	693,871.93	728,530.83	764,920.95	803,128.75	843,245.03	885,365.12	929,589.10	976,022.08	1,024,774.38	1,075,961.86	1,129,706.16	1,186,134.98
235,185.36	242,240.92	249,508.15	256,993.40	264,703.20	272,644.29	280,823.62	289,248.33	297,925.78	306,863.55	316,069.46	325,551.55	335,318.09

7	8	9	10	11	12	13	14	15	16	17	18	19
\$6,731,277.20	\$6,832,319.13	\$6,931,352.55	\$7,028,065.46	\$7,122,123.93	\$7,213,170.83	\$7,300,824.41	\$7,384,676.97	\$7,464,293.26	\$7,539,208.92	\$7,608,928.85	\$7,672,925.39	\$7,730,636.47
\$336,227.30	\$341,274.34	\$346,221.06	\$351,051.87	\$355,750.09	\$360,297.88	\$364,676.18	\$368,864.61	\$372,841.45	\$376,583.49	\$380,066.00	\$383,262.62	\$386,145.29
235,185.36	242,240.92	249,508.15	256,993.40	264,703.20	272,644.29	280,823.62	289,248.33	297,925.78	306,863.55	316,069.46	325,551.55	335,318.09
\$6,832,319.13	\$6,931,352.55	\$7,028,065.46	\$7,122,123.93	\$7,213,170.83	\$7,300,824.41	\$7,384,676.97	\$7,464,293.26	\$7,539,208.92	\$7,608,928.85	\$7,672,925.39	\$7,730,636.47	\$7,781,463.67
5,083,887.09	5,007,356.56	4,929,343.71	4,849,819.84	4,768,755.67	4,686,121.38	4,601,886.55	4,516,020.18	4,428,490.67	4,339,265.80	4,248,312.75	4,155,598.03	4,061,087.53



20 2031	21 2032	22 2033	23 2034	24 2035	25 2036	26 2037	27 2038	28 2039	29 2040	30 2041	31 2042	32 2043
1,245,382.42	1,307,589.27	1,372,903.36	1,441,479.88	1,513,481.80	1,589,080.22	1,668,454.77	1,751,794.09	1,839,296.21	1,931,169.05	2,027,630.95	2,128,911.11	2,235,250.22
345,377.63	355,738.96	366,411.13	377,403.47	388,725.57	400,387.34	412,398.96	424,770.93	437,514.05	450,639.48	464,158.66	478,083.42	492,425.92

20	21	22	23	24	25	26	27	28	29	30	31	32
\$7,781,463.67	\$7,824,770.14	\$7,859,878.45	\$7,886,068.24	\$7,902,573.88	\$7,908,581.88	\$7,903,228.21	\$7,885,595.50	\$7,854,710.07	\$7,809,538.78	\$7,748,985.77	\$7,671,888.95	\$7,577,016.38
\$388,684.11	\$390,847.27	\$392,600.93	\$393,909.11	\$394,733.57	\$395,033.66	\$394,766.25	\$393,885.50	\$392,342.77	\$390,086.46	\$387,061.84	\$383,210.85	\$378,471.97
345,377.63	355,738.96	366,411.13	377,403.47	388,725.57	400,387.34	412,398.96	424,770.93	437,514.05	450,639.48	464,158.66	478,083.42	492,425.92
\$7,824,770.14	\$7,859,878.45	\$7,886,068.24	\$7,902,573.88	\$7,908,581.88	\$7,903,228.21	\$7,885,595.50	\$7,854,710.07	\$7,809,538.78	\$7,748,985.77	\$7,671,888.95	\$7,577,016.38	\$7,463,062.43
3,964,746.46	3,866,539.37	3,766,430.11	3,664,381.84	3,560,357.01	3,454,317.32	3,346,223.76	3,236,036.55	3,123,715.12	3,009,218.15	2,892,503.50	2,773,528.20	2,652,248.48

<b>33</b> <b>2044</b>	<b>34</b> <b>2045</b>	<b>35</b> <b>2046</b>	<b>36</b> <b>2047</b>	<b>37</b> <b>2048</b>	<b>38</b> <b>2049</b>	<b>39</b> <b>2050</b>	<b>40</b> <b>2051</b>	<b>41</b> <b>2052</b>	<b>42</b> <b>2053</b>	<b>43</b> <b>2054</b>	<b>44</b> <b>2055</b>
2,346,900.97	2,464,128.67	2,587,211.90	2,716,443.13	2,852,129.47	2,994,593.34	3,144,173.27	3,301,224.73	3,466,120.90	3,639,253.64	3,821,034.36	4,011,895.03
507,198.70	522,414.66	538,087.10	554,229.71	570,856.61	587,982.30	605,621.77	623,790.43	642,504.14	661,779.26	681,632.64	702,081.62

<b>33</b>	<b>34</b>	<b>35</b>	<b>36</b>	<b>37</b>	<b>38</b>	<b>39</b>	<b>40</b>	<b>41</b>	<b>42</b>	<b>43</b>	<b>44</b>
\$7,463,062.43	\$7,328,643.70	\$7,172,294.79	\$6,992,463.81	\$6,787,507.67	\$6,555,687.07	\$6,295,161.33	\$6,003,982.87	\$5,680,091.39	\$5,321,307.82	\$4,925,327.88	\$4,489,715.37
\$372,779.97	\$366,065.75	\$358,256.12	\$349,273.57	\$339,036.01	\$327,456.57	\$314,443.31	\$299,898.94	\$283,720.56	\$265,799.33	\$246,020.13	\$224,261.28
507,198.70	522,414.66	538,087.10	554,229.71	570,856.61	587,982.30	605,621.77	623,790.43	642,504.14	661,779.26	681,632.64	702,081.62
\$7,328,643.70	\$7,172,294.79	\$6,992,463.81	\$6,787,507.67	\$6,555,687.07	\$6,295,161.33	\$6,003,982.87	\$5,680,091.39	\$5,321,307.82	\$4,925,327.88	\$4,489,715.37	\$4,011,895.03
2,528,619.71	2,402,596.37	2,274,132.10	2,143,179.61	2,009,690.72	1,873,616.28	1,734,906.23	1,593,509.51	1,449,374.09	1,302,446.93	1,152,673.93	1,000,000.00

## Endowment Fund Calculations for Stillwater Lift Bridge 2012 Investment Scenario

### Calculation of Present Value of Bridge Demolition Costs

\$4,011,895.03 FV  
 4.995% interest rate 5%, less .005% administrative fee  
 43 n  
 \$493,286.23 PV

### Demolition Costs and Maintenance Costs (to calculate amount of initial total endowment)

YEAR	2008	2009	2010	2011	0 2012	1 2013	2 2014	3 2015	4 2016	5 2017
Demolition Costs					\$493,286.23	517,925.88	543,796.27	570,958.90	599,478.30	629,422.24
Maintenance Costs Adjusted for Inflation					0	202,872.96	208,959.15	215,227.92	221,684.76	228,335.30
					\$5,712,186.39	NPV of Maintenance Costs				
					<u>\$493,286.23</u>	PV of Demolition Costs				
<b>INITIAL ENDOWMENT REQUIRED</b>					<u>\$6,205,472.62</u>	<b>Total Endowment</b>				

### Presentation of endowment, annual earnings, maintenance costs, and amount remaining for demolition (in dollars adjusted for inflation)

YEAR	0	1	2	3	4	5
Beginning	\$6,205,472.62	\$6,205,472.62	\$6,312,563.01	\$6,418,916.39	\$6,524,313.34	\$6,628,518.03
Earnings (based on 5% interest rate)		\$309,963.36	\$315,312.52	\$320,624.87	\$325,889.45	\$331,094.48
Maintenance Costs		202,872.96	208,959.15	215,227.92	221,684.76	228,335.30
Ending	\$6,205,472.62	\$6,312,563.01	\$6,418,916.39	\$6,524,313.34	\$6,628,518.03	\$6,731,277.20
Value in 2008 Dollars (Ending)	5,513,482.05	5,445,272.31	5,375,741.42	5,304,863.79	5,232,613.34	5,158,963.48

6 2018	7 2019	8 2020	9 2021	10 2022	11 2023	12 2024	13 2025	14 2026	15 2027	16 2028	17 2029	18 2030
660,861.88	693,871.93	728,530.83	764,920.95	803,128.75	843,245.03	885,365.12	929,589.10	976,022.08	1,024,774.38	1,075,961.86	1,129,706.16	1,186,134.98
235,185.36	242,240.92	249,508.15	256,993.40	264,703.20	272,644.29	280,823.62	289,248.33	297,925.78	306,863.55	316,069.46	325,551.55	335,318.09

6	7	8	9	10	11	12	13	14	15	16	17	18
\$6,731,277.20	\$6,832,319.13	\$6,931,352.55	\$7,028,065.46	\$7,122,123.93	\$7,213,170.83	\$7,300,824.41	\$7,384,676.97	\$7,464,293.26	\$7,539,208.92	\$7,608,928.85	\$7,672,925.39	\$7,730,636.47
\$336,227.30	\$341,274.34	\$346,221.06	\$351,051.87	\$355,750.09	\$360,297.88	\$364,676.18	\$368,864.61	\$372,841.45	\$376,583.49	\$380,066.00	\$383,262.62	\$386,145.29
235,185.36	242,240.92	249,508.15	256,993.40	264,703.20	272,644.29	280,823.62	289,248.33	297,925.78	306,863.55	316,069.46	325,551.55	335,318.09
\$6,832,319.13	\$6,931,352.55	\$7,028,065.46	\$7,122,123.93	\$7,213,170.83	\$7,300,824.41	\$7,384,676.97	\$7,464,293.26	\$7,539,208.92	\$7,608,928.85	\$7,672,925.39	\$7,730,636.47	\$7,781,463.67
5,083,887.09	5,007,356.56	4,929,343.71	4,849,819.84	4,768,755.67	4,686,121.38	4,601,886.55	4,516,020.18	4,428,490.67	4,339,265.80	4,248,312.75	4,155,598.03	4,061,087.53

19 2031	20 2032	21 2033	22 2034	23 2035	24 2036	25 2037	26 2038	27 2039	28 2040	29 2041	30 2042	31 2043
1,245,382.42	1,307,589.27	1,372,903.36	1,441,479.88	1,513,481.80	1,589,080.22	1,668,454.77	1,751,794.09	1,839,296.21	1,931,169.05	2,027,630.95	2,128,911.11	2,235,250.22
345,377.63	355,738.96	366,411.13	377,403.47	388,725.57	400,387.34	412,398.96	424,770.93	437,514.05	450,639.48	464,158.66	478,083.42	492,425.92

19	20	21	22	23	24	25	26	27	28	29	30	31
\$7,781,463.67	\$7,824,770.14	\$7,859,878.45	\$7,886,068.24	\$7,902,573.88	\$7,908,581.88	\$7,903,228.21	\$7,885,595.50	\$7,854,710.07	\$7,809,538.78	\$7,748,985.77	\$7,671,888.95	\$7,577,016.38
\$388,684.11	\$390,847.27	\$392,600.93	\$393,909.11	\$394,733.57	\$395,033.66	\$394,766.25	\$393,885.50	\$392,342.77	\$390,086.46	\$387,061.84	\$383,210.85	\$378,471.97
345,377.63	355,738.96	366,411.13	377,403.47	388,725.57	400,387.34	412,398.96	424,770.93	437,514.05	450,639.48	464,158.66	478,083.42	492,425.92
\$7,824,770.14	\$7,859,878.45	\$7,886,068.24	\$7,902,573.88	\$7,908,581.88	\$7,903,228.21	\$7,885,595.50	\$7,854,710.07	\$7,809,538.78	\$7,748,985.77	\$7,671,888.95	\$7,577,016.38	\$7,463,062.43
3,964,746.46	3,866,539.37	3,766,430.11	3,664,381.84	3,560,357.01	3,454,317.32	3,346,223.76	3,236,036.55	3,123,715.12	3,009,218.15	2,892,503.50	2,773,528.20	2,652,248.48

32 2044	33 2045	34 2046	35 2047	36 2048	37 2049	38 2050	39 2051	40 2052	41 2053	42 2054	43 2055
2,346,900.97	2,464,128.67	2,587,211.90	2,716,443.13	2,852,129.47	2,994,593.34	3,144,173.27	3,301,224.73	3,466,120.90	3,639,253.64	3,821,034.36	4,011,895.03
507,198.70	522,414.66	538,087.10	554,229.71	570,856.61	587,982.30	605,621.77	623,790.43	642,504.14	661,779.26	681,632.64	702,081.62

32	33	34	35	36	37	38	39	40	41	42	43
\$7,463,062.43	\$7,328,643.70	\$7,172,294.79	\$6,992,463.81	\$6,787,507.67	\$6,555,687.07	\$6,295,161.33	\$6,003,982.87	\$5,680,091.39	\$5,321,307.82	\$4,925,327.88	\$4,489,715.37
\$372,779.97	\$366,065.75	\$358,256.12	\$349,273.57	\$339,036.01	\$327,456.57	\$314,443.31	\$299,898.94	\$283,720.56	\$265,799.33	\$246,020.13	\$224,261.28
507,198.70	522,414.66	538,087.10	554,229.71	570,856.61	587,982.30	605,621.77	623,790.43	642,504.14	661,779.26	681,632.64	702,081.62
\$7,328,643.70	\$7,172,294.79	\$6,992,463.81	\$6,787,507.67	\$6,555,687.07	\$6,295,161.33	\$6,003,982.87	\$5,680,091.39	\$5,321,307.82	\$4,925,327.88	\$4,489,715.37	\$4,011,895.03
2,528,619.71	2,402,596.37	2,274,132.10	2,143,179.61	2,009,690.72	1,873,616.28	1,734,906.23	1,593,509.51	1,449,374.09	1,302,446.93	1,152,673.93	1,000,000.00

## **Appendix 5. Previous Endowment Calculations**

**Principal Investment (2003 – Memo from Terry C. Pederson, Wisconsin Department of Transportation)**

**Demolition (2003 – *Maintenance Projections and Annualized Costs*, Appendices A and B, HNTB)**

**Demolition (2000 – Memo from Terry C. Pederson, Wisconsin Department of Transportation)**

**Demolition (1999 – *Stillwater Lift Bridge (# 4654) Estimated Maintenance and Operational Costs*, Minnesota Department of Transportation)**





**Principal Investment (2003 – Memo from Terry C. Pederson,  
Wisconsin Department of Transportation)**

**Calculated for combinations of  
interest at three, five, and seven  
percent over 20 years, 40 years, and  
infinity**



*Date:* June 27, 2003

*To:* File

*From:* Terry C Pederson, P.E.  
District Planning Projects Engineer

*Subject:* Project I.D. 1550-00-02  
St. Croix River Bridge and Approaches  
STH 64  
St. Croix County  
Net Present Value – Annual Maintenance and Removal

The following are calculations of what money would need to be put into an interest-bearing account today at a given interest rate to be sufficient funding for annual maintenance and operations of the existing Stillwater bridge for a number of years and to have enough money at the end of the time period to remove the structure.

**August 2000 Calculations:** The annual maintenance and operations of the bridge are \$ 150,000. The removal cost for the bridge is estimated to be \$ 1,000,000. Life is infinity.

$$p = a(p/a) + f(p/f) = (\$ 150,000)(14.286) + (\$ 1,000,000)(0.0000) = \$ 2,142,900^*$$

\* \$ 2,142,900 at 7% would generate \$ 150,003 each year so the fund would generate money for infinity and have \$ 2,142,900 to cover the \$ 1,000,000 removal cost at any time.

If the bridge were to be projected to last only 20 years and one needed \$150,000 per year for maintenance and operation and \$ 1,000,000 for removal at the end of the 20 years, \$ 1,847,500 would need to be put into an account paying seven percent interest today to cover both those costs. For 40 years, you would need a deposit today of \$ 2,066,600. Hence the \$ 2,000,000 figure I have quoted.

**June 2003 Calculations:** Annual maintenance and operations is projected to be \$250,000. For combinations of interest of 3%, 5% and 7% and 20 and 40 years and infinity, the initial deposit to cover annual maintenance and operations and removal costs are:

	3 percent	5 percent	7 percent
20 years	\$ 4,272,950**	\$ 3,492,400	\$ 2,906,900
40 years	\$ 6,085,350	\$ 4,431,750	\$ 3,399,800
Infinity	\$ 8,333,250	\$ 5,000,000	\$ 3,571,500

\*\* \$ 4,272,950 at 3% interest would generate \$ 128,188.5 the first year to cover the \$ 250,000 annual maintenance and operations costs. The principal would be slowly eroded until in 20 years, one would have \$ 1,000,000 left for removal.



**Demolition (2003 – *Maintenance Projections and Annualized Costs*,  
Appendices A and B, HNTB)**

**Page 1 calculated in 2003 dollars  
without contingency or escalation**

**Page 2 calculated in 2003 dollars  
without contingency; dollar values  
adjusted using an annual escalation  
rate of 2.5 percent**



**Structure Preservation - Traffic Control System**

Ref. No.	Item	Action	Cost Per Event (2003 US\$)	Occurrences Years 2010 to 2024	Occurrences Years 2025 to 2039	Occurrences Years 2039 to 2055	45 Yr. Cost (2003 US \$)
92	Traffic Barriers (Veh. & Ped.)	Misc. Repair	\$ 1,300	1	1	1	\$ 3,900
93	Traffic Signals / Bells & Gongs	Misc. Repair	\$ 500	1	1	1	\$ 1,500
94	Traffic Gate Support	Misc. Repair	\$ 2,500			1	\$ 2,500
Projected Costs:				\$ 1,800	\$ 1,800	\$ 4,300	\$ 7,900
Annualized Cost:				\$ 200			

**Structure Preservation - Machinery/Tender's House**

Ref. No.	Item	Action	Cost Per Event (2003 US\$)	Occurrences Years 2010 to 2024	Occurrences Years 2025 to 2039	Occurrences Years 2039 to 2055	45 Yr. Cost (2003 US \$)
95	Deck & Grating	Misc. Repair	\$ 1,300		1	1	\$ 2,600
96	Windows / Door / Lock Set	Misc. Repair	\$ 400		1	1	\$ 800
97	Sheathing & Roof	Misc. Repair	\$ 2,500			1	\$ 2,500
98	AC / Heating / Telephone / Detection / Suppres.	Misc. Repair	\$ 400	1	2	3	\$ 2,400
Projected Costs:				\$ 400	\$ 2,500	\$ 5,400	\$ 8,300
Annualized Cost:				\$ 200			

**Structure Preservation - Bridge Lighting**

Ref. No.	Item	Action	Cost Per Event (2003 US\$)	Occurrences Years 2010 to 2024	Occurrences Years 2025 to 2039	Occurrences Years 2039 to 2055	45 Yr. Cost (2003 US \$)
99	Roadway Lighting	Misc. Repair	\$ 2,200	1	1	1	\$ 6,600
Projected Costs:				\$ 2,200	\$ 2,200	\$ 2,200	\$ 6,600
Annualized Cost:				\$ 100			

**Component Failure**

Ref. No.	Item	Action	Cost Per Event (2003 US\$)				45 Yr. Cost (2003 US \$)
100	Substruct. E. Abut. Foundation Stabilization	Repair	\$ 350,000				\$ 500,000
101	Substructure Chloride Extraction (6 Piers)	Repair	\$ 571,500				\$ 572,000
102	Substructure - Pier Replacement (2 each)	Demo. & Replace	\$ 450,000				\$ 450,000
103	Superstructure Bearings	Rehab.	\$ 48,500				\$ 48,000
104	Lower Chord Connections - Bolts for Rivets	Repair	\$ 256,000				\$ 256,000
105	Low. Chrd. Gusset Plate Repair	Replace	\$ 650,000				\$ 650,000
106	Vehicular & Transition Deck	Replace	\$ 402,000				\$ 402,000
107	Pedestrian Deck	Replace	\$ 200,000				\$ 200,000
108	Cntrwght. Trunnion Replacement	Replace	\$ 425,000				\$ 425,000
109	Operating Drums Replacement (2 each)	Replace	\$ 62,000				\$ 62,000
110	Counterweight Sheave (1 each)	Replace	\$ 650,000				\$ 650,000
106	Demolition - One Time Cost If Bridge Removed	Remove Bridge	\$ 600,000				\$ 600,000
Annualized Cost:				\$ 107,000			\$ 4,815,000

These opinions of maintenance projections and annual cost are based on concepts without benefit of :

1) prel. design & plans, 2) final design & plans, 3) accurate quantities or 4) confirmation of the level of maintenance. Therefore, the opinions cost are subject to change.

