BRIDGE # 69840
TH 194 NB over SUPERIOR ST(MSAS171)

DISTRICT: District 1       COUNTY: St. Louis       CITY/TOWNSHIP: Duluth

Date(s) of Inspection: 04/27/2015 - 04/27/2015
Equipment Used: A-62, Other - Confined Space Entry procedures and equipment.

Owner: State Highway Agency

Inspected By: Carter, Rodney; Fishbein, Joseph; Theisen, Scott

Report Written By: Rodney Carter
Report Reviewed By: Joe Fishbein
Final Report Date: 11/24/2015

MnDOT Bridge Office
3485 Hadley Avenue North
Oakdale, MN 55128
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Bridge Location Map
I. Findings Summary

This report documents the findings of the 2015 Routine and Fracture Critical Inspection of Bridge 69840 - TH 194 NB over Superior Street (MSAS 171). The inspection was conducted on April 27, 2015. The inspection was conducted by Rodney Carter, Joe Fishbein, and Scott Theisen.

Significant Findings

The following is a summary of significant inspection findings from the 2015 Routine and Fracture Critical Inspection. This also includes significant findings from past inspections that have not been resolved or corrected. No critical structural deficiencies were observed during this inspection.

1. The 1998 load rating did not take into consideration the integral steel pier caps, but was only based upon the steel girders (Appendix D).

Recommendation: A new load rating should be performed that takes into consideration the load carrying capacity of the integral steel pier caps. This was also recommended starting in 2009/2011/2013/2015.

2. The north approach appears to have settled from 1" down to 2" since 2011 (Photo 11). The south approach has no change from the previous inspection, with no settlement but two longitudinal cracks present (Photo 7).

Recommendation: Continue to monitor settlement of the approaches. If settlement continues, consider countermeasures.

3. There is minor surface corrosion on both ends of bridge, mainly on the fascia girders and abutment bearings.

Recommendation: MnDOT District 1 should consider spot painting the fascia girders at the field splices and abutment bearings (also noted in 2011/2013/2015).

4. The north relief joint appears to have completely failed; south relief joint has two areas 1' long that have lost adhesion (Photo 13).

Recommendation: MnDOT District 1 should consider repairing the entire north joint and areas of the south joint. Repair of the north joint was also recommended in 2011/2013/2015.

5. The East end of the North strip seal gland is pulled out at the East Rail kick-out and the leaking is causing accelerated corrosion to superstructure below. The South strip seal gland is pulled out for 1 foot and leaking below. Both strip seal glands are filled with dirt.

Recommendation: Repair or replace the glands ASAP. Clean the plugged expansion joints.

6. Concrete deck has unsealed cracks with moderate size and density (Photo 10). Cracks are spaced about every 4' throughout deck. Poured deck joint sealant has lost adhesion and failed on the south approach.

Recommendation: Continue monitoring the deck cracks and poured joints and, if necessary, seal the deck cracks and reseal the poured joints.
**NBI Condition Summary**

Complete NBI and element condition ratings are provided in the 7-Day Fracture-Critical Report (Appendix B).

<table>
<thead>
<tr>
<th>Item</th>
<th>Current</th>
<th>Suggested</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deck</td>
<td>6 (Satisfactory Condition)</td>
<td>6 (Satisfactory Condition)</td>
<td>[2015 F/C Inspection] Concrete deck has unsealed cracks with moderate size and density.</td>
</tr>
<tr>
<td>Superstructure</td>
<td>6 (Satisfactory Condition)</td>
<td>6 (Satisfactory Condition)</td>
<td>[2015 F/C Inspection] No change in condition from previous inspection.</td>
</tr>
<tr>
<td>Substructure</td>
<td>6 (Satisfactory Condition)</td>
<td>6 (Satisfactory Condition)</td>
<td>[2015 F/C Inspection] No change in condition from previous inspection.</td>
</tr>
<tr>
<td>Channel</td>
<td>N (Not Applicable)</td>
<td>N (Not Applicable)</td>
<td></td>
</tr>
</tbody>
</table>

**Inventory Updates**

None
II. Inspection Logistics

The focus of this report is the presentation of findings from the in-depth fracture critical and routine inspection of Bridge 69840 conducted on April 27, 2015. The 2015 inspection was performed by Rodney Carter, Joe Fishbein, and Scott Theisen of the MnDOT Bridge Office.

Bridge Description

Bridge 69840 carries the ramp from northbound I-35 to northbound Mesaba Avenue (MNTH 194) over West Superior St. The bridge is located at the southwest end of downtown Duluth. The bridge runs from south to north. The bridge has three continuous steel multi-girder spans, with a total length of 294 ft. (see figure #1). Both piers are a “hammerhead” configuration, with an integral steel box girder cap welded directly to a cylindrical steel column (the column bases are bolted to a concrete footing). This bridge is classified as “fracture critical” due to the two integral steel pier caps. The abutments are reinforced concrete.

The bridge was designed by HNTB (Howard, Needles, Tammen, & Bergendoff). The plans are dated July 15, 1968. The bridge was constructed in 1969 (the primary construction contractor was E. W. Coons), and was opened to traffic in 1971. The bridge deck was rehabbed in 1987. The contract included new railings and copings, a 2” low slump concrete overlay & deck repairs, and new expansion joints. A spot painting contract was let in 1995.

The roadway width on the bridge deck is 30.3 ft. (it was widened slightly when the curbs were eliminated in 1987). There are two lanes, with a steep upward grade to the north (varies from 4.48% to 6.52%). The average daily traffic (ADT) on the bridge is 9,250 (2004) & heavy commercial traffic (HCADT) is 278. The average daily traffic (ADT) on the roadway below the bridge is 8,300 (2003): see SIA in Appendix A.

The design load rating is HS 20 (+Mod): 1965 AASHO specifications. The most recent load rating was performed in 1998. The operating load rating is HS 38.1 and the inventory load rating is HS 22.9 (Appendix D). Load posting is not required (the bridge is open to legal loads).

Bridge 69840 is owned and maintained by MnDOT District 1; design plans and shop drawings are available on the MnDOT Electronic Document Management System (EDMS). This bridge is currently classified as “Not Eligible” for the National Register of Historic Places.

Inspection Access

The steel pier caps were accessed using an Aspen Aerials A-62 “snooper”. A lane closure was required on the bridge (provided by MnDOT District 1) and on the roadway below the bridge.

