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INTRODUCTION

Part 4 of the Bridge Inspection Manual provides additional inspection guidance in the following four areas:

- Wearing Surface Ratings
- Scour
- Bats and Birds
- Fracture Critical Inspections

4-1.0 WEARING SURFACE RATINGS

4-1.01 Portland Cement Condition Ratings

All decks / slabs that have overlays with flexible, semi-rigid, and rigid materials are to be rated as outlined in this section.

The following general condition ratings shall be used as a guide in evaluating the wearing surface:

**Condition Rating Guide for rigid Portland cement overlays:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>NOT APPLICABLE</td>
</tr>
<tr>
<td>9</td>
<td>EXCELLENT CONDITION</td>
</tr>
<tr>
<td>8</td>
<td>VERY GOOD CONDITION – no problems noted</td>
</tr>
<tr>
<td>7</td>
<td>GOOD CONDITION - minor cracking with a crack width of 0.016” or less and less than 1% delamination</td>
</tr>
<tr>
<td>6</td>
<td>SATISFACTORY CONDITION - cracking width of 0.021” with a spacing of greater than 3 ft. Delamination less than 5%</td>
</tr>
<tr>
<td>5</td>
<td>FAIR CONDITION - cracking width less than 0.021” with a spacing of between 1.0 – 3.0 ft. Delamination less than 10%</td>
</tr>
<tr>
<td>4</td>
<td>POOR CONDITION - crack width greater than 0.05” or a spacing less than 1 ft. Delamination between 10% - 25%. Unpatched or unsound patching of spalled areas</td>
</tr>
</tbody>
</table>
PART 4: ADDITIONAL INSPECTION GUIDANCE

3 SERIOUS CONDITION - delamination greater than 25%. The wearing surface is no longer effective.

4-1.02 Epoxy Condition Ratings

The following general condition ratings shall be used as a guide in evaluating a semi-rigid (epoxy and polyester material) wearing surface:

Condition Rating Guide for Semi-Rigid Overlays

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>NOT APPLICABLE</td>
</tr>
<tr>
<td>9</td>
<td>EXCELLENT CONDITION</td>
</tr>
<tr>
<td>8</td>
<td>VERY GOOD CONDITION – no problems noted</td>
</tr>
<tr>
<td>7</td>
<td>GOOD CONDITION - minor cracking with a crack width of 0.016” or less.</td>
</tr>
<tr>
<td>6</td>
<td>SATISFACTORY CONDITION - cracking width of 0.016” with a spacing of greater than 10 ft. Delamination less than 0.5%. Minor wearing of the surface.</td>
</tr>
<tr>
<td>5</td>
<td>FAIR CONDITION - cracking width less than 0.016” with a spacing of greater than 5.0 ft. Delamination and loss of bond less than 1%. Minor wearing of the surface.</td>
</tr>
<tr>
<td>4</td>
<td>POOR CONDITION - crack width greater than 0.016” or a spacing less than 3 ft. Delamination and bond loss between 1% - 5%. Unpatched or unsound patching of spalled areas. Worn areas of the surface less than 5%.</td>
</tr>
<tr>
<td>3</td>
<td>SERIOUS CONDITION - delamination and bond loss greater than 5%. Worn areas of the surface greater than 5%. The wearing surface is no longer effective.</td>
</tr>
</tbody>
</table>
4-2.01 Bridge Scour Evaluation Procedures For Local Public Agencies

4-2.01(01) Introduction

Several catastrophic bridge failures resulting from scour led to the development and initiation of the national bridge scour evaluation program in 1988. That program required each state to develop procedures to ensure each bridge over a waterway, whether existing or under design, was evaluated as to its vulnerability to scour in order to determine the prudent measures to be taken for its protection. INDOT’s initial approach to this program for existing bridges was published in 1995. The approach was recently reviewed and due to inadequacies and limitations in the program, INDOT determined those evaluations were no longer acceptable. In addition, documents for many of the scour evaluations conducted during the initial program are no longer maintained in each bridge’s bridge file. Therefore, the primary purpose of these revised scour evaluation procedures is: (1) to apply a risk-based approach to scour evaluations and the development and implementation of Plans of Action (POAs); and (2) to ensure those efforts are properly documented in each bridge file. The result of this effort will be that each bridge will be assigned a Scour Critical Evaluation Rating (Item 113) based on the following bridge scour evaluation procedures. Those bridges identified as scour critical or coded as U (unknown foundation) will require a Plan of Action (POA) to be developed and implemented.

The expected outcome of this process is to determine an accurate scour rating for each bridge based on existing documents, field conditions, and engineer judgement, or determine what documents are needed for an accurate scour rating. This process is to be completed utilizing an appropriate combination of office and field reviews. It is anticipated that the office reviews would include review of the online bridge files from INDOT and interviews with County staff. It may also include review of historical bridge files not available online from INDOT. It is anticipated the field reviews would be accomplished concurrently during an NBIS routine bridge inspection. The “Scour Evaluator” is responsible for the overall scour evaluation and is required to sign the forms. The “Scour Evaluator” must be a Professional Engineer that is a certified NBIS Team Leader in Indiana. It is preferred that these scour evaluation procedures be conducted by a multi-disciplinary team knowledgeable in hydraulic, geotechnical, bridge design, and bridge inspection procedures.

4-2.01(02) Initial Screening Process

Screen each bridge utilizing the INITIAL SCOUR SCREENING PROCEDURE FOR LOCAL PUBLIC AGENCIES form in Appendix A. Bridges with multiple foundations should analyze the worst case. Answer each question and assign NA or a Scour Critical Evaluation Rating (Item 113) per the form. Sign and date the form; then upload the completed form to INDOT’s
electronic bridge file. If the assigned Scour Critical Evaluation Rating (Item 113) from the INITIAL SCOUR SCREENING PROCEDURE FOR LOCAL PUBLIC AGENCIES equals N, 9, or 8; the INDOT Scour Evaluation Procedure is complete for that bridge. If the INITIAL SCOUR SCREENING PROCEDURE FOR LOCAL PUBLIC AGENCIES equals NA, the Scour Critical Evaluation Rating (Item 113) can’t be determined through the INITIAL SCREENING PROCESS and the bridge must be assessed or analyzed per the SCOUR ASSESSMENT/SCOUR ANALYSIS Procedures.

4-2.03 Scour Assessment/Scour Analysis

Utilize the following guideline to determine whether the bridge will be assessed via the SCOUR ASSESSMENT PROCEDURE FOR LOCAL PUBLIC AGENCIES form in Appendix B or analyzed in accordance with Hydraulic Engineering Circular 18 (HEC-18) in order to assign a Scour Critical Evaluation Rating (Item 113). See Appendix C for HEC-18 guidance.

1. For bridges with KNOWN foundations, identify each bridge as either Moderate Risk or Low Risk. Moderate Risk Bridges are those that cross the rivers and streams identified on the map in Appendix D or identified by the Inspection Team Leader. Low Risk bridges are all other bridges.
   a. Analyze each Moderate Risk Bridge by utilizing the procedures in HEC-18 in order to assign a Scour Critical Evaluation Rating (Item 113). Additional guidance is in Appendix C.
   b. Assess or Analyze each Low Risk Bridge by either of the following methods:
      i. Utilize the SCOUR ASSESSMENT PROCEDURE FOR LOCAL PUBLIC AGENCIES form in Appendix B in order to assign a Scour Critical Evaluation Rating (Item 113). Answer each question by circling the appropriate answer and, if applicable, assign a Scour Critical Evaluation Rating (Item 113) per the form. Sign and date the form; then upload the completed form to INDOT’s electronic bridge file location. OR
      ii. Utilize procedures in HEC-18 to assign a Scour Critical Evaluation Rating (Item 113).