The cost of labor, equipment and materials for maintenance are subject to market forces, which HNTB has no control over. The opinions of probable construction costs provided herein are made on the basis of engineering experience and represent our best judgment as experienced design professionals. However, no warranty or guarantee is provided or implied that actual total maintenance and operations costs will not vary significantly from the opinions of cost presented herein.

**Structure Preservation - Traffic Control System**

Ref. No.	Item	Action	Cost Per Event (2003 US\$)	Occurrences Years 2010 to 2024	Occurrences Years 2025 to 2039	Occurrences Years 2039 to 2055	45 Yr. Escalated Cost
92	Traffic Barriers (Veh. & Ped.)	Misc. Repair	\$ 1,300	1	1	1	\$ 8,400
93	Traffic Signals / Bells & Gongs	Misc. Repair	\$ 500	1	1	1	\$ 3,200
94	Traffic Gate Support	Misc. Repair	\$ 2,500			1	\$ 7,500
Projected Escal. Cost:				\$ 2,600	\$ 3,700	\$ 12,800	\$ 19,100
Annualized Escal. Cost:				\$ 400			

**Structure Preservation - Machinery/Tender's House**

Ref. No.	Item	Action	Cost Per Event (2003 US\$)	Occurrences Years 2010 to 2024	Occurrences Years 2025 to 2039	Occurrences Years 2039 to 2055	45 Yr. Escalated Cost
95	Deck & Grating	Misc. Repair	\$ 1,300		1	1	\$ 6,600
96	Windows / Door / Lock Set	Misc. Repair	\$ 400		1	1	\$ 2,000
97	Sheathing & Roof	Misc. Repair	\$ 2,500			1	\$ 7,500
98	AC / Heating / Telephone / Detection / Suppres	Misc. Repair	\$ 400	1	2	3	\$ 5,800
Projected Escal. Cost:				\$ 600	\$ 5,100	\$ 16,100	\$ 21,800
Annualized Escal. Cost:				\$ 500			

**Structure Preservation - Bridge Lighting**

Ref. No.	Item	Action	Cost Per Event (2003 US\$)	Occurrences Years 2010 to 2024	Occurrences Years 2025 to 2039	Occurrences Years 2039 to 2055	45 Yr. Escalated Cost
99	Roadway Lighting	Misc. Repair	\$ 2,200	1	1	1	\$ 14,200
Projected Escal. Cost:				\$ 3,100	\$ 4,500	\$ 6,600	\$ 14,200
Annualized Escal. Cost:				\$ 300			

**Component Failure**

Ref. No.	Item	Action	Cost Per Event (2003 US\$)				45 Yr. Escalated Cost
100	Substruct. E. Abut. Foundation Stabilization	Repair	\$ 350,000				\$ 1,259,500
101	Substructure Chloride Extraction (6 Piers)	Repair	\$ 571,500				\$ 1,440,900
102	Substructure - Pier Replacement (2 each)	Demo. & Replace	\$ 450,000				\$ 1,133,600
103	Superstructure Bearings	Rehab.	\$ 48,500				\$ 120,900
104	Lower Chord Connections - Bolts for Rivets	Repair	\$ 256,000				\$ 644,900
105	Low. Chrd. Gusset Plate Repair	Replace	\$ 650,000				\$ 1,637,400
106	Vehicular & Transition Deck	Replace	\$ 402,000				\$ 1,012,600
107	Pedestrian Deck	Replace	\$ 200,000				\$ 503,800
108	Cntrwght. Trunnion Replacement	Replace	\$ 425,000				\$ 1,070,600
109	Operating Drums Replacement (2 each)	Replace	\$ 62,000				\$ 156,200
110	Counterweight Sheave (1 each)	Replace	\$ 650,000				\$ 1,637,400
106	Demolition - One Time Cost If Bridge Removed	Remove Bridge	\$ 600,000				\$ 1,511,400
Average Annual Escal. Cost:				\$ 269,500			\$ 12,129,200

These opinions of maintenance projections and annual cost are based on concepts without benefit of :

1) prel. design & plans, 2) final design & plans, 3) accurate quantities or 4) confirmation of the level of maintenance.  
Therefore, the opinions cost are subject to change.

The cost of labor, equipment and materials for maintenance are subject to market forces, which HNTB has no control over. The opinions of probable construction costs provided herein are made on the basis of engineering experience and represent our best judgment as experienced design professionals. However, no warranty or guarantee is provided or implied that actual total maintenance and operations costs will not vary significantly from the opinions of cost presented herein.



**Demolition (2000 – Memo from Terry C. Pederson, Wisconsin  
Department of Transportation)**

**Calculated in 2000 dollars assuming  
a seven percent interest rate**



CORRESPONDENCE/MEMORANDUM

State of Wisconsin

*Date:* August 26, 2000

*To:* File

*From:* Terry C Pederson, P.E.  
District Planning Projects Engineer

*Subject:* Project I.D. 1550-00-02  
St. Croix River Bridge and Approaches  
STH 64  
St. Croix County  
Net Present Value – Annual Maintenance

The following is a calculation of what money would need to be put into an interest-bearing account today at seven percent interest to be sufficient funding for annual maintenance and operation of the existing Stillwater bridge for a number of years and to have enough money at the end of the time period to remove the structure. The annual maintenance and operating costs of the bridge are \$ 150,000. The removal costs for the bridge is estimated to be \$ 1,000,000.

## DESIGN/FINAL COMPUTATIONS

Wisconsin Department of Transportation

ED408 983

ANNUAL MAINTENANCE & OPERATIONS COST: \$150,000<sup>00</sup>

ASSUMED APR = 7%

(HAVE BEEN AVERAGING  
\$137,000 RECENTLY  
THOUGH.)

NO. OF YEARS = 30 YEARS

PRESENT SUM EQUIVALENT TO A 30 YEAR ANNUAL PAYMENT  
OF \$150,000<sup>00</sup> AT 7% INTEREST

$$P = (a)(P/a)_{30}^{7\%} = (\$150,000^{00})(12.409) = \$1,861,350^{00}$$

FOR 20 YRS:

$$P = (150,000)(10.594) = \$1,589,100^{00}$$

FOR 50 YRS:

$$P = (150,000)(13.801) = \$2,070,150^{00}$$

→ USE \$2 MILLION

FOR ∞:

$$P = (150,000)(14.286) = \$2,142,900^{00}$$

Post-It® Fax Note 7671

Date	1-3-01	# of pages	1
To	TODD CLARKOWSKI		
Co/Dept.	MNDOT		
Phone #	(651) 582-1169		
Fax #	(651) 582-1308		
From	Terry Pederson		
Co.	WISDOT		
Phone #	See my e-mail		
Fax #			

FAXED TO MNDOT/DATE: 3-28-00

Project/Structure No.	1550-00-02	Hwy. No.	STH 1A	County	ST. CROIX	Computations by	T.C.P.	Date	8-26-00
Name of Road	ST. CROIX RIVER BRIDGE AND APPR.					Checked by		Date	
Title/Item	OPERATIONS & MAINTENANCE LUMP SUM PAYMENT					Sheet	1	Of	1

**Demolition (1999 – *Stillwater Lift Bridge (# 4654) Estimated  
Maintenance and Operational Costs*, Minnesota Department of  
Transportation)**

**Calculated in 1999 dollars**



# Stillwater Lift Bridge (# 4654) Estimated Maintenance and Operational Costs

[Estimated costs are in 1999 dollars]

Year	2000	2001	2002	2003	2004 (a)	2005	2006	2007	2008	2009 (b)	2010	2011	2012	2013	2014 (c)	2015	2016	----->	2031 (d)	
<b>Proposed activities:</b>																				
Lift operations	\$70k/yr ----->										----->									
Routine Maintenance - Bridge	30k/yr ----->										----->									
Routine Maintenance - Electrical	5k/yr ----->										----->									
Ongoing steel repairs (1)	22k/yr ----->													Operational and general maintenance expenses would continue until the bridge and remaing causeway are removed						
Ongoing lift span repairs (2)	10k/yr ----->																			
Partial causeway removal (3)						200k														
Bridge and remaining causeway removed (4)																				
Annual Cost:	\$137k	137k	137k	137k	137k	337k	137k	115k	115k	115k	105k	105k	105k	105k	650k					
Cumulative total:	\$137k	274k	411k	548k	685k	1,022k	1,159k	1,274k	1,389k	1,504k	1,609k	1,714k	1,819k	1,924k	2,574k					

## Extraordinary repairs (as proposed these repairs have been defined as extraordinary and would not be done):

Repaint bridge (5), (6)						1,600k									400k	Operational and maintenance expenses would continue throughout the life of the bridge. However, it is unclear what the extent of the required repairs would need to be to get the bridge to its 100th year.			
Redeck Bridge and major steel repairs (7)															1,400k				
Rehabilitation of lift span electrical and mechanical systems (8)										2,000k									

(a) Anticipated opening of the new bridge; existing bridge closed to vehicle traffic converted to pedestrians and bicycle crossings.

(b) Lichtenstein report, anticipated end of bridges life based on extraordinary work required on lift span,

(c) Proposed date certain removal date, 10 years after completion of the new bridge.

(d) The average life span of a bridge in Minnesota is 60 years, even with extensive repairs it is unlikely that the Stillwater lift bridge will reach 100 years.

(1) Lichtenstein report recommends steel repairs within 5-7 years at a total estimated cost of \$150,000.

(2) Lichtenstein report recommends mechanical repair costs to the lift span at a total estimated cost \$75,000 - \$100,000 through 2009.

(3) Initial causeway removal; reduction in height to elevation 680 (five feet above normal pool) a 16 ft. wide unpaved top provided; connection to Wisconsin shoreline perpetuated.

(4) Lift bridge and remaing causeway removal, submerged sandbar and sand point left in-place to replicate original shoreline.

(5) DOT estimate to repaint bridge is \$1,600,000, includes removing all accessible paint, pack rust and surface rust; enclosing bridge to capture blasting residues, steel repairs, bridge closed for about 3 months.

(6) DOT estimate, additional painting needed when deck removed and significant steel repairs/replacement occurs, additional areas will also be accessible for painting once deck is removed.

(7) DOT estimate, steel replacement of floor beams under deck joints, stringers near joints, and fascia stringers; repair truss bottom chord, gusset plates, interior floor beams; replace majority of bearing assemblies.

(8) DOT estimate based on Lichtenstein and HNTB estimates; work includes replacement of electrical and mechanical systems, as well as, addressing various code issues.

Mechanical: main drive reducer, brakes, shafts, couplings, bearings, machinery supports, clutches, operating ropes, counterweight ropes

Electrical: Main drive motor, motor starters, service upgrade, console upgrade, navigation lighting, wire/conduit replacement

Code issues: span locks, traffic gates, barrier gates, remodel control house.

**draft**





## **Appendix 6.      Enabling Legislation – Examples**





## ***Minnesota Statutes 2005, 92.69***

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[Minnesota Statutes 2005, Table of Chapters](#)

[Table of contents for Chapter 92](#)

### **92.69 Endowment account.**

#### **Subdivision 1. Proceeds of land acquisition account.**

To ensure educational opportunities provided by Minnesota scientific and natural areas as described in section [86A.05](#), subdivision 5, are adequately available for present and future generations, the proceeds received under Laws 1986, chapter 449, sections 1 to 3 that are credited to the land acquisition account under section [94.165](#) must be spent on scientific and natural areas.

Subd. 2. **Account.** (a) A natural areas legacy endowment account is established in the state treasury. The commissioner of natural resources shall accept private contributions for educational opportunities provided by scientific and natural areas and deposit the contributions in the account. The principal deposited in the account shall be retained in the endowment account.

(b) The interest from the principal may be spent by the commissioner of natural resources for the protection, management, and inventory of lands with rare and endangered species or undisturbed plant communities that qualify as state scientific and natural areas under section [86A.05](#), subdivision 5.

HIST: 1986 c 449 s 4



## ***Minnesota Statutes 2005, 473I.04***

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[Minnesota Statutes 2005, Table of Chapters](#)

[Table of contents for Chapter 473I](#)

### **473I.04 Sports facilities fund.**

Subdivision 1. **Creation.** The sports facilities fund is established as a special account in the state treasury.

#### **Subd. 2. Baseball park revenue bond proceeds account.**

A baseball park revenue bond proceeds account is established in the sports facilities fund. The proceeds of any bonds issued under section [473I.06](#) must be credited to the account. The amount necessary to make the loan under section [473I.05](#) is appropriated from the account to the commissioner.

Subd. 3. **Baseball park debt service account.** (a) A baseball park debt service account is established in the sports facilities fund. The assets of the account and its investment earnings are pledged to and may only be used to pay principal and interest on bonds issued under section [473I.06](#).

(b) The State Board of Investment shall contract with the investment advisors specified by the team to invest money in the endowment account. The account must be invested in authorized investments under section [11A.24](#), except (1) corporate obligations described in section [11A.24](#), subdivision 3, paragraph (b), and (2) investments described in section [11A.24](#), subdivision 6, paragraph (a), clauses (1) to (4).

(c) The commissioner shall review the investment performance of the account at the end of the second year after the baseball park begins operations and every four years thereafter. The commissioner shall require the owner of the baseball park to impose a surcharge on admissions to events at the baseball park, in one-half of one percent increments, not to exceed five percent, in an amount sufficient to equal the money that would be in the fund, if an 8.5 percent annual rate of return had been earned. Notwithstanding the preceding sentence, the commissioner shall set the required rate of return for the first four years after the account is established. If the rate of return on the fund during the period exceeded 8.5 percent, the commissioner may use the excess to retire or defease the bonds. In making the determination under this paragraph, the commissioner must assume that the municipality has timely made all payments required under the loan agreement, regardless of whether the payments were made.

(d) In addition, the commissioner may require, as part of the loan agreement, that the municipality exercise its authority under section [473I.07](#) to provide money to the commissioner to make up any deficiency that is not eliminated under paragraph (c). The municipality may recover from the team any payments made under this paragraph.

(e) Money in the debt service account is appropriated to the commissioner to pay principal and interest on bonds issued under section [473I.06](#).

HIST: 2002 c 397 s 8



## ***Minnesota Statutes 2005, 62J.694***

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[Minnesota Statutes 2005, Table of Chapters](#)

[Table of contents for Chapter 62J](#)

### **62J.694 Medical education endowment fund.**

Subdivision 1. **Creation; use of cash reserves.** (a) The medical education endowment fund is created in the state treasury. The State Board of Investment shall invest the fund under section [11A.24](#). All earnings of the fund must be credited to the fund. The principal of the fund must be maintained inviolate, except that the principal may be used to make expenditures from the fund for the purposes specified in this section when the market value of the fund falls below 105 percent of the cumulative total of the tobacco settlement payments received by the state and credited to the tobacco settlement fund under Minnesota Statutes 2002, section [16A.87](#), subdivision 2. For purposes of this section, "principal" means an amount equal to the cumulative total of the tobacco settlement payments received by the state and credited to the tobacco settlement fund under Minnesota Statutes 2002, section [16A.87](#), subdivision 2.

(b) If the commissioner of finance determines that probable receipts to the general fund will be sufficient to meet the need for expenditures from the general fund for a fiscal biennium, after using the cash reserves of the tobacco use prevention and local public health endowment fund, excluding an amount sufficient to meet the annual appropriations in section [144.395](#), subdivision 2, the commissioner may use cash reserves of the medical education endowment fund, excluding the amounts needed to meet the appropriations described in subdivisions 2 and 2a, to pay expenses of the general fund. If cash reserves are transferred to the general fund to meet cash flow needs, the amount transferred, plus interest at a rate comparable to the rate earned by the state on invested commissioner of finance cash, as determined monthly by the commissioner, must be returned to the endowment fund as soon as sufficient cash balances are available in the general fund, but in any event before the end of the fiscal biennium. An amount necessary to pay the interest is appropriated from the general fund. If cash reserves of the endowment fund are used to pay expenses for the general fund, notwithstanding subdivision 2, paragraph (d), the Academic Health Center shall be held harmless to the extent possible. When determining the fair market value of the fund, for the purposes described in subdivisions 2 and 2a, the value of the cash reserves transferred to the general fund must be included in the determination.

(c) The Academic Health Center account is created as a separate account in the medical education endowment fund. The account is invested under paragraph (a). All earnings of the account must be credited to the account. The principal of the account must be maintained inviolate, except that the principal may be used to make expenditures from the account for the purposes specified in subdivision 2a when the value of the account falls below an

amount equal to deposits made to the account under Minnesota Statutes 2002, section [16A.87](#), subdivision 3, paragraph (b).

Subd. 2. **Expenditures.** (a) Up to five percent of the fair market value of the fund excluding the value of the Academic Health Center account, is annually appropriated for medical education activities in the state of Minnesota. The appropriations are to be transferred quarterly for the purposes identified in the following paragraphs.

(b) For fiscal year 2000, 70 percent of the appropriation in paragraph (a) is for transfer to the Board of Regents for the instructional costs of health professional programs at the Academic Health Center and affiliated teaching institutions, and 30 percent of the appropriation is for transfer to the commissioner of health to be distributed for medical education under section [62J.692](#).