Special Requirements

Confined space entry procedures were required to enter the steel pier caps. All personnel had received confined space training prior to this inspection. The Duluth Fire Department was called prior to entering the confined space and immediately after exiting the confined space each time.
**Inspection Procedures**

An in-depth (close-up visual) inspection was performed on the two fracture critical steel pier caps. This included an internal inspection of the pier caps and steel support columns (confined space entry procedures were required).

This inspection also included a routine inspection of the superstructure, abutments, and deck.

1. Fracture Critical Members: Integral Steel Pier Caps
   a. Perform confined space entry and inspection of fracture critical steel pier caps.

2. Fatigue Prone Details: Focus mainly on D, E, and E’ categories – See details list for locations.
   a. Check all fatigue prone details for defects.

3. Other Miscellaneous Inspection Details: Snooper Access.
   a. Check all girders and bearings for corrosion, proper function, orientation and missing hardware.
   b. Check substructure for movement, scaling, and cracking concrete.
   c. Visual inspection of deck, railing, signing.
III. Fracture Critical Members/Fatigue Prone Details

Fracture critical members (those subject to tensile or reversal loading) are shown in red on the framing plan (page 7). Steel structural members subjected to tension or reversal stresses can develop fatigue cracks. The three primary parameters affecting fatigue crack propagation are stress range, the number of stress cycles, and the type of detail.

Other factors - such as out-of-plane bending, heat straightening, or field-welded repairs - can increase the likelihood of fatigue cracking. For the purpose of designing bridges for fatigue caused by in-plane bending stress, AASHTO describes weld details and connections using an alphabetical designation ranging from stress category "A" (best fatigue resistance) to stress category "E" (most susceptible to fatigue crack growth). Fatigue detail categories are defined in Table 6.6.1.2.3-1 of the AASHTO LRFD Bridge Design Specifications and Section 8.1.5 of the FHWA Bridge Inspector’s Reference Manual (BIRM).

The table on Page 11 identifies the fatigue prone details present on this bridge. Fatigue prone details present that are not defined by AASHTO or FHWA (if any) - such as details prone to fatigue cracking due to out of plane bending - would also be included in this table.
BRIDGE 69840 FRAMING PLAN

S. ABUT EXP BRG

PIER 1 INTEGRAL

PIER 2 INTEGRAL

N. ABUT EXP BRG

SPAN 1

SPAN 2

SPAN 3
Figure 1: Plan & Elevation View of Br #69840 (from original plans)
Figure 2: Shop Drawing of Steel Pier Cap, Girder Stubs, and Upper Portion of Column

Figure 3: Cross-Section of Steel Pier Cap at Interior Girder
Figure 4: Cross-Section of Steel Cap at Column Bearing Stiffener

Figure 5: Shop Drawing of Pier Column Bases
<table>
<thead>
<tr>
<th>Member &amp; Location</th>
<th>Detail Description &amp; Photo Reference</th>
<th>AASHTO Stress Category</th>
<th>AASHTO Detail Number</th>
<th>Potential Crack Initiation Point</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Steel Girders</strong></td>
<td>Shop welded girder flange and web splices (full-penetration groove welds, ground smooth and radiographically inspected).</td>
<td>B</td>
<td>5.1</td>
<td>From internal discontinuities in the filler metal or the fusion boundary.</td>
</tr>
<tr>
<td>Fillet welded web stiffeners</td>
<td>C’</td>
<td>4.1</td>
<td>From the toe of the fillet weld.</td>
<td></td>
</tr>
<tr>
<td>“Tight fit” web stiffener detail at bottom flange (at diaphragm stiffeners and intermediate stiffeners in positive moment regions).</td>
<td>NA</td>
<td>NA</td>
<td>In the toe of the bottom flange/web weld or at the termination of the stiffener weld.</td>
<td></td>
</tr>
<tr>
<td>“Tight fit” web stiffener detail at top flange (intermediate diagrams in negative moment regions).</td>
<td>NA</td>
<td>NA</td>
<td>In the toe of the top flange/web weld or at the termination of the stiffener weld.</td>
<td></td>
</tr>
<tr>
<td><strong>Steel Pier Caps</strong></td>
<td>Fillet welded web stiffeners</td>
<td>C’</td>
<td>4.1</td>
<td>From the toe of the fillet weld.</td>
</tr>
<tr>
<td>“Tight fit” internal web stiffener detail at top flange in negative moment regions.</td>
<td>NA</td>
<td>NA</td>
<td>In the toe of the top flange/web weld or at the termination of the stiffener weld.</td>
<td></td>
</tr>
<tr>
<td>Backer bar along bottom flange/web weld, with discontinuities at flange bend locations.</td>
<td>B’</td>
<td>3.2</td>
<td>From discontinuities in weld or backer bar.</td>
<td></td>
</tr>
<tr>
<td><strong>Steel Columns</strong></td>
<td>Vertical complete joint penetration weld (one on each column) - ground smooth and RT tested.</td>
<td>B</td>
<td>5.1</td>
<td>From internal discontinuities in the filler metal or the fusion boundary.</td>
</tr>
<tr>
<td>Horizontal field splice (complete joint penetration weld) located 4 ft. below the cap) - discontinuous welded backer bar in place.</td>
<td>C</td>
<td>5.3</td>
<td>From discontinuities in the toe of the weld or along the fusion boundary.</td>
<td></td>
</tr>
<tr>
<td>Plug welds in scattered locations near the welded field splice.</td>
<td>E</td>
<td>AWS D1.1 8.3</td>
<td>In base metal adjacent to plug weld.</td>
<td></td>
</tr>
<tr>
<td>Welded attachments (ladder rungs, steel rods, and stubs).</td>
<td>E</td>
<td>7.1</td>
<td>In base metal adjacent to weld.</td>
<td></td>
</tr>
<tr>
<td>Fillet welded stiffeners</td>
<td>C’</td>
<td>4.1</td>
<td>From the toe of the fillet weld.</td>
<td></td>
</tr>
</tbody>
</table>
IV. Inspection Field Notes

Photos referenced in the Field Inspection Notes are found in Section V of this report.
Field Inspection Notes – Bridge #69840 (District 1A – Duluth)

South Abutment & Wingwalls:

[2009] The South Abutment parapet/back wall has cracking on the east end.) [2011] The south abutment parapet/backwall has cracking on the east end (CS2-1 LF) [2013] No change in condition from previous inspection. The concrete wingwalls have no significant deterioration except for some light cracking. [2015 F/C Inspection] No change. (Photo 40)

Span #1 (88 ft.): 4 welded girders (54” deep) - no lateral bracing

Pier #1 (Welded Steel “Hammerhead” Pier):

- **Pier Cap (External Notes):** Mag Particle should be brought on inspections to check the welds at the bottom flange to steel pier cap connection. A few were not one continuous weld. [11/17/2011] G. Elmquist added notes to correspond with the 04/04/2011 FC inspection report. Steel pier caps are in good condition with very little sign of deterioration. [2013 / 2015 F/C] No change in condition from previous inspection. (Photos 23 & 53)

- **Pier Cap (Internal Notes):** Same condition as noted in external notes. (2013) No change in condition from previous inspection. There are bird droppings inside the pier caps. [2015 F/C Inspection] Interior of Pier cap at Pier 1 has paint failure with freckling rust on floor (Photos 44 – 46, 47 - 49).

- **Column (External Notes):** Rust at bottom flange and behind some bolts. [2009] The pier columns have minor surface corrosion. [2010] Winter sand built up on bottom flange. Footings have several light cracks. [11/17/2011] G. Elmquist added notes to correspond with the 04/04/2011 FC inspection report. The painted steel columns have minor surface corrosion. [2013] No change in conditions from previous inspection. [2015 F/C Inspection] No change in previously noted condition. (Photo 41)

- **Column (Internal Notes):** Same condition as noted in external notes. (Photos 50 & 51)

- **Reinforced Concrete Footing:** (2011/11/17 G. Elmquist added notes and changed element CS to correspond with the 04/04/2011 FC inspection report. The concrete footings below the steel columns have light cracking and are covered with debris.) [2013] No change in condition from previous inspection. (2014) No change. [2015 F/C Inspection] No change. (Photo 33)

Span #2 (118 ft.): 4 welded girders (54” deep) - no lateral bracing

Pier #2 (Welded Steel “Hammerhead” Pier):

- **Pier Cap (External Notes):** [11/17/2011] G. Elmquist added notes to correspond with the 04/04/2011 FC inspection report. Steel pier caps are in good condition with very little sign of deterioration. [2013 / 2015 F/C] No change in condition from previous inspection. (Photos 24, 64 – 68)
**Pier Cap (Internal Notes):** Same condition as noted in external notes. [2013] No change in condition from previous inspection. There are bird droppings inside the pier caps. [2015 F/C Inspection] No change. (Photos 69 -75)

**Column (External Notes):** Rust at bottom flange and behind some bolts. [2009] The pier columns have minor surface corrosion. [2010] Winter sand built up on bottom flange. Footings have several light cracks. [11/17/2011] G.Elmquist added notes to correspond with the 04/04/2011 FC inspection report. The painted steel columns have minor surface corrosion.) [2013] No change in condition from previous inspection. [2015 F/C Inspection] No change in previously noted condition. (Photo 24)

**Column (Internal Notes):** Same condition as noted in external notes. (Photos 76 & 77)

**Reinforced Concrete Footing:** [2011/11/17 G.Elmquist added notes and changed element CS to correspond with the 04/04/2011 FC inspection report. The concrete footings below the steel columns have light cracking and are covered with debris.) [2013] No change in condition from previous inspection. (2014) No change. [2015 F/C Inspection] No change.

**Span #3 (88 ft.): 4 welded girders (54” deep) - no lateral bracing**

**North Abutment & Wingwalls:**

[2010] North Abutment repaired. [2011] The North Abutment has 2 LF of CS3 with spalling and corroding rebar at the NW corner mast wall. [2013] No change in condition from previous inspection. The concrete wingwalls have no significant deterioration except for some light cracking. [2015 F/C Inspection] No change. (Photos 17 & 20, 22)

<table>
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<tr>
<th>Elements</th>
<th>Notes</th>
</tr>
</thead>
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<tr>
<td><strong>Girders</strong></td>
<td>[2009] F/C report notes - Some flaking rust (minor section loss) is present at the fascia girder splices - there is corrosion on the east girder near the northeast abutment footing.) [11/17/2011] G.Elmquist added notes and to correspond with the 04/04/2011 FC inspection report. The painted steel girders are in good condition with very little deterioration. The areas around the fascia girder splices have areas of flaking rust (about 12 LF in total). The east fascia girder has extensive flaking rust at the north abutment due to the leaking joint. [2013] No change in condition from previous inspection. [2015 F/C Inspection] No change in previously noted condition. (Photos 16, 54-57)</td>
</tr>
<tr>
<td><strong>Diaphragms</strong></td>
<td>[All years] Same as girder notes. [2013] Add element 380 in an update report to account for these bridge members. [2015 F/C Inspection] Element added for the Diaphragms (Photo 42). Span1 G3-G4 Diaphragm has light surface corrosion with minor flaking and freckling rust, this is typical of all Diaphragms.</td>
</tr>
</tbody>
</table>
rusted. Bearing 4 at the north abutment has severe corrosion due to leaking joint. Bearing 4 at the south abutment has extensive corrosion due to leaking joint.


[2013] No change in condition from previous inspection. The South Abutment expansion bearing at Girder A was in approximately the neutral position. However, the other bearings showed movement at the following locations: South Abutment Girder A 3/8" in expansion, North Abutment Girder A 1/2" in contraction, and North Abutment Girder D 1/4" in contraction at 30-40 degrees.

[2015 F/C Inspection] Bearing 3 under girder C & Bearing 4 under girder D at the South abutment are in CS 2 due to moderate corrosion. Bearing 3 under girder C at North abutment is in CS2 due to moderate corrosion. Bearing 4 under girder D at north abutment is in CS3 (Photos 28 – 32) (Photos 59 - 63).

BEARING MEASUREMENTS: South abutment are G1 ½" s, G2 1/8" s, G3 1/8" s, G4 1/8" s all at 55 degrees. North abutment are G1 Neutral, G2 Neutral, G3 3/8" n, G4 ¼" n all at 55 degrees.

Paint System

[2011/2013] The superstructure and substructure were painted with a lead/aluminum system in 1970. A spot painting contract was performed in 1995. Currently, there is minor paint failure and surface corrosion (approximately 5% unsound paint), with some isolated areas of flaking rust (minor section loss) - spot painting could be considered.