2. For bridges with UNKNOWN foundations, identify each bridge as either Moderate Risk or Low Risk. Moderate Risk Bridges are those that cross the rivers and streams identified on the map in Appendix D or identified by the Inspection Team Leader. Low Risk bridges are all other bridges. Use one of the following methods.
PART 4: ADDITIONAL INSPECTION GUIDANCE

a. Assign a Scour Critical Evaluation Rating (Item 113) = “U” and develop a POA, OR

b. Analyze each Moderate Risk Bridges by utilizing the procedures in HEC-18 in order to assign a Scour Critical Evaluation Rating (Item 113). Additional guidance is in Appendix C.

c. Foundations can be determined by either of the following methods:
   i. Use NDE to determine foundation type, OR
   ii. Infer foundation information based on similar bridges in county built in similar timeframe or year of construction (see FHWA guidance: http://www.fhwa.dot.gov/unknownfoundations/); if using inference, document the methodology used.

d. Assess or Analyze each Low Risk Bridge by either of the following methods:
   i. Utilize the SCOUR ASSESSMENT PROCEDURE FOR LOCAL PUBLIC AGENCIES form in Appendix B in order to assign a Scour Critical Evaluation Rating (Item 113).

   Answer each question by circling the appropriate answer and, if applicable, assign a Scour Critical Evaluation Rating (Item 113) per the form. Sign and date the form; then upload the completed form to INDOT’s electronic bridge file location. OR

   ii. Utilize procedures in HEC-18 in order to assign a Scour Critical Evaluation Rating (Item 113). Additional guidance is in Appendix C.

Infer foundation information based on similar bridges in county built in similar timeframe or year of construction; if using inference, document the methodology used. The following assumptions can be used in lieu of inference:

1. If rock is near surface, spread footings can be assumed
2. If the top of the spread footing can be located for probing or other means, the bottom of the spread footing can assumed to be 3’ lower than the top of the footing.
3. If the foundation is unknown, and the pile length cannot be reasonably assured, then treat the bridge as if it is supported on spread footing.
Bridges with Scour Critical Evaluation Rating (Item 113) = 0, 1, 2, or 3 are defined as Scour Critical. A Plan of Action (POA) is required to be developed and implemented for each bridge defined as Scour Critical or with a Scour Critical Evaluation Rating (Item 113) = U. Bridges not defined as Scour Critical are monitored for scour during routine inspections.

Definitions:

- **“No signs or history of scour”**: in performing the office and field reviews outlined in the INTRODUCTION, scour was not reported.
- **“Significant scour on Spread Footings”**: any portion of spread footing with more than 1’ depth exposure.
  - **“Significant Scour on Piles”**:
    - **End bent/ Abutment with spillslopes**: any exposure of piles deeper than 4’ below cap.
    - **Vertical faced abutments**: any exposure of piles.
    - **Interior pile bent/ drilled shaft**: any exposure of piles deeper than 3’ below normal channel bottom.
    - **Interior bent/pier with footing or mudsill**: any exposure of piles.
- **“Appropriately sized scour countermeasures”**: determination is based on existing study or an engineering judgement. The following should be considered:
  - If the current scour countermeasures are damaged, then they might not be appropriately sized.
  - Class I vs Class II or concrete underpin based on stream velocity.
  - Length of service.
- **“Stream banks unstable”**: A stream bank is considered unstable when it is susceptible to erosion (the process by which the land’s surface is worn away by actions of wind, water, ice, and gravity). If the bank is bare, or rills, gullies, or channels are forming, then the bank is considered unstable. Look for bank sloughing, undermining, evidence of lateral movement, or damage to bank stabilization measures. It is also important to look up and down the stream (approximately 200’) for side channels feeding into the main stream below the bridge for bank stability. Consider NBIS Item 61 as a mean to confirm stream stability conditions.
4-2.03 Scour Ratings During Field Reviews

The most recent Scour Critical Evaluation Rating (Item 113) from FHWA memo can be found on the FHWA website: http://www.fhwa.dot.gov/engineering/hydraulics/policymemo/revguide.cfm
BRIDGE INSPECTION MANUAL

PART 4: ADDITIONAL INSPECTION GUIDANCE

APPENDICES

A – Form - INITIAL SCOUR SCREENING PROCEDURE FOR LOCAL PUBLIC AGENCIES
B – Form - SCOUR ASSESSMENT PROCEDURE FOR LOCAL PUBLIC AGENCIES
C – Form - SCOUR ANALYSIS SUMMARY (HEC-18) FOR LOCAL PUBLIC AGENCIES
D - MAP OF MODERATE RISK BRIDGES FOR USE WITH SCOUR EVALUATION PROCESS FOR LOCAL PUBLIC AGENCIES
E – Flowchart – OVERALL BRIDGE SCOUR EVALUATION PROCEDURES FOR LOCAL PUBLIC AGENCIES
BRIDGE INSPECTION MANUAL

PART 4: ADDITIONAL INSPECTION GUIDANCE

APPENDIX A

DRAFT - FORM

Indiana Department of Transportation INITIAL SCOUR SCREENING PROCEDURE FOR LOCAL PUBLIC AGENCIES

1. Is the bridge over a waterway? Yes/No
   • If No, complete the information at the bottom of this form and code Item 113 = “N”
   • If Yes, go to 2

2. Are all of the foundations on dry land well above flood water elevations or floodway? Yes/No
   • If Yes, complete the information at the bottom of this form and code Item 113 = “9”
   • If No OR Unknown, go to 3

3. Was the bridge designed and constructed to resist scour; and do plans show depth of foundation to be below the depth of Q100 scour (with sufficient length for friction piles)? Yes/No or Unknown
   • If Yes, complete the information at the bottom of this form and code 113 = “8”
   • If Unknown, OR the foundations are not below the Q100, go to 4

4. Are spread footings on erosion resistant rock or pile foundations of sufficient depth (20’) below scour with no signs or history of scour**? Yes/No
   • If Yes, complete the information at the bottom of this form and code Item 113 = “8”
   • If No OR Unknown, go to 5

5. Is the bridge a single span bridge that meets all following criteria? Yes/No
   i. Appropriately sized scour countermeasures in place**, AND
   ii. Elevation of stream bottom above bottom of footing/pile cap, AND
   iii. Does not have any signs or history of scour
      • If Yes, complete the information at the bottom of this form and code Item 113 = “8”
      • If No, go to 6
PART 4: ADDITIONAL INSPECTION GUIDANCE

6. Is the bridge a 4-Sided Box Culvert or a Pipe Culvert with no signs or history of scour? Yes/No
   • If Yes, complete the information at the bottom of this form and code Item 113 = “8”
   • If No, go to 7

7. Is the bridge a single span concrete arch bridge with no signs or history of scour? Yes/No
   • If Yes, complete the information at the bottom of this form and code Item 113 = “8”
   • If No, complete the information at the bottom of this form, code “NA” on this form, and go to SCOUR ASSESSMENT PROCEDURES (Appendix B)

** See the “Definitions” section

To Be Completed by Scour Evaluator

Coding from INITIAL SCOUR SCREENING PROCEDURE: NA OR Item 113 = N, 9, 8

Coding by Scour Evaluator: NA OR Item 113 = N, 9, 8

Justification if different:

County: County Bridge#: NBI

Bridge # Screening performed by:

Signed: Date:
BRIDGE INSPECTION MANUAL

PART 4: ADDITIONAL INSPECTION GUIDANCE

Appendix B

DRAFT - FORM

Indiana Department of Transportation SCOUR ASSESSMENT PROCEDURE FOR LOCAL PUBLIC AGENCIES

1. CULVERTS: Is the bridge a 4-sided box culvert or a pipe culvert?
   • If Yes, go to 9.
   • If No, go to 2.a

2. HISTORICAL SCOUR PERFORMANCE:
   a. Has the bridge experienced a flood with a documented 100 yr. return interval which did not result in significant scour?
      • Yes, assign a rating of "8" to Scour Critical Evaluation Rating (Item 113)
      • No, go to 2.b
      • Unknown, go to 2.b
   b. Is the bridge >50 years old with no signs or history of scour and not on granular or soft soil?
      • Yes, assign a rating of "8" to Scour Critical Evaluation Rating (Item 113)
      • No, go to 3
      • Unknown, go to 3

