Office of the Auditor General
Performance Audit Report

Bridge Inspection Program and Michigan Bridge Management and Inspection System (MiBRIDGE)

Michigan Department of Transportation

January 2021

State of Michigan Auditor General
Doug A. Ringler, CPA, CIA

591-0169-19

The auditor general shall conduct post audits of financial transactions and accounts of the state and of all branches, departments, offices, boards, commissions, agencies, authorities and institutions of the state established by this constitution or by law, and performance post audits thereof.

The auditor general may make investigations pertinent to the conduct of audits.

Article IV, Section 53 of the Michigan Constitution

OAG
Office of the Auditor General

Report Summary

Performance Audit

Bridge Inspection Program and Michigan Bridge Management and Inspection System (MiBRIDGE)

Michigan Department of Transportation (MDOT)

Report Number:
591-0169-19

Released:
January 2021

MDOT's Bureau of Bridges and Structures (BOBS) is responsible for administering the State's bridge inspection program in compliance with National Bridge Inspection Standards (NBIS) for highway bridges located on public roads that are longer than 20 feet. The bridge inspection program is critical to ensuring the safety of Michigan highway bridges; identifying repair and maintenance needs; and determining the appropriate allocation of MDOT bridge funds. As of June 16, 2020, BOBS records indicated that there were 11,212 bridges in Michigan. In fiscal year 2018, MDOT inspected or caused to be inspected 6,385 bridges. MiBRIDGE is MDOT's primary source of bridge-related data. MiBRIDGE is used by bridge inspectors and bridge management personnel to maintain an inventory of all bridges as required by NBIS.

Audit Objective	Conclusion
Objective #1: To assess the effectiveness of MDOT's efforts to administer its quality control (QC) and quality assurance (QA) program over bridge inspections and load ratings.	Effective

Findings Related to This Audit Objective	Material Condition	Reportable Condition	Agency Preliminary Response
Opportunities exist for MDOT to further evaluate and improve QC and QA practices to increase the number of jurisdictions that receive an effective QC rating. Between 2012 and 2019, 106 (41%) of 258 jurisdictions did not receive an effective rating for their QC processes (Finding #1).		X	Agrees

Audit Objective	Conclusion
Objective #2: To assess MDOT's compliance with selected federal and State requirements for its bridge inspection program.	Complied, with exceptions

Findings Related to This Audit Objective	Material Condition	Reportable Condition	Agency Preliminary Response
Three (25%) of 12 bridge owners did not maintain all required QC documentation. Also, 5 (20%) of 25 bridge files reviewed did not contain an initial scour assessment (Finding #2).		X	Agrees

Audit Objective			Conclusion
Objective #3: To assess the effectiveness of MiBRIDGE access, backup, and application controls.			Moderately effective
Findings Related to This Audit Objective	**Material Condition**	**Reportable Condition**	**Agency Preliminary Response**
Of the inactive MiBRIDGE accounts, 54% had not been accessed in over 120 days and 23% did not have a last log on date, and therefore, we were unable to identify when those users last accessed MiBRIDGE (Finding #3).		X	Agrees

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January 28, 2021

Mr. Todd Wyett, Chair
State Transportation Commission
and
Paul C. Ajegba, PE, Director
Michigan Department of Transportation
Murray D. Van Wagoner Building
Lansing, Michigan

Dear Mr. Wyett and Mr. Ajegba:

This is our performance audit report on the Bridge Inspection Program and Michigan Bridge Management and Inspection System (MiBRIDGE), Michigan Department of Transportation.

We organize our findings and observations by audit objective. Your agency provided preliminary responses to the recommendations at the end of our fieldwork. The *Michigan Compiled Laws* and administrative procedures require an audited agency to develop a plan to comply with the recommendations and to submit it to the State Budget Office upon completion of an audit. Within 30 days of receipt, the Office of Internal Audit Services, State Budget Office, is required to review the plan and either accept the plan as final or contact the agency to take additional steps to finalize the plan.

We appreciate the courtesy and cooperation extended to us during this audit.

Sincerely,

Doug Ringler

Doug Ringler
Auditor General

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BRIDGE INSPECTION PROGRAM AND MICHIGAN BRIDGE MANAGEMENT AND INSPECTION SYSTEM (MIBRIDGE)

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AUDIT OBJECTIVES, CONCLUSIONS, FINDINGS, AND OBSERVATIONS

ADMINISTRATION OF QC AND QA PROGRAM

BACKGROUND

National Bridge Inspection Standards* (NBIS) require the Michigan Department of Transportation (MDOT) to ensure that systematic quality control* (QC) and quality assurance* (QA) procedures are used Statewide to maintain a high degree of accuracy and consistency in the data produced in its bridge inspection program. QC and QA reviews are not actual bridge inspections but an evaluation of the procedures that qualified team leaders* (QTLs) use to conduct the inspections. Bridge inspections and load rating calculations are the responsibility of the bridge owner. MDOT does not possess the legal authority to inspect local agency-owned bridges. However, as part of the QC and QA processes, MDOT is responsible for regular auditing of bridge files, inspection procedures, and inspector qualifications and for noting deficient processes to the local-agency owners. MDOT is responsible for follow-up such as issuance of plans of corrective action when those owners do not attempt required efforts to ensure compliance with NBIS.

QC procedures are performed by State, county, city, village, and township bridge owners*, or their consultants, annually to verify that accurate bridge inspection and load rating* data is collected by the QTLs and to immediately address any safety deficiencies identified.

QA reviews are performed annually on selected jurisdictions* or regions by two consultants contracted by MDOT. The jurisdictions or regions are selected using a risk-based approach. QA reviews ensure that bridge owners, or their consultants, implemented effective QC procedures to monitor the bridge inspection and load rating program. The QA consultants perform a preliminary assessment of the bridge owners,' or their consultants,' QC processes. If the QA consultant determines that the QC process was effective, then the consultant performs the QA review. However, if the consultant determines that the QC process was not performed or was not effective, then the QA consultant must perform both the QC and QA reviews. Under these circumstances, the independent QC review requires verification of inspector and load rating engineer credentials, performance of additional file and field reviews of bridge inspections, and review of additional load ratings. MDOT's QA consultants prepare an annual report to inform MDOT of the QC and QA reviews performed, results of those reviews, and overall recommendations for improvement.

AUDIT OBJECTIVE

To assess the effectiveness* of MDOT's efforts to administer its QC and QA program over bridge inspections and load ratings.

** See glossary at end of report for definition.*

CONCLUSION

Effective.

FACTORS IMPACTING CONCLUSION

- MDOT implemented a bridge inspection program as required by NBIS.
- MDOT program managers* met federal qualifications, including required credentials and training, for administering MDOT's bridge inspection program.
- MDOT established QC and QA procedures for bridge owners, and their consultants, that included federal requirements and industry best practices.
- For program year 2019, the Federal Highway Administration (FHWA) rated the State's bridge inspection program as effective.
- MDOT contracted with two qualified, independent QA consultants who performed reviews of 74 bridge owners' QC procedures for the 2018-19 review period.
- Survey responses from bridge owners indicated:
    - 86% of 147 respondents agreed or somewhat agreed that MDOT provided sufficient guidance regarding delegated QC responsibilities and 86% of 152 respondents either agreed or somewhat agreed that MDOT provided sufficient guidance regarding the required QC procedures.
    - 94% of 140 respondents were either satisfied or very satisfied with MDOT's QA process.
- Reportable condition* related to continuing to evaluate and improve QC and QA practices (Finding #1).

** See glossary at end of report for definition.*

FINDING #1

Continued improvements to QC and QA practices recommended.

MDOT should continue to evaluate and improve its QC and QA practices over the State's bridge inspection program to help ensure increased accuracy and consistency of bridge inspection and load rating data.

NBIS requires MDOT to ensure that systematic QC and QA procedures are used to maintain a high degree of accuracy and consistency in the inspection program. FHWA annually reviews a sample of MDOT and local agency bridge inspections against 23 NBIS metrics*.

During program years 2017 through 2019, FHWA reported that MDOT was in compliance or substantial compliance with 19 (83%) of 23 metrics related to bridge inspection procedures. FHWA draft findings identified 4 of the 23 metrics as non-compliance. MDOT submitted a plan of corrective action and FHWA subsequently issued final findings noting the 4 metrics as conditional compliance (see Exhibit #1). Conditional compliance indicates that MDOT is required to take corrective action to achieve compliance for the Statewide program. In the 2012 through 2019 annual QA consultant reviews, 106 (41%) of 258 jurisdictions did not receive an effective rating for their QC processes.

To continue to improve its QC and QA practices, MDOT should:

a. Document QC and QA results in the Michigan Bridge Management and Inspection System* (MiBRIDGE) or elsewhere to provide MDOT with the means to monitor the effectiveness of QC from a Statewide perspective. Complete documentation would enable MDOT to more readily:

   - Track the dates and results of QA reviews to ensure that all jurisdictions are periodically reviewed.
   - Ensure that the appropriate number of QC reviews are performed for all bridge inspectors, or their consultants, requiring a QC review.
   - Verify that bridge owners, or their consultants, implemented additional QC procedures to remediate deficiencies discovered.
   - Monitor the completeness and quality of required QC documentation.

b. Continue to evaluate the results of the QA consultants' reviews and implement the common recommendations on a Statewide basis to help MDOT and the bridge owners achieve an effective QC rating. For example:

   (1) MDOT should create a checklist of bridge inspection file documentation needed for QA reviews.

