

2019 NBIS QA REVIEW SUMMARY REPORT

Report Date:
March 31, 2020

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1. INTRODUCTION

The Illinois Department of Transportation (IDOT) is required to perform Quality Assurance (QA) reviews of its bridge inspection and load rating practices in order to comply with the National Bridge Inspection Standard (NBIS). As part of the QA review, the IDOT Bureau of Bridges & Structures (BBS) conducts process audits to document compliance with NBIS requirements and IDOT policy.

Seventeen counties were selected for bridge inspection reviews. Staff interviews, documentation reviews, and field reviews at bridge sites were conducted for each agency. The reviews were typically attended by the agency Program Manager, Team Leaders, and the local IDOT District Bridge Liaison.

Three local agency bridges were selected for load rating reviews. Independent Load Rating Inspections (LRI) were completed for the selected bridges and were compared to the existing LRI's. Independent load rating calculations were also prepared for each bridge and the results were compared to the existing load rating factors. In addition, the documentation of these load ratings was reviewed.

This document summarizes the findings of the individual reviews.

2. PROGRAM MANAGEMENT

2.1 *Personnel*

The following summarizes the review findings regarding personnel:

- All of the agencies had Program Managers that were approved by IDOT.
- All of the agencies had Program Managers that were current on refresher training.
- All of the agencies had Team Leaders that were approved by IDOT.
- All of the agencies had Team Leaders that were current on refresher training.

2.2 Inventory & Inspection Scheduling

The inventory of bridges in the reviewed agencies' programs were under the jurisdictions shown in the following table:

Jurisdiction	Number of Bridges
County	707
Township	1,968
Total	2,675

For purposes of this report, a bridge is defined as a structure carrying a public roadway and greater than 20.0 feet in length. The inventory numbers presented in this report only includes structures meeting this definition and are based on data downloaded from the Illinois Structure Information System (ISIS) prior to each agency's review.

The following summarizes the review findings regarding scheduling:

- There were 14 agencies that had an in-house system for tracking inspection schedules.
- There were three agencies that relied entirely on reports from IDOT to track inspection schedules.
- There were 16 agencies that used the IDOT Inspection Date Notification web portal.

2.3 Quality Control

The following summarizes the review findings regarding quality control:

- All of the agencies had some level of quality control in place to ensure that quality bridge inspections were being performed.
- All of the agencies had Program Managers that reviewed inspection reports.
- There were ten agencies that completed regular field reviews of Team Leaders.
- All of the agencies contacted IDOT when they had critical findings.
- There were 16 agencies that were familiar with Section 3 of the IDOT Structural Services Manual.

- There were 16 agencies that were familiar with the 23 NBIS Metrics.

3. ROUTINE INSPECTIONS

3.1 Inventory & Delinquencies

The agencies reviewed completed routine inspections at the intervals shown in the following table:

Inspection Interval	Number of Bridges
48 mos.	1,190
24 mos.	1,484
12 mos.	0
<12 mos.	1
Total	2,675

There were nine agencies that had routine inspection delinquencies. The delinquencies are summarized in the following tables:

Currently Delinquent for Next Inspection	Number of Bridges
Lower Risk – Less than 4 mos. delinquent	3
Higher Risk – Less than 4 mos. delinquent	4
Lower Risk – More than 4 mos. delinquent	0
Higher Risk – More than 4 mos. delinquent	0
Total	7

Previously Delinquent for Last Inspection	Number of Bridges
Lower Risk – Less than 4 mos. delinquent	121
Higher Risk – Less than 4 mos. delinquent	16
Lower Risk – More than 4 mos. delinquent	2
Higher Risk – More than 4 mos. delinquent	0
Total	139

Delinquencies were typically due to issues with scheduling, high water, weather, consultant contracts, equipment rental, railroad coordination, and bridge construction.