[2015 F/C Inspection] No change.

Steel Pier Caps

See detailed notes on previous pages.

Steel Pier Columns

See detailed notes on previous pages.

Abutments & Wingwalls

See detailed notes on previous pages.

Bridge Deck & (Underside)

Transverse cracking with efflorescence 10 ft. intervals, a few areas with rust staining and delamination occurring.

[11/17/2011] G. Elmquist added notes and changed element CS to correspond with the 04/04/2011 FC inspection report. Transverse cracking with efflorescence at 10 ft. intervals. There are a few areas with rust staining and delamination.

[2012] - cracks should be sealed.

[2013] No change in condition from previous inspection.

[2015 F/C Inspection] Concrete deck has unsealed cracks with moderate size and density (Photos 9 – 10, & 38). Cracks are spaced about every 4' throughout deck. No change in the underside of deck. (Photos 39 & 58)

Wearing Surface

[11/17/2011] G. Elmquist added notes to correspond with the 04/04/2011 FC inspection report. Concrete deck (low slump overlay) has no areas of spalls, delaminations or temporary patches. Existing patchwork is in good condition with very little signs of deterioration.

[2013] No change in condition from previous inspection.

[2015 F/C Inspection] No change in previously noted condition.

Railings

Spalls along southeast rail 10 in. diam. by 2 in. deep.

[11/17/2011] G. Elmquist added notes and changed element CS to correspond with the 04/04/2011 FC inspection report. 30 LF along SE corner rail has spalling along the base and popouts throughout. The NE cover plate bolt is sheared off. (Photo 15)

[2013] No change in condition from previous inspection.
### Expansion Joints

- **[10/10/2008]** North strip seal leaking on east end onto B4. South strip seal out 1 ft & leaking between B3 & B4. Also leaking on east side.
- **[11/17/2011]** G. Elmquist added notes to correspond with the 04/04/2011 FC inspection report. NE gland is pulled out at the east rail kick out (behind cover plate). This is causing leakage down the north abutment which is corroding the east fascia girder and bearing. The south strip seal joint is also leaking on the east side.
- **[2012]** Strip seal filled with dirt.
- **[2013]** No change in condition from previous inspection.
- **[2015 F/C Inspection]** No change. Both Strip seals are filled with dirt. (Photos 14 & 34)

### Poured Joints

- **[2009]** Rubber replaced.
- **[11/17/2011]** G. Elmquist added notes to correspond with the 04/04/2011 FC inspection report. Gland was repaired in 2009 and is in good condition. **[2013]** No change in condition from previous inspection.
- **[2015 F/C Inspection]** Poured sealant has lost adhesion and failed on the south approach.

### Approaches

- **[10/10/2008]** The south approach has two longitudinal cracks. North approach panel has settled 1 in.
- **[11/17/2011]** G. Elmquist added notes to correspond with the 04/04/2011 FC inspection report. NE approach panel sill is still settled 1 inch.
- **[2013]** The north approach appears to have settled down to 2". The south approach has no change from previous inspection.
- **[2015 F/C Inspection]** No change in North approach settling (Photos 11 & 12). The South approach has a 6' moderate crack with a 2'x6' delam at the center line, next to strip seal (Photo 5). South approach has a 30' longitudinal crack at East Rail. (Photos 6 & 7)

### Approach Relief Joint

- **[2009]** The north joint seal has completely failed, and part of the south joint seal has failed.
- **[11/17/2011]** G. Elmquist added notes and changed element CS to correspond with the 04/04/2011 FC inspection report. Approach relief joints have been repaired in 2010. 2 LF of the NE corner is losing adhesion.
- **[2013]** North relief joint appears to have completely failed; south relief joint has two areas 1’ long that have lost adhesion. Condition state has been changed to reflected these findings.
- **[2015 F/C Inspection]** The north joint seal has completely failed and adjacent concrete is plow scraped (Photo 13). The South joint has moderate deterioration. The filler material has lost adhesion or missing. (Photo 36)

### Signing

- **[2009]** Leftover connection hardware on the sign supports (east railing).
- **[11/17/2011]** G. Elmquist changed note to correspond with the 04/04/2011 FC inspection report that horizontal clearance signs are no longer required.
- **[2013]** No change in condition from previous inspection.
- **[2015 F/C Inspection]** No change. (Photo 26)

### Guardrail

- **[2013]** Approach guardrail is in good condition with no impact damage.
- **[2015 F/C Inspection]** SE corner end treatment has impact damage (Photos 3 & 4). There are 2 guardrails on Superior St. below the bridge. Guardrail is located between the sidewalk and piers 1 & 2 (Photos 25 & 27).

### Drainage

- **[2013]** There are no deck drains; however, there are curb drains on both north and south approaches and they appear to be functioning as designed. (Photo 18)
| Miscellaneous | [2009] A conduit has been added along the west side of the bridge. [11/17/2011] G. Elmquist added notes to correspond with the 04/04/2011 FC inspection report. Conduit line runs along inside west fascia girder and down column 1. [2012] Strip seals need to be cleaned. [2013] No deficiencies noted during this inspection. |
| Slopes | [2015 F/C Inspection] The two catch basins at the Southeast & Southwest ends of the bridge are plugged (Photos 35 & 37). [2012] There are 2 x 4's attached at North abutment slope for walking. [2013] No deficiencies noted during this inspection. [2015 F/C Inspection] No change. (Photo 43) |
| | |
Pictures

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Pictures

Photo 59 - Bearing 4 Under Girder D at North Abutment

Photo 60 - Bearing 4 Under Girder D at North Abutment
Pictures

Photo 61 - Bearing 4 Under Girder D at North Abutment

Photo 62 - Bearing 4 Under Girder D at North Abutment
Pictures

Photo 63 - Bearing 2 Under Girder B at North Abutment

Photo 64 - Pier 2 Paint Failure West Side of Cap
Pictures

Photo 65 - Pier 2 Cap Weld Defect to G3 North Face East Side

Photo 66 - Pier 2 Cap Weld Defect to G3 North Face East Side
Pictures

Photo 67 - Pier 2 Cap Weld Porosity to G4 North Face

Photo 68 - Pier 2 Cap Weld Porosity to G4 North Face
Pictures

Photo 69 - Pier 2 Cap Floor Pigeon Feces

Photo 70 - Pier 2 Cap Interior Looking West
Pictures

Photo 71 - Pier 2 Cap Interior Looking West

Photo 72 - Pier 2 Cap East End Backing Bar Splice
Pictures

Photo 73 - Pier 2 Cap East End Backing Bar Splice

Photo 74 - Pier 2 Cap East End Backing Bar Splice
Pictures

Photo 75 - Pier 2 Cap East End Backing Bar Splice

Photo 76 - Pier 2 Column Interior
Photo 77 - Pier 2 Column Interior Looking Up
Appendix A: SI&A
## MnDOT Structure Inventory Report