** See glossary at end of report for definition.*

(2) Bridge owners, or their consultants, should ensure that their QC files contain all required documentation, such as QC plans and evidence that QC reviews were performed, field and file reviews were performed by an independent QTL, and the inspector and reviewer had professional certification.

MDOT informed us that it implemented QA consultant recommendations by discussing QC and QA at conferences and county road association meetings and by issuing bridge advisories*. A formal evaluation of the QA consultants' recommendations would help MDOT proactively identify and address the causes of QC deficiencies and the resources needed to implement them.

c. Provide bridge owners with additional training and tools to ensure that they, or their consultants, performed effective QC. Our survey of, and site visits to, local bridge jurisdictions disclosed that 23 (14%) of 168 bridge owners were not always aware of their responsibilities for performing QC. MDOT could expand its Local Bridge Owners Guide to include information on QC responsibilities; continue to update templates, forms, and checklists to inform bridge owners, or their consultants, how to implement QC best practices; and include on its Web site additional training, conference videos, and frequently asked questions for correcting identified QC deficiencies and improving QC processes.

d. Ensure that the QA consultants fully documented their QA reviews. All 5 of the quality assessment checklists reviewed did not include the QA consultant's verification of load rating engineer credentials. Also, MDOT did not ensure that bridge inspectors updated inspection records to include QA consultant comments related to bridge condition ratings.

After bringing this to management's attention, MDOT provided the credentials for 4 of the 5 engineers.

MDOT informed us that it followed up with bridge owners when the QA consultants identified safety issues; however, it did not have a policy to follow up with bridge owners or consultants who did not receive an effective QC assessment.

RECOMMENDATION

We recommend that MDOT continue to evaluate and improve its QC and QA practices over the State's bridge inspection program to help ensure increased accuracy and consistency of bridge inspection and load rating data.

** See glossary at end of report for definition.*

AGENCY PRELIMINARY RESPONSE

MDOT provided us with the following response:

MDOT agrees with the OAG's conclusion that it effectively administers the State's Bridge Inspection Program and agrees with the recommendation. MDOT administers the State's Bridge Inspection Program with a continual commitment to improvement.

Additionally, in regard to past FHWA reviews of MDOT's bridge inspection program, MDOT has always made proactive and reactive program modifications and developed policy that consistently results in FHWA findings of compliance and conditional compliance.

COMPLIANCE WITH SELECTED FEDERAL AND STATE REQUIREMENTS

BACKGROUND

NBIS defines a bridge as a structure including supports over a depression or obstruction, such as water, highway, or railway, that has a track or passageway for carrying traffic or other moving loads and an opening of more than 20 feet between ends. NBIS requires the inspection of bridges be completed in accordance with the inspection procedures in The Manual for Bridge Evaluation by the American Association of State Highway and Transportation Officials (AASHTO Manual). NBIS also requires that a bridge be rated for its safe load-carrying capacity in accordance with the AASHTO Manual. A bridge's safe load-carrying capacity is based on its current structural condition. As such, the AASHTO Manual requires that the bridge load rating be reviewed and updated to reflect any changes in the bridge's condition noted during the inspection.

During routine inspections*, inspectors assign National Bridge Inventory condition ratings to the three main structural elements of each bridge, ranging from 0 (failed) to 9 (excellent). The lowest rating assigned to each of these three elements serves as the bridge's overall condition rating.

NBIS requires the maintenance of bridge files and a bridge inventory to include appropriate data to allow assessment of the current bridge condition, including bridge inspection results and actions taken to address inspection findings.

NBIS also requires states to use QC and QA procedures to maintain a high degree of accuracy and consistency in the bridge inspection program. These procedures include bridge inspector refresher training, periodic field review of inspection teams, independent review of inspection reports, and validation of bridge inspection information such as load ratings and scour* assessments. NBIS allows states to delegate these functions; however, this does not relieve the State of any of its responsibilities. In Section 254.1 of the *Michigan Compiled Laws,* the Legislature delegated bridge inspection responsibilities, including QC, to bridge owners. Bridge owners, or their consultants, are required to ensure that QC is performed annually on all QTLs that they employ. MDOT uses QA consultants to periodically perform QA reviews for each bridge to determine whether bridge owners, or their consultants, are using effective QC to evaluate completed bridge inspections and load ratings. MDOT uses the results of these QA reviews to monitor QC effectiveness and implement corrective action for bridge owners and the overall bridge inspection program to timely remediate deficiencies identified that may affect the State's NBIS compliance.

** See glossary at end of report for definition.*

AUDIT OBJECTIVE

To assess MDOT's compliance with selected federal and State requirements for its bridge inspection program.

CONCLUSION

Complied, with exceptions.

FACTORS IMPACTING CONCLUSION

- Bridge owners and their consultants timely assigned, performed, and documented 98% of bridge inspections for the audit period.
- MDOT implemented a monthly process to validate that QTLs met federal credential and training requirements for performing bridge inspections and load ratings.
- MDOT established bridge inspection procedures for bridge owners and their consultants that included federal requirements and industry best practices.
- MiBRIDGE inspection records indicated that a different QTL performed the subsequent bridge inspection for 93% of inspections completed between calendar years 2014 and 2019.
- In 99% of the MiBRIDGE scour critical bridge* records, the required initial scour assessment and plan of action* were included.
- Survey responses from 139 bridge owners disclosed that 81% of respondents either strongly agreed or somewhat agreed that MDOT's QA review helped their jurisdiction to improve the quality of their bridge inspection program.
- Reportable condition related to the need for additional oversight of bridge owners (Finding #2).

** See glossary at end of report for definition.*

FINDING #2

Additional oversight of bridge owners needed.

MDOT should continue to improve its oversight to ensure that all bridge owners performed and completely documented their bridge inspection activities, such as QC, load rating, and scour assessments. Additional oversight will help improve the overall quality of the bridge inspection program and maintain compliance with NBIS.

MDOT developed the Michigan Structure Inspection Manual* (MiSIM) to provide guidance to bridge owners and inspectors for meeting the requirements of NBIS and Michigan's bridge inspection program policies and procedures. The goal of MiSIM is to clarify minimum requirements, inspection procedures, and documentation for completing bridge and structure inspections. MiSIM requires that bridge owners and consultants develop QC procedures and ensure that an independent QTL performs annual QC procedures on other QTLs who performed inspections or load ratings for the bridge owner.

We sampled 12 MDOT and local bridge owners from three regions to determine whether QC procedures were performed to independently verify bridge inspections and load ratings. For calendar year 2017, we also selected one bridge inspection from each sampled bridge owner who received a QC review to determine whether the required items were verified and documented in the QC bridge file. In addition, we randomly sampled 25 posted bridges* and 25 bridges requiring a scour evaluation to verify that documentation existed in the electronic or hard-copy bridge file of the proper load rating and minimum assessment of scour vulnerabilities, respectively. MDOT did not always ensure that:

a. Bridge owners, or their consultants, properly performed or documented QC reviews. We noted:

   - 1 (8%) of the 12 bridge owners did not maintain evidence that its consultant performed QC on the bridge inspector. The bridge owner informed us that a QC review was not performed by the consultant because of an oversight.

   - 1 (8%) of the 12 bridge owners did not ensure that an independent QTL performed the QC file review on one bridge.

   - For the 10 bridge owners that had a QC review performed, 1 (10%) did not retain a signed statement from its consultant substantiating the completion of QC reviews for each inspection team leader.

** See glossary at end of report for definition.*

- 3 (25%) of the 12 bridge owners did not maintain all required QC documentation to validate the results of the QC reviews. One of the 3 bridge owners did not maintain any documentation of its QC review. This bridge owner informed us that its consultant performed the QC review; however, the consultant did not provide documentation of the QC review. The missing documentation included requests for action, scour action plans, critical findings, photographs, and a log from each inspection with deck elevation and all poor elements.

b. Bridge owners maintained standard QC procedures. One (8%) of the 12 bridge owners did not document its consultant's QC procedures for annually evaluating bridge inspectors and load rating engineers who worked on its bridge inventory. Bridge owners use these procedures to verify that accurate data is collected by qualified individuals and immediately address deficiencies identified.

c. Bridge owners' consultant contracts specified the requirements of the QC reviews. Two (17%) of the 12 bridge owners did not ensure that its consultant contract specified the appropriate number of file and field reviews. Bridge owners must ensure that QC file reviews are performed on at least 5% of inspections and load ratings performed annually by each inspector or load rating engineer. The bridge owners must also ensure that QC field reviews are performed on at least 50% of the files reviewed. Although NBIS does not specify contract language for QC of bridge inspectors, accurate requirements help ensure that the bridge owner received the services for which it contracted.

d. Bridge owners maintained electronic or hard-copy bridge files containing complete documentation of load rating calculations. Two (8%) of the 25 load rating calculations did not include documentation in the hard-copy files of the engineer who performed the calculation and the engineer who checked the calculation.

