Bridge R0437, owned by Pope County, carries Old Mill Pond Road over the East Branch of the Chippewa River in the community of Terrace. The bridge was originally constructed in 1903 by Jonas M. Danelz, a local resident who re-established milling operations in the community of Terrace that same year. The bridge is significant as a contributing structure in the National Register listed Terrace Mill Historic District and the National Register listed Terrace Historic District.

Bridge R0437 is a single span stone masonry arch structure. The arch spans about 25 feet and the overall length of the structure including the wingwalls is 98 feet. The headwalls and wingwalls are grout filled and reinforced-concrete block with stone masonry veneer. Bridge R0437 carries pedestrian traffic over the Chippewa River at the Terrace Mill Historic District in Pope County. The bridge is adjacent to Bridge 1816 that carries County State-Aid Highway (CSAH) 21 over the Chippewa River.

The bridge is in good condition and appears to adequately serve its purpose of carrying pedestrian traffic over the East Branch of the Chippewa River. With proper maintenance, stabilization, and preservation activities, it is believed that Bridge R0437 can continue to serve in its present capacity for 20 years or longer. An abridged report is presented because Bridge R0437 has been recently rehabilitated.

The bridge was rehabilitated in 1998, which required reconstruction of the headwalls, resurfacing the walkway, and tuck-pointing of the masonry arch. The original arch barrel was supported by false work forms during rehabilitation and the original arch remains. New concrete block headwalls and wingwalls were added and a stone veneer using original stone was added to exterior surfaces.

Any work on Bridge R0437 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 R0437 – PEDESTRIAN over E BR CHIPPEWA RIVER

PROJECT LOCATION
POPE COUNTY
SEC. 33, TO 124NN, R 37W
UTM ZONE: 15        NAD: 27
USGS QUAD NAME: TERRACE
EASTING: 1045983 ft.
NORTHING: 16543079 ft.
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 Abridged 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. Due to private ownership, recently completed engineering/preservation studies, or recently executed rehabilitation projects, a small number of bridges were identified for abridged reports. An abridged report compiles readily available information, especially data about the bridge’s historic significance. Additionally, recent rehabilitation work that has been completed is described and documented with photographs where available. Maintenance activities directed toward continued structure serviceability are recommended where appropriate.

Recommendations are not included within the Abridged Bridge Reports. However any future work should be 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) prepared Guidelines, which 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
historic bridge preservation 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 historic 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 Abridged Bridge Report will provide the bridge owner and other interested parties with detailed
information related to the historic nature of the bridge and varied information concerning the condition of
the bridge depending on information furnished at the time of report preparation. This information will
enable historic bridge owners to make more informed decisions when planning for their historic
properties.
Description
The Terrace Mill Stone Arch Bridge, also known as Bridge R0437 by the Minnesota Department of Transportation (MnDOT), is located in Terrace, Pope County, Minnesota and is a part of the Terrace Mill Historic District (PO-CFL-006) and the Terrace Historic District (PO-CFL-007). The bridge is located approximately 200 feet north of the Terrace Mill and spans the east branch of the Chippewa River. A spillway from the nearby mill dam runs under the bridge and into the Chippewa River. The stone arch bridge is located directly adjacent to the west side of Bridge 1816, which was constructed in 1915, and carries present-day County State Aid Highway (CSAH) 21 over the river; Bridge R0437 carries only pedestrian and bicycle traffic. The east side of Bridge R0437 abuts Bridge 1816, only the west side of Bridge R0437 is visible.

Bridge R0437 is a single-span masonry arch bridge that was originally constructed in 1903, and rehabilitated in 1998. An inscription on the keystone reads “JMD 1903.” Bridge R0437 has a structure length of 30 feet, a span length of 25 feet, and a deck width of 18 feet. Abutments on the north and south sides anchor the bridge into the steep slopes of the Chippewa River bank. The abutments are comprised of the original stone that now acts as a veneer over a new reinforced-concrete arch and footing placed on over the existing arch and behind the original stone abutment. The non-load bearing closed spandrels on the bridge are constructed of concrete block and faced with the original stone. The riverstones are applied in a random coursing with raked joints. The voussoir stones are slightly larger and have been shaped into squares and rectangles as compared to the smaller, rounder stones covering the spandrels. The bridge retains its original arch barrel, which is constructed of stone and carries the load of the span. There is not a defined capstone or parapet.

