Bridge L8505 carries Seven Bridges Road (also known as Snively Boulevard) over Amity Creek in Duluth. Constructed in 1912, it was one of eight stone-faced bridges along the boulevard that were designed by the Minneapolis firm of Morell and Nichols. Four of the historic bridges, including L8505, remain and are owned by the City of Duluth. Bridge L8505 is significant for aesthetics and is a contributing resource of the National Register-eligible Skyline Parkway Historic District.

Bridge L8505 is a single span, Neoclassical, concrete arch bridge. The arch is comprised of reinforced concrete and spans 28 feet. The railings, headwalls and wingwalls are constructed of locally quarried gabbro stone. The arches rise from concrete spread footing abutments faced with stone. The earth-filled arches are topped with a 17-foot-8-inch-wide bituminous roadway.

Bridge L8505 underwent a major rehabilitation in 2001 where the entire bridge was repointed, the arch and walls were excavated and waterproofed, a drainage system was installed, the roadway was replaced, the railing was disassembled and re-built, the underside of the arch was repaired, and the north slopes were protected with riprap. The bridge abutments were scoured during a June 2012 flood event. A repair plan has been prepared and work to protect the abutments will be conducted in the summer of 2014.

Bridge L8505 is in good condition overall and appears to adequately serve its purpose of carrying vehicular and pedestrian traffic. With proper maintenance, stabilization and preservation activities it is believed Bridge L8505 could continue to serve in its present capacity for 20 years or longer.

Any work on Bridge L8505 should proceed according to the Secretary of the Interior’s Standards for the Treatment of Historic Properties (Standards) [36 CFR part 67] and The Secretary’s Standards with Regard to Repair, Rehabilitation, and Replacement Situations, as adapted by the Virginia Transportation Research Council (Guidelines).
Bridge Location:

Bridge Number: L8505

Map of Bridge Location:

Bridge L8505 - E SKYLINE over AMITY CREEK

PROJECT LOCATION
ST. LOUIS COUNTY
SEC. 32, T051N, R 13W
UTM ZONE: 15 NAD: 27
USGS QUAD NAME: DULUTH
EASTING: 1887175 ft.
NORTHING: 17026449 ft.

MINNESOTA DEPARTMENT OF TRANSPORTATION (MnDOT)
LOCAL HISTORIC BRIDGE REPORT

JUNE 2014
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.
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.
Bridge Number: L8505

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 Unknown

Designer/Engineer Morell and Nichols

Description
Bridge L8505 is a single-span, filled-spandrel, reinforced-concrete barrel arch bridge. It carries Seven Bridges Road over Amity Creek in rural Amity Park in Duluth. The two-lane vehicular road is bordered by mixed forest, park, and residential lands. As the name of this segment suggests, it is characterized by a series of stone-faced bridges crossing the Amity Creek. The winding nature of the roadway, mostly closed in by forest with glimpses of Amity Creek, defines the character of this segment. The surface is paved with a bituminous surfacing, with gravel and grass verges.

Constructed in 1912 a north-south axis, L8505 is an overall length of 32 feet, main span length of 28 feet, and out-out width of 21 feet. The masonry of the bridge is pitch-faced, rough-ashlar with a defined arch ring. The headwalls, wingwalls and railings are solid masonry with the native gabbro stone and the abutments are stone faced with a concrete core. Formwork is visible on the arch barrel. Stylistic details consist of cap stones along the top of the railings and arch ring made of pink opal granite and split-faced pilasters that extend up from the spring line of the arch to the railing. A horizontal stringcourse also extends along the length of the bridge at the base of the railing. The pilasters, coursing, and accentuated architectural details result in an overall formal and refined appearance indicative of the Neoclassical style. The bridge rests on concrete footings and has U-shaped abutments.