   To ensure the accuracy of load rating calculations, MDOT requires bridge owners to identify both the engineer who completed the analysis and the engineer who reviewed the analysis, one of whom must be a licensed professional engineer in Michigan. According to Bridge Advisory 2019-03, MDOT implemented a policy requiring load ratings to be entered into MiBRIDGE. MDOT informed us that this policy will enable it to monitor load ratings entered into MiBRIDGE after May 2019 to automatically verify that the engineer who performed the load rating analysis is not the same engineer who reviewed the analysis and that one of the two is a licensed professional engineer in Michigan.

e. Bridge files contained an initial scour assessment. Five (20%) of the 25 bridge files did not contain an initial scour assessment. Documenting initial scour assessments for bridges over water helps local bridge owners develop and implement procedures for designing and inspecting bridges to address scour vulnerabilities to minimize safety concerns during a flood or high-water flow event.

FHWA identified similar deficiencies in its reviews for program years 2017 through 2019. MDOT informed us that it has implemented additional monitoring to improve bridge owner compliance with these items.

RECOMMENDATION

We recommend that MDOT continue to improve its oversight to ensure that all bridge owners perform and completely document their bridge inspection activities, such as QC, load ratings, and scour assessments.

AGENCY PRELIMINARY RESPONSE

MDOT provided us with the following response:

MDOT agrees that it should continue to improve its oversight efforts, consistent with its continuous improvement efforts.

MDOT has already augmented and implemented applicable policy and procedures to address the items in parts a., b., d., and e.

ACCESS, BACKUP, AND APPLICATION CONTROLS

BACKGROUND

Access controls* limit or detect inappropriate access to computer resources, thereby protecting the resources from unauthorized modification, loss, and disclosure. For access controls to be effective, they should be properly authorized, implemented, and maintained.

A backup is a copy of one or more data files created in case the original data file becomes lost or unusable. Regularly backing up data is considered to be one of the most cost-effective ways to mitigate service interruptions.

Application controls* help ensure that MiBRIDGE data is valid, properly authorized, and completely and accurately processed and reported.

AUDIT OBJECTIVE

To assess the effectiveness of MiBRIDGE access, backup, and application controls.

CONCLUSION

Moderately effective.

FACTORS IMPACTING CONCLUSION

- MDOT granted MiBRIDGE users appropriate access to complete bridge inspection program activities as of June 25, 2019.
- MDOT designed MiBRIDGE to facilitate the entry of bridge inspection and load rating data.
- MDOT, in conjunction with the Department of Technology, Management, and Budget (DTMB), performed routine backups of MiBRIDGE and its database as of September 2019.
- Reportable condition related to the need to fully establish and implement access and backup controls over MiBRIDGE to authorized users (Finding #3).

** See glossary at end of report for definition.*

FINDING #3

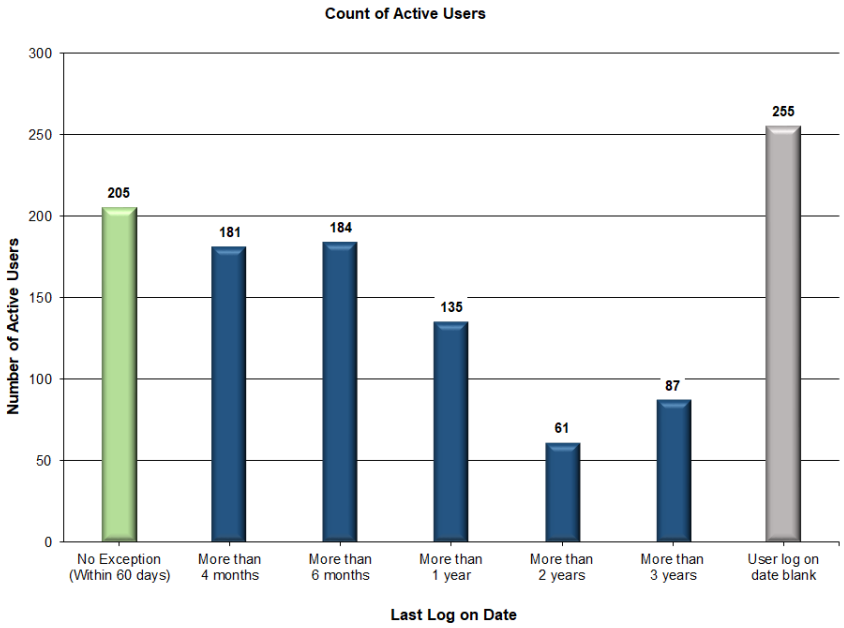
Additional MiBRIDGE access and backup controls needed.

MDOT, in conjunction with DTMB, did not fully establish and implement effective access and backup controls over MiBRIDGE to help ensure that only authorized users have access to bridge inspection and load rating data and minimize the risk of losing critical inspection data in the event of a system failure.

MDOT, in conjunction with DTMB, did not:

a. Disable inactive MiBRIDGE accounts in accordance with the State of Michigan (SOM) Technical Standard 1340.00.020.01. The Standard requires that State agencies annually review access rights for continued appropriateness and disable accounts that are inactive for more than 60 days.

   The following table presents the number of days since 1,108 users accessed their MiBRIDGE accounts:



   Specifically, 648 (58%) accounts had not been accessed in more than 120 days. Also, 255 (23%) accounts did not have a last log on date; therefore, we could not determine when those users last accessed MiBRIDGE. Upon bringing this matter to DTMB's attention, DTMB informed us that it inadvertently deleted the ability to capture the last log on date and time and would reestablish that capability.

b. Ensure that MiBRIDGE access was removed timely when individuals left State employment. SOM Technical Standard 1340.00.020.01 requires MDOT to notify DTMB within 24 hours when users are terminated or transferred or immediately based on system data classification or after an unfriendly separation. We identified 24 (2%) active accounts that belonged to departed employees. None of

the employees accessed MiBRIDGE after their departure date.

c. Implement procedures for periodically reviewing and recertifying user rights to ensure that access remained appropriate based on the user's job responsibilities. Because MiBRIDGE users are decentralized across the State, MDOT should coordinate its review with the local bridge owners.

d. Fully test DTMB's ability to restore the MiBRIDGE database from backup files. SOM Technical Standard 1340.00.070.01 requires application owners to ensure that backup information is tested at least annually to verify the reliability of backup media and information integrity.

   DTMB provided us with documentation that the database administrators regularly restored point-in-time images of the MiBRIDGE database to its test environment. However, during the audit period, DTMB did not test its ability to restore the database using transactional backup files. Transactional backup files are important because some bridge inspectors input their inspection results directly into MiBRIDGE without maintaining hard-copy source documents. In the event of a system failure, bridges may need to be reinspected if data is lost and cannot be restored.

RECOMMENDATION

We recommend that MDOT, in conjunction with DTMB, fully establish and implement effective access and backup controls over MiBRIDGE.

AGENCY PRELIMINARY RESPONSE

MDOT provided us with the following response:

MDOT agrees with the recommendation and, considering the existence of hundreds of potential users who are dispersed across the State in local agencies, will correspondingly explore its options on complying with the intent of the requirements, or seek to obtain a waiver from DTMB of the requirements.

SUPPLEMENTAL INFORMATION

UNAUDITED
Exhibit #1

BRIDGE INSPECTION PROGRAM AND MIBRIDGE
Michigan Department of Transportation (MDOT)

Final Status of FHWA's 23 Bridge Inspection Metric Reviews After MDOT Submitted PCAs
For Program Years 2017 Through 2019

Metric		Program Year Compliance*		
Number	Description	2017	2018	2019
1	Bridge Inspection Organization	C	C	C
2	Qualifications of Personnel - Program Manager	C	C	C
3	Qualifications of Personnel - Team Leader(s)	SC	C	SC
4	Qualifications of Personnel - Load Rating Engineer	C	C	C
5	Qualifications of Personnel - UW (Underwater) Bridge Inspection Diver	C	C	C
6	Inspection Frequency - Routine - Lower Risk Bridges	SC	SC	SC
7	Inspection Frequency - Routine - Higher Risk Bridges	SC	SC	SC
8	Inspection Frequency - Underwater - Lower Risk Bridges	C	C	C
9	Inspection Frequency - Underwater - Higher Risk Bridges	C	C	C
10	Inspection Frequency - Fracture Critical Member	C	C	C
11	Inspection Frequency - Frequency Criteria	C	C	C
12	Inspection Procedures - Quality Inspections	SC	C	SC
13	Inspection Procedures - Load Rating	C	CC(1)	CC
14	Inspection Procedures - Post or Restrict	C	CC(1)	CC
15	Inspection Procedures - Bridge Files	CC(1)	CC	CC(1)
16	Inspection Procedures - Fracture Critical Members	C	C	C
17	Inspection Procedures - Underwater	C	C	C
18	Inspection Procedures - Scour Critical Bridges	SC	CC(1)	CC
19	Inspection Procedures - Complex Bridges	SC	SC	C
20	Inspection Procedures - QC and QA	C	C	C
21	Inspection Procedures - Critical Findings	C	C	C
22	Inventory - Prepare and Maintain	C	C	C
23	Inventory - Timely Updating of Data	SC	C	C

*Compliance Highlights and Definitions:

C -	Compliance - Adheres to NBIS regulations.
SC -	Substantial Compliance - Adheres to NBIS regulations with minor deficiencies. Deficiencies to be corrected within 12 months unless related to issues that would more efficiently be corrected during the next inspection.
CC -	Conditional Compliance - Taking corrective action with FHWA-approved plan of corrective action (PCA).
CC(1) -	FHWA initially identified this metric status as noncompliance and, upon MDOT's submission of a PCA, FHWA recharacterized the metric status to conditional compliance.