3. SCOUR COUNTERMEASURES:
   a. Are scour countermeasures in place, functioning properly, and have minor to no damage?
      • Yes, go to 3.b
      • No, go to 4
      • Unknown, go to 4
   b. Are the scour countermeasures appropriately sized?
      • Yes, go to 3.c
      • No, go to 4
      • Unknown, go to 4
c. Has the bridge experienced a flood with a documented 50 year return interval with no damage to the installed countermeasures?
   - Yes, go to 3.d
   - No, go to 4
   - Unknown, go to 3.d

d. If scour countermeasures are present, were they installed to correct a previously existing problem with scour?
   - Yes, assign a rating of "7" to Scour Critical Evaluation Rating (Item 113)
   - No, assign a rating of "8" to Scour Critical Evaluation Rating (Item 113)
   - Unknown, assign a rating of "8" to Scour Critical Evaluation Rating (Item 113)

4. GEOMORPHIC CONDITIONS AFFECTING SCOUR RESISTANCE:
   a. Is the stream bed degrading?
      - Yes, go to 7
      - No, go to 4.b
      - Unknown, go to 7
   b. Is the channel meandering?
      - Yes, go to 7
      - No, go to 4.c
      - Unknown, go to 7
   c. For natural streams, are there channel bends of greater than 30 degrees within 100 feet upstream of the bridge?
      - Yes, go to 7
      - No, go to 4.d
      - Unknown, go to 7
   d. Are the stream banks unstable?
      - Yes, go to 7
      - No, go to 4.e
      - Unknown, go to 7
   e. Are bridge substructure units skewed from the direction of flow?
      - Yes, go to 7
      - No, go to 4.f
      - Unknown, go to 7
f. Do ice jams or debris block more than 10% of the flow cross section?
   • Yes, go to 7
   • No, go to 5
   • Unknown, go to 7

5. SINGLE SPAN BRIDGE CONSIDERATIONS:
   a. Is the bridge multiple-span?
      • Yes, go to 6
      • No, go to 5.b
   b. Is the bridge a single span and the Waterway Adequacy (NBI Item 71) is greater than 5
      • Yes, go to 5.c
      • No, go to 6
   c. Is the bridge supported by concrete abutments on piles?
      • Yes, assign a rating of “8” to Scour Critical Evaluation Rating (Item 113)
      • No, go to 5.d
      • Unknown, go to 5.d
   d. Is the bridge supported by timber abutment on piles?
      • Yes, assign a rating of “8” to Scour Critical Evaluation Rating (Item 113)
      • No, go to 5.e
      • Unknown, go to 5.e
   e. Is the bridge supported by end bent on piles with a spillslope at each end bent?
      • Yes, assign a rating of “8” to Scour Critical Evaluation Rating (Item 113)
      • No, go to 5.f
      • Unknown, go to 5.f
   f. Is the bridge on concrete abutments?
BRIDGE INSPECTION MANUAL

PART 4: ADDITIONAL INSPECTION GUIDANCE

• Yes, go to 5.g
• No, go to 5.h
• Unknown, go to 6

g. Is the bridge over a waterway labeled as a “Ditch”?
• Yes, assign a rating of “8”
• No, go to 5.h
• Unknown, go to 5.h

h. Does the waterway have a slope of less than 0.5 feet per mile?
• Yes, assign a rating of “8” to Scour Critical Evaluation Rating (Item 113)
• No, go to 6
• Unknown, go to 6

6. REDUCED RISK BRIDGES:
   a. Is the bridge programmed for replacement or rehabilitation within 5 years
      • Yes, go to 6.c
      • No, go to 6.b
      • Unknown, go to 6.b

   b. Is the bridge programmed to receive an installation of scour countermeasures within 2 years?
      • Yes, go to 6.c
      • No, go to 6.d
      • Unknown, go to 6.d

   c. Does the bridge have any signs or significant history of scour?
      • Yes, go to 7
      • No, assign a rating of “5” to Scour Critical Evaluation Rating (Item 113).
      • Unknown, go to 7

   d. Is the road classified as a "Rural Minor Collector or Local Road" (Item 26 - Functional Classification of Rural Minor Collector or Local)
      • Yes, go to 6.e
PART 4: ADDITIONAL INSPECTION GUIDANCE

- No, go to 7
- Unknown, go to 7

e. Is the estimated average daily traffic (ADT) over the bridge less than 200?
  - Yes, assign a rating of “5” to Scour Critical Evaluation Rating (Item 113).
  - No, go to 7
  - Unknown, go to 7

7. FOUNDATIONS ON SPREAD FOOTINGS SCOUR RESISTANCE ASSESSMENT: If the foundation is unknown, and the pile length cannot be reasonably assured, then treat the bridge as if it is supported on spread footing

a. Is the bridge supported on spread footings?
  - Yes, go to 7.b
  - No, go to 8
  - Unknown, treat it as spread footing and go to 7.b

b. Is the spread footing on rock?
  - Yes, go to 7.c
  - No, go to 7.j
  - Unknown, treat as granular or soft soil, go to 7.q

All of the following questions (7.c through 7.i) assume that the spread footing is on ROCK

c. ...and footing socketed into rock, regardless of exposure?
  - Yes, assign a rating of "8"
  - No, go to 7.d

d. ...and top of footing is not exposed?
  - Yes, assign a rating of "8"
  - No, go to 7.e

e. ...and the top of footing is exposed?
  - Yes, assign a rating of "5"
  - No, go to 7.f

f. ...and the footing is fully exposed with no rock degradation?
PART 4: ADDITIONAL INSPECTION GUIDANCE

- Yes, assign a rating of "4"
- No, go to 7.g

g. ... and the footing is fully exposed with rock degradation and less than 10% undermining?
   - Yes, assign a rating of "3"
   - No, go to 7.h

h. ... and the footing is fully exposed with rock degradation and more than 10% undermining?
   - Yes, go to 7.i

i. ... and failure is eminent?
   - Yes, assign a rating of "1" – Close the Bridge
   - No, assign a rating of "2" – Create Critical Finding

j. Is the spread footing on stiff clays/clay till (Qu > 1.5 tsf)
   - Yes, go to 7.k
   - No, go to 7.q
   - Unknown, treat as granular or soft soil, go to 7.q

All of the following questions (7.k through 7.p) assume that the spread footing is on stiff clays/clay till (Qu > 1.5 tsf).

k. ... and no observed scour?
   - Yes, assign to rating of, "5"
   - No, go to 7.l

l. ... and scour present and the footing not exposed?
   - Yes, assign a rating of "5"
   - No, go to 7.m

m. ... and scour present, < ½ of the top of the footing exposed and determined to be stable?
   - Yes, assign a rating of "4"
   - No, go to 7.n

n. ... and scour present, > ½ of the top of the footing exposed?
   - Yes, less than 10% of footing undermined, assign a rating of "3"
PART 4: ADDITIONAL INSPECTION GUIDANCE

- Yes, scour is adjacent to less than 25% of the face of the footing (below footing), assign a rating of “3”
- No, go to 7.o

o. ...and scour present and > ½ of footing exposed and determined unstable?
- Yes, 10% or more of the footing is undermined, go to 7.p
- Yes, Scour is adjacent to more than 25% of the face of footing, go to 7.p

p. ...and failure is eminent?
- Yes, assign a rating of "1" – Close the Bridge
- No, assign a rating of "2" – Create Critical Finding

All of the following questions (7.q through 7.u) assume that the spread footing on granular or soft soils (Qu < 1.5 tsf).

q. Is there any observed scour on the spread footing?
- Yes, go to 7.r
- No, assign a rating of “5”

r. Scour present, however the footing is not exposed?
- Yes, assign a rating of "4"
- No, go to 7.s

s. Scour present and the footing exposed with less than 10% scour to the face of the footing?
- Yes, assign a rating of "3"
- No, go to 7.t

t. Scour present and the footing exposed with more than 10% scour to the face of the footing (below footing) or otherwise considered unstable?
- Yes, go to 7.u

u. Is failure of the spread footing eminent?
- Yes, assign a rating of "1" – Close the Bridge
- No, assign a rating of "2" – Create Critical Finding
8. FOUNDATIONS ON PILES SCOUR RESISTANCE ASSESSMENT: If the foundation is unknown, and the pile length cannot be reasonably assured, then treat the bridge as if it is supported on spread footing.