3.2 Inspections & Documentation

The following summarizes the review findings regarding routine inspections:

- All of the agencies had IDOT certified Team Leaders present during all routine inspections.
- There were three agencies that thoroughly checked inventory data during routine inspections.
- All of the agencies used current IDOT inspection forms to document routine inspection findings.
- All of the agencies assigned new condition ratings at the bridge during routine inspections.
- All of the agencies recorded new condition ratings on routine inspection forms even when they were the same as previous condition ratings.
- There were two agencies that did not record new codings in the Additional Inspection data section on BBS-BIR page 2 when they were the same as previous codings.
- There were four agencies that did not justify condition ratings of "5" or less on the routine inspection forms.
- All of the agencies had the Program Manager's signature on routine inspection reports.
- There was one agency that did not have the Team Leader's signature on all routine inspection reports.
- All of the agencies kept the original routine inspection reports with "wet" signatures in the bridge file.

- There were four agencies that did not have routine inspection procedures that provided quality assessments of the bridges.
- There were four agencies that did not have quality documentation of the routine inspection findings.

4. UNDERWATER INSPECTIONS

4.1 Inventory & Delinquencies

There were six agencies reviewed that had bridges requiring underwater inspections. These agencies completed underwater inspections at the intervals shown in the following table:

Inspection Interval	Number of Bridges
60 mos.	18
48 mos.	0
36 mos.	0
24 mos.	0
12 mos.	0
Total	18

None of the agencies had underwater inspection delinquencies.

4.2 Inspections & Documentation

The following summarizes the review findings regarding underwater inspections:

- All of the applicable agencies had IDOT certified Team Leaders present during all underwater inspections.
- All of the applicable agencies checked the condition of submerged structural elements during underwater inspections.
- All of the applicable agencies checked the streambeds for scour during underwater inspections.

- All of the applicable agencies used current IDOT inspection forms to document underwater inspection findings.
- All of the applicable agencies recorded new condition ratings on underwater inspection forms even when they were the same as previous condition ratings.
- All of the applicable agencies included data in the underwater inspection reports documenting streambed elevations.
- There was one agency that did not have a written underwater inspection plan incorporated into the bridge file.
- All of the applicable agencies had the Program Manager's signature on underwater inspection reports.
- All of the applicable agencies had the Team Leader's signature on underwater inspection reports.
- All of the applicable agencies kept the original underwater inspection reports with "wet" signatures in the bridge file.
- All of the applicable agencies had underwater inspection procedures that provided quality assessments of the bridges.
- All of the applicable agencies had quality documentation of the underwater inspection findings.

5. FRACTURE CRITICAL MEMBER INSPECTIONS

5.1 Inventory & Delinquencies

There were 12 agencies reviewed that had bridges requiring fracture critical member (FCM) inspections. These agencies completed FCM inspections at the intervals shown in the following table:

Inspection Interval	Number of Bridges
24 mos.	16
12 mos.	13
<12 mos.	0
Total	29

There were four agencies that had FCM inspection delinquencies. The delinquencies are summarized in the following tables:

Currently Delinquent for Next Inspection	Number of Bridges
Less than 4 mos. delinquent	1
More than 4 mos. delinquent	0
Total	1

Previously Delinquent for Last Inspection	Number of Bridges
Less than 4 mos. delinquent	3
More than 4 mos. delinquent	1
Total	4

Delinquencies were typically due to scheduling issues, inspections being overlooked, and misunderstanding IDOT inspection interval policy.

5.2 Inspections & Documentation

The following summarizes the review findings regarding FCM inspections:

- All of the applicable agencies had IDOT certified Team Leaders present during all FCM inspections.
- There were two agencies that did not inspect all FCM's at arm's length.
- All of the applicable agencies used current IDOT inspection forms to document FCM inspection findings.
- All of the applicable agencies recorded new condition ratings on FCM inspection forms even when they were the same as previous condition ratings.
- There was one agency that did not include quantitative data in the FCM inspection reports documenting the inspection findings.
- There were three agencies that did not have a written FCM inspection plan incorporated into the bridge file.

- All of the applicable agencies had a sketch that clearly identified all of the bridges FCM's incorporated into the bridge file.
- There was one agency that did not have the Program Manager's signature on all FCM inspection reports.
- There was one agency that did not have the Team Leader's signature on all FCM inspection reports.
- All of the applicable agencies kept the original FCM inspection reports with "wet" signatures in the bridge file.
- There were two agencies that did not have FCM inspection procedures that provided quality assessments of the bridges.
- There was one agency that did not have quality documentation of the FCM inspection findings.

