Bridge 5744, also known as the Split Rock Bridge, is located at the western boundary of the Split Rock Creek State Park in Pipestone County. It carries Township Road 254 over Split Rock Creek, approximately 8 miles southwest of Pipestone. It is owned by Eden Township. The bridge was constructed as a Works Progress Administration (WPA) project and was completed in 1938. The Split Rock Bridge is listed in the National Register for its high artistic value as an outstanding example of an ornamental park bridge and as the largest stone-arch span of any active bridge in Minnesota.

Bridge 5744 is a stone-arch bridge with a single-span of 50 feet. The structural arch, abutments, headwalls, wingwalls, and railings are built with local quartzite stone. The semicircular stone arch rises from stone abutment walls. The roadway above the arch is paved with bituminous and measures 24 feet between the stone curbs, which form the base of the railings.

Bridge 5744 is in overall fair condition and appears to adequately serve its purpose of carrying vehicular and pedestrian traffic. The most significant defects in the structure include masonry mortar that has begun to crack and fail, several areas where the stone appears to be misaligned from its original position, and lack of proper internal drainage. With proper maintenance, stabilization and preservation activities it is believed Bridge 5744 could continue to serve in its present capacity for 20 years or longer.

Any work on Bridge 5744 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 5744 – TWP 254 over SPLIT ROCK CREEK

PROJECT LOCATION
PIPESTONE COUNTY
SEC. 22, TO 105NN, R 46W
UTM ZONE: 14 NAD: 27
USGS QUAD NAME: PIPESTONE SOUTH
EASTING: 753104 ft. 
NORTHING: 15962495 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 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. 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.
I – Project Introduction

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 report.

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 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.
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**
Works Progress Administration (WPA)

**Designer/Engineer**
Albert G. Plagens; Elmer Keeler, Pipestone County Highway Department

**Description**
The Split Rock Bridge is a single-span stone-arch bridge that carries Township Road 254 over Split Rock Creek. The bridge is located in a rural area of Pipestone County, approximately 8 miles southwest of Pipestone. Surviving in unaltered condition, the bridge forms part of the western boundary of the Split Rock Creek State Park.

The Split Rock Bridge is constructed of locally quarried, bluish-pink Sioux Quartzite blocks with a split-faced surface. Symmetrically framed by stepped, flared, random-ashlar wingwalls, the bridge displays a single segmental arch with random-ashlar headwalls. Rising 12 feet over a span of 50 feet, the arch springs about 14 feet above grade from coursed-ashlar abutments. The overall width of the bridge is about 28 feet. Except for oversized keystones, the rectangular ring stones are of uniform size and shape. Masonry joints are about one-half-inch thick. Surmounted by a well-defined cap stones, the parapets rise above roadway level to serve as railings. At the south end of the east railing, a commemorative stone plaque bears the inscription: "Split Rock Bridge/Works Progress/Administration/Project/1938."

**Significance**
In 1935 state and federal officials authorized the construction of a masonry dam across Split Rock Creek in the southwest corner of Pipestone County. The project had both short- and long-term goals. It aimed at providing immediate employment for the local citizenry, as well as future recreational opportunities for the entire region. By impounding the waters of Split Rock Creek, the dam created the county's only lake, intended as the nucleus of Split Rock Creek State Park. The general plan also included the construction of a stone-arch bridge on the park's access road, just downstream from the dam. Although funded as separate projects, the bridge and dam were conceived as an integrated landscape design. As described in Bridge 5744's National Register nomination, "rising above the surrounding prairies, the two massive masonry structures form a visually arresting point-and-counterpoint of delicately colored pink Sioux Quartzite."

In December 1936, as the dam was nearing completion, the Works Progress Administration (WPA) submitted final specifications for the stone-arch bridge to the Minnesota State Highway Department. The specifications and presumably the plans were prepared by Pipestone County Highway Engineer Elmer Keeler and Albert G. Plagens, a consulting architect from New Ulm, Minnesota. Plagens is best known for his work on another New Deal project, the WPA-sponsored, Moderne-style Public Library and Historical Museum in New Ulm. Construction on the bridge commenced in 1937 using Sioux Quartzite quarried a few miles away near the city of Jasper, long-known for its building stone and accomplished masons. The bridge was completed in 1938 for an approximate cost of $46,000.
WPA bridges were typically designed in two stylistic trends: a Rustic, traditional style or a WPA/government Deco Moderne style. Rustic style bridges were often found in parks or park-like settings and featured wood, stone, or stone veneer construction. The Split Rock Bridge reflects the WPA Rustic style, and was clearly intended to showcase the area's masonry tradition. On most New Deal bridge projects in Minnesota, stonework was used only as a decorative veneer. In contrast, the Split Rock Bridge is an authentic, load-bearing stone arch with an impressive 50-foot span. Instead of the Moderne or historic revival styles customarily employed during the period, the bridge has an almost modernist simplicity, which focuses attention on the natural colors and textures of the local Sioux Quartzite.

