INSTRUCTIONAL MEMORANDUMS
To Local Public Agencies

To:	Counties and Cities	Date: July 7, 2023
From:	Local Systems Bureau	I.M. No. 7.020
Subject:	Bridge Inspections	

Contents: This Instructional Memorandum (I.M.) includes guidelines and procedures for a Local Public Agency (LPA) to assist them in complying with the National Bridge Inspection Standards (NBIS). This I.M. also includes the following attachments:

Attachment A - Bridge Scour Stability Worksheet – Level A Evaluation (Word)
Attachment B - Intermediate Scour Assessment Flowchart – Level B Evaluation
Attachment C - Intentionally left blank
Attachment D - Scope of Services for NBI Bridge Inspection Services (Word)
Attachment E - Iowa Legal Trucks Diagrams
Attachment F - Routine Permit Trucks Diagrams
Attachment G - USGS Hydrologic Region Map with Region Descriptions
Attachment H - Unknown Foundations Guidance, Flowchart, Risk Assessment, Worksheet, and Plan of Action (POA) - Level A Evaluation (Word)
Attachment I - Unknown Foundations Flowchart - Level B Evaluation
Attachment J - Quality Assurance Field Review Worksheet (Word)
Attachment K - Nonredundant Steel Tension Member Locations and Conditions for Trusses Form (Word)
Attachment L - Nonredundant Steel Tension Member Locations and Conditions for Thru/Two Girders Form (Word)
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INTRODUCTION

According to Iowa Code Chapter 314.18, the counties, cities, and other public agencies are responsible for the safety inspection and evaluation of all highway bridges under their jurisdiction which are located on public roads, in accordance with the NBIS. These responsibilities include inspection policies and procedures, inspections, reports, load ratings, quality control (QC), quality assurance (QA), maintaining a bridge inventory, and other requirements of the NBIS.

The NBIS may be found in 23 CFR 650. The following are additions or clarifications to the indicated subsections of 23 CFR 650.

DEFINITIONS (23 CFR 650.305)

Armored Countermeasure (Armoring) - Material such as Class E Revetment, according to Section 4130 of the Standard Specifications, placed under and around a bridge structure for the purpose of protecting the embankment or berm from scour and/or erosion. Armoring is not a permanent countermeasure since the material is subject to displacement during a major flood event which is considered to be the lesser of the 500 year or roadway overtopping event.

Bridge Inspector Refresher Training Course – (FHWA-NHI-130053) – The major goals of this course are to refresh the skills of practicing bridge inspectors in fundamental visual inspection techniques, review the background knowledge necessary to understand how bridges function, communication issues of national significance relative to the nations' bridge infrastructures, re-establish proper condition and appraisal rating practices, and review the professional obligations of bridge inspectors.

Nonredundant Steel Tension Member Inspection Techniques for Steel Bridges Training Course – (FHWA-NHI-130078) – The course curriculum for this training reflects current practices, while addressing new and emerging technologies available to bridge inspectors. In addition, the course features exemplary training, hands-on workshops for popular types of nondestructive evaluation (NDE) equipment, and a case study of an inspection plan for a Nonredundant Steel Tension Member bridge.

Nonredundant Steel Tension Member (NSTM)- A steel member in tension, or with a tension element, whose failure would probably cause a portion of or the entire bridge to collapse. Floor beams are considered to be Nonredundant Steel Tension Member members when the floor beam spacing is greater than 14 feet.

Bridge Inspection Interval Tolerance - A period of time to allow for unforeseen circumstances such as severe weather, concern for bridge inspector safety, concern for inspection quality, the need to optimize scheduling with other bridges, or other unique situations may be cause to adjust the scheduled inspection date. The adjusted date should not extend more than three months beyond the scheduled inspection date for bridges on 24-month or greater intervals. The adjusted date should not extend more than two months beyond the scheduled inspection date for bridges on 12-month intervals.

Independent Party - An entity not influenced by or affiliated with the LPA or the LPA's Program Manager. An LPA or consulting firm with more than one Program Manager can utilize an alternate Program Manager from the same consulting firm or LPA to conduct the QA review.

Low Water - Water depth of less than 6 feet.

Monthly Notifications – automated notifications sent by e-mail to the LPAs by the Iowa DOT's Bridges and Structures Bureau regarding inspections past due or bridges not in compliance with posting requirements on a monthly basis.

Permanent Countermeasure - Designed to account for all three major types of scour (i.e. long term degradation, general or contraction scour, and local pier or abutment scour). Properly designed and installed systems satisfy the requirements of a "Permanent" classification. Examples of permanent systems include:

- Fabric Formed Articulated Block Mattress (ABM)
- Stone Revetment
- Proprietary Articulated Concrete Block (ACB)
- Gabion Mattress

Stone revetment is subject to displacement during a major flood event which is considered to be the lesser of the 500 year or roadway overtopping event. Therefore, unless the revetment is designed in accordance with Hydraulic Engineering Circular (HEC) HEC 23 and contained, it cannot be considered to provide adequate protection to attain a "Permanent" classification. The following are some examples of permanent stone revetment:

- Burial below the contraction scour elevation.
- Installation of cut-off walls.

- Placing the revetment as launchable stone.

Safety Inspection of In-service Bridges Course – (FHWA-NHI-130055) – This course is based on the "Bridge Inspector's Reference Manual" and provides training on the safety inspection of in-service highway bridges. Satisfactory completion of this course will fulfill the training requirements of the National Bridge Inspection Standards (NBIS) for a comprehensive training course. This course does not address Nonredundant Steel Tension Member, underwater, or complex structures.

Scour Plan of Action (POA) - A POA is a written procedure developed by the bridge owner or delegated Program Manager that outlines the monitoring plan for a specific bridge. The plan provides guidelines and practical information pertaining to each bridge for the purpose of monitoring foundation scour during flood events.

Standard bridge – a bridge constructed using the "Bridge Standards" developed by the Iowa DOT. See the Procedures for Rating Standard Bridges section below in this I.M.

Structural Inventory and Inspection Management System (SIIMS)(R) - Bridge inspection data collection software.

Scour Evaluation - Scour evaluation is the process of determining the susceptibility of each bridge for scour. The depth, or level, of this process varies for each bridge. Some bridges may be determined scour safe after the first level of evaluation, Level A. Other bridges cannot be determined scour safe after Level A so they shall go to Level B using assessment procedures. Still others may need to go to the highest level of evaluation, Level C.

Level A - Bridge Scour Stability Worksheets (see Attachment A to this I.M). Bridges that meet the required Stability Total of less than 35 points, do not need any further evaluation, and may be considered scour safe. Bridges with a Stability Total of 35 points or greater need further evaluation using the Level B Intermediate Scour Assessment Procedures Flowchart (see Attachment B to this I.M).

Level B - Intermediate Scour Assessment Procedures Flowchart (see Attachment B to this I.M). From this assessment, bridges are determined to be either stable, limited risk needing monitoring, scour susceptible needing monitoring, or scour susceptible needing a Level C Evaluation.

Level C - This is the most in-depth level of the evaluation process needed for those bridges that do not satisfy guidelines in the Level B Evaluation. A full computational analysis is completed using the Federal Highway Administration's HEC 18 procedures and a determination is made concerning the stability of the bridge. Bridge owners may decide to develop a Plan of Action (POA) for these structures in lieu of the Level C Evaluation.

Thalweg - The lowest point in the stream channel along the cross section.

Unknown Foundation Plan of Action (POA) – A risk based POA developed by the bridge owner or Program Manager after completing the unknown foundation risk assessment worksheet to determine the level of risk to the traveling public.

USE OF CONSULTANT SERVICES

Use of consultant services for bridge inspection in accordance with this I.M. is acceptable. For consistency in inspections, it is strongly recommended that Attachment D to this I.M., Scope of Services for NBIS Bridge Inspection Services, be included in the Request for Proposal, if applicable, and the agreement. Use of Attachment D to this I.M., Scope of Services for NBIS Bridge Inspection Services, will ensure the NBIS requirements and activities are met.

OFFICIAL BRIDGE FILES

It is the expectation of the Federal Highway Administration (FHWA) that the bridge owner will maintain a complete Bridge File for each individual bridge with all the required components documenting the bridge's inspection history. The various forms and documents required to be completed by the Iowa DOT in SIIMS qualify as "State Forms", which are required to be completed as part of the Official Bridge File.

The Iowa DOT as the Official Bridge Inspection Organization has the authority to establish requirements for the completion of State forms and other supporting documentation in a manner consistent with managing a bridge

management system and quality assurance program. Therefore, the SIIMS records serve in this capacity as part of the Official Bridge File.

There are however, other documents that are not required to be included in SIIMS that should be maintained by the bridge owner as stated in the AASHTO Manual for Bridge Evaluation (MBE) Section 2.2, Components of Bridge Records. These also constitute part of the bridge file and the owner is free to keep such records in either hard copy or electronic format of their choosing. In conclusion, the Bridge File is a combination of SIIMS bridge records required to be maintained by the Iowa DOT and other documents maintained separately by the bridge owner as per the MBE.

BRIDGE INSPECTION ORGANIZATION (23 CFR 650.307, a-g)

According to Iowa Code 314.18, the counties, cities, and other public agencies are responsible for the safety inspection and evaluation of all highway bridges under their jurisdiction, which are located on public roads, in accordance with the NBIS. These responsibilities include inspection policies and procedures, inspection reports, load ratings, QC, QA, maintaining a bridge inventory, and other requirements of the NBIS.