6. SPECIAL INSPECTIONS

6.1 Inventory & Delinquencies

There were 15 agencies reviewed that had bridges requiring special inspections. These agencies completed special inspections at the intervals shown in the following table:

Inspection Interval	Number of Special Inspections
48 mos.	0
24 mos.	5
12 mos.	36
<12 mos.	24
Total	65

The special inspections had ISIS Item Number 92C1 (Special Feature Type) coded:

- A - Structural Damage/Deterioration - Steel Superstructure Elements
- B - Structural Damage/Deterioration - Concrete Superstructure Elements
- D - Structural Damage/Deterioration - Steel Substructure Elements

- E - Structural Damage/Deterioration - Concrete Substructure Elements
- F - Structural Damage/Deterioration - Timber Substructure Elements
- I - Underwater Condition Inspection - Spread Footings not adequately keyed into rock or protected from the effects of streambed scour
- L - Existing Streambed Scour Adjacent to Spread Footing
- Q - Substructure Movement or Settlement
- R - Pin & Link in Multi-Girder (Redundant) Bridge
- S - Specifically Identified Problematic Structural Details
- Z - Other

No agencies had bridges that were currently delinquent for their next special inspection. There were two agencies that had a combined total of 10 inspections that were less than four months delinquent for their last special inspection.

Delinquencies were typically due to high water, weather, and misunderstanding IDOT inspection interval policy.

6.2 Inspections & Documentation

The following summarizes the review findings regarding special inspections:

- All of the applicable agencies used current IDOT inspection forms to document special inspection findings.
- All of the applicable agencies recorded new condition ratings on special inspection forms even when they were the same as previous condition ratings.
- All of the applicable agencies clearly identified the features requiring special inspection in the bridge file.
- All of the applicable agencies had the Program Manager's signature on special inspection reports.
- All of the applicable agencies kept the original special inspection reports with "wet" signatures in the bridge file.
- There were two agencies that did not have special inspection procedures that provided quality assessments of the inspected feature.
- All of the applicable agencies had quality documentation of the special inspection findings.

7. SCOUR EVALUATIONS

There were three agencies with a combined total of seven scour critical bridges. The following summarizes the review findings regarding scour evaluations:

- All of the agencies had completed scour critical evaluations for all bridges over waterways.
- All of the applicable agencies had a scour Plan of Action (POA) for each scour critical bridge.
- There was one agency that did not have scour POA's incorporated into the bridge file.
- There were two agencies that did not regularly review and update the scour POA's as needed.
- There was one agency that did not document field visits that were part of an implemented scour POA.
- There were six agencies that did not incorporate justification for the coding of ISIS Item 113 into the bridge file whenever possible.

8. AGENCY LOAD RATING & POSTING

All agencies had a combined total of 116 load posted bridges. There were six agencies with a combined total of 16 closed bridges. The following summarizes the review findings regarding load ratings:

- According to ISIS, there were two agencies that did not have properly posted bridges.
- All of the agencies had their load ratings completed by the BBS.
- All of the agencies notified IDOT whenever work affecting the load rating had been completed.
- All of the applicable agencies regularly reviewed posting and closing signs.
- All of the applicable agencies had their posting and closing signs annually reviewed by IDOT.

9. BRIDGE FILE

The following summarizes the review findings regarding bridge files:

- There were two agencies that did not have well organized bridge file systems.

- All of the agencies had all of the significant bridge file components.
- All of the agencies made their bridge files accessible to the inspection team.
- There was one agency that did not have Bridge File Checklists (IDOT form BBS BFC) in the bridge files.

10. BRIDGE MAINTENANCE

The following summarizes the review findings regarding bridge maintenance:

- All of the agencies used routine NBIS inspections to help identify bridge maintenance needs.
- All of the agencies tried to ensure that maintenance needs were addressed in a timely manner.

11. BRIDGE SITE VISITS

Site visits were made to 106 bridges. Condition ratings and inventory data items on the respective Master Structure Reports were compared with conditions observed in the field.

11.1 Condition Ratings

There were several bridges that had condition ratings which were not within the allowable tolerance of ± 1 . The following are common observations made during the site visits regarding condition ratings:

Item Number 58 (Deck Condition)

- For prestressed concrete box beam bridges without a 4" or thicker reinforced concrete overlay, should be rated the same as the Superstructure Condition (Item 59) using the superstructure rating criteria.

