

2017 NBIS QA REVIEW SUMMARY REPORT

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Prepared for:

Illinois Department of Transportation
Bureau of Bridges & Structures

Prepared by:



100 Lanter Court, Suite 1

Collinsville, IL 62234

Phone: (618) 345-2200

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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 and one IDOT district were selected for bridge inspection reviews. Staff interviews, documentation reviews, and field reviews at bridge sites were conducted for each agency.

Three local agency bridges and two state bridges were selected for load rating reviews. Independent load rating calculations were prepared for each bridge and the results were compared to the existing load rating factors. The documentation of these load ratings was also 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
State	777
County	626
Township	2,016
Total	3,419

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 13 agencies that had an in-house system for tracking inspection schedules.
- There were five agencies that mainly relied on reports from IDOT to track inspection schedules.
- There were two agencies that did not use 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 11 agencies that completed regular field reviews of Team Leaders.
- All of the agencies contacted the BBS when they had critical findings.
- There were 17 agencies that were familiar with Section 3 of the IDOT Structural Services Manual.
- All of the agencies 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.	1,507
24 mos.	1,864
12 mos.	47
<12 mos.	1
Total	3,419

No agencies had bridges that were currently delinquent for their next routine inspection. There were 12 agencies that had routine inspection delinquencies as summarized in the following table:

Previously Delinquent for Last Inspection	Number of Bridges
Lower Risk – Less than 4 mos. delinquent	150
Higher Risk – Less than 4 mos. delinquent	18
Lower Risk – More than 4 mos. delinquent	1
Higher Risk – More than 4 mos. delinquent	0
Total	169

Delinquencies were typically due to weather, high water, inspections being overlooked, ISIS items being miscoded, and scheduling conflicts.

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 12 agencies that did not thoroughly check 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.
- There were two agencies that did not record new condition ratings on routine inspection forms when they were the same as previous condition ratings.
- There were five agencies that did not record new codings in the Additional Inspection data section when they were the same as previous codings.
- There were five 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.
- There was one agency that did not keep the original routine inspection reports with "wet" signatures in the bridge file.
- There were five 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.	20
48 mos.	0
36 mos.	0
24 mos.	0
12 mos.	0
Total	20

No agencies had bridges that were currently delinquent for their next underwater inspection. There were three agencies that had underwater inspection delinquencies as summarized in the following table:

Previously Delinquent for Last Inspection	Number of Bridges
Lower Risk – Less than 4 mos. delinquent	4
Higher Risk – Less than 4 mos. delinquent	1
Lower Risk – More than 4 mos. delinquent	0
Higher Risk – More than 4 mos. delinquent	0
Total	5

Delinquencies were typically due to weather, high water, personnel changes, and scheduling conflicts.

4.2 Inspections & Documentation

The following summarizes the review findings regarding underwater inspections:

- There was one agency that did not have 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.
- There was one agency that did not have the Team Leader's signature on all underwater inspection reports.
- There was one agency that did not keep 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 nine 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.	4
<12 mos.	0
Total	20

No agencies had bridges that were currently delinquent for their next FCM inspection. There were three agencies that had FCM inspection delinquencies as summarized in the following table:

Previously Delinquent for Last Inspection	Number of Bridges
Less than 4 mos. delinquent	3
More than 4 mos. delinquent	0
Total	3

Delinquencies were typically due to miscommunications with township commissioners and scheduling conflicts.

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 four 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.
- There was one agency that did not record new condition ratings on FCM inspection forms when they were the same as previous condition ratings.
- There were five agencies that did not include quantitative data in the FCM inspection reports documenting the inspection findings.

- There were six 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.
- All of the applicable agencies had the Program Manager's signature on FCM inspection reports.
- All of the applicable agencies had the Team Leader's signature on FCM inspection reports.
- There was one agency that did not keep the original FCM inspection reports with "wet" signatures in the bridge file.
- There were four agencies that did not have FCM inspection procedures that provided quality assessments of the bridges.
- There were five agencies that did not have quality documentation of the FCM inspection findings.