The NBIS regulations apply to all publicly owned highway bridges longer than 20 feet located on public roads. Railroad and pedestrian structures that do not carry vehicular traffic are not covered by the NBIS regulations. Similarly, the NBIS does not apply to inspection of sign support structures, high mast lighting, retaining walls, noise barrier structures, and overhead traffic signs. Tunnels, since they are not bridges, are not covered by the NBIS. Tunnels are required to be inspected according to the National Tunnel Inspection Standards (NTIS). Bridges within the public right-of-way but not on the roadway, such as entrances to fields and driveways to private properties, are not covered by the NBIS regulations.

A privately owned bridge on a public highway where the bridge is connected to a public road on both ends and is subject to the NBIS as per 23 CFR 650.303.

The Bridge Owner shall have a Program Manager who is assigned the above responsibilities. The Bridge Owner may retain a consultant to perform the duties of Program Manager.

QUALIFICATIONS OF PERSONNEL (23 CFR 650.309, a-h)

FHWA now offers an accelerated bridge inspection course for professional engineers. FHWA-NHI 130056 Safety Inspection of In-Service Bridges for Professional Engineers is a 5-day course that can be completed by licensed professional engineers, in lieu of the FHWA-NHI 130055 Safety Inspection of In-Service Bridges.

Bridge inspection experience is defined in the NBIS as active participation in bridge inspections in accordance with the NBIS, in either field inspections, or a supervisory or management role. A combination of bridge design, bridge maintenance, bridge construction, and bridge inspection experience, with the predominant amount in bridge inspection, is acceptable.

The Iowa DOT has developed the following criteria to determine if an individual with experience performing bridge inspections has the qualifications of a Team Leader in accordance with 23 CFR 650.309(b).

1. Licensed Professional Engineers are required to successfully complete the Safety Inspection of In-Service Bridges Course (FHWA-NHI-130055) or the Safety Inspection of In-Service Bridges for Professional Engineers (FHWA-NHI-130056) and 6 months of inspection experience.
2. Technicians are required to have a minimum of 5 years of bridge inspection experience as defined in the NBIS. The FHWA allows 2.5 years in bridge related work, such as bridge construction inspection, bridge maintenance, bridge design, or bridge construction to count towards the 5-year requirement. The individual shall participate in a minimum of 500 field inspections under the supervision of a qualified Team Leader, along with the successful completion of the Safety Inspection of In-Service Bridges Course (FHWA-NHI-130055).
3. Engineer Interns that have successfully completed the Fundamentals of Engineering Exam are required to have a minimum of 2 years of bridge inspection experience. The FHWA allows 1 year in bridge related work such as bridge construction inspection, bridge maintenance, bridge design, or bridge construction to count towards the 2-year requirement. The individual shall participate in a minimum of 200 field inspections under the supervision of a qualified Team Leader along with the successful completion of the Safety Inspection of In-Service Bridges Course (FHWA-NHI-130055).

4. Individuals with an associate's degree in engineering or engineering technology are required to have a minimum of 4 years of bridge inspection experience. The FHWA allows 2 years in bridge related work such as bridge construction inspection, bridge maintenance, bridge design, or bridge construction to count towards the 4-year requirement. The individual shall participate in a minimum of 400 field inspections under the supervision of a qualified Team Leader along with the successful completion of the Safety Inspection of In-Service Bridges Course (FHWA-NHI-130055).

Bridge inspectors not qualified as Team Leaders may assist the Team Leader but may not inspect bridges independently. Education and experience requirements for bridge inspectors who are not Team Leaders should be determined by the Program Manager or Bridge Owner.

Program Managers and Team Leaders who perform field inspections on NSTMs shall complete the Nonredundant Steel Tension Member (NSTM) Inspection Techniques for Steel Bridges Training Course FHWA-NHI 130078. It is strongly recommended that Program Managers and Team Leaders who perform field inspections on NSTMs complete the Nonredundant Steel Tension Member Inspection Techniques for Steel Bridges Training Course (FHWA-NHI 130078) every ten years.

The NBIS requires bridge inspection refresher training for Program Managers and Team Leaders as part of QC and QA. The Bridge Inspection Refresher Training Course (FHWA-NHI 130053) is required to meet the refresher training requirement of 18 hours every 60 months, following the completion of the Safety inspection of In-Service Bridges Training Course.

Program Managers and Team Leaders whose qualifications have expired have 12 months from the expiration date to successfully complete the Bridge Inspection Refresher Training Course before they are disqualified. The Program Managers and Team Leaders can perform inspection duties during the 12 month "Grace Period"; however, if they have not completed the Bridge Inspection Refresher Training Course within the 12 months they will be disqualified as a Program Manager or Team Leader until they complete this required course.

The two-week Safety Inspection of In-Service Bridges Course has been updated. As a result of the significant improvements made to this course, there are new requirements of the participants. All participants taking the two-week course must have successfully completed **one** of the following prerequisite courses with a score of 70% or better:

- Prerequisite Assessment for Safety Inspection of In-Service Bridges Course (FHWA-NHI-130101A): a 1-hour web-based course at no cost. This is a test out course for those individuals with significant experience and/or a comprehensive background in bridge inspection or engineering.
- Introduction to Safety Inspection of In-Service Bridges Course (FHWA-NHI-130101): a 14-hour web-based course at no cost. This course is for individuals with limited experience with in-service bridge inspection.
- Engineering Concepts for Bridge Inspectors Course (FHWA-NHI-130054): a 5-day instructor led course for which there is an associated cost per person. This is an in-person course for those individuals with limited experience with in-service bridge inspection.

Upon successful completion of one of the prerequisite requirements, participants may enroll in the two-week Safety Inspection of In-Service Bridges Course, for up to 2 years. After 2 years, participants will need to retake one of the prerequisites prior to enrolling. Participants must bring a certificate of completion from one of the prerequisite options to the first day of the Safety Inspection of In-Service Bridges Course.

Professional Engineers that have successfully completed the Safety Inspection of In-Service Bridges course have met the qualifications to be bridge inspection Program Managers as per the NBIS. The Iowa DOT provides access to bridge records authorized by the bridge owners in SIIMS bridge inspection software to these individuals once they have submitted the Bridge Inspector form provided on the SIIMS website to the Iowa DOT for review and approval.

Approved Program Managers are provided access to all forms and records for each bridge in SIIMS authorized by the bridge owner. Individuals approving the Load Rating form are required to be Professional Engineers licensed in the state of Iowa. Therefore, each person that is required to approve the load rating information must submit the Bridge Load Rating form provided in SIIMS. The Bridge Load Rating form must be reviewed and approved by the DOT, or by an approved Program Manager who has submitted the Bridge Inspector form including Professional License information. Editing of the Bridge Load Rating form by other users with authorized access to the bridge forms is permitted but approval can only be completed by a qualified Load Rater.

Underwater bridge inspection divers who did not complete the Safety Inspection of In-Service Bridges (FHWA-NHI-130055 or FHWA-NHI-130056) course prior to June 6, 2022 must complete the NHI Underwater Inspection (FHWA-NHI-130091) course.

INSPECTION INTERVAL (23 CFR 650.311)

Routine Inspections (23 CFR 650.311, a-g)

The required inspection interval for routine inspections may be extended by the interval tolerance (23 CFR 650.311, e) to account for unforeseen circumstances as described in the definition of bridge inspection interval tolerance. Subsequent inspections should adhere to the previously established interval; that is the use of the interval tolerance should be an exception. The inspection date recorded for Item 90, Inspection Date, shall be the actual date the new inspection is initiated. The details of why the bridge inspection was late shall be documented in SIIMS.

A late inspection is defined as not being completed within the bridge inspection interval tolerance. If 10 or more bridges will be late for inspection in a given month for a local public agency, an e-mail submitted to the DOT explaining the delayed inspections is acceptable, in lieu of entering comments for each bridge individually.

Bridges having two or more of the following condition ratings at a 3 or less, for Item 58, Deck; Item 59, Superstructure; or Item 60, Substructure; NBI Item 91, Inspection Interval shall be changed to an interval of 12 months. In only one condition rating is a 3 or less, for Item 58, Deck; Item 59, Superstructure; or Item 60, Substructure; a special inspection of the specific element shall be conducted at a 24-month inspection interval that falls between the Routine or In-Depth inspection interval. A more frequent inspection cycle can be implemented at the Program Manager's discretion.

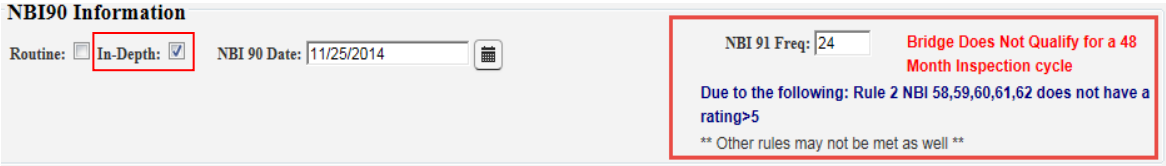
When the condition rating of Item 62, Culvert; is a 3 or less, NBI Item 91, Inspection Interval; shall be changed to 12 months or a special inspection shall be scheduled at a 24-month interval that falls between the Routine or In-Depth inspection interval.

Extended Inspection Interval

The criteria for qualifying bridge structures for 48-month inspection interval are listed in the Bridge Inspection Manual.