Source: The OAG created this exhibit using data compiled from the U.S. Department of Transportation, Metrics for the Oversight of the National Bridge Inspection Program, and FHWA Reviews of Michigan for program years 2017, 2018, and 2019.

Exhibit #2

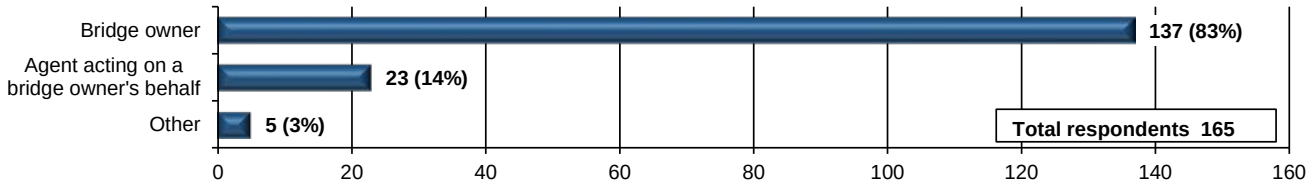
BRIDGE INSPECTION PROGRAM AND MIBRIDGE
Michigan Department of Transportation (MDOT)

Bridge Owner Quality Control and Quality Assurance Survey Results

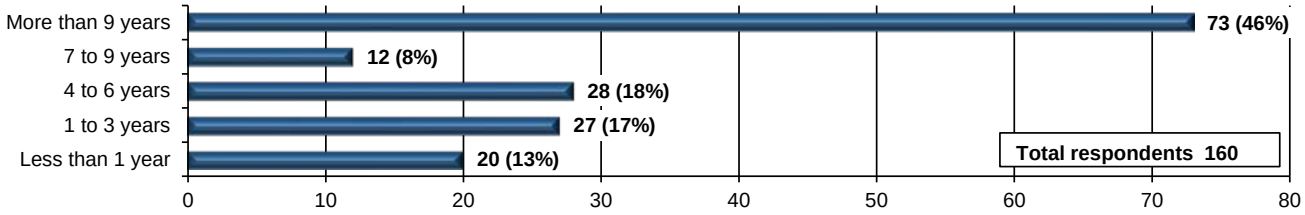
165 Respondents
425 Total recipients of survey
39% Response Rate

GENERAL QUESTIONS

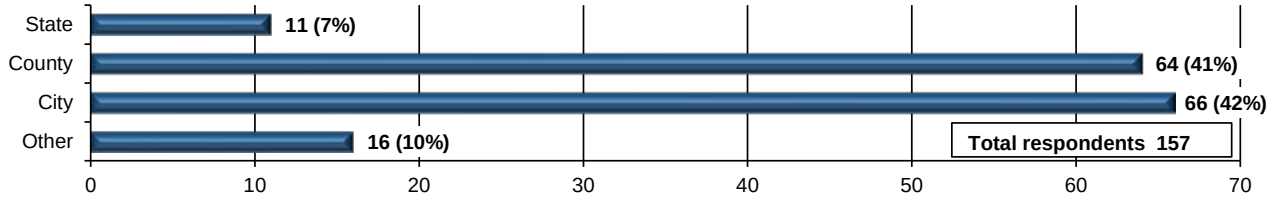
1. What is your role in the bridge inspection process?



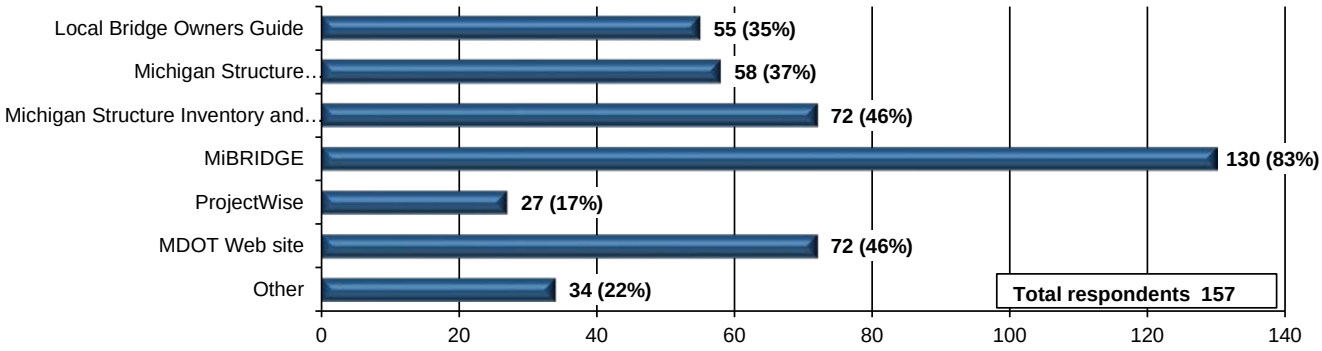
2. How long have you been identified as a bridge owner, or an agent acting on a bridge owner's behalf, at your current jurisdiction?



3. What is your jurisdiction of bridge ownership?



4. Which of the following resources do you use to aid in the bridge inspection process? (Select all that apply.)



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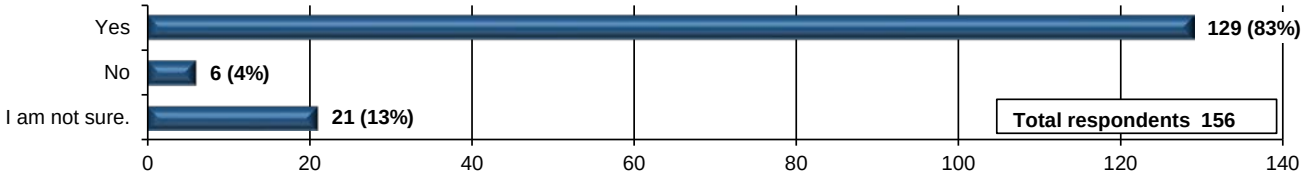
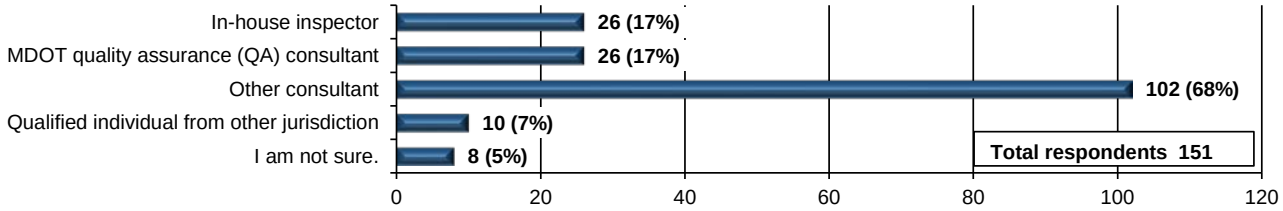
QUALITY CONTROL

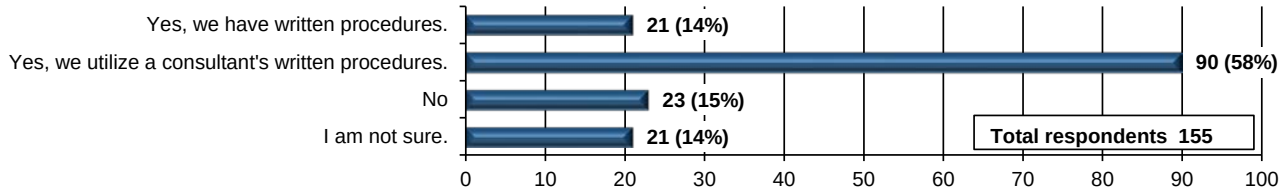
5. Does your jurisdiction, or an agent acting on your behalf, perform quality control reviews?