Split Rock Bridge survives unaltered and displays a high level of integrity. Its historic rural setting remains with the associated dam and park to the east and open prairie to the west, thus retaining integrity of location, setting, feeling, and association. The masonry has been repointed, in some areas, in a manner consistent with the original technique, and the bridge retains integrity of design, materials, and workmanship. The period of significance is 1938, coinciding with its construction date.

Bridge 5744 is listed in the National Register of Historic Places Criterion C in the area of Engineering as an outstanding example of a stone arch park bridge, achieving its aesthetic effect through the purity of its form and the beauty of its WPA Rustic style random ashlar masonry. In addition, the bridge displays an exceptional span length of 50 feet, the largest stone-arch span of any active bridge in the state. It is significant within the Minnesota Masonry-Arch Highway Bridges MPDF. It meets the Registration Requirements by displaying exceptional masonry work and a span length greater than 30 feet. It also meets the Registration Requirements as an excellent example of a park masonry-arch highway bridge.

Additional research, study, and evaluation of Split Rock Creek Park are necessary to determine if the bridge is contributing to a historic district under the Federal Relief Construction Multiple Property Documentation Form Registration Requirements under the Social and Recreational Facilities property type.

**Historic Context**

Minnesota Masonry-Arch Highway Bridges, 1870-1945
Federal Relief Construction in Minnesota, 1933-1941

**National Register Status**

Listed (Individually)

**Criterion A Significance**

N/A

**Criterion C Significance**

Engineering: High artistic value; Important type; Variation of type

**Historic District**

N/A

**SHPO inventory number**

PP-EDN-001
Sources Used to Compile Section II -- Historic Data


Field inspection by LHB, Inc. and Mead & Hunt, Inc., 2 October, 2013.
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 single-span stone-arch bridge by the WPA.
Feature 2: Overall aesthetics of the stone arch and wingwalls as revealed through the use of local Sioux Quartzite laid in a random-ashlar pattern, a defined arch ring, and stepped wingwalls.
Minnesota Department of Transportation (MnDOT)  
Local Historic Bridge Report

III – Bridge Data  

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**Location**
- Feature Carried: TWP 254
- Feature Crossed: Split Rock Creek
- County: Pipestone
- Ownership: Eden Township

**MnDOT Structure Data**
- Main Span Type: 812 MASONRY ARCH
- Main Span detail: SPANDREL FILLED ARCH
- Abutment: 4-Masonry - 0-Unknown
- Piers: N-Not Applicable - N-Not Applicable
- Total Length: 67.5 ft
- Main Span Length: 50 ft
- Total Number of Span(s): 1
- Skew (degrees): 0
- Structure Flared: No Flare
- Roadway Function: Rural, Local

**Reported Owner Inspection Date**  
7/12/2012

**Sufficiency Rating**  
80.3

**Sufficiency Rating**  
HS 24

**Inventory Rating**  
HS 18

**Structure Status**  
A - Open

**Posting**  
VEH: SEMI: DBL:

**Design Load**  
UNKN

**Current Condition Code**
- Deck: 6
- Superstructure: 5
- Substructure: 5
- Channel and Protection: 6
- Culvert: N

**Current Appraisal Rating**
- Structural Evaluation: 5
- Deck Geometry: 6
- Underclearances: N
- Waterway Adequacy: 8
- Approach Alignment: 8

**Fracture Critical**  
No

**Deficient Status**  
ADEQ

**Roadway Clearances**
- Roadway Width: 24.2 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: 60 (1997)
- Truck ADT Percentage: Not given
- Bypass Detour length: 4 miles
- Number of Lanes: 2

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

**Non-MnDOT Data**

**Approach Roadway Characteristics**
- Lane Widths: N:11.5 ft ; S: 12 ft
- Shoulder Width: N: 5 ft ; S: 3 ft
- Shoulders Paved or Unpaved: N: Paved; S: Unpaved
- Roadway Surfacing: N: Bituminous; S: Aggregate

**Location of Plans**  
Pipestone County

**Plans Available**  
1935 Original 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 5744 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 5744, Township Road 254 over Split Rock Creek, is a stone-arch bridge with a single-span of 50 feet. The structural arch, abutments, headwalls, wingwalls, and railings are comprised of quartzite stone, which was sourced from a local quarry. The semicircular stone arch rises from stone abutment walls, which project approximately 14 feet from the stream bed. The underside arch reaches a height of approximately 12 feet above the arch spring line. The roadway is paved with bituminous and measures 24 feet between the stone curbs, which are integral with the railings.