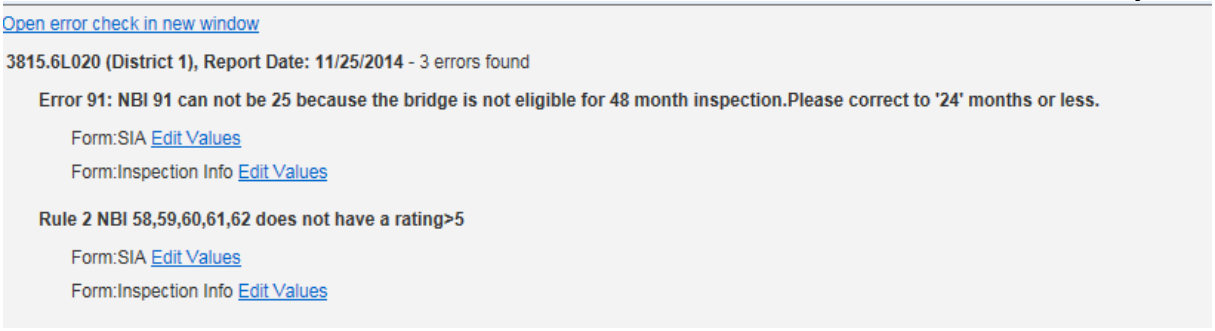
An in-depth inspection must be completed in order to go to an extended inspection interval. Also, all other rules set forth by the FHWA must be satisfied at the time of the inspection. These rules are detailed in the Bridge Inspection Manual.

When an inspection report is created, SIIMS will indicate on the Inspection Info form whether the bridge is eligible for a 48-month inspection cycle based on the current edit asset values. If the bridge is not eligible, SIIMs will indicate the bridge is not eligible with the statement "Bridge Does Not Qualify for a 48-Month Inspection Cycle" and why after the "Due to the following:" as shown in the screen shot below.



As the bridge is inspected, criteria could change that make a bridge ineligible or eligible for an extended inspection. If this happens the Inspection Info will only be updated after going to the Error Check form or when trying to finalize an inspection report as shown below.

Error check form


Open error check in new window

3815.6L020 (District 1), Report Date: 11/25/2014 - 3 errors found

Error 91: NBI 91 can not be 25 because the bridge is not eligible for 48 month inspection.Please correct to '24' months or less.

Form:SIA Edit Values

Form:Inspection Info Edit Values

Rule 2 NBI 58,59,60,61,62 does not have a rating>5

Form:SIA Edit Values

Form:Inspection Info Edit Values

A management report called Extended Inspection Frequency Report can be run and used to determine if a bridge is eligible or not eligible for an extended inspection interval. If the bridge passes all the rules except rule 17 (An In-depth inspection was not done at the current inspection and the last value of NBI 91 was not 48) the bridge may be eligible for an extended inspection interval of up to 48 months at the next inspection if an in-depth inspection is performed.

Underwater Inspections (23 CFR 650.311, b)

Underwater inspection requirements covered in this article pertain to the inspection of the structural elements such as abutments or piers to determine the structural integrity. If at any time during the 60-month underwater inspection interval, the water level is less than 6 feet around a substructure element, inspections may be performed with a method appropriate for the element without the use of divers.

Structures that experience low water levels less than 6 feet have the structural elements inspected by means of wading and probing. The DOT suggests inspecting the underwater substructure elements on a 48-month inspection interval when the low water level is more than 2 feet and less than 6 feet. Using a 60-month interval can be difficult to schedule outside of the routine inspection intervals. Using a 48-month interval may eliminate the need to schedule a separate inspection for the underwater portions of the structure. If the 48-month inspection interval is utilized, then Item 92B, Underwater Inspection (interval), needs to reflect the 48-month interval and Item 93B, Underwater Inspection (date), needs to have the date of the underwater inspection entered.

Bridges that have Item 60, Substructure or Item 61, Channel Condition with a condition rating of 3 or less due to deficiencies below the waterline must have an underwater inspection interval of 24 months or less. Other factors that may impact interval of inspections are Item 29, ADT; Item 70, Posting; Item 64, Operating Rating; all items under Structure Type and Materials; environment; age; and scour characteristics.

Underwater inspection intervals can be increased to 72 months when the following criteria is met.

1. NBI Item 113, Scour Critical Bridge, may not be coded as U, T, 6,4,3,2,1, or 0.
2. NBI Item 60, Substructure, must be coded 6 or better for the portion of the substructure elements that are under water.
3. NBI Item 61, Channel, must be coded 6 or better.
4. Substructure elements under water must be concrete encased or buried below the stream bed, unless designed otherwise. A substructure with timber or steel piling that are not encased and extend above the waterline cannot be placed on a 72-month interval. A substructure with timber or steel piling designed to be completely buried below the stream bed that have been exposed by stream bed degradation or stream migration cannot be placed in a 72-month interval.
5. A spread footing, founded on rock, is not required to be buried below the stream bed and can be placed on a 72-month interval. A spread footing, not founded on rock, cannot be placed on a 72-month interval.
6. Bridge was designed for H-20, HS-20, or HL-92 loading.

Nonredundant Steel Tension Members (NSTMs) (23 CFR 650.311, c)

Criteria for Inspection Intervals of 12 Months

1. The alignment of NSTMs or sub-elements has measurably changed from the as-built condition.
2. Deterioration in tension areas of a NSTM has caused Item 59, Superstructure, to have a condition rating of 4 or less.

3. Item 60, Substructure, with a condition rating of 4 or less, when the substructure elements controlling the rating are NSTM or are supporting the NSTM.

If the grouping of NSTMs (overall condition) is a 4 or less, the entire super/substructure must receive a NSTM inspection at a 12-month interval. However, if an isolated NSTM is poor or in serious condition but the larger grouping/super/substructure is in better condition, a special inspection may be performed on the isolated element(s) rather than the entire super/substructure.

Special Inspection Criteria

1. Deterioration is progressing at a rate that warrants inspection more frequently than 24 months or when there is a condition rating of 3 or less.
2. Channel degradation or channel movement is progressing at a rate that warrants inspection more frequently than 24 months and when the bridge is considered scour critical.
3. More frequent inspections should be considered when temporary supports are in place.
4. Fatigue cracks have been found in a redundant steel structure. Special Inspections can be stopped when repair has been performed to mitigate the cracks.
5. Fatigue cracks have been found in a NSTM. Special Inspections should continue even after cracks have been mitigated. Only after the potential for any future fatigue cracks has been eliminated can Special Inspections be stopped on a Nonredundant Steel Tension Member bridge.
6. Collision damage has severely affected the load capacity of the bridge and repairs cannot be done within a reasonable time period. Once repairs have been made, the Special Inspections can be stopped.
7. Section loss has severely affected the load capacity of the bridge. Once repairs or rehabilitation work have been completed, the Special Inspections can be stopped.

Upon completing the final Special Inspection, the check box must be marked in the Inspection Information section, to indicate that no additional Special Inspections are required. If the check box is not marked, the inspection interval will continue and the Special Inspection will be due again according to the interval specified. The “Yes/No” field on the SIA must be changed to “No” for the Special Inspection.

INSPECTION PROCEDURES

Initial Inspections (23 CFR 650.313, b,e,f)

The Initial Routine inspection is to be completed within 3 months of the bridge being open to traffic. When the bridge is first entered into the inventory, the inspection interval will be set at 3 months. This will cause the monthly late inspection notice, from SIIMS, to be sent as a reminder of the inspection being due.

The Initial Underwater inspection is to be completed within 12 months of a bridge being open to traffic. If an Underwater inspection using divers will be needed, advanced preparation may be needed before construction begins to schedule an inspection.

The Initial NSTM inspection is to be completed within 12 months of the bridge being opened to traffic. This inspection can normally be done as part of the Initial Routine inspection.

Load Rating (23 CFR 650.313, k)

Bridges are to be load rated in accordance with the ACTION-Revisions to the Recording and Coding Guide for the Structure, Inventory and Appraisal of the Nation's Bridges (Coding Guide) Items 63 and 65, Method Used to Determine Operating and Inventory Ratings, dated November 15, 2011 and FHWA Policy Memorandum on Bridge Load Ratings for the National Bridge Inventory, dated October 30, 2006. Item 64, Operating Rating; and Item 66, Inventory Rating; will need to be updated accordingly upon completion of the new load rating capacity calculations. Computations shall be performed based on items found during the most recent field inspection. See the Load Rating Evaluation Form in SIIMS.

At the discretion of the Program Manager, Team Leader, or Load Rater, the bridge may be re-rated to reflect changes in condition, method of analysis used, or changes in acceptable load rating methodologies. The re-rating may be justified without changes in the condition codes of Item 58, Deck; Item 59, Superstructure; or Item 60, Substructure. A new Bridge Load Rating Report form will need to be generated in SIIMS and the form

certified by a Professional Engineer, licensed in the State of Iowa, when the controlling member changes or the controlling capacity is reduced.

SI&A Item (106) Year Reconstructed is completed when repairs to the bridge coincide with re-rating the structure based on the following repairs or rehabilitation:

1. Concrete Deck Replacement (Overlays not included)
2. Deck Widening
3. Superstructure Replacement
4. Other Improvements that change the bridge geometry.

Procedures for Rating Standard Bridges

The following procedure should be utilized for determining the load ratings of standard bridges that have been rated by the Iowa Highway Research Board Project, HR-239 and TR-713. There are currently 5 phases of the report available for different standard bridge designs (Load Rating for Standard Bridges (1982), Load Rating for Secondary Bridges (1991), Load Rating for Standard Bridges, Phase III (1998), Load Rating for Standard Bridges, Phase IV (2008), Load Rating for Standard Bridges, Phase V (2016) and 2016 Concrete Box Beam Standards).

1. Identify the standard bridge used. Refer to project plans, if available, in the Bridge File to determine the version of the standard utilized. Some standards have multiple versions due to minor revisions.

