Bridge 90646 carries Wooddale Avenue over Minnehaha Creek in Edina, Hennepin County, Minnesota. It is owned by the City of Edina. The bridge was constructed in 1937 by the Works Progress Administration (WPA) as part of a federal relief project to replace an earlier timber stringer bridge at the same location. The bridge is significant for its association with the WPA federal-relief program, its aesthetics, and as a representative example of a multi plate arch bridge in the state.

Bridge 90646 is a single-span corrugated multi plate arch structure. The span length is 18 feet. The steel plate arch is supported by cast-in-place concrete spread footings. The bridge features limestone masonry headwalls, railings and wingwalls.

Bridge 90646 is in fair condition and appears to adequately serve its purpose of carrying vehicular and pedestrian traffic. With proper maintenance, stabilization and preservation activities, it is believed Bridge 90646 could continue to serve in its present capacity for 20 years or longer.

Any work on Bridge 90646 should proceed according to the Secretary of the Interior’s Standards for the Treatment of Historic Properties (Standards) [36 CFR part 67] and The Secretary’s Standards with Regard to Repair, Rehabilitation, and Replacement Situations, as adapted by the Virginia Transportation Research Council (Guidelines).
Bridge Location

Bridge Number: 90646

Bridge 90646 – WOODDALE AVE over MINNEHAHA CREEK

PROJECT LOCATION
HENNEPIN COUNTY
SEC. 18, TO 028NN, R 24W
UTM ZONE: 15  NAD: 27
USGS QUAD NAME: MINNEAPOLIS SOUTH
EASTING: 1552535 ft.
NORTHING: 16316256 ft.

Minnesota Department of Transportation (MnDOT)
Local Historic Bridge Report
Executive Summary

Bridge Location

I. Project Introduction
II. Historic Data
III. Bridge Data
IV. Existing Conditions/Recommendations
V. Projected Costs

Appendices

A. Glossary
B. Guidelines for Bridge Maintenance and Rehabilitation based on the Secretary of the Interior's Standards
C. Documents
This Bridge Report is a product of a comprehensive study performed for approximately 140 historic bridges owned by county, city, township, private and other state agencies besides MnDOT. The study is the second phase of a multi-phased process developed and executed in partnership with representatives from the Federal Highway Administration (FHWA); State Historic Preservation Office (SHPO); MnDOT State Aid; MnDOT Cultural Resources Unit (CRU); the US Army Corps of Engineers (USACE); local public works and county highway departments; county and township boards and city councils; the preservation community and the general public. To perform the study, MnDOT retained the consultant team of LHB Inc., Mead & Hunt Inc., and The 106 Group.

The general goals of the study include:

- Gathering and compiling the existing historic and bridge condition data and other relevant information on the bridges in the study group into bridge reports.
- National Register nominations for a select number of bridges within the study group which the bridge owner may request a nomination to be prepared.
- Updating MnDOT’s Management Plan for Historic Bridges in Minnesota based on the study’s findings.
- Producing a narrative for the MnDOT Historic Bridge Website to disseminate information regarding locally owned historic bridges in Minnesota.
- Investigating and preparing a summary regarding how other states have funded historic bridge programs and structured Programmatic Agreements when multiple non-state entities are the owners of historic bridges.

The Bridge Reports compile and summarize the historic and engineering information concerning the structures. It is important to note that this report indicates if a bridge is located within a known historic district, but it does not identify all known or potential historic properties. Potential impacts to adjacent or surrounding historic properties, such as archaeological sites or other structures must be considered. Contact MnDOT CRU early in the project planning process in order to identify other potential historic properties. The reports also document the existing use and condition of the bridges along with assessments of the maintenance, stabilization and preservation needs of each structure, including cost estimates. The maintenance activities, along with regular structural inspections and anticipated bridge component replacement activities are routine practices directed toward continued structure serviceability. Stabilization activities address immediate needs identified as necessary to maintain a bridge’s structural and historic integrity and serviceability. Preservation activities are near term or long term steps that need to be taken to preserve and in some cases restore a bridge’s structural and historic integrity and serviceability. In assessing preservation activities, a design life of 20 years or longer is typically considered. In addition to general restoration activities and dependent on the severity of deterioration, preservation activities may include spot repair, disassembly and reassembly or replacement of specific bridge components.

Recommendations within the Bridge Reports are consistent with the Secretary of the Interior’s Standards for the Treatment of Historic Properties (Standards). The Standards are basic principles created to help preserve the distinct character of a historic property and its site, while allowing for reasonable change to meet new engineering standards and codes. The Standards recommend repairing, rather than replacing...
deteriorated features whenever possible. The Standards apply to historic properties of all periods, styles, types, materials and sizes and encompass the property's location and surrounding environment.

The Standards were developed with historic buildings in mind and cannot be easily applied to historic bridges. The Virginia Transportation Research Council (Council) adapted the Standards to address the special requirements of historic bridges. They were published in the Council's 2001 Final Report: A Management Plan for Historic Bridges in Virginia, *The Secretary’s Standards with Regard to Repair, Rehabilitation, and Replacement Situations*, provide useful direction for undertaking maintenance, repair, rehabilitation, and replacement of historic bridges and are included in the Appendix to this plan.

Existing bridge data sources typically available for Minnesota bridges were gathered for the study. These sources include:

- **PONTIS**, a bridge management system formerly used by MnDOT to manage its inventory of bridges statewide, and its replacement system, SIMS (Structure Information Management System)
- The current MnDOT Structure Inventory Report and MnDOT Bridge Inspection Report. Reports are available for the majority of the bridges (not available for bridges in private ownership)
- Database and inventory forms resulting from the 2012 Minnesota Local Historic Bridge Study and other prior historic bridge studies as incorporated into the database
- Existing Minnesota historic contexts studies for bridges in Minnesota, including *Reinforced-Concrete Highway Bridges in Minnesota, 1900-1945*, *Minnesota Masonry-Arch Highway Bridges, 1870-1945*, *Iron and Steel Bridges in Minnesota, 1873-1945* and *Minnesota Bridges 1955-1970*
- Field investigations documenting the general structural condition and determining character-defining features

Additional data sources researched and gathered for some of the bridges as available also included:

- Files and records at MnDOT offices
- Original bridge construction plans, rehabilitation plans, and maintenance records of local owners
- Files and documents available at the SHPO office, including previous inventory forms, determinations of eligibility, studies, and compliance documents
- Existing historical and documentary material related to the National Register-eligible bridges

The Appendix contains the following: a Glossary explaining structural and historic preservation terms used in the report, the Guidelines for Bridge Maintenance and Rehabilitation based on the Secretary of the Interior’s Standards, a list of engineering and historic documents available for this bridge, and copies of the MnDOT Structure Inventory and Bridge Inspection Reports current at the time of the report preparation.

The Bridge Report will provide the bridge owner and other interested parties with a comprehensive summary of the bridge condition and detailed information related to the historic nature of the bridge. This information will enable historic bridge owners to make informed decisions when planning for their historic properties.
Minneapolis Department of Transportation (MnDOT)
Local Historic Bridge Report

II – Historic Data

Bridge Number: 90646

This narrative is drawn from previous documents, as available for the subject bridge, which may include determination of eligibility (also known as Phase II evaluation), Minnesota Architecture/History Inventory Form, National Register nomination, Multiple Property Documentation Form, and/or applicable historic contexts. See Sources for details on which documents were used in compiling this Historic Data section.