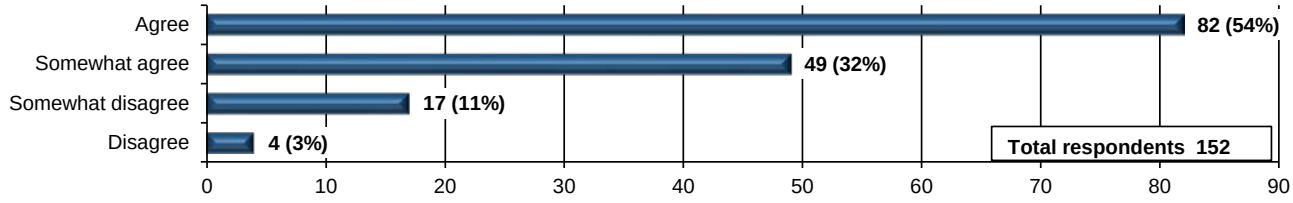
6. Who performs your quality control reviews? (Select all that apply.)



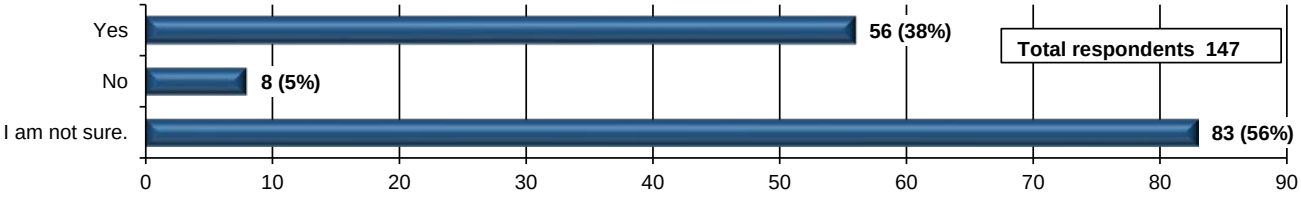
7. Does your jurisdiction have written quality control procedures?



8. MDOT has provided clear guidance regarding items that owners are required to include in their quality control procedures. (Please indicate your level of agreement.)



9. Did MDOT review and approve the quality control procedures that you utilize?



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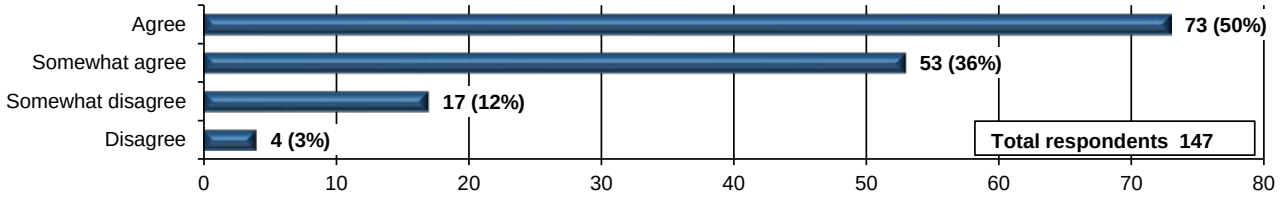
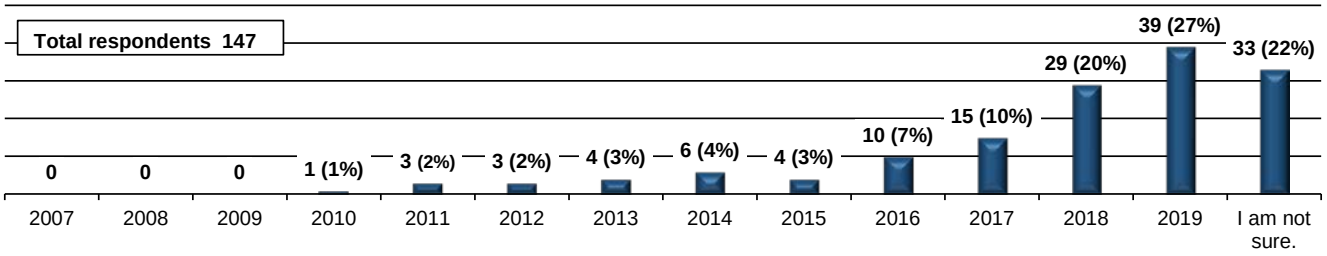
10. MDOT has provided sufficient guidance regarding delegated bridge owner quality control responsibilities. (Please indicate your level of agreement.)

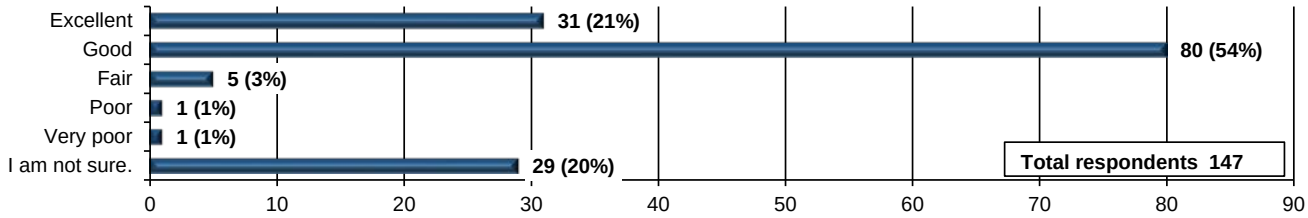


QUALITY ASSURANCE

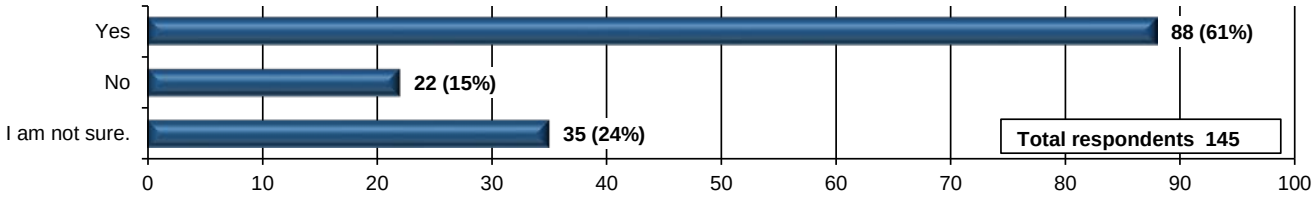
11. Please provide the last known year that MDOT, or the QA consultant, conducted either a quality assurance review or quality control review at your jurisdiction.



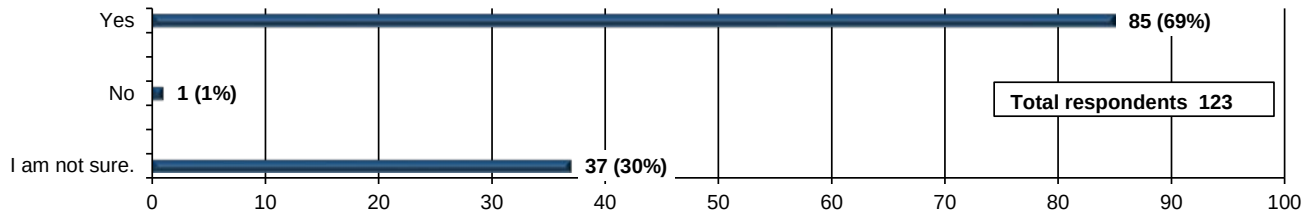
12. How would you rate the quality of the feedback provided by MDOT or the QA consultant who performed your most recent review?



13. Did your most recent review result in recommendations?



14. Did your jurisdiction implement those recommendations?



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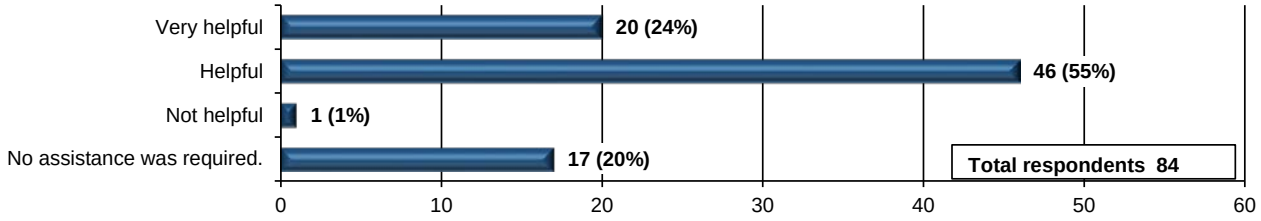
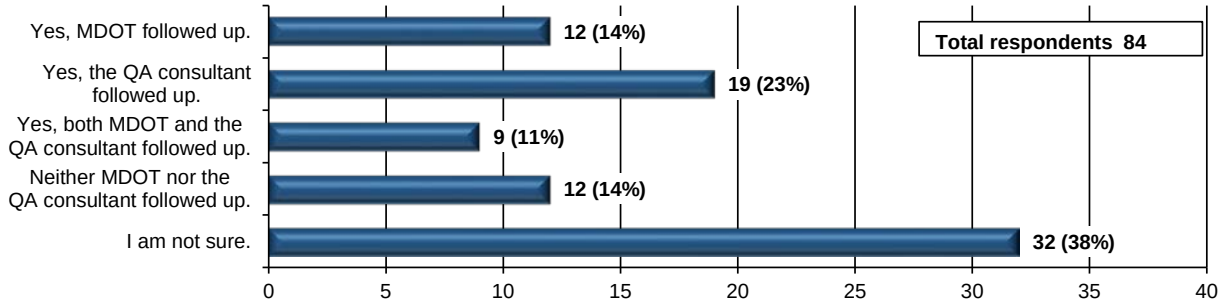
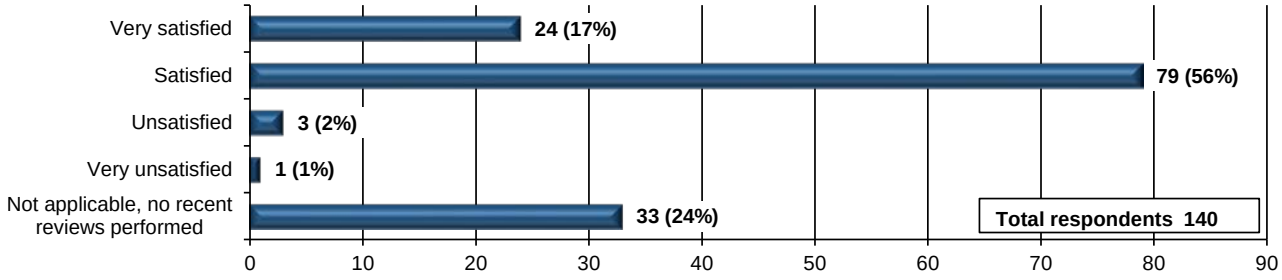
15. How would you rate MDOT's assistance with implementing the recommendations?