2. Item 27, Year Built, is a good indicator of which standard version was used, if you are unable to locate the original plans. Some verification may be necessary in the field to determine exactly which version was utilized.

3. Review the applied dead load to determine if it matches the standard rating assumptions.

4. The operating and inventory ratings in the summary for each standard bridge are coded as an HS rating. This is NOT what should be coded on Items 64, Operating Rating, and Item 66, Inventory Rating, on the SI&A form. These numbers shall be converted to a tonnage based on a 36 ton truck.

   The HS number shall be multiplied by the ratio of 36 tons/20 tons = 1.8 and this number recorded on the SI&A in Items 64, Operating Rating, and Item 66, Inventory Rating. For example, if the operating and inventory ratings are listed as HS 32.0 and HS 23.3 respectively; then Item 64, Operating Rating, should be coded 57.6 (32.0 tons x 1.8 = 57.6 tons) and Item 66, Inventory Rating, should be coded 41.9 (23.3 tons x 1.8 = 41.9 tons).

5. Some of the HR-239 reports include detailed computations for review of the critical and non-critical elements. These computations can be adjusted when changes to the dead load conditions are encountered or section loss in structural elements are noted.

6. Some of the standard bridges have restrictions to the number of vehicles that may be on the bridge at one time even if the roadway will accommodate more than one vehicle. If bridges are rated using one lane loading these bridges shall be posted accordingly and Item 41, Posting Status, on the SI&A coded based on the restriction.

7. When standard ratings are used from any of the HR-239 reports, the Bridge Load Rating Report does not require a signature by a Professional Engineer, licensed in the State of Iowa. In the Load Rating Report, use the drop-down menu to identify the appropriate standard for the bridge.

The Federal Government instituted a policy to use only metric units for all measurement. Therefore, FHWA requires all National Bridge Inventory data to be in metric units. The Iowa DOT has chosen to use English units instead of metric. SIIMS was developed using English units for all measurements; including, but not exclusive to, vertical and horizontal clearances, deck widths, bridge length, and Inventory and Operating ratings. These English values will be converted to metric units by SIIMS for the annual National Bridge Inventory submittal.

The Inventory, Operating, and Posting ratings are typically governed by superstructure elements; and in some cases, deck elements. Further analysis may be necessary to determine the capacity if significant changes in condition or applied dead load are noted based on the current conditions. Substructures should be reviewed for deterioration and rated, if necessary. Section loss should be reviewed and losses considered in adjustments to the original ratings.

Load Factor Rating (LFR) Requirements

Bridges are to be load rated in accordance with the FHWA Policy Memorandum on Bridge Load Ratings for the National Bridge Inventory, dated October 30, 2006, for all bridges constructed, replaced, or rehabilitated since January 1, 1994. See Appendix B, Background History of FHWA memo. Bridges in this category shall be rated by load factor methods.

These ratings are required for the HS ratings Items 64, Operating Rating, and Item 66, Inventory Rating, on the SI&A. The bridge owner may elect to use Load Factor Rating (LFR), Allowable Stress Rating (ASR), or Load and Resistance Factor Rating (LRFR) to establish load limits for purposes of load posting.

Bridges built or rehabilitated since January 1, 1994, falling into the following categories shall be rated by the Load Factor Rating method:

1. Bridges constructed or replaced with the following materials:

    a. Steel produced in 1936 (33 ksi or better) or after.
    b. Prestressed concrete.
    c. Reinforced concrete.

2. Bridges that undergo major rehabilitation or repairs and not previously rated using LRFR.

Bridges designed with the Load and Resistance Factor Design (LRFD) method prior to October 1, 2010, shall be rated with LRFR whenever re-rating is needed.

The following material types do not require LFR analysis and may be analyzed using ASR:

1. Masonry including stone, concrete block, or clay brick.

2. Bridges constructed with timber and designed prior to October 1, 2010.

3. Rolled steel produced prior to 1936 (30 ksi or less).

Bridge Load Rating Report

A Bridge Load Rating Report has been developed in SIIMS for each bridge to help identify the critical elements for the capacity rating of the structure and for certification of the ratings by a Professional Engineer, licensed in the State of Iowa.

1. All rating calculations shall be certified by a Professional Engineer, licensed in the State of Iowa, and summarized on the Bridge Load Rating Report in SIIMS.

2. The Bridge Load Rating Report shall be reviewed by the Program Manager or Team Leader to ensure that it indicates the critical element, the operating and inventory ratings and the method of analysis used to determine the rating capacity of the bridge.

3. Rating calculations for standard bridges shall be reviewed using the Load Rating Evaluation Form in SIIMS by a Professional Engineer, licensed in the State of Iowa, to verify the ratings are still applicable under the current condition ratings and applied loads of the bridge, and be summarized on the Bridge Load Rating Report. For standard bridges the Controlling Element and Location fields are not required to be completed.

4. The ratings for a standard bridge found in one of the HR-239 reports can be entered in the Load Rating Report when the bridge is still in a condition that warrants this rating. When this rating is entered, a licensed engineer must place their name, date, and license number at the bottom of

the Load Rating Report form. The engineer must place the following comment in the comment box at the bottom of the Load Rating Report form when using ratings from HR-239: “The engineer’s name on this report is not certifying these ratings, but is only verifying they are the correct ratings from the HR-239 report published by the Iowa DOT for this standard bridge.

5. If a Bridge Load Rating Report has been previously completed, existing ratings shall be reviewed with the critical elements being determined from available file information and accepted by a Professional Engineer, licensed in the State of Iowa. Recertification is not required for existing computations included in the file that are deemed reasonable based on the present condition of the structure.

6. Re-ratings needed due to reasons listed in the Load Rating Evaluation Form in SIIMS will need to be certified if the element re-rated becomes the critical element and controls the capacity of the structure.

7. Completing the Load Rating Table on the Bridge Load Rating Report is required for all bridges being rated for the first time or re-rated, even if posting is not required. Tonnage data are required in the table.

8. Bridges that are rated for both one lane and two lane traffic shall have the Load Rating Table completed for both one lane and two lane values to support the bridge posting or restriction.

9. The criteria in the MUTCD and Recording and Coding Guide defining one lane as 16.0 feet will be utilized to determine the code for Item 28, Lanes on the Structure; on the SI&A form and on any width restriction posting at the bridge site.

10. The guidance in the MBE defining a one lane structure for rating purposes as having a roadway width of 18.0 feet or less, will be utilized for load rating.

11. Permit load adequacy is required for all bridges where routine permit loads (from 90,000lbs to 156,000lbs) will be allowed. Routine permit load ratings have been completed for all standards issued from 2006 to present. This does not include the All-Systems Overweight permit loads.

Culverts

When a culvert has a fill depth greater than the length shown for Item 49, Structure Length, the live load is considered insignificant and the load capacity can be coded as 99.9 tons for Item 64, Operating Rating, and Item 66, Inventory Rating.

The dimensions for Corrugated Metal Pipe (CMP) or Reinforced Concrete Box Culvert (RCB) structures should be included in the Comments section of the Structural Inventory and Appraisal section of the Bridge Load Rating Report to clarify the structure dimensions for load rating review.

Posting

All bridges shall be rated for the following vehicles:

1. Type 4
2. 3S3A
3. 3-3
4. Special Haul Vehicles (SHV’s) - SU4, SU5, SU6 and SU7
5. 5-2

All bridges with continuous spans or simple span lengths of 100 feet or greater shall also be rated for:

1. 3S3B
2. 4S3

Diagrams of the Iowa Legal Trucks are in Attachment E to this I.M.

Load Rating for Special Haul Vehicles (SHV) are to be completed according to the schedule shown under the "Records/Load Rating Calculations" section in this I.M.

Load ratings for SHV's may be initially evaluated for simple span bridges, with existing Load Ratings, by using the method provided in the Load Rating Manual in SIIMS. If the initial load ratings for SHV's show that no posting is needed, the initial evaluation should be uploaded in SIIMS under the Load Rating section. This evaluation shall be dated and show the name of the individual who performed the evaluation.

The Load Rating form may not need to be updated at this time. Load Rating forms shall be updated according to the schedule shown in this I.M. Future updates to the Load Rating form shall include all load limits for SHV's.

If the initial analysis of a simple span bridge shows that posting is needed, a load rating analysis shall be performed by a Professional Engineer licensed in the State of Iowa and the Load Rating form updated accordingly in SIIMS.

For bridges that are not simple span, a load rating analysis shall be done according to the MBE. The load capacity for each SHV shall be documented in SIIMS on the Load Rating form and certified by a Professional Engineer licensed in the State of Iowa.

Whenever the Load Rating form is updated in SIIMS for SHV loadings, the ratings must be certified by a Professional Engineer licensed in the State of Iowa. Some standard bridges will be load rated for SHV's by the Iowa DOT and will not require certification of the load ratings (see paragraph 4 in the Bridge Load Rating Report section in this I.M. for more guidance).

SHV's are to be rated as per the Load Rating Manual Section 5.9.2 in SIIMS. Adding the load ratings for the SHV to the Bridge Load Rating Report is not considered a re-rating of the bridge. All bridges that require re-rating shall be rated for the SHV.

It is recommended that bridge owners utilize the triple truck weight limit sign R12-5 to post for the SHV load restriction. The Type 4 straight truck will generally accommodate most of the SHV posting restrictions. It is recommended that the posting values on the R12-5 sign not exceed the Iowa legal load maximums of 28,40,40 respectively. For example: The SU-7 truck rates less than legal at 30 tons, the R12-5 posting would be 28-40-40.