In 2001 the bridge underwent a rehabilitation that consisted of disassembly and reconstruction of the upper 2 feet 6 inches of the railing and the upper 3 feet 6 inches of pilasters. The original railing stone and cap stones were also reinstalled as part of the project. Other activities included installation of new pilaster cap stones, removal and repointing of mortar joints at select locations, and concrete repair on the underside of the arch. A new drainage system was installed and existing tie rods and backer plates were also replaced; the results of these activities are not visible. Following a flood event in 2012, concrete underpinnings were added to the bottom of both abutments and spot repointing of stone masonry was completed.

Significance
Bridge L8505 is one of the original eight stone-faced bridges located on Seven Bridges Road, which is a contributing segment of the National Register-eligible Skyline Parkway Historic District. The Parkway generally extends in a southwest-northwest direction from the southern part of St. Louis County, along the bluff on Duluth's western periphery, to the unincorporated townships of Duluth and Midway at the shore of Lake Superior located northeast of downtown Duluth. The Parkway connects each segments and has both urban and natural settings with a variety of associated resources.
Seven Bridges Road is also known as Snively Boulevard. Samuel Snively, a local attorney and developer, assembled land with the intention of building a picturesque parkway that would meet with the extension of the Rogers Parkway. Snively constructed the scenic roadway between 1899 and 1903. The road was difficult and costly to build due to its location in the steep Lester River valley, and the need for the construction of 10 rustic bridges over Amity Creek.

In 1909 Snively donated the road and bridges to the city. By the time Snively Boulevard was transferred to the Park Board, it had become overgrown and the original wooden bridges had fallen into ruin. The Park Board announced that money from the bond issue for the western extension of Rogers Parkway would also be used to upgrade Snively Boulevard. Eight stone bridges, including Bridge L8505, were constructed over the next two years on the road. Officially opened in 1912, the roadway was constructed as a scenic byway. In 1927 a 5-mile addition along Amity Creek was built connecting Snively's original drive with Vermillion Road. By 1930 it was included in the Park Department's annual report as a 5.82-mile segment from 62nd Avenue East and Superior Street to Jean Duluth Road, indicating that at that time the Amity Creek Segment was included as part of Snively Boulevard.

The new stone bridges were designed by the Minneapolis landscape architectural firm of Morell and Nichols. Though named “Seven Bridges Road,” the roadway actually crossed eight bridges. Each bridge was made of reinforced-concrete and faced with a rustic native gabbro stone, blasted from cliffs in the vicinity and collected from the creek bed. Six-inch cap stones made of pink opal granite quarried near St. Cloud detailed the length of the bridge retaining walls, abutments, and railings. Each bridge featured similar Neoclassical details such as defined abutment pilasters, defined stringcourse that separates the railings that are constructed with native gabbro stone, and heavy cap stones. The rustic Neoclassical design of each bridge reflected the natural setting and location within the parkway. Over time the bridges became a distinctive characteristic of the parkway that enhanced the rustic, winding, and forested setting of the road.

Bridge L8505 has undergone alterations, most notably activities conducted as part of a 2001 rehabilitation project. The upper 2 feet 6 inches of the railing and upper 3 feet 6 inches of pilasters were disassembled and reconstructed using original stones where possible. Other activities included installation of new stone pilaster cap stones, removal and repointing of mortar joints at select locations, and concrete repair on the underside of the arch. New materials, including pilaster capstones and mortar, were compatible in terms of color and texture. A new drainage system was installed and existing tie rods and backer plates were also replaced; these features are not visible and do not impact the overall integrity of the structure. The State Historic Preservation Office reviewed the rehabilitation plans and found them to be keeping with the Secretary of the Interior's Standards. Bridge L8505 retains integrity of its location, setting, design, workmanship, materials, feeling, and association. The period of significance is 1912 to correspond with its date of construction.