Bridge 5744 is in overall fair condition. The County reported that in 1993, the dam upstream of the bridge failed. The County also stated that the rushing water applied tremendous forces to the bridge, but there was little noticeable damage. In 2001, the bridge was repointed using state grant funds for historic properties. The far south end of the west railing (above the wingwall) was hit by a maintenance vehicle. This portion of the rail has been repaired. The most significant defects in the structure include masonry mortar that has begun to crack and fail, several areas where the stone appears to be misaligned from its original position, and lack of proper internal drainage.

Serviceability Observations

The bridge is located on a rural township road and is currently open to vehicular traffic with no apparent load posting restrictions from legal loads.

Condition Observations

Roadway

The bituminous roadway is in fair condition. Records state that the road was overlaid in 2010. There is transverse cracking throughout the driving surface over the bridge. These cracks have been sealed.

Railings

The railings are in fair to poor condition. In 2012, the County noticed an outward bow in both of the bridge railings. They have begun to monitor the condition and it has remained unchanged since it was first noticed. On the interior of both railings, the mortar is missing, cracked or separating from the stone over the entire surface. The mortar on the exterior faces is in good condition with less than 5 percent of the joints failed. On both railings, the cap stones appear to be moving outward near the center of the rail. On the west rail, the cap appears to have moved up to 1 inch and the east rail caps have moved up to 2
inches. The curb at the bottom of each rail has significant wear, presumably from de-icing salts and snow plow blades.

Headwalls and Wingwalls
The headwalls and wingwalls are in fair condition. The mortar of the headwalls appears to be in good condition except for some minor areas of cracking. At the west headwall, there is a slight separation of the mortar from the arch ring stones near the center of the bridge in the region of the west keystone. Also in this location, the mortar on the bottom face of the arch ring stones is failing and/or separating from the arch stones.

The wingwalls are in varying condition. The upper 3 to 4 feet of each wingwall has deteriorated mortar (especially on the inside faces). The mortar in all the wingwalls below the upper 3 to 4 feet is in good condition and the mortared joints are less than 5 percent failed. There is efflorescence on all of the wingwall faces, indicating that there is moisture leaching from behind the walls. All slopes in front of the wingwalls appear to be stable.

The northwest wingwall appears to be moving in the upper 6 feet of the wingwall and railing. It appears that this upper portion of the wall is leaning or moving backwards towards the road. There are stones that appear to have been displaced up to one-quarter inch based on the position of the stone and the surrounding mortar. The southeast and southwest wingwalls also appear to be slightly out of plumb and tilted backwards. The slope in front of the southwest wingwall has been riprapped to remedy previous erosion issues. The northeast wingwall appears to be plumb with no signs of movement.

Arch and Abutments
There is heavy efflorescence along the outer edges of the stone arch and the abutment walls. The mortared joints were inaccessible during the field assessment, but they appear to be intact in the arch except in the area noted near the west keystone (see headwall condition) and along the waterline at each abutment where the mortar is cracking and missing at various locations. There were no weeps from an internal drainage system observed in the arch or abutment. There is no evidence of movement of the arch or abutments.

Approach/Waterway Observations
The approach roadway is in good condition. The roadway to the south of the bridge is paved with aggregate and the roadway over the bridge and to the north of the bridge has bituminous surfacing. The roadway slopes upwards away from each end of the bridge, putting the bridge at the bottom of a sag vertical curve. There are 2 delineator signs at each corner of the bridge (8 total).

There were no issues observed with the waterway. The stream banks appear to be stable. There is a dam located just upstream of the bridge.

