

FINAL MIDTOWN CORRIDOR INDIVIDUAL BRIDGE SUMMARY AND MANAGEMENT PLAN



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Executive Summary

The Cedar Avenue Bridge (Bridge 90437) carries vehicular and pedestrian traffic over the Midtown Greenway in the city of Minneapolis. The bridge was constructed in 1916-1917 and is a contributing element in the Chicago, Milwaukee, and St. Paul Railroad Grade Separation Historic District.

Bridge 90437 is a skewed, three-span continuous concrete multi-beam bridge with arched fascia girders. The overall bridge length is approximately 100 feet and the bridge width from curb to curb is 40 feet with an 8 foot sidewalk on both sides of the bridge. The railings consist of original 36 inch tall concrete railings with an added steel pipe to provide an overall height of approximately 42 inches. It has two stub abutments, with the Midtown Greenway trail located beneath the center span of the bridge. It is one of the bridges in the historic district that retains the greatest historic integrity in terms of both the structure and its immediate setting. It is located in the most intact part of the historic district, which is the segment from 11th Avenue eastward.

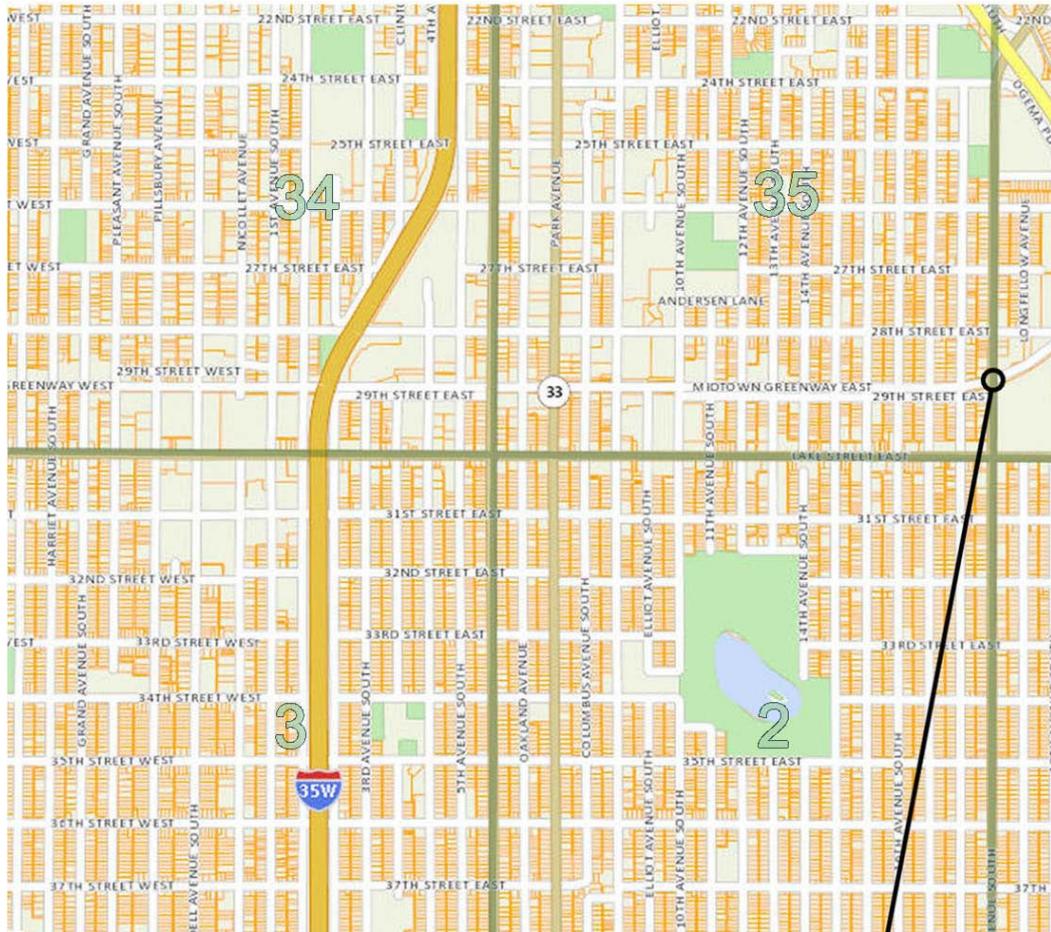
Bridge 90437 is a heavily used bridge with average daily traffic (ADT) of 13532 in 2012. It is in poor structural condition with the superstructure, substructure, and deck having structural condition codes of 4, 4, and 5 respectively. The bridge has an inventory rating of HS 23.2. (See page 16 for definition of structural condition codes and inventory rating). Over half of the beams are in poor condition with spalls and exposed, corroded reinforcement. There are also spalls on the underside of the deck. The substructure is cracked and spalled; the abutments are also settling. With proper maintenance, stabilization, and preservation activities it is believed Bridge 90437 could continue to serve its present purpose for 20 years or longer, although it is estimated that only about 23% of total historic fabric would be retained.

Attached to the south end of the east rail is the 1920s boundary wall of the Pioneers and Soldiers Memorial Cemetery. Because the cemetery has been designated a Minneapolis Landmark, proposed alterations potentially involving the boundary wall must be reviewed by the Minneapolis Department of Community Planning and Economic Development (CPED) and the Minneapolis HPC.

Any work on Bridge 90437 should proceed according to the Secretary of the Interior's Standards for the Treatment of Historic Properties (36 CFR part 67) and the "Guidelines for Bridge Maintenance and Rehabilitation Based on the Secretary of the Interior's Standards" as adapted by the Virginia Transportation Research Council.



Bridge Location



Bridge 90437
Cedar Ave S



Location
Minneapolis
Hennepin County
T 29, R 24W, Sec 35,36

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I – Project Introduction

This individual bridge summary and management plan is an appendix to the Midtown Corridor General Bridge Management Plan (2015) which must be used in conjunction with this document. The overall plan describes the objectives, methods, and results of the Midtown Corridor Historic Bridge Study and provides further information on the recommended stabilization, preservation, and maintenance activities contained herein. This individual plan is based on visual observations; the overall plan discusses additional testing that should be completed before any preservation alternatives are pursued. The overall plan discusses the likely cause of the existing deterioration, intent of the preservation alternatives, and what statutes need to be considered when working on this historic bridge.

The purpose of the Midtown Corridor Bridge Study and this individual bridge summary is to determine the work required to preserve the bridge in accordance with the Secretary of the Interior's Standards by assessing current conditions and proposing a set of treatment alternatives that address structural deficiencies, deteriorating historic fabric, and bridge longevity while at the same time protecting the historic character and integrity of the bridge and, in turn, that of the 2.8-mile Chicago, Milwaukee and St. Paul Railroad (CM&StP) Grade Separation Historic District.

The Midtown Corridor Bridge Study is part of a several-year cooperative effort, led by MnDOT, to promote the preservation of historic bridges across the state. "Historic" bridges are defined by federal law as bridges listed on, or eligible for, the National Register of Historic Places. The Midtown Corridor bridges are a subset of bridges addressed in the Minnesota Local Historic Bridge Study. Launched in 2012, two phases of the Minnesota Local Historic Bridge Study have been completed, with the most recent phase examining approximately 140 historic bridges across Minnesota owned by entities other than MnDOT. The Minnesota Local Historic Bridge Study is conducted through a partnership that includes MnDOT State Aid, the MnDOT Cultural Resources Unit (CRU), the Federal Highway Administration (FHWA), the State Historic Preservation Office (SHPO), the Army Corps of Engineers, local public works and county highway departments, county and township boards and city councils, the historic preservation community, and the general public.

The Minnesota Local Historic Bridge Study is designed to encourage the preservation of the state's locally-owned historic bridges by compiling historic and engineering data on each bridge, analyzing bridge condition, and preparing a set of recommended treatment activities for each bridge. The recently completed statewide study also prepared National Register nominations for a select number of bridges, providing updates to MnDOT's 2006 Management Plan for Historic Bridges in Minnesota, producing content for MnDOT's Historic Bridges website, and exploring how other states are funding and managing historic bridge programs with an emphasis on locally-owned bridges.

An individual bridge report was prepared for each bridge in the Minnesota Local Historic Bridge Study. Each individual report suggests stabilization, preservation, and maintenance activities for each bridge. Stabilization activities are designed to maintain the bridge in its current state until a more substantial repair project is undertaken. These measures might be emergency repairs, or minor repairs intended to prevent emergency repairs in the near future. Preservation activities are designed to preserve the bridge and keep it in service for the next 20 to 30 years. Maintenance activities include items such as annual inspections and cleaning, vegetation removal, minor concrete repairs, and spot painting. This individual bridge report was created for the Midtown Corridor Bridge Study with the same purpose as the Minnesota Local Historic Bridge Study.