Item Number 59 (Superstructure Condition)

- Should accurately account for leaking keyway joints.
- Should accurately account for independent movement of concrete box beams.
- Should accurately account for longitudinal cracks in prestressed concrete box beams.
- Should accurately account for spalls in prestressed concrete box beams.

- Should accurately account for section loss in steel members.
- Should accurately account for spalls in concrete channel beams around primary reinforcement steel.

Item Number 60 (Substructure Condition)

- Should accurately account for piles and footings that are exposed due to scour.
- Should accurately account for section loss in steel piles.
- Should accurately account for decay in timber members.
- Should accurately account for spalls in concrete members.

Item Number 61 (Channel Condition)

- Should accurately account for channel migration.
- Should accurately account for slope protection failures.

11.2 Inventory Data

The following are common observations made during the site visits regarding inventory data:

Item Number 1G (Key Route Station)

- Should be verified for accuracy since Latitude (Item 16) and Longitude (Item 17) are calculated based on this value.

Item Number 8A1 (Bridge Remarks (General))

- Could be used to identify when an incorrect Structure Number is shown on a name plate.

Item Number 27 (Construction Type Indicator)

- Should be coded 'O' when a structure is completely replaced.
- Should be coded 'R' when a structure is reconstructed.

Item Number 27A (Construction Year)

- Should be confirmed when different from the year shown on name plate.

Item Number 31 (Design Load)

- Should be confirmed when different from design load shown on name plate.

Item Number 32 (Approach Roadway Width)

- Should be verified for accuracy.
- Should include width of pavement and all-weather shoulders.

Item Number 33A (Bridge Median Width)

- Should be verified for accuracy.

Item Number 34 (Skew Direction)

- Should be verified for accuracy.

Item Number 34A (Skew Angle)

- Should be verified for accuracy.

Item Number 36A (Railing Appraisal (Bridge))

- Should be verified that bridge railings meet current standards.

Item Number 36B (Railing Appraisal (Approach Guardrail Transition))

- Should be verified that transitions exist and meet current standards.

Item Number 36C (Railing Appraisal (Approach Guardrail))

- Should be verified that guardrails exist and meet current standards.

Item Number 36D (Railing Appraisal (Approach Guardrail Ends))

- Should be verified that guardrail ends exist and meet current standards.

Item Number 36E/F (Guardrail Type On (Right/Left))

- Should be verified for accuracy.

Item Number 41 (Bridge Status)

- Should be verified for accuracy.

Item Number 43A (Main Structure Material)

- Should be verified for accuracy.

Item Number 43B (Main Structure Type)

- Should be verified for accuracy.

Item Number 45 (Total Number of Main Spans)

- Should be verified for accuracy when coded as single span with Item 49 (Structure Length) coded significantly longer than Item 48 (Length of Longest Span).

Item Number 48 (Length of Longest Span)

- Should be verified for accuracy.
- Should be measured along centerline of roadway.
- Should not be the same as Item 112 (AASHTO Bridge Length)

Item Number 49 (Structure Length)

- Should be verified for accuracy.
- Should be measured along centerline of roadway.

Item Number 50A/B (Sidewalk Width On (Right/Left))

- Should be verified for accuracy.

Item Number 50C (Sidewalks Under Structure Indicator)

- Should be verified for accuracy.

Item Number 51 (Total Bridge Roadway Width On)

- Should be verified for accuracy.
- Should exclude the width of non-mountable medians.

Item Number 52 (Total Deck Width)

- Should be verified for accuracy.
- Should be measured perpendicular to structure centerline.

Item Number 59A (Last Paint Date)

- Should be verified for accuracy.

Item Number 59C (Utilities Attached)

- Should be verified to ensure all utilities attached to the structure are included.

- Should be verified that utilities are still attached to the structure.

Item Number 60A/B (Substructure Material (Abutments/Piers))

- Should be completed for all applicable structures.

Item Number 64B1 (Operating Rating Factor)

- Should be entered into ISIS for all structures.

Item Number 66B1 (Inventory Rating Factor)

- Should be entered into ISIS for all structures.