**Bridge ID:** 69840

**Roadway:** TH 194 NB

**Over:** SUPERIOR ST (MSAS171)

**Date:** 11/24/2015

### GENERAL

<table>
<thead>
<tr>
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<tbody>
<tr>
<td></td>
<td>District</td>
<td>1A</td>
<td>Crew</td>
<td>0.2 MI N OF JCT TH 35</td>
<td>34 - 050N - 14W</td>
<td>46 Deg 46 Min 46 Sec 46.29</td>
<td>92 Deg 92 Min 6 Sec 28.50</td>
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<th>Custodian</th>
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<th>MN Year Reconstructed</th>
<th>FHWA Year Reconstructed</th>
<th>MN Temporary Status</th>
<th>Bridge Plan Location</th>
<th>Date Opened to Traffic</th>
<th>On-Off System</th>
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<td>1987</td>
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<td></td>
<td>1 - CENTRAL</td>
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### ROADWAY

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<th>Route Sys</th>
<th>Number</th>
<th>Roadway Name or Description</th>
<th>Year</th>
<th>Level of Service</th>
<th>Roadway Type</th>
<th>1 - 1-way traffic</th>
<th>Control Section (TH Only)</th>
<th>Reference Point</th>
<th>Detour Length</th>
<th>Lanes</th>
<th>ADT</th>
<th>Year</th>
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<td></td>
<td>Route 03</td>
<td>MNTH</td>
<td>TH 194 NB</td>
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<td></td>
<td>6933</td>
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<th>Year</th>
<th>%</th>
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<td>9250</td>
<td>2004</td>
<td>3%</td>
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<table>
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<td>Roadway Width</td>
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<td>Vertical Clearance</td>
<td>ft.</td>
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<td>Horizontal Clear.</td>
<td>ft.</td>
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<td>Lateral Clearance</td>
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<td>Appr. Surface Width</td>
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<td>Bridge Roadway Width</td>
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<td>5 - Huck Bolt</td>
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<td>Abutment Foundation</td>
<td>1 - CONC</td>
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<td>(Material/Type)</td>
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<td>1 - CONC</td>
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<th>Service Under</th>
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<th>Main Span Detail</th>
<th>Appr. Span Type</th>
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<th>Culvert Type</th>
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<th>Inventory Rating</th>
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<td>1 - LF (LF)</td>
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<th>Natl. Load</th>
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<td>22.9</td>
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<table>
<thead>
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<th>Posting Date</th>
<th>Rating Date</th>
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<tr>
<td>Pinned Asbly.</td>
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<td>Spec.Feat.</td>
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### CAPACITY RATINGS

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<td>HS 20+MOD</td>
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### NBI CONDITION RATINGS

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<th>Unsound Deck %</th>
<th>Superstructure</th>
<th>Substructure</th>
<th>Water Adequacy</th>
<th>Approach Alignment</th>
<th>Rating Date</th>
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<td>6 - Satisfactory Condition</td>
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<td>8 - Equal to present desirab</td>
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<th>Water Adequacy</th>
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<td>8 - Equal to present desirab</td>
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<th>Unsound Deck %</th>
<th>Superstructure</th>
<th>Substructure</th>
<th>Water Adequacy</th>
<th>Approach Alignment</th>
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<td>6 - Satisfactory Condition</td>
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### IN DEPTH INSPECTION

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<td>Underwater</td>
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<tr>
<td>Pinned Asbly.</td>
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<tr>
<td>Spec.Feat.</td>
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<tr>
<th>Drainage Area (sq. mi.)</th>
<th>Waterway Opening</th>
<th>Y/N</th>
<th>Freq</th>
<th>Date</th>
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<tbody>
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Appendix B: 7 Day FC Report
7 Day Fracture Critical Report  (Report Date: 06/04/2015)

Disclaimer: The condition ratings in this report are only suggested. It is the responsibility of the Bridge Owner to approve inspection data in SIMS.

Bridge # 69840
Facility Carried: TH 194 NB
Facility Intersected: SUPERIOR ST(MSAS171)
Bridge Owner: State Highway Agency
Inspection Date(s): 04/27/2015 - 04/27/2015
Primary Inspector: Carter, Rodney
Other Inspector(s): Fishbein, Joseph; Theisen, Scott
Method of Access: A-62, Other - Confined Space Entry procedures and equipment.
Traffic Control: A left lane closure was required on the bridge and on the roadway below (provided by D1 Carton bridge crew).

Scope of Inspection: Routine and Fracture Critical

Critical Structural Deficiencies (Yes/No) No
New Load Rating Recommended (Yes/No) Yes The 1998 Load Rating does not account for the steel pier caps.
Traffic Safety Hazard (Yes/No) No
Structural Analysis Recommended (Yes/No) No

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<th>NBI Condition Ratings</th>
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<td>Substructure</td>
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<td>6</td>
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<td>Channel</td>
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<td>N</td>
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[2015 F/C Inspection] Concrete deck has unsealed cracks with moderate size and density.
[2015 F/C inspection] No change in condition from previous inspection.
[2015 F/C Inspection] No change in condition from previous inspection.

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<tr>
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MnDOT Bridge No. 69840
2015 Routine and Fracture Critical Bridge Inspection Report

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Element Rating Notes:

ELEMENT #022: (2011/11/17 G.Elmquist added notes to correspond with the 04/04/2011 FC inspection report. Concrete deck (low slump overlay) has no areas of spalls, delaminations or temporary patches. Existing patchwork is in good condition with very little signs of deterioration.)

[2013] No change in condition from previous inspection. (2014) No change. [2015 F/C Inspection] No change in previously noted condition.