This bridge report's activities follow the Secretary of the Interior's Standards for the Treatment of Historic Properties and, in particular, the Standards for Rehabilitation and accompanying Guidelines. The Secretary of the Interior's Standards are basic principles created to help preserve the distinct character of a historic property and its site, while allowing for reasonable changes to meet new engineering standards and codes. The Standards take a conservative approach to the preservation of historic fabric and 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. Recommendations for the Midtown Corridor bridges are also

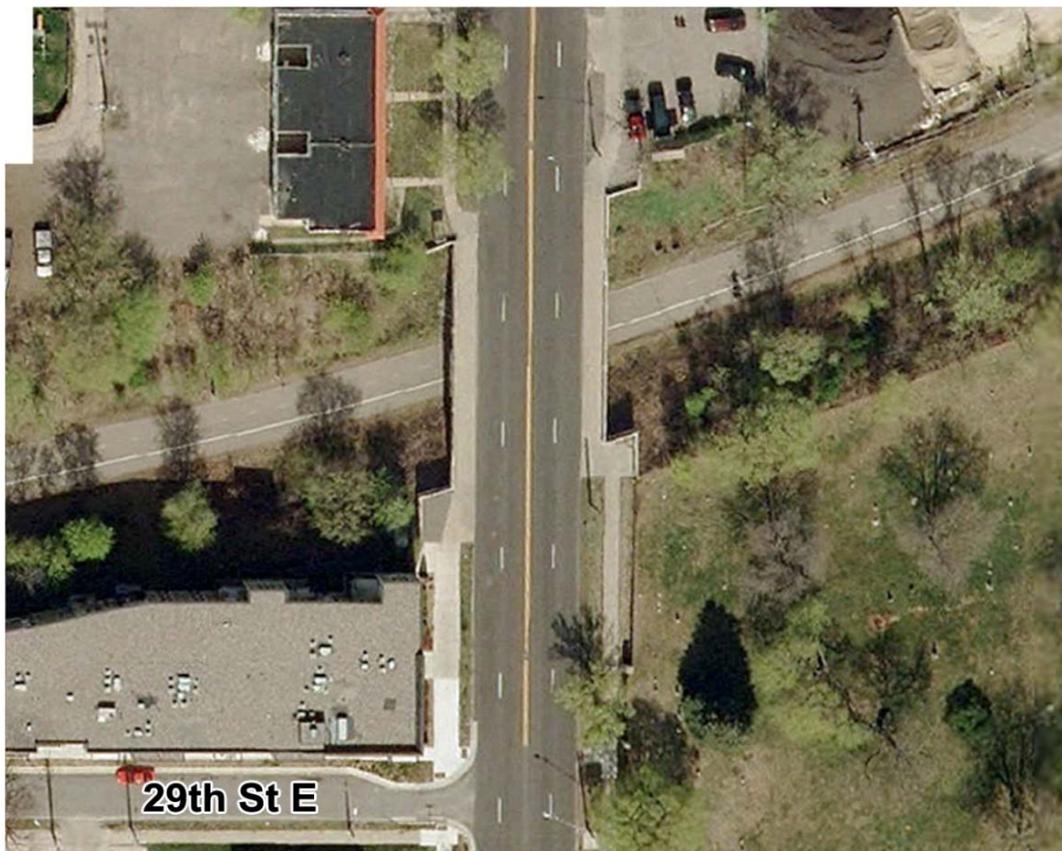
consistent with best practices outlined in the National Park Service's Preservation Brief 15 entitled *Preservation of Historic Concrete*, and with the "Guidelines for Bridge Maintenance and Rehabilitation Based on the Secretary of the Interior's Standards," as adapted by the Virginia Transportation Research Council.

To compile this report, engineering and historical data were gathered from a variety of sources including multiple field visits, original construction plans, current MnDOT Structure Inventory Reports and MnDOT Bridge Inspection Reports, load ratings where available, historic photographs and documents, and the National Register nomination for the CM&StP Railroad Grade Separation Historic District.

Included in the appendices of this report are a glossary of historic preservation and engineering terms, the Virginia "Guidelines for Bridge Maintenance and Rehabilitation based on the Secretary of the Interior's Standards," and engineering and historical documents pertinent to this bridge such as the current MnDOT Structure Inventory and Bridge Inspection reports.

This individual bridge report is designed to provide the bridge owner and other interested parties with a comprehensive summary of engineering and historic data and recommendations that will enable historic bridge owners to make informed decisions when planning for and managing their historic properties. Again, this report should be used in conjunction with the overall Midtown Corridor General Bridge Management Plan which provides additional information and a multi-bridge perspective.

Below is an aerial view of Bridge 90437 to provide an understanding of the physical context of the bridge.



Hennepin Co. aerial 2012

II – Historical Data

Contractor: Chicago, Milwaukee, and St. Paul (CM&StP) Railroad

Designer/Engineer: H. C. Lothholz, Engineer of Design, CM&StP Railroad
Charles Frederick Loweth, Chief Engineer, CM&StP Railroad

Description

Bridge 90437 carries Cedar Avenue S. (CSAH 152) over the Chicago, Milwaukee, and St. Paul Railroad. Built in 1916-1917, it is a three-span, Neoclassical Revival style, continuous concrete deck girder bridge.

Geometrics. The bridge is about 122 feet long (measured end of rail to end of rail) and about 60 feet wide. The bridge is one of several in the CM&StP corridor designed to be wider than the others (which are mostly 49 to 51 feet wide) so a streetcar track could be accommodated between two vehicle lanes.

The center span measures about 34 feet and the outer spans about 32 feet 5 inches. The bridge is skewed 18 degrees (the only other historic bridge in the corridor that is skewed is 18th Avenue one block to the west).

The street is about 40 feet wide between the curbs. Today there are four travel lanes (most of the corridor's bridges carry two lanes). The concrete deck has a bituminous overlay. (The decks were originally paved with 4-inch-thick wood blocks ("Track Depression Work" 1915).) The sidewalks retain their original width of approximately 8 feet but have received an overlay. (Original plans indicate the sidewalks were to be divided into 4-foot squares; historic photos suggest this occurred on at least some bridges.)

Structure. The substructure is comprised of concrete abutments and two piers or bents. Each pier has four square columns with a rounded-arched cross beam system that extends to the fascia to support cantilevered raised sidewalks. The bridge seat has simple Neoclassical coping.

The multi-beam continuous structural system uses non-prismatic reinforced concrete beams (roughly 13 inches wide, 4 feet deep, and 5 feet apart). The four center beams are wider than the outer beams to support the heavier streetcar load. The lower edge of the beams is angled to follow the lower curve of the fascia beams.

The fascias are haunched and ornamented with recessed panels that align with the pier columns. Two smoke shields (19 feet long) are incorporated into the fascia above the center span.

Railings. The bridge has approximately 36-inch-tall solid concrete railings topped by a modern pipe rail at about 42 inches. The rail posts form squat, square columns with a base, shaft, and capital. The rail panels are similarly detailed. Both posts and panels have simple recessed panels in the shaft region. The handrail has a peaked rather than flat top; only the Cedar Avenue and 18th Avenue bridges – the two eastern bridges and the last two built – have handrails with this shape.

Near the ends of the bridge the railings move apart laterally, tracing the edge of the abutments. The north end of the west rail was not designed with a final return. The south end of the west rail is now missing its post. At three of the railing ends (all but the northwest), the sidewalks were designed to widen following the rail footprint.

Concrete surface. The bridge was originally unpainted (see Historic Integrity below). The surface of the abutments, piers, beams, underside of deck, and, to some extent, fascia, retains original board form lines. The fascia and railings have a fairly smooth finish. According to a 1915 article in *Engineering News*, the bridge railings built in 1913-1914 had a surface texture achieved by removing the forms after 24 hours and treating the concrete "with a stiff wire brush to expose the red granite screenings in the aggregate." For the railings built in 1915-1917, "It was decided to discontinue this practice, as a smooth concrete face seems to give a more pleasing effect and to bring out more clearly the angles and planes of the design."

Instead, the forms remained in place at least 48 hours and the concrete was rubbed “with emery stone just enough to take out surface irregularities or brushed with cement grout to remove surface discolorations” (“Track Depression at Minneapolis” 1915).

The underside of the deck is blackened by locomotive smoke. Date blocks reading “1916” are cast into the abutments near the northeast and southwest corners.

Other. A city watermain was originally suspended under the deck; one remains there today. (Plans indicate other utility lines originally crossed beneath the floor of the trench.)

There is sloped gravel fill against both abutments. (The south slope is retained by low timbers; the north slope by a low keystone block wall built ca. 2009.)

Attached to the southeast corner of the bridge rail is one end of the boundary wall (circa 1928) of Pioneers and Soldiers Memorial Cemetery. Established in 1853, the cemetery was listed on the National Register of Historic Places in 2002 and named a Minneapolis Landmark (i.e., a Minneapolis HPC site) in 2006.

Attached (or adjacent) to both the northeast and northwest corners of the bridge are mortared, coursed stone rubble retaining walls aligned east-west near the top of the trench. The northeast wall is roughly 10 feet long and the northwest about 25 feet. The walls may have been built soon after the trench was completed. They are now topped by chainlink fences. There may be other early walls or wall segments adjacent to or near the bridge.