a. Is the bridge supported on Pile Foundations?
   - Yes, go to 8.b
   - No, go to 7.a
   - Unknown, go to 7.a

All of the following questions (8.b through 8.p) assume that the bridge has a pile foundation.

b. For any soil type, are the pile tips > 40’ below ground surface and piles not exposed by significant scour?
   - Yes, assign a rating of "8".
   - No, go to 8.c

c. Are the piles socketed or driven into rock not exposed by "significant" scour?
   - Yes, assign a rating of "8"
   - No, go to 8.d

d. Are the piles socketed or driven into rock and exposed by "significant" scour?
   - Yes, assign a rating of "5"
   - No, go to 8.e

e. Are the bridge pile tips on rock but not socketed or driven into rock?
   - Yes, go to 8.f
   - No, go to 8.j

All of the following questions (8.f through 8.j) assume that the bridge has a pile foundation where the tips are on rock but not socketed or driven into rock.

f. …and has minor/no existing scour present or has occurred previously with a 3-foot minimum thickness of cohesive soil in upper ½ of embedded pile length?
   - Yes, assign a rating of "8"
   - No, go to 8.g

g. …and has minor/no existing scour present or has occurred previously with no layers of cohesive soil in upper ½ of embedded pile length?
   - Yes, assign a rating of "5"
   - No, go to 8.h
PART 4: ADDITIONAL INSPECTION GUIDANCE

h. ...and has observed scour or erosion with a 3-foot minimum thickness of cohesive soil in upper ½ of embedded pile length?
   - Yes, assign a rating of "4"
   - No, go to 8.i

i. ...and has no observed scour but a history of significant scour or erosion with no layers of cohesive soil in upper ½ of embedded pile length?
   - Yes, assign a rating of "3"
   - No, go to 8.j

j. and has observed significant scour with no layers of cohesive soil in upper ½ of embedded pile length?
   - Yes, assign a rating of "2"
   - No, go to 8.k

k. Are the bridge piles, friction piles in cohesive soils?
   - Yes, go to 8.l
   - No, assign a rating of “2”

All of the following questions (8.k through 8.r) assume that the bridge has a pile foundation are friction piles in cohesive soils.

l. ... and a minimum 3-ft layer w/ Qu> 1.5 tsf in upper ½ of embedded pile length required, where minor/no existing scour is present or has occurred previously with Pile tips > 15’deep?
   - Yes, assign a rating of “8"
   - No, go to 8.m

m. ...and a minimum 3-ft layer w/ Qu> 1.5 tsf in upper ½ of embedded pile length required, where minor/no existing scour is present or has occurred previously with Pile tips <15’ deep?
   - Yes, assign a rating of “5"
   - No go to 8.n

n. ...and a minimum 3-ft layer w/ Qu> 1.5 tsf in upper ½ of embedded pile length required with a history of significant scour/erosion with Plie tips > 35’ deep?
   - Yes, assign a rating of “8"
   - No, go to 8.o

o. ...and a minimum 3-ft layer w/ Qu> 1.5 tsf in upper ½ of embedded pile length required with a history of significant scour/erosion with Plie tips <35’ and > 20’ deep
   - Yes, assign a rating of “5"
   - No, go to 8.p
p. …and a minimum 3-ft layer w/ Qu> 1.5 tsf in upper ½ of embedded pile length required with a history of significant scour/erosion with Pile tips < 20’ deep without significant scour present
   • Yes, assign a rating of “4”
   • No, go to 8.q
q. …and a minimum 3-ft layer w/ Qu> 1.5 tsf in upper ½ of embedded pile length required with a history of significant scour/erosion with Pile tips < 20’ deep with significant scour present but determined stable?
   • Yes, assign a rating of “3”
   • No, go to 8.r
r. …and a minimum 3-ft layer w/ Qu> 1.5 tsf in upper ½ of embedded pile length required with a history of significant scour/erosion with pile tips < 20’ deep with significant scour present or piles otherwise determined unstable?
   • Yes, go to 8.s
s. Is failure of the pile eminent?
   • Yes, assign a rating of "1" – Close the Bridge
   • No, assign a rating of "2" – Create Critical Finding

9. CULVERT (STRUCTURES UNDER FILL)
a. What is the shape of the culvert?
   • Box
   • Pipe
b. Does the culvert have significant scour behind the ends of the box and the cut-off walls due to undermining of the wingwalls?
   • Yes, go to 9.b.i
   • No, go to 9.c
   • Unknown, go to 9.c
   i. Is the stream bed degrading?
      • Yes, assign rating of "4"
      • No, go to 9.b.ii
      • Unknown, assign rating of “4”
   ii. Is the channel meandering?
      • Yes, assign rating of “4”
iii. For natural streams, are there channel bends of greater than 30 degrees within 100 feet upstream of the bridge?

• Yes, assign rating of “4”
• No, go to 9.b.iv
• Unknown, assign rating of “4”

iv. Are the stream banks unstable?

• Yes, assign rating of “4”
• No, assign rating of “5”
• Unknown, assign rating of “4”

c. Does the culvert have scour adjacent to the cut-off walls?

• Yes, go to 9.c.i
• No, assign rating of “5”
• Unknown, go to 9.c.i

i. Is the stream bed degrading?

• Yes, assign rating of “2”
• No, go to 9.c.ii
• Unknown, assign rating of “2”

ii. Is the channel meandering?

• Yes, assign rating of “2”
• No, go to 9.c.iii
• Unknown, assign rating of “2”

iii. For natural streams, are there channel bends of greater than 30 degrees within 100 feet upstream of the bridge?

• Yes, assign rating of “2”
• No, go to 9.c.iv
PART 4: ADDITIONAL INSPECTION GUIDANCE

- Unknown, assign rating of “2”

iv. Are the stream banks unstable?
- Yes, assign rating of “2”
- No, assign rating of “3”
- Unknown, assign rating of “2”

To Be Completed by Scour Evaluator

Scour Critical Evaluation Rating (Item 113) from SCOUR ASSESSMENT PROCEDURE: 8, 7, 5, 4, 3, 2, 1

Scour Critical Evaluation Rating (Item 113) by Scour Evaluator: 8, 7, 5, 4, 3, 2, 1 Justification if different:

County: County Bridge#: NBI
Bridge # Foundation type:
Assessment performed
by: Signed:
Date:
Indiana Department of Transportation SCOUR ANALYSIS SUMMARY (HEC-18) FOR LOCAL PUBLIC AGENCIES

The scour analysis will be completed using HEC-RAS in accordance with HEC-18 and the INDOT Design Manual. Only Q100 will be used for the analysis. A summary of the scour parameters from the HEC-18 analysis will be uploaded to the bridge file (see below). A determination of the proper Coding for Item 113 will be made following the FHWA coding guide.

Scour Parameters

- Q100 Discharge = cfs.
- Elevation @ Q100 = MSL
- Velocity @ Q100 = ft./sec.
- Contraction Scour Depth = ft.
- Total Scour Depth = ft.
- Low Scour Elevation = MSL
To Be Completed by Scour Evaluator

Scour Critical Evaluation Rating (Item 113) from SCOUR ASSESSMENT PROCEDURE: 8, 7, 5, 4, 3, 2, 1

Scour Critical Evaluation Rating (Item 113) by Scour Evaluator: 8, 7, 5, 4, 3, 2, 1 Justification if different:

County:                                           County Bridge#:
NBI Bridge # Foundation type:
Assessment performed by:
Signed:
Date:
BRIDGE INSPECTION MANUAL

PART 4: ADDITIONAL INSPECTION GUIDANCE

Appendix D

DRAFT

Indiana Department of Transportation MAP OF MODERATE RISK BRIDGES FOR USE WITH SCOUR EVALUATION PROCESS FOR LOCAL PUBLIC AGENCIES
PART 4: ADDITIONAL INSPECTION GUIDANCE
4-2.02 Bridge Scour Plan Of Action (Poa) Procedures For Local Public Agencies

Bridge scour Plans of Action (POAs) are plans that document the action to be taken during a triggering flood event for scour critical bridges. Plans of Action are required for any bridge with a scour critical rating (item 113) of U, 3, or 2. Bridges with a scour critical rating (item 113) of 1 or 0 are closed and will require replacement or scour countermeasures depending on the condition of the bridge before they can be rerated and opened to traffic. If the rerating of these bridges results in a rating (item 113) of U, 3, or 2 a POA must be developed. Appendix A contains a POA form.