The governing truck between a Type3, Type 4, SU4, SU5, SU6, or SU7 shall be used for the straight truck weight limit, not to exceed 28 tons on the R12-5 sign.

The governing truck between a 3S2,3S3A, or 3S3B shall be used for the semi-truck weight limit, not to exceed 40 tons on the R12-5 sign.

The governing truck between a 3-3 or 5-2 shall be used for the double bottom truck weight limit, not to exceed 40 tons on the R12-5 sign.

Advanced posting is required for all bridges with weight restrictions. Advanced posting is to inform a driver of a bridge restriction at an intersection that allows them to bypass the bridge.

Use of the Triple Axle posting sign is not required when utilizing the triple truck R12-5 posting. The single truck weight limit sign can be utilized when the SHV load restriction is 10 tons or less.

The posting signs installed at a bridge to inform the public of weight restrictions should be installed in a timely manner. A risk-based approach is needed to ensure signs are installed at the most critical bridges as soon as possible. Three risk levels have been established. Each risk level has criteria defining the risk and the time frame allowed to install signs for restricting loads.

> Risk level 1: *Emergency situations* – when significant deterioration or damage is found that requires immediate calculations to determine the load capacity. Posting signs shall be installed within 48 hours of finding the bridge to be inadequate to carrying legal loads. If posting signs cannot be installed within 48 hours, the bridge shall be closed until posting signs can be installed.

Risk level 2: *High risk* – when the superstructure or substructure condition rating changes to a 4 or less and posting is required due to this change in condition. The posting signs shall be installed within 30 days of finalization of the recognition of need by the County Board of Supervisors or City Council, which is in the form of a resolution or ordinance. Efforts should be made to finalize the need at the earliest possible opportunity to protect public safety.

Risk level 3: *Low risk* – when posting for weight limits is needed due to minor changes in condition. The condition ratings for the deck, superstructure, and substructure may or may not have changed since the last inspection. The bridge is on a route with a low ADT and has little or no truck traffic. The posting signs shall be installed within 90 days of finalization of the inspection report.

Criteria has also been established for bridges that are rated independently of a bridge inspection, that do not pose a risk to the traveling public and are not addressed in the risk-based time frames.

Other Load Postings: FHWA and DOT policy changes can generate the need for local agencies to have bridges in their inventories rated that are not in concert with the annual bridge inspections. Therefore, bridges that are rated independently of a bridge inspection that warrant load posting, are required to be posted within 6 months of the completion of the load ratings.

Posting signs should limit all vehicles as efficiently as possible. Posting for a single gross weight limit, maximum axle weight limit, or both are the most enforceable means of restricting vehicles. Any method described in the Manual for Uniform Traffic Control Devises (MUTCD) is appropriate. Using the signs in the MUTCD with pictorial images of vehicles is allowed as long as it is clearly understood that the number of axles shown on any one vehicle could be literally interpreted if/when a violation is taken to court.

Bridges that have adequate capacity of legal vehicles up to 40 tons, but do not have adequate capacity for legal vehicles over 40 tons should be posted for a maximum gross limit of 40 tons regardless of the allowable limit calculated. This eliminates confusion about any permit vehicles that are within the 40 to 48 ton range. The triple axle weight limit sign may be beneficial to include in this situation.

Bridges do not need to be posted for loads that are annual permit loads. Bridges that commonly carry vehicles that fall under the annual permit types should be documented in SIIMS so when a permit request is made these bridges can be included on the permit as embargoed for that vehicle.

Item 70, Posting, should be calculated using the most restrictive legal truck. The most restrictive truck will be the one with the lowest Rating Factor (RF). 1.0 – RF = % below legal load. Use this % to determine which coding, between 0 and 5, should be entered in Item 70, Posting. When Item 70, Posting, is equal to 4 or less, posting the bridge for the appropriate restriction is required. Item 41, Posting Status, shall be coded for the required restriction. The rating method for Item 70, Posting, does not have to be the same method used for Item 64, Operating Ratings, and Item 66, Inventory Rating. If a bridge is re-rated for Item 64, Operating Rating, and Item 66, Inventory Rating using the LFR or LRFR methods, the posting limits do not have to be re-calculated by these methods.

Bridge structures that have Item 41 coded (P) for Posted prior to an inspection, should remain coded (P) following the inspection, even if the posting limit changes. When a bridge requires posting for the first time, Item 41 can be coded (B) until the bridge posting is installed. Once posting signs are installed, Item 41 shall be changed to (P). Item 41 can be coded (B) for a maximum of six months.

Bridge owners that require one lane traffic for structures with two lane width on gravel routes, should utilize the “One Lane” posting W5-3 in the MUTCD. For paved routes, bridge owners should utilize the DOT signing layout for primary routes. Reference the Bridge Rating Manual for the signing layout for traffic control on restricted bridges.

Advanced Posting

Bridges shall have advance load postings at the last available location to avoid crossing an embargoed structure by using an alternative route or turning around. The signs shall be readily visible and installed in accordance with the MUTCD 2009 Edition, Section 2B.59, Weight Limit Signs.

When bridges are clearly visible and signs legible from the advance intersection, both advanced warning signs and signing at the bridge site are not required. The signing located at the bridge site will be sufficient to warn oncoming traffic.

When there are multiple bridges on a roadway that require load posting, only the most restrictive posting is required to have advanced posting installed as per the MUTCD.

Advance warning signs that restrict the bridge to one lane or limits the number of vehicles on the structure at one time shall also be located far enough in advance of the structure to allow the traffic to slow down prior to crossing the bridge along with oncoming traffic.

Overload or Superload Permitting

The bridge owner shall review requests for overload crossings of their bridges to minimize damage, ensure public safety, and protect the integrity of the local infrastructure.

1. The bridge load carrying capacity shall be reviewed and computations completed as required to determine if the specific overload will cause overstress to the structure.

2. Permit requests and approvals shall be kept on record for documentation. Special requirements such as reduction of speed, centering on the roadway, elimination of braking, and other restrictions should be noted on the permit.

3. The bridge owner has the right to be compensated for costs associated with the review for the overload permit by the individual/company requesting the permit as per Iowa Code 321E.14, Fees for Permits. 761 Iowa Administrative Code (IAC) 511.5(8), Fair and Reasonable Costs, states that the permit-issuing authority may charge any permit applicant a fair and reasonable cost for measures necessary to avoid damage to public property including structures and bridges.

4. Any request can be denied if it is determined the overload will be detrimental to the public facility.

5. Bridges that will be crossed by annual routine permit loads shall be evaluated for Routine Permit Trucks (see Attachment F to this I.M). If the bridge does not have the capacity to carry one or more of these trucks, when center-lined at 5 mph, the inadequacy shall be recorded on the Load Rating Bridge Report form in SIIMS.

Records (23 CFR 650.313, n)

Bridge owners are required to maintain a complete, accurate, and current record of each bridge under their jurisdiction, either electronically or hard copy, as per the American Association of State Highway and Transportation Officials Manual for Bridge Evaluation (AASHTO Manual). The components of a complete bridge record are listed in the AASHTO Manual. Many of the items listed will be included in SIIMS for each bridge. Bridge owners are encouraged to include electronic copies of these items in SIIMS as soon as possible.

Uploading Bridge Records

Bridge records that are NOT associated with a specific bridge inspection, such as scour analysis, unknown foundation analysis, channel cross sections, etc., should be uploaded into SIIMS utilizing the FILES Tab. Uploading these general documents in conjunction with an inspection will conceal the documentation in that specific record, making it difficult to locate the documents for future reference.

The following list of items shall not to be considered in lieu of the requirements in the AASHTO Manual. All of the items in the AASHTO Manual will not be available for every bridge structure; therefore, the items listed below should be included in each Bridge File as a minimum. However, any and all items addressed in the AASHTO Manual should be included in the bridge file when available.

Bridge Plans

Plans for bridges are not required to be in the file folder; however, they are required to be readily available to the bridge owner, Program Manager, or Team Leader at all times. Plans for bridges let after January 1, 2011, shall be included in SIIMS. Bridge owners are encouraged to scan relevant plan sheets

for bridges let prior to January 1, 2011, and include them in SIIMS. Bridge owners are also encouraged to include piling logs from new bridge construction in SIIMS.

Repair Plans

Plans for bridge repair are not required to be in the file folder; however, they are required to be readily available to the bridge owner, Program Manager, or Team Leader at all times. Plans for bridges let after January 1, 2011, shall be included in SIIMS. Bridge owners are encouraged to scan relevant plan sheets for bridges let prior to January 1, 2011, and include them in SIIMS.

Photographs

A road view, side view, and under view of the bridge structure are the minimum requirement. The road view is required to contain the bridge posting sign for verification of posting installation and load posting restrictions. When one lane restriction posting is utilized in lieu of two-lane bridge posting, a photograph of the one lane posting is required.

Structures with Item 58, Deck; Item 59, Superstructure; Item 60, Substructure; Item 61, Channel / Channel Protection; and Item 62, Culvert, coding of 4 or less are required to have photographs of the deficiency. Photographs of elements that are the reason for a condition rating of 4 or less are required. The photos should be as detailed as necessary to convey the condition to anyone reviewing the report.

Structures that have had no changes from the previous inspection do not require updated photographs; however, the previous photographs are required to be brought forward into the most recent inspection as part of the bridge inspection file. It is strongly recommended that at least one new photograph be taken during each bridge inspection to verify that the inspection has been completed. All relevant photographs taken after January 1, 2012, will be required in SIIMS.