ELEMENT #107: (2009 F/C report notes - Some flaking rust (minor section loss) is present at the fascia girder splices - there is corrosion on the east girder near the northeast abutment footing.) (2011/11/17 G.Elmquist added notes and to correspond with the 04/04/2011 FC inspection report. The painted steel girders are in good condition with very little deterioration. The areas around the fascia girder splices have areas of flaking rust (about 12 LF in total). The east fascia girder has extensive flaking rust at the north abutment due to the leaking joint.)

[2013] No change in condition from previous inspection.

[2015 F/C Inspection] No change.

ELEMENT #202: Rust at bottom flange and behind some bolts. (2010 - Winter sand built up on bottom flange. Footings have several light cracks.) (12/29/2010 G.Elmquist - Notes and ratings from 2009 F/C inspection report - The pier columns have minor surface corrosion.) (2011/11/17 G.Elmquist added notes to correspond with the 04/04/2011 FC inspection report. The painted steel columns have minor surface corrosion.)


ELEMENT #215: (12/29/2010 G.Elmquist - Notes and CS from 2009 F/C inspection report added: The south abutment parapet/back wall has cracking on the east end.) 2010- North abutment repaired (2011/11/17 G.Elmquist added notes and changed element CS to correspond with the 04/04/2011 FC inspection report. The south abutment parapet/backwall has cracking on the east end (CS2-1 LF). The north abutment has 2 LF of CS3 with spalling and corroding rebar at the NW corner mast wall.)


ELEMENT #220: (2011/11/17 G.Elmquist added notes and changed element CS to correspond with the 04/04/2011 FC inspection report. The concrete footings below the steel columns have light cracking and are covered with debris.)


ELEMENT #300: 10/10/08 North strip seal leaking on east end onto B4. South strip seal out 1 ft & leaking between B3 & B4. Also leaking on east side. (2011/11/17 G.Elmquist added notes to correspond with the 04/04/2011 FC inspection report. NE gland is pulled out at the east rail kick out (behind cover plate). This is causing leakage down the north abutment which is corroding the east fascia girder and bearing. The south strip seal joint is also leaking on the east side.)

(2012 - Strip seal filled with dirt)

[2013] No change in condition from previous inspection. (2014) NE cover plate missing one bolt. [2015 F/C Inspection] No change. Both Strip seals are filled with dirt.

ELEMENT #301: rubber replaced in (09) (2011/11/17 G.Elmquist added notes to correspond with the 04/04/2011 FC inspection report. Gland was repaired in 2009 and is in good condition.)


ELEMENT #311: 10/10/08 Slide bearings on high abutment North need grease. Have zerks but heavily rusted. Need new ones.

(12/29/2010 G.Elmquist - CS rating changed to match 2009 F/C inspection report.) (2011/11/17 G.Elmquist added...
at Pier 1 has paint failure with freckling rust on floor (Photo 43). [2013] No change in condition from previous inspection. (2014) No Change. [2015 F/C Inspection] Bearing 3 under girder C & Bearing 4 under girder D at the South abutment are in CS 2 due to moderate corrosion. Bearing 3 under girder C at North abutment is in CS2 due to moderate corrosion. Bearing 4 under girder D at north abutment is in CS3 (Photo 61).

ELEMENT #321: 10/10/08 The south approach has two longitudinal cracks. North approach panel has settled 1 in. (2011/11/17 G. Elmquist added notes to correspond with the 04/04/2011 FC inspection report. NE approach panel sill is still settled 1 inch.)

[2013] The north approach appears to have settled down to 2”. The south approach has no change from previous inspection. (2014) The N. panel has 2’ of pourable jt. that has failed. [2015 F/C Inspection] No change in North approach settling. The South approach has a 6’ moderate crack with a 2’x6’ delam at the center line, next to strip seal (Photo 5). South approach has a 30’ longitudinal crack at East Rail.

ELEMENT #331: Spalls along southeast rail 10 in. diam. by 2 in. deep. (2011/11/17 G. Elmquist added notes and changed element CS to correspond with the 04/04/2011 FC inspection report. 30 LF along SE corner rail has spalling along the base and popouts throughout. The NE cover plate bolt is sheared off.)


ELEMENT #358: 10/10/08 5 inch diam. hole in the deck 3 inches deep. deck crack sealed in (09) with 2501 (2011/11/17 G. Elmquist added notes and changed element CS to correspond with the 04/04/2011 FC inspection report. Concrete deck has cracks with moderate size and density.)

[2013] No change in condition from previous inspection. (2014) transverse cracks are lt. to mod with 4’ to spacing, there are few longitudinal cracks. [2015 F/C Inspection] Concrete deck has unsealed cracks with moderate size and density (Photo 9). Cracks are spaced about every 4’ throughout deck.

ELEMENT #359: Transverse cracking with efflorescence 10 ft. intervals, a few areas with rust staining and delamination occurring. (2011/11/17 G. Elmquist added notes and changed element CS to correspond with the 04/04/2011 FC inspection report. Transverse cracking with efflorescence at 10 ft intervals. There are a few areas with rust staining and delamination.) (2012 - cracks should be sealed) [2013] No change in condition from previous inspection.

[2015 F/C Inspection] No change in the underside of deck.

ELEMENT #363: (12/29/2010 G. Elmquist - notes added from 2009 F/C inspection report: Minor section loss is present on the fascia girder splices.) (2011/11/17 G. Elmquist added notes to correspond with the 04/04/2011 FC inspection report. Minor section loss is present on the fascia girder splices. Pitting areas of up to 1/16 in. are present.)

[2013] No change in condition from previous inspection. [2015 F/C Inspection] No change.

ELEMENT #380: [2015 F/C Inspection] Element added for the Diaphragms (Photo 41). Span1 G3-G4 Diaphragm has light surface corrosion with minor flaking and freckling rust, this is typical of all Diaphragms.

ELEMENT #387: (2011/11/17 G. Elmquist added notes to correspond with the 04/04/2011 FC inspection report. Concrete wingwalls have small amounts of light cracking.)

[2013] No change in condition from previous inspection. (2014) NE wing has a 3”x3” spall and SE wing has a 5’ spall along the vert. mid jt. with 6” exposed rebar. [2015 F/C Inspection] No change.

ELEMENT #412: (Notes from 2009 F/C report - The north joint seal has completely failed, and part of the south joint seal has failed.) (2011/11/17 G. Elmquist added notes and changed element CS to correspond with the 04/04/2011 FC inspection report. Approach relief joints have been repaired in 2010. 2 LF of the NE corner is loosing adhesion.)