Bridge owners are encouraged to mitigate scour risk by installing properly designed countermeasures at bridges. The installation of properly designed scour countermeasures allows item 113 to be coded to reflect that the bridge is no longer scour critical and does not require a POA. FHWA Hydraulic Engineering Circular number 23 provides guidance to properly design scour countermeasures.

The minimum triggering event to implement the plan of action is when a flood warning is issued for the County. A flood watch or warning is announced by the National Weather Service which includes the county or drainage area tributary to the bridge (http://www.weather.gov/subscribe). If there is a USGS gaging station in or near the county, flood stage for the stream gage can be used as a triggering event. Waterways with stream gages can be found at: http://water.usgs.gov/wateralert/. Other triggering methods may be used as long as they can easily be determined.

A determination must be made if a monitoring plan can be used for the bridge during a flood event or if the bridge will be closed at the triggering event. The monitoring plan needs to include what will be monitored and the frequency that it will be monitored. The name of the responsible person monitoring and maintaining the log book must be included in the monitoring plan.

The closure plan needs to include what will trigger closure such as a flood warning, stream reaching bank full, water reaching the low structure, road overflow, signs of bridge movement, etc. It needs to include instructions on who to contact and how to get the closure implemented. At a minimum the County Engineer or County Highway Supervisor need to be notified. The plan needs to include the name and phone number of that contact person. The plan needs to include what needs to be inspected before reopening the bridge. It may require that the flood water recedes before the inspection can take place.

Appendix B contains the form that owners should use to document their actions to monitor or close scour critical bridges during notification events.

The POA and monitoring log need to be uploaded to BIAS as part of the bridge file.

The POA should be updated every 4 years or when personnel changes occur that affect the POA.
Appendix A

Indiana Department of Transportation

PLAN OF ACTION

Bridge Scour Plan of Action

Structure No.: __________ Date: __________

Triggering Event for Monitoring and Frequency:

Monitoring Plan:

Closure Plan:

Closure Notification:

Emergency Management Director: Phone:

Highway Engineer/Supervisor*: Phone:

* Responsible for completing the POA monitoring log

Secondary Highway Contact: Phone:

Reopening Inspection Requirements:

Written by: Signed:
Indiana Department of Transportation
BRIDGE SCOUR MONITORING/CLOSING REPORT FORM

POA MONITORING LOG BOOK

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4-3.0  BATS AND BIRDS

4-3.01  Introduction

Some species of bats are listed as endangered or threatened under the federal Endangered Species Act, and many species of birds are protected under the Migratory Bird Treaty Act. Both federal laws prohibit actions that harm these animals. Bats and birds may use bridges for roosting or nesting, which means they could be harmed by construction activities. Inspectors must perform a preliminary screening for bats and cliff swallows as a part of each inspection for state-owned bridges.
4-3.02 Habitat Detection

Some species of birds nest under highway bridges on walls or beams, typically near waterways or reservoirs. In particular, inspectors should look for two types of swallow nests. Cliff swallow nests have a distinctive rounded top, as shown above in Figures 4:8-1 and 4:8-2. Cliff swallows are a colony nesting bird and there may be several to hundreds under one bridge.

Barn swallows do not nest in colonies. Their nests are generally found alone and the shape is indistinct, as shown in Figure 4:8-3. Barn swallows are not tracked by the Indiana State Department of Natural Resources, but are discussed here to highlight the differences between cliff swallows and barn swallows. Other bird nests, such as those of robins and warblers, may also be found and should be documented in the inspection.

Bats may roost in any dark, warm, quiet spot on a bridge, which makes them more difficult to see during an inspection. Most bats in Indiana are very small, about the size of an adult's thumb, and some species prefer to wedge into small crevasses to roost. Bats may leave signs of use, such as guano or staining, even if a structure is inspected during the bats' inactive season (mid-fall through mid-spring) or if the roosting bats themselves are not visible. Droppings are usually small and mouse-like, brown or black, and appear directly under the roost site. Urine stains are usually a few inches in size immediately below roosts, and may have a strong odor. Stains from fur oil may also be visible at the entrance to cavity roosts. INDOT's Environmental Services Division has developed a short online tutorial about investigating structures for bats. This tutorial is available through INDOT University.
Take care not to touch any bats or expose yourself to danger. If bitten, call the Department of Health at 317-233-1325 and record the incident immediately. Few bats have rabies; however, it is a deadly virus. If bitten by a bat, you will need rabies post-exposure shots.

In general, investigation of the structure should include the following:

1. Screen the entire structure for bird nests and provide photographs.
2. Look for roosting bats in sheltered features of the structure, including all protected joints, cracks, and small cavities.
3. Look for signs of bat use. Note the location of guano piles, urine stains, and fur stains.
4. Listen for squeaks or chirps and note location.
5. Photograph roosting bats, guano, urine, or fur stains.

Figure 4:3-3: Single Barn Swallow Nest
Figure 4:3-4: Bat Droppings

Figure 4:3-5: Bats Roosting Along Crack and Associated Staining
Figure 4:3-6: Bat Guano on Riprap

Figure 3:8-7: Bat
4-3.03 Coding

The presence of bats, birds, or signs of bat or bird use, are recorded in the inspection report. Follow the prompts in the fields on the inspection report data entry form and add photographs of what is found.
4-4.0  FATIGUE AND FRACTURE CRITICAL INSPECTIONS

4-4.01  The Fracture Critical Inspection

Proper identification, classification, inspection, and reporting of all fracture critical bridges and the subsequent members are crucial to the longevity of Indiana’s bridges and the safety of the public. Uniformity in reporting permits the inspectors to accurately and closely monitor any problems throughout the life of the structure. Detailed and accurate reporting also permits the bridge owner to maintain and repair the bridge before major problems evolve.

4-4.01(01)  Classification of Fracture Critical Members

The FHWA defines a fracture critical member as a steel member in tension, or with a tension element, whose failure would probably cause a portion of, or the entire, bridge to collapse. A fracture critical bridge is one that contains a fracture critical member. The FHWA presents two criteria for identifying a fracture critical bridge:

- Steel members must be in tension, or elements/fibers of the member must be in tension. These loading conditions may include tensile forces, shear, flexure, and torsion. Load analysis ratings may indicate some members experience a stress reversal (varies from tension to compression) under various loads. Such members are to be included under this criteria.

- There must be no load path redundancy of the bridge, in which no other structural elements are capable of carrying the load if a main load-carrying member fails. For a bridge to be defined as non-load path redundant, it must have two or less load paths.

Some typical bridges that may be considered fracture critical include, but are not limited to, these types:

- Truss bridges containing two main load-carrying members
- Through girder bridges
- Two-girder bridges
- Tied arch bridges
- Box girders
- Cable-stayed bridges
- Suspension bridges
- Steel rigid frame bridges
- Bridges containing steel cross-girders or steel pier caps

See Appendix B for examples of fracture critical bridges, components, bending diagrams, typical...
crack locations, and typical pin-and-hanger parts. Timber covered bridges (trusses) with steel vertical tension hangers are not coded as fracture critical (Item 92A). Unless a structural analysis indicates these are primary members, they are to be considered a secondary member (non-fracture critical).