Item Number 70A2 (Posted Single Unit Weight Limit)

- Actual posting should be verified for accuracy.

Item Number 70B2 (Posted Combination Type 3S-1 Weight Limit)

- Actual posting should be verified for accuracy.

Item Number 70C2 (Posted Combination Type 3S-2 Weight Limit)

- Actual posting should be verified for accuracy.

Item Number 71 (Waterway Adequacy Appraisal)

- Should be verified based on observed overtopping frequencies.

Item Number 92B (Underwater Inspection Interval)

- Confirm if underwater inspections are appropriate based on IDOT basic submergence criteria.

Item Number 102 (One or Two Way Traffic)

- Should be verified for accuracy.

Item Number 107 (Deck Structure Type)

- Should be verified for accuracy.

Item Number 107A (Deck Structure Thickness)

- Should be verified for accuracy.

- For prestressed box beam bridges, should be the depth of the beam.
- For channel beam bridges, should be the thickness of the beam flange.
- For timber decks, should be the thickness of the timber planks.
- For milled or hydro-scarified decks, should follow guidance in the IDOT Structural Services Manual.

Item Number 108A (Type of Wearing Surface)

- Should be verified for accuracy.

Item Number 108C (Deck Protection)

- Should be verified for accuracy.

Item Number 108D (Total Deck Thickness)

- Should be verified for accuracy.
- Should include the Deck Structure Thickness (Item 107A) plus overlay thickness when applicable.
- Should be equal to the Deck Structure Thickness (Item 107A) when there is no overlay.

Item Number 112 (AASHTO Bridge Length)

- Should be verified for accuracy.
- Should be measured along centerline of roadway.

12. IDOT LOAD RATINGS

In general, bridge load ratings appeared to be completed in accordance with the AASHTO Manual for Bridge Evaluations and current IDOT policy. All bridge load ratings were certified by an Illinois Licensed Structural Engineer and documented following IDOT policy. Discrepancies that were identified during this review were not due to load rating calculations, assumptions, or methodologies.

The Load Rating Inspections (LRI) reviewed did not appear to provide a thorough examination of the entire bridge. LRI documentation did not quantify the location and extent of deficiencies. Steel section loss measurements were not taken according to IDOT policy. Wearing surface thickness measurements were also found to be inaccurate.

Based on conversations with both IDOT and local agency personnel, there appears to be uncertainty about the LRI responsibilities of each organization. Local agency inspectors assume that an IDOT LRI involves a thorough inspection of the entire bridge. IDOT inspectors appear to rely on information in the local agency inspection reports to identify problem areas and the LRI is limited to those areas. In addition, documentation of LRI findings are not routinely being incorporated into the Bridge File.

13. FHWA 23 NBIS METRICS

Compliance with the 23 NBIS Metrics was not explicitly part of these reviews. However, several of the agencies reviewed had deficiencies that should be addressed in order for the State to achieve a higher level of compliance during future FHWA reviews:

Qualifications of Personnel – Program Managers (NBIS Metric 2)

The NBIS requires that each Program Manager meet the requirements of the Code of Federal Regulations paragraph 650.309 (a) and 650.313 (g).

All of the agencies appeared to be compliant with this metric.

Qualifications of Personnel – Team Leaders (NBIS Metric 3)

The NBIS requires that each Team Leader meet the requirements of the Code of Federal Regulations paragraph 650.309 (b) and 650.313 (g).

All of the agencies appeared to be compliant with this metric.

Routine Inspection Frequency – Lower Risk Bridges (NBIS Metric 6)

The NBIS requires that each lower risk bridge is inspected at regular intervals not to exceed its defined inspection frequencies. Lower risk bridges are defined as those with superstructure and substructure, or culvert condition ratings of fair or better, and not state legal load restricted.

There were nine agencies that may not be compliant with this metric.

Routine Inspection Frequency – Higher Risk Bridges (NBIS Metric 7)

The NBIS requires that each higher risk bridge is inspected at regular intervals not to exceed its defined inspection frequencies. Higher risk bridges are defined as those with superstructure and substructure, or culvert condition ratings of poor or worse, or are state legal load restricted.

There were seven agencies that may not be compliant with this metric.