The deck is approximately 17 feet wide and is comprised of a four-inch thick concrete sidewalk. On the west side of the bridge, 4-foot-wide sidewalks approach the bridge from both the north and south, converging at the deck. The east side approaches are covered in turf. The west side of the bridge, along with the portion of the east side that is directly over the arch, features a cedar wood railing. The railings have 4-by-4-inch-square posts and 2-by-6-inch and 2-by-8-inch rails.

Significance
Over time, three mills have stood on the site of the present-day mill in Terrace. The first mill was built c. 1870 and was destroyed by fire in 1888. A second mill was built in 1888, but was disassembled and moved to the nearby village of Brooten in the mid-1890s when the railroad through Brooten was constructed. The third and present mill and the associated stone arch bridge over the east branch of the Chippewa River were built in 1903 by Jonas Magnus Danelz. Little is known about Danelz; in addition to
the Terrace Mill, he is known to have run a flour mill in Swift Falls in the early 1870s, and operated two additional flour mills in Canada before those were destroyed by fire. While it appears that Danelz was capable in the milling industry, it is unknown whether he had any formal engineering training that would have aided him in designing either the mill or the stone arch bridge.

From its construction in 1903 until 1915, Bridge R0437 functioned as a vehicular roadway over the Chippewa River from the north. The bridge served an important function by providing farmers who lived on the north side of the river, and their supply of grain, access to and from the mill. In 1915, a steel beam bridge (Bridge 1816) was constructed to replace the stone arch bridge. The new structure was built adjacent to the northeast side of the stone arch bridge and carried what is now CSAH 21 over the river. Upon the completion of Bridge 1816, the stone arch bridge was abandoned. The Terrace Mill continued to operate until closing in 1967.

In 1979 the non-profit Terrace Mill Foundation (TMF) incorporated and began a 30-year commitment to restoring and maintaining the mill and property. That same year, the Terrace Mill Historic District, which includes the mill, the mill dam, the raceway system, Bridge R0437 and Bridge 1816, and the Miller’s House, was listed in the National Register of Historic Places. Soon after the Terrace Historic District, a well-preserved example of a small rural community developed around local milling operations, was also listed in the National Register. When the TMF incorporated and purchased the Terrace Mill site, one of its main priorities was to restore the mill and its associated properties to their original condition. Though it would be years before the TMF would be able to rehabilitate the bridge, as early as 1989, the TMF board began deliberations about what could be done to restore Bridge R0437.

Rehabilitation efforts began on May 11, 1998. Lakeview Construction of Glenwood, Minnesota was the contractor. As part of the rehabilitation, the arch barrel was repointed, and any severely deteriorated stones were repaired or replaced in-kind. The spandrel walls and abutments were disassembled and reconstructed using salvaged and matching new stone. To strengthen the spandrels and abutments, new concrete block walls were added behind them, so they are not visible. A wooden railing was added to the bridge to replicate a railing that existed on the structure during the historic district’s period of significance. The design was based on photos of the bridge after its construction. At the same time, the adjacent Bridge 1816 (determined not eligible in 2014 due to alterations) was also rehabilitated and a sheet pile weir was constructed on the east side of Bridge 1816 to ensure constant water levels and to control the flow of water on the spillway. Reopened in the fall of 1998, Bridge R0437 is now a pedestrian-only bridge that enables visitors to understand and experience how the bridge contributed to the functioning of the Terrace Mill. SHPO concurred that the rehabilitation efforts for R0437 had no adverse effect to the bridge or historic district.

While the bridge is not individually eligible due to alterations, rehabilitations efforts did not affect its integrity as a contributing resource to the Listed Terrace Mill Historic District. Bridge R0437 remains in its original location; adjacent to the Terrace Mill. As such it retains its integrity of location and setting, and is still carries a load. Bridge R0437 was rehabilitated in 1998 in accordance with the Secretary of Interior Standards. Deteriorated features were repaired or replaced in-kind on a limited basis. Concrete block walls were added behind the spandrel walls and abutments as part of the rehabilitation, and while they are not visible, the replacement of original material compromises integrity of design and materials.
However, Bridge R0437 retains sufficient overall integrity to convey its historic feeling and association with the mill and continues to be a contributing resource within the Terrace Mill Historic District and the Terrace Historic District.