Scour Evaluation Data

All scour evaluation documentation is required to be in SIIMS, including the Bridge Scour Stability Worksheet, Level A Evaluation (see Attachment A to this I.M.); Intermediate Scour Assessment Procedures Flowchart, Level B Evaluation (see Attachment B to this I.M.); and/or Level C HEC 18 calculations. Bridge owners or Program Managers are required to indicate the level of scour analysis completed using the check boxes on the Channel/Channel Protection tab in SIIMS. POAs are required to be in SIIMS and indicated on the Channel & Channel Protection form. Scour analysis worksheets and POAs are required to be in SIIMS.

Channel Cross Section

A channel cross section is required on the upstream side for all bridge structures over waterways, with the exception of structures with artificial channels through the bridge, such as Corrugated Metal Pipe (CMP) culverts or Reinforced Concrete Box (RCB) culverts.

The channel cross section is required to be a part of the bridge record. A standard Channel Cross Section form has been incorporated into SIIMS, however, hand-drawn channel cross sections can be utilized and are required to be uploaded in SIIMS if the SIIMS form is not used. Each bridge structure is required to have a data point at the top of bank, toe of bank, thalweg, and each substructure unit.

Channel Cross Sections are to be updated every 10 years for SIIMS, unless conditions at the bridge warrant more frequent monitoring. Bridge owners should consider providing channel cross sections for RCB and CMP culverts when extenuating circumstances, such as extreme upstream channel change creates a potential for piping around the structure.

Additional channel cross section data is required in Section 2.4.1.2 of the Manual for Bridge Evaluation (MBE) to include (when available):

1. Material type supporting the foundations
2. Elevation of abutment and/or pier pile tips.
3. Bottom of abutment and pier footing elevations.
4. Pile logs

If any of the items listed above are not available, they should be noted in the comments on the Channel Cross Section.

Local Agency Bridge Data Forms

The MBE specifies that the Bridge File should reflect the information in the current bridge inspection report and that each Bridge File should include a chronological record of all inspections performed. Therefore, the field notes are required to be included in the Bridge File. The Field Data Collection form in SIIMS was developed for the purpose of documenting field notes and shall be completed in SIIMS.

The two types of bridge inspections, In-Depth and Routine, are determined based on the condition and type of structure being inspected. In-Depth Inspections are recommended for structures that contain elements in less than satisfactory condition or structures that require arm's length inspection of elements. In-Depth Inspections are required to have all the appropriate sub elements addressed with comments to support the NBI condition rating. Routine inspections are required to have supporting documentation corresponding to the sub element or element(s) with notable defects that resulted in the reduction of a NBI condition rating.

An In-Depth Inspection is recommended for structures meeting the following criteria:

1. All Nonredundant Steel Tension Member bridges.
2. Fatigue vulnerable bridges.
3. Structurally Deficient bridges.
4. Bridges with two or more condition ratings equal to 5 (Item 58, Deck; Item 59, Superstructure; Item 60, or Substructure).
5. Culverts with a condition rating equal to 5.

Comments are required to support any deck, superstructure, substructure, or culvert condition rating of (5) or less. Comments for sub elements with condition ratings of (5) or less are highly recommended but not required.

Team Leaders should provide field data that quantifies the amount of concrete deterioration, percent of timber decay or steel section loss for bridge elements that are coded a 4 or less, so the load rating engineer can accurately determine the load carrying capacity of the structure.

Structure Inventory and Appraisal Forms (SI&A)

The SI&A forms will be completed and stored in SIIMS.

Load Rating Calculations (23 CFR 650.313, k-l)

FHWA requires all bridge structures be rated for its safe load carrying capacity as per 23 CFR 650.313(c).

The Bridge File is required to include a complete record of the calculations of the bridges load carrying capacity. A standard Bridge Load Rating Report has been incorporated into SIIMS and is required to be completed for each bridge structure. The load rating calculations or Bridge Load Rating Report is required to be signed by a Professional Engineer, licensed in the State of Iowa, for all non-standard bridge load ratings. Electronic signatures for the forms in SIIMS are not required, but a signed copy of the load rating calculations is required to be in the Bridge File. Bridge owners are encouraged to have an electronic scanned copy of the signed Bridge Load Rating form included in SIIMS.

Certifications on the Bridge Load Rating Report are required to be updated anytime the inventory rating, operating rating, and/or load restrictions are changed in the Load Rating Table. If load rating information is added without changing the inventory rating, operating rating, or load restrictions, re-certification is not required.

When engineering judgement is needed for reinforced concrete structures with no plans or illegible plans, the rating engineer must document the reasoning behind the inventory and operating rating used.

1. Reasons for the rating should include calculations based on similar structures, load testing, or assumed reinforcing based on year of construction and normal design practices from that era.
2. The design load may or may not be known. If the design load is not known, a reasonable assumption should be made based on the year of construction and design criteria of that era.
3. Deterioration that is used as a determining factor in the rating should be documented thru photos, sketches, and written explanations.
4. Assumptions for Posting tonnages should be documented.
5. Ratings shall be based on the most current inspection documentation.
6. Engineering judgement does not apply to steel structures or CMP.

For structures meeting the criteria for assigned ratings, the ratings shall be:

1. Rating Factors
    a. Inventory rating = 1.0
    b. Operating rating = 1.3

Or

2. Rating tonnages (English)
    a. Inventory rating = 36 (HS20)
    b. Operating rating = 48 (HS27)

Bridge structures that rate 2.7 Metric Tons or less for Item 64 Operating Rating shall be closed or; if the bridge can carry Legal Iowa truck loads of 3 tons, Item 64 should be re-evaluated to determine if a value above 2.7 Metric Tons should be entered in order to keep the bridge open.

Culverts:

The DOT has developed the CulvertCalc software for rating reinforced box culverts. Installation Instructions, CulvertCalc Technical Manual, and CulvertCalc User Manual are available.

RCB culverts (Item 43 = 119 or 219 only), with plans and a NBI 62 condition rating equal to or greater than 5, that have been analyzed and found to have inadequate capacity for live load in the culvert walls and floors, but have adequate capacity in the positive moment top slab, may be rated using engineering judgement.

Engineering judgment can be utilized for NBI Item 63 and 65 Rating Method coded as 0, NBI items 64 and 66 shall be based on the design loads. The load ratings will need to be sealed by a licensed professional engineer in the state of Iowa and the following note will be required to be added in the comments section of the Bridge Load Rating Report:

“The following bridge has been inspected and engineering judgment has been used to determine the culvert can carry all legal loads in the state of Iowa as agreed with the FHWA. See the Iowa DOT Load Rating Manual for full load rating requirements for using engineering judgement for box culverts.”

Assigned load ratings are allowed when the design load is HS-20 or HL-93 or greater and the structure has a Bridge Condition Index (BCI) > 70. The following criteria shall also be applied.

1. Designed LFD or LRFD
2. Built according to plans
3. No changes to the loading conditions or structure condition that would require re-rating as required on the Load Rating Evaluation form in SIIMS
4. Design calculations or plans showing the design loading and AASHTO specification with the stamp of the design engineer readily available or a standard culvert design provided by the DOT was used.

Once a culvert is 50 years old or has a condition rating of 5 or less, load rating calculations shall be performed.

Bridges:

The Federal Highway Administration (FHWA) concurred with the results of the parametric study completed by the DOT in 2016, which concluded that structures with an operating rating > 45tons (excluding culverts) do NOT require rating for Special Haul Vehicles (SHV’s) based on the following:

1. Bridges that are posted for the Iowa Legal Trucks would encompass the SHV ratings by being more restrictive.

2. Bridges that rated 45 tons or greater for Operating Rating would encompass the SHV ratings based on the fact that the multiple axle configurations would not generate more than 45 tons.

   The Bridge Load Rating Report is to contain the following note in the comments box for bridges with an operating >45 tons:

   "Based on the parametric study by the D.O.T. Office of Bridges and Structures, this bridge does not need to be rated for Special Haul Vehicles (SHV's) because the operating rating is greater than or equal to 45 tons. Any further re-rating performed, must include analysis of SHV's."

Assigned load ratings are allowed when the design load is HS-20 or HL-93 or greater and the bridge has a Bridge Condition Index (BCI) > 70. The following criteria shall also be applied.

1. Designed LFD or LRFD
2. Built according to plans
3. No changes to the loading conditions or structure condition that would require re-rating as required on the Load Rating Evaluation form in SIIMS
4. Design calculations or plans showing the design loading and AASHTO specification with the stamp of the design engineer readily available.

Once a bridge is 30 years old or has a condition rating of 5 or less, load rating calculations shall be performed.

Load Rating Evaluation Form

The Load Rating Evaluation Form, in SIIMS, is required to be completed for each in-depth or routine inspection. The Program Manager or Team Leader completing this form in SIIMS is not confirming that the load rating calculations are correct, only that the condition of the bridge has or has not changed. If any of the items on the form indicate that the condition of the bridge has changed since the most recent load rating calculations, then re-rating the structure for load carrying capacity is required.

When the Load Rating Evaluation Form requires the load ratings to be re-evaluated and the ratings do not change upon re-evaluation, the load rater must change the answer to the question "Does this bridge need to be re-rated" on the Load Rating Evaluation Form to "No" and insert their name and the date at the top of the Load Rating Evaluation Form. This will document that the load ratings have been reviewed and are still appropriate for the current conditions.

Critical Features

NSTM and scour critical elements are addressed in SIIMS.

Special Inspection Equipment

The list of specialized equipment and any additional requirements to complete the bridge inspection is included in SIIMS.

Critical Findings (23 CFR 650.313, q)

A standard Critical Finding report form has been incorporated into SIIMS. The completed report is to be filed in SIIMS.