6. SPECIAL INSPECTIONS

6.1 Inventory & Delinquencies

There were 14 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.	10
24 mos.	16
12 mos.	70
<12 mos.	35
Total	131

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
- G - Underwater Condition Inspection - Debris and/or Erodible Soils
- K - Underwater Condition Inspection - Scour Critical Evaluation Monitoring
- L - Existing Streambed Scour Adjacent to Spread Footing
- N - Existing Streambed Scour Adjacent to Pile Bent Substructure Unit
- Q - Substructure Movement or Settlement
- R - Pin & Link in Multi-Girder (Redundant) Bridge
- S - Specifically Identified Problematic Structural Details
- Z - Other

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

Currently Delinquent for Next Inspection	Number of Special Inspections
Less than 4 mos. delinquent	2
More than 4 mos. delinquent	0
Total	2

Previously Delinquent for Last Inspection	Number of Special Inspections
Less than 4 mos. delinquent	13
More than 4 mos. delinquent	0
Total	13

Delinquencies were typically due to weather, miscommunications with township commissioners, inspections being overlooked, and scheduling conflicts.

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.
- There were four agencies that did not include photos or quantitative data in the special inspection reports documenting the inspection findings.
- 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.
- There was one agency that did not keep the original special inspection reports with "wet" signatures in the bridge file.
- There were three agencies that did not have special inspection procedures that provided quality assessments of the inspected feature.
- There were four agencies that did not have quality documentation of the special inspection findings.

7. SCOUR EVALUATIONS

There were two agencies with a combined total of 15 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.
- All of the applicable agencies had the scour POA's incorporated into the bridge file.
- None of the applicable agencies regularly reviewed and updated the scour POA's as needed.
- All of the applicable agencies documented field visits that were part of an implemented scour POA.
- There were five agencies that did not incorporate justification for the coding of ISIS Item 113 into the bridge file whenever possible.

8. AGENCY LOAD RATING & POSTING

There were 14 agencies with a combined total of 90 load posted bridges. There were seven agencies with a combined total of 21 closed bridges. The following summarizes the review findings regarding load ratings:

- According to ISIS, there were three agencies that did not have properly posted bridges.
- All of the agencies had their load ratings completed by the BBS.
- There were two agencies that did not notify 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:

- All of the agencies had well organized bridge file systems.
- There was one agency that did not have all of the significant bridge file components.
- All of the agencies made their bridge files accessible to the inspection team.
- All of the agencies had plans for completing the Bridge File Checklist (IDOT form BBS BFC).

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.
- There were two agencies that did not ensure that maintenance needs were addressed in a timely manner.

11. BRIDGE SITE VISITS

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)

1. 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.
2. Should accurately account for spalls, cracks, and efflorescence.

Item Number 59 (Superstructure Condition)

1. Should accurately account for leaking keyway joints.
2. Should accurately account for independent movement of concrete box beams and concrete channel beams.
3. Should accurately account for longitudinal cracks in prestressed concrete box beams.
4. Should accurately account for section loss in steel members.
5. Should accurately account for spalls in concrete members.

Item Number 60 (Substructure Condition)

1. Should accurately account for piles and footings that are exposed due to scour.
2. Should accurately account for section loss in steel members.
3. Should accurately account for observed pile movement.
4. Should accurately account for cracks and spalls in concrete members.
5. Should accurately account for missing stones in masonry members.

Item Number 61 (Channel Condition)

1. Should accurately account for endslope failures.
2. Should accurately account for channel debris.
3. Should accurately account for slopewall conditions.