[2013] North relief joint appears to have completely failed; south relief joint has two areas 1’ long that have lost adhesion. Condition state has been changed to reflected these findings. (2014) S. jt. now has 11’ that has failed. The N. edge of the N. jt. concrete is plow scraped. [2015 F/C Inspection] The north joint seal has completely failed and adjacent concrete is plow scraped (Photo 12). The South joint has moderate deterioration. The filler material has lost adhesion or missing.

ELEMENT #422: (2010 - North east beam end has paint failure.) (2011/11/17 G. Elmquist added notes and changed element CS to correspond with the 04/04/2011 FC inspection report. NE beam has paint failure due to leaking joint.) 2012- Light LOS along B4 on north abutment 3’ out.

[2013] There is minor surface corrosion on both ends of bridge mainly on the facia girders. Condition state was changed to reflect these findings. [2015 F/C Inspection] No change.

ELEMENT #427: Pier1 was inspected 07. Mag Particle should be brought on the next inspection to check the welds.
at the bottom flange to stl.pier cap connection. A few were not one continuous weld. (2011/11/17 G.Elmoquist added
notes to correspond with the 04/04/2011 FC inspection report. Steel pier caps are in good condition with very little
sign of deterioration.)

[2013] No change in condition from previous inspection.(2014) no change. [2015 F/C Inspection] Interior of Pier cap
at Pier 1 has paint failure with freckling rust on floor (Photo 43).

ELEMENT #964: DO NOT DELETE THIS CRITICAL FINDING SMART FLAG. (2011/11/17 G.Elmoquist added notes
and changed element CS to correspond with the 04/04/2011 FC inspection report. No Critical Findings were
observed during the 2011 inspection cycle.)

[2015 F/C Inspection & 2013] No critical findings were observed during this inspection.

ELEMENT #966: [2015 F/C Inspection] No significant issues noted with fracture-critical elements.

ELEMENT #981: (12/29/2010 G.Elmoquist - Notes from 2009 F/C inspection report: There is leftover connection
hardware on the sign supports (east railing). (2011/11/17 G.Elmoquist changed note to correspond with the
04/04/2011 FC inspection report that horizontal clearance signs are no longer required.)

[2013] No change in condition from previous inspection.


ELEMENT #982: [2013] Approach guardrail is in good condition with no impact damage.(2014) &[2015 F/C
Inspection] SE corner end treatment has impact damage (Photo 3). There are 2 guardrails on superior st. below the
bridge. Guardrail is located between the sidewalk and piers 1 & 2.

ELEMENT #984: [2013] There are no deck drains; however, there are curb drains on both north and south
approaches and they appear to be functioning as designed. (2014) No change. [2015 F/C Inspection] The two catch
basins at the Southeast & Southwest ends of the bridge are plugged (Photo 34).

ELEMENT #985: (2012 - There are 5-2 x 4's attached at n. abut. for walking.)

[2013] No deficiencies noted during this inspection. (2014) 1' of polyguard is failed at S. end. [2015 F/C Inspection]
No change.

ELEMENT #988: (12-29-2010 G.Elmoquist - Notes added from 2009 F/C inspection report: A conduit has been added
along the west side of the bridge.)(2011/11/17 G.Elmoquist added notes to correspond with the 04/04/2011 FC
inspection report. Conduit line runs along inside west fascia girder and down column 1.) (2012 - strip seals need to
be cleaned)

[2013] No deficiencies noted during this inspection. (2014) no change.

General Notes:
06/01/2009 Fracture Critical Inspection: P. Wilson/ J. Johnson./ D.Rychlak
07/06/2009 Annual Inspection finished: D.Rychlak/ T. Janke
04/16/2010 Inspection: S. Gries
06/22/2010 UB50 snooper Inspection conducted by G.Wright/F.Anderson
(12/29/2010: Dow Rychlak raised NBI on substructure to 6 Due to 2010 repair.)
(FC Inspection team leader(s) Pete Wilson, Scott Theisen and assistant inspector David Hedeen performed
04/04/2011 inspection. No D1 inspector assisted with this inspection. G.Elmoquist entered 04/04/2011 inspection
data into SIMS on 11/17/2011.)
04-09-2012 Inspection: R.Carter / J.Loons
08-28-2012 Snooper inspection D Rychlak/ Chris Smith
4-14-2014 Inspection: K. Rohling I. Schatz
09/15/2014 a-62 inspection pier caps only: M.Chell/J.Benson
4/27/2015 - Routine and Fracture-Critical inspection performed by Team leaders Joe Fishbein, Scott Theisen, &
Rodney Carter.

Inventory Item Notes:

58. Deck NBI: [2015 F/C Inspection] Concrete deck has unsealed cracks with moderate size and density.

36A. Brdg Railings NBI:

36B. Transitions NBI:

36C. Appr Guardrail NBI:

36D. Appr Guardrail Terminal NBI:

59. Superstructure NBI: [2015 F/C Inspection] No change in condition from previous inspection.

60. Substructure NBI: [2015 F/C Inspection] No change in condition from previous inspection.
61. Channel NBI:

62. Culvert NBI:

71. Waterway Adeq NBI:

72. Appr Roadway Alignment NBI:
Appendix C: Structural Assessment Report - FC
PURPOSE:

This report is a structural assessment of the structure and its ability to carry loads based on conditions identified in the attached bridge inspection report. The assessment is only a cursory review intended to provide guidance as to the relative hazards for structural conditions and deficiencies identified. This report is mandatory for all fracture critical bridges and is completed by the MnDOT Bridge Office upon receipt of the 7 Day FC Report; however, it is an OPTIONAL tool for agencies to utilize at their discretion for all other inspection types.