Contractor

WPA

Designer/Engineer

Hennepin County Highway Department

Description

Bridge 90646 is a single-span, multi plate arch bridge that carries Wooddale Avenue over Minnehaha Creek in Edina, Hennepin County, Minnesota. The Edina Country Club golf course is located directly west of the bridge and St. Stephens Episcopal Church is located directly east of the bridge. The bridge is oriented in a north-south alignment over Minnehaha Creek. At this location the creek is narrow and rocky, and has sloped banks which are covered with dense growth of small trees and shrubs.

The bridge has a total length of 44 feet, a span of 18 feet, and an out-and-out width of 40 feet 5 inches. The deck is 40 feet wide and carries a 32-foot-wide roadway that has a bituminous wearing surface applied over earth fill. A concrete sidewalk extends along the east side of the roadway. The bridge’s semi-circular arch and barrel are constructed of Armco Multi plate corrugated steel plates, which are bolted together. The voussoirs are rectangular-shaped and are applied perpendicular to the arch. The voussoirs increase in height closer to the center of the arch where an elongated keystone marks the middle. The abutments have engaged pilasters and are constructed of reinforced-concrete with Platteville limestone facing with raked mortar joints.

The bridge’s headwalls and wingwalls (also referred to as spandrel walls) extend above the deck to form the railing. The engaged pilasters also extend above the deck forming the railing end posts. The solid railings are slightly arched and topped with a thin limestone cap that overhangs the width of the railings. A plaque inscribed with “WPA 1937” is located on the inside of the south end of the eastern railing. Short limestone retaining walls extend upstream and downstream from the end posts.

Significance

In March 1937 the Village of Edina turned its attention to replacing a deteriorated bridge on Wooddale Avenue over Minnehaha Creek. The existing crossing was a timber-stringer structure that was both too narrow and too light for the traffic demands of the site. The new bridge was to be a WPA project, which meant that the Village was responsible for providing engineering and materials, while the federal work-relief agency would pay for the labor. According to the council minutes, there were four different types of construction under consideration: “reinforced concrete, piling with I beams, creosoted wood culverts, and inverted multi plate steel arch on concrete base with rubble or boulder stone facings.” The Village decided in favor of the stone-faced, multi plate arch—the type that most suited the crossing’s residential location and the WPA’s work-relief aesthetic.

For bridge plans, the Village turned to the Hennepin County Highway Department, and it secured the multi plate arch from the Lyle Pipe and Culvert Company. In August 1937, the Edina Crier announced
that "one of the village's most attractive civic improvements, the new Wooddale Avenue Bridge is being completed. The structure, a modern, 40-foot inverted Armco culvert span, replaces the old 16-foot bridge that had stood for many years. Stonework has been completed, workmen in the last few days have been applying the finishing touches, and the bridge has been opened to traffic."

The Armco Culvert Manufacturers Association introduced multi plate in 1931. The galvanized, corrugated-iron product was fabricated in curved segments to facilitate shipping in "nested" position. For bridge construction, the segments were bolted together in the field to form an arch, which was typically anchored by concrete headwalls and abutments. Frequently, the concrete work was ornamented with stone facing in order to simulate a stone-arch bridge. Such construction found ready acceptance with work-relief planners of the 1930s, for the stone-faced, multi plate arch bridge was highly compatible with the New Deal's agenda of promoting highway beautification, local craft skills and materials, and labor-intensive public works projects.

Bridge 90646 exemplifies the types of projects undertaken by the WPA as a labor-intensive project that utilized local laborers for its construction. With its Platteville limestone walls, Bridge 90646 also exemplifies the Rustic Style design aesthetic popularized by the WPA. The Rustic Style is a style of architecture that was previously developed by the National Park Service (NPS). Rustic Style buildings and structures were designed to harmonize with the natural environment. The hallmark of buildings and structures constructed in the Rustic Style is that they were built with whatever materials were available locally, utilized labor intensive building methods, and often had a hand-crafted appearance. Platteville limestone was chosen to harmonize with the design of the nearby St. Stephen’s Episcopal Church. This is in keeping with the design principles of the Rustic Style, as Platteville limestone is a locally available material and the use of it emphasizes the bridge’s relationship with its surrounding environment.

Research did not reveal any alterations to Bridge 90646 since its construction. It retains integrity of design, workmanship, and materials. The bridge continues to carry a vehicular road over Minnehaha Creek in Edina. The bridge retains integrity of setting, feeling, location, and association. The period of significance for the bridge is 1937 corresponding with the date of its construction.

Bridge 90646 is eligible for the National Register under Criterion A in the area of Politics and Government, for its association with the WPA. The bridge is an outstanding and rare surviving example of a single-span, multi plate arch bridge with masonry facing that was constructed by the WPA. The bridge represents the impact of New Deal public works programs in Edina and is the only New Deal multi plate arch bridge extant in Hennepin County. As such, Bridge 90646 is significant for its exemplification of the types of labor-intensive public works projects undertaken by the WPA during the Great Depression, in order to provide work for the unemployed.

Bridge 90646 is also eligible for the National Register for its design and workmanship under Criterion C in the area of Engineering. With its roughly coursed, rubble limestone veneer, Bridge 90646 is an excellent example of the Rustic Style as applied to bridges. The Multiple Property Documentation Form (MPDF) associated with this context presents the following registration criteria for the multi plate arch type:
Minnesota Department of Transportation (MnDOT)
Local Historic Bridge Report

II – Historic Data

<table>
<thead>
<tr>
<th>Bridge Number: 90646</th>
</tr>
</thead>
</table>

Since the multi-plate arch bridge is most notable for its modular corrugated-metal construction and stone headwalls and spandrels, these features should be clearly visible and relatively unaltered. And since the multi-plate arch bridge enjoyed its vogue at least partly because of the New Deal's encouragement of roadside beautification, the bridge's workmanship and design should be on the original site, harmonious with the general setting, of high aesthetic quality, and of New Deal vintage.

Bridge 90646 satisfies all of these criteria.

**Historic Context**
Iron and Steel Bridges in Minnesota, 1873-1945

**National Register Status**
Eligible (Individually)

**Criterion A Significance**
Politics/Government

**Criterion C Significance**
Engineering: High artistic value

**Historic District**
N/A

**SHPO inventory number**
HE-EDC-633

**Sources Used to Compile Section II -- Historic Data**

- Bridge 90646 electronic record in the Minnesota Department of Transportation Bridge Database.
- Bridge 90646 File, in Minnesota Department of Transportation, St. Paul.
- Bridge 90646 File, in Edina City Hall, Edina, Minnesota.
- Edina City Council, Minutes, 12, 16 October 1936, 8 March 1937, in Edina City Hall.
- The following notices in the *Edina Crier* of 1937: "New 40-foot Bridge over Minnehaha Creek" (September), "Work Finished on Wooddale Bridge" (August).
- Field inspection by Denis Gardner, 8 October 1996.
- Field inspection by LHB, Inc. and Mead & Hunt, Inc., 31 July 2013.
- National Register Nomination Draft, Bridge 90646, Edina, Hennepin County, Minnesota.
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. Features may include materials, engineering design, and structural and decorative details. Often, the character-defining features include important historic fabric. However, historic fabric can also be found on other elements of a bridge that have not been noted as character-defining. For this reason, it is important to consider both character-defining features and the bridge’s historic fabric when planning any work.