Bridge R0437 is a contributing resource to the Terrace Mill Historic District and the Terrace Historic District, as it played an important role in the function and commercial success of the mill by providing access to the mill from farms on the north side of the Chippewa River. The bridge benefitted both the local farmers who travelled to the mill to have their grain processed and the mill itself, as it facilitated the opening of the mill to a much larger market area by providing customer access to the site from lands across the river.

**Historic Context**

Minnesota Masonry-Arch Highway Bridges, 1870-1945

**National Register Status**

Contributing to Listed Historic District

**Criterion A Significance**

N/A

**Criterion C Significance**

N/A

**Historic District**

Terrace Mill

**SHPO inventory number**

PO-CFL-009

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


Field inspection by LHB, Inc. and Mead & Hunt, Inc., June 27, 2013.

Gaffney, Andrea


Hess, Jeffrey


Minnesota Historical Society [MHS]


National Park Service [NPS]
II – Historic Data


Pope County Highway Department
1995 *District 4 Transportation Enhancement Fund Application*. Terrace Mill Restoration Folder, on file at the Pope County Historical Society, Glenwood, Minnesota.

Pope County Recorder’s Office


Schluter, Dean
1998 *Stone Arch Bridge Before Restoration Photographs*. Terrace Mill Restoration Folder, on file at the Pope County Historical Society, Glenwood, Minnesota.

Swift County History

*The Starbuck Times*
1975 “Will the Terrace Mill Survive?” 29 October. Starbuck, Minnesota.

Terrace Mill Foundation
1995 *Project Activity Report Form MHS Grant Number 121-94-1722*. Terrace Mill Restoration Folder, on file at the Pope County Historical Society, Glenwood, Minnesota.


Widseth Smith Nolting
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: Masonry arch bridge with stone veneer on headwalls spandrels that aesthetically conveys the structure’s association with other properties within the historic district and of the same period.
Feature 2: Setting within the Terrace Mill Historic District.
Minneota Department of Transportation (MnDOT)
Local Historic Bridge Report - Abridged

III – Bridge Data

Bridge Number: R0437

**Date of Construction (remodel)**: 1903 (1998)

**Common Name (if any)**: Stone Arch Bridge

**Location**
- Feature Carried: PEDESTRIAN
- Feature Crossed: E Br Chippewa River
- County: Pope
- Ownership: Pope County

**MnDOT Structure Data**
- Main Span Type: 812 MASONRY ARCH
- Main Span detail: Filled Spandrel
- Substructure Type - Foundation Type:
  - Abutment: N-Not Applicable - N-Not Applicable
  - Piers: N-Not Applicable - N-Not Applicable
- Total Length: 29.7 ft
- Main Span Length: 25 ft
- Total Number of Span(s): 1
- Skew (degrees): 0
- Structure Flared: No Flare
- Roadway Function: Rural, Minor Collector
- Custodian/Maintenance Type: County

**Reported Owner Inspection Date**: 10/2/2012

**Sufficiency Rating**: N/A

**Operating Rating**: PED

**Inventory Rating**: PED

**Structure Status**: A - Open

**Posting**: VEH: SEMI: DBL: PED

**Current Condition Code**
- Deck: N
- Superstructure: N
- Substructure: N
- Channel and Protection: N
- Culvert: 7

**Current Appraisal Rating**
- Structural Evaluation: N
- Deck Geometry: N
- Underclearances: N
- Waterway Adequacy: 8
- Approach Alignment: N

**Fracture Critical**: No

**Deficient Status**: N/A

**Roadway Clearances**
- Roadway Width: N/A
- 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: 1 (2009)
- Truck ADT Percentage: Not given
- Bypass Detour length: 99 miles
- Number of Lanes: N/A (PED)