<table>
<thead>
<tr>
<th>BRIDGE NO.: 69840</th>
<th>BRIDGE OWNER: State Highway Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE INSPECTED: 04/27/2015</td>
<td>STRUCTURE TYPE: Steel Continuous Stringer/Multi-beam or Girder</td>
</tr>
<tr>
<td>FACILITY CARRIED: TH 194 NB</td>
<td>FEATURES INTERSECTED: SUPERIOR ST(MSAS171)</td>
</tr>
</tbody>
</table>

TYPE OF INSPECTION: [ ] ROUTINE [✓] FRACTURE CRITICAL [ ] PINNED ASSEMBLY: [ ] SPECIAL: [ ] DAMAGE: [ ] OTHER:

Check all that apply:

- Redundancy: [ ] Load Path [ ] Structural [ ] Internal
- Connection Type: [ ] Riveted [✓] Bolted [✓] Welded [ ] Other:
- Welded

1. Was a critical finding identified during this inspection or upon structural review?
   [ ] Yes  [✓] No

   a) If selected "Yes" above, state briefly the finding(s):

2. If a critical finding was identified, what is the current status?
   [ ] Pending  [ ] Resolved  [✓] N/A

   a) Briefly state actions taken:

3. Does the condition of any bridge component indicate impaired function? Examples of bridge components with impaired function include elements that are: frozen or immovable, out-of-plumb or misaligned, distorted or structurally deformed, excessively deteriorated, cracked, broken, eroded or scoured.
   [ ] Yes  [ ] No

66
a) If selected "Yes" above, state briefly the component(s) and condition(s):

4. Does the overall condition of the bridge, or any of its components mentioned in Question 3, suggest the need for detailed structural analysis and/or a revised load rating?  
   ☑️ Yes  ☐ No

   a) If selected "Yes", state the reason for this recommendation and indicate a proposed timeframe in accordance with State of Minnesota Rule 8810.9500 (Subpart 2):
   The 1998 load rating did not account for the integral pier cap. This will require a new bridge load rating. This was noticed in 2013 report.

5. Based on the structural assessment of these findings, recommendations include:

   ☑️ Repair/Maintenance  ☑️ Monitoring Plan
   ☐ Other  ☐ Increased Inspection Frequency

Explain recommended actions:
   The northeast gland is pulled out at the east rail kick-out and the leaking is causing accelerated corrosion to the east fascia beam. Repair or replace this gland ASAP.
   Continue monitoring the settlement of approach panels and, if needed, fill the pavement to solve the settlement problems.
   Continue monitoring corrosion and section loss of the connections, bearings and girders.
   Continue monitoring the deck cracks and poured joints and, in necessary, seal the deck cracks and reseal the poured joints.

6. Other comments:
   Need to find retrofit required to improve the redundancy of the integral pier caps.
   Repair failed relief joints at approach panels.
   Clean the plugged expansion joints.

Bridge Office Reviewer  Jihshya Lin  5/31/2015
Appendix D: 1998 Load Rating
MINNESOTA DEPARTMENT OF TRANSPORTATION
BRIDGE RATING and LOAD POSTING REPORT

BRIDGE LOCATION and DESCRIPTION

Bridge No. 69840
T.H. No. 194 NB
Ref. Point 17+0.004
Year Built 1908

County 69
Type 401
Description 3 Span 29'-6" Rdwy
over Saperon St.
Location 01N 104910' E 71835'

DATA FOR BASIS OF REPORT
(check appropriate boxes)

☐ Bridge Inventory File
☐ Bridge Inspection Report
☐ Current Bridge Rating & Load Posting Report
☐ Bridge Plans
(Original, Repair/Reconstruction)
☐ Computer Analysis
☐ Manual Analysis

WEARING COURSE
Type CONC
Thickness 2"

as of Date 1998

METHOD OF RATING
(check appropriate box)

☒ 1 Load Factor (LF)
☐ 2 Allowable Stress (AS)
☐ 3 Load & Resistance Factor (LRFD)
☐ 4 Load Testing
☐ 5 No Rating Analysis performed

GROUP LD. & NUMBER
669022

DESIGN LOAD = HS70
(Live load category for which
the bridge was designed)

PERMIT CODES
(For overload permits)
A B C D
1 1 1 9

SUMMARY OF RATING and LOAD POSTING ANALYSIS

INVENTORY RATING OPERATING RATING POSTING REQUIRED LOAD POSTING LIMITS

H ____________ ____________ YES ____________ ____________ Tons
HS 22.9 HS 38.1 NO ____________ ____________ Tons
HS 38.1

Vehicle
Type M3
Wgt = 24 Ton

Semi-Trailer
Type M3S2
Wgt = 40 Ton

Truck-Full Trailer
Type M3-3
Wgt = 40 Ton

CERTIFICATION
I hereby certify that this report was prepared by me or under my direct supervision and
that I am a duly registered professional engineer under the laws of the State of Minnesota.

Signed John W. Damer
Date 1-15-98 Reg. No. 7925

Rated by
Checked by 11598

Date Revised
STATE OF MINNESOTA
DEPARTMENT OF TRANSPORTATION
BRIDGE RATING SHEET

STEEL BEAM - COMPOSITE & NON-COMPOSITE LOAD FACTOR

BRIDGE LOCATION AND DESCRIPTION

Bridge No. 694460
T. H. No. 194 NB
Mile Point 17+0.064
Year Built 1968

Type 401
Description 3 Spans over Superior St.
Location 0.2 MI N of Lot NN35

SUMMARY OF RATING AND LOAD POSTING

Structure: Group I/D & No. 669022

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<tr>
<th>INVENTORY RATING</th>
<th>OPERATING RATING</th>
<th>LOAD POSTING REQUIRED?</th>
<th>LOAD POSTING LIMITS</th>
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<tbody>
<tr>
<td>H 229 or HS 381</td>
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<td>Yes</td>
<td>Vehicle Type M3</td>
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<tr>
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<td></td>
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<td>Weight = 24T</td>
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<td></td>
<td></td>
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<td>Semi-Trailer Comb.</td>
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ANALYSIS DATA

RATING

Distribution Lanes
Distribution Width
Allowable Stress - Steel (FY)
Critical Point Location
Controlling Rating Factor
Moment Available for Unfactored Live Load per Beam
Moment Available for Unfactored Live Load per Lane

<table>
<thead>
<tr>
<th></th>
<th>INVENTORY</th>
<th>OPERATING</th>
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<td>Distribution Width</td>
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<tr>
<td>Allowable Stress</td>
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<tr>
<td>Controlling Rating</td>
<td>Moment</td>
<td>3604</td>
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</table>

DESCRIPTION OF SECTION

Span Length 88', 116', 88'
Roadway Width 29'-6'
Slab Thickness 7" + 1/2 = 10 1/2"
W. C. Thickness 2" CONC
Beams Size: 54 x 3"w, 54 x 3"w, 91/2" w
Crs: 91/2" w
Sec. Mod. for Live Load 1439.6 in3

DL: W. C. = 7344/3, New Rail f/s = 577/3 = 191 bv, Diag. + Huc = 157v