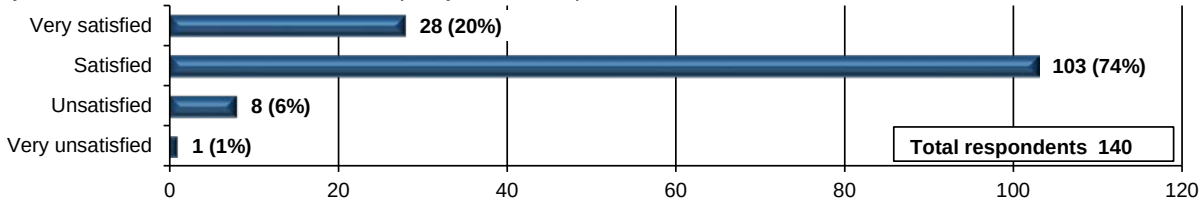
16. Did MDOT or the QA consultant follow up to determine whether your jurisdiction had implemented the recommendations?



17. Please rate your overall satisfaction with MDOT or the QA consultant's assistance with follow-up after the most recent review.



18. Please rate your overall satisfaction with MDOT's quality assurance process.



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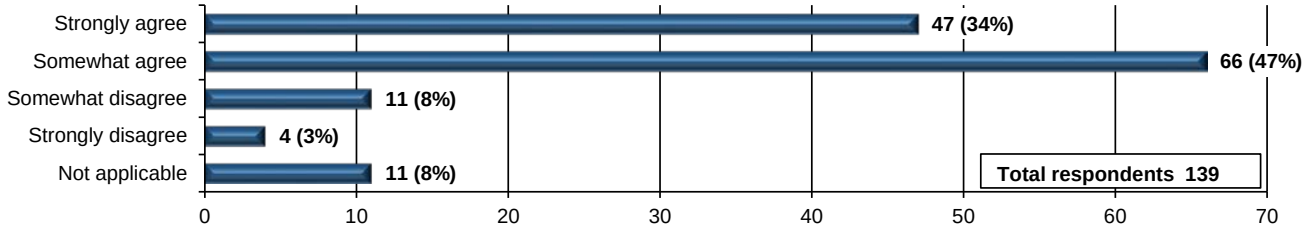
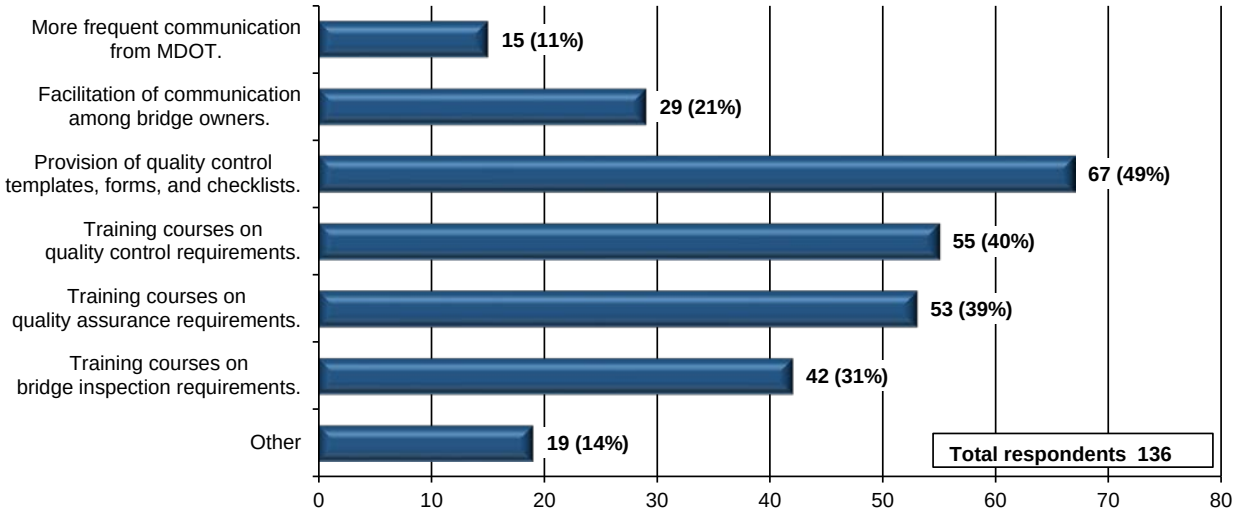
19. The quality assurance review helps my jurisdiction to improve the quality of the bridge inspection program. (Please indicate your level of agreement.)



ADDITIONAL INFORMATION

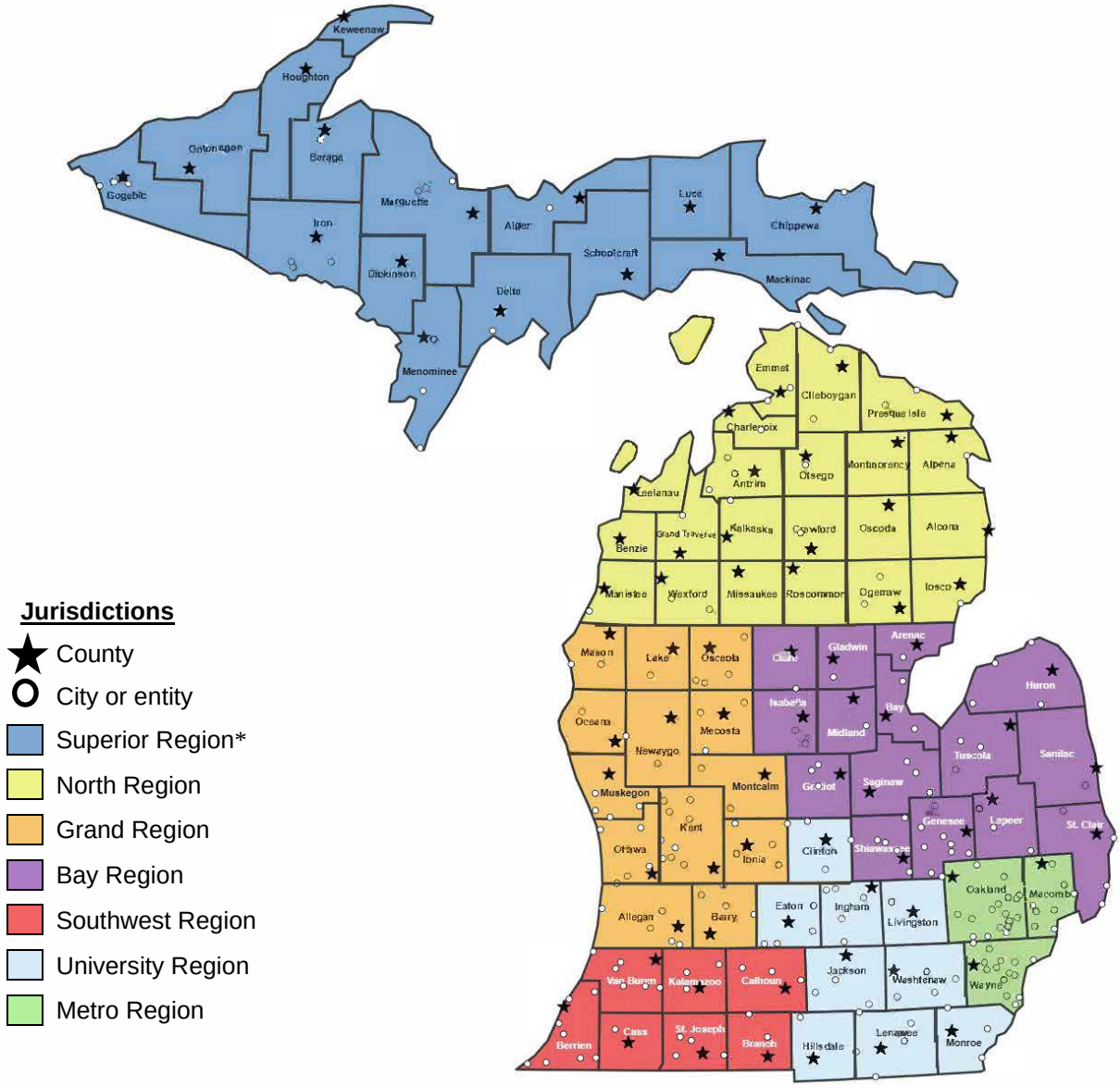
20. Please select the areas for which you would like additional guidance or assistance from MDOT to improve the bridge inspection quality control and quality assurance processes. (Select all that apply.)