Feature 1: Design and construction of a multi plate arch.
Feature 2: Overall WPA Rustic Style design aesthetic as represented through use of a randomly coursed limestone, masonry parapet/railing with stone cap, curved limestone wingwalls, and limestone arch ring. This feature includes the concrete plaque identifying the bridge as “WPA 1937.”
# Minnesota Department of Transportation (MnDOT)
## Local Historic Bridge Report

### III – Bridge Data

<table>
<thead>
<tr>
<th>Date of Construction (remodel)</th>
<th>1937</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Name (if any)</td>
<td></td>
</tr>
</tbody>
</table>

#### Location
- Feature Carried: WOODDALE AVE
- Feature Crossed: Minnehaha Creek
- County: Hennepin
- Ownership: City of Edina

#### MnDOT Structure Data
- *Data Current (as of): Sep 2013*
- Main Span Type: 315 STEEL PIPE ARCH
- Substructure Type - Foundation Type:
  - Abutment: 1-Concrete - 1-Spread/Soil
  - Piers: N-Not Applicable - N-Not Applicable
- Total Length: 21 ft
- Main Span Length: 18 ft
- Total Number of Span(s): 1
- Skew (degrees): 0
- Structure Flared: No Flare
- Roadway Function: Urban, Local
- Custodian/Maintenance Type: City

#### Reported Owner Inspection Date
- 10/29/2012

#### Sufficiency Rating
- 61.7

#### Operating Rating
- HS 18

#### Inventory Rating
- HS 12

#### Structure Status
- A - Open

#### Reported Owner Inspection Date
- 10/29/2012

### Sufficient Rating
- 61.7

### Operating Rating
- HS 18

### Inventory Rating
- HS 12

#### Structure Status
- A - Open

#### Design Load
- UNKN

### Current Condition Code

<table>
<thead>
<tr>
<th>Deck</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superstructure</td>
<td>N</td>
</tr>
<tr>
<td>Substructure</td>
<td>N</td>
</tr>
<tr>
<td>Channel and Protection</td>
<td>6</td>
</tr>
<tr>
<td>Culvert</td>
<td>7</td>
</tr>
</tbody>
</table>

### Current Appraisal Rating

| Structural Evaluation | 4 |
| Deck Geometry | 3 |
| Underclearances | N |
| Waterway Adequacy | 8 |
| Approach Alignment | 8 |

#### Fracture Critical
- No

#### Deficient Status
- F.O.

### Roadway Clearances
- Roadway Width: 31 ft
- Vert. Clearance Over Rdwy: N/A
- Vert. Clearance Under Rdwy: N/A
- Lat. Clearance Right: 0 ft
- Lat. Clearance Left: 0 ft

### Roadway Data
- ADT Total: 5300 (2005)
- Bypass Detour length: 7 miles
- Number of Lanes: 2

### Waterway Data
- Scour Code: I-LOW RISK

### Non-MnDOT Data

#### Approach Roadway Characteristics

- Lane Widths: 16 ft
- Shoulder Width: N/A (C&G)
- Shoulders Paved or Unpaved: N/A (C&G)
- Roadway Surfacing: Bituminous

#### Location of Plans
- City of Edina

#### Plans Available
- Original Plan Sheet

---

* Non-MnDOT data collected during field survey. All other fields of data collected from MnDOT September of 2013. See Appendix C for MnDOT inventory and inspection report data.

** Unless a significant number of crashes are noted on or near a bridge, the accident data is not detailed in this report.
Existing Conditions
Available information, as detailed in the Project Introduction section, concerning Bridge 90646 was reviewed prior to visiting the bridge site. The site visit was conducted to establish the following:

1. General condition of structure
2. Conformation to available extant plans
3. Current use of structure
4. Roadway/pedestrian trail geometry and alignment (as applicable)
5. Bridge geometry, clearances and notable site issues

General Bridge Description
Bridge 90646 is a single-span corrugated multi plate arch structure, about 44 feet in total length. The plate arch span is approximately 18 feet. The steel plate arch is supported by cast-in-place concrete spread footings. Bridge 90646 carries Wooddale Avenue over Minnehaha Creek in the City of Edina. The bridge features limestone masonry headwalls, railings and wingwalls. The bituminous-surface roadway is about 32 feet wide, gutter to gutter. There is a 4-foot-wide sidewalk on the east side of the bridge. The railing height varies from 3 feet 10 inches on the ends to about 4 feet 5 inches at mid-span. Railings and wingwalls are parallel to the roadway. Remnants of smaller curved stone masonry walls were noted off each end of the existing wingwalls. These walls are somewhat intact on the east side but are missing nearly entirely on the west side. There are also small stone masonry walls present along the stream channel that abut each of the bridge wingwalls.

Serviceability Observations
The bridge is currently open to vehicular and pedestrian traffic with no apparent load posting restrictions from legal loads.

Condition Observations
Roadway Surface
The existing bituminous roadway is in good condition with no significant deficiencies noted.

Bridge Railings
The stone masonry bridge railings are solid limestone masonry capped with limestone slabs. The original bridge plans show timber elements in the railing details, but no timber elements are present at this time. The railings comprise the top level of the masonry headwalls and wingwalls and are about 2 feet thick. The railing height varies along the length of the bridge with the end minimum height at about 3 feet 10 inches at the ends, and a maximum mid-span height of 4 feet 5 inches. The east rail leans outward about 1 inch in 4 feet.

The condition of the existing stone masonry railings is fair to poor. The relatively soft limestone has weathered and deteriorated with nearly all stones cracked, and widespread areas of mortar deterioration, especially on the roadside face of the railings. Crumbled stone and mortar has collected at the base of the railings. The solid limestone slab railing caps are nearly 100 percent deteriorated.
Bridge Headwalls and Wingwalls
The stone masonry headwalls and wingwalls below the railing are in fair condition. The stone in these areas is in markedly better condition than the railing stones, presumably due to less exposure to road salts. Widespread deterioration of the mortar was noted. Many areas of the mortar on the headwalls were cracked and de-bonded from the stone. Arch ring stones along the perimeter of the plate arch were in good to fair condition. Alignment and geometry of the headwalls and wingwalls appeared to be true.

Steel Multi Plate Arch
The galvanized steel multi plate arches are in good condition overall. Though water conditions were relatively high at the time of this site visit, the zinc coating appeared to be in good condition overall. Active corrosion was noted at and near the connection of the arch to the concrete abutments with the most severe being at the southeast corner.

Substructures
The substructures are cast-in-place concrete footings bearing on the native soil. Due to the high water level at the time of the field assessment, access to most of the footings was not possible. Scouring and undermining of the east end of the south footing was noted, about 3 feet in length and 12 inches in depth beneath the bottom of the footing.

Approach/Waterway Observations
The bridge approaches appear suitable for the current bridge function with no deficiencies noted other than the presence of a mature tree at the southeast corner that may be affecting the stone masonry wingwalls. The waterway geometry appears to be adequate, though the velocity at the time of the field assessment was high. The retaining walls along the channel that abut the bridge wingwalls at the water's edge were noted to be poor condition with undermining and missing stones throughout.

Accident Data
There are 27 reported accidents within 500 feet of the bridge site, in the MnMCAT system. The majority of these crashes took place at the intersection of Wooddale Avenue and 50th Street (a highly traveled roadway). The bridge is not considered a contributing factor to this high number of vehicular accidents.

Date of Engineering Site Visit by LHB
July 31, 2013
Existing Conditions/Recommendations

Condition 1: Bridge approach, looking north

Condition 2: West elevation, looking northeast
Condition 3: Looking north at top of west railing
(note deteriorated masonry on the top and at the base of the railing)

Condition 4: View of east railing, looking south
Condition 5: General view of northeast wingwall

Condition 6: General view of northeast wingwall masonry
Condition 7: General corrosion at waterline

Condition 8: Corrosion in southeast corner
Condition 9: Stamp on inside of steel plate arch

Condition 10: Remnants of walls off ends of wings, west side
Condition 11: Typical east side channel wall (northeast shown)

Condition 12: Typical west side channel wall (southwest shown)
Condition 13: Tree growing near southeast corner
Overall Recommendations
The bridge is currently open to vehicular and pedestrian traffic. The recommendations which follow assume the structure’s use will remain the same. Bridge 90646 is not currently load posted. However, the latest rating of the bridge was performed in 1973. The bridge rating is outdated and should be re-evaluated for the current condition of the structure. Costs for this rating have been included in the Preliminary Design and Assessment estimate.