Date of Engineering Site Visit by LHB
October 2, 2013
Condition 1: East elevation

Condition 2: Bridge plaque, southeast rail
Minneapolis Department of Transportation (MnDOT)
Local Historic Bridge Report

IV – Existing Conditions/Recommendations

Bridge Number: 5744

Condition 3: South approach, looking north (note curvature of railings)

Condition 4: North approach, looking south
Condition 5: Grouted riprap behind northeast wingwall

Condition 6: Cracking and separating mortar, northeast railing above wingwall
Minnesota Department of Transportation (MnDOT)
Local Historic Bridge Report

IV – Existing Conditions/Recommendations

Bridge Number: 5744

Condition 7: East railing

Condition 8: Southwest wingwall (note previous repair on rail/wingwall, left side of picture)
Condition 9: West rail and curb (typical condition, note missing mortar on cap and curb)

Condition 10: West keystone (note separation of mortar above ring stones indicating possible movement and missing mortar between arch and keystone)
Condition 11: Northwest wingwall/west headwall railing, interior face (note crack at corner and displacement of stones/mortar)

Condition 12: Northwest wingwall, exterior face (note displacements of wall stones below wingwall cap)
Condition 13: Northwest wingwall and north abutment

Condition 14: Northeast wingwall
Condition 15: Southwest Wingwall, south abutment, arch underside

Condition 16: Southeast wingwall and south abutment
Condition 17: Arch underside (typical condition)

Condition 18: North abutment
Overall Recommendations
The bridge is currently open to vehicular traffic. The recommendations which follow assume the structure’s use will remain the same.

Recommended Stabilization Activities

1. Saw-cut along existing bituminous paving and patch edges along curb with bituminous to reduce the amount of water that can reach the interior surfaces of the bridge.

Recommended Preservation Activities

Roadway
The roadway pavement is in fair condition and has recently been overlaid. The only recommendation for this surface is to keep the transverse cracks and the longitudinal joints at the curb edge sealed, which is detailed below in the maintenance recommendations.

Railings
The railings should be monitored both at the centers of the railings and at the wingwalls to determine whether the stones are continuing to move. If they are moving, a cause should be determined. Costs for monitoring have not been included in the estimate. After the cause of movement has been remedied, the areas where the stones have moved should be removed and reconstructed to place the stones back to their original alignment. The railings should also be 100 percent repointed on the inside face and selectively repointed on the exterior faces. Prior to initiating stone re-setting and pointing work 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. The stone layout, geometrics and exact stone location should also be carefully documented so that the stones that are re-set are placed back in their original position.

Due to the rapid degrade of the interior railing mortar (repointed in 2001), it is recommended that a more suitable mortar mix be used for repointing of the railings and curb and the railing surfaces should be sealed with a clear penetrating silane-based sealer. To maintain historic integrity, test sealers in advance to assure they do not discolor/darken the existing stone or mortar color.

The railings do not appear to meet current design standards. Prior to future improvements, it may be required to obtain a structural and/or geometric variance from current bridge railing standards. These exceptions have been granted in the past for historic bridges in similar low volume roadway settings. No changes to the railing are proposed or estimated.

Stone Headwalls and Wingwalls
Along with the railings, the headwalls and wingwalls should also be monitored for continued movement at locations indicated in the conditions section of this report. If movement continues, further investigation into the cause is recommended. If they are not continuing to move, areas that are misaligned should be
reconstructed to re-set the stone in their original positions. The remaining areas should be selectively repointed; due to the recent repointing work, the areas that will require repointing will be minimal. For purposes of cost estimating, a select area of reconstruction is assumed and approximately 15 percent of the total wall area is estimated to be repointed. Reconstruction and repointing should be conducted in the same manner as described above in the railing recommendations. Dewatering will be required for repointing of the bottoms of the wingwalls below the stream elevation.

Arch and Abutments
The arch and abutments should be selectively repointed where the mortared joints have failed, particularly at the joint between the arch and the arch ring stones and along the water line on the abutments. Due to evidence of moisture infiltration through the joints in the arch and abutment mortared joints and the inability to physically access the joints for assessment, repointing needs have been estimated at 50 percent. The repointing should be conducted in the same manner as described above in the railing recommendations. Dewatering will be required for repointing of the bottoms of the abutments below the stream elevation.

The heavy efflorescence on the arch and abutment indicates that the original drainage system (if there was one in place) is no longer functioning as intended. The moisture that is seeping through the mortared joints (as well as potential freezing of saturated soils and mortar joints) may be contributing to the movement of the wingwalls and headwall. This trapped moisture can also cause a rapid deterioration of the mortar's structural integrity. It is recommended that the fill over the arch and behind the abutments be excavated to expose the interior surfaces of the arch, abutments, headwalls and wingwalls. Once exposed, these areas should be repointed, and then a waterproof membrane should be applied. A drainage system should be installed before the arch is backfilled. This scope will require the removal and replacement of the bituminous driving surface. All of this work would be buried after the roadway and arch fill is replaced. The timing of this work should be determined based upon the observed movement of various elements of the bridge, the condition of the mortar, and the need for the roadway to be replaced.

