

2021 NBIS QA REVIEW SUMMARY REPORT

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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 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.

Four 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 and Team Leaders.

Seven local agency bridges and three 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
County	166
Township	439
Other	7
Total	612

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 four agencies that had an in-house system for tracking 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 3 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.	224
24 mos.	388
12 mos.	0
<12 mos.	0
Total	612

One agencies had bridges that were currently delinquent for their next routine inspection.

Currently Delinquent for Next 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

There were four 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	28
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	32

Delinquencies were typically due to bad weather and highwater.

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 no 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 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

All agencies reviewed that had no bridges requiring underwater inspections.

5. FRACTURE CRITICAL MEMBER INSPECTIONS

5.1 Inventory & Delinquencies

There was one agency 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.	2
12 mos.	0
<12 mos.	0
Total	2

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	0
More than 4 mos. delinquent	1
Total	1

The delinquencies were typically due to weather.

5.2 Inspections & Documentation

The following summarizes the review findings regarding FCM inspections:

- The agency had IDOT certified Team Leaders present during all FCM inspections.
- The agency inspected all FCM's at arm's length.
- The agency used current IDOT inspection forms to document FCM inspection findings.
- The agency recorded new condition ratings on FCM inspection forms even when they were the same as previous condition ratings.
- The agency did not include quantitative data in the FCM inspection reports documenting the inspection findings.
- The agency had a written FCM inspection plan incorporated into the bridge file.
- The agency had a sketch that clearly identified all of the bridges FCM's incorporated into the bridge file.
- The agency had the Program Manager's signature on FCM inspection reports.
- The agency had the Team Leader's signature on FCM inspection reports.
- The agency kept the original FCM inspection reports with "wet" signatures in the bridge file.

6. SPECIAL INSPECTIONS

6.1 Inventory & Delinquencies

There were four 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.	0
12 mos.	13
<12 mos.	8
Total	21

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
- C - Structural Damage/Deterioration - Timber Superstructure Elements
- D - Structural Damage/Deterioration - Steel Substructure Elements
- E - Structural Damage/Deterioration - Concrete Substructure Elements
- F - Structural Damage/Deterioration - Timber Substructure Elements
- Q - Substructure Movement or Settlement
- Z - Other

There were no agencies that had special inspection delinquencies.

6.2 Inspections & Documentation

The following summarizes the review findings regarding special inspections:

- One agency did not use 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 but none had date of last noted change referenced.
- 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

Scour critical evaluations had been completed for all bridges over waterways. The agency had no bridges that were scour critical.

All of the agencies 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 thirty-seven bridge files reviewed. All bridge files incorporated the original IDOT Bridge Scour Assessment Procedure (BSAP) Summary sheet but only fifteen had the BSAP worksheet. The remaining bridge files did not contain any significant information justifying the coding.

8. AGENCY LOAD RATING & POSTING

There were four agencies with a combined total of twenty-two load posted bridges. There were two agencies with a combined total of three closed bridges. The following summarizes the review findings regarding load ratings and postings:

- According to ISIS, there was one agency 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 23 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 longitudinal cracks and keyway leakage in prestressed concrete box beams.
- Should accurately account for spalls in prestressed concrete box beams.

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.

11.2 Inventory Data

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

Item Number 19 (Bypass Length)

- Should be verified for accuracy.

Item Number 27 (Construction history)

- Should be verified for accuracy.

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 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 43A (Main Structure Material)

- Should be verified for accuracy.

Item Number 43B (Main Structure Type)

- Should be verified for accuracy.

Item Number 44 BN/BF (Near and Far Span Type)

- Should be verified for accuracy.

Item Number 44 AN/AF (Near and Far Span Material)

- Should be verified for accuracy.

Item Number 49 (Structure Length)

- Should be verified for accuracy.

Item Number 92B (Underwater Inspection Interval)

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

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 108D (Total Deck Thickness)

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

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. The following are suggestions concluded by WHKS & Co. that IDOT should consider for its load rating Program.

1. The wording in IDOT Structural Services Manual Section 4.3.4.4.1 on culvert barrel walls and bottom slabs indicates that these “are typically excluded from the load rating.” While no exception was taken to the policy, there may be confusion on when to include the walls into the rating. It is the view of WHKS to take a more conservative approach and include the walls and bottom slabs of the culvert into the rating. Then reserve the use of the rational method if the load rating results in poor load carrying capacities, or when the walls or bottom slab is in poor condition as prescribed in that section. The interpretation of “typically” could lead to variances in load ratings particularly if the ratings are above 1.0.
2. The IDOT Structural Services Manual Section 4.3.4.4.1 indicates that shear shall be evaluated for the top slab. No exception is taken to this section, however, in the event that shear controls for top slabs with less than 2’ of fill, shear can be ignored in the top slabs per article 3.24.4 of the AASHTO Standard Spec. If this is allowed and shear in the sidewalls do not control, this could prevent some lower ratings or pre-mature postings. It is the view of WHKS (similar to item 1) to take the more conservative approach and check shear and only to disallow the use of shear if the rating results in a sub-par rating. Some clarification on this may be warranted.
3. Ensure that all BrR model inputs are accurate and correct since they could adversely affect future model usage when evaluating permit loading or deterioration.

4. Ensure other supporting information regarding the structure in ISIS is updated to match current conditions at the time of inspection or rating. Examples would be updating the deck structure thickness, overlay type, and total deck thickness.

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 was one agency 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.

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.

All of the agencies appeared 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 was one 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 was one agency 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.

All of the agencies appeared to be conditionally compliant with this metric since they had started taking channel cross-sections in accordance with IDOT Circular Letter 2019-14.

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 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.

One agency appears to have at least one bridge that meet the basic submergence criteria specified in Section 3.3.4 in the 2017 IDOT Structural Services Manual. This bridge is not receiving formal underwater inspections and the underwater elements are not being properly inspected during routine inspections.

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 developments found during the evaluation of this report that IDOT will monitor 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. Continue to encourage local public agencies to use ISIS/BIS which provides another inspection scheduling tool and also provides built-in quality control of inspection documentation.
3. Review wording in IDOT Structural Services Manual Section 4.3.4.4.1 to clarify shear controls for top slabs with less than 2' of fill.
4. Review wording in IDOT Structural Services Manual Section 4.3.4.4.1 to clarify when to include the walls into the rating.
5. Ensure that all BrR model inputs are accurate since they could adversely affect future uses of the model.