(c) For fiscal year 2001, 49 percent of the appropriation in paragraph (a) is for transfer to the Board of Regents for the instructional costs of health professional programs at the Academic Health Center and affiliated teaching institutions, and 51 percent is for transfer to the commissioner of health to be distributed for medical education under section [62J.692](#).

(d) For fiscal year 2002, and each year thereafter, 42 percent of the appropriation in paragraph (a) is appropriated for the instructional costs of health professional programs at the University of Minnesota Academic Health Center, and 58 percent is for transfer to the commissioner of health to be distributed for medical education under section [62J.692](#).

(e) A maximum of \$150,000 of each annual appropriation to the commissioner of health in paragraph (d) may be used by the commissioner for administrative expenses associated with implementing section [62J.692](#).

Subd. 2a. **Expenditure; Academic Health Center account.**

(a) Beginning in January 2002, up to five percent of the fair market value of the Academic Health Center account is annually appropriated to the Board of Regents for the costs of the Academic Health Center. Appropriations are to be transferred quarterly and may only be used for instructional costs of health professional programs at the Academic Health Center and for interdisciplinary academic initiatives within the Academic Health Center, except as specified in paragraph (b).

(b) Of the amount appropriated under paragraph (a), \$4,850,000 shall be transferred annually to the commissioner of health no later than April 15 of each year for distribution under section [62J.692](#), subdivision 4.

Subd. 3. **Audits required.** The legislative auditor shall audit endowment fund expenditures to ensure that the money is spent for the purposes set out in this section.

Subd. 4. **Sunset.** The medical education endowment fund expires June 30, 2015. Upon expiration, the commissioner of finance shall transfer the principal and any remaining interest to the general fund.

Subd. 5. **Effective date.** This section is only in effect if there are funds available in the medical education endowment fund.

HIST: 1999 c 245 art 11 s 2; 2000 c 392 s 3,4; 1Sp2001 c 1 art 2 s 3-5;  
2002 c 220 art 15 s 3; 2002 c 374 art 8 s 1; 2003 c 112 art 2 s 50; 1Sp2003 c  
14 art 7 s 20; 2004 c 228 art 1 s 17



## **Appendix 7.      General Outline of Minnesota Legislative Process**



## **The Legislative Process in Minnesota**

### **Step 1 - Idea**

Anyone can suggest an idea for legislation; however legislators are the only ones who can move an idea through the process.

### **Step 2 – Legal Form**

The Office of the Revisor of Statutes and staff from other legislative offices work with legislators to put the idea for a new law into proper legal form. The Revisor's office is responsible for assuring that the proposal's form complies with the rules of both bodies before the bill can be introduced into the Minnesota House of Representatives and the Minnesota Senate.

### **Step 3 - Authors**

Each bill must be sponsored by a legislator who will introduce it in the Legislature. That legislator is the chief author whose name appears on the bill along with the bill's file number to identify it as it moves through the legislative process.

### **Step 4 – Introduction**

The chief House author of the bill introduces it in the House; the chief Senate author introduces it in the Senate. The presiding officers of the House and the Senate refer the companion bills to the appropriate committees for discussion.

### **Step 5 - Committee**

The bill is discussed in one or more committees. After discussion, committee members recommend approval or disapproval to the full House and full Senate. The House committee sends a report to the House regarding its action on the bill; the Senate committee does likewise in the Senate.

### **Step 6 - Floor**

After the full House or Senate accepts the committee report, the bill is placed on the house agenda called the General Register or the Senate agenda called General Orders. (A committee can recommend that non-controversial bills bypass the General Register or General Orders and go onto the Consent Calendar, where bills usually pass without debate.) After this point, House and Senate procedures differ slightly.

### **Step 7 – General Register**

In the House, the General Register serves as a parking lot where bills await action by the full body. Bills chosen to appear on the Calendar for the Day or the Fiscal Calendar are drawn from the General Register. In the Senate, bills are listed on the General Orders agenda. Senate members, acting as the "committee of the whole," debate the issue and offer amendments on the bill. Afterwards, they vote to recommend passage of the bill, progress (delay action), or further committee action. Sometimes they recommend that a bill not pass. From here, the bill is placed on the Calendar for the Day.

### **Step 8 – Calendar for the Day**

In the House, the Calendar for the Day is a list of bills the House Rules and Legislative Administration Committee has designated for the full House to vote on. Members can vote to amend the bill, and after amendments are dispensed with, a vote of the full body is taken. The House also has a Fiscal Calendar, on which the chair of the House Ways and Means Committee or House Taxes Committee can pull for consideration any tax or finance bill that has a second reading. The bills are debated, amended, and passed in one day.

In the Senate, bills approved by the “committee of the whole” are placed on the Calendar. At this point, the bill has its *third reading*, after which time the bill cannot be amended unless the entire body agrees to it. Toward the end of the session, the Senate Committee on Rules and Administration designates bills from the General Orders calendar to receive priority consideration. These Special Order bills are debated, amended, and passed in one day.

A bill needs 68 votes to pass the House and 34 votes to pass the Senate. If the House and the Senate each pass the same version of the bill, it goes to the governor for a signature.

### **Step 9 - Conference**

If the House and Senate versions of the bill are different, they go to a conference committee. In the House, the speaker appoints three or five representatives, and in the Senate, the Subcommittee on Committees of the committee on Rules and Administration selects the same number of senators to form the committee. The committee meets to discuss the differences in the two bills and to reach a compromise.

### **Step 10 - Floor**

The conference committee’s compromise bill then goes back to the House and the Senate for another vote. If both bodies pass the bill in this form, it is sent to the governor for his or her approval or disapproval. (If one or both bodies reject the report, it goes back to the conference committee for further consideration.)

### **Step 11 - Governor**

The Governor may sign a bill into law, veto it within three days; or allow it to become law by not signing it. During session, the House and Senate can override a governor’s veto. This requires a two-thirds vote in the House (90 votes) and Senate (45 votes).

The majority of all new laws go into effect on the first day in August following a legislative session unless a bill specifies another date. The exceptions are bills that contain an appropriation. They become effective the first day of July which begins a new fiscal year.

*Source: Minnesota State Government Series 6, State Law Process, How a Bill Becomes Law; Minnesota House of Representatives Public Information Services*

## **Appendix 8.      Discussion of NTHP Policies as Trustee**



*Email correspondence between Greg Coble of the NTHP and Darryl Daniels of Jacobsen/Daniel Associates – May 2008*

**From:** Greg Coble  
**Sent:** Thursday May 1, 2008 4:44 PM  
**To:** Darryl Daniels  
**CC:** Royce Yeater  
**Subject:** Stillwater Lift Bridge Endowment

Hello Darryl-

First, let me say that the National Trust staff would be interested in holding these endowment funds for the Stillwater Lift Bridge. We have discussed this with National Trust President Richard Moe and he is very supportive of doing this, given our long term commitment to saving and preserving the bridge. We plan to discuss this with the Finance Committee of our Board of Trustees in two weeks when they meet in Denver. After that, I can get you the model of an agreement, but not knowing exactly how these funds would come to us, I'm not sure we have an appropriate model. In the case of Congressional Cemetery, which is a similar situation to the Stillwater Bridge, the National Trust received a direct federal appropriation to create an endowment for the maintenance of the cemetery. It sounds like in this situation, the federal money may go to Mn/DOT and they would then work to transmit the funds to the National Trust. In any case, I have outlined below the basic parameters from the National Trust's perspective:

- The National Trust would have to own the funds in perpetuity.
- We would act only as a fiscal agent and have no management responsibilities for the bridge or the expenditure responsibility (unless we were indemnified by the state).
- The National Trust's role would be restricted to managing the bridge endowment funds comingled with other National Trust endowment funds.
- The endowment fund would be restricted solely to the use of the Stillwater Bridge. The fund would be charged (on an allocated basis) endowment management and custodian fees like all funds within our endowment; this is normally below 1% of value but can fluctuate up or down, but not by much. Funds would be withdrawn annually in line with our spending policy and would be transmitted for maintenance to the local Stillwater Bridge management entity. Our annual spending policy is currently 5% of average of the value of the endowment for the previous three years. For a new endowment such as this, our policy provides for a withdrawal in the first year equal to 5% of the beginning value of the endowment. For the second year, it is 5% of the average of the previous two years values. Etc.
- We would also be interested in addressing a worst case event that the Stillwater Bridge is destroyed by some type of disaster. We would want to have an expressed understanding of the use of the funds in such a worst case situation. Our possible interest might be for the funds to be targeted to other preservation needs, possibly even for the preservation of historic bridges in Minnesota and Wisconsin.

It is also worth noting that the National Trust currently owns and manages a \$230M endowment. As a result, we have achieved a significant degree of investment diversification that is difficult for smaller endowments to achieve. Over the past 25 years, our investment returns have averaged 13.6% annually.

Darryl, please let me know if you have any questions or other issues at this time. I will be in contact with you after I discuss this with our Board of Trustees Finance Committee.

-Greg

*Greg Coble, Vice President, Business & Finance, National Trust for Historic Preservation, 1785 Massachusetts Avenue, N.W., Washington, D.C.*



**Appendix 9. Minnesota Community Foundation – Summary of Services**





**MINNESOTA COMMUNITY FOUNDATION**

What's your vision?

THE SAINT PAUL FOUNDATION



# Establishing Family Foundations

## Two Alternatives

### Is A Family Foundation For You?

Because of your personal success, you are in a unique position to benefit those people and organizations you care most about. As you develop your financial and estate plans, you may discover that charitable giving will benefit you both personally and financially. A traditional mechanism for philanthropy and charitable giving has been the private family foundation. While this structure is still available, there is another interesting alternative you can consider. Minnesota Community Foundation and The Saint Paul Foundation have prepared this comparison to help you decide which structure is right for you.

### Donor Advised Funds

You can structure a foundation for your family as a Donor Advised Fund. Through an agreement with either foundation, your contribution will be set up in a specially named fund. The fund will be managed and administered by Minnesota Community Foundation/The Saint Paul Foundation. You will be able to choose fund advisors and advise the Foundation about preferences regarding grant recipients and gift amounts. Distributions will be made in the fund's name and you will receive quarterly financial statements. As the fund is considered part of Minnesota Community Foundation/The Saint Paul Foundation's holdings, it will receive all related tax-exempt benefits.

### Private Foundations

Private foundations allow extensive donor control over distributions and board selection. However, they are highly controlled by the government with many special restrictions, including administrative and reporting burdens, public access to information, excise taxes and a required minimum payout.

### Minnesota Community Foundation/The Saint Paul Foundation

Minnesota Community Foundation and The Saint Paul Foundation are community foundations. Each foundation is a public charity that administers and manages charitable funds—including family foundations—on behalf of private donors, families and nonprofit organizations. Together they manage assets of more than \$570 million. We would welcome the opportunity to work with you as you consider establishing a family foundation.

*For more information about establishing a family foundation, contact:*

**Minnesota Community Foundation/The Saint Paul Foundation**, 55 Fifth Street East – Suite 600, Saint Paul, Minnesota 55101-1797

Telephone: 651.224.5463 or 800.875.6167 • Fax: 651.224.9502 • [www.mncommunityfoundation.org](http://www.mncommunityfoundation.org) • [www.saintpaulfoundation.org](http://www.saintpaulfoundation.org)

As described in this chart, Donor Advised Funds are managed and administered by  
Minnesota Community Foundation / The Saint Paul Foundation.

Comparisons	Donor Advised Fund	Private Foundation
Creating the Foundation	Established at Minnesota Community Foundation/ The Saint Paul Foundation	Nonprofit corporation or trust organized as a private foundation
Tax-exempt Status	Shares the public charity tax exempt status of Minnesota Community Foundation/The Saint Paul Foundation	Must apply for private foundation tax exempt status from the IRS
Start-up Costs	No cost to donor	Similar to corporate start-up requiring substantial legal, accounting and operational start-up costs
Recommended Size	\$10,000 or more	Substantial assets required
Charitable Deductions • Cash Gifts	Tax deduction available up to 50% of adjusted gross income in any one year	Tax deduction is limited to 30% of adjusted gross income in any one year
Charitable Deductions • Appreciated Property	Tax deduction available for full fair market value Deduction available up to 30% of adjusted gross income in any one year	Tax deduction available for full fair market value Applies only to publicly traded stocks Other appreciated assets receive deductions limited to cost basis The deduction is limited to 20% of adjusted gross income in any one year
Donor Control	Donor recommends grants; IRS requires that final decisions rest with Minnesota Community Foundation/The Saint Paul Foundation	Donor retains complete control over investments and grantmaking, subject to IRS requirements
Self-dealing Rules	Private foundation self-dealing rules do not apply	Strict regulations prohibit most transactions between a private foundation and its donors (including related persons or corporations)
Payout Requirements	Do not apply	Annually must distribute for charitable purposes at least 5% of its asset value regardless of its income
Administrative Concerns • Personnel, facility, gift and grant management	Services provided by Minnesota Community Foundation/ The Saint Paul Foundation	Must establish and/or obtain these services
Annual Costs	Minimal	Administration can be costly
Annual Taxes	None	Generally income is tax exempt but subject to excise tax of up to 2% of net investment gain including net capital gains
Annual Tax Filings and Returns	Not required (reported as part of Minnesota Community Foundation/ The Saint Paul Foundation's annual reporting)	Must be filed by the private foundation with required supporting schedules
Investments	Fund assets are professionally invested through Minnesota Community Foundation/The Saint Paul Foundation as part of more than \$570 million in endowment funds	Must research and secure its own investment vehicles
Fiduciary Responsibility	Minnesota Community Foundation/The Saint Paul Foundation fulfills the associated fiduciary responsibilities	The private foundation board has full fiduciary responsibility
Liability and Risk Insurance	Provided by Minnesota Community Foundation/ The Saint Paul Foundation up to \$10 million	Must be purchased by the private foundation

**Appendix 10. Minnesota Community Foundation – Sample Agreement Form**



## Sample Agreement

### AGREEMENT ESTABLISHING THE \_\_\_\_\_ FUND UNDER THE PLAN FOR MINNESOTA COMMUNITY FOUNDATION

THIS AGREEMENT is made this day of \_\_\_\_\_, 20\_\_ , by and between (the Donor) and Minnesota Community Foundation, a Minnesota nonprofit corporation (the Foundation). The Donor hereby creates a charitable fund to be known as the Fund (the Fund) which will be administered by the Foundation upon the following terms:

1. **PURPOSE**            The purpose of the Fund is to make grants to (*name of charitable organization*).
2. **CONTRIBUTIONS**        The Fund will include all property contributed by the Donor or by others and accepted by the Foundation for inclusion in the Fund. All contributions to the Fund are irrevocable.
3. **ADMINISTRATION**       Minnesota Community Foundation will administer the Fund in accordance with this Agreement and the provisions of the Plan for Minnesota Community Foundation that is on file in the office of the Clerk of District Court of Ramsey County, Minnesota, and any future amendments thereof, all of which provisions and amendments are hereby incorporated by reference. The Plan authorizes Minnesota Community Foundation's Board of Directors to modify any restriction or condition of this Agreement if, in the sole judgment of the Board of Directors, such restriction or condition becomes unnecessary, incapable of fulfillment, or inconsistent with the charitable needs of the community. Minnesota Community Foundation has ultimate authority and control over the Fund and all distributions from the Fund.
4. **DISTRIBUTIONS**        The Foundation will distribute to (*name of charitable organization*), in furtherance of its charitable purposes, such amounts of the Fund's net income or principal or both as determined by the spending policy adopted by the Foundation and amended from time to time, at such times as the Foundation deems appropriate.
5. **FEES AND EXPENSES**       The Foundation will be paid an administrative fee from the Fund in accordance with the policies adopted by the Foundation and amended from time to time. In addition, the fund will pay its share of investment and other expenses related to the Fund.
6. **COMMINGLING OF ASSETS**       The Foundation may commingle the assets of the Fund with the assets of any other fund or funds which the Foundation holds and administers, provided that the separate identity of the Fund, and the distributions therefrom, are at all times maintained.

IN WITNESS WHEREOF, the parties have executed this Agreement as of the date written above.

*(Donor)*

MINNESOTA COMMUNITY FOUNDATION

By \_\_\_\_\_

Its \_\_\_\_\_

*Source: Minnesota Community Foundation*

*DRAFT AGREEMENT*

*DESIGNATED FUND, GENERAL SUPPORT*

*C:\Documents and Settings\maw\Desktop\Designated Fund, General Support.Minnesota.doc 01/26/04*



## **Appendix 11. State Board of Investment – Duties and Powers**



## **The Minnesota State Board of Investment**

The duties and powers of the SBI are outlined in the state constitution and are summarized for this report.

*The state board shall:*

*(1) Act as trustees for each fund for which it invests or manages.*

*(2) Formulate policies and procedures deemed necessary and appropriate to carry out its functions. Procedures adopted by the board must allow fund beneficiaries and members of the public to become informed of proposed board actions.*

*(3) Employ investment advisors and consultants as it deems necessary.*

*(4) Maintain a record of its proceedings.*

*(5) As it deems necessary, establish advisory committees to assist the board in carrying out its duties.*

*(6) Establish a formula or formulas to measure management performance and return on investment. Public pension funds in the state shall utilize the formula or formulas developed by the state board.*

*(7) Employ, at its discretion, qualified private firms to invest and manage the assets of funds over which the state board has investment management responsibility.*

Source:

*Minnesota State Constitution*



**Minnesota Department of Transportation (Mn/DOT)**  
**Historic Bridge Management Plan**

**Bridge Number: 4654**

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**Appendices**

**Appendix J.      Relegated and Out-of-Scope Issues Related to Trail  
Conversion**



## **Relegated and Out-of-Scope Issues Related to Trail Conversion**

Items included here were considered during the collaboration of the Stillwater Lift Bridge Management Plan but were excluded from the plan because they were considered to be outside the scope of the plan or outside the boundaries of the project. The issues are identified here for future consideration.

### **Trail amenities (out of scope and out of boundary)**

In keeping with the Secretary of the Interior Standards (SOIS) for rehabilitation of cultural landscapes, other hardscape amenities such as bike racks, and trash receptacles will not be located on the bridge or concourse. The addition of these features would detract from the historic aspects of the Stillwater Lift Bridge, and pose a potential conflict with high-speed users (bicyclists, in-line skaters etc.). Rather, these amenities will be located just off of the bridge on the Wisconsin causeway or in Lowell Park.

Benches will not be installed on the deck or within the truss area due to potential conflict between pedestrians and high-speed users (bicycles, in-line skates, etc). However, the need for benches will be reassessed 2-3 years following conversion. At that time, if it is determined that benches are needed, their design and placement will be developed in accordance with the SOIS.

### **Accent lighting (out of scope)**

Accent lighting on the bridge was considered but not implemented due to concerns by the National Park Service that it would impact the features of the river that made it eligible for the National Wild and Scenic Rivers System.