**Waterway Data**
- Scour Code: E-CULVERT

**Non-MnDOT Data**

**Approach Roadway Characteristics**
- Lane Widths: 6' Walk
- Shoulder Width: N/A (PED)
- Shoulders Paved or Unpaved: N/A (PED)
- Roadway Surfacing: Conc Walk

**Location of Plans**
- Pope County

**Plans Available**: 1998 Rehabilitation Plans

* 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 R0437 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 R0437 is a single span stone masonry arch structure. The arch spans about 25 feet and the overall length of the structure including the wingwalls is 98 feet. The headwalls and wingwalls are grout filled and reinforced-concrete block with stone masonry veneer. Bridge R0437 carries pedestrian traffic over the Chippewa River at the Terrace Mill Historic District in Pope County. The bridge is adjacent to Bridge 1816 that carries CSAH 21 over the Chippewa River; therefore, there are no wingwalls on the east face of the arch. The bridge walking surface is concrete and grass. Timber railings are mounted to concrete curbs atop the stone headwall. There is approximately 16 feet of clear width between the timber railings. The timber railings are 3'-6" tall.

Serviceability Observations
The bridge is closed to vehicular traffic. The bridge serves pedestrian traffic exclusively (vehicle traffic is prevented from using the bridge by curbs and barrier railings).

Condition Observations

Roadway Surface
The existing concrete walkway is in good condition with no apparent significant deficiencies noted.

Bridge Railings
The timber bridge railings are in good condition with no apparent significant deficiencies noted.

Stone Masonry Headwalls and Wingwalls
The stone masonry veneer headwalls and wingwalls are in good condition. A small section of veneer was missing from the south headwall near the ground line. Headwall masonry veneer appears to be granitic type field stone with chiseled to nearly flat exposed surface.

Stone Masonry Arch
The stone masonry arch was noted to be in good condition with no significant deficiencies. Structural arch stones appear to be softer sedimentary type stone (limestone, dolomite etc.).

Substructures
The condition of the substructures and foundation that were placed in 1998 is unknown. The headwall and abutment at the south springing line were slightly undermined/ scoured at the same location of the missing veneer noted above.
Approach Observations

NA

Date of Engineering Site Visit by LHB
June 27, 2013
Condition 1: Bridge west elevation, looking southeast

Condition 2: Walking surface, looking north (note adjacent bridge)
Condition 3: Wingwall masonry veneer

Condition 4: Underside of stone arch
Condition 5: Underside of arch looking east

Condition 6: Weir structure east of bridge
Overall Recommendations
The overall condition of the bridge can be described as good. The bridge was completely rehabilitated in 1998, the spillway was resurfaced in 2006 and appears to be in good condition. An electronic copy of the rehabilitation plans is available from MnDOT CRU (see Appendix C for all electronic resources provided to MnDOT CRU as part of this bridge report).

Recommended Stabilization Activities
None.

Recommended Preservation Activities
There are no required preservation activities noted at this time. The noted scouring at the spring line of the south abutment and missing stone veneer (approximately 3 square feet) at the southwest corner near the spring line should be monitored for potential future repair needs. At this time these issues do not appear to be jeopardizing the integrity of the structure.

Recommended Annual Maintenance Activities

1. Flush bridge headwalls and railings each spring with water to remove dirt and salt residue, especially east headwall that is adjacent to Bridge 1816. 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.
Summarized Maintenance Construction Cost Estimate

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 or from a previous study. 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. Only through a thorough review of options and comprehensive structural and historic assessment can a definitive conclusion for replacement of historic elements be formed.

The opinion of probable maintenance cost provided below is presented in 2013 dollars. This cost was developed without benefit of a detailed, thorough bridge inspection, bridge survey or completion of preliminary design for the estimated work. The estimated cost represents an opinion based on background knowledge of historic unit prices and comparable work performed on other structures. The opinion of cost is intended to provide a programming level of estimated cost. This cost 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 has been included in the maintenance cost estimate.