Setting and Views. The bridge is located within the Chicago, Milwaukee, and St. Paul Railroad Grade Separation Historic District. (See the Master map in the Midtown Corridor General Bridge Management Plan (2015) for the historic district boundaries.) The historic district’s identical bridges span the trench and are closely spaced – one block apart – giving the corridor strong visual continuity and a tunnel-like effect. The trench is about 110-120 feet wide at the top of the slope and 22 feet deep; near Cedar Avenue the trench is curved and the sides slope at roughly 30 degrees. A recreational trail now replaces the railroad tracks. The floor of the trench beneath the bridge is at a single grade, as it was historically.

Vegetation on the trench slopes in most of the corridor consists largely of volunteer deciduous trees, shrubs, and herbaceous plants.

Corridor views in both directions, from on and below the bridge, are dominated by the curved trench, its wooded slopes, and the identical historic bridges. Views from the top of the bridge also include surrounding city blocks.

When the bridge was built, the setting was comprised of a rail corridor, with about 20 trackside industries, aligned through a largely residential neighborhood. The bridge’s setting is now a mix of residential and commercial. Southeast of the bridge is Pioneers and Soldiers Memorial Cemetery. Southwest of the bridge is a recent apartment building. To the northwest is a circa 1900 apartment building and to the northeast is a more recent parking lot and commercial building. The bridge is located in Minneapolis’ East Phillips neighborhood.

Historic Integrity

Bridge 90437 retains strong historic integrity of location, design, setting, materials, workmanship, feeling, and association. It is one of the most intact bridges in the historic district in terms of both the structure and its setting. The bridge is located in the most intact part of the district, which is the segment from 11th Avenue eastward. Alterations to the bridge and its immediate setting include:

- o The bridge no longer carries a streetcar; it carries four rather than two lanes of traffic.
- o The south end of the west rail is missing its post.

- o Simple pipe rails have been added to the concrete rails to increase the railing height.
- o The lower part of the piers and abutments and roadway side of the railings have been painted grayish white. Painting of the piers and abutments occurred sometime after 1995.
- o Trains traveled the corridor until the summer of 2001. The last tracks were removed ca. 2002. (The original plans propose two main line tracks beneath the center span.)
- o A bituminous-paved recreational trail was installed under the center span, this segment opening in 2004. A square safety light was mounted on the north pier.
- o Unobtrusive modern shoebox streetlights have been added to the trail near the bridge.
- o The concrete deck has a bituminous overlay. (It was originally paved with 4-inch-thick wood blocks.)
- o Sidewalks have received a concrete overlay.
- o Low walls now retain the abutments' sloped gravel fill: a timber wall on the south and a ca. 2009 keystone block wall on the north.
- o Modern chainlink fencing is now attached or adjacent to several corners of the bridge at the top of the trench.
- o See also changes described in Setting and Views above.



Attached to the southeast corner of the bridge is the circa 1928 wall of Pioneer and Soldiers Memorial Cemetery (at right in photo). The cemetery is both listed on the National Register of Historic Places and a Minneapolis HPC site.



Mortared stone retaining walls are attached to the northeast (shown above) and northwest corners of the bridge. They were built to support private property, probably soon after the bridge was built.

Significance

Bridge 90437, built in 1916-1917 to carry Cedar Avenue S. over the Chicago, Milwaukee, and St. Paul Railroad (CM&StP), is an excellent example of the Neoclassical Revival style, continuous reinforced concrete girder bridges that are a significant component of the CM&StP Grade Separation Historic District. This bridge is one of the most intact in the historic district in terms of both the structure and the immediate setting. The 2.8-mile-long historic district is comprised of a railroad corridor trench as well as 40 bridges. Thirty-eight bridges carry urban streets over the trench, one bridge carries I-35W over the trench, and one bridge at 29th Street east of Dupont Avenue does not span the trench but historically provided track-level access to it. Twenty-seven of the bridges are original; 26 of the 27 (all but the 29th Street Bridge) are nearly identical. The massive grade separation project, which coincided with an expansion of the CM&StP main line, involved more than a decade of planning and controversy. The tracks were not only depressed, but the set of bridges that crossed them was designed with an emphasis on aesthetics. The project played a significant role in the development of Minneapolis by advancing civic planning, facilitating transportation, increasing safety, protecting the quality of adjacent residential neighborhoods, and enhancing community aesthetics, all while maintaining important rail service and the viability of trackside industries. The bridges were designed by the CM&StP and built in 1912-1917 by railroad labor. The Minnesota historic bridge study found the CM&StP corridor bridges to be significant within the statewide historic context "Reinforced Concrete Highway Bridges in Minnesota, 1900-1945." They are the work of designers identified in the context study as significant (J. H. Prior, H. C. Lothholz, and C. F. Loweth) and, as a collection, display unusual aesthetic qualities. According to the bridge study inventory form, "From an engineering perspective, the new crossings also were notable as early Minnesota examples of continuous, concrete, girder construction – a bridge type rarely used in the state for highway crossings" (Hess ca. 1997). The historic district was determined eligible for the National Register in 1997. It was officially listed on the National Register in 2005 under Criterion A (broad patterns of history) in the area of Community Planning and Development. The level of significance is listed as Local and the period of significance as 1912-1916. Bridge 90437 is contributing to the district.

Bridge 90437 was one of the last six bridges built in the corridor. The bridges were generally built in sequence from west to east in 1912-1917. According to original plans, Bridge 90437 (CM&StP Bridge 0-1508) was built between mid-June and early September 1916 with the railing and smoke shield constructed in 1917. (See the sheets for construction details.)

The railroad trench and bridges were designed by J. H. Prior and H. C. Lothholz who successively served as Engineer of Design for the CM&StP. (Prior's signature appears on plans for bridges west of about Stevens Avenue, and Lothholz signed plans for bridges from approximately Stevens Avenue eastward.) The railroad's Chief Engineer for the design process was Charles F. Loweth. All three men are considered significant engineers within the statewide historic context "Reinforced Concrete Highway Bridges in Minnesota, 1900-1945" (Frame 1988).

The trench and bridges were constructed by crews of CM&StP workers supervised by W. R. Powrie, District Engineer for the railroad. Plan sheets for Bridge 90437 indicate Assistant Engineer was W. E. Duckett, Carpenter Foreman was G. Tornes, and Concrete Foreman was O. Dahl. In July of 1915 there were 500 men on the corridor project, more than half of whom were working on the bridges (Bainbridge 1915; "Track Depression Work" 1915).

Of the six corridor bridges that carried streetcar lines, the historic bridges at Nicollet, Bloomington, and Cedar Avenue remain standing.

Immediately adjacent to the southeast of the bridge is Pioneers and Soldiers Memorial Cemetery, listed on the National Register of Historic Places in 2002 and also a Minneapolis Landmark (see the master map in the Midtown Corridor General Bridge Management Plan). The bridge railing touches the cemetery wall.



Photo of the Cedar Avenue Bridge taken circa 1917 (City of Minneapolis Public Works Department photo).

Historic Context	Urban Centers, 1870-1940 Railroad Development in Minnesota, 1862-1956 Reinforced Concrete Highway Bridges in Minnesota, 1900-1945
National Register Status	Contributing to Listed Historic District
NRHP Historic District	Chicago, Milwaukee and St. Paul Railroad Grade Separation Historic District
Criterion A Significance	Community Planning and Development
Criterion C Significance	N/A
SHPO Inventory Number	HE-MPC-7304
Minneapolis HPC Status	Not individually designated, not in a district

Sources Used to Compile Section II – Historical Data

Bainbridge, C. N. "A Large Track Depression Project at Minneapolis." *Railway Age Gazette*, Dec. 3, 1915.

Construction Plans for Cedar Avenue So. Crossing 0-1508. Eleven sheets dated 1916. CM&StP Railway Engineering Department. City of Minneapolis files.

Frame, Robert M. "Reinforced Concrete Highway Bridges in Minnesota." National Register of Historic Places Multiple Property Documentation Form (MPDF). Aug. 15, 1988. State Historic Preservation Office, St. Paul.

Hennepin County Regional Rail Authority (HCRRRA). *Cultural Landscape Management Treatment Guidelines for the Chicago, Milwaukee, and St. Paul Railroad Grade Separation Historic District of the Midtown Corridor, Minneapolis, Minnesota*. 2006.

Hess, Jeffrey A. "Bridge 90437." Minnesota Historic Bridge Inventory Form, ca. 1997.

Photographs, Historic Aerial, of Minneapolis. 1937 and 1938. Borchert Map Library, University of Minnesota, Minneapolis.

Photographs, Historic, of Midtown Greenway Bridges. City of Minneapolis Public Works Department.

Photographs, Historic, of Midtown Greenway Bridges. Hennepin County Library, Minneapolis.

Photographs, Historic, of Midtown Greenway Bridges. Minnesota Historical Society, St. Paul.

"Photographs of Twenty-Four Early Minneapolis Businesses." Circa 1917. Photograph album. Hennepin County Library, Minneapolis.