Source: The OAG created this exhibit to summarize all responses from bridge owners regarding quality control and quality assurance.

BRIDGE INSPECTION PROGRAM AND MIBRIDGE
Michigan Department of Transportation

MDOT Region Map, Including Bridge Locations of QC and QA Reviews
Years 2007 Through 2020



Jurisdictions

- ★ County
- O City or entity
- Superior Region*
- North Region
- Grand Region
- Bay Region
- Southwest Region
- University Region
- Metro Region

To view the interactive map with more detail, click the link: https://audgen.michigan.gov/591-0169-19-map/

*MDOT planned to conduct QA reviews in the Superior Region in 2020.

Source: The OAG created this map using data from the 2007 through 2017 Quality Assurance Review of Safety Inspections for MDOT and Local Agency Bridges, QA consultant work plans for the 2018-2019 review period, MDOT's 2020 QA review plan for the Superior Region, and QA consultant reviews performed in the Grand Region in 2020.

PROGRAM AND SYSTEM DESCRIPTION

Title 23, Part 650, sections 301 through 317 of the *Code of Federal Regulations*, referred to as NBIS, requires MDOT to administer the State's bridge inspection program to meet federal requirements for highway bridges located on public roads that are longer than 20 feet. The bridge inspection program is critical to ensuring the safety of Michigan highway bridges, identifying repair and maintenance needs, and determining the appropriate allocation of MDOT bridge funds. On July 21, 2017, MDOT reorganized its existing bridge resources and functions into the Bureau of Bridges and Structures (BOBS) to centralize and streamline decision-making over the life of Michigan's bridges and structures from design to operations. According to BOBS, as of June 16, 2020, there were 11,212 bridges in Michigan, including approximately 4,500 owned and inspected by the State and 6,700 owned and inspected by local bridge owners. In fiscal year 2018, these owners inspected, or caused to be inspected, 6,385 bridges. In fiscal year 2019, MDOT expended approximately $2.6 million to operate the bridge inspection program.

BOBS is responsible for establishing Statewide procedures related to bridge inspections, load rating calculations, QC and QA procedures, and other NBIS program requirements. Bridge inspections include the process to observe the condition of the bridge, identify any changes, ensure that the structure continues to satisfy present service requirements, and update the inventory. Load rating calculations determine the carrying capacity of a bridge. QC and QA procedures are intended to reduce inconsistency and minimize the differences in bridge inspection results among staff and consultants performing the bridge inspections and load ratings to ensure that MDOT obtains precise data in MiBRIDGE.

In June 2009, the Transportation Research Board released its Guideline for Implementing Quality Control and Quality Assurance for Bridge Inspection that identified the following characteristics of effective QC and QA programs:

- Independent reviews
- Objective and quantitative measures of quality
- Quality program documentation
- Comprehensive coverage of the inspection and load rating program
- Established procedures for corrective actions
- Established schedule for evaluations
- Documented review procedures

Federal regulations allow states to delegate QC and QA responsibility to bridge owners or their consultants. However, MDOT remains responsible for compliance with NBIS. Section 254.1 of the *Michigan Compiled Laws* delegates the

responsibility for performing QC procedures to bridge owners including MDOT engineers in the seven regions; BOBS for State-owned bridges; and counties, cities, villages, or township jurisdictions for non-State-owned bridges.

MiBRIDGE is MDOT's primary source of bridge-related data, including plan drawings, photographs, safety inspection reports, load ratings, scour assessments and plans of action, and critical findings. MiBRIDGE is used by bridge inspectors and bridge management personnel to maintain an inventory of all bridges as required by NBIS. MiBRIDGE is also used by local bridge owners, consultants, and the public.

AUDIT SCOPE, METHODOLOGY, AND OTHER INFORMATION

AUDIT SCOPE

To examine the records and processes of the bridge inspection program and MiBRIDGE. We conducted this performance audit* in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

PERIOD

Our audit procedures, which included a preliminary survey, audit fieldwork, report preparation, analysis of agency responses, and quality assurance, generally covered October 1, 2016 through June 30, 2020.

METHODOLOGY

We conducted a preliminary survey of the bridge inspection program and MiBRIDGE. During our preliminary survey, we:

- Interviewed MDOT management and staff to obtain an understanding of their responsibilities and activities related to the State's bridge inspection program, including inspection and QC and QA procedures.
- Reviewed federal regulations, industry best practices, manuals, contracts, and guidance applicable to MDOT's operations regarding bridge inspections and load ratings.
- Analyzed the results of FHWA's 23 bridge inspection metric reviews for program years 2017 through 2019 to determine the State's compliance with NBIS. We also reviewed MDOT's plans of corrective action* (PCAs).
- Obtained an understanding of MDOT's QTL process and validated if key staff were properly credentialed and trained as of August 9, 2019.
- Obtained an understanding of MDOT's QC activities delegated to bridge owners.
- Obtained an understanding of MDOT's QA process by interviewing MDOT personnel and reviewing contracts, weekly reports, and the 2017 annual report of the QA consultant.
- Performed preliminary testing of selected inspection procedures in MiSIM to identify potential risk areas for review.

** See glossary at end of report for definition.*

- Obtained an understanding of MiBRIDGE.
- Interviewed MDOT and DTMB personnel responsible for MiBRIDGE processes, including establishing user access.
- Reviewed SOM IT technical policies, standards, and procedures for MiBRIDGE. We also reviewed industry best practices.

OBJECTIVE #1

To assess the effectiveness of MDOT's efforts to administer its QC and QA program over bridge inspections and load ratings.

To accomplish this objective, we:

- Surveyed 425 bridge owners in MIBRIDGE as of July 29, 2019 to assess their opinion of MDOT's QC and QA practices for the bridge inspection program (see Exhibit #2).
- Reviewed qualifications of all 3 MDOT bridge inspection program managers for the audit period to determine federal NBIS compliance.
- Compared MiSIM QC and QA policies and procedures for alignment with federal laws and regulations, industry best practices, and QA consultant contracts.
- Interviewed one of MDOT's QA consultants to obtain an understanding of oversight of QC and QA in MDOT's bridge inspection program.
- Analyzed the 10 QA consultant annual reports completed between 2007 and 2017 and 2 QA consultant work plans for the 2018-2019 review period to determine the QC or QA reviews performed. We also reviewed MDOT's QA review plan for the Superior and Grand Regions for 2020 and the 24 QA consultants' reviews performed in the Grand Region in 2020 (see Exhibit #3).
- Assessed MDOT's efforts to follow up QA consultant recommendations to MDOT and bridge owners and implement corrective actions to improve the bridge inspection program.
- Randomly sampled 5 of the 26 QA reviews that the consultant conducted between August 2016 and January 2018 for compliance with selected MiSIM contract provisions.
- Reviewed QA consultant quarterly and weekly reports to evaluate if MDOT used this documentation to provide oversight of activities performed. We analyzed the 6 quarterly reports that MDOT received from the 2 QA

consultants between April and December 2019. We also analyzed 5 of the 14 weekly reports that MDOT indicated that it received from the 2 QA consultants in a random and judgmental sample of 7 of 27 weeks between April 1, 2019 and October 7, 2019. Because we judgmentally sampled the population of weeks to review, we could not project our results to the entire population of weekly reports received for the year.

- Analyzed QA consultant expenditures and supporting documentation for 29 invoices dated December 11, 2018 through December 3, 2019 to determine proper documentation, approval, and payment.

- Evaluated MDOT's process to monitor QC and QA for bridge owners in the bridge inspection program.

- Assessed reasonableness of MDOT's progress in implementing PCAs for FHWA-noted noncompliance.

Our random samples were selected to eliminate bias and enable us to project the results to the respective populations.

OBJECTIVE #2

To assess MDOT's compliance with selected federal and State requirements for its bridge inspection program.

To accomplish this objective, we:

- Evaluated MDOT's process to monthly validate bridge inspector credentials.

- Inquired of bridge owners regarding MDOT's communication of MiSIM bridge inspection policies and procedures.