### **Crosswalk off east end of bridge (out of boundary)**

It is recommended that a pedestrian crossing be created on the trail just off the east end of the bridge. Since this crosswalk would be outside the boundaries of the conversion project, the Stillwater Lift Bridge Management Plan may only make recommendations regarding the design of the crosswalk. It is recommended that the crossing be designed similar to those located on the bridge. As described in Section 6.4.1, the crossings will be 10 feet wide and delineated with painted stripes. Tactile strips will be installed at the base of the crossings as a detectable warning for visually impaired users.

### **Vehicle barrier (out of scope)**

The lack of energy absorbing traffic barriers on the bridge is a safety concern that has been given a great deal of consideration during the collaboration process. It is a general recommendation of AASHTO that such barriers be provided for movable bridges. Previous reports for the bridge noted the lack of barriers and discussed the challenges involved with incorporating such components into the facility. This feature was not incorporated into the 2005 rehabilitation project as Mn/DOT deemed construction of a barrier gate inappropriate due to a lack of traffic accidents at the bridge and concerns over impacts to the bridge's historic character.

The Mn/DOT Metro Traffic Unit prepared a crash list for the Stillwater Lift Bridge area for the years 1997 through 2007. They found there were zero crashes coded to this area, except for one fatal crash in 2006. This statistic falls below the threshold of two or more fatal crashes at one location in any three-year period. Based on this data, Mn/DOT has determined that new gated, permanent barriers on the bridge are not required.

**Historic Bridge Interpretation Program (out of scope)**

The *Amended Section 106 Memorandum of Agreement for the St. Croix River Crossing Project* includes provisions for the preparation, publication, and distribution of an interpretive book and field guide on the Stillwater Lift Bridge. It does not outline the scope of a broader interpretation program. A comprehensive program for interpretation of the historic bridge that may include interpretive signage on the bridge and concourse should be prepared before any specific interpretation measures are undertaken.

**Interpretive Signage (out of scope)**

No interpretive signage will be developed as part of conversion project. Rather, it will be developed through another mitigation item with Mn/DOT and the National Park Service.

**Flood and Retaining Wall Project (out of boundary)**

The U.S. Army Corps of Engineers (USACE), in partnership with the City of Stillwater, is developing plans for Stage 3 of the Stillwater Flood and Retaining Wall Project. Stage 3 involves the construction of a low floodwall/levee along the western side of Lowell Park, in the area immediately adjacent to the bridge and the concourse. Stages 1 and 2 were completed in 1997 and 2002, and involved areas away from the bridge. A draft engineering documentation report was completed in May 2008 and the first construction contracts could be awarded in spring 2009. The figure on the next page shows the proposed flood wall (item 7) and its relationship to the concourse and bridge. Because the wall will be aligned around the west side of the concourse and will not cross Chestnut Street, it is outside the scope of the Stillwater Lift Bridge Project.





Location of the proposed flood (item 7) wall in relation to the concourse and bridge (source: *Engineering Documentation Report, St. Croix River at Stillwater, Minnesota, Flood and Retaining Wall Project, Stage 3, SEH*)



**Minnesota Department of Transportation (Mn/DOT)**  
**Historic Bridge Management Plan**

**Bridge Number: 4654**

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**Appendices**

**Appendix K. List of Skilled Riveters**



## List of Skilled Riveters

Firm Name	Contact Person and Information	Location of Work & Projects Worked On
JAG	Timothy Jagielski 4391 E. Territorial Road Camden, MI 49232 Home: (517) 270-3275 Cell: (517) 270 3275 <a href="mailto:hjag@frontiernet.net">hjag@frontiernet.net</a>	Has riveting experience in the US, Canada, and South America on ships, the Panama Canal gates, steel mills, bridges, and more.
The Makers of Hand Forged Iron	Doug Lockhart 14 Gallagher Street Logan, OH 43138 Business: (740) 385-7192 Cell: (740) 603 6535 <a href="mailto:doug@themakersofhandforgediron.com">doug@themakersofhandforgediron.com</a>	<b><u>Ohio</u></b> Zoarville Station Bridge (1868), a modified Fink through truss.
Bach Ornamental & Structural Steel	Nels Raynor 4140 Keller Road Holt, MI Phone: (517) 694-4311 <a href="mailto:nraynor350@aol.com">nraynor350@aol.com</a>	<b><u>Michigan</u></b> Kent Street Bridge (1907), a 224-foot-long Parker through truss.  Charlotte Highway Bridge (1886), a double-intersection, Pratt (Whipple) truss.  Has rivet removal experience on a conventional steel bridge.
Village Blacksmith	Ross Brown 4881S Fitzwilliam Rd. Bringhust, IN 46913 Phone: (765) 202-0149	<b><u>Indiana</u></b> Vallonia Bridge (1887), a wrought iron, two-span, double-intersection, Pratt through-truss.  Washington Co. Bridge #120 (1876), a King wrought-iron, arch-beam bowstring.  Daniels Ford Bridge (1901), a steel, pin-connected Pratt pony-truss span.
John T. Camden Construction Co.	4167E County Route 350S Pierceton, IN 46562 Phone (574) 594-2497	<b><u>Indiana</u></b> Has performed restoration and rivet work on historic bridges in Indiana for 10 years, including Pony Truss, Thru Truss, Bowstring, and Bedstead types.



# MINNESOTA HISTORIC PROPERTY RECORD

## PART I. PROPERTY IDENTIFICATION AND GENERAL INFORMATION

**Common Name:** Stillwater Lift Bridge  
**Bridge Number:** 4654  
**Identification Number:** WA-SWC-322  
**Location:**  
Feature Carried: TH 36  
Feature Crossed: St. Croix River, City Street  
Descriptive Location: at Wisconsin State Line  
Town, Range, Section: 30N-20W-28  
Town or City: Stillwater  
County: Washington

### UTM:

Zone: 15  
Easting: 4989254  
Northing: 515529

### Quad:

Stillwater  
7.5 Minute Series  
1983

### Present Owner:

State

### Present Use:

Mainline

### Significance Statement:

The Stillwater Lift Bridge is significant under Criterion C: Engineering as a rare surviving example of vertical-lift highway bridge construction of the Waddell and Harrington type. Only six vertical-lift highway bridges were built in Minnesota and Wisconsin prior to World War II, and the Stillwater Bridge is one of three that still survives and features counterweighted, cable-and-tower design. The bridge was declared eligible for listing in the National Register in 1987.

The significance of the Stillwater Bridge is best evaluated within the general context of Minnesota and Wisconsin movable highway bridges. Movable bridges, also known as drawbridges, are constructed over navigable waterways when it is impractical or uneconomical to build fixed bridges of sufficient height to permit the passage of vessels. Human ingenuity has devised numerous systems for lifting, dropping, folding, rotating, and retracting a span to provide temporary clearance. By the early twentieth century, however, American engineers had focused their attention on three, basic, drawbridge categories: swing, bascule, and vertical lift.

Briefly defined, a swing span revolves in a horizontal plane around a vertical axis, a bascule span rotates in a vertical plane around a horizontal axis, and a vertical-lift span rises and descends in a vertical plane. A total of 108 movable highway bridges existed in Minnesota and Wisconsin in 1935, with Wisconsin claiming more than six times the share of its neighbor. Wisconsin's greater dependence on movable bridges was a function of both its canal system along the industrialized Fox water-way and its numerous navigable rivers in major port cities (Green Bay, Manitowoc, Milwaukee, Racine, Sheboygan). In contrast, commercial navigation in Minnesota was largely restricted to the Mississippi River, where elevated bluffs obviated the need for movable spans.

Virtually all nineteenth-century movable bridges were of the swing-span variety and were constructed into the early twentieth century. As late as 1935, a total of 51 highway swing spans were in operation in the Minnesota and Wisconsin. Not one of these structures survives. The demise of the highway swing span was nationwide, reflecting its growing incompatibility with an urban setting. There were two basic problems. First, the central pivot pier increasingly became an obstruction to navigation for the ever-larger vessels of the late nineteenth and early twentieth centuries. Second, the swing span itself squandered valuable space. By requiring a clear turning radius, it prohibited the development of docking facilities adjacent to the bridge site. These shortcomings were especially onerous along highly industrialized urban waterways, where shipping channels tended to be narrow, highway crossings numerous, and real estate prices high. For less crowded sites, the swing span remained a viable form of technology well into the twentieth century. Most surviving swing spans are railroad bridges in rural regions or in relatively un-congested urban areas. But in the downtown waterfronts of late nineteenth-century American cities, the swing span was marked for extinction. Its major adversary was the federal government. No matter how loudly shipping and real-estate interests might denounce the swing span, there was no effective means of regulating movable-bridge design until the early 1890s when Congress authorized the War Department to approve plans for all new bridges over navigable waterways and to seek the alteration of any existing bridge that interfered with "reasonably free, easy and unobstructed" navigation. In 1892 the War Department sent a clear message of future policy by way of Chicago, demanding the removal of a two-year-old swing span from one crossing of the Chicago River and denying permission to build a new swing span at another. The search for an alternate drawbridge technology began in earnest. By 1895, municipal authorities spanned the Chicago River at South Halsted Street with the world's first, modern, vertical-lift bridge.

During the mid-nineteenth century, an occasional vertical-lift span was constructed in Europe and the United States. Although their engineering was often ingenious, the bridges themselves were quite modest, designed mainly for "canals and small navigable streams in cases where it was only necessary to lift the spans a few feet to clear traffic in the channels." The modern, long-span, high-rise vertical-lift bridge dates from the last decade of the nineteenth century. In 1892, the City of Duluth, Minnesota hosted a design competition for constructing a drawbridge over its harbor entrance on Lake Superior, which comprised a clear channel 250-feet in width. Under the rules of the competition, the successful design "would leave the entire width of the canal free to passing vessels," which effectively eliminated traditional, center-pier swing spans.

Most responses to the Duluth competition employed some form of "sliding draw" mechanism, whereby the span moved back and forth on rollers. A striking exception was a design submitted, and later patented, by John Alexander Low Waddell (1854-1938), a consulting engineer based in Kansas City, Missouri, who, during the next forty years, would become "one of the best-known bridge engineers in the United States." Waddell proposed to build "a vertical lift bridge consisting of a simple truss span 260 feet long so constructed and supported as to allow being raised vertically to a height of 140 feet above the surface of the canal.

At each end of the movable span is a tower 170 ft. high, carrying at its top built steel pulleys about 15 ft. in diameter. Over these pulleys steel wire ropes, or chain cables, pass. One end of each



cable is attached to the end piers of the trusses, and the other end to counter-weights which exactly balance the dead weight of the span. The only work left for the operating machinery is to overcome the weight due to dirt, water, snow, etc. The power for operating the bridge is supplied by two electric motors placed at mid-span; the upward and downward motion being regulated by racks and pinions communicating with the power by means of steel shafting and spur and mitre wheels.

Although the Duluth authorities selected Waddell's design, the War Department vetoed the construction of any drawbridge at that site at that time. Waddell, however, had devised a seemingly practical solution to the drawbridge problem. His vertical-lift span did not obstruct navigation and dockage like a swing span, nor did it clutter up the shore approaches like a sliding-draw span. A few months after the cancellation of the Duluth project the City of Chicago commissioned Waddell to modify his original design for a 130-foot span capable of 150-foot clearance over the Chicago River at South Halsted Street. This structure was completed in 1894.

In 1907 Waddell formed a partnership with John Lyle Harrington (1868-1942), a skilled civil and mechanical engineer who was largely responsible for reworking Waddell's invention into "a rational, well-integrated design." In its essential form and dynamics the "Waddell and Harrington version" remained true to the original 1892 design: "A simple span equipped with machinery for operation, suspended at each end by wire ropes which pass over sheaves on towers and connect to counterweights about equal to the span weight." Before the partnership dissolved in 1914, Waddell and Harrington de-signed about 30 vertical-lift spans for highway and railroad crossings. After they parted company, both men continued to work in the field, and Harrington's new office -- Harrington Howard, and Ash --became particularly well known as was its successor, Ash, Howard, Needles and Tammen (today the firm is incorporated as HNTB).

Six vertical-lift highway bridges were constructed in Minnesota and Wisconsin before World War II. At least five were designed by Waddell and Harrington or successor firms. All were of the standard Waddell and Harrington type. The Stillwater Bridge was the last of this cohort to be completed. Its predecessor at the site was a timber pontoon, swing-bridge built in 1910. Owned and maintained by the City of Stillwater the bridge was taken over by the Minnesota Department of highways in 1925. By that time, the structure was "fast deteriorating so as to be a source of apprehension for the safety of "...the loads it is obliged to carry." When the bridge was closed to heavy traffic in 1928, the Minnesota Department of Highways prepared preliminary plans for its replacement.

These plans called for a series of fixed concrete-slab and steel-truss spans, which were to be designed by the Minnesota highway agency itself, and a single vertical-lift span, which was to be the responsibility of an engineering firm specializing in such work. In November 1929, a design contract for \$3,150 was awarded, on a competitive basis, to Ash, Howard, Needles & Tammen of Kansas City, Missouri. Construction on the bridge proper began the following summer, with the Minneapolis firm of Peppard and Fulton serving as general contractor and the American Bridge Company (Minneapolis and Gary plants) serving as fabricator. The project was completed in August 1931 for a total cost of \$460,174, shared on an approximately 50-50 basis by the states of Minnesota and Wisconsin.

At the time of the bridge's completion, the St. Croix River was only lightly used as a navigable waterway. Since most of the traffic was small craft, there was little occasion to operate the lift span. As the Minnesota Department of Highways noted in 1938, "for several years not a single request for its opening was received." Although the bridge was far more intensely involved in highway traffic, it was in the role of maintaining, rather than initiating, patterns of transportation, which, in fact, were already well established by the 1930s.

## **PART II. HISTORICAL INFORMATION**

### **Date of Construction:**

1930-31

### **Contractor and/or Designer (if known):**

Contractor: Peppard & Fulton – builder; American Bridge Company (Minneapolis & Gary Plant) – fabricator.

Designer: Minnesota Department of Highways (fixed span); Ash, Howard, Needles, and Tammen (vertical-left span) – engineer.

### **Historic Context:**

### **National Register Criterion:**

C

## PART III. DESCRIPTIVE INFORMATION

### Descriptive Information:

Connecting Stillwater, Minnesota, on the west with Houlton, Wisconsin, on the east, the Stillwater Bridge is a relatively unaltered 10-span, 2-lane highway crossing of the St. Croix River; it includes a counterweighted, tower-and-cable, vertical-lift span of the Waddell and Harrington type.

At the site of the Stillwater Bridge, the St. Croix River is approximately 1,800 feet wide. The bridge itself, however, spans only about 1,050 feet. The remaining distance is covered by an earthen causeway, which was built out from the Wisconsin shore to reduce the grade difference between the opposing banks, as well as to lower the fabrication costs of the bridge. Resting on reinforced-concrete piers and abutments, the bridge superstructure displays, from east to west, the following sequence of spans: 1 concrete-slab approach span, 5 fixed steel trusses, 1 vertical-lift span, 1 fixed steel truss, and 2 concrete-slab approach spans.

The six fixed truss spans are of similar size and configuration. Measuring approximately 140 feet in length, each is a 7-panel, riveted, through Parker truss with angle-iron portal, top-lateral, and sway bracing. The webs are further stiffened by horizontal, angle-iron bracing across the four center panels. Except for the top chord --which consists of heavy paired channels tied with cover plate above and X-lacing below --the web members are built of paired, back-to-back angles tied with batten plates (as in the bottom chord and diagonals) or V-lacing (as in the verticals).

The vertical-lift span is also a 140-foot, 7-panel, Parker Through Truss. In its method of operation, the span embodies a design originally developed by J. A. L. Waddell in 1892, and subsequently refined in partnership with John Lyle Harrington. The general type is customarily known as a "Waddell and Harrington vertical lift." The span is raised and lowered by steel cables passing over sheaths at the top of steel towers mounted on the span's piers. To ensure easy movement, the span is counterweighted by concrete blocks that travel up and down within the tower framework. Originally, the motive force was supplied by a gasoline engine, which was replaced by a 25-horsepower electric motor in 1980. The control machinery is sheltered in a welded, plate-steel, gable-roofed "operator's house" mounted at roadway level on a steel framework at mid-span on the north (upstream) side. Reduction gears and winding drums for the cables are located beneath the house. With the span in raised position, vertical navigational clearance is 57 feet above normal pool elevation. The span itself is engineered for a rise of 48 feet, although an additional 3 feet of lift are available for emergency situations.

Measuring 23 feet in width, the bridge's concrete deck is bordered on the north by an angle-iron railing and on the south by a concrete sidewalk with an ornamental metal railing. The sidewalk is cantilevered on metal brackets. Although ornamental street lights have been removed from their newel posts along the sidewalk, a few of the original lighting fixtures remain on the concrete railings at the westernmost, concrete-slab, approach span. The concrete deck was rebuilt in 1973, as was the east-shore, concrete-slab, approach span in 1979. None of these alterations has significantly affected the bridge's integrity. The vertical-lift span remains in operation during the May-October navigation season. The bridge is undergoing substantial rehabilitation in 2005, including removal of the original operator's house and replacement with a new house.

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## **PART V. PROJECT INFORMATION**

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### **C. Historic context: Historic Iron and Steel Bridges in Minnesota, 1873-1945**

NOTE: The original text of this context is included in "Iron and Steel Bridges in Minnesota," National Register of Historic Places, Multiple Property Documentation Form, prepared by Fredric L. Quivik and Dale L. Martin, 1988, available in the Minnesota State Historic Preservation Office.

#### ***Historic Iron and Steel Bridges in Minnesota, 1873-1945***

Since its statehood in 1858, Minnesota has been reliant on bridges to maintain the effective transportation system needed to conduct commerce. The earliest bridges in the state were primarily wooden structures, but in the last quarter of the 19th century, iron and steel, materials which became available in large quantities as the United States industrialized, assumed the major role in carrying Minnesota's highways and railroads over rivers, streams, and other barriers. Iron was more common until the 1890s, when steel emerged as the preferred material. Although steel began to give way to reinforced concrete after 1910, it nevertheless, continued to play an important part in bridge building up to the present. This historic context will focus on iron and steel bridges in Minnesota from the time when the oldest surviving iron bridge in the state was built until the end of World War II, when the economy of the state and the nation moved into a new era.

