

2020 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
OA Project Number 17096.007

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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 two IDOT districts 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 and Team Leaders.

One local agency bridge and one state bridge 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	1,531
County	768
Township	2,526
Total	4,825

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 16 agencies that had an in-house system for tracking inspection schedules.
- There were three agencies that relied entirely on reports from the BBS to track inspection schedules.

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 14 agencies that completed regular field reviews of Team Leaders.
- All of the agencies contacted IDOT when they had critical findings.
- All of the agencies were familiar with Section 3 of the IDOT Structural Services Manual.
- All of the agencies were familiar with the IDOT Structure Information and Procedure Manual.
- All of the agencies were familiar with the FHWA 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.	1,890
24 mos.	2,745
12 mos.	187
<12 mos.	3
Total	4,825

No agencies had bridges that were currently delinquent for their next routine inspection. There were seven 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	45
Higher Risk – Less than 4 mos. delinquent	9
Lower Risk – More than 4 mos. delinquent	1
Higher Risk – More than 4 mos. delinquent	0
Total	55

Delinquencies were typically due to flooding, bad weather, injured inspectors, and inspections being outside the normal inspection cycle.

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 six 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 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.
- All of the agencies had the Team Leader's signature on routine inspection reports.
- All of the agencies kept the original routine inspection reports with "wet" signatures in the bridge file.

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.	34
48 mos.	7
36 mos.	1
24 mos.	31
12 mos.	14
Total	87

No agencies had bridges that were currently delinquent for their next underwater inspection. There were two 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	2
Higher Risk – Less than 4 mos. delinquent	0
Lower Risk – More than 4 mos. delinquent	0
Higher Risk – More than 4 mos. delinquent	0
Total	2

The delinquencies were due to scheduling issues and equipment issues.

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 were two agencies 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.

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.	66
12 mos.	22
<12 mos.	0
Total	88

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

Previously Delinquent for Last Inspection	Number of Bridges
Less than 4 mos. delinquent	2
More than 4 mos. delinquent	0
Total	2

The delinquencies were due to personnel changes.

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.
- All of the applicable agencies inspected 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 were two agencies that did not include quantitative data in the FCM inspection reports documenting the inspection findings.
- All of the applicable agencies had a written FCM inspection plan incorporated into the bridge file.
- There was one agency that did not have 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.
- All of the applicable agencies kept the original FCM inspection reports with "wet" signatures in the bridge file.

6. SPECIAL INSPECTIONS

6.1 Inventory & Delinquencies

There were 17 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.	22
24 mos.	41
12 mos.	92
<12 mos.	71
Total	226

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
- I - Underwater Condition Inspection - Spread Footings not adequately keyed into rock or protected from the effects of streambed scour
- 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
- P - Embankment Movement or Settlement
- Q - Substructure Movement or Settlement
- R - Pin & Link in Multi-Girder (Redundant) Bridge
- S - Specifically Identified Problematic Structural Details
- T - Deck
- U - Dapped Girders/Beams
- Z - Other

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

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

The delinquencies were due to scheduling issues and equipment issues.

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.

7. SCOUR EVALUATIONS

There were three agencies with a combined total of 28 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.
- There was one agency that did not regularly review and update the scour POA's as needed.

- All of the applicable agencies documented field visits that were part of an implemented scour POA.
- There were 15 agencies that were in the process of completing channel cross sections in accordance with IDOT Circular Letter 2019-14.

Documentation justifying the coding of ISIS Item 113 (Scour Critical Evaluation) was reviewed for each agency with a total of 185 bridge files reviewed. There were 75 bridge files that incorporated the original IDOT Bridge Scour Assessment Procedure (BSAP) worksheet. The remaining bridge files did not contain any significant information justifying the coding.

8. AGENCY LOAD RATING & POSTING

There were 17 agencies with a combined total of 151 load posted bridges. There were seven agencies with a combined total of 25 closed bridges. The following summarizes the review findings regarding load ratings and postings:

- According to ISIS, there were four 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:

- 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.

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 123 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.
- Should be rated independently of the superstructure on precast concrete channel beam bridges.
- Should accurately account for holes in the deck.

Item Number 59 (Superstructure Condition)

- 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 severe rocker bearing misalignment and movement.
- Should accurately account for spalls in precast concrete channel beams around primary reinforcement steel.

Item Number 60 (Substructure Condition)

- Should accurately account for piles that are exposed due to scour.
- Should accurately account for section loss in steel piles.

- Should accurately account for section loss in steel pile caps.

Item Number 61 (Channel Condition)

- Should accurately account for channel migration.

11.2 Inventory Data

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

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 34 (Skew Direction)

- Should be verified for accuracy.
- IDOT local bridge liaisons need to ensure that inventory discrepancies noted by the inspection team are changed in ISIS.

Item Number 34A (Skew Angle)

- Should be verified for accuracy.
- IDOT local bridge liaisons need to ensure that inventory discrepancies noted by the inspection team are changed in ISIS.

Item Number 36A (Railing Appraisal (Bridge))

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

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

- Should be verified that transitions meet current standards.

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

- Should be verified that transitions 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 48 (Length of Longest Span)

- Should be verified for accuracy.

Item Number 49 (Structure Length)

- Should be verified for accuracy.

Item Number 51 (Total Bridge Roadway Width On)

- Should be verified for accuracy.
- IDOT local bridge liaisons need to ensure that inventory discrepancies noted by the inspection team are changed in ISIS.
- Should be coded appropriately for bridges with fill.

Item Number 52 (Total Deck Width)

- Should be verified for accuracy.
- Should be coded appropriately for bridges with fill.

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 (Substructure Material (Abutments))

- Should be verified for accuracy.

Item Number 62E (Culvert Fill Depth)

- Should be coded appropriately for bridges with fill.

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 72 (Approach Roadway Alignment)

- Should be verified based on speed reduction due to bridge alignment.

Item Number 92A (Fracture Critical Inspection Interval)

- Closed bridges over waterways do not require FCM inspections.

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.

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 or timber runner 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.

Item Number 113 (Scour Critical Evaluation)

- Should be verified for accuracy.

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. Discrepancies identified included the use of a future wearing surface in the bridge load ratings and various issues with the AASHTOWare Bridge Rating model.

All bridge load ratings were certified by an Illinois Licensed Structural Engineer and documented following IDOT policy.

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 seven agencies that may not be fully 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 six agencies that may not be fully 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 two agencies that may not be fully 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 applicable 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 was one agency that may not be fully 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 12 agencies that may not be fully 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 fully 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 five agencies that may not be fully 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 was one agency that may not be fully 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 were three agencies that may not be fully 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 fully 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. Incorporate all inventory data on the routine inspection form to encourage agencies to review this data during inspections.
4. Encourage all agencies to try and locate any documentation justifying the Scour Critical Evaluation coding.
5. Review all required posting and actual posting data in ISIS and correct any discrepancies.
6. Continue to encourage local agencies to use BIS which provides another inspection scheduling tool and also provides built-in quality control of inspection documentation.
7. Review wording in IDOT Structural Services Manual Section 4.3.4.2 to clarify that a FWS should not be included in initial load ratings.
8. Review wording in IDOT Structural Services Manual Section 4.3.4.2 to clarify that the Lever Rule shall only be used to calculate the exterior beam LLDF for ASR and LFR.
9. Ensure that all BrR model inputs are accurate since they could adversely affect future uses of the model.
10. Ensure quality control on which BrR versions are being used since the program is not backwards compatible.