Once a bridge is designated as fracture critical, each individual member and connection must be identified for the inspection. Any attachment connected to the tension area of a fracture critical member and having a length in the direction of the tension stress greater than four inches shall be considered part of the tension component and, therefore, shall be considered fracture critical. For definition purposes and uniformity in reporting, the portions of the fracture critical member within a minimum of 12 inches of the entire connection (gusset plates, connection plates, etc.) shall be considered a fracture critical connection, whereas the portion of the tension member beyond the 12-inch window shall be considered a fracture critical member. See Figures 4:11-14 through 4:11-16 for examples of this definition. The Inspection Team Leader shall use sound judgment to expand the minimum 12-inch criteria to include additional fatigue details, and also consider the scale of the bridge and associated members. Floor beam connections, lateral bracing connections, bearings, gusset plates, connection angles, pins, hangers, etc. are all typically considered as part of the fracture critical connection.

Figure 4:4-1: Fracture Critical Truss Connection
In the event that original design plans of a fracture critical bridge clearly indicate that a tension member is not fracture critical due to internal redundancies within the bridge, these members will still require a detailed Fracture Critical Inspection. These tension members may only be omitted from the Fracture Critical Inspection if permission is given by the owner and the State Program Manager prior to the inspection.

**4-4.01(02) Inspector Qualification**

All Inspection Team Leaders for fracture critical bridges must:
1. Meet requirements in Part 1, Chapter 2
2. Possess adequate knowledge and understanding of how a fracture critical bridge functions, and where possible defects may occur
3. Possess suitable knowledge of the function of the specific bridge undergoing the inspection and, subsequently, the more complex bridges will warrant more knowledgeable, experienced inspectors; knowledge includes the understanding and ability to perform testing or recommend advanced testing procedures at problem areas; must be current on issues with the type of bridges being inspected
4. Physical ability to provide a hands-on inspection of all fracture critical members and connections in the individual bridge

4-4.01(03) Inspection Interval

Fracture Critical Inspections shall be performed at a regular interval not to exceed 24 months. If necessary, the inspection interval may be reduced. The inspection may be a supplemental inspection to the Routine Inspection.

4-4.01(04) Inspection Preparation

The fracture critical Plan of Action must be developed and/or reviewed and updated prior to performing a Fracture Critical Inspection. The inspection Plan of Action plays a crucial role in assisting all current and future inspectors at the bridge. The Plan of Action serves as an important first step in performing a thorough and complete investigation of all fracture critical members, while identifying necessary means, methods, and equipment required to perform this inspection. The inspection Plan of Action is a required element for every fracture critical report. These minimum requirements must be met for acceptance of the report by the Indiana Department of Transportation (INDOT). A full sample report, including the inspection Plan of Action is included in Appendix C.

At a minimum, the inspection Plan of Action shall include the following:

1. Sketch(es) of the superstructure with locations of all fracture critical members and connections clearly identified; primary members that are not fracture critical should be clearly identified, as well
2. An elevation view for trusses with locations labeled by letters and numbers similar to the nomenclature indicated in Figure 4:4-4
3. Use a framing plan and elevation view for a through girder with detail locations labeled by letters and numbers similar to the nomenclature indicated in Figure 4: 4-5
4. A north arrow
5. A general listing of all fracture critical members
6. A brief historical fact statement, such as a summary of repairs and rehabilitations or prior history of any problems
7. All inspection tools and access equipment required/used for the inspection
8. Traffic control requirements
9. Inspection frequency

Other items that should be reviewed and made available to the inspector, if available, prior to the inspection include the following:
1. Existing bridge plans and any repair/rehabilitation plans
2. Historical data and maintenance history of the bridge
3. Prior load ratings or a preliminary load rating (invaluable in determining fracture critical members)
4. Prior inspection reports

![TYPICAL ELEVATION SKETCH (TRUSS) AND NOMENCLATURE](image)

**Figure 4:4-4: Typical Inspection Plan Sketch (Truss)**

Note: Panel points are typically labeled beginning from South to North or from West to East in Figure 4:11-17.
4-4.01(05) Field Inspection

The National Bridge Inspection Standard requires a hands-on inspection of all fracture critical members and/or components. Hands-on is defined as being within arm’s reach (two feet) of these components. INDOT firmly enforces the hands-on requirement during inspections due to the relatively small size and difficulty in locating cracks and adequately inspecting fatigue and other details. The hands-on inspection requirement warrants the utilization of ladders, man lifts, climbing, and Under-bridge vehicles to inspect all fracture critical components and members. Cracks and other deficiencies cannot be adequately located and inspected with the utilization of binoculars or outside of the inspector’s reach from the member.

Primary compression members, floor beams, and secondary members such as lateral bracing, portal bracing, etc. are not considered fracture critical. These items require inspection and reporting during the Routine Inspection cycle. However, special consideration should be given to ensure that all primary and secondary members are inspected during the Routine or Fracture Critical Inspection and that no members have been missed during the entire inspection cycle. At a minimum, the Inspection Team Leader should perform a brief walkthrough of all secondary and non-fracture critical primary members during the Fracture Critical Inspection as a simple means...
to ensure all members have been inspected. When expensive equipment such as an under-bridge vehicle or man lift is utilized during the Fracture Critical Inspection, the Inspection Team Leader should strongly consider and plan to utilize this equipment for the inspection of any difficult-to-inspect, non-fracture critical members or problem areas on the bridge.

It is imperative that the inspector adequately identify and inspect each fracture critical member and fatigue detail. The FHWA suggests inspection for fatigue cracks in welded bridges should be performed at, but not limited to, the following locations:

For out-of-plane distortion in welded bridges, inspect the following locations:

1. Girder webs at floor beam and diaphragm connections
2. Ends of diaphragm connection plates in girder bridges
3. Box girder webs at diaphragms
4. Lateral bracing gusset plates on girder webs at floor beam connections
5. Floor beam and cantilever bracket connections to girders
6. Pin-connected hanger plates and fixed-pin plates

For main members in welded bridges, inspect the following locations:

1. Ends of welded cover plates
2. Groove welds in flange plates
3. Butt welds in longitudinal stiffeners
4. Web plates with cut-outs and filler welds
5. Intersecting groove welds
6. Welded repairs and reinforcement
7. Back-up bar splices
8. Stress risers

For connections and attachments in welded bridges, inspect the following locations:

1. Cut short flanges
2. Coped beam ends
3. Blocked flange plates
4. Welded rigid connections of cross-girders at bents
5. Welded flange attachments
6. Intersecting welds at gusset plates and diaphragms
In general, the locations where fatigue cracks develop in riveted and bolted bridges are similar to those in welded bridges. The FHWA suggests inspection for fatigue cracks in riveted or bolted bridges should be performed at, but not limited to, the following locations:

1. Rivets/bolts at end connections (check for cracking and prying)
2. End connection angle
3. Girder webs at floor beam connections
4. Floor beam connections to girders
5. Diaphragm connections to girders
6. Cantilever bracket connections to girders
7. Truss hangers
8. Eyebars (see Figures 4:11-19 and 4:11-20)
9. Tack welds
10. Rivet heads and bolts made of certain types and ages of steel on older bridges may have fatigue issues, especially if pack rust has developed between connection members; additional stress may be placed on the nut or rivet head at these locations

The thickness of primary truss gusset plates should be measured as a part of a Fracture Critical Inspection. If the section cannot be adequately measured with traditional measurement devices, inspectors should use an appropriate NDT technology to assess the gusset plate condition and quantify the plate thickness.
4-4.01(06) Field Inspection Reporting

Each bridge owner has unique requirements and preferences for bridge reporting. The guidelines listed in this section are the minimum reporting requirements for acceptance of a fracture critical report. Although these minimum requirements must be met for acceptance of the report by INDOT, the inspecting agency may provide alternate report formats meeting internal guidelines, as long as the criteria set forth in this chapter are met. An example inspection report has been provided in Appendix C. The following are minimum requirements for a Fracture Critical Inspection report:

1) Inspection Plan of Action
2) General statement discussing inspection procedures
3) Date, temperature, and weather conditions of the inspection
4) Time duration of the inspection
5) Inspection Team Leaders and Inspection Team Members present at the inspection
6) General summary of inspection results
7) Testing performed, and locations of these tests
8) Recommendations for repairs and maintenance, highlighting urgent repairs and listing programmed repairs
9) Photographs of every fracture critical member, connection, or component assigned a
condition rating of 4 or less