Underwater Inspection Frequency – Lower Risk Bridges (NBIS Metric 8)

The NBIS requires that each lower risk bridge that cannot be inspected visually at low water by wading or probing is inspected at regular intervals not to exceed their defined inspection frequencies. Lower risk bridges are defined as those with substructure or culvert condition ratings of fair or better, and evaluated as not being scour critical.

All of the agencies appeared to be compliant with this metric.

Underwater Inspection Frequency – Higher Risk Bridges (NBIS Metric 9)

The NBIS requires that each higher risk bridge that cannot be inspected visually at low water by wading or probing is inspected at regular intervals not to exceed their defined inspection frequencies. Higher risk bridges are defined as those with substructure or culvert condition ratings of poor or worse, or are evaluated as being scour critical.

All of the agencies appeared to be compliant with this metric.

Inspection Frequency – Fracture Critical Member (NBIS Metric 10)

The NBIS requires that all fracture critical members are inspected at regular intervals not to exceed their defined inspection frequencies.

There were four agencies that may not be compliant with this metric.

Inspection Procedures – Quality Inspections (NBIS Metric 12)

The NBIS requires that each bridge is inspected with a nationally recognized acceptable inspection procedure, with the necessary quality of assessment, rating, and documentation.

There were 11 agencies that may not be compliant with this metric.

Inspection Procedures – Post or Restrict (NBIS Metric 14)

The NBIS requires that bridges be posted or restricted when the maximum unrestricted legal loads or State routine permit loads exceed that allowed under the operating rating or equivalent rating factor.

There were two agencies that may not be compliant with this metric.

Inspection Procedures – Bridge Files (NBIS Metric 15)

The NBIS requires that bridge files be prepared in order to maintain reports on the results of bridge inspections together with notations of any action taken to address the findings of such inspections, maintain relevant maintenance and inspection data to allow assessment of current bridge condition, and record the findings and results of bridge inspections on standard forms.

There were three agencies that may not be compliant with this metric.

Inspection Procedures – Fracture Critical Members (NBIS Metric 16)

The NBIS defines a fracture critical member (FCM) inspection as a hands-on inspection of a FCM or member component that may include visual and other non-destructive evaluation. A hands-on inspection is an inspection within arm's length of the component. The locations of the FCM's must be identified and the FCM inspection frequency and inspection procedures described in the inspection records for each bridge requiring FCM inspections.

There were four agencies that may not be compliant with this metric.

Inspection Procedures – Underwater (NBIS Metric 17)

The NBIS requires that the locations of the underwater elements are identified and the underwater inspection frequency and inspection procedures are described in the inspection records for each bridge requiring underwater inspections.

There was one agency that may not be compliant with this metric.

Inspection Procedures – Scour Critical Bridges (NBIS Metric 18)

The NBIS requires that all bridges that are scour critical have a plan of action (POA) prepared to monitor known and potential deficiencies and to address critical findings. The bridges must also be monitored in accordance with the POA.

There was one agency that may not be compliant with this metric.

Inspection Procedures – QC/QA (NBIS Metric 20)

The NBIS requires that agencies assure systematic quality control (QC) and quality assurance (QA) procedures are used to maintain a high degree of accuracy and consistency in the inspection program. This includes periodic field reviews of inspection teams and independent reviews of inspection reports.

All of the agencies appeared to be compliant with this metric.

14. CONCLUSIONS

The following are suggestions that IDOT should consider to help improve the quality of the State's NBIS programs:

1. Continue to emphasize the importance the deficiencies noted in this report to all agencies throughout the state.
2. Encourage local agencies to pool their resources so that a smaller number of inspection teams are completing a larger number of inspections each year.
3. Explore ways to assist local agencies with proper access equipment for FCM inspections.
4. Provide basic training on SIMS Link that shows how to connect tables.
5. Include a report in SIMS County that shows inspection due dates.
6. Continue to provide agencies with reports showing inspection due dates.
7. Incorporate all inventory data on the routine inspection form to encourage agencies to review this data during inspections.
8. Review quality control procedures to help ensure LRIs have accurate findings and adequate documentation.
9. Clarify the LRI responsibilities of local agency and IDOT inspectors.
10. Explore ways to shift more resources to LRIs.