Before European-American fur traders arrived in Minnesota in the early 19th century, the region's transportation network consisted of the trails and water routes of the Indians. The U.S. government established a fort (now Fort Snelling) at the confluence of the Minnesota and Mississippi rivers in 1819, and nearby Mendota soon became a major fur-trading center. Improved trails led from there to the rich fur-trapping areas of the Red River Valley and beyond. Serving the rugged Red River carts, these roads, which were little more than cleared swathes through the landscape, relied on convenient fords for stream crossings. When Minnesota became a Territory in 1849, there were few, if any, permanent bridges within its borders. The territorial legislature immediately authorized boards of county commissioners to maintain roads, license ferries, set toll rates, and build bridges. This coincided with the beginning of rapid settlement of Minnesota. In 1850, Minnesota had a population of 6,077; ten years later, the population was 172,023; and by 1870, the state had grown to 439,706 residents. Most of these people lived in rural areas and needed good roads and bridges to get supplies and to move their produce to market.<sup>1</sup>

#### ***Agriculture and Rural Settlement***

From small beginnings in the 1840s, agriculture became the state's major economic activity within two decades. The first farmers produced food for their own subsistence and sold some vegetables and grain in nearby settlements. By the end of the 1850s, cash crops had assumed the dominant position. In 1859 farmers in Minnesota grew over two million bushels each of three crops: corn, wheat, and oats. Wheat output increased much faster than that of the other two—between 1860 and 1870, it multiplied almost ninefold. Until after the Civil War most agriculture was located in the southern one-third of the state. In the decade after the war, many settlers moved into the Red River Valley, initiating the "bonanza" period, known for its large farms and extensive use of machinery. The predominance of grain growing in the state resulted in related industrial developments, primarily flour milling and the manufacture of agricultural implements in the Twin Cities. While wheat, corn, and oats remained the major crops through the early 20th century, farmers also diversified. They also produced other grains, such as barley and rye, as well as potatoes, orchard fruit, livestock, hay, and dairy goods. Agriculture was a vital economic activity throughout the southern, central, and northwestern sections of the state.<sup>2</sup>

## *Railroads*

Railroads were essential for creating the existing patterns of settlement and economic development. Their efficient, inexpensive transportation made possible the growth of communities and the establishment of full-scale agriculture, mining, and manufacturing.

The railroad system in Minnesota began as routes connecting towns on the Mississippi River with inland points and other rivers. Although many companies were incorporated or received state charters in the late 1850s, no construction occurred until early in the next decade. With a federal land grant to help pay for a line connecting the heads of navigation on the Mississippi and Red rivers, the St. Paul & Pacific completed a track between St. Paul and St. Anthony in 1862. After construction of a bridge across the Mississippi five years later, it reached Minneapolis. The company fulfilled its mandated goal by reaching Breckenridge in 1871. After changes of ownership and name (St. Paul, Minneapolis & Manitoba Railway, in 1879 and Great Northern Railway, in 1890), it grew to become a transcontinental line. Other lines begun in the 1860s also eventually became parts of major railway systems. Small companies with tracks originating at the Mississippi River towns of Minneapolis, St. Paul, Hastings, Winona, and La Crescent built southwest and west, creating routes later absorbed by the Chicago, St. Paul, Minneapolis & Omaha Railway; Chicago, Milwaukee & St. Paul Railway; and the Chicago & Northwestern Railway. The Minnesota Central Railway, (soon to be part of the Milwaukee system) built a line south from the Twin Cities, providing a link in the first rail route between Minnesota and the important rail center of Chicago, completed in 1867. The first of the four lines connecting Minneapolis/St. Paul and the head of Lake Superior was completed in 1870.<sup>1</sup>

The 1870s included a half-decade of economic depression followed by over a decade of renewed expansion of rail networks. In 1870 the Northern Pacific RR began construction of a route intended to connect Lake Superior and Puget Sound. It completed tracks west from Duluth into northern Dakota Territory before the Panic of 1873 ended work and brought bankruptcy. Almost all other companies temporarily halted building projects at that time and some also suffered financial ruin. Improvement of the economy in the late 1870s saw the resumption of construction and the emergence of new enterprises. By the turn of the century, almost all the main lines—including projects such as the Chicago Great Western to the south of the Twin Cities and the Minneapolis, St. Paul & Sault Ste. Marie (Soo) to the west—were in place. Railroads continued to add secondary and branch lines into the early twentieth century. As a result, southern, central, and northwestern Minnesota—the main agricultural areas of the state—had dense networks of rail lines.<sup>2</sup>

Most of Minnesota's railroads had extensive tracks and facilities in Minneapolis and St. Paul. Along with Omaha and Kansas City, the Twin Cities were one of the busiest rail centers on or near the eastern edge of the Great Plains. Several companies had their headquarters in large buildings in the Twin Cities. Almost all had switchyards, transfer and industrial tracks, locomotive terminals, freight depots, and shares in union passenger stations. Three major rail routes connected the two city centers. One company—the Minnesota Transfer Railway., based in the "Midway district" of western St. Paul—existed mainly to handle freight traffic between the trunk lines, serving industrial customers as a secondary function.<sup>3</sup>

In addition to building rail lines and support facilities in Minnesota, railways encouraged town settlement and economic development. Rail transportation made the land accessible for large-scale agricultural, industrial and urban growth. Distinct departments and subsidiaries of railroads—such as townsites companies and farm extension services—sought to create new traffic by bringing farmers, merchants,

and manufacturers to places along their tracks. In this way, railways helped create the need for new road bridges. The market and banking centers along rail lines depended on networks of rural roads in the surrounding countryside. In the early twentieth century, railways supported the "Good Roads" movement, as they believed it would bring more traffic to their stations and freight yards. Railroads also brought the iron and steel from suppliers and fabricators in industrial centers to the areas of bridge construction.<sup>4</sup>

Although railroads built numerous bridges in Minnesota, almost all are beyond the scope of this project, which deals only with spans which carry, or cross, public roads. Nevertheless, railways had a significant influence on the evolution of vehicular bridge construction in Minnesota. Many of the important bridge designers and builders in the state came to the area as railroad employees, in which capacity they gained their initial experience. Railways also erected some vehicular bridges, such as those over rail lines in cities (Great Northern erected L-8899, 6992, and 92353 over its tracks in Minneapolis).

The decline of the railroads began just after the end of World War I. The popularity and availability of motor vehicles resulted in diminishing local rail passenger and freight business in the 1920s. In the following decades, railways cut services and dismantled tracks. Through the rest of the twentieth century increasingly effective competition continued to cause railway abandonment, while technological changes enabled companies to carry the surviving traffic with fewer tracks and facilities. However, the legacy of the railroads is still apparent in the locations of towns and the facilities which serve economic activities such as grain farming and iron mining.

### *Urban Development*

Urban growth in Minnesota began in the 1840s with the establishment of settlements along the Mississippi and lower St. Croix Rivers. At the time of the creation of Minnesota Territory in 1849, the selection of St. Paul as the capital indicated and influenced its urban potential. Nearby, the industrial village of St. Anthony developed as a potential rival. Until the extensive building of railroads in the late 1860s, settlement followed rivers—the Mississippi, Minnesota, and St. Croix—and the shore of Lake Superior. Even after construction of the railways enabled large numbers of settlers to create inland communities, such as Albert Lea, Willmar, and Crookston, this early pattern persisted. Of the ten largest cities in Minnesota at the turn of the century, six were located along the Mississippi, and one each on the Minnesota River, the St. Croix, and Lake Superior. Since the 1850s, the state's most prominent urban center remained the twin cities of St. Paul and Minneapolis.<sup>5</sup>

Most bridges in cities and towns crossed natural barriers, primarily watercourses and ravines. Few, except in the Twin Cities, crossed human-made features, such as railroad tracks. Some towns were located on both sides of a river. Examples range in size from Minneapolis to Cannon Falls in Goodhue County, on the Cannon River. Bridges were obviously important to these communities. The first large bridge in Minnesota, as well as the first permanent span over the Mississippi River, was the suspension bridge, completed in 1855, which linked Minneapolis and St. Anthony. Other bridges replaced and supplemented this early span, making possible the municipal consolidation of the latter into the former in 1872 and the continued growth of Minneapolis through the following century. Most communities along rivers were situated on only one shore. In these cases, bridges served to link them to the rural districts and smaller settlements on the other side. This removed natural obstacles for the rural residents and increased the area over which the merchants and bankers in the larger towns could extend their business.<sup>6</sup>

Beyond the two general scenarios mentioned above, other types of relations between towns and bridges occurred. An example is represented by events at Zumbro Falls in Wabasha County. The first settlement grew in the 1860s on the south bank of the Zumbro River at a ferry landing. In 1878, with the arrival in the area of the first railroad, a new town called Zumbro Falls was platted on the north side of the river and a little to the east. The first bridge, made of pontoons and beam spans, linked the ferry landings and hence was closer to the original community. The two wooden successors to the first span maintained the original alignment. The fourth bridge, constructed of iron in the late 1880s, aroused controversy. Residents of the newer town of Zumbro Falls felt its location should reflect the fact that the local center of population had moved eastward from the early ferry sites. They lost, however, and the iron bridge [No. L-1098] was erected at the same place as the earlier structures.<sup>7</sup>

Road bridges over railroad lines are common in larger cities such as Minneapolis, St. Paul, and Duluth. They can also be found in smaller communities with large rail switchyards. An example is bridge No. 7803 which carries a road over Duluth, Missabe & Iron Range's Proctor Yard in a rural portion of Hermantown. Grade crossings of railway tracks and roads have always been places of danger and inconvenience for both railroads and travelers on roads. They were hazardous spots for pedestrians and motorists, who often underestimated the speed of trains and overestimated their ability to stop quickly. Crossings in urban places caused additional problems, because the stopping and switching of trains on multiple tracks blocked streets for many minutes at a time. In most towns and smaller cities, grade crossings guarded by watchmen or, later, by electronic signals, offered more safety, even if not easing congestion. However, in large urban centers such as the Twin Cities extensive grade separation projects resulted in placing main line tracks either in excavated trenches or on elevated fills. The former occurred in both Minneapolis and St. Paul, resulting in the need for many bridges.<sup>8</sup>

One rail corridor in northern Minneapolis featured four street crossings within the same number of city blocks. After the 1870s, the Manitoba Road (Great Northern after 1890) and the Minneapolis & St. Louis Railway had parallel, adjacent lines running southwest-northeast through the north side of Minneapolis. The five tracks separated the downtown from the northwestern parts of the city, hindering the development of the latter. In the late 1880s, the city proposed that the two railways lower their tracks and build street bridges over the resulting trench. The Manitoba agreed by March 1888, but the M&StL opposed the change. The case reached the Minnesota Supreme Court, which decided in favor of the city. By the early 1890s, the city council had "granted" rights to GN to build specific bridges. The railway constructed four spans on First and Second Streets, Washington Avenue, and Third Street, and remained responsible for their future maintenance. The two which survive—Washington Avenue [No. 6992] and First Street [No. L-8899] —were altered in the early 1930s, when the GN strengthened the lower chords and lower panel intersections. They represent the legal and engineering problems created by road-railway crossings.<sup>9</sup>

#### *The First Minnesota Bridges and Their Builders*

Most of the bridges needed in rural Minnesota were relatively short of span. Some of the major rivers, especially the St. Croix, the Minnesota, and the Mississippi, required much larger structures. In the mid-19th century, small bridges were usually built by local contractors (often farmers acting as contractors) and were rather crude affairs, typically comprised of an unsophisticated superstructure supported by an unsound substructure. Rarely did these bridges last more than a few years, either collapsing under a heavy load or washing away in a spring flood. It was not uncommon that a nearby farmer would repair or



rebuild a bridge in lieu of paying his road taxes, and the result was usually as shaky as the original.<sup>10</sup> Nevertheless, rural residents had to make due with the situation until an improved system, in the form of contractors specializing in bridge construction, arrived on the scene in the 1860s and 1870s.

To bridge the major rivers, Minnesotans relied on individuals with some expertise in engineering and the construction of large structures. Moreover, such projects typically cost more than nascent local governments could afford. Thus private bridge companies emerged to build bridges, selling shares of stock to raise construction capital, and then charging tolls to cover operating expenses and shareholder dividends. During the three-year period ending in 1857, fifteen bridge companies were incorporated in Minnesota to build and operate at least as many large bridges. One of the most notable of these privately-owned spans was the Hennepin Avenue Suspension Bridge built by the Mississippi Bridge Company in 1854-55. The structure crossed the Mississippi River, linking the cities of Minneapolis and St. Anthony. Designed by Thomas M. Griffith, who had participated in the construction of a suspension bridge over Niagara Falls in 1850, the bridge featured a 640-foot span hung from wire cables supported by wooden towers.<sup>11</sup>

Other large Minnesota bridges of the 1850s crossed the St. Croix River at Taylor's Falls and the Mississippi River at St. Paul (at the site of the present Wabasha Bridge), St. Cloud, and Little Falls. By the end of 1858, there were a total of three bridges over the Mississippi in Minneapolis.<sup>12</sup> Joseph S. Sewell designed both the St. Paul bridge and the span at Taylor's Falls, the latter a 150-foot wooden arch structure. The St. Paul bridge, on the other hand, was a 1300-foot, nine-span Howe truss of wood and iron.<sup>13</sup> The Howe truss (described on page 7) was the most common structural type for long-span bridges in Minnesota prior to the introduction of all-iron bridges around 1870. With the exception of the suspension bridge in Minneapolis and the wooden arch structure at Taylor's Falls, the other major bridges built in Minnesota during the 1850s were probably Howe trusses as well.

As the need for larger bridges in Minnesota increased, so did the activity of out-of-state bridge builders. In 1856-1857, for example, Stone, Boomer, and Boyington of Chicago received \$50,000 for constructing the 1000-foot, multi-span, truss Lower Falls Bridge, located about one mile below the suspension bridge in Minneapolis.<sup>14</sup> This marked the beginning of a period during which local governments and private bridge companies awarded many, if not most, of the contracts for larger bridges to construction firms from other states. This trend was facilitated by the beginning of the railroad era in Minnesota in the 1860s, which soon brought about the possibility of direct and rapid transportation of manufactured materials from more industrialized centers in the east. This trend would not be reversed until the late 1880s when several Minnesota bridge builders established themselves and the state developed its own industrial capacity.

Although out-of-state companies captured much of the bridge building business in Minnesota during the period from the early 1860s to the end of the 1880s, there were several important Minnesota contractors as well. Silas Barnard of Mankato gained a sound reputation around 1870 for his numerous wood and iron Howe trusses in Blue Earth and the surrounding counties.<sup>15</sup> An even more important career was that of Horace E. Horton of Rochester. Horton built his first bridge, a wood arch span over the Zumbro River in Olmsted County, in 1867. He went on to build numerous smaller bridges throughout Minnesota and the neighboring states. He also built several of the larger bridges in Minnesota during the 1880s, before relocating and forming the Chicago Bridge and Iron Company in 1889.<sup>16</sup>

### *The Iron and Steel Bridge Era*

In the 1860s and 1870s, several national bridge building companies gained their reputations by adapting wrought iron to the task of comprising bridge superstructures. Their new bridge designs followed two trends of engineering and industrial development. The first involved the design and patenting of efficient and reliable trusses, primarily of wood, but also of wood and iron (the latter used for tension members). Several 19th century engineers developed trusses which were used in a variety of applications, usually experimental and limited. The three most important patents were the Howe truss (William Howe, 1840), which consisted of diagonal members in compression and vertical members in tension; the Pratt truss (Thomas and Caleb Pratt, 1844), comprised of vertical members in compression and diagonal members in tension; and the Warren truss (developed in the United States by Squire Whipple in 1849 without knowledge of James Warren's invention of the same truss in England the year before), which had diagonals in both tension and compression. In the 19th century, the Howe truss was the most commonly used wood truss; by the late 19th century, when iron and steel replaced wood for longer spans, the Pratt became the most widely used truss. In the 20th century, after the riveted connection replaced the pin-connection as standard practice, the Warren truss became more frequently used for steel bridges. The Warren's first wide use was for pony trusses; it later received extensive use for the longer spans, previously served by the Pratt through truss, as well.<sup>17</sup>

At about the same time as engineers were experimenting with various truss configurations, others were attempting to employ iron for bridges. Two types of iron, cast and wrought, were used in bridges. Cast iron contains more carbon than does steel and includes other impurities. As its name implies, it is usually cast into required shapes. Its brittleness makes it unsuitable for forging and rolling. The collapse of the Ashtabula Bridge in Ohio in 1876 ended the use of cast iron in bridges. Wrought iron is nearly pure, containing only a tiny amount of slag. It can be easily worked and is used for forging and blacksmith work. In the mid-19th century, mills rolled wrought iron, in the same manner as steel, to produce structural shapes such as I-beams, channels, angle sections, and plates. Wrought iron remained the principal bridge-building metal into the late 19th century. After the Civil War, the adoption of the Bessemer converter made possible the production of large amounts of steel at low cost. Bridge builders, however, used Bessemer steel in limited quantities. Large-scale open-hearth steel production beginning in the 1890s made steel the preferred material. Wrought iron disappeared from bridge work by the mid-1890s.<sup>18</sup>

Initially iron bridges were built entirely of cast iron, or they utilized cast iron for compression members and wrought iron for tension members. By the 1850s, most engineers recognized that the brittleness of cast iron made it unreliable even for compression members in bridge trusses. In that decade, rolled shapes of wrought iron, such as angle and channel sections and I-beams, became available on the American market. The Keystone Bridge Company of Pittsburgh was one of the first to use wrought iron for all members of its bridge trusses. The Phoenix Iron Company of Phoenixville, Pennsylvania, developed a tubular girder of wrought iron shapes which was excellent in compression, shear, and bending. In the 1860s, several engineers, such as Zenas King of Cleveland, Ohio, and David Hammond of the Wrought Iron Bridge Company of Canton, Ohio, developed tubular arch, or bowstring arch, truss bridges, all generally derived from the masonry arch. King's tubular arch was rectangular in section, while Hammond employed the Phoenix tubular girder, which was circular in section. Bowstring arch bridges suffered from a number of technical problems, however, and by the end of the 1870s their use had largely ended.<sup>19</sup> By

the 1880s, the wrought iron, pin-connected Pratt through truss had become the standard structural type for long-span bridges in Minnesota.