Site visits to the bridge by ONE, SRF, Gemini Research, Braun Intertec, MacDonald and Mack, and Wiss Janney Elstner, 2013-2014.

SRF Consulting Group Inc. *Alternatives Analysis Report for the Portland Avenue and Cedar Avenue Bridges Over the Midtown Corridor*. Prepared for the Hennepin County Transportation Dept., Dec.

2008.

TKDA and Hess Roise. *Midtown Corridor Historic Bridge Study*. Prepared for City of Minneapolis, 2007.

“Track Depression at Minneapolis.” *Engineering News*, March 18, 1915.

“Track Depression Work of the C. M. and St. P. Ry. at Minneapolis.” *Railway Review*, July 17, 1915.

Vermeer, Andrea C., and William E. Stark. “Chicago, Milwaukee, and St. Paul Railroad Grade Separation.” National Register of Historic Places Registration Form. Dec. 23, 2004.

“Views of the 29th Street Track Depression Construction Project in Minneapolis.” Chicago, St. Paul, and Minneapolis Railroad. Circa 1917. Photo album call #212. Minnesota Historical Society, St. Paul.

Character-Defining Features

Character-defining features are prominent or distinctive qualities or elements of an historic property that contribute significantly to its physical character, historic integrity, and significance. A list of character-defining features does not identify all important aspects of an historic property, however. Each historic property contains additional elements of location, design, setting, materials, workmanship, feeling, and association that together comprise its historic integrity or authenticity. Character-defining features of Bridge 90437 are listed below. (See the Midtown Corridor General Bridge Management Plan (2015) for character-defining features of the historic district.)

Feature 1: Reinforced concrete three-span bridge carrying a city street and raised sidewalks over a railroad trench 110-120 feet wide and 22 feet deep with moderately sloping sides. The trench curves at this location. Neoclassical Revival design shared by 26 bridges (originally 37). From both on and below the bridge, views of the trench and closely spaced identical bridges create visual continuity; the three spans create a tunnel-like effect.



Feature 2: Abutments with classical coping on bridge seats and date block imprints. Piers comprised of four square columns joined by rounded arches that extend to the fascia to support cantilevered sidewalks. Multiple beams integrated with the deck; central beams are wider for streetcar support; beams are angled to follow the curve of the fascia beams. Fascias are haunched with recessed panel detailing over the piers and smoke shields above the center span.



Feature 3: 36-inch-tall concrete railings with both posts and panels divided into classical base, shaft, and capital. Simple recessed panels. Triangular-topped handrails (only Cedar and 18th have these). Railings move apart laterally, tracing the edge of the abutments; sidewalks widen correspondingly.



Feature 4: Unpainted concrete surfaces (some now painted) with board form lines on abutments, piers, beams, and underside of the deck; smoother finish on fascia and railings.



III – Bridge Data

Date of Construction (remodel) 1916-1917
Common Name (if any)

Location

Feature Carried: Cedar Avenue S. (CSAH 152)
Feature Crossed: Midtown Greenway
County: Hennepin
Ownership (assumed not confirmed): Hennepin County Regional Rail Authority

MnDOT Structure Data

Data Current (as of): Oct 2014
Main Span Type: Continuous Concrete Girder, tee beam
Main Span detail:
Substructure Type - Foundation Type:
Abutment: Concrete – Spread Footing on Soil
Piers: Concrete – Spread Footing on Soil
Total Length: 100.6 ft
Main Span Length: 34.0 ft
Total Number of Span(s): 3
Skew (degrees): 18 Left
Structure Flared: No Flare
Roadway Function: Urban Minor Arterial
Custodian/Maintenance Type: Hennepin County/City of Minneapolis

Reported Owner Inspection Date 9/10/2013

Sufficiency Rating¹ 50.3

Operating Rating² HS 38.6

Inventory Rating² HS 23.2

Posted Load³ A - Open

Posting³ N/A

Design Load Unknown, designed before standard design trucks existed

Current Condition Code⁴

Deck: 5
Superstructure: 4
Substructure: 4
Channel and Protection: N/A
Culvert: N/A

Roadway Clearances

Roadway Width: 40 ft curb to curb
Vert. Clearance Over Rdwy: N/A
Vert. Clearance Under Rdwy: 18'-6" +/-
North Span: 29.0 ft clear opening;
all sloped to abutment
Center Span: 30.25 ft clear opening;
level; location of trail
South Span: 29.0 ft; clear opening
all sloped to abutment

Fracture Critical⁵ No

Deficiency Status⁶ Structurally Deficient

Current Appraisal Rating⁷

Structural Evaluation: 4
Deck Geometry: 2
Underclearances: N/A
Waterway Adequacy: N/A
Approach Alignment: 8

Roadway Data

ADT Total: 13532 (2012)
Truck ADT Percentage: Not available
Bypass Detour length: 1 mile
Number of Lanes: 4

1 - Sufficiency Rating is used to determine funding eligibility and priority for bridge replacement and rehabilitation. It is based on condition codes, inventory rating, appraisal ratings, ADT, and detour length.

2 - The bridges are load rated using an AASHTO defined 36 ton truck. An inventory rating of HS 12 implies the bridge may safely be able to carry a 21 ton truck indefinitely. An operating rating equal to HS 18 implies the maximum permissible live load that the bridge can carry is 32 tons.

3 - If the bridge is posted, the bridge cannot safely carry standard trucks used to design a new bridge. The posting values are determined by rating the bridge with model trucks determined by AASHTO. The trucks have specific distances between axles and axle loads. Typically, if the calculated operating rating is less than HS 27, calculations are completed to determine if posting is required. If the operating rating is greater than HS 27, it is assumed that posting is not required for the bridge.

4 - Bridges are provided structural condition codes based on inspection findings. The codes range between 9 and 0. A code of 9 is excellent condition; a code of 0 is failed – beyond corrective action. Code 5 is fair condition and code 4 is poor condition.

5 - A bridge is fracture critical if the failure of one member will likely cause a section or the entire bridge to collapse.

6 - Deficiency status is an additional check used to determine funding eligibility. If it is rated as structurally deficient or functionally obsolete, the bridge is eligible for funding. A bridge is structurally deficient if any of the deck, superstructure, or substructure condition codes are 4 or less, or if the structure evaluation appraisal rating is 2 or less. A bridge is functionally obsolete if any of the listed appraisal ratings are 3 or less.

7 - Bridges are rated on a scale of 0 to 9. Structural evaluation of 4 meets minimum tolerable limits. Deck geometry rating of 2 means intolerable, requires high priority of replacement. Approach alignment rating of 8 means no speed reduction required.

Non-MnDOT Data

Roadway Characteristics

Lane Widths: 10 ft
Shoulder Width: 0 ft; not striped
Shoulders Paved or Unpaved: Paved
Roadway Surfacing: Bituminous overlay

Sidewalk Characteristics

Sidewalk Width East & West: 8.0 ft
Railing Height East & West: 3.5 ft
Pedestrian Ramps: N/A to all corners
Type of Pedestrian Ramp:

Location of Plans

City of Minneapolis

Accident Data

Info not specific enough to report

Previous Repairs, if any

Minor shotcrete repairs were completed to north and south spans. Metal railing added to the top of the concrete rail to improve railing height. Shade of white paint applied to abutments and pier columns to cover graffiti.

IV – Existing Conditions/Activities

As described in the Project Introduction section, the bridge was visited multiple times. These visits were conducted to determine the existing condition of the bridge and vertical clearance.

General Bridge Description:

Bridge 90437 is a 3-span skewed continuous concrete girder bridge which carries four lanes of traffic on Cedar Avenue over the Midtown Greenway in the city of Minneapolis. There are 12 tee beams in each of the three spans. There is a concrete deck topped with a bituminous overlay. The bridge has two stub abutments, and two 4-column piers. The roadway width is 40 feet from curb to curb and there is an 8 foot sidewalk on either side of the bridge. The railings are made of concrete and stand 36 inches tall. A steel pipe rail was added on top to provide an additional 6 inches of height.

Serviceability Observations:

The bridge is structurally deficient due to its condition and deck geometry, but is currently not posted. The NBI condition codes for the superstructure and substructure are a 4, while the NBI condition code for the deck is a 5. Bridges are provided structural condition codes based on inspection findings. The codes range between 9 and 0. A code of 9 is excellent condition; a code of 0 is failed – beyond corrective action. A code of 5 suggests fair condition and a code of 4 suggests poor condition. These codes are used to assist in determining the sufficiency rating of the bridge which is used to determine funding eligibility and priority for bridge replacement and rehabilitation.

Bridge 90437 is narrower than the roadway north and south of the bridge and this bridge does not provide any shoulders for a four lane road.

Condition Observations:

Superstructure:



7 of the 10 interior beams in the center span are deteriorated.

A few of the bays have minor deck spalls, but the entire deck is undergoing significant freeze/thaw damage.



7 of the 10 interior beams in the south span are deteriorated; additional beams are covered in shotcrete.