The bridge is eligible for the National Register within the Multiple Property Documentation Form of “Reinforced-Concrete Highway Bridges in Minnesota, 1900-1945” under Criterion C in the area of Engineering. The bridge displays high artistic value represented in its Neoclassical design features and ornamentation. Additionally, Bridge L8505 is a contributing resource to the National Register-eligible Skyline Parkway Historic District.
**Minneapolis Department of Transportation (MnDOT)**

**Local Historic Bridge Report**

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<tr>
<td>Criterion C Significance</td>
<td>Engineering: High artistic value</td>
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<td>Historic District</td>
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<td>SHPO inventory number</td>
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**Sources used to Compile Section II – Historic Data**

“Bridge L8505.” Structure Inventory Sheet & related documents, MnDOT files, St. Paul.


Mead & Hunt, Inc. “Bridge L8505 Minnesota Architecture-History Inventory Form.” Prepared for MnDOT (August 2014)


Field investigation by LHB, Inc. and Mead & Hunt, Inc. 28 August 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: Neoclassical architectural details found on the reinforced-concrete arch with rustic stone masonry headwalls, wingwalls and railings including defined abutment pilasters, a defined stringcourse visually separating the railing, and heavy stone caps atop the railing and pilasters.
Feature 2: Skyline Parkway setting. The bridge is located along Seven Bridges Road, a contributing segment of the National Register-eligible Skyline Parkway.
### Local Historic Bridge Report

#### Bridge Number: L8505

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<td>Feature Crossed:</td>
<td>Amity Creek</td>
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<td>County:</td>
<td>St. Louis</td>
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<tr>
<td>Ownership:</td>
<td>City of Duluth</td>
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**MnDOT Structure Data**

- *Data Current (as of):* Sep 2013
- **Main Span Type:** 112 CONC ARCH
- **Main Span detail:** SPANDREL FILLED ARCH
- **Substructure Type - Foundation Type:**
  - Abutment: 1-Concrete - 2-Spread/Rock
  - Piers: N-Not Applicable - N-Not Applicable
- **Total Length:** 32.2 ft
- **Main Span Length:** 28.2 ft
- **Total Number of Span(s):** 1
- **Skew (degrees):** 0
- **Structure Flared:** No Flare
- **Roadway Function:** Urban, Local
- **Custodian/Maintenance Type:** City

**Reported Owner Inspection Date**

- 10/25/2011

**Sufficiency Rating**

- 91

**Operating Rating**

- HS 30

**Inventory Rating**

- HS 20

**Structure Status**

- A - Open

**Posting**

- VEH: SEMI: DBL:

**Design Load**

- UNKN

**Current Condition Code**

- Deck: N
- Superstructure: 8
- Substructure: 8
- Channel and Protection: 6
- Culvert: N

**Current Appraisal Rating**

- Structural Evaluation: 8
- Deck Geometry: 4
- Underclearances: N
- Waterway Adequacy: 8
- Approach Alignment: 6

**Fracture Critical**

- No

**Deficient Status**

- ADEQ

**Roadway Clearances**

- Roadway Width: 18 ft
- Vert. Clearance Over Rdwy: N/A
- Vert. Clearance Under Rdwy: N/A
- Lat. Clearance Right: 0 ft
- Lat. Clearance Left: 0 ft

**Bypass Detour length:** 7 miles

**Non-MnDOT Data**

**Approach Roadway Characteristics**

- **Lane Widths:** 9 ft
- **Shoulder Width:** 1 ft
- **Shoulders Paved or Unpaved:** Unpaved
- **Roadway Surfacing:** Bituminous

**Location of Plans**

- City of Duluth

**Plans Available**

- Original Plan Excerpt, 2002 Rehab Plan & 2013 Flood Repair Plan

---

* 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.**
Minnesota Department of Transportation (MnDOT)
Local Historic Bridge Report

IV – Existing Conditions/Recommendations

Bridge Number: L8505

Existing Conditions
Available information, as detailed in the Project Introduction section, concerning Bridge L8505 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 L8505 is a single span concrete arch bridge, in Duluth, Minnesota. It is one of eight bridges that carry East Skyline Parkway (a.k.a. Seven Bridges Road) over Amity Creek. It is the fifth bridge from the south. The structural arch is comprised of reinforced concrete and spans 28 feet. The railings, headwalls and wingwalls are constructed of locally quarried gabbro stone. The arch rises from concrete spread footing abutments faced with stones which bear on bedrock. The underside of the arch reaches a height of 12 feet above Amity Creek. The earth-filled arches are topped with a 17.7-foot wide bituminous roadway.