The influence of out-of-state bridge builders became especially pronounced with the introduction of iron bridges to Minnesota around 1870. Zenas King of Cleveland, Ohio, built one of the first iron bridges in the state (one newspaper account stated that "this is evidently not the first one of its kind in Minnesota") over the Rum River at Anoka in 1870. Both 100-foot spans were patented King's Tubular Arches and rested on stone abutments and a stone pier. The bridge cost \$14,000, of which \$7,000 came from an appropriation by the Minnesota legislature.<sup>20</sup> Although this bridge was only one-fifth the length of the wooden Howe truss Lower Falls Bridge in Minneapolis, it cost more than one-fourth as much. This higher cost for an iron bridge was typical, but builders argued that the greater first cost was justifiable in the long run due to the superior strength and durability of an iron bridge.<sup>21</sup> Although several other iron bridges attracted notice in Twin Cities newspapers, such as spans over the Cannon River at Northfield in 1872 and Cannon Falls in 1874, the wood-and-iron Howe truss remained the most widely used structural type through the 1870s. For example, in 1873, the City of Minneapolis built a wood-and-iron, 1560-foot, multi-span, Howe truss bridge over the Mississippi at Eighth Avenue North.<sup>22</sup>

Blue Earth County played an especially notable role in bringing iron bridges to Minnesota. The county experienced its first great surge of settlement during the 1860s, with the population growing from 4,803 in 1860 to 17,302 ten years later. The arrival of the railroad in 1868 helped to spur this growth.<sup>23</sup> Because of the numerous rivers and their tributaries, which flow through the county towards the Minnesota River at Mankato, the county and its townships required an especially large number of bridges to carry people and goods to and from market and railroad centers. Embarking on a program to build high quality, permanent bridges in the late 1860s, the county first turned to iron in 1872. In response to a request for bids to build a bridge over the LeSueur River in Decoria Township, four out-of-state contractors submitted plans and costs for their respective iron bridges. Silas Barnard (already noted as the local contractor for substantial Howe truss bridges) submitted a bid for a wooden Howe truss. Three of the five commissioners were appointed as a committee to examine the suitability of iron bridges and to award the contract if they approved of the new material. They selected the proposal of the Wrought Iron Bridge Company of Canton, Ohio, whose bid in this case was even lower than that of Barnard.<sup>24</sup>

The following February, 1873, the Minneapolis Tribune reported that "the Commissioners of Blue Earth County are going to re-bridge the county. The entire system has been declared a fraud and the necessity of doing work all over decided upon."<sup>25</sup> From that point until the end of the century, every bridge built by the county (townships still had the responsibility of building smaller bridges) except two wood bridges (1875 and 1881) were built of iron or steel.<sup>26</sup> The county built the first bridge in this campaign in 1873 over the LeSueur River in South Bend Township near the John Kerns farm. Once again, the Wrought Iron Bridge Company was low bidder, at \$6000, and received the contract for the superstructure.<sup>27</sup> The Kerns Bridge [No. L-5669], which still stands at its original location, is a 190-foot, single-span, wrought iron, bowstring arch truss. It is the oldest surviving bridge (with good integrity) in Minnesota.<sup>28</sup> Although the Wrought Iron Bridge Company also bid on the next Blue Earth County bridge, constructed over the Watonwan River in Garden City Township in 1874, the King Iron Bridge and Manufacturing Company (as Zenas King called his firm after 1871) of Cleveland submitted a lower bid and received the contract.<sup>29</sup>

The commissioners awarded subsequent contracts for iron bridges in the 1870s to such contractors as the Keystone Bridge Company of Pittsburgh, Soulerin, James and Company of Milwaukee, Horace E. Horton, as well as to the Wrought Iron Bridge Company.<sup>30</sup> The 1875 bridge erected by Soulerin, James and Company over the Blue Earth River at Vernon Center now stands in a park in LeSueur County [No. 4846]. Leon Soulerin and Garth W. James established a bridge-building firm in Milwaukee in 1870. Two years later, the firm was known as the Milwaukee Bridge & Iron Works, although it evidently still bid on projects, such as the Blue Earth County job, under the name of Soulerin, James and Company. By 1877, both men had left the Milwaukee Bridge & Iron Company.<sup>31</sup> The 1875 bridge which Soulerin, James and Company built at Vernon Center is the oldest surviving Pratt truss bridge in Minnesota.

### *Early Bridge Builders*

Although Horace E. Horton became a major bridge builder in the 1880s, out-of-state companies apparently continued to dominate the bridge construction market in Minnesota through that decade.<sup>32</sup> Surviving wrought iron bridges from the 1880s include the 1888 Hennepin Avenue Bridge [No. 90589] over the Mississippi River in Minneapolis, built by Horton and the Wrought Iron Bridge Company;<sup>33</sup> the 1890 Wabasha Street Bridge [No. 6524] over the Mississippi in St. Paul,<sup>34</sup> and the 1889 Zumbro River Bridge [No. L-1098] at Zumbro Falls,<sup>35</sup> both built by Horton; the Merriam Street Bridge [No. 27664, formerly part of the 1887 Broadway Avenue Bridge] in Minneapolis built by the King Bridge Co.; the 1885 Hannover Bridge [No. 92366] over the Crow River between Hennepin and Wright counties built by the Morse Bridge Company of Youngstown, Ohio; and the 1883 Kennedy Bridge [No. L-5665] over the LeSueur River in Blue Earth County,<sup>36</sup> and the 1888 Marshall Avenue/Lake Street Bridge [No. 6520] over the Mississippi River between St. Paul and Minneapolis,<sup>37</sup> both built by the Wrought Iron Bridge Co. The out-of-state bridge contractors, however, provided valuable experience to their agents who were resident in Minnesota, and several of these men would, in the 1890s, establish their own bridge-contracting firms. Although out-of-state companies would continue to play an important role in bridge construction into the 20th century, Minnesota-based builders soon dominated the market.

Seth M. Hewett and Commodore P. Jones were two of the early Minnesota bridge builders to establish their own firms. Hewett and Jones assume added importance because, unlike Horton, who moved to Chicago, they played out their careers in Minnesota. Moreover, they provided early employment for several of the state's more prolific or significant bridge builders. Jones began his career as a bridge builder in Minneapolis around 1880. Little else is known of his background. Hewett had been in the lumber trade in Iowa in the 1870s, building a few bridges to supplement his business, before moving to Minneapolis in about 1882. By linking the lumber business with contracting, he was typical of many bridge builders of the period. For a brief time, 1883-1884, the two men formed a bridge contracting partnership called Jones and Hewett. Agent for the firm was Alexander Y. Bayne, an individual who would be important in Minnesota bridge building over the next four decades. After the partnership dissolved, Jones and Hewett each continued long carriers erecting bridges in Minnesota and throughout the region as far west as Montana.<sup>38</sup> No bridges survive in Minnesota from the Jones and Hewett partnership.

After leaving the partnership, Hewett became an agent for the Smith Bridge Company of Toledo, Ohio, and he formed the Minnesota Stone Company to build stone bridges and stone foundations for wood or iron bridges. In 1887, Hewett left the Minnesota Stone Company and started his own S.M. Hewett and Co. Two nephews from his hometown of Hope, Maine, William S. Hewett and Arthur L. Hewett, came to Minneapolis to work for the elder Hewett. William formed his own W.S. Hewett and Co. in 1897, with his

cousin Arthur joining him as agent. Perhaps in response, Seth Hewett changed the name of his company to the Hewett Bridge Company, which continued building bridges through the first decade of the 20th century.<sup>39</sup> Two of S.M. Hewett's truss bridges are known to survive, the 1893 Albright Mill Bridge [No. 90684] in Middleville Township<sup>40</sup> and the 1893 North Fork Bridge [No. L-8123] in Marysville Township,<sup>41</sup> both over the North Fork of the Crow River in Wright County. Also still standing is the Kingston Township Bridge [No. 90980] over the North Fork of the Crow River in Meeker County, built by the Hewett Bridge Company in 1899.<sup>42</sup>

Jones started his own Jones Bridge Company after leaving the partnership with Hewett. Bayne stayed with him as agent and Milo A. Adams, another bridge builder of late 19th and early 20th century importance, was his foreman. In 1887, Jones became involved in the Minnesota Stone Company and formed his own Minneapolis Bridge Company. In subsequent years, Jones would be an agent for the Milwaukee Bridge and Iron Company and form yet another firm, the Minneapolis Bridge and Iron Company.<sup>43</sup> Four bridges of the Minneapolis Bridge and Iron Company are known to survive in Minnesota: the Medelia Township Bridge [No. 6527] over the Watonwan River and the Long Lake Township Bridge [No. L-8044] over the South Fork of the Watonwan River, both built in 1908 in Watonwan County, and the 1903 Ulen Bridge [No. L-8344] over the South Branch of the Wild Rice River, and the 1908 Highland Grove Bridge [No. L-8367] over the Buffalo River, both in Clay County.<sup>44</sup> In 1911, Jones and Seth Hewett reunited in a firm called the Great Northern Bridge Company.<sup>45</sup> At least four bridges erected by this company are known to survive: the 1912 Clearwater River [No. L-0817] in Red Lake County, and the 1911 Otter Tail River Bridge [No. 198], the 1917 Red River Bridge [No. 90021], and the 1922 Red River Bridge [No. 3609], all in Wilkin County.<sup>46</sup>

Apparently, Bayne and Adams were among the more prolific bridge builders in Minnesota, both on their own behalf and on behalf of the companies for which they worked.<sup>47</sup> Adams had moved to Minneapolis to work on construction of James J. Hill's Stone Arch Bridge over the Mississippi River. After working with Jones, he became the traveling agent for the King Bridge Company, serving Minnesota as well as a region as far west as Montana. Around the turn of the 20th century, as the King Bridge Company became less active in Minnesota, Adams formed his own M.A. Adams Bridge Company, which he headed (with a minor name change to the M.A. Adams Company in 1914) until his death in 1922.<sup>48</sup> More than ten of Adams bridges are known to survive in Minnesota, the oldest of which is the 1904 Upper Plum Creek Bridge [No. L-6913] in North Hero Township of Redwood County<sup>49</sup> and the longest of which are the 1915 Cannon River Bridge [No. 1324] in rural Red Wing and the 1916 North Branch Bridge [No. 2129] on the outskirts of Mazeppa in Wabasha County.<sup>50</sup> Another important M.A. Adams bridge is the 1910 Cottonwood River Bridge [No. L-6881] in Redwood, an early example of a riveted Warren through truss, built during the period when the pin-connected Pratt through truss was the preferred truss type for comparable spans (120 feet).<sup>51</sup>

Following his tenure as agent for C.P. Jones, A.Y. Bayne briefly went into business for himself before becoming manager of the new bridge department of the Gillette-Herzog Manufacturing Company in 1890. He stayed with that company for ten years until it merged with 23 other companies from around the United States to form the giant American Bridge Company. Bayne served as manager of the contracting department of the American Bridge Company's Gillette-Herzog branch for about three years before establishing his own firm, A.Y. Bayne and Company, in 1903.<sup>52</sup> Bayne's surviving Minnesota bridges include the 1906 Bear Creek Bridge [No. L-4885], the 1909 Deer Creek Bridge [No. 7970] and others in

Fillmore County; the 1909 3rd Street North Bridge [No. L-5391] over the Cannon River in Cannon Falls, and the 1904 Walcott Township Bridge [No. L-2733] over the Straight River in Rice County.<sup>53</sup> In 1914, Bayne formed a new Minneapolis Bridge Company (neither of C.P. Jones earlier companies with a similar name existed by this time)<sup>54</sup> surviving bridges of which include the 1920 Iberia Bridge [No. 3279] over the Cottonwood River in Brown County,<sup>55</sup> the 1914 Bear Creek Bridge [No. L-4883] in Fillmore County,<sup>56</sup> and the 1931 Wabasha Bridge [No. 4588] over the Mississippi River.<sup>57</sup>

In 1908, Bayne and William S. Hewett formed a brief partnership. Only one of their joint projects is known to survive, the Minnesota Soldiers Home Bridge over Minnehaha Creek in Minneapolis [No. 5756]. A three-hinged steel arch with braced spandrels, the bridge was designed and erected by Bayne and Hewett with steel fabricated by Minneapolis Steel and Machinery. Hewett was probably the design engineer for the project, because in other phases of their careers, he engaged in a variety of design efforts, while Bayne was known strictly for his construction superintendence.

William S. Hewett and Company had prospered since he left his uncle's company in 1897, securing bridge construction contracts throughout Minnesota and a several-state region. In 1906, William and his cousin, Arthur Hewett, re-organized to form the Security Bridge Company, headquartered in Minneapolis. During this period, William turned much of his attention away from bridge contracting and toward a number of engineering design efforts, such as the Soldiers Home Bridge. Another important job was his 1905 design for the strengthening of the Marshall/Lake Bridge [No. 6520] over the Mississippi River between Minneapolis and St. Paul. Hewett was also important for his contributions to the development of improved technologies for the use of concrete. Since the 1890s, he had participated in several experimental reinforced concrete bridge projects (employing the Melan-type concrete arch). He patented a pre-cast concrete culvert which, could be assembled in sections, called the Security Culvert. Perhaps William Hewett's most noteworthy innovation was a means of using pre-stressed concrete for the construction of large concrete water tanks, for which he is credited as one of the originators of pre-stressed concrete technology.<sup>59</sup>

Several William S. Hewett and Company bridges survive, including the 1904 Seaforth Bridge [No. L-6930] over the Redwood River in Redwood County; and the 1897 pin-connected Pratt pony truss span which was moved to the Zumbro Bottoms Bridge [No. L-1130] over the Zumbro River to serve as an approach span, and the 1906 Elgin Township Bridge [No. L-1170] over the North Fork of the Whitewater River, both in Wabasha County.<sup>60</sup> With William devoting less attention to bridge contracting, Arthur Hewett became president of the Security Bridge Company and moved its headquarters to Billings, Montana in 1911. Nevertheless, the Security Bridge Company was quite active building bridges in Minnesota prior to that time. Three Security bridges known to survive in Minnesota are the 1907 Cottonwood Street Bridge [No. 246] over the Cottonwood River in New Ulm, the 1907 Phelps Mill Bridge [No. L-0885] over the Otter Tail River at Phelps Mill, and the 1910 Miller Creek Bridge [No. 2128] in Wabasha County.<sup>61</sup>

One other important Minneapolis-based bridge builder was Lawrence H. Johnson. Born in Germany, he moved to Minneapolis in 1883 to work for C.P. Jones old Minneapolis Bridge Company, after which he served as an agent for the Milwaukee Bridge and Iron Company, the Wrought Iron Bridge Company, and the Wisconsin Bridge and Iron Company. In 1905, Johnson formed the Hennepin Bridge Company, which was active in a region extending from Wisconsin to Montana. From 1901 to 1909, he also served in the Minnesota legislature, and he was the speaker of the house in 1907.<sup>62</sup> The only bridge surviving in

Minnesota that Johnson is known to have built is the 1903 Delhi Bridge [No. 89850] over the Minnesota River between Redwood and Renville counties. He built the bridge two years before forming the Hennepin Bridge Company.<sup>63</sup>

In addition to the Minneapolis-based bridge builders, whose markets extended beyond Minnesota's borders, there were other contractors who were locally important. For example, the Fargo Bridge and Iron Works of Fargo, North Dakota, built several bridges for local governments in northwestern Minnesota. Established in about 1905 by Francis E. Dibley, with Elmer H. Stranahan as his agent, the Fargo Bridge and Iron Works was able to win some bids in northwestern Minnesota, no doubt because of its geographical proximity relative to Minneapolis. A surviving Fargo Bridge and Iron Works bridge is the 1907 Kragnes Bridge [No. 90818] over the Buffalo River in Clay County, which is across the Red River from Fargo.<sup>64</sup>

### *Bridge Engineers*

William S. Hewett was important as a bridge builder and as a bridge engineer. Bridge engineers had continued to play a major role in the design of Minnesota bridges through the end of the 19th century, but it was not until 1905-1911, with the creation of the Minnesota Highway Commission, that engineers were involved in virtually every bridge construction project. Prior to that time, only the largest bridges and the largest local governments enjoyed the services of professional engineers. Because they were the two largest cities in the state and both spanned the Mississippi River, Minneapolis and St. Paul were among the first to hire engineers as city employees. These engineers designed a wide assortment of smaller bridges for creek and railroad crossings as well as the giant -structures which carried traffic over the Mississippi. The works of Thomas Griffith and Joseph Sewell, two consulting engineers, have already been described. City engineers also completed important designs in the Twin Cities.

Leonard W. Rundlett was the city engineer for St. Paul for a lengthy period around the turn of the 20th century. Born in Maine in 1846 and educated at Bowdoin College, he came to St. Paul in the early 1870s to work as a surveyor for the St. Paul and Pacific Railroad. In 1874 he became assistant city engineer and soon thereafter the city engineer for St. Paul. Rundlett remained in office until 1911 and died in 1916.<sup>65</sup> The City Bridge Engineer in Rundlett's office was Andreas W. Munster, who held that position from 1884 to 1906.<sup>66</sup> The office was responsible for conventional bridge designs, like the 1900 Raymond Avenue Bridge [No. 90402] over the Great Northern tracks, as well as bridges which demonstrated significant expertise in structural engineering. Rundlett's office designed two such bridges in the late 1880s which still stand, the Selby Avenue Bridge [No. 62501] over the tracks of the Milwaukee Road and the Wabasha Street Bridge [No. 6524] over the Mississippi River. The Selby Avenue Bridge is notable because of its extreme skew relative to the tracks, the consequent offset of the middle piers, and the manner in which Rundlett designed the truss spans to accommodate those conditions. The Wabasha Street Bridge is an important cantilever structure, comparable to other large, late 19th-century cantilever bridges built over the Mississippi at downstream locations in Minnesota and Iowa.<sup>67</sup>

In Minneapolis, the city engineer for many years was Andrew Rinker, whose career milestones closely paralleled Rundlett's. Born in Philadelphia in 1849, Rinker moved to Minneapolis in 1871. There he practiced civil engineering and surveying with George Cooley until becoming city engineer in 1877. Except for a brief stint in private practice between 1895 and 1903 (working as an engineer and officer of

the Great Falls Water Power and Townsite Company in Montana), Rinker worked for Minneapolis until becoming the engineer for the Twin Cities Rapid Transit Company in 1916, two years before his death.<sup>68</sup> Two bridges known to be designed by Rinker's office survive, the Hennepin Avenue Bridge [No. 90589] over the Mississippi River and the Merriam Street Bridge [No. 27664], which is comprised of one span of the former Broadway Bridge [No. 2722] over the Mississippi. The Hennepin Avenue Bridge, built between 1887 and 1891, is an important, two-span, steel arch deck bridge with unbraced spandrel vertical members.<sup>69</sup> The Merriam Street Bridge is the last remaining, 19th-century, Pratt through truss span from a vehicular bridge over the Mississippi River in the Twin Cities. Although several Twin Cities bridges had other configurations, such as the steel-arch Hennepin Avenue Bridge or the cantilever deck-truss Wabasha Street Bridge, the multi-span Pratt through truss was often used to span the Mississippi until the advent of reinforced concrete arch construction in the early 20th century.<sup>70</sup> An important innovator of reinforced-concrete arch bridge design was Frederick Cappelen, who served as assistant to Rinker and as city engineer during Rinker's absence and following his retirement. Cappelen participated in the design of the Hennepin Avenue Bridge.<sup>71</sup>

At least one major vehicular bridge over the Mississippi in the Twin Cities, the Marshall Avenue/Lake Street Bridge, was not designed by either of the city engineers' offices, but rather by a private consulting engineer, Joseph Sewell. Located along the border between Ramsey and Hennepin counties, the bridge was jointly financed by the two counties which granted ownership of the bridge to their respective cities shortly after the Wrought Iron Bridge Company had completed construction.<sup>72</sup> Sewell, whose contributions as an engineer to early Minnesota bridge construction have already been noted, was followed later in the century by several other consulting engineers who specialized in bridge design, such as the firm of Loweth and Wolff. Charles F. Loweth began working as a bridge engineer in St. Paul and as an agent for bridge companies in the early 1880s. He was a foreman for H.E. Horton in the late 1880s and briefly joined Horton in Chicago to work for the Chicago Bridge and Iron Works. In 1901, Loweth joined with Louis P. Wolff to form an engineering firm which designed both highway and railroad bridges. Prior to joining Loweth, Wolff had been the Red Wing city engineer and had worked with Loweth in designing the bridge over the Mississippi at Red Wing. Loweth and Wolff targeted local governments as a market for their engineering services by offering to assist local governments in designing bridges which complied with early Minnesota Highway Commission specifications (see discussion below).<sup>73</sup>

Since the establishment of the State Highway Commission, professional engineers, both as government employees and in private practice, have continued to play an important role in the design and construction supervision of bridges which safely and effectively meet Minnesota's ever-changing needs.