NSTM (23 CFR 650.313,f)

A list can be generated by selecting Management Report under the Manager menu in SIIMS and running the report for NSTM bridges, underwater inspections, scour critical bridges, unknown foundations, and bridges that are load posted.

Nonredundant Steel Tension Member (NSTM) Bridges

The following information shall be kept as part of the inspection records for each NSTM bridge as required by the NBIS.

1. A sketch of the bridge showing the location of all NSTMs.

2. The inspection interval and procedures that are necessary to inspect each NSTM within arm's reach. The procedure may include equipment required (i.e. climbing equipment, ladder, snooper truck) or access methods (i.e. ground access, walk on lower chord) used to inspect the member.

3. Inspection notes describing condition of each NSTM.

The Nonredundant Steel Tension Member Locations and Conditions for Trusses or for Thru/Two Girders forms (see Attachment K or L to this I.M.) shall be utilized to provide information described in items 1 thru 3 above to comply with the NBIS. Bridge owners may elect to produce their own form in lieu of completing the Nonredundant Steel Tension Member Locations and Conditions form; however, this will require review and approval by FHWA. The Iowa DOT has developed a Sample Nonredundant Steel Tension Member Location and Conditions form as shown in Attachment M to this I.M.

Utilize the drop down menu on the Supplementary Inspection Information page stating whether or not the bridge is Nonredundant Steel Tension Member. Check the box by "Nonredundant Steel Tension Member Sketch" after it has been uploaded into SIIMS.

Underwater Inspections (23 CFR 650.313, e)

The Program Manager is responsible for adhering to the requirements for diver qualifications as per the Bridge Inspector's Reference Manual (BIRM). The Iowa DOT requires the LPA bridge inspection Program Manager or Team Leader to be on-site to supervise all underwater inspections.

The following information shall be kept as part of the inspection records for each bridge requiring underwater inspection.

1. The location of all elements requiring an underwater inspection.

2. The inspection interval and procedures necessary to inspect each element. The procedure may include equipment required or access methods used to inspect the member.

Use the standardized underwater inspection form in SIIMS to document all underwater inspections and procedures.

Piers within a stream or river with localized scour, with a scour depth of 6' or more, do not require dive inspection unless the scour hole is not repaired or naturally silted in to less than 6' depth within 5 years of originally discovering the scour. This should be documented on the channel cross section form or with sketches.

Scour Critical Bridges

The following information shall be kept as part of the inspection records for each bridge determined to be scour critical or with unknown foundations. Item 113, Scour Critical, shall be coded as 2 or 3.

1. Scour Analysis Procedures

   Any structure with an artificial channel (i.e., culverts, CMPs, etc.) does not require scour analysis and Item 113 can be coded an 8, Scour Stable.

   The analysis used to determine the Item 113, Scour Critical, coding shall be included in the

inspection file for each bridge as applicable. This may include a Level A, B, or C scour evaluation (see Attachment A and Attachment B to this I.M.).

If a bridge has been designed for scour, a computed scour depth notation shall be shown on the plans or included in the inspection file. Item 113, Scour Critical, can be coded 5 if there are plans uploaded in SIIMS that contain the scour data on the situation plan, in lieu of scour calculations.

Level C requirements: When Level A and B analysis have not been sufficient to determine scour susceptibility, a Level C analysis is required. Level C scour analysis can be done by utilizing Hydraulic Engineering Circular (HEC) 18 analysis or other appropriate hand calculations.

2. Scour Inspection Interval

   All bridges should be monitored for changes that may affect the scour rating at the routine inspection interval.

   Review Level A Bridge Scour Stability Worksheets (see Attachment A to this I.M.) and upstream channel cross section to determine scour rating.

3. Plan Of Action (POA)

   A POA needs to include a specific plan for monitoring, inspecting, or closure for structures that have been determined to be scour susceptible during and after a flood event. There are two methods in which structures can be analyzed for scour susceptibility.

   Structures with known foundation type and depth are analyzed to determine if the structure is susceptible to scour during a flood event. Structures with unknown foundations are analyzed to determine the level of risk that the structure poses to the traveling public during a flood event. Guidance and commentary for unknown foundation analysis is provided in Attachment H and Attachment I to this I.M.

   Structures with unknown foundations can be determined to have a Low, Moderate, or High risk to the traveling public during a flood event. POA's are developed and implemented for Low, Moderate, and High risk unknown foundations.

   Bridges with unknown foundations that are determined to be Low risk can have a basic POA that simply requires the structure to be inspected for scour as part of the regularly scheduled bridge inspection. Bridges with known foundation type and depth that are determined to be scour critical will have a POA similar to a Moderate risk POA for a structure with an unknown foundation. Bridges with unknown foundations that are determined to be High risk involve the installation of countermeasures, which require inspection following a flood event.

   Moderate or High risk POA should include the following information:

   General Information

   The name of the individual that completed the POA form should be included along with the date that the form was completed. Bridge identification information should be included such as local identification numbers and FHWA numbers. The condition code should be provided for Item 113, Scour Critical, to identify the scour status of the bridge. A detailed description of the bridge location should be part of the POA document to be utilized by the individual responsible for monitoring the bridge during a flood event.

   Functional Groups

   Management and local maintenance personnel are the two functional groups that will be involved in the monitoring process during a flood event.

   The management personnel can be comprised of the City Engineer, County Engineer, or a designated representative. This individual will be involved in implementing bridge closure plans and the process of reopening of closed bridges. This individual is the ultimate authority

for closing and re-opening bridge structures and should be identified in the POA by job title. Stating the individual's job title eliminates voiding the POA due to personnel changes.

The local maintenance personnel can be comprised of the grader operator, road superintendent, or maintenance superintendent where the bridge structure falls under their area of responsibility. This individual will be involved in the process of monitoring the development of flooding conditions, implementing bridge closure plans, general monitoring of bridge condition during floods, and advising management of bridge closures. Again, this individual should be identified in the POA by job title to eliminate voiding the POA due to personnel changes.

Initiation of Monitoring

Local maintenance personnel shall initiate monitoring when the trigger mechanism or mechanisms developed by management have occurred. These trigger mechanisms should be site specific for each bridge structure. Some examples of trigger mechanisms are flood watches or warnings issued by the National Weather Service that include the drainage area for the bridge being monitored, or the local maintenance personnel witness heavy rainfall in the vicinity of the drainage area.

Records shall be kept of each bridge that was monitored as a result of a rain event. The report should include observed water levels, the amount of rain fall and the timeline of the rainfall.

Structures that are monitored during a flood event are required to be inspected to by the local maintenance personnel and the findings provided to management for the purpose of determining if any follow up action is required such as armoring.

Closure Procedures

The trigger mechanisms utilized to determine closure of the bridge structure need to be specified in the POA. A critical water surface elevation should be determined for closure of the bridge. This could be a conservative elevation that can be calculated from the plans based on 25 or 50 year flood elevation. This elevation can be painted on a pier or abutment and/or marked on a witness post so the local maintenance personnel can determine if they need to continue monitoring or initiate closure procedures.

Other criteria such as visually observed distress to the approach roadway or significant erosion to the stream banks may also be listed as secondary criteria for closure.

Post Flood Monitoring and Reopening Procedures

Regardless of whether the bridge is closed as a result of flooding, a scour inspection that includes a channel cross section should be performed after the flood waters have receded. Bridges determined to be High risk are required to have the countermeasures inspected following the flood event to determine if repairs are required.

Further inspections such as in-depth, damage, and/or underwater inspections may be required depending on its structure type, site characteristics, and conditions observed from the scour inspection.

Details of the criteria required to re-open the structure should be clearly stated. Following the flood event, these structures are required to be inspected by a Professional Engineer, licensed in the State of Iowa, or a Team Leader prior to opening the bridge, to determine if the structure has changed from its pre-flood condition and if any additional follow-up action is required.

The scour POA should be re-evaluated and updated after the conclusion of every flood or high-water event in which the POA is implemented. The POA should also be updated based on learning new information about foundation type, changed stream profile or condition of the channel, or other changes to the initial criteria used to develop the POA.

Scour Countermeasures

If the post flood inspections warrant the installation of scour countermeasures, the repairs should be prioritized for all bridges evaluated as scour critical or high risk. The scour inspection in the bridge records should include the plans to install the countermeasures with the estimated repair date. This may be the date the countermeasure installation is programed in the STIP or if it is to be installed by local maintenance staff, the report should include the estimated repair date.

Scour critical bridges that have countermeasures installed for the purpose of armoring the structure to remain open during a single flood event are required to meet the criteria in Section 4130 of the Standard Specifications. Reference to the Armored Countermeasure in the Definitions section in this I.M.

Item 113, Scour Critical, can be coded 7 if the structure has a POA developed and implemented with an approved countermeasure installed. Broken concrete does not constitute an armored countermeasure and does not meet the criteria in the Standard Specifications.

Item 113, Scour Critical, can be coded 8 if permanent countermeasures are installed. Reference Permanent Countermeasure in the Definitions section in this I.M.

When Item 113, Scour Critical, is coded 2 or less, Item 60, Substructure, shall be coded 2 or less as per HEC-18, Section 10.3.2 Bridge Inspection, FHWA Recording and Coding Guide.

New and reconstructed bridges shall be designed to resist scour in accordance with HEC 18, as required by AASHTO Bridge Design Specifications and FHWA Technical Advisory, Evaluating Bridges for Scour, dated October 28, 1991.

Unknown Foundations

The following information shall be kept as part of the inspection records for each bridge with unknown foundations.