Item Number 113 (Scour Critical Evaluation)

1. Should be reevaluated when significant scour is observed in the field.

11.2 Inventory Data

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

Item Number 8A1 (Bridge Remarks (General))

1. Could be used to identify when an incorrect Structure Number is shown on a name plate.
2. Remarks should be accurate.

Item Number 8B (Multi-level Structure Number)

1. Should be verified for accuracy.

Item Number 27A (Construction Year)

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

Item Number 27B (Construction Route Number)

1. Should be confirmed when different from route number shown on name plate.

Item Number 27C (Construction Section Number)

1. Should be confirmed when different from section number shown on name plate.

Item Number 27D (Construction Station Number)

1. Should be confirmed when different from station number shown on name plate.

Item Number 31 (Design Load)

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

Item Number 32 (Approach Roadway Width)

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

Item Number 34 (Skew Direction)

1. Should be verified for accuracy.

Item Number 34A (Skew Angle)

1. Should be verified for accuracy.

Item Number 36A (Railing Appraisal (Bridge))

1. Should be verified that bridge railings exist and meet current standards.

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

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

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

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

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

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

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

1. Should be verified for accuracy.

Item Number 43A (Main Structure Material)

1. Should be verified for accuracy.

Item Number 43B (Main Structure Type)

1. Should be verified for accuracy.

Item Number 45 (Total Number of Main Spans)

1. Should be verified for accuracy.

Item Number 48 (Length of Longest Span)

1. Should be verified for accuracy.
2. Should be measured along centerline of roadway.

Item Number 49 (Structure Length)

1. Should be verified for accuracy.
2. Should be measured along centerline of roadway.

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

1. Should be verified for accuracy.
2. Should be coded for all sidewalks 18" and wider.

Item Number 51 (Total Bridge Roadway Width On)

1. Should be verified for accuracy.

Item Number 52 (Total Deck Width)

1. Should be verified for accuracy.
2. Should be measured perpendicular to structure centerline.

Item Number 59C (Utilities Attached)

1. Should be verified to ensure all utilities attached to the structure are included.
2. Should be verified that existing utilities attached to the structure are still attached to the structure.

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

1. Should be verified for accuracy.
2. Should be completed for all applicable structures.

Item Number 70 (Bridge Posting Level)

1. Should be verified for accuracy.

Item Number 101 (Parallel Structure Designation)

1. Should be verified for accuracy.

Item Number 102 (One or Two Way Traffic)

1. Should be verified for accuracy.

Item Number 107 (Deck Structure Type)

1. Should be verified for accuracy.

Item Number 107A (Deck Structure Thickness)

1. Should be verified for accuracy.

2. For bridges with concrete overlays, should be the depth of the original deck after milling or hydroscarification.
3. For prestressed box beam bridges, should be the depth of the beam.
4. For channel beam bridges, should be the thickness of the beam flange.

Item Number 108A (Type of Wearing Surface)

1. Should be verified for accuracy.

Item Number 108B (Type of Membrane)

1. Should be verified for accuracy.

Item Number 108D (Total Deck Thickness)

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

Item Number 112 (AASHTO Bridge Length)

1. Should be verified for accuracy.
2. 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.

IDOT should continue efforts to document the “unwritten rules” used to load rate structures. Quality control procedures should also be continuously reviewed to ensure that errors are minimized in load rating calculations and documentation.

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 did not appear to 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 did not appear to 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.

There were three agencies that did not appear 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.

There was one agency that did not appear 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 three agencies that did not appear to 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 was one agency that did not appear to 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 six agencies that did not appear to 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 did not appear to 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.

All of the agencies appeared to 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 of the previously noted deficiencies to all agencies throughout the state.
2. Continue to provide training for IDOT District Bridge Liaisons.
3. Consider having the BBS send monthly delinquency reports directly to local agencies.
4. Correlate information in the Inspection Date Notification website and ISIS before sending delinquency notices.
5. Continue efforts to modernize ISIS so that local agencies have the option to fill out and submit inspection reports electronically.

6. Explore ways to condense the various inventory reports and organize them so the information is easier to input into ISIS.
7. Consider providing SIMS training outside of the IACE meetings.
8. Encourage local agencies to pool their resources so that a smaller number of inspection teams are completing a larger number of inspections each year.
9. Establish IDOT policies for paperless bridge file systems.
10. Continue efforts to document and make readily available “unwritten rules” used to load rate structures.
11. Continually review the effectiveness of quality control procedures to ensure that errors are minimized in both the bridge load rating calculations and documentation.