- Judgmentally sampled and performed site visits, including interviews, of 12 of 69 bridge owners within 3 of 7 MDOT regions who are responsible for varying numbers of bridges and with bridge inspections performed in calendar year 2017 to obtain an understanding of their processes and assess their opinions regarding the State's QA and QC program. We also reviewed one arbitrarily selected 2017 bridge inspection from each bridge owner to review QC documentation for compliance with MiSIM. We judgmentally selected these 3 regions, and the 4 bridge owners within those regions, that were not subject to a QA review during the audit period. Because we judgmentally sampled the bridge owners, we could not project our results to the entire population.

- Randomly sampled 25 of the 1,038 posted bridges in MiBRIDGE as of August 15, 2019 to assess whether the

load ratings documented in the bridge file were complete and consistent with the bridge's load-carrying capacity.

- Randomly sampled 25 of 8,164 structures identified as bridges over water in MiBRIDGE as of August 15, 2019 to assess whether bridge owners performed and documented initial scour assessments of the bridge's susceptibility to water erosion over its lifetime.

- Analyzed the 1,601 bridges identified as scour critical in MiBRIDGE as of August 20, 2019 to determine whether the bridge file contained the required initial scour assessment and scour plan of action.

- Analyzed the population of 34,662 routine inspections documented in MiBRIDGE from January 2014 to August 2019 to determine whether bridge owners rotated inspectors on subsequent inspections.

- Analyzed the population of 19,166 bridge inspections in MiBRIDGE from October 1, 2016 to August 15, 2019 to determine whether they were timely assigned and performed. We also analyzed the dates that bridge inspectors created inspection documentation in MiBRIDGE to determine if they entered results within 30 days of the inspection.

Our random samples were selected to eliminate bias and enable us to project the results to the respective populations.

OBJECTIVE #3

To assess the effectiveness of MiBRIDGE access, backup, and application controls.

To accomplish this objective, we:

- Validated whether users and user groups had proper access and log on capabilities to MiBRIDGE.

- Validated whether inactive MiBRIDGE user accounts were timely disabled. We also analyzed e-mail addresses of MiBRIDGE user accounts to determine whether user access was disabled after leaving State employment.

- Obtained an understanding of MDOT and bridge owner opinions regarding MiBRIDGE.

- Reviewed the MiBRIDGE backup and recovery processes.

- Randomly sampled and tested 25 daily backups between September 3, 2018 and September 2, 2019 on the three MiBRIDGE servers to determine whether the backup files were successfully created and recovery testing was performed. Our random sample was

selected to eliminate bias and enable us to project the results to the respective populations.

CONCLUSIONS

We base our conclusions on our audit efforts and any resulting material conditions* or reportable conditions.

When selecting activities or programs for audit, we direct our efforts based on risk and opportunities to improve State government operations. Consequently, we prepare our performance audit reports on an exception basis.

AGENCY RESPONSES

Our audit report contains 3 findings and 3 corresponding recommendations. MDOT's preliminary response indicates that it agrees with all of the recommendations.

The agency preliminary response that follows each recommendation in our report was taken from the agency's written comments and oral discussion at the end of our fieldwork. Section 18.1462 of the *Michigan Compiled Laws* and the State of Michigan Financial Management Guide (Part VII, Chapter 4, Section 100) require an audited agency to develop a plan to comply with the recommendations and to submit it to the State Budget Office upon completion of an audit. Within 30 days of receipt, the Office of Internal Audit Services, State Budget Office, is required to review the plan and either accept the plan as final or contact the agency to take additional steps to finalize the plan.

** See glossary at end of report for definition.*

PRIOR AUDIT FOLLOW-UP

Following is the status of the reported findings from our March 2015 performance audit of the Bridge Inspection Program, Michigan Department of Transportation (591-0169-14):

Prior Audit Finding Number	Topic Area	Current Status	Current Finding Number
1	Risk-Based Bridge Inspection Frequencies	Not in scope of this audit.	
2	Plans of Action for Scour Critical Bridges	Not in scope of this audit.	
3	Inspection Frequencies for Structurally Deficient Bridges	Not in scope of this audit.	
4	Inspection Timeliness	Complied	Not applicable
5	False Decking	Not in scope of this audit.	

SUPPLEMENTAL INFORMATION

Our audit report includes supplemental information presented as Exhibits #1 through #3. Our audit was not directed toward expressing a conclusion on Exhibits #1 and #3. Exhibit #2 supported the conclusions to the first and second audit objectives.

GLOSSARY OF ABBREVIATIONS AND TERMS

AASHTO Manual	The Manual for Bridge Evaluation by the American Association of State Highway and Transportation Officials.
access controls	Controls that protect data from unauthorized modification, loss, or disclosure by restricting access and detecting inappropriate access attempts.
application controls	Controls that are directly related to individual computer applications. These controls help ensure that transactions are valid, properly authorized, and completely and accurately processed and reported.
BOBS	Bureau of Bridges and Structures.
bridge advisories	MDOT's communication providing guidance regarding bridge safety; inspection; management; and load rating to its regions, bridge owners, and consultants.
bridge owner	A State department or local agency to whom the Legislature delegated the responsibility to ensure that bridge safety inspections, load rating calculations, and QC activities are performed for Michigan bridges within their areas.
DTMB	Department of Technology, Management, and Budget.
effectiveness	Success in achieving mission and goals.
FHWA	Federal Highway Administration.
IT	information technology.
jurisdiction	The physical location of bridges within a bridge owner's authority.
load rating	The determination of the load-carrying capacity of a bridge using bridge plans and supplemented by information gathered from a field inspection.
material condition	A matter that, in the auditor's judgment, is more severe than a reportable condition and could impair the ability of management to operate a program in an effective and efficient manner and/or

	could adversely affect the judgment of an interested person concerning the effectiveness and efficiency of the program. Our assessment of materiality is in relation to the respective audit objective.
MDOT	Michigan Department of Transportation.
metrics	Minimum standards established by FHWA to assess the condition of the nation's bridges, measure compliance with NBIS requirements, and promote consistency among the states in measurement and reporting.
Michigan Bridge Management and Inspection System (MiBRIDGE)	A Web-based structure management application allowing bridge owners, engineers, inspectors, consultants, and managers to view and enter information for bridge and culvert assets across the State of Michigan.
Michigan Structure Inspection Manual (MiSIM)	Michigan guidance to bridge owners, or consultants, to meet federal NBIS requirements and Michigan's bridge inspection program policies and procedures.
National Bridge Inspection Standards (NBIS)	Federal regulations (specifically, Title 23, Part 650, sections 301 through 317 of the *Code of Federal Regulations*) establishing requirements for inspection procedures, frequency of inspections, qualifications of personnel, inspection reports, and preparation and maintenance of bridge inventory records.
performance audit	An audit that provides findings or conclusions based on an evaluation of sufficient, appropriate evidence against criteria. Performance audits provide objective analysis to assist management and those charged with governance and oversight in using the information to improve program performance and operations, reduce costs, facilitate decision-making by parties with responsibility to oversee or initiate corrective action, and contribute to public accountability.
plan of action	A plan to monitor known and potential deficiencies and to address critical findings caused by scour.
plan of corrective action (PCA)	MDOT action taken resulting from FHWA deficiencies noted during the annual review of bridge inspection metrics.
posted bridge	A bridge where the maximum unrestricted legal load-carrying capacity or State routine permit load exceeds the load-carrying capacity allowed under its operating rating.

program manager	The individual responsible for the bridge inspection program who has been assigned or delegated the duties and responsibilities for bridge inspection, reporting, and inventory. The program manager provides overall leadership and is available to inspection team leaders to provide guidance.
qualified team leader (QTL)	The individual in charge of an inspection team who is responsible for planning, preparing, and performing the field inspection of the bridge.
quality assurance (QA)	The use of sampling or other measures to evaluate bridge owner's, or their consultant's, QC effectiveness to verify the quality level of the entire bridge inspection and load rating program. These reviews identify deficiencies that MDOT and the bridge owner, or their consultants, can correct by changes to the overall program, including requirements, procedures, training, or guidelines.
quality control (QC)	An internal check by the bridge owner, or their consultant, to maintain the quality of bridge inspections and load ratings at or above a specified level. These reviews identify and correct errors, inconsistencies, or omissions in specific bridge inspections or load ratings performed by the bridge owner or their consultant.
reportable condition	A matter that, in the auditor's judgment, is less severe than a material condition and falls within any of the following categories: an opportunity for improvement within the context of the audit objectives; a deficiency in internal control that is significant within the context of the audit objectives; all instances of fraud; illegal acts unless they are inconsequential within the context of the audit objectives; significant violations of provisions of contracts or grant agreements; and significant abuse that has occurred or is likely to have occurred.
routine inspection	A regularly scheduled inspection consisting of observations and/or measurements needed to determine the physical and functional condition of the bridge, to identify any changes from initial or previously recorded conditions, and to ensure that the structure continues to satisfy present service requirements.
scour	Erosion of streambed or bank material due to flowing water often localized around piers and bridge abutments.
scour critical bridge	A bridge with a foundation element that has been determined to be unstable for the observed or evaluated scour condition.
SOM	State of Michigan.

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