10) Photographs of each fracture critical member at a frequency of not greater than 10 years (to be included in the bridge file)

11) Photographs of any cracks inspected or discovered

12) Recommended inspection interval

13) Documentation of inspection results for each individual member and/or component, including the following:
   a) Individual member rating
   b) Noted section loss
   c) AASHTO fatigue category
   d) Brief statement discussing the presence of cracks (or lack thereof)
   e) Adequate documentation of fatigue damage
   f) A table showing the primary truss gusset plates, thickness measurement taken, location of each measurement, and the inspection procedure used to take each measurement

APPENDICES
APPENDIX B  FRACTURE CRITICAL DETAILS

TRUSS MEMBERS

THROUGH HOWE TRUSS

THROUGH PRATT TRUSS

THROUGH WARREN TRUSS

QUADRANGULAR THROUGH WARREN TRUSS

THROUGH WHIPPLE TRUSS

CAMEL BACK TRUSS

THROUGH BALTIMORE TRUSS

K-TRUSS

THROUGH TRUSS

PONY TRUSS

DECK TRUSS
SIMPLE SPAN TRUSS
Cracks being pulled open by tensile forces.
Fatigue Categories A, B (on eyebar body), or E (on net section of eyebar head)
Fatigue Category A, B (on hanger plate body), or E (on net section of hanger or pin plate)
Fatigue Categories E and E’
Web Out-of-Plane Bending at Floor Beam Connection Plate
FLANGE AND WEB ATTACHMENTS

Fatigue Category

Fatigue Category

Gusset

Crack

L > 4"

M

M

M

Crack

M

M

M
LONGITUDINAL STIFFENERS

Fatigue Category

Fatigue Category E

Tension Flange

Girder

Crack

Longitudinal Stiffener

Compression

Tension
I. INTRODUCTION

A. Location and Description

Bridge No. 001 is located 0.1 miles south of State Road 99. The map location is at E-9. The bridge carries traffic on Main Street over Nameless Creek. The bridge is located at a latitude of N39°00’01.1” and a longitude of W86°00’01.1”.

Bridge No. 001 is a single span steel pony truss. The structure is on an approximate zero degree skew. The structure length is 127 feet with a maximum span length of 124.0 feet. The structure has a clear roadway width of 28.0 feet. The average daily traffic was estimated to be 11083 vehicles per day in 2008. The bridge has an H rating of XX tons.
B. History

The estimated year of construction for Bridge No. 001 is 1946. The bridge was reconstructed in 1986 and repaired in 1995.
II. FIELD INVESTIGATION

A. Members to be Inspected

The following truss tension members are considered to be non-redundant, fracture critical bridge members:

- lower chords and lower chord connections
- diagonals and diagonal connections in tension
- verticals and vertical connections in tension
- floor beam connections

B. Inspection Procedures

An up-close visual inspection was performed to locate possible problem areas in the fracture critical members.

If any suspect surface discontinuities were found, a dye penetration test would be performed. This test can help locate stringers (long, thin laminations), scams (shallow, thin voids), laminations (flat, subsurface discontinuities), and cracks in the base metal. It is also of use in checking for weld-related cracking and porous groove welds. This was not needed at this bridge.

C. Equipment Required for Inspection

Tools and equipment used to inspect each member or connection included a hard hat, safety glasses, chipping hammer, scraper, wire brush, feeler gauges, calipers, tape measure, flashlight, magnifying glass, swivel mirror, camera, and a punch.

A dye penetration kit was available for a more detailed inspection if needed.

A 20’ extension ladder was used to inspect the upper chord connections and various members and lower chord connections and various members were inspected by free climbing with safety restraints.

D. Bridge Cleaning Requirements

The lower chord and bearings contained heavy dirt and roadway debris. The highway department power washed all lower chord members and bearings prior to the inspection. The highway department also removed heavy vegetation overgrowth around the bridge to assist in the inspection. Hand brushes and a scraper were utilized by the inspector to clean individual locations.

E. Traffic Maintenance Requirements

All lower chord members and connections were accessible without roadway restrictions. The highway department provided temporary roadway closures at each end of the bridge for the portions of the inspection requiring the utilization of a ladder.
F. Date and Conditions of Inspection

Date: 5/29/10
Temperature: 55° F
Conditions: Overcast
Inspection Duration: 5 hours

G. Other items

Original bridge plans were available to the inspector dated July 1945, as well as rehabilitation plans dated 1986 and repair plans dated 1995. The previous inspection consultant provided copies of load ratings as well as previous inspection reports. Field notes tracking several deficiencies were made available by the previous inspection consultant in order to monitor the development of several deficiencies at the bridge.

III. SUMMARY OF INSPECTION RESULTS

A. Connections

All of the connections were in satisfactory to good condition with the exception of NE L1U1 which is in fair condition. No deterioration or section loss was found that would affect the load capacity of any fracture critical connections. Debris has accumulated at the lower chord connections. No cracks were found.

B. Members

All of the members are in satisfactory to good condition, with the exception of SW L1U1 which is in fair condition. No deterioration or section loss was found that would affect the load capacity of any fracture critical members. Debris has accumulated on the lower chord. No cracks were found.

IV. NBIS CODING INFORMATION

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<td>Fracture critical inspection every 24 months</td>
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V. SUMMARY OF RECOMMENDATIONS

Programmed Repairs: The lower chord should be cleaned regularly to remove debris.

Urgent Repairs: None

VI. FIELD NOTES

The following rating system was used to rate the fracture critical members and connections:

9  Excellent Condition
8  Very Good Condition - No noteworthy deficiencies
7  Good Condition - Some minor problems
6  Satisfactory Condition - Minor structural deterioration
5  Fair Condition - Minor section loss
4  Poor Condition - Advanced section loss, deterioration
3  Serious Condition - Local failures are possible
2  Critical Condition - Advanced deterioration of primary elements
1  Imminent Failure Condition - Major deterioration - Structure should be closed
0  Failed Condition - Out of service - Bridge condition beyond corrective action

Connection at Southwest L0:

<table>
<thead>
<tr>
<th>MEMBER</th>
<th>FATIGUE CAT.</th>
<th>RATING</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Chord</td>
<td>D</td>
<td>6</td>
<td>Light surface rust and moderate pitting. Minor expansion rust at floor beam connection angle. Areas of heavy pitting with minor section loss on inside flanges and top and bottom of web. No cracks evident.</td>
</tr>
<tr>
<td>Bearing</td>
<td>D</td>
<td>7</td>
<td>Light surface rust and minor pitting. Minor expansion rust between angles and plates and between gusset plates and lower chord flanges. Bearings near limit of rotation. No cracks evident.</td>
</tr>
<tr>
<td>Floor Beam</td>
<td>B</td>
<td>7</td>
<td>Light surface rust on repairs and bolted connection. No cracks evident.</td>
</tr>
</tbody>
</table>
Connection at Southwest L1:

<table>
<thead>
<tr>
<th>MEMBER</th>
<th>FATIGUE CAT.</th>
<th>RATING</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Chord</td>
<td>E</td>
<td>6</td>
<td>Light surface rust and minor pitting. Areas of heavy pitting with minor section loss on inside flanges and top of web. One rivet head is missing on each angle. Expansion rust between gusset plate and flange with minor section loss. Welded repairs to member have created a fatigue prone detail however no cracks evident.</td>
</tr>
<tr>
<td>Vertical</td>
<td>D</td>
<td>6</td>
<td>Light surface rust and minor pitting. Minor expansion rust and section loss at floor beam connection on inside flange. 20% section loss at inside flange at plate connection. No cracks evident.</td>
</tr>
<tr>
<td>Vertical (L1U1)</td>
<td>D</td>
<td>6</td>
<td>Light surface rust, minor section loss, and minor pitting. Minor expansion rust at floor beam connection on inside flange. No cracks evident.</td>
</tr>
<tr>
<td>Floor Beam</td>
<td>D</td>
<td>6</td>
<td>Light surface rust, minor section loss, and minor pitting. Minor expansion rust at floor beam connection on inside flange. No cracks evident.</td>
</tr>
</tbody>
</table>