1. A POA for monitoring bridges with unknown foundations should be developed and implemented to reduce the risk to users from a bridge failure during and immediately after a flood event (see HEC 23). Also, the use of risk assessment, standard design practices, and engineering judgment can be used to reduce the risk of scour induced failures.

2. Use Attachment H and Attachment I to this I.M. to evaluate the bridge according to the following procedures:

    a. Use the Unknown Foundations Flowchart - Level A Evaluation (see Attachment H to this I.M.) to determine if the foundation type and depth can be determined. If not, then go to step b below.
    b. Complete the Unknown Foundation Risk Assessment Worksheet - Level A Evaluation (see Attachment H to this I.M.) utilizing the USGS Hydrologic Region (see Attachment G to this I.M.) information provided and the SI&A form. Determined the risk category based on the point totals and go to step c below.
    c. Structures determined to have “Moderate” or “High” risk unknown foundations based on the Risk Assessment Worksheet - Level A Evaluation (Attachment H to this I.M.) may utilize the Unknown Foundations Assessment Flowchart - Level B Evaluation (Attachment I to this I.M.) to determine if the category of risk can be reduced.
    d. Refer to Attachment H to this I.M. for guidance on developing the appropriate POA.
    e. Check the appropriate boxes on the Channel/Channel Protection form in SIIMS that indicated the level of evaluation that was completed and the risk level of the POA that was developed and implemented.

The risk-based POAs developed for the unknown foundations are required to be in SIIMS.

Bridge owners are cautioned that simply developing a POA for each bridge with an unknown foundation without first making every effort to determine the foundation (by discovery or inference) may not be advisable. The personnel required to implement POA’s for a large number of bridges during a widespread rainfall event may overwhelm staff.

Load Posting (23 CFR 650.313, l)

Maintain a list of posted bridges with weight limits for each bridge. Additionally, it is recommended that a map be prepared showing the locations of these bridges.

Quality Control (QC) and Quality Assurance (QA) (23 CFR 650.313, p)

Quality Control (QC) Program

It is the Program Manager's responsibility to ensure the following:

1. The "Monthly Notifications" are reviewed to identify any bridges that have not been inspected within the specified interval or are not in compliance with load posting requirements.

2. SIIMS is used to document each inspection, including but not limited to the following:

   a. Local Agency Field Data Collection Forms in SIIMS are completed.
   b. The Supplemental Inspection Information tab is completed in SIIMS for each bridge.

3. Master lists are maintained as required in the Inspection Procedures-Master List section of this I.M.

4. Team Leaders maintain the education/experience/training requirements contained in the Qualifications of Personnel section of this I.M.

5. The individual charged with the overall responsibility for load rating bridges is a Professional Engineer, licensed in the State of Iowa.

Quality Assurance (QA) Program

Bridge Record Reviews

A review of the bridge records for LPA's to determine if they contain the minimum items listed in Inspection Procedures – Records section of this I.M., will be conducted by the Bridges and Structures Bureau utilizing SIIMS on an annual basis for randomly selected LPAs. Additional reviews of the bridge records will be conducted during on site reviews in conjunction with the DOT's annual oversight of the LPAs.

Team Leader Reviews

It is the Program Manager's responsibility to ensure the following:

1. Team Leader Reviews are conducted every 4 years.

   a. Independent party review by a Professional Engineer qualified as a Team Leader.
   b. Field review of inspection data for 10 bridges inspected during the past 12 months. The bridges selected shall include, but not limited to, predominant bridge types inspected and bridges with lower sufficiency ratings. The bridges selected shall include some bridges with Item 58, Deck; Item 59, Superstructure; Item 60, Substructure; Item 62, Culvert; or Item 70, Posting; rated 4 or less (if available for the bridges inspected by the Team Leader).
   c. Reviewer accompanies the Team Leader during the inspection of 2 of the 10 selected bridges.
   d. Quality Assurance Field Review Worksheet (Attachment J of this I.M.) completed for each bridge inspected.
   e. Verification of the validity of information provided by an individual to obtain approval to utilize SIIMS as a Team Leader.
   f. Documentation that the Team Leader has completed the Bridge Inspector Refresher Training Course and, if needed, Nonredundant Steel Tension Member Inspection Techniques for Steel Bridges Training Course.

The findings of the Team Leader Reviews shall be attached to an e-mail to eric.souhrada@dot.iowa.gov. The report shall be stamped and signed by the reviewer. If there are negative findings regarding the Team Leader, the report shall include corrective recommendations, or actions taken, to resolve those findings.

2. Disqualification and re-instatement of Team Leaders

The Program Manager shall disqualify a Team Leader if they have provided invalid information to obtain approval to utilize SIIMS as a Team Leader or have not completed the required training required by the Qualification of Personnel section of this I.M. The disqualification shall be as follows:

a. Invalid information willfully provided to obtain approval to utilize SIIMS as a Team Leader: Permanent disqualification as a Team Leader.
b. Non Compliance with the Qualification of Personnel section of this I.M: Disqualification as a Team Leader until they meet the requirements of Qualification of Personnel section of this I.M.

Load Rating Engineer Reviews

Load Rating Engineer reviews will be conducted by the Bridges and Structures Bureau utilizing SIIMS in conjunction with on-site field reviews as part of the Iowa DOT's annual oversight of the LPA's program.

Critical Findings (23 CFR 650.313, q)

Purpose

The purpose of the Critical Finding Bridge Report in SIIMS is to ensure that serious bridge damages or defects are reported, the necessary notifications are made to the bridge owner by the Program Manager or Team Leader, and that proper and timely action is taken to ensure the safety of the traveling public. This process alerts the bridge owner so damage or deterioration can be repaired in a proper and timely manner and that the damage and repairs are documented.

FHWA will query the Critical Finding Reports in SIIMS monthly; therefore, it is imperative that the LPA's complete the Critical Finding Report in SIIMS as per this I.M.

Criteria

For the following criteria, the Critical Finding form in SIIMS shall be completed.

1. A bridge collapse.
2. Full or partial closure of the bridge due to potential deficiencies that affect load carrying capacity.
3. A NSTM rating that is reduced to serious or worse condition (3) or less.
4. A deck, superstructure, or substructure component is reduced to critical or worse condition (2) or less.
5. The channel condition is rated in critical or worse condition (2) or less.
6. Immediate load restriction or posting or immediate repair work to a bridge, including shoring, to remain open.

Procedure for County/City Bridges

1. The individual discovering the critical finding shall:

a. Immediately report the finding to the responsible local official, who may notify law enforcement or maintenance personnel to close the bridge.
b. Complete Part I of the critical finding report within 48 hours of the finding.

2. The responsible local official shall

a. Take action to ensure the safety of the traveling public.
b. Complete Part II of the critical finding report within 5 days of the finding.

3. Before a closed bridge may be reopened to traffic, a Professional Engineer, licensed in State of Iowa, shall approve any structural repairs, the bridge shall be load rated, and the bridge shall be inspected by a Team Leader.

INVENTORY (23 CFR 650.315)

Iowa DOT maintains an inventory of all bridges subject to NBIS. This inventory is available for viewing and updating by local agencies in SIIMS. All local agencies shall enter their inventory data updates into the database using this access system. User names and passwords are available by request from the State of Iowa Enterprise A & A System. Access to SIIMS will be approved and granted by the Iowa DOT Office of Bridges and Structures, Bridge Maintenance and Inspection (BM&I) Unit.

The Iowa DOT Form 107 is required to be completed for bridge removals, replacements, and new structures, prior to the structure being opened to traffic. Closed structures or removed structures that will not be replaced should be removed from the bridge inventory. All bridges closed for more than ten years shall be removed from the bridge inventory. Instructions are here: https://iowadot.gov/analytics/documents/form107InstGuide.pdf

New Bridge Data:

Within 30 days of receiving the new FHWA number for a new bridge or bridge replacement, all of the required NBI data must be populated in SIIMS. If the bridge has not been built or is not open to traffic, Item 41, Posting Status, must be coded as G.

Bridges must have an initial inspection within 3 months of opening to traffic.

Bridges with NSTM must have a NSTM inspection completed within 12 months of opening to traffic.

Bridges requiring underwater inspection must have the underwater inspection completed within 12 months of opening to traffic.

Modifications to a Bridge or Change in Load Restriction:

Modification to a bridge that alters the geometry or changes to a bridge load restriction must be updated in the NBI within 90 days of the change.

For all types of bridge inspections, the inspection dates and condition codes shall be entered into SIIMS within the required month of the field inspection.

Final approval of inspection reports, including load ratings if necessary, shall be completed in SIIMS within 90 days of the field inspection.

Late Inspections

The LPA will be in non-compliance with the NBIS inspection interval requirements, when a bridge on a 24-month or more interval has not been inspected within four months of the required inspection interval, and a Plan of Corrective Action (PCA) has not been approved by the FHWA and the Iowa DOT.

The LPA will be in non-compliance with the NBIS inspection interval requirements, when a bridge on a 12-month or less interval has not been inspected within three months of the required inspection interval, and a Plan of Corrective Action (PCA) has not been approved by the FHWA and the Iowa DOT.

The LPA will be in non-compliance with the NBIS inspection interval requirements, when a bridge inspection report has not been finalized within four months, following the inspection of the bridge, and a PCA has not been approved by the FHWA and the Iowa DOT.

LPA's out of compliance with the NBIS bridge inspection interval and/or finalization requirements will not be allowed to let any projects at the Iowa DOT until a full NBIS metrics review has been completed by the Iowa DOT. The Iowa DOT will reserve the right to close any non-compliant structure that poses a hazard to the traveling public until the non-compliant structure has an up to date and finalized inspection report.