Stabilization, preservation, and maintenance activities that could extend the serviceability and overall longevity of the bridge are detailed below.

Recommended Stabilization Activities

1. Remove mature tree in southeast corner.

Recommended Preservation Activities
The overall condition of the bridge can be described as fair. While the multi plate arches are in good condition, save for some minor corrosion, the stone masonry on the bridge is in fair to poor condition, particularly the railing. Some geometric distortion was noted in the east railing but overall the bridge lines appeared straight and true.

An overall preservation plan should be developed to improve the noted deficiencies. Based on our field observations the bridge appears to be nearing a critical point in its lifespan where investment in the near term could significantly delay or prevent accelerated deterioration or loss of the bridge superstructure. The recommended preservation activities are:

Bridge Railings
Due to their deteriorated condition, it is recommended to remove and replace the stone masonry railings down to the arch crown elevation. The railing stones are spalled, cracked, and eroded beyond the point of practical salvage. At the time of rehabilitation planning, a detailed study should be conducted to determine the level of repair required and analysis should be conducted to confirm that the current condition of the masonry precludes repair. The estimated costs contained in this report assume that the railings will require reconstruction to the limits described above. A mortar study should be performed to ensure selection of a mortar that is compatible in composition, strength, color, texture and tooling. To maintain historic integrity it will also be necessary for the project construction details to fully define the repointing requirements including but not limited to such items as joint preparation, mortar finish and tooling, mortar curing, and preparation of repointing test panels. Similarly, the replacement stones selected shall match the original stones in color, origin (if possible) and composition. At the time of rail reconstruction, it is recommended that the four smaller decorative walls off each wingwall at roadway level be reconstructed.

Arch, Roadway & Sidewalk
When either the roadway and sidewalk need to be replaced, or the arch begins to show signs of corrosion, it is recommended that the sidewalk and bituminous surface be removed and replaced and at the same time, remove the earth fill above the steel multi plate arch and inspect steel surfaces for
corrosion. After any corrosion of the top surface is addressed, the fill shall be replaced with clean aggregate and include a drainage system. Consideration for installation of a waterproofing membrane should also be made. This repair is anticipated to be required in approximately 10 years and has been included in the preservation cost estimate.

Bridge Headwalls and Wingwalls
The alignment and condition of the headwalls makes them a very good candidate to be rehabilitated before they deteriorate to the level where replacement is required. Although the stones appear to be severely weathered, it was observed that removal of mortar and repointing of stone masonry on headwalls and wingwalls would be possible with very limited loss of original stones. It will be required to replace those stone that do not hold up to the repointing process (estimate 60 square feet). At the time of rehabilitation planning, a detailed study should be conducted to determine the level of repair required. Repair mortar and replacement stones should be chosen as detailed in the Railing Section above.

Channel Walls
The stone masonry walls at the channel edge are severely deteriorated and should be reconstructed. As with the railing, headwalls and wingwalls, the decision to replace these historic elements should follow a detailed study and repair or replacement shall follow the same guidelines for selection of replacement stones and mortar.

Substructures
It is recommended to underpin the concrete footings to mitigate scour action. Concrete underpin walls placed at the scoured locations shall be designed to be as visually unobtrusive as possible while protecting the footings from continued scour.

Recommended Annual Maintenance Activities

1. Flush bridge roadway, sidewalks, and stone masonry railings, headwalls and wingwalls each spring with water to remove salt residue. Low pressure spray, less than 400 psi, should be used to ensure there is no damage to surface finishes. Test flushing method and water pressure to ensure it does not damage or abrade the bridge surfaces.
Minnesot a Departmen t of Transportatio n (MnDOT)
Local Historic Bridge Report

V – Projected Costs

<table>
<thead>
<tr>
<th>Summarized Maintenance, Stabilization and Preservation Construction Cost Estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is important to recognize that the work scope and cost estimates presented herein are based on a limited level assessment of the existing structure. In moving forward with future project planning, it will be essential to undertake a detailed structure assessment addressing the proposed work for the structure. It is also important that any future preservation work follow applicable preservation standards with emphasis to rehabilitate and repair in-place structure elements in lieu of replacement. This includes elements which are preliminarily estimated for replacement within the work scope of this report. Only through a thorough review of rehabilitation and repair options and comprehensive structural and historic assessment can a definitive conclusion for replacement of historic fabric be formed.</td>
</tr>
</tbody>
</table>

The opinions of probable construction and administrative costs provided below are presented in 2013 dollars. These costs were developed without benefit of a detailed, thorough bridge inspection, bridge survey or completion of preliminary design for the estimated improvements. The estimated costs represent an opinion based on background knowledge of historic unit prices and comparable work performed on other structures. The opinions of cost are intended to provide a programming level of estimated cost. These costs will require refinement and may require significant adjustments as further analysis is completed in determining the course of action for future structure improvements. A 20 percent contingency and 7 percent mobilization allowance has been included in the construction cost estimates.

Administrative and engineering costs are also presented below. Engineering and administrative costs are also to be interpreted as programming level only. Costs can be highly variable and are dependent on structure condition, intended work scope, project size and level of investigative, testing and documentation work necessary. Additional studies, evaluation, and historical consultation costs not exclusively called out may also be incurred on a case-by-case basis.

Maintenance, Stabilization and Preservation Costs (refer to the work item breakdown on the next page)

| Opinion of Annual Cost- Maintenance Activities: | $ 1,800 |
| Opinion of Construction Cost- Stabilization Activities: | $ 2,650 |
| Opinion of Construction Cost- Preservation Activities: | $ 494,280 |

Estimated Preliminary Design, Final Design, Construction Administration Costs

| Preliminary Design and Assessment | $ 12,000 |
| Final Design and Plans | $ 45,000 |
| Construction Administration | $ 55,000 |
## MAINTENANCE, STABILIZATION & PRESERVATION COST ESTIMATE (2013 DOLLARS)