6 of the 10 interior beams in the north span are deteriorated

Substructure:



Cracks are present in the abutments indicating movement of the center portion of the abutment relative to the adjoining wing walls. This movement appears to be both vertical and horizontal. Shear blocks are not present. About 15 linear feet of cracks are less than ½ inches in width; about 25 linear feet of cracks are more than ½ inches in width on the south abutment.

There are deep and shallow spalls on the south abutment. There are about 100 square feet of spalls where the unsound concrete is likely more than 4 inches deep and about 50 square feet of more shallow spalls.



Cracks located on the north abutment appear to be much deeper and are believed to protrude through the abutment stem.



The pier columns and caps appear to be in fair condition. The far northeast column has major freeze/thaw damage while the other columns have some spalls. There are about 20 square feet of spalls where the unsound concrete is likely more than 4 inches deep and about 50 square feet of more shallow spalls.

Railings and Sidewalks:



The railings are in poor condition. The railing is badly pitted throughout; the toe concrete is flaking apart. Vertical rebar is also visible in one panel.

The sidewalk appears to be in fair condition.



This is a typical condition of original posts. (One post was reconstructed in-kind).



The southwest post is missing.

The entire length of the railing is in poor condition (290 linear feet).

Approaches:



Bituminous pavement approaches are at each end of the bridge. Utilities are present in the approaches with two manhole covers present.

Non-Structural Condition:



A watermain is supported on the bridge between the first two interior beams on the west side of the bridge.

Date of Site Visit: December 13, 2013 and May 22, 2014

Overall Considerations:

The Cedar Avenue Bridge is currently open to vehicular traffic. The activities that follow assume the bridge will remain open to vehicular and pedestrian traffic.

The bridge was built in 1916-1917. Design standards for newly constructed bridges are different in 2014 than they were in 1916; among other requirements, vehicle loadings and railing crash level requirements are greater now. The activities presented below are intended to rehabilitate deteriorated portions of the bridge. The original load capacity of the bridge would be restored.

Once a project begins and the purpose and need are identified, the owner may desire or need additional vehicle load capacity, railing crash capacity, additional lanes or sidewalk widths, etc. Designers should consider the use of design exceptions and the use of non-typical details during project development. It may be possible for a deviation from current standards to be accepted by all parties. Creative solutions are encouraged to provide safe, durable, and functional designs that minimize the impact to the historic integrity of the bridge.

Stabilization Activities:

For the purposes of this report, stabilization is defined as measures performed to maintain the bridge in its current state until a more substantial repair project is undertaken. These measures could be minor repairs which are intended to prevent the need for emergency repairs in the near future, or could be emergency repairs.

There are no stabilization activities for this bridge.

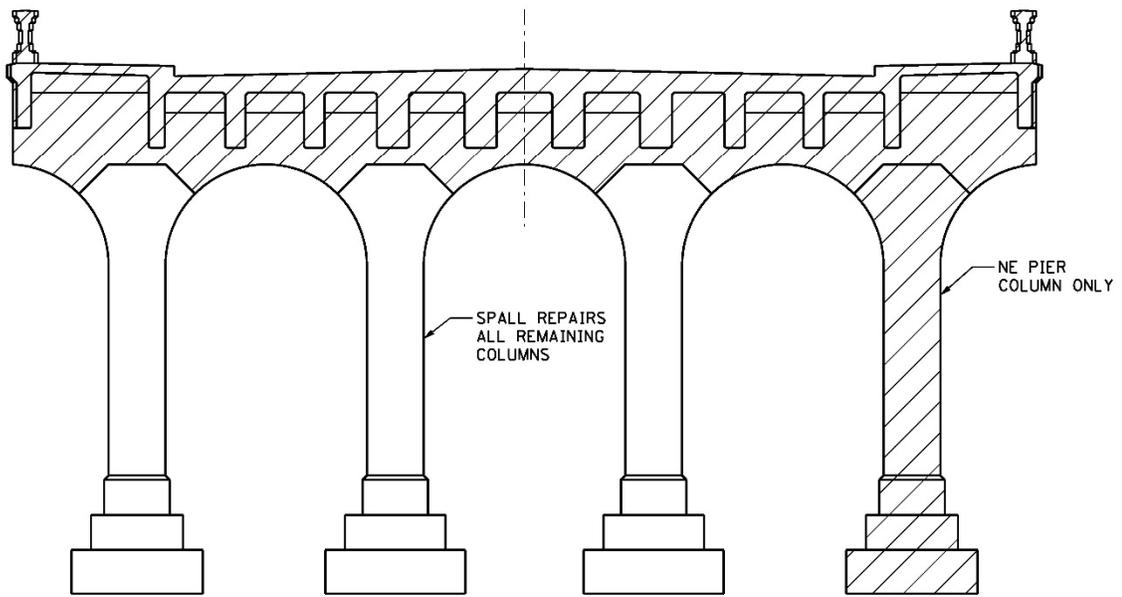
Preservation Activities:

For the purposes of this report, preservation is defined as actions taken to preserve the structural and historic integrity of the bridge for the next 20 to 30 years.

According to the Secretary of the Interior's Standards, historic fabric should be retained and repaired where possible. During the site visits completed in late 2013 and 2014, much of the bridge was found so seriously deteriorated that most of the structure is likely irreparable. It is estimated that only about 23% of total historic fabric would be retained, primarily in the south abutment and wing walls, and the pier columns. The percentage is based off of total cubic yards of concrete placed during original construction, excluding footings.

The north abutment has severe cracks which are believed to protrude through the entire concrete section, thereby causing the abutment to act as pieces instead of one entity as intended. The far northeast pier column also has major freeze/thaw damage; the damage is believed to be deep into the concrete and therefore, precludes repair. The deck has significant freeze/thaw damage and most of the beams are in poor condition. For these reasons, the following items are suggested to be replaced: north abutment, far east pier column in the north bent, beams, deck, sidewalk, and railing. A typical section showing removal limits is provided on the following page.

When a project need and purpose are defined, testing can be completed to better define the damage. Consultation among interested parties should take into account the future project's Purpose and Need, preservation of the historic district's overall integrity, additional environmental impacts, and other factors. One possibility is in-kind replacement of these items to original dimensions per the Secretary of the Interior's Standards for Reconstruction. For purposes of the preservation estimate, an allowance for in-kind replacement of these portions of the bridge was included.



TYPICAL SECTION

 REMOVE AND REPLACE IN KIND

South Abutment and Piers:

The south abutment and remaining pier columns would require spall repairs, both major (where approximately 4 inches of concrete is estimated to be replaced) and minor (where approximately 2 inches of concrete is estimated to be replaced). With the major repairs, the existing reinforcement should be cleaned and assessed for corrosion. Additional reinforcement may need to be added depending on the extent of the corrosion. All new concrete should be finished with a board form treatment to line up with the original board form lines and should match the texture and color of the adjacent historic concrete.

A few narrow cracks on the south abutment need to be filled with epoxy which is compatible with the adjacent historic concrete.

A few major cracks on the south abutment would need repair. The repair would likely consist of new reinforcement bars which are stitched into the existing concrete and span over the large crack. All replacement concrete would be finished similar to the spall repairs.

Helical anchors are suggested to prevent further settlement of the south abutment and wing walls. Helical anchors would be installed by drilling through the abutment and wing wall footings and vertical faces. The new concrete which will replace the concrete removed to install the anchors would be finished similar to the spall repairs.

Concrete Approach Panels:

Concrete approach panels would be added to either end of the bridge to prevent water from collecting behind the abutments. This will alleviate pressure behind the abutments and in the deck. Structure excavation is required so that a concrete ledge can be built on the back side of the abutment wall to support the concrete approach panel. This ledge will not be visible as it will be buried beneath the new approach panel.

Cumulatively the recommended work is expected to meet the Secretary of the Interior's Standards.

Maintenance Activities:

Annual maintenance activities should be performed on this bridge. The maintenance activities should include an annual inspection, power washing of the deck each spring, clearing vegetation that interferes with the abutments and wing walls, spot painting the metal railing to repair chipped paint, and fixing spalls as required.

V – Projected Costs

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 on rehabilitating and repairing 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 costs provided below are presented in 2014 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 25% contingency and 10% mobilization allowance has been included in the construction cost estimates. These values differ from the Minnesota Local Historic Bridge Study and are based off of previous estimates and bid tabs on work items performed in the Midtown Corridor.

Administrative and engineering costs are also presented below as 20% of the preservation activities. Engineering and administrative costs are also to be interpreted as programming level only. Costs can be highly variable and are dependent on the structure condition, intended work scope, project size, and level of investigative, testing, and documentation work necessary. Additional studies, evaluation, and historical consultation costs not exclusively called out may also be incurred on a case-by-case basis.

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

Opinion of Annual Cost - Maintenance Activities:	\$	7,500
Opinion of Construction Cost - Stabilization Activities:	\$	0
Opinion of Construction Cost - Preservation Activities:	\$	3.9 million

(Note the estimated maintenance costs assume the preservation activities are already completed).