Bridge L8505 is in good condition overall. It underwent a major rehabilitation in 2001 where the entire bridge was repointed, the arch and walls were excavated and waterproofed, a drainage system was installed, the roadway was replaced, the railing was disassembled and re-built, the underside of the arch was repaired, and the north slopes were protected with riprap. The bridge abutments were scoured during the June 2012 flood event. A repair plan has been prepared and work to protect the abutments will be conducted in the summer of 2014.

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

Condition Observations

Bridge Railings
The bridge railings are in good condition. In 2001, the rails were dismantled and rebuilt from the stringcourse up with the original stone. The original rail cap stones were salvaged; however the pilaster caps were missing and replaced with new stones to match the original pilaster caps. Presently, the masonry mortar appears to be in good condition with some minor cracking. This bridge is not open during the winter; therefore, it does not have heavy exposure to road salts. Additionally, a fillet was built into the roadway edge to direct runoff water away from the base of the rail. This protects the mortared joints from scour and introduction of moisture which could cause damage during freeze thaw cycles.

Roadway Slab
The roadway over the bridge is in good condition overall. The roadway has very minor cracking, but there are no signs of settlement. This bituminous roadway was placed in 2001 during the most recent rehabilitation project.
Headwalls and Wingwalls
The masonry headwalls and wingwalls are in good condition. In 2001, they were 100 percent repointed and several missing stones were replaced with stones to match the original stone. Also during that rehabilitation, the walls were excavated and the inside faces received a waterproof membrane. The walls appear to be plumb. The mortared joints are showing minor cracking. The bottom of the wingwalls nearest the abutments are scoured and under water. These scoured locations of the walls will be protected with riprap as part of the 2014 repair project.

Concrete Arch
The concrete arch is in good condition. During the 2001 rehabilitation, portions of the underside of the arch were removed, reinforcement was placed and shotcrete was used to build back the surface. Additionally, the arch was excavated, waterproofed and a drainage system was installed. Currently, there are small areas of cracking and leaching, but the overall arch is in good condition. There is graffiti painted on the arch above each abutment.

Abutments
The abutments are in fair condition. The abutments were repointed during the 2001 rehabilitation. During the June 2012 flood event, the streambed and abutments were scoured and both abutments are now undermined and exposed at their base. Both abutments will be protected with riprap as part of a repair project planned for the summer of 2014.

Approach/Waterway Observations
The bridge slopes are currently in poor condition in the vicinity of the bridge. The stream banks were scoured at each corner of the bridge. These areas will be filled and protected with riprap as part of a repair project planned for the summer of 2014. Upstream of the bridge, the stream has been filled with large rock deposits and has been re-directed to the south. The DNR has determined that the stream will not be aligned back to its original flow line and will remain as is. The roadway approaches atop the bridge are in good condition; however the delineator signs at the bridge corners are missing.

Date of Engineering Site Visit by LHB
August 28, 2013
Condition 1: West elevation, looking north
Condition 2: East elevation, looking west
Condition 3: North approach, looking south

Condition 4: Pilaster caps (non-historic) and rail cap (original)
Condition 5: Arch underside, typical condition

Condition 6: Stream condition, upstream
(note rock deposit in location of original stream path)
Condition 7: Scour at southwest corner

Condition 8: Northwest abutment corner (note scour of bedrock)
Overall Recommendations
Bridge L8505 is currently open to vehicular and pedestrian traffic. The recommendations which follow assume the structure’s use will remain the same.