### *Suppliers and Fabricators*

The erection of iron and steel bridges was preceded by two distinct manufacturing processes—the reduction and rolling of the metal, and its fabrication into pieces appropriate for bridge assembly.

Bridge iron came from foundries and rolling mills. After reduction of the combined iron ore, coke, and limestone (flux) in blast furnaces, the resulting pig iron could be remelted and poured into molds to create cast iron shapes. To make wrought iron, puddlers stirred the molten pig iron to remove impurities. The product could then go to a forge shop or rolling mill.



Steel began like iron, with ore, fuel, and flux in blast furnaces at integrated steel mills. The resulting pig iron became steel in open-hearth furnaces. Then rolling mills produced I-beams, channel and angle sections, plates, bars, and other structural pieces. The steel used in bridges recorded in this survey came from throughout the main steel-producing belt of the nation: Pennsylvania and the states next to the Great Lakes. I-beams and channel sections marked "ILLINOIS" (made at South Chicago) and "CARNEGIE" (rolled in Pittsburgh) was most commonly observed. The United States Steel Corporation absorbed both of these companies and their mills in 1901. Less frequently seen were products of Cambria (Johnstown, Pennsylvania), Inland (East Chicago), and Jones & Laughlin (Pittsburgh). Bridges often included steel from two or more mills. Bridge No. 77--in rural northwestern Olmsted County; built in 1911--has structural components from the Carnegie, Cambria, and Eastern steel companies (the last in Pottstown, Pennsylvania). Although Minnesota had at various times two steel mills--in Duluth and Minneapolis--and Superior, Wisconsin had one, no products from these were observed.<sup>74</sup>

Fabricators bought standard lengths and sizes of rolled steel products and fashioned them into bridge parts. Their plants were large industrial complexes including several distinct functions. After receiving an order for a bridge, clerical staff arranged contractual and shipping details while the engineering department prepared detailed plans, lists, and instructions for fabrication and erection. The template shop made or used already existing wood patterns, which guided the workers in the riveting shop, who cut, punched, and bored the steel. They also did as much assembly as was possible, riveting together chord members, struts, and other built-up sections which would be transported to the bridge site for completion. For pin-connected bridges, two other departments were also important. The machine shop turned the pins, as well as doing other planing and finishing. The forge shop produced eye-bars and other items requiring foundry and blacksmith work. Additional features of a fabrication plant included a power plant, offices, and storage.<sup>75</sup>

Companies which fabricated bridges also prepared and built other large features. Their facilities for and experience in engineering and preparation of steel made it logical that they also did business concerning other metal-framed structures. Companies which listed themselves as bridge fabricators also advertised water towers, tanks, steel-framed buildings for industrial and commercial functions, power plants, roof trusses, and mine headframes.<sup>76</sup>

Of the bridges in this survey with known fabricators (25 out of 94 total), most were prepared outside of Minnesota. Like the mills which rolled the steel, almost all fabricators noted in this project were located in the Great Lakes region and Pennsylvania. Those known to have fabricated two or more bridges in this survey include the American Bridge Company (main plant at Ambridge, Pennsylvania; one of its secondary plants in Minneapolis), Central States Bridge Company (Indianapolis), Keystone Bridge Company (Pittsburgh), King Bridge Company (Cleveland), and Wrought Iron Bridge Company (Canton, Ohio). All of these, except for the Keystone Bridge Company, also served as the contractor for their bridges.

Some bridge fabrication occurred in Minneapolis and St. Paul. Along with flour milling, lumber manufacturing, printing, and railroad equipment repair, companies in the related fields of structural and ornamental iron and machine and foundry work were among the largest industrial employers in the Twin Cities. Of the two, Minneapolis had more companies and employees doing this work. For example, in

1905, seven firms there engaging in structural and ornamental iron work had 854 employees, compared to four companies in St. Paul with 459 workers.<sup>77</sup>

At least three Twin Cities companies did their own bridge fabrication. One of the largest concerns was the Gillette-Herzog Manufacturing Company. It had a large plant in Minneapolis at Seventh Avenue and Second Street Southeast. Gillette-Herzog fabricated structural steel for industrial buildings and structures throughout a region ranging from Michigan to the Gulf of Mexico to the Pacific coast. In 1900-1901, just before its absorption into U.S. Steel's American Bridge Company, it employed, at three different times during the year, 480, 310, and 270 people. Of all the iron, foundry, and machine work firms in the Twin Cities at this time, only the Minneapolis Threshing Machine Company had more employees. Gillette-Herzog also erected many of the bridges for which it fabricated steel. The most elaborate of the surviving Gillette-Herzog steel trusses is the 1899 Forestville Bridge [No. 6263] in Fillmore County. A pin-connected Pratt through truss span, it has ornate iron cresting along the top edges of the portal bracing.<sup>78</sup>

After the American Bridge Company took over the Gillette-Herzog plant, the Gillette family started a new business, the Minneapolis Steel and Machinery Company, in which bridge fabrication and construction played a major role. By 1903, the Minneapolis Steel & Machinery Company had a plant along Hiawatha Avenue between East 28th and Lake Streets which covered about two and one-half blocks. The largest building was the structural (riveting) shop, about 250 by 125 feet in dimension. Other major buildings housed the machinery shop, foundry, blacksmith shop, pattern (template) shop, pattern storage, and other large storage areas. A 1908 source states the company had 1,200 employees. Among the products it advertised in 1909 were steel structural buildings, store fronts, stairs, water tanks and towers, bridges, and steel grain elevators. Like Gillette-Herzog, Minneapolis Steel and Machinery served a large regional market. The third firm in the Twin Cities was the St. Paul Foundry Company, which apparently did bridge fabrication only, not contracting. From its plant at Como Avenue and Mackubin Street, it also produced mill buildings, tanks and towers, and ornamental iron.<sup>79</sup>

It is possible that these fabricators prepared much of the steel for Minnesota bridge contractors who did construction only. Among these were Minneapolis-based builders such as M. A. Adams, A. Y. Bayne, and the several Hewett firms, as well as companies in such smaller cities as Red Wing and New Ulm, which bid on and won bridge contracts. The Minneapolis Steel and Machinery Company prepared the steel for bridges ranging in size from a 63-foot, riveted Warren pony truss [No. 12] built in 1908 in Goodhue County by Red Wing businessman William P. Glardon to the 622-foot steel deck arch Soldiers Home Bridge [No. 5756] erected over Minnehaha Creek in Minneapolis by Bayne & Hewett. Minneapolis Steel and Machinery apparently also played an important role in establishing high standards for steel bridges built in Minnesota just prior to the establishment of the Minnesota State Highway Commission, which created its own standards. In the early 20th century, many local governments, because they were trying to save money for construction costs, hired contractors to erect bridges of low quality. In the absence of state government specifications, Minneapolis Steel and Machinery promulgated a set of standard bridge specifications to local governments, developed especially for Minnesota traffic conditions (heavy steam traction engines placed the greatest stresses on Minnesota bridges at that time).<sup>80</sup>

### *Patterns of Bridge Builders' Business*

In researching the builders of bridges in the various areas of Minnesota, certain patterns seem to appear. For example, A.Y. Bayne apparently obtained an especially large number of the bridge contracts in Fillmore and Rice counties in the early 20th century and M.A. Adams usually was successful bidder in Lac Qui Parle and Redwood counties during that period.<sup>81</sup> This pattern may be due to a practice of "pooling," which was common in Minnesota and elsewhere during the late 19th century and perhaps the early 20th. H.E. Horton is known to have participated in pooling arrangements prior to his moving to Chicago. He and such companies as the King Iron Bridge and Manufacturing Company, the Wrought Iron Bridge Company, S.M. Hewett, and the Gillette-Herzog Manufacturing Company staked out territories. Whenever a bridge construction project was advertised, agents for each of the companies would meet near the site and discuss the cost of the project. If they could agree, they would permit the company in whose territory the bridge would be built to submit the low bid, allowing for a comfortable profit, and the others would submit higher bids. If they could not agree, then the bidding would be truly competitive. At the conclusion of the project, the successful bidder would disperse a portion of the profits to the other companies in the pool. This helped companies obtain revenue during lean years when there might not be much construction activity in their respective territories.<sup>82</sup> Although no known evidence indicates that the major Minneapolis-based bridge builders participated in such pooling arrangements, they had worked with one another at various stages of their careers and the geographical patterns suggest that such pools may well have existed.

The major Minneapolis-based bridge builders were apparently the most successful of the Minnesota contractors. Nevertheless, they certainly did not, as a group, build every bridge in the state during the various periods of their activity. Contractors from states to the south and east continued to bid on projects and were often successful in obtaining contracts. In the northwest part of the state, the Fargo Bridge and Iron Company of Fargo, North Dakota, was active (its only known surviving bridge is the 1907 Kragnes Bridge, No. 90818, over the Buffalo River in Clay County).<sup>83</sup> Moreover, contractors who do not appear to have made a career of bridge building occasionally were successful bidding on projects. For example, the Mayer Brothers of Mankato were the successful bidder on the 1904 Ziegler's Ford Bridge [No. L-5659] over the Big Cobb River in Blue Earth County.<sup>84</sup> The Mayer Brothers were an iron and steel fabricating firm who, as far back as the 1890s, manufactured earth-moving machinery, boilers, jails, and architectural iron work. They did not advertise themselves as bridge contractors or fabricators and are not known to have bid on other jobs.<sup>85</sup> In another instance, H. Hauser was the successful bidder on the Swede's Forest Bridge [No. 89851] over the Minnesota River between Redwood and Renville counties.<sup>86</sup> He owned the Hauser Lumber Company in nearby Fairfax. Like many lumbermen, he probably also engaged in a fair amount of contracting and likely had contact with a fabricator of steel bridges. He bid on several other projects in the area as well, but this is the only bridge he is known to have built.

### *The Era of State Control of Bridge Building*

Around the turn of the 20th century, despite the fact that many high quality bridges were erected, reformers pointed out that often local governments awarded contracts to the lowest bidder in the absence of sound technical advice. As a result, shoddy structures had been built and the state was plagued with collapsing bridges. Most bridge accidents in Minnesota were in the nature of steam traction engines overloading small wooden bridges, a problem due in part to the transition from animal power to the mechanized era. Bridge experts noted, however, that a significant number of bridges failed due to faulty design, poor workmanship, and inadequate construction supervision. Furthermore, most local

governments did not have the resources to hire trained and experienced bridge engineers. Elected officials often relied on the advice of traveling agents of the competing bridge building firms, many of whom were quite skilled at sounding technically informed, but actually lacked the engineering training or experience necessary to specify a bridge for a given location. Sometimes the county surveyor had training and experience in bridge design and construction, but there was no guarantee that the county commissioners would act on his advice.<sup>87</sup> As the Second Annual Report of the State Highway Commission of Minnesota editorialized in 1908: "A great defect in Minnesota's highway system is that bridges are contracted for without advice or assistance of a bridge engineer, and there is no supervision of construction. Reputable companies build only the best, but if a county insists on light and cheap, they can find someone to build it."<sup>88</sup>

The Minnesota legislature moved to correct the situation in stages. In 1905, the legislature created the Minnesota State Highway Commission (SHC), called for the appointment of a State Engineer, and appropriated \$5,000 for the salary of the engineer and other costs of the commission. The SHC hired George Cooley (Andrew Rinker's former partner) as its first engineer. As an incentive to local governments, the legislature offered state aid for bridges which met specifications established by the State Engineer. To do so, the local government could either submit its own plans or ask the State Engineer for assistance. Meeting state standards usually resulted in a higher cost bridge, but local governments which participated in the program did not complain, and, in fact, advocated that the MHC offer expanded services.<sup>89</sup>

An example of the way this early process worked can be seen in the history of construction of the Bullard Creed Bridge [No. 12]. The Goodhue County commissioners requested bids for a small bridge in Hay Creek Township. Seven bridge builders responded in January, 1908, each with its own plans (and one, the Security Bridge Company, with three plans), some of which were for concrete and some of which were for a steel bridge. In May, Louis Wolff of Loweth and Wolff met with the commissioners to explain to them the advantages of building a bridge designed to meet state specifications. The commissioners agreed to pay Wolff a fee of \$100 for such a design and the project was re-bid. In June, 1908, seven contractors, different from the earlier group, submitted bids for bridges meeting state standards which were somewhat higher in cost, and the contract was awarded to William P. Glardon, who owned a draying business and a wood and coal dealership in Red Wing.<sup>90</sup>

Based on early demand for assistance from the State Highway Commission, the legislature increased the annual appropriation to \$8,700 in 1909. Convinced of the benefit of expert supervision of bridge construction, the 1911 legislature amended original State Highway Commission law to require that assistants to the State Engineer must supervise all state-aided bridge construction. The commission was given an annual budget of \$150,000 and employment was increased to 45 staff engineers. In 1913, the law was again amended to specify that the SHC must participate in projects which cost over \$500. Local governments were supposed to submit plans and specifications for such bridges to the SHC for inspection, or the local governments could request that the SHC provide such documents for a proposed bridge. SHC engineers would also inspect the bridge during the course of construction and at completion. During 1912, for example, the Bridge Department of the SHC furnished plans for 214 steel and concrete bridges, provided miscellaneous assistance for a total of 410 bridges, and completed final inspections of 148 bridges. By the end of 1913, the SHC had prepared 84 sets of standard plans for bridges ranging in span from 10 to 190 feet.<sup>91</sup>

Thus, 1911, marked the end of the era of bridge builders supplying bridge designs. Although each local government still had the option of hiring its own bridge engineer, either in a full time staff position or as a consultant for a construction project with special conditions, design for bridges exceeding \$500 in cost had to meet SHC specifications and be inspected by SHC engineers. Although some local governments, especially the larger ones, hired their own engineers, most counties and towns looked increasingly to the SHC for guidance. Consequently, after 1911 bridges in Minnesota assumed much greater similarity, lacking the subtle differences in portal bracing or means of connecting floor beams to superstructure which characterized the bridges of the various builders in the previous era, especially the 19th century.

## EPILOG

The adoption of standardized plans coincided with the rise of reinforced concrete as a major structural material. Standardized plans reduced the variety of metal truss designs. Increased use of reinforced concrete reduced the frequency with which metal truss were built. As bridge engineers became more familiar with the new material, they increasingly specified reinforced- concrete slab-and-girder construction for crossing that otherwise would have been spanned with a pony truss. Designers also came to recognize the advantages of reinforced concrete for longer spans as well, especially in the arch configuration over deep gorges. Although metal truss bridges continued to play a major in Minnesota during the 1920s and 1930s, they would never regain the dominant position they had enjoyed during the period 1880-1910, when they epitomized safe, economical, and durable highway engineering.

By 1930, reinforced concrete had become the dominant material in Minnesota bridge engineering, although its hegemony over short-span structures was challenged by the emergence of a new type of metal construction. In 1931, the Armco Culvert Manufacturers' Association introduced a galvanized, corrugated-iron product known as "Multi-Plate."<sup>92</sup> Corrugated iron had been used in culverts since 1896. Although highway engineers initially questioned the materials durability, subsequent field inspections generally agreed with a 1924 Minnesota study that "corrugated pure iron pipe is superior in every detail and much more economical than either cast iron pipe or reinforced concrete pipe for small waterways."<sup>93</sup> Despite such glowing accounts, corrugated metal culverts had one distinct drawback: they were shipped in prefabricated sections that were difficult to handle in the field.

This problem was alleviated by Armco Multi Plate, which was manufactured in "circular segments that are assembled in the field by bolting the plates together instead of being shop-fabricated complete."<sup>94</sup> The built-up design permitted the construction of larger spans with thicker gauge, and since the individual segments could be shipped in a "nested" position (something which is impossible for a complete, cylindrical culvert), they were cheaper to transport than prefabricated culvert. Although Multi Plate's chief application was backfilled pipe culverts, Armco also aggressively marketed a low-cost bridge design using Multi-Plate arches for spans up to about 25 feet. To prevent undermining and shifting of the structure, the arch was generally anchored to concrete abutments with concrete or stone headwalls.<sup>95</sup>

When stone was used in the headwalls, the Multi Plate structure took on the appearance of a stone-arch bridge, which strongly appealed to New Deal sensibilities concerning roadside beautification, local craftsmanship, and labor-intensive public works projects. Armco shrewdly emphasized these points in its advertising: "Multi Plate Arches . . . Designed to fit any local conditions — can use local labor on Work Relief Projects. Use of stone end-walls not only makes attractive structure, but employs local material and labor."<sup>96</sup> In Minnesota, approximately 35 Multi Plate "stone-arch" bridges survive from the New Deal

period. The following are especially picturesque in their design: the two-arch bridge over Milliken Creek in Dodge County [No. 89096], the three-arch bridge over Turtle Creek in Todd County [No. L-7075], the two-arch bridge over a tributary of the Zumbro River near Zumbro Falls in Wabasha County [No. 3219], and the two-arch bridge over Mission Creek in Duluth [No. 5757].<sup>97</sup> After World War II, the Multi Plate arch was largely replaced by the Multi Plate arch pipe, a backfilled ovoid structure that requires neither abutments for headwalls.<sup>98</sup>

Since the period during which the bridges described in this context were built, traffic conditions have continued to change, resulting in related changes in standards for bridge construction. This fact, rather than decay or collapse--the leading causes of the disappearance of earlier wooden bridges from the landscape—is the major reason why so few iron and steel truss bridges survive to this day. Automobile and truck traffic is now much more dense and moves at higher speeds, resulting in a need for bridges which are wider than those built in the early 20th century. Consequently, bridges at many locations have been replaced in recent years by structures meeting current standards. Because the increase in traffic density has been greater in and near urban areas, a greater percentage of the surviving steel or iron truss bridges are found in relatively remote locations of rural Minnesota.