Estimated Preliminary Design, Final Design, and Construction Administration Costs: \$ 780,000

MAINTENANCE, STABILIZATION, & PRESERVATION COST ESTIMATE (2014 DOLLARS)					
Bridge No. 90437 (Cedar Ave.)					
December 31, 2014					
			ESTIMATED QUANTITIES AND COST		
ITEM NO.	ITEM	UNIT	QUANTITY / ANTICIPATED LIFE CYCLE (YRS)	UNIT COST	TOTAL ESTIMATE
MAINTENANCE COSTS					
1	ANNUAL INSPECTION	LUMP SUM	1	\$1,000	\$1,000
2	POWER WASHING DECK	LUMP SUM	1	\$1,500	\$1,500
3	VEGETATION REMOVAL	LUMP SUM	5	\$10,000	\$2,000
4	SPOT PAINTING METAL RAILING	LUMP SUM	10	\$5,000	\$500
5	LOOSE CONCRETE REMOVAL/REPAIR	LUMP SUM	1	\$1,000	\$1,000
	25% CONTINGENCY				\$1,500
ESTIMATED MAINTENANCE COSTS					\$7,500
STABILIZATION COSTS					
1				\$0	\$0
	25% CONTINGENCY				\$0
ESTIMATED STABILIZATION COSTS					\$0
PRESERVATION COSTS					
	MOBILIZATION @ 10%				\$283,000
1	STRUCTURE EXCAVATION	LUMP SUM	1	\$30,000	\$30,000
2	HELICAL ANCHORS	EACH	20	\$5,000	\$100,000
3	EPOXY CRACK REPAIR	LF	15	\$125	\$1,875
4	REINFORCEMENT CRACK REPAIR	LF	25	\$200	\$5,000
5	MINOR SPALL REPAIR - ABUT	SF	50	\$175	\$8,750
6	DEEP SPALL REPAIR - ABUT	SF	100	\$210	\$21,000
7	MINOR SPALL REPAIR - PIER	SF	50	\$175	\$8,750
8	DEEP SPALL REPAIR - PIER	SF	20	\$210	\$4,200
9	ABUTMENT REPLACEMENT	CY	136	\$3,000	\$408,000
10	PIER COLUMN REPLACEMENT	CY	20	\$4,500	\$90,000
11	APPROACH PANELS	EACH	2	\$43,000	\$86,000
12	BEAM AND DECK REPLACEMENT	CY	308	\$5,500	\$1,694,000
13	ADD STRUCTURAL DECK	SF	4100	\$25	\$102,500
14	NEW OVERLAY	SF	6039	\$11	\$66,429
15	RECONSTRUCT RAIL	LF	290	\$700	\$203,000
	25% CONTINGENCY				\$778,200
ESTIMATED PRESERVATION COSTS					\$3,891,000
IN-KIND REPLACEMENT COSTS					
1	BRIDGE REMOVAL	CY	780	\$400	\$312,000
2	BRIDGE REPLACEMENT	SF	6039	\$425	\$2,566,575
	25% CONTINGENCY				\$719,700
ESTIMATED IN-KIND REPLACEMENT COSTS					\$3,599,000

Appendix A. Glossary

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

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

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

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

Condition, fair – A bridge or bridge component of which all primary structural elements are sound, but may have minor deterioration, section loss, cracking, spalling, or scour.

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

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

Condition rating – Level of deterioration of bridge components and elements expressed on a numerical scale according to the NBI system. Components include the substructure, superstructure, deck, channel, and culvert. Elements are subsets of components, e.g., piers and abutments are elements of the component substructure. The evaluated bridge is compared with a new bridge built to current design standards. Component ratings range from 0 (failure) to 9 (new) or N for (not applicable); elements are rated on a scale of 1-3, 1-4 or 1-5 (depending on the element type and material). In all cases condition state 1 is the best condition with condition state 3, 4 or 5 being the worst condition. In rating a bridge's condition, MnDOT pairs the NBI system with the newer and more sophisticated Pontis element inspection information, which quantifies bridge elements in different condition states and is the basis for subsequent economic analysis.

Corrosion – The general disintegration of metal through oxidation.

Cutwater – The wedge-shaped end of a bridge pier, designed to divide the current and break up ice.

Decay – Deterioration of wood as a result of fungi feeding on its cell walls.

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

Deck geometry – One of five NBI appraisal ratings. This rating appraises the functionality of a bridge's roadway width and vertical clearance, taking into account the type of roadway, number of lanes, and ADT.

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

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

Design exception – A deviation from federal design and geometric standards that takes into account environmental, scenic, aesthetic, historic, and community factors that may have bearing upon a transportation project. A design exception is used for federally funded projects where federal standards are not met. Approval requires appropriate justification and documentation that concerns for safety, durability, and economy of maintenance have been met.

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

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

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

Extant – Currently or actually existing.

Extrados – The upper or outer surfaces of the voussoirs which compose the arch ring. Often contrasted with intrados.

Footing – The enlarged, lower portion of a substructure which distributes the structure load either to the earth or to supporting piles.

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

Functionally obsolete – The Federal Highway Administration (FHWA) classification of a bridge that does not meet current or projected traffic needs because of inadequate horizontal or vertical clearance, inadequate load-carrying capacity, and/or insufficient opening to accommodate water flow under the bridge. An appraisal rating of 3 or less for deck geometry, underclearance, approach alignment, structural evaluation or waterway adequacy will designate a bridge as functionally obsolete.

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

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

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

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

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

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

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

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

Keystone – Wedge-shaped stone, or voussoir, at the crown of an arch.

Load Rating – The determination of the live load carrying capacity of a bridge using bridge plans and supplemented by field inspection.

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

Minnesota Historical Property Record – A documentary record of an important architectural, engineering, or industrial site, maintained by the Minnesota Historical Society as part of the state's commitment to historic preservation. MHPR typically includes large-format photographs and written history, and may also include historic photographs, drawings, and/or plans. This state-level documentation program is modeled after a federal program known as the Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER).

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

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

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

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

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

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

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

Pointing – The compaction of mortar into the outermost portion of a joint and the troweling of its exposed surface to secure water tightness and/ or desired architectural effect (when replacing deteriorated mortar).

Pony truss – A through bridge with parallel chords and having no top lateral bracing over the deck between the top chords.

Posted load – Legal live-load capacity for a bridge which is associated with the operating rating. A bridge posted for load restrictions is inadequate for legal truck traffic.

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

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

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

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

Rehabilitation – The act or process of returning a historic property to a state of utility through repair or alteration which makes possible an efficient contemporary use, while preserving those portions or features of the property that are significant to its 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 distintegration 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 bridges 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.

Tee beam – A reinforced concrete superstructure system distinguished by a “T” shape. The lower portion of the system are rectangular reinforced concrete beams. The upper portion is a reinforced concrete deck. The two parts form an integral system which works together to resist applied loads.

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:

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

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

1. Every reasonable effort shall be made to continue an historic bridge in useful transportation service. Primary consideration shall be given to rehabilitation of the bridge on site. Only when this option has been fully exhausted shall other alternatives be explored.
2. The original character-defining qualities or elements of a bridge, its site, and its environment should be respected. The removal, concealment, or alteration of any historic material or distinctive engineering or architectural feature should be avoided.
3. All bridges shall be recognized as products of their own time. Alterations that have no 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