Recommended Annual Maintenance Activities

1. Monitor and seal cracks in bituminous pavement in roadway and along railings.

2. Stone masonry should be flushed with water each spring to remove dirt, debris and de-icing salts. 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.

3. Repeat application of water repelling silane sealer to bridge railings at interval appropriate to product used.
Summarized Maintenance, Stabilization and Preservation Construction Cost Estimates

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.

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 historic 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: $ 2,680
- Opinion of Construction Cost- Stabilization Activities: $ 2,600
- Opinion of Construction Cost- Preservation Activities: $ 704,150

Estimated Preliminary Design, Final Design, Construction Administration Costs

- Preliminary Design and Assessment $ 14,000
- Final Design and Plans $ 70,000
- Construction Administration $ 85,000
### Maintenance, Stabilization & Preservation Cost Estimate (2013 Dollars)

**Bridge No. 5744**  
**JULY 2014**

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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.

**Characteristic-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 historic, 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 historic basis and that seek to create a false historic 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 5744**

**Historic Data**
- Research

**Local Data**
- Minnesota Local Bridge Study Meeting Handout
- Pipestone Co 5744 Minnesota Local Bridge Study Meeting Handout

**MnDOT Reports**
- Accident Report
- 5744 2011 Condition Sheet
- 5744 Bridge Survey 2012
- 5744 Inspection 07-12-12
- 5744 Inspection 07-17-14
- 5744 Inventory 05-29-13
- 5744 Rating Report 2012

**Photos**
- 5744 April 2005 Photos
- 5744 LHB 10-02-13
- 5744 M&H Photos 10-2-13
- Report Photos

**Plans**
- 1935 Plan (tiff)
- Bridge 5744 – 2001 Rehab Description
# Mn/DOT Bridge Inspection Report

### Bridge 5744: TWP 254 Over Split Rock Creek

**Inspected by:** PIPESTONE COUNTY  
**Bridge Type:** MASONRY ARCH  
**NBI Deck:** 6  |  **Super:** 5  |  **Sub:** 5  |  **Chan:** 6  |  **Culv:** N

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**Notes:**

- [Road was overlayed in 2010.]
- [Moderate cracking of mortar between stones. 2005-2012. MONITOR bowing out of center of both rails per Dave Halbersma 4-18-12. Measured by stringline deflection outward of both rails in 2012. 0.4" measured along both east and west rails. 2012.]
- [Mortar appears to be gone for 6" in south weep spot. 2000-2012. The top outside 6 stones on the west side & the top outside 5 stones on the east side have separation in joints from possible movement. 2012.]
- [Showing major efflorescence. Moisture coming through abutments. North abutment has several spots where water is weeping through joints. 2000-2012. 1 weep spot on each arch. 2003-2012. 1 cracked block 2" above water on south abutment with efflorescence. 2006-2012.]
- [Wingwalls are showing efflorescence. Moisture coming through wings. 2000-2012. NE wing has 4 spots where water is weeping through joints. 2001-2012.]
- [DO NOT DELETE THIS CRITICAL FINDING SMART FLAG.]
- [Erosion by wings. 2001-2012. Riprap placed at NE corner in 2004. Scrub trees are growing on all banks but will probably help the erosion problem. 2003-2012.]
- [Some cracks in mortar between curb joints. 2006-2012.]
- [Jim Pierce from Mn/Dot thought this element would work best since there is not an actual deck, to rate the surface, talked to him in 2006.]
### Mn/DOT BRIDGE INSPECTION REPORT

**BRIDGE 5744**  
**TWP 254 OVER SPLIT ROCK CREEK**  
**INSP. DATE: 07-12-2012**

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**Notes:**  
[Tuckpointing done in 2001. Some tuckpointing is starting to loosen. 2004-2012]

**General Notes:**  
Water was low enough to walk along both abutments. 2004-2008 & 2012  
Water was up, could get across half of each abutment. 2010

**Inspected by Jerid Johnson 7-12-2012**

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**Inspector's Signature**

---

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

**Bridge ID: 5744**  
**TWP 254 over SPLIT ROCK CREEK**  
**Date: 05/29/2013**

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