## Notes

1. For overviews of Minnesota's railroad history, see Henry A. Castle, Minnesota: Its Story and Biography 3 vol. (Chicago: Lewis Publishing Co., 1915), vol. 1, pp. 434-446; Blegen, Minnesota: A History of the State, pp. 295-304.
2. Ibid.
3. John M. Wickre, "Railroads," in Nicholas Westbrook (ed.), A Guide to the Industrial Archeology of the Twin Cities (St. Paul-Minneapolis: Society for Industrial Archeology, 1983), pp. 72-87; Steven Glischinski, "A Tale of Twin Cities," Trains, Oct. 1986, pp. 24-36.
4. For a map of railroad-platted townsites in one county (Blue Earth), see "The Blue Earth County Multiple Resource Area," (report in the files of the State Historic Preservation Office, Minnesota Historical Society; 1979).
5. Federal Writers' Project, Minnesota: A State Guide (New York: The Viking Press, 1938), pp. 48-63, discusses urban growth in its overview history. The ten largest cities in Minnesota at the turn of the century were, in order, Minneapolis, St. Paul, Duluth, Mankato, Winona, Stillwater, Faribault, Red Wing, Brainerd, and St. Cloud.
6. Scott F. Anfinson, "Archeological Potentials for the West Side of the Central Minneapolis Waterfront" (report for the Minnesota Historical Society, 1984), p. 76.
7. Franklyn Curtis-Wedge (ed.), History of Wabasha County, Minnesota (Winona: H. C. Cooper, Jr., & Co., 1920), pp. 113-114.
8. John R. Stilgoe, Metropolitan Corridor: Railroads and the American Scene (New Haven: Yale University Press, 1983), pp. 167-188, is a discussion of road-railroad crossings.
9. Minneapolis Tribune, 7 March 1888; "G.N.Ry . -C.St .P.M.&O.Ry . Joint Report, Short Line Bridges, July 2, 1931" [Great Northern Collection, Minn. Hist. Soc.: V. P. -Operating, box 21 F 14 6F], pp. 64-65, 196-197.
10. Arthur J. Larsen, The Development of the Minnesota Road System (St. Paul: Minnesota Historical Society, 1966), pp. 305-306.
11. Robert M. Frame III, "Historic Bridge Project," (unpublished report to the Minnesota State Historic Preservation Office, 1985), pp. 8-9.
12. Frame, "Historic Bridge Project," p. 9; Daily Minnesotan, May 15, November 23, 1857; Pioneer Democrat, May 11, 1858.
13. F.B. Maltby, "The Mississippi River Bridges: Historical and Descriptive Sketch of the Bridges over the Mississippi River," Journal of the Western Society of Engineers 8(August 1903): 434-436.

14. St. Anthony Express Weekly, July 5, 1856.
15. Mankato Weekly Record, January 8, 1870.
16. Horton's career in Minnesota is well described in Eli Woodruff Imberman, "The Formative Years of Chicago Bridge & Iron Company" (PhD dissertation, University of Chicago, 1973); for a description of Horton's first bridge, see p. 100.
17. Carl W. Condit, American Building: Materials and Techniques from the Beginnings of the Colonial Settlements to the Present (Chicago: University of Chicago Press, 1968), pp. 96, 100-101; J.A.L. Waddell, The Designing of Ordinary Iron Highway Bridges (New York: John Wiley & Sons, 1891), pp. iii-iv; J.A.L. Waddell, Bridge Engineering (John Wiley & Sons, Inc., 1916), pp. 20-21.
18. Waddell, Bridge Engineering, pp. 17, 28; Charles C. Schneider, "The Evolution of the Practice of American Bridge Building," Transactions of the American Society of Civil Engineers 54 (1905):218, 222.
19. Book of Designs of Wrought Iron Bridges Built by the Wrought Iron Bridge Company of Canton, Ohio (Canton: Hartzell & Saxton, Printers, 1874), pp. 8-9, 20-21; David A. Simmons, "The Risk of Innovation: Ohio Bridge Patents in the 19th Century," Proceedings of the First Historic Bridges Conference, (Columbus: Ohio Historical Society, 1985), pp. 118-119, 123; Waddell, Bridge Engineering p. 17.
20. Minneapolis Daily Tribune, March 5, 1869, January 1, 1871; St. Paul Daily Pioneer, December 29, 1870.
21. Book of Designs of Wrought Iron Bridges, p. 10.
22. St. Paul Daily Press, February 25, 1872; St. Paul Daily Dispatch, November 16, 1874; Minneapolis Tribune, January 1, 1873.
23. "The Blue Earth County Multiple Resource Area," p. 2.
24. Blue Earth County [Mankato], "Commissioners Record," Book A, p. 496.
25. Minneapolis Tribune, February 18, 1873.
26. Thomas Hughes, History of Blue Earth County (Chicago: Middle West Publishing Company, 1908), p. 307.
27. Blue Earth County, "Commissioners Record," Book A, p. 535.
28. This conclusion is based on Frame's "Historic Bridge Project." An earlier masonry arch bridge in Washington County (1872) has lost its integrity of design and materials. The oldest surviving bridge structure, which has lost its integrity of location and setting, is the Zumbrota Covered Bridge. Built in



1869 and recorded by the Historic American Buildings Survey shortly after its establishment in the 1930s, the Zumbrota Covered Bridge was moved to the fairgrounds at Zumbrota in 1932. In 1970, the bridge was again moved. It now sits in a specially-designated park next to the Zumbro River. The bridge does not span the river, however.

29. Blue Earth County, "Commissioners Record," Book A, p. 579.
30. Blue Earth County, "Commissioners Record," Book B, pp. 1, 3, 157, 160, 294, 295, 345.
31. Robert Newbery, "Metal Truss Highway Bridges in Wisconsin," unpublished draft, 1988, n.p., Wisconsin Department of Transportation.
32. This statement is based on research in a fairly small, but geographically dispersed, sample of local government records examined during the course of this project. A definitive, quantitative statement to this effect would only be possible after a thorough analysis of all local government records in the state.
33. Kenneth Broas, "Steel Arch Bridge, HAER No. MN-18," Historic American Engineering Record documentation, National Park Service, Denver, 1987.
34. "Erection of the Wabasha Street Bridge, St. Paul, Minn.," The Engineering News 25(December 26, 1891): 58-59.
35. Curtiss-Wedge, History of Wabasha County, Minnesota, p. 113-114; Imberman, "The Formative Years of Chicago Bridge and Iron Company," p.236.
36. Blue Earth County, "Commissioners Record," Book B, pp. 562, 573.
37. Alan Kramer, "Lake/Marshall Bridge, HAER No. MN-6," Historic American Engineering Record documentation, National Park Service, Denver, 1987.
38. Fredric L. Quivik, "Montana's Minneapolis Bridge Builders," IA: The Journal of the Society for Industrial Archeology, 10 (1984): 39.
39. Ibid, pp. 39, 45.
40. Wright County [Buffalo], "Commissioners Record," Book E, p. 95.
41. Wright County, "Commissioners Record," Book E, p. 96.
42. "MNDOT Supplemental Structure Inventory," form in MNDOT file for Br. No. 90980.
43. Quivik, "Minneapolis Bridge Builders," p. 45.
44. The builder of all four bridges is identified by a maker's plate on each bridge.

45. Quivik, "Minneapolis Bridge Builders," p. 46.
46. Frame, "Historic Bridge Project," p. 76; "Supplemental Structure Inventory" for each bridge in the respective MNDOT bridge files.
47. Again, this statement is based on impressions gained from random, but not scientific, samples of local government records (see note 34). Also, based on the limited field survey accomplished during this project, more Bayne and Adams bridges seem to survive than those of any other bridge builder.
48. Quivik, "Minneapolis Bridge Builders," pp. 44, 46.
49. This bridge is virtually identical to several other riveted Warren pony truss bridges which Adams built in Redwood County. Although a specific record of his building this bridge has not been found (the bridge may have been built solely by the township), inspection of the Redwood County Commissioners Record during the period leading up to 1910 reveals that Adams won most bids in the county.
50. Maker's plates on bridges.
51. Maker's plate on bridge. That the pin-connected Pratt through truss was still preferred in Minnesota at this time for 80-140 foot spans can be seen in the "Standard Specifications for Steel and Concrete Highway Bridge," Minnesota State Highway Commission Bulletin No. 9, April 1, 1912, p. 6; Warren trusses are mentioned only as pony trusses for 45-80 foot spans.
52. Quivik, "Minneapolis Bridge Builders," pp. 42, 44, 45.
53. Maker's plate on bridges.
54. Quivik, "Minneapolis Bridge Builders," p. 46.
55. Brown County [New Ulm], "Commissioners Record," Volume H, pp. 99, 147, 168, 169, 171, 187, 210, 311.
56. Maker's plate on bridges.
57. This bridge was built by the Minneapolis Bridge Company after Bayne had died and Oliver Mattison was president; agreement between Industrial Contracting Company and Minneapolis Bridge Company, May 16, 1930; and memorandum from Joseph J. Bright to E.J. Miller, March 24, 1947, in MNDOT file for Br. No. 4588.
58. Quivik, "Minneapolis Bridge Builders," p. 45.
59. Curzon Dobell, "Prestressed Concrete Tanks," paper delivered at the First United States Conference on Prestressed Concrete, MIT, Cambridge, August, 1951; William S. Hewett, "A New Method of Constructing Reinforced-Concrete Water Tanks," Proceedings of the American Concrete Institute, 19(1923): 41-52; Quivik, "Minneapolis Bridge Builders," p. 45.

60. Maker's plates on bridges.
61. Maker's plates on bridges.
62. Quivik, "Minneapolis Bridge Builders," p. 47; Frame, "Historic Bridge Project," p. 81
63. Redwood County, "Commissioners Record," Book E, pp. 367, 386, 414, and 431.
64. City Directory for Fargo and Moorhead (Fargo: Pettibone Directory Company, 1901, 1905, 1907, and 1909), listings under Dibley, Fargo Bridge and Iron, and Stranahan; maker's plate on bridge.
65. Frame, "Historic Bridge Project," pp. 94-95.
66. Susan Hodapp, "Smith Avenue High Bridge, HAER No. MN-5," Historic American Engineering Record documentation, National Park Service, Denver, 1984, p. 38.
67. Other cantilever bridges over the Mississippi River were at Winona (1894), Dubuque (1887), Clinton (1891), and Muscatine (1890), F.B. Maltby, "The Mississippi River Bridges," pp. 434-437, 448-449, 457-458, 463-464, 470-471.
68. Frame, "Historic Bridge Project," pp. 93-94; Kenneth Broas, "Steel Arch Bridge, HAER No. MN-18," Historic American Engineering Record documentation, National Park Service, Denver, 1987, p. 20.
69. The history of the Hennepin Avenue bridge is thoroughly documented in Broas, "Steel Arch Bridge, HAER No. MN-18."
70. The 19th-century bridges over the Mississippi River in the Twin Cities, both vehicular and railroad, from the Hennepin Avenue bridge downstream, are illustrated in Maltby, "The Mississippi River Bridges," pp. 419-441. The bridges above Hennepin Avenue were through trusses.
71. Broas, "Steel Arch Bridge, HAER No. MN-18," p. 21.
72. The history of the Marshall/Lake bridge is well documented in Alan Kramer, "Lake/Marshall Bridge, HAER No. MN-6," Historic American Engineering Record documentation, National Park Service, Denver, 1987.
73. Frame, "Historic Bridge Project," pp. 85, 102; Imberman, "The Formative Years of Chicago Bridge & Iron Company," p. 267; Franklin Curtiss-Wedge, ed., History of Dakota and Goodhue Counties, Minnesota (Chicago: H.C. Cooper, Jr., & Co., 1910), p. 590; Maltby, "Mississippi River Bridges," p. 446.
74. Victor S. Clark, History of Manufactures in the United States, Volume III: 1893-1928 (Carnegie Institution of Washington, 1929; reprinted: New York: Peter Smith, 1949), pp. 15-135, contains extensive coverage of the iron and steel industry at the time most of the bridges in this project were built. Mention of the steel mills in Minnesota and at Superior is on p. 45. F. H. Kindl, "The

Manufacture of. Structural Steel in the United States," Cassier's Magazine 17 (February 1900): 259-278, describes the reducing and rolling processes.

75. Charles Evan Fowler, "Some American Bridge Shop Methods," Cassier's Magazine 17 (January 1900):200-215.
76. The Improvement Bulletin, 2 January 1909, p. 3; 6 Feb. 1909, p. 2.
77. Tenth Biennial Report of the Bureau of Labor of the State of Minnesota, 1905-1906 (Minneapolis: Harrison & Smith Co., 1907), pp. 492, 494, 496, 498.
78. Seventh Biennial Report of the Bureau of Labor of the State of Minnesota, 1899-1900 (St. Paul: Pioneer Press Company, 1901), p. 823.
79. Atlas of Minneapolis, Hennepin County, Minnesota, 1903 (Minneapolis: Minneapolis Real Estate Board, 1903), p. 44; Horace B. Hudson, A Half Century of Minneapolis (Minneapolis: Hudson Publishing Co., 1908); The Improvement Bulletin, 2 January 1909, p.3.
80. Minneapolis Steel and Machinery Co., "General Specifications for Steel Highway Bridges," 1908, Minnesota Historical Society Pamphlet Collection; C.E. Nagel, "Highway Bridges," Proceedings of the Minnesota Surveyors' and Engineers' Society, Nineteenth Annual Meeting, 1914, published by the Society, p. 23.
81. To be able to make a definitive statement, one would have to research and record every bridge contract letting in the state, a task far beyond the scope of this project. The conclusions about Bayne and Adams, Rice and Redwood counties, are derived from scanning several years of commissioners minutes for Redwood County, supervisors minutes for Walcott Township in Rice County, and city council minutes for the City of Faribault.
82. Imberman provides an extensive discussion of pooling in his dissertation, "The Formative Years of Chicago Bridge and Iron Company." See especially pp. 153-164, 173-176, 260-262, 267-269, 288. For a list of those bridge builders with whom Horton had pooling arrangements, see the appendix on pp. 603-605.
83. Maker's plate on bridge.
84. Blue Earth County, "Commissioner Record," Book F, pp. 461, 465, 471, 477, 479.
85. The Mayer Brothers had an illustrated advertisement in every issue of the 1895 Improvement Bulletin.
86. Redwood County [Redwood Falls], "Commissioners Record," Book F, pp. 37, 131, 194, 239.
87. Second Annual Report of the State Highway Commission of Minnesota, December 15, 1906 (St. Paul: Pioneer Press, Manufacturing Dept., Printers, 1906), p. 61; Waddell, The Designing of Ordinary

Iron Highway Bridges, pp. 158-158; C.E. Nagel, "Highway Bridges," Proceedings of the Minnesota Surveyors' and Engineers' Society, Nineteenth Annual Meeting (St. Paul: by the Society, 1914), p 23.

88. Second Annual Report of the State Highway Commission of Minnesota, p. 62.
89. Report of the State Highway Commission for 1909 & 1910 (St. Paul: Pioneer Press, 1910), p. 21; Report of the State Highway Commission of Minnesota, 1909-1910-1911 (St. Paul: Pioneer Press, 1911), p. 37; Frame, "Historic Bridge Project," p. 71; Meeker County Commissioners to State Highway Commission, resolution dated March 13, 1908, Minnesota Highway Department, Meeker County folder, 1906-1912, Minnesota State Archives, Minnesota Historical Society.
90. Goodhue County [Red Wing], "Commissioners Record," Vol. 7, pp. 564-565, 593-594, 601-602; Curtiss-Wedge, History of Dakota and Goodhue Counties, p. 1017.
91. Report of the State Highway Commission of Minnesota, 1909-1910-1911, p.37; Report of the State Highway Commission of Minnesota for 1912-1913, pp. 9-10; Report of the State Highway Commission of Minnesota for 1914, p. 11.
92. "Corrugated-Iron Pipe of Multi-Plate Design Introduced on Illinois Central Railroad," Engineering News-Record, 107 (November 19, 1931): 805-806; Armco Drainage and Metal Products, Inc., Handbook of Drainage and Construction Products (Chicago: Lakeside Press, R.R. Donnelley and Sons Company, 1955), p. 69.
93. Henry B. Kenny, "State Highway Culverts Inspected," Minnesota Techno-Log, 5 (December 1924): 10. By 1926, corrugated metal had become the preferred material for culverts throughout the country. Only a decade earlier, however, the Minnesota Highway Commission had banned the use of corrugated-metal culverts on state-aid construction projects on the grounds that "they are not permanent" -- "concrete is permanent and is therefore recommended"; see "Materials Used for Highway Culverts," Public Works, 57 (September 1926): 288; Report of the State Highway Commission of Minnesota for 1914 (n. pub., 1915), p. 17; State Highway Commission of Minnesota, "Standard Specifications for corrugated Metal Culverts," Bulletin No. 14 (n. pub., 1915), p. 1.
94. "Corrugated-Iron Pipe of Multi-Plate Design Introduced on Illinois Central Railroad," 805.
95. Handbook of Culvert and Drainage Practice (Chicago: Lakeside Press, R.R. Donnelley and Sons Company, 1937), p.260-265; "Details of a Beautiful Stone Arch Bridge," Public Works, 66 (September 1935), 13; Beautiful Low-Cost Bridges (Minneapolis: Lyle Culvert and Pipe Company, 1935).
96. Advertisement for "Armco Multi Plate Arches, Lyle Culvert and Pipe Company," in Minnesota Federation of Architecture and Engineering Societies, 23 (May 1938). In 1935, the Roosevelt Administration required that at least one percent of federal highway allotments to the states be expended on "Roadside Development Projects;" ensuing government publications prominently featured Multi Plate "stone-arch" bridges as examples of highway beautification. See "Highways . . . and Where They Lead You in Marvelous Minnesota" (Minnesota State Highway Department, 1937),

n.p.; Works Progress Administration of Minnesota, WPA Accomplishments (no pub., 1939), n.p.; Biennial Report of the Commissioner of Highways of Minnesota for 1935-1936 (Minneapolis: Syndicated Printing Co., 1937), p. 28; Biennial Report of the Commissioner of Highways of Minnesota for 1937-1938 (Minneapolis: Syndicated Printing Co., 1939), p. 18; Harold E. Olson, "Roadside Development Along the Trunk Highways of Minnesota," Minnesota, 23 (April 1938): 10-11.

97. This brief assessment of surviving Multi Plate bridges is based primarily on a review of MNDOT inventory files for all structures computer-identified as Multi Plate; see "DOT Bridge Inventory Listing of Steel Arch Structures with Main Span Less than 75'," unpublished computer printout, February 1987, MNDOT.
98. Armco Drainage Products Association, "Low-Clearance Drainage Structures, The Armco Pipe-Arch" (no pub., 1941); Jeffrey A. Hess, Interview with Clement P. Kachelmyer, Preliminary Design Engineer, MNDOT, May 12, 1988.

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