Recommended Stabilization Activities
No stabilization activities are programmed.

Recommended Preservation Activities

Bridge Railings
The railings were rehabilitated in 2001. There were no major deficiencies noted during the field inspection. There are very minor cracks visible in the mortared joints which do not require a repair.

Roadway Slab
The roadway is in good condition. There is no recommended repair at this time.

Headwalls and Wingwalls
The headwalls and wingwalls are in good condition. Although the mortar in the stone joints is beginning to crack in some locations, the cracking is not significant to determine when repointing would be required. Therefore, no repair is recommended at this time.

Concrete Arch
The concrete arch is currently in good condition. There is no recommended repair at this time. There is graffiti present that should be removed or covered up. It is recommended that on all future projects and maintenance, a graffiti treatment process be developed to address graffiti and impacts of the breathability of the concrete and the appearance of the structure.

Abutments
The abutments are in good condition. There are no recommendations for repair at this time.

Approach Roadway
The delineator signs are missing along the approach roadway at each end of the bridge. It is recommended that these signs be replaced to increase the visibility of the bridge at night and reduce the risk of the bridge ends being hit by vehicles. This item relates to the roadway and is not included in the cost estimate, but should be completed as soon as practical.

Recommended Annual Maintenance Activities

1. Annual removal or covering of graffiti. To also include removal or covering of non-matching cover-up paint. See Concrete Arch section above for further details.

2. Remove and replace silicone sealant between rail cap stones as it fails. It is anticipated that approximately 10 percent of the joints may need repair each year. A colored sealant that matches the mortared joints should be 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)

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Estimated Preliminary Design, Final Design, Construction Administration Costs

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## MAINTENANCE, STABILIZATION & PRESERVATION COST ESTIMATE (2013 DOLLARS)

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**April 13, 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.

**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 disentegration 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 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 L8505

Historic Data
• Research

Local Data
• 7 Bridges Road – 1995 Summary of Bridge Needs
• Bridges 1-8 Rehab Project Description Report

MnDOT Report
• 2012 Local Historic Bridge Report
• Accident Report
• 2010 Condition Sheet L8505
• L8505 Inspection 10-2-13
• L8505 Inspection 10-25-11
• L8505 Inventory 05-30-13
• L8505 Rating Report 2011

Photos
• 2002 Photos
• L8505 LHB Photos 2012-13
• L8505 M&H Photos 08-28-13
• Report Photos
• 1995 Photos Bridges 1-7

Plans
• 2002 – L8505 Rehab Plans
• 2013 – L8505 Flood Repair
• L8505 Original Elevation
• Original 1911 Plan Excerpts
Mn/DOT BRIDGE INSPECTION REPORT

BRIDGE LS505  E SKYLINE OVER AMITY CREEK  INSPI. DATE: 10-25-2011

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General Notes:

*1999
Need armor to protect upstream side.
Snow on road surface.
*1999
*2000- SE guardrail missing, SE missing sections. Flow on upstream NS eroding embankment and causing undermining on abutment.

Inspector's Signature

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

**Bridge ID:** L8505  
**E SKYLINE** over **AMITY CREEK**  
**Date:** 05/30/2013

### General
- **Agency Br. No.:**  
- **District:**  
  - **Maint. Area:**  
- **County:** 69 - ST LOUIS  
- **City:** DULUTH  
- **Township:**  
- **Desc. Loc.:** 1.4 Mi N OF JCT CSAH12  
- **Sect., Twp., Range:** 32 - 05NN - 13W  
- **Latitude:** 46d 51m 22.61s  
- **Longitude:** 92d 00m 48.02s  
- **Custodian:** CITY  
- **Owner:** CITY  
- **Inspection By:** CITY OF DULUTH  
- **BMU Agreement:**  
  - **Year Built:** 1912  
  - **Year Fed Rehab:** 2001  
  - **Year Remodeled:**  
- **Temp:** NO PLAN  
- **Plan Avail.:** NO PLAN