### Bridge No. 90646

**January 7, 2014**

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>ITEM</th>
<th>UNIT</th>
<th>QUANTITY</th>
<th>UNIT COST</th>
<th>TOTAL ESTIMATE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MAINTENANCE COSTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>FLUSH STONE MASONRY HEADWALLS AND RAILINGS</td>
<td>LUMP SUM</td>
<td>1</td>
<td>$1,500.00</td>
<td>$1,500.00</td>
</tr>
<tr>
<td></td>
<td>20% CONTINGENCY</td>
<td>LUMP SUM</td>
<td>1</td>
<td>$300.00</td>
<td>$300.00</td>
</tr>
<tr>
<td><strong>ESTIMATED MAINTENANCE COSTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$1,800</td>
</tr>
<tr>
<td><strong>STABILIZATION COSTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MOBILIZATION @ 7%</td>
<td>LUMP SUM</td>
<td>1</td>
<td>$150.00</td>
<td>$150.00</td>
</tr>
<tr>
<td>1</td>
<td>REMOVE TREE</td>
<td>TREE</td>
<td>1</td>
<td>$2,000.00</td>
<td>$2,000.00</td>
</tr>
<tr>
<td></td>
<td>20% CONTINGENCY</td>
<td>LUMP SUM</td>
<td>1</td>
<td>$500.00</td>
<td>$500.00</td>
</tr>
<tr>
<td><strong>ESTIMATED STABILIZATION COSTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$2,650</td>
</tr>
<tr>
<td><strong>PRESERVATION COSTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MOBILIZATION @ 7%</td>
<td>LUMP SUM</td>
<td>1</td>
<td>$27,000.00</td>
<td>$27,000.00</td>
</tr>
<tr>
<td>1</td>
<td>REMOVE BITUMINOUS PAVEMENT</td>
<td>SQ FT</td>
<td>2175</td>
<td>$4.00</td>
<td>$8,700.00</td>
</tr>
<tr>
<td>2</td>
<td>REMOVE CONCRETE CURB AND GUTTER</td>
<td>LIN FT</td>
<td>150</td>
<td>$5.00</td>
<td>$750.00</td>
</tr>
<tr>
<td>3</td>
<td>REMOVE CONCRETE SIDEWALKS</td>
<td>SQ FT</td>
<td>450</td>
<td>$3.00</td>
<td>$1,350.00</td>
</tr>
<tr>
<td>4</td>
<td>REMOVE MASONRY (RAILINGS)</td>
<td>LIN FT</td>
<td>88</td>
<td>$110.00</td>
<td>$9,680.00</td>
</tr>
<tr>
<td>5</td>
<td>COMMON EXCAVATION</td>
<td>CU YD</td>
<td>450</td>
<td>$12.00</td>
<td>$5,400.00</td>
</tr>
<tr>
<td>6</td>
<td>REPLACE EARTH ARCH FILL &amp; ROAD BASE MATERIAL</td>
<td>CU YD</td>
<td>450</td>
<td>$26.00</td>
<td>$11,700.00</td>
</tr>
<tr>
<td>7</td>
<td>REPLACE BITUMINOUS PAVEMENT</td>
<td>TON</td>
<td>70</td>
<td>$110.00</td>
<td>$7,700.00</td>
</tr>
<tr>
<td>8</td>
<td>REPLACE CONCRETE SIDEWALKS</td>
<td>SQ FT</td>
<td>450</td>
<td>$12.00</td>
<td>$5,400.00</td>
</tr>
<tr>
<td>9</td>
<td>REPLACE CONCRETE CURB AND GUTTER</td>
<td>LIN FT</td>
<td>150</td>
<td>$24.00</td>
<td>$3,600.00</td>
</tr>
<tr>
<td>10</td>
<td>UNDERPIN CONCRETE ABUTMENTS</td>
<td>LIN FT</td>
<td>25</td>
<td>$1,400.00</td>
<td>$35,000.00</td>
</tr>
<tr>
<td>11</td>
<td>RECONSTRUCT STONE MASONRY WALLS (STREAM)</td>
<td>SQ YD.</td>
<td>45</td>
<td>$2,200.00</td>
<td>$99,000.00</td>
</tr>
<tr>
<td>12</td>
<td>RECONSTRUCT STONE MASONRY WALLS (WING ENDS)</td>
<td>SQ YD.</td>
<td>10</td>
<td>$2,500.00</td>
<td>$25,000.00</td>
</tr>
<tr>
<td>13</td>
<td>RECONSTRUCT STONE MASONRY RAILINGS</td>
<td>SQ YD.</td>
<td>45</td>
<td>$1,200.00</td>
<td>$54,000.00</td>
</tr>
<tr>
<td>14</td>
<td>STONE RAILING CAPS</td>
<td>LIN FT</td>
<td>88</td>
<td>$700.00</td>
<td>$61,600.00</td>
</tr>
<tr>
<td>15</td>
<td>100% REPOINTING OF HEADWALLS AND WINGWALLS</td>
<td>SQ FT</td>
<td>400</td>
<td>$28.00</td>
<td>$11,200.00</td>
</tr>
<tr>
<td>16</td>
<td>STONE MASONRY REPLACEMENT</td>
<td>SQ FT</td>
<td>60</td>
<td>$220.00</td>
<td>$13,200.00</td>
</tr>
<tr>
<td>17</td>
<td>DRAINAGE SYSTEM</td>
<td>LUMP SUM</td>
<td>1</td>
<td>$3,000.00</td>
<td>$3,000.00</td>
</tr>
<tr>
<td>18</td>
<td>WATERPROOFING MEMBRANE</td>
<td>SQ FT</td>
<td>1400</td>
<td>$20.00</td>
<td>$28,000.00</td>
</tr>
<tr>
<td></td>
<td>20% CONTINGENCY</td>
<td>LUMP SUM</td>
<td>1</td>
<td>$83,000.00</td>
<td>$83,000.00</td>
</tr>
<tr>
<td><strong>ESTIMATED PRESERVATION COSTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$494,280</td>
</tr>
</tbody>
</table>
Appendix A. Glossary
Glossary

**Abutment** – Component of bridge substructure at either end of bridge that transfers load from superstructure to foundation and provides lateral support for the approach roadway embankment.

**Appraisal ratings** – Five National Bridge Inventory (NBI) appraisal 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, fair** – A bridge or bridge component of which all primary structural elements are sound, but may have minor deterioration, section loss, cracking, spalling, or scour.

**Condition, good** – A bridge or bridge component which may have some minor deficiencies, but all primary structural elements are sound.

**Condition, poor** – A bridge or bridge component that displays advanced section loss, deterioration, cracking, spalling, or scour.

**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) or N for (not applicable); elements are rated on a scale of 1-3, 1-4 or 1-5 (depending on the element type and material). In all cases condition state 1 is the best condition with condition state 3, 4 or 5 being the worst condition. In rating a bridge’s condition, MnDOT 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.

**Corrosion** – The general disintegration of metal through oxidation.

**Cutwater** – The wedge-shaped end of a bridge pier, designed to divide the current and break up ice.
**Decay** – Deterioration of wood as a result of fungi feeding on its cell walls.

**Delamination** – Surface separation of concrete, steel, glue laminated timber plies etc. into layers.

**Deck geometry** – One of five NBI appraisal 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 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 federal design and geometric standards 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 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 tons according to the AASHTO 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 load demands. A bridge that is posted for load restrictions is not adequate to accommodate present or expected legal truck traffic.

**Deterioration** – Decline in condition of surfaces or structure over a period of time due to chemical or physical degradation.

**Efflorescence** – A deposit on concrete or brick caused by crystallization of carbonates brought to the surface by moisture in the masonry or concrete.

**Extant** – Currently or actually existing.

**Extrados** – The upper or outer surfaces of the voussoirs which compose the arch ring. Often contrasted with intrados.
**Footing** – The enlarged, lower portion of a substructure which distributes the structure load either to the earth or to supporting piles.

**Fracture Critical Members** – Tension members or tension components of bending members (including those subject to reversal of stress) whose failure would be expected to result in collapse of the bridge.

**Functionally obsolete** – The Federal Highway Administration (FHWA) classification of a bridge that does not 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. An appraisal rating of 3 or less for deck geometry, underclearance, approach alignment, structural evaluation or waterway adequacy will designate a bridge as functionally obsolete.

**Gusset plate** – A plate that connects the horizontal and vertical members of a truss structure and holds them in correct position at a joint.

**Helicoidal** – Arranged in or having the approximate shape of a flattened coil or spiral.

**Historic fabric** – The material in a bridge that was part of original construction or a subsequent alteration within the historic period of the bridge (i.e., more than 50 years old). Historic fabric is an important part of the character of the historic bridge and the removal, concealment, or alteration of any historic material or distinctive engineering or architectural feature should be avoided if possible. Often, the character-defining features include important historic fabric. However, historic fabric can also be found on other elements of a bridge that have not been noted as character-defining.