Maintenance Cost (refer to the work item breakdown on the next page)

Opinion of Annual Cost- Maintenance Activities: $1,800
### MAINTENANCE, STABILIZATION & PRESERVATION COST ESTIMATE (2013 DOLLARS)

**Bridge No. R4037**  
October 25, 2013

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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 R0437

Historic Data
- Research

Local Data
- FW Scanned image from Pope County Hwy Dept (3).msg
- Minnesota Local Bridge Study Meeting Handout.pdf
- Pope County Handout.pdf
- R0437 FW Scanned image from Pope County Hwy Dept (2).msg
- R0437 ReportReturned with comments.pdf

MnDOT Reports
- Reports from City
- R0437 Condition Sheet 2010.pdf
- R0437 Inspection 10-02-12.pdf
- R0437 Inventory 05-29-13.pdf

Photos
- 2012 (Keystone Bridge Info.JPG)
- Historic Photos
- R0437 M&H Photos 6-27-13
- R0437 Photos 2007
- R0437_LHB_06-27-13
- Report Photos

Plans
- 1998 Construction Plans
Mn/DOT BRIDGE INSPECTION REPORT

Inscribed by: POPE COUNTY

BRIDGE R0437 PEDESTRIAN OVER E BR CHIPPEWA RIVER INSPE. DATE: 10-02-2012

County: POPE Location: 0.1 Mls Of Jct CSAH 23 Length: 29.7 ft
City: CSDA
Section: 33 Township: 124NN Range: 37W Local Agency Bridge Nbr:
Span Type: MASONRY ARCH

Open, Posted, Closed: OPEN

Appraisal Ratings - Approach: N Waterway: 8
MN Scour Code: E-CULVERT Def. Stat: N/A Sulf Rate: N/A

Required Bridge Signs - Load Posting: NOT REQUIRED Traffic: NOT REQUIRED
Horizontal: NOT REQUIRED Vertical: NOT APPLICABLE

STRUCTURE UNIT: 0

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General Notes: THE CEDAR RAILING WAS POWER WASHED AND TREATED WITH A SEALER. BLN '12

Inspector's Signature

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

**Bridge ID:** R0437  
**Description:** Pedestrian over E BR CHIPPEWA RIVER  
**Date:** 05/29/2013

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### *STRUCTURE* +

| Service On | PED-BICYCLE |
| Service Under | STREAM |
| Main Span Type | MASONRY ARCH |
| Main Span Detail | |
| Appr. Span Type | |
| Appr. Span Detail | |
| Skew | |
| Culvert Type | 29'X15' ARCH |
| Barrel Length | |
| Number of Spans | |
| MAIN: 1 APPR: 0 TOTAL: 1 |
| Main Span Length | 25.0 ft |
| Structure Length | 29.7 ft |
| Deck Width | 17.5 ft |
| Deck Material | N/A |
| Wear Surf Type | N/A |
| Wear Surf Install Year | |
| Wear Course/Fill Depth | |
| Deck Membrane | NONE |
| Deck Protect. | N/A |
| Deck Install Year | |
| Structure Area | 520 sq ft |
| Roadway Area | |
| Sidewalk Width - L/R | |
| Curb Height - L/R | |
| Rail Codes - L/R | |

### *ROADWAY DIMENSIONS* +

| Vertical Clearance | |
| Roadway Width | |

### *SAFETY FEATURES* +

| Structure Flared | NO |
| Parallel Structure | NONE |
| Field Corn. ID | |
| Cantilever ID | |
| Foundations | |
| Abut. | N/A |
| Pier | N/A |
| Historic Status | ON REGISTER |
| On-Off System | OFF |

### *PAINT* +

| Year Painted | Pct. Unsound |
| Painted Area | |

### *WATERWAY* +

| Drainage Area | 100 sq ft |
| Waterway Opening | |
| Navigation Control | NO PRMT REQS |
| Pier Protection | NOT APPL |
| Nav. Vert./Horz. Ctr. | |
| Nav. Vert. Lift Bridge Clear. | |
| Scour Evaluation Year | |
| Scour Evaluation Year | |

### *CAPACITY RATING* +

| Design Load | PED |
| Operating Rating | PED |
| Inventory Rating | PED |
| Posting | |
| Rating Date | |

### Mn/DOT Permit Codes

| A: N | B: N | C: N |