### Roadway
- **Bridge Match ID (TIS):** 1  
- **Roadway O/U Key:** 1-ON  
- **Route Sys/Nbr:** MUN 712  
- **Roadway Name or Description:** E SKYLINE  
- **Roadway Function:** MAINLINE  
- **Roadway Type:** 1 LN/2 WAY  
- **Control Section (TH Only):**  
  - **Ref. Point (TH Only):**  
  - **Date Opened to Traffic:**  
  - **Detour Length:** 7 mi  
  - **Lanes:** 1 Lane ON Bridge  
  - **ADT (YEAR):** 72 (1985)  
  - **HCDT:**  
- **Functional Class:** URBAN LOCAL  
- **EDWY DIMENSIONS:**  
  - **If Divided:** NB-EB SB-WB  
  - **Roadway Width:** 18.0 ft  
  - **Vertical Clearance:**  
    - **Max. Vert. Clear.:**  
    - **Horizontal Clear.:**  
  - **Lateral Clr. - Lt/Rt:**  
  - **Appr. Surface Width:** 21.0 ft  
  - **Roadway Width:** 18.0 ft  
  - **Median Width:**  
- **MISC. BRIDGE DATA:**  
  - **Structure Flared:** NO  
  - **Parallel Structure:** NONE  
  - **Field Conn. ID:**  
  - **Cantilever ID:**  
  - **Foundations:**  
    - **Abut.:** CONC - SPRD ROCK  
    - **Pier:** N/A  
    - **Historic Status:** ELIGIBLE  
    - **On - Off System:** OFF  
- **PAINT:**  
  - **Year Painted:**  
  - **Prt. Unsound:**  
  - **Painted Area:**  
  - **Primer Type:**  
  - **Finish Type:**  
- **BRIDGE SIGNS:**  
  - **Posted Load:** NOT REQUIRED  
  - **Traffic:** NOT REQUIRED  
  - **Horizontal:** NOT REQUIRED  
  - **Vertical:** NOT APPLICABLE

### Inspection
- **Deficient Status:** ADEQ  
- **Sufficiency Rating:** 91.0  
- **Last Inspection Date:** 10-25-2011  
- **Inspection Frequency:** 24  
- **Inspector Name:** DULUTH  
- **Structure:** A-OPEN  

### MBI Condition Ratings
- **Deck:**  
- **Superstructure:** 8  
- **Substructure:** 8  
- **Channel:** 6  
- **Culvert:**  

### NEI Appraisal Ratings
- **Structure Evaluation:** 8  
- **Deck Geometry:** 4  
- **Underclearances:** N  
- **Waterway Adequacy:** 8  
- **Approach Alignment:** 6

### Safety Features
- **Bridge Railing:** 0-SUBSTANDARD  
- **GR Transition:** 0-SUBSTANDARD  
- **Appr. Guardrail:** 0-SUBSTANDARD  
- **GR Termini:** N-NOT REQUIRED

### In-Depth Inspections
- **Frac. Critical:**  
- **Underwater:**  
- **Pinned Asby:**  
- **Spec. Feat.:**

### Waterway
- **Drainage Area:**  
- **Waterway Opening:** 200 sq ft  
- **Navigation Control:** NO PRMT REQD  
- **Pier Protection:** NOT APPL  
- **Nav. Vert./Horz. Ctr.:**  
- **Nav. Vert. Lift Bridge Clear.:**
- **MN Scour Code:** I-LOW RISK  
- **Scour Evaluation Year:** 1992

### Capacity Ratings
- **Design Load:** UNKN  
- **Operating Rating:** HS 30.00  
- **Inventory Rating:** HS 20.00  
- **Rating Date:** 07-21-2011  
- **Mn/DOT Permit Codes:** A: N  
  - **B:** N  
  - **C:** N