**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.

**Intrados** – The inner or lower surface of an arch. Often contrasted with extrados.

**Inventory rating** – The load level a bridge can safely carry for an indefinite amount of time expressed in 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.

**Keystone** – Wedge-shaped stone, or voussoir, at the crown of an arch.
**Load Rating** – The determination of the live load carrying capacity of a bridge using bridge plans and supplemented by field inspection.

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

**Minnesota Historical Property Record** – A documentary record of an important architectural, engineering, or industrial site, maintained by the Minnesota Historical Society 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** – 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 truck type, expressed in tons or by the rating factor described in design load (see above).

**Pack rust** – Rust forming between adjacent steel surfaces in contact which tends to force the surfaces apart due to the increase in steel volume.

**Pier** – A substructure unit that supports the spans of a multi-span superstructure at an intermediate location between its abutments.

**Pointing** – The compaction of mortar into the outermost portion of a joint and the troweling of its exposed surface to secure water tightness and/or desired architectural effect (when replacing deteriorated mortar).
**Pony truss** – A through bridge with parallel chords and having no top lateral bracing over the deck between the top chords.

**Posted load** – Legal live-load capacity for a bridge which is associated with the operating rating. A bridge posted for load restrictions is inadequate for legal 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. MnDOT’s *Bridge Preservation, Improvement and Replacement Guidelines* 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, slow 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 which 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. MnDOT’s *Bridge Preservation, Improvement and Replacement Guidelines* 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*.

**Ring stone** – One of the separate stones of an arch that shows on the face of the headwall, or end of the arch. Also known as a voussoir.
**Scaling** – The gradual distentegration of a concrete surface due to the failure of the cement surface caused by chemical attack or freeze-thaw cycles or rebar too close to the surface and oxidizing from exposure to chlorides.

**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 a bridge’s vulnerability to scour (see above). MnDOT utilizes letter designations to represent specific descriptions of a bridge’s susceptibility and/or present condition in regards to scour. Range in condition and scour susceptibility does not necessarily correlate alpha numerically to the MnDOT scour code letters so it is important to understand the specific scour description for each MnDOT scour code. The scour codes and descriptions can be found in the “MNDOT Bridge Inspection Field Manual”.

**Section loss** – Loss of a member’s cross sectional area and resulting strength usually by corrosion or decay.

**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.

**Spall** – Depression in concrete caused by a separation of a portion of the surface concrete, revealing a fracture parallel with or slightly inclined to the surface.

**Spring line** – The imaginary horizontal line at which an arch or vault begins to curve. As example, the point of transition from the vertical face of an abutment to the start of arch curvature extending from abutment face.

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

**Stringcourse** – A horizontal band of masonry, generally narrower than other courses and sometimes projecting, that extends across the structure’s horizontal face as an architectural accent. Also known as belt course.

**Structural evaluation** – Condition rating 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.
**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 bridge is also classified as structurally deficient if it has an appraisal rating of 2 or less for its structural evaluation or waterway adequacy. A structurally deficient bridge is restricted to lightweight vehicles; requires immediate rehabilitation to remain open to traffic; or requires maintenance, rehabilitation, or replacement.

**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. MnDOT may use the rating as a basis for establishing eligibility and priority for replacement or rehabilitation. Typically, bridges which are structurally deficient and have sufficiency ratings between 50 and 80 are eligible for federal rehabilitation funds and those which are structurally deficient with sufficiency ratings of 50 and below are eligible for replacement.

**Through truss** – A bridge with parallel top and bottom chords and top lateral bracing with the deck generally near the bottom chord.

**Under-clearances** – One of five NBI appraisal 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 State Aid Operations Statute Rules 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.

**Voussoir** – One of the separate stones forming an arch ring; also known as a ring stone.

**Waterway adequacy** – One of five NBI appraisal ratings. This rating appraises a bridge’s waterway opening and passage of flow under or through the bridge, frequency of roadway overtopping, and typical duration of an overtopping event.
Appendix B. Guidelines for Bridge Maintenance and Rehabilitation based on the Secretary of the Interior’s Standards
The Secretary’s Standards with Regard to Repair, Rehabilitation, and Replacement Situations

Adapted from:

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.
Appendix C. Documents
Additional Electronic Data
Bridge 90646

Historic Data
- Research

Local Data
- 2013 MN Local Historic Bridge Study
- 90646 Returned Form
- Questionnaire MN Local Historic Bridge Study

MnDOT Reports
- Accident Report
- From City of Edina
  - Inspection records from 1973 - 2013
- 90646 Condition Sheet 2010
- 90646 Inspection 10-29-13
- 90646 Inventory 05-29-13

Photos
- 2005 Photos
- 90646_LHB_07-31-13
- 90646_M&H Photos_7-31-13
- 90646 Report Photos

Plans
- Bridge No.281
### Mn/DOT Bridge Inspection Report

**Bridge 90646: Wooddale Ave Over Minnehaha Creek**

**Inspected by:** City of Edina  
**Inspec. Date:** 10-29-2012

**County:** Hennepin  
**City:** Edina  
**Route:** MSAS 150  
**Ref. Pt.:** 022+00.585  
**Length:** 21.0 ft

**Maint. Area:** Roadway Area / Pct. Undis.; **Deck Width:** 40.4 ft

**Local Agency Bridge No.:**  
**Span Type:** Steel Arch  
**Control Section:**  
**NBI Deck:** N  
**Super. N:** N  
**Sub. N:** N  
**Chan:** 6  
**Culv:** 7

**Open, Posted, Closed:** Open  
**Appraisal Ratings - Approach 8:**  
**Waterway 8:**  
**MN Scour Code:** I - Low Risk  
**Def. Stat.:** F.O.  
**Suff. Rate:** 81.7  
**Required Bridge Signs - Load Posting:** Not Required  
**Traffic:** Not Required  
**Horizontal:** Not Required  
**Vertical:** Not Applicable

### Structure Unit: 0

<table>
<thead>
<tr>
<th>ELEM NBR</th>
<th>ELEMENT NAME</th>
<th>ENV INSPECT DATE</th>
<th>QTY CS1</th>
<th>QTY CS2</th>
<th>QTY CS3</th>
<th>QTY CS4</th>
<th>QTY CS5</th>
<th>QTY CS6</th>
</tr>
</thead>
<tbody>
<tr>
<td>407</td>
<td>BITUMINOUS APPROACH</td>
<td>10-29-2012</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10-29-2011</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Notes:**  
- [2007] No deterioration noted.  
- [2009] Long crack along roadway centerline off of N end of culvert. No additional deterioration noted.  
- [2009 - 2012] No additional new deterioration noted.

| 333      | RAILING - OTHER | 10-29-2012       | 98 LF   | 0       | 98      | 0       | N/A     | N/A     |
|          |                | 10-29-2011       | 98 LF   | 0       | 98      | 0       | N/A     | N/A     |

**Notes:**  
- [2007] Fill around storm sewer C.B. to lead N.E. corner. No additional deterioration noted.  
- [2008] Masonry elements are deteriorating (crumbling) throughout. No additional deterioration noted.  
- [2009 - 2012] No additional new deterioration noted.

| 240      | STEEL CULVERT  | 10-29-2012       | 43 LF   | 43      | 0       | 0       | 0       | N/A     |
|          |                | 10-29-2011       | 43 LF   | 43      | 0       | 0       | 0       | N/A     |

**Notes:**  
- [2007] Surface rusting observed along footing connection. Pack rust observed at bolted connection at extreme W end of bridge. No additional deterioration noted.  
- [2008] No additional deterioration noted.  
- [2009] Rusting observed at abandoned outlet in the steel culvert.  
- [2010 - 2012] No additional new deterioration noted.