Connection at Southwest L2:

<table>
<thead>
<tr>
<th>MEMBER</th>
<th>FATIGUE CAT.</th>
<th>RATING</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Chord</td>
<td>D</td>
<td>6</td>
<td>Light surface rust and minor pitting. Areas of heavy pitting and minor section loss on inside flanges, top of web, and on rivets. 15-20% section loss of flange at gusset plate and flange connection. Expansion rust between splice plates at the lower chord web. No cracks evident.</td>
</tr>
<tr>
<td>Vertical</td>
<td>D</td>
<td>6</td>
<td>Light surface rust and minor pitting. Areas of heavy pitting and minor section loss on inside flange under railing connection, on web at lower chord splice and on vertical connection plates. Minor out of plane distortion from impact damage below rail. No cracks evident.</td>
</tr>
<tr>
<td>Diagonal</td>
<td>D</td>
<td>7</td>
<td>Light surface rust and minor pitting. Areas of heavy pitting, expansion rust and minor section loss on inside flange at gusset plate connection. No cracks evident.</td>
</tr>
<tr>
<td>Diagonal (L2U3)</td>
<td>D</td>
<td>7</td>
<td>Light surface rust and minor pitting. Areas of heavy pitting, expansion rust and minor section loss on inside flange at gusset plate connection. No cracks evident.</td>
</tr>
<tr>
<td>Floor Beam</td>
<td>B</td>
<td>7</td>
<td>Light surface rust on repairs and bolted connection. No cracks evident.</td>
</tr>
</tbody>
</table>
Connection at Southwest L3:

<table>
<thead>
<tr>
<th>MEMBER</th>
<th>FATIGUE CAT.</th>
<th>RATING</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Chord</td>
<td>D</td>
<td>6</td>
<td>Light surface rust and minor pitting. Areas of heavy pitting and minor section loss on inside flanges, top of web, and on rivets. No cracks evident.</td>
</tr>
<tr>
<td>Vertical (L3U3)</td>
<td>D</td>
<td>6</td>
<td>Light surface rust and minor pitting. Areas of heavy pitting and on inside flange and web. Heavy expansion rust at inside flange and lower chord connection. No cracks evident.</td>
</tr>
<tr>
<td>Floor Beam</td>
<td>D</td>
<td>6</td>
<td>Light surface rust and minor pitting. Minor expansion rust at floor beam connection angles and lower flange connection. No cracks evident.</td>
</tr>
</tbody>
</table>

*In order to avoid redundancy, several pages of the Sample Report have been deleted.*
West Truss Lower Chord Members:

<table>
<thead>
<tr>
<th>MEMBER</th>
<th>FATIGUE CAT.</th>
<th>RATING</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Chord (Southwest L0L1)</td>
<td>A</td>
<td>6</td>
<td>Light surface rust and minor pitting. Areas of heavy pitting and minor section loss on inside flanges and on top of web. No cracks evident.</td>
</tr>
<tr>
<td>Lower Chord (Southwest L1L2)</td>
<td>A</td>
<td>6</td>
<td>Light surface rust and minor pitting. Areas of heavy pitting and minor section loss on inside flanges and on top of web. No cracks evident.</td>
</tr>
<tr>
<td>Lower Chord (Southwest L2L3)</td>
<td>A</td>
<td>6</td>
<td>Light surface rust and minor pitting. Areas of heavy pitting and minor section loss on inside flanges and on top of web. No cracks evident.</td>
</tr>
<tr>
<td>Lower Chord (Southwest L3L4)</td>
<td>A</td>
<td>6</td>
<td>Light surface rust and minor pitting. Areas of heavy pitting and minor section loss on inside flanges and on top of web. Heavy section loss of rivet heads (50-75%) at splice in web only. No cracks evident.</td>
</tr>
<tr>
<td>Lower Chord (Northwest L3L4)</td>
<td>A</td>
<td>6</td>
<td>Light surface rust and minor pitting. Areas of heavy pitting and minor section loss on inside flanges and on top of web. Heavy section loss of rivet heads (20%) at splice in web only. No cracks evident.</td>
</tr>
<tr>
<td>Lower Chord (Northwest L2L3)</td>
<td>A</td>
<td>6</td>
<td>Light surface rust and minor pitting. Areas of heavy pitting and minor section loss on inside flanges and on top of web. No cracks evident.</td>
</tr>
<tr>
<td>Lower Chord (Northwest L1L2)</td>
<td>A</td>
<td>6</td>
<td>Light surface rust and minor pitting. Areas of heavy pitting and minor section loss on inside flanges and on top of web. No cracks evident.</td>
</tr>
<tr>
<td>Lower Chord (Northwest L0L1)</td>
<td>A</td>
<td>6</td>
<td>Light surface rust and minor pitting. Areas of heavy pitting and minor section loss on inside flanges and on top of web. No cracks evident.</td>
</tr>
<tr>
<td>Vertical (Southwest L1U1)</td>
<td>A</td>
<td>5</td>
<td>Light surface rust and moderate pitting. Areas of heavy pitting on inside of south web with 20% section loss on web. No cracks evident.</td>
</tr>
<tr>
<td>Vertical (Southwest L2U2)</td>
<td>A</td>
<td>7</td>
<td>Light surface rust and minor pitting. Localized areas of surface rust and moderate pitting. No cracks evident.</td>
</tr>
<tr>
<td>Vertical (Southwest L3U3)</td>
<td>A</td>
<td>6</td>
<td>Light surface rust and minor pitting. Areas of heavy pitting, surface rust and minor section loss on inside flanges and on north face of web. No cracks evident.</td>
</tr>
<tr>
<td>Vertical (West L4U4)</td>
<td>A</td>
<td>7</td>
<td>Light surface rust and minor pitting. No cracks evident.</td>
</tr>
<tr>
<td>Vertical (Northwest L3U3)</td>
<td>A</td>
<td>7</td>
<td>Light surface rust and minor pitting. No cracks evident.</td>
</tr>
</tbody>
</table>
Vertical (Northwest L2U2) A 7 Light surface rust and minor pitting. No cracks evident.

Vertical (Northwest L1U1) A 7 Light surface rust and minor pitting. No cracks evident.

Diagonal (Southwest L2U1) A 7 Light surface rust and minor pitting. No cracks evident.

Diagonal (Southwest L2U3) A 7 Light surface rust and minor pitting. Localized areas of surface rust and moderate pitting. No cracks evident.

Diagonal (Southwest L4U3) A 7 Light surface rust and minor pitting. Localized areas of surface rust. No cracks evident.

Diagonal (Northwest L4U3) A 6 Light surface rust and minor pitting. Areas of web with heavy pitting and section loss. No cracks evident.

Diagonal (Northwest L2U3) A 7 Light surface rust and minor pitting. No cracks evident.

Diagonal (Northwest L2U1) A 7 Light surface rust and minor pitting. No cracks evident.

Note: Heavy debris accumulation on lower chords. Large areas of paint are beginning to peel on members.

West Gusset Plates with Corrosion and Requiring Non-Destructive Evaluation:

<table>
<thead>
<tr>
<th>CONNECTION</th>
<th>THICK.</th>
<th>LOCATION/METHOD OF MEASUREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southwest L0</td>
<td>½”</td>
<td>Ultra-sonic Testing. Dimension taken 3” past the end of the interior lower chord.</td>
</tr>
<tr>
<td>Northwest L2</td>
<td>¾”</td>
<td>Ultra-sonic Testing. Dimension taken between lower chord Northwest L1L2 and Diagonal Northwest L2U3.</td>
</tr>
<tr>
<td>Northwest U3</td>
<td>½”</td>
<td>Ultra-sonic Testing. Dimension taken between vertical Northwest L3U3 and Diagonal Northwest L2U3. A man-lift was required for testing</td>
</tr>
</tbody>
</table>

*In order to avoid redundancy, several pages of the Sample Report have been deleted.*