2013 MnDOT Structure Inventory Report

Mn/DOT Structure Inventory Report

Bridge ID: 90437 CEDAR S (CSAH 152) over HCRRRA

Date: 10/27/2014

+ GENERAL +	+ ROADWAY +	+ INSPECTION +
Agency Br. No. 4750	Bridge Match ID (TIS) 1	Deficient Status S.D.
District METRO Maint. Area	Roadway O/U Key 1-ON	Sufficiency Rating 50.3
County 27 - HENNEPIN	Route Sys/Nbr CSAH 152	Last Inspection Date 09-10-2013
City MINNEAPOLIS	Roadway Name or Description CEDAR S	Inspection Frequency 12
Township	Roadway Function MAINLINE	Inspector Name HENNEPIN
Desc. Loc. 0.1 MI N OF LAKE ST	Roadway Type 2 WAY TRAF	Structure A-OPEN
Sect., Twp., Range 36 - 029NN - 24W	Control Section (TH Only)	+ NBI CONDITION RATINGS +
Latitude 44d 57m 00.00s	Ref. Point (TH Only)	Deck 5
Longitude 93d 14m 48.00s	Date Opened to Traffic 01-01-1916	Superstructure 4
Custodian COUNTY	Detour Length 1 mi.	Substructure 4
Owner RAILROAD	Lanes 4 Lanes ON Bridge	Channel N
Inspection By HENNEPIN COUNTY	ADT (YEAR) 15,841 (2008)	Culvert N
BMU Agreement	HCA DT	+ NBI APPRAISAL RATINGS +
Year Built 1916	Functional Class. URB/MINOR ART	Structure Evaluation 4
Year Fed Rehab	+ RDWY DIMENSIONS +	Deck Geometry 2
Year Remodeled	If Divided NB-EB SB-WB	Underclearances N
Temp	Roadway Width 40.0 ft	Waterway Adequacy N
Plan Avail. MUNICIPAL	Vertical Clearance	Approach Alignment 8
+ STRUCTURE +	Max. Vert. Clear.	+ SAFETY FEATURES +
Service On HWY;PED	Horizontal Clear. 39.9 ft	Bridge Railing 0-SUBSTANDARD
Service Under PED;BICYCLE	Lateral Clr. - Lt/Rt	GR Transition N-NOT REQUIRED
Main Span Type CONC DECK GIRD	Appr. Surface Width 40.0 ft	Appr. Guardrail N-NOT REQUIRED
Main Span Detail	Roadway Width 40.0 ft	GR Termini N-NOT REQUIRED
Appr. Span Type	Median Width	+ IN DEPTH INSP. +
Appr. Span Detail	+ MISC. BRIDGE DATA +	Frac. Critical
Skew 18L	Structure Flared NO	Underwater
Culvert Type	Parallel Structure NONE	Pinned Asbly.
Barrel Length	Field Conn. ID	Spec. Feat.
Number of Spans	Cantilever ID	+ WATERWAY +
MAIN: 3 APPR: 0 TOTAL: 3	Foundations	Drainage Area
Main Span Length 34.0 ft	Abut. CONC - SPRD SOIL	Waterway Opening
Structure Length 100.6 ft	Pier CONC - SPRD SOIL	Navigation Control NOT APPL
Deck Width 60.0 ft	Historic Status ELIGIBLE	Pier Protection
Deck Material C-I-P CONCRETE	On - Off System ON	Nav. Vert./Horz. Clr.
Wear Surf Type BITUMINOUS	+ PAINT +	Nav. Vert. Lift Bridge Clear.
Wear Surf Install Year	Year Painted Pct. Unsound	MN Scour Code A-NON WATERWAY
Wear Course/Fill Depth 0.58 ft	Painted Area	Scour Evaluation Year 1993
Deck Membrane NONE	Primer Type	+ CAPACITY RATINGS +
Deck Protect. N/A	Finish Type	Design Load UNKN
Deck Install Year	+ BRIDGE SIGNS +	Operating Rating HS 38.60
Structure Area 6,036 sq ft	Posted Load NOT REQUIRED	Inventory Rating HS 23.20
Roadway Area 6,039 sq ft	Traffic NOT REQUIRED	Posting
Sidewalk Width - L/R 8.0 ft 8.0 ft	Horizontal NOT REQUIRED	Rating Date 01-23-2013
Curb Height - L/R 0.33 ft 0.33 ft	Vertical NOT APPLICABLE	Mn/DOT Permit Codes
Rail Codes - L/R 36 36		A: N B: N C: N

BRIDGE INVENTORY REPORT.PPT

2013 MnDOT Bridge Inspection Report

10/27/2014

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Mn/DOT BRIDGE INSPECTION REPORT

Inspected by: HENNEPIN COUNTY

BRIDGE 90437 CEDAR S (CSAH 152) over HCRRA

INSP. DATE: 09-10-2013

County: HENNEPIN Location: 0.1 MI N OF LAKE ST Length: 100.6 ft
 City: MINNEAPOLIS Route: CSAH 152 Ref. Pt.: 013+00.890 Deck Width: 60.0 ft
 Township: Control Section: Maint. Area: Rdwy. Area / Pct. Unsnd: 6,039 sq ft
 Section: 36 Township: 029NN Range: 24W Local Agency Bridge Nbr: 4750 Paint Area/ Pct. Unsnd:
 Span Type: CONC DECK GIRD Culvert N/A
 NBI Deck: 5 Super: 4 Sub: 4 Chan: N Culv: N
 Open, Posted, Closed: OPEN
 Appraisal Ratings - Approach: 8 Waterway: N MN Scour Code: A-NON WATERWAY Def. Stat: S.D. Suff. Rate: 50.3
 Required Bridge Signs - Load Posting: NOT REQUIRED Traffic: NOT REQUIRED
 Horizontal: NOT REQUIRED Vertical: NOT APPLICABLE

STRUCTURE UNIT: 0

ELEM NBR	ELEMENT NAME	ENV	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4	QTY CS 5
13	BIT. O/L (CONC DECK)	4	09-10-2013 09-19-2012	6,039 SF 6,039 SF	6,039 6,039	0 0	0 0	0 0	0 0
Notes: [13. New bit O/L prior to '12 inspection. '13-several mod long & trans cracks.]									
320	CONC APPR SLAB-BITOL	4	09-10-2013 09-19-2012	2 EA 2 EA	2 2	0 0	0 0	0 0	N/A N/A
Notes: [320. New bit O/L prior to '12 inspection. '13-no change.]									
333	RAILING - OTHER	4	09-10-2013 09-19-2012	203 LF 203 LF	0 0	98 98	105 105	N/A N/A	N/A N/A
Notes: [333. Conc railings have many vert cracks, hollow areas and spalls w/ rebar exp. Conc rail posts are very spalled and deteriorated. Galvanized metal pipe handrails. SW corner rail posts gone/deteriorated. Metal railing bent in NE @ wingwall. '13-no change.]									
110	CONCRETE GIRDER	3	09-10-2013 09-19-2012	1,201 LF 1,201 LF	0 0	0 0	890 902	311 299	N/A N/A
Notes: [110. 12 T girders. Few long cracks in some girders. Many excessive leaching and hollow areas. Some of the patches are spalling. Accident damage to all girders in center span. Many of the beams over the N and S spans are patched. Some rebar exposed. SOUTH SPAN: 2nd and 10th from E cracked long w/ efflor. 5th, 6th, 7th, 8th and 11th from E shotcreted. Some shotcrete repair areas are spalling and some are cracking. Cracks and delam @ abut and pier. '13-2nd & 11th from E are spalled w/ rebars exp. CENTER SPAN: 2nd and 3rd from E severely delam'd and spalled w/ deteriorated exp rebar the full length. 5th - 8th from E spalled w/ many rebar exp. 11th from E delam'd and spalled w/ deteriorated exp rebar. NORTH SPAN: 2nd, 3rd, 5th, 7th, 10th, and 11th from E shotcreted. Some shotcrete repairs spalled and vert cracked again. Haunch spalled away @ N abut in 10th from W. Cracks and spalls @ abut. '13-haunch spall repaired @ N abut.]									
205	CONCRETE COLUMN	4	09-10-2013 09-19-2012	8 EA 8 EA	0 0	6 6	2 2	0 0	N/A N/A
Notes: [205. At the N pier, 2nd column from the E, a large delam has formed on the N side. At the N pier, E column has many vert cracks. '13-delam on 2nd column from E @ N pier is now a spall w/ rebar exp.]									
215	CONCRETE ABUTMENT	4	09-10-2013 09-19-2012	171 LF 171 LF	0 0	0 0	171 171	0 0	N/A N/A
Notes: [215. Both footings exp. Some cracks, spalls and leaching on many diaphragms. Cracks on the beam seats. Surface finish peeled. '13-no change. N ABUTMENT: Tipped to the S. See #360, settlement. Large crack @ W end. Large crack and spall on E side. S ABUTMENT: Tipped to the N. See #360, settlement. Rebar exp w/ minor section loss @ parapet wall. Large vert crack @ SE and SW area of face and wingwall.]									