| 388      | CULVERT HEADWALL | 10-29-2012      | 2 EA    | 0       | 2       | 0       | 0       | N/A     |
|          |                  | 10-29-2011       | 2 EA    | 0       | 2       | 0       | 0       | N/A     |

**Notes:**  
- [2007] Element includes headwall and flares. CSS is warranted based on the condition of the flares at the W end of the culvert. No additional deterioration noted.  
- [2008] Spalled masonry elements at the W end of the S culvert footing. No additional deterioration noted.  
- [2009] Mold/masonry wall is leaning to the N towards creek. Top of NE glare has displaced a little more than an inch.  
- [2010] Both the E masonry wingwall flares have been undermined due to scour action. The assignment of the CSS is not warranted.  
- [2011] Undermining evident under low flow. Portions of the masonry are unsupported in mortar cracking visible at several locations. No additional new deterioration noted.  
- [2012] No additional new deterioration noted.

| 421      | CULVERT FOOTING | 10-29-2012      | 82 LF   | 0       | 82      | 0       | 0       | N/A     |
|          |                  | 10-29-2011       | 82 LF   | 0       | 82      | 0       | 0       | N/A     |

**Notes:**  
- [2007] Surface scale observed along entire footing length. Some spall area noted at W end of footing. No exposed rebar noted. No additional deterioration noted.  
- [2008] Vertical cracks in both footings near the culvert mid-point. Cracks are located under the utility pipe. No additional deterioration noted.  
- [2009] Water may be working its way through a hole at the top of the footing where the steel culvert connects to the footing.  
- [2010] The E end of the N footing has been undermined due to sour action. No additional new deterioration noted.  
- [2011] Gap between the headwall and west end of north footing measured at 0.75" inches. No additional new deterioration noted.  
- [2012] 0.375" gap remains. No additional deterioration noted.

| 357      | PACK RUST       | 10-29-2012      | 1 EA    | 0       | 1       | 0       | 0       | N/A     |
|          |                  | 10-29-2011       | 1 EA    | 0       | 1       | 0       | 0       | N/A     |

**Notes:**  
- [2007] Pack rust located at bolted connection on the extreme W end of the culvert.  
- [2008 - 2012] No additional deterioration noted.
## Mn/DOT BRIDGE INSPECTION REPORT

**BRIDGE 90646  WOODDALE AVE OVER MINNEHAHA CREEK**

**INSP. DATE: 10-29-2012**

<table>
<thead>
<tr>
<th>STRUCTURE UNIT: 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELEM NBR</td>
</tr>
<tr>
<td>360</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- [2007] Element refers to curb settlement at the NW side of the bridge and displacement of NE headwall flare.
- [2008] No additional deterioration noted.
- [2009] No additional deterioration noted.
- [2010] Measured displacement of the SE wingwall flare are: 1 1/2" S and 1" E. No additional new deterioration noted.
- [2011] No additional new deterioration noted.
- [2012] To monitor for southwest wingwall movement, a measurement of 195" was made between the NW intersection of the culvert arch and footing and the paint spot on near mid-height on the wall adjacent to the culvert end.

| 361 | SCOUR | 2 | 10-29-2012 | 1 EA | 0 | 1 | 0 | N/A | N/A |
| | | | 11-03-2011 | 1 EA | 0 | 1 | 0 | N/A | N/A |

**Notes:**
- [2006] Scour hole exists on west end of bridge.
- [2007] Scour holes noted near drain outlets.
- [2008] No additional deterioration noted.
- [2009] No additional deterioration noted.
- [2010] Undermining of the two E masonry wingwall flares and the E portion of the N footing due to scour action. Adverse effects were not evident at the time of the review; although a 6" deep depression had formed behind the SE flare, presumably due to loss of backfill via scour action. Undermining of SW flare remains unchanged. Also, a 4" deep scour hole was measured near the W end of the N footing. The undermining warrants a lowering of the CS1 to CS2. Updated channel section taken. No additional new deterioration noted.

| 904 | CRITICAL FINDING | 2 | 10-29-2012 | 1 EA | 1 | 0 | N/A | N/A | N/A |
| | | | 11-03-2011 | 1 EA | 1 | 0 | N/A | N/A | N/A |

**Notes:**
- [2005] DO NOT DELETE THIS CRITICAL FINDING SMART FLAG.
- [2009 - 2012] None.

| 902 | GUARDRAIL | 2 | 10-29-2012 | 1 EA | 1 | 0 | 0 | N/A | N/A |
| | | | 11-03-2011 | 1 EA | 1 | 0 | 0 | N/A | N/A |

**Notes:**
- [2006] See previous comments.
- [2009] Guardrail is not present.
- [2010 - 2012] No additional new deterioration noted.

| 984 | DRAINAGE | 2 | 10-29-2012 | 1 EA | 0 | 1 | 0 | N/A | N/A |
| | | | 11-03-2011 | 1 EA | 0 | 1 | 0 | N/A | N/A |

**Notes:**
- [2006 - 2012] No deterioration noted.

| 985 | SLOPES | 2 | 10-29-2012 | 1 EA | 1 | 0 | 0 | N/A | N/A |
| | | | 11-03-2011 | 1 EA | 1 | 0 | 0 | N/A | N/A |

**Notes:**
- [2005] The slopes in front of the wingwalls are experiencing some minor erosion.
- [2007 - 2012] No additional new deterioration noted.

| 986 | CURB & SIDEWALK | 2 | 10-29-2012 | 1 EA | 1 | 0 | 0 | N/A | N/A |
| | | | 11-03-2011 | 1 EA | 1 | 0 | 0 | N/A | N/A |

**Notes:**
- [2007] Curb settlement at NW corner of bridge.
- [2008 - 2012] No additional new deterioration noted.

| 987 | ROADWAY OVER CULVERT | 2 | 10-29-2012 | 1 EA | 1 | 0 | 0 | N/A | N/A |
| | | | 11-03-2011 | 1 EA | 1 | 0 | 0 | N/A | N/A |

**Notes:**
- [2007] No deterioration noted.
- [2008] No deterioration noted.
- [2010 - 2012] No additional new deterioration noted.
Mn/DOT BRIDGE INSPECTION REPORT

STRUCTURE UNIT: 0


<table>
<thead>
<tr>
<th>ELEM NBR</th>
<th>ELEMENT NAME</th>
<th>ENV INSPI DATE</th>
<th>QUANTITY</th>
<th>QTY CS 1</th>
<th>QTY CS 2</th>
<th>QTY CS 3</th>
<th>QTY CS 4</th>
<th>QTY CS 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>988</td>
<td>MISCELLANEOUS</td>
<td>2 10-29-2012</td>
<td>1 EA</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11-03-2011</td>
<td>1 EA</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Notes:
[2006] Tree and brush removal required along NW and SW wingwalls.
[2007] Tree and brush removal required along wingwall slopes.
[2008] Tree and brush removal from wingwall slopes. Utility pipe running through the culvert has been partially cut, exposing the insulation. Insulation should be tested for ACM.
[2008] Utility conduit has been removed. Tree and brush removal from headwall slopes.

General Notes:
[1999] RIPRAP NEEDED ALONG NE AND SE CORNERS.
RECONSTRUCT RETAINING WALL NW CORNER. UNDER BRIDGE - RIPRAP ALONG THE NORTH FOOTING - MATCH THE SOUTH SIDE.
[2003] Tree and brush removal is recommended along SW and NW wingwalls.
[2008] Tree and brush removal required along NW and SW wingwalls.
[2007] Insp 08-23-2007 by HLE & JRM. Overcast with light rain and highs in the 70’s.
[2008] Insp 11-10-2008 by HLE and BMD. Sunny with a high of 34°F.
[2009] Insp 09-11-2009 by HLE and JRM. Partly cloudy with times of sunshine with a high of 62°F.
[2010] Insp 10-09-2010 by HLE and AFK. Sunny with a high of 84°F.
[2011] Insp 11-3-2011 by HLE (TKDA) and AFK (Edina). Sunny with a high in the lower 50’s.
[2012] Insp 10-29-2012 by HLE (TKDA) and AFK (Edina). Overcast with a temperature in the mid-40’s. NBI Condition Codes: Channel - 6 based on deterioration & undermining of the bank protection. Culvert - 7 based on corrosion of the arch, and cracking, spalling, and surface scale of the concrete footings.

Inspector's Signature

Reviewer's Signature / Date
### Mn/DOT Structure Inventory Report

**Bridge ID:** 90646  
**WOODDALE AVE over MINNEHAHA CREEK**  
**Date:** 05/29/2013

<table>
<thead>
<tr>
<th><strong>GENERAL</strong></th>
<th><strong>ROADWAY</strong></th>
<th><strong>INSPECTION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Agency Br. No.</td>
<td>Bridge Match ID (TIS) 1</td>
<td>Deficient Status F.O.</td>
</tr>
<tr>
<td>District</td>
<td>Roadway O/A Key 1-ON</td>
<td>Sufficiency Rating 61.7</td>
</tr>
<tr>
<td>County</td>
<td>Route Sys/Nbr MSAS 150</td>
<td>Last Inspection Date 10-29-2012</td>
</tr>
<tr>
<td>City</td>
<td>Roadway Name or Description WOODDALE AVE</td>
<td>Inspection Frequency 12</td>
</tr>
<tr>
<td>Township</td>
<td>Roadway Function MAINLINE</td>
<td>Inspector Name EDINA</td>
</tr>
<tr>
<td>Desc. Loc.</td>
<td>Roadway Type 2 WAY TRAF</td>
<td>Structure A-OPEN</td>
</tr>
<tr>
<td>Sect., Twp., Range</td>
<td>Control Section (TH Only)</td>
<td><strong>NSI CONDITION RATINGS</strong></td>
</tr>
<tr>
<td>Latitude</td>
<td>Ref. Point (TH Only)</td>
<td>Deck</td>
</tr>
<tr>
<td>Longitude</td>
<td>Date Opened to Traffic</td>
<td>Superstructure</td>
</tr>
<tr>
<td>Custodian</td>
<td>Detour Length 7 mi.</td>
<td>Substructure</td>
</tr>
<tr>
<td>Owner</td>
<td>Lanes 2 Lanes ON Bridge</td>
<td>Channel</td>
</tr>
<tr>
<td>Inspection By</td>
<td>ADT (YEAR) 5,300 (2005)</td>
<td>Culvert</td>
</tr>
<tr>
<td>BMU Agreement</td>
<td>HCADT</td>
<td><strong>NSI APPRAISAL RATINGS</strong></td>
</tr>
<tr>
<td>Year Built</td>
<td>Functional Class. URBAN LOCAL</td>
<td>Structure Evaluation 4</td>
</tr>
<tr>
<td>Year Fed Rehab</td>
<td></td>
<td>Deck Geometry 3</td>
</tr>
<tr>
<td>Year Remodeled</td>
<td></td>
<td>Underclearances N</td>
</tr>
<tr>
<td>Temp</td>
<td></td>
<td>Waterway Adequacy 8</td>
</tr>
<tr>
<td>Plan Avail.</td>
<td></td>
<td>Approach Alignment 8</td>
</tr>
<tr>
<td><strong>STRUCTURE</strong></td>
<td><strong>ROW DIMENSIONS</strong></td>
<td><strong>SAFETY FEATURES</strong></td>
</tr>
<tr>
<td>Service On</td>
<td></td>
<td>Bridge Railing 0-SUBSTANDARD</td>
</tr>
<tr>
<td>Service Under</td>
<td>Roadway Width 31.0 ft</td>
<td>GR Transition 0-SUBSTANDARD</td>
</tr>
<tr>
<td>Main Span Type</td>
<td></td>
<td>Appr. Guardrail 0-SUBSTANDARD</td>
</tr>
<tr>
<td>Main Span Detail</td>
<td>Median Width 31.0 ft</td>
<td>GR Termini 0-SUBSTANDARD</td>
</tr>
<tr>
<td>Appr. Span Type</td>
<td></td>
<td><strong>IN DEPTH INS.</strong></td>
</tr>
<tr>
<td>Appr. Span Detail</td>
<td></td>
<td>Frac. Critical</td>
</tr>
<tr>
<td>Skew</td>
<td></td>
<td>Underwater</td>
</tr>
<tr>
<td>Culvert Type</td>
<td></td>
<td>Pinned Asby.</td>
</tr>
<tr>
<td>Number of Spans</td>
<td>Structure Flared NO</td>
<td><strong>WATERWAY</strong></td>
</tr>
<tr>
<td>MAIN: 1</td>
<td>Parallel Structure NONE</td>
<td>Drainage Area</td>
</tr>
<tr>
<td>AP: 0</td>
<td>Field Conn. ID</td>
<td>Waterway Opening 100 sq ft</td>
</tr>
<tr>
<td>TOTAL: 1</td>
<td>Cantilever ID</td>
<td>Navigation Control NO PRMT REQD</td>
</tr>
<tr>
<td>Main Span Length</td>
<td>Foundations</td>
<td>Pier Protection NOT APPL</td>
</tr>
<tr>
<td>18.0 ft</td>
<td>Abut. CONC - SPRD SOIL</td>
<td>Nav. Vert./Horz. Cir.</td>
</tr>
<tr>
<td>21.0 ft</td>
<td>Historic Status ELIGIBLE</td>
<td>MN Scour Code I-LOW RISK</td>
</tr>
<tr>
<td>Deck Width</td>
<td>On-Off System OFF</td>
<td>Scour Evaluation Year 1993</td>
</tr>
<tr>
<td>40.4 ft</td>
<td></td>
<td><strong>CAPACITY RATINGS</strong></td>
</tr>
<tr>
<td>Deck Material</td>
<td></td>
<td>Design Load UNKN</td>
</tr>
<tr>
<td>N/A</td>
<td></td>
<td>Operating Rating HS 10.00</td>
</tr>
<tr>
<td>Wear Surf Type</td>
<td></td>
<td>Inventory Rating HS 12.00</td>
</tr>
<tr>
<td>BITUMINOUS</td>
<td></td>
<td>Posting</td>
</tr>
<tr>
<td>Wear Surf Install Year</td>
<td></td>
<td>Rating Date 06-01-1973</td>
</tr>
<tr>
<td>Wear Course/Fill Depth</td>
<td></td>
<td><strong>BRIDGE SIGNS</strong></td>
</tr>
<tr>
<td>2.00 ft</td>
<td></td>
<td>Posted Load NOT REQUIRED</td>
</tr>
<tr>
<td>Deck Membrane</td>
<td>Primer Type</td>
<td>Traffic NOT REQUIRED</td>
</tr>
<tr>
<td>NONE</td>
<td>Finish Type</td>
<td>Horizontal NOT REQUIRED</td>
</tr>
<tr>
<td>Deck Protect.</td>
<td></td>
<td>Vertical NOT APPLICABLE</td>
</tr>
<tr>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deck Install Year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structure Area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>845 sq ft</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roadway Area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>646 sq ft</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sidewalk Width - L/R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curb Height - L/R 0.50 ft</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rail Codes - L/R 01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>01</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