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ELEM NBR	ELEMENT NAME	ENV	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4	QTY CS 5
234	CONCRETE CAP	4	09-10-2013 09-19-2012	121 LF 121 LF	0 0	109 121	12 0	0 0	N/A N/A
Notes: [234. Seepage over both caps w/ efflor and leaching. W arch of both piers has a crack under 4th beam from W. North-W cantilever has a 2' crack @ end. Fine vert crack over W arch. '13-cap spalled on W end. Many fine map cracks over E arch & S face over all arches. Map crack w/ efflor over 2 E columns. South-Several vert cracks near center arch and W cantilever. Spall w/ rebar exp under 4th beam from W. '13-fine vert crack over W arch. Map crack w/ rust & efflor over E column.]									
387	CONCRETE WINGWALL	1	09-10-2013 09-19-2012	4 EA 4 EA	0 0	0 0	4 4	0 0	N/A N/A
Notes: [387. All walls weathered, cracked and tipped forward. See #360, Settlement. SW wall is diag/horiz cracked. SE wall has diag/horiz crack. NW wall cracked and bowed w/ 2" separation. SE and SW wings have a large crack +/-6' behind abut face. NE is cracked and spalled @ abut joint. '11-top of NW wall is 3" back from lower wall @ crack. '12-top of NW wall is 3 1/2" back from lower wall. '13-no change.]									
359	CONC DECK UNDERSIDE	2	09-10-2013 09-19-2012	1 EA 1 EA	0 0	0 0	1 1	0 0	0 0
Notes: [359. Map cracking and many fine long cracks w/ efflor. Minor spalls w/ rebar exp. 4' X 3' patch @ SE w/ wood form still in place. Heavily weathered w/ minor spalls and rebar exp. '13-delam & some spalls w/ heavy efflor under NB gutter over trail. Long cracks w/ efflor @ both gutter lines.]									
360	SETTLEMENT	2	09-10-2013 09-19-2012	1 EA 1 EA	0 0	1 1	0 0	N/A N/A	N/A N/A
Notes: [360. Continue to monitor wingwalls and abuts. Take measurements every year. See form in bridge folder for documentation. Measurements from '11 to '12 show NW has continued to settle. '13-no change.]									
964	CRITICAL FINDING	2	09-10-2013 09-19-2012	1 EA 1 EA	1 1	0 0	N/A N/A	N/A N/A	N/A N/A
Notes: [964.]									
981	SIGNING	2	09-10-2013 09-19-2012	1 EA 1 EA	1 1	0 0	0 0	0 0	0 0
Notes: [981. No parking signs @ both approaches. Snow emergency route in SE corner. Watch Force Police sign in NW corner.]									
984	DRAINAGE	2	09-10-2013 09-19-2012	1 EA 1 EA	1 1	0 0	0 0	N/A N/A	N/A N/A
Notes: [984.]									
985	SLOPES	2	09-10-2013 09-19-2012	1 EA 1 EA	0 0	1 1	0 0	N/A N/A	N/A N/A
Notes: [985. Crushed limestone over deteriorated conc. 4 course exposed modular block wall along N pier @ bottom of slope. Watermain break in '11 caused erosion hole in N slope paving-restored by City. '13-no change.]									
986	CURB & SIDEWALK	2	09-10-2013 09-19-2012	1 EA 1 EA	0 0	1 1	0 0	N/A N/A	N/A N/A
Notes: [986. Curb and walk have some fine cracks and several minor spalls on W side. Walk spalled, cracked and settled @ SW approach. Trans cracks on E. NE walk settled. '13-SE walk settled.]									

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988	MISCELLANEOUS	2	09-10-2013	1 EA	0	1	0	N/A	N/A
			09-19-2012	1 EA	0	1	0	N/A	N/A

Notes: [988. Bit bike and ped path under center span. 8" diameter utility pipe(Mpls water) under slab @ 2nd bay from W. Watermain supports deteriorated-Mpls bridge repaired in '06. 1 light on S side of N pier. '11-watermain attached to bridge broke in Sept. City of Mpls restored. 5 of 6 remaining conc watermain supports in center span over trail are badly deteriorated. S span conc supports are bad also. Notified City about problem. '13-last remaining conc WM supports replaced with metal supports since '12 inspection.]

General Notes: *Bridge 90437 (4750) CSAH 152 (Cedar Ave S)/HCRRA, Midtown Greenway Corridor 9/10/13. WJM and PTH.

Scheduled for replacement in '08. Turnback: Route designation change in '95.

Recommended Repairs:

- 13. Seal cracks in bit O/L on bridge and approach panels.
- 110. Monitor deteriorated conc girders.
- 110. Repair deteriorated reinforced conc T girders if bridge is not replaced soon.
- 360. Continue to monitor abuts and wingwalls for settlement.
- 359. Monitor bottom of deck and remove any delam'd conc which may drop onto bit path under bridge.

Inspector's Signature

Reviewer's Signature / Date

2013 Load Rating Report

FORM RC-CL Revised Jan. 2012	MnDOT BRIDGE RATING AND LOAD POSTING REPORT FOR COUNTY AND LOCAL AGENCIES		
Bridge Location and Description			
Hwy. No. <u>Cedar Ave</u>	Over <input checked="" type="checkbox"/> Under <input type="checkbox"/>	Bridge No. <u>90437</u>	
	Midtown Greenway		
Year Built <u>1916</u>	Year Remodeled _____	Replaces Br. _____	
Type <u>CConc Dk Gird</u>	County <u>Hennepin</u>	Ref. Pt. _____	
Description <u>Bridge 90437 is a 3-span continuous reinforced concrete deck girder. It has a 40'-0" roadway width, 58'-0" deck width, 2 - concrete railings, 2 - 8'-0" sidewalks and an 18 degree skew.</u>			
Location <u>0.1 Miles N. of Lake St. in Minneapolis</u>			
Data for Basis of Report (Check all that apply)			NBI Condition Ratings
<input checked="" type="checkbox"/> Bridge Inventory File			Deck <u>5</u>
<input checked="" type="checkbox"/> Previous Bridge Rating and Load Posting Report			Superstructure <u>4</u>
<input checked="" type="checkbox"/> Bridge Plans			Substructure <u>4</u>
<input checked="" type="checkbox"/> New <input type="checkbox"/> Overlay			ADTT <u>504</u>
<input type="checkbox"/> Repair/Reconstruction _____			
<input type="checkbox"/> Other Dead Load Modifications _____			
<input checked="" type="checkbox"/> Bridge Inspected by <u>HLE</u> Date <u>11/29/2013</u>			
<input type="checkbox"/> Damaged Component _____			
<input type="checkbox"/> Deteriorated Component _____			
Types of Analysis:			
<input checked="" type="checkbox"/> Manual <input type="checkbox"/> Computer* <input type="checkbox"/> BARS <input checked="" type="checkbox"/> Virtis, V.6.2 <input type="checkbox"/> Other*			
* Hand calculations for rating of bridge deck.			
Method of Rating (Check appropriate box)		Design Load <u>Unknown</u>	
<input checked="" type="checkbox"/> Load Factor (LF) <input type="checkbox"/> Assigned Load Ratings		Design Method <u>ASD</u>	
<input type="checkbox"/> Allowable Stress (AS)			
<input type="checkbox"/> Load & Resistance Factor (LRFR)			
<input type="checkbox"/> Load Testing			
<input type="checkbox"/> No Rating Computations performed			
Summary of Rating and Load Posting Analysis			
Load Posting		Bridge Rating	
Required <input type="checkbox"/> Not Required <input checked="" type="checkbox"/>		Inventory _____ Operating _____	
Sign	TONS	HS <input checked="" type="checkbox"/> RF <input type="checkbox"/>	HS <input checked="" type="checkbox"/> RF <input type="checkbox"/>
R12-1A <input type="checkbox"/>		<u>23.2</u>	<u>38.6</u>
R12-5a <input type="checkbox"/>			
R12-5 <input type="checkbox"/>	M3 M3S2 M3-3		
R12-X11 <input type="checkbox"/>	45		
I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.			
Signature: <u>Joseph R. Mueller</u>		Date: <u>1/23/2013</u>	
(Typed or Printed) Name: <u>Joseph R. Mueller</u>		License No. <u>49106</u>	
(Typed or Printed) Employed by (<input type="checkbox"/> Agency/ <input checked="" type="checkbox"/> Firm): <u>TKDA</u>			
My signature below indicates that I have read and fully agreed with the load rating report.			
Program Administrator's Signature: _____		Date: _____	

FORM RD-CL Revised Jan. 2012	BRIDGE RATING DETAILS				
Bridge Type <u>CConc Deck</u> Rating Method <u>LFD</u> Roadway Width <u>40'-0"</u> <input type="checkbox"/> Curved <input type="checkbox"/> Tapered Beam Spacing <u>5'-0"</u> <input checked="" type="checkbox"/> Live Load Distribution Factor Single <u>S/6.5</u> Multiple <u>S/6</u> <input type="checkbox"/> Finite/Grid Element Analysis	Bridge No. <u>90437</u> Design Load: <u>Unknown</u> Inventory Rating: <u>23.2</u> Operating Rating: <u>38.6</u> Rated <u>HLE</u> Checked <u>MJD</u> Date <u>1/22/2013</u> Sheet <u>2</u> of <u>2</u>				
<p style="text-align: center;">3-SPAN CONTINUOUS REINFORCED CONCRETE DECK GIRDER</p>					
BEAM ELEVATION ² Show span lengths, structure/beam depths.					
Truck	Rating Factor	Span/ Pier	Location	Limit State ¹	Notes/Comments
HS 20 Inventory	1.16	0.5L	Deck	Ultimate Moment	Truck Load
HS 20 Operating	1.93	0.5L	Deck	Ultimate Moment	Truck Load
Post, M3	2.18	0.4L	Sp. 1	Ultimate Moment	Beam "G1"
Post, M3S2	2.36	0.4L	Sp. 1	Ultimate Moment	Beam "G1"
Post, M3S3	2.28	0.4L	Sp. 1	Ultimate Moment	Beam "G1"
Type SU4	1.95	0.4L	Sp. 1	Ultimate Moment	Beam "G1"
Type SU5	1.84	0.4L	Sp. 1	Ultimate Moment	Beam "G1"
Type SU6	1.70	0.4L	Sp. 1	Ultimate Moment	Beam "G1"
Type SU7	1.62	0.4L	Sp. 1	Ultimate Moment	Beam "G1"
¹ Choose from: service or ultimate; shear or moment ² Elevation may be on back or another sheet if it won't fit here.					