



# MICHIGAN

OFFICE OF THE AUDITOR GENERAL

## AUDIT REPORT



THOMAS H. MCTAVISH, C.P.A.  
AUDITOR GENERAL

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.

– Article IV, Section 53 of the Michigan Constitution

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Michigan  
*Office of the Auditor General*  
**REPORT SUMMARY**

*Performance Audit*

Report Number:  
591-0169-08

*Bridge Inspection Program*

*Michigan Department of Transportation (MDOT)*

Released:  
May 2010

*MDOT must inspect, or cause to be inspected, all State-owned and locally owned highway bridges that are at least 20 feet long and located on public roads in accordance with various State and federal requirements. MDOT staff inspect State-owned bridges. MDOT delegated responsibility for inspecting locally owned bridges to their respective owners, including cities, villages, townships, and counties. As of March 28, 2010, MDOT records reflected that there were 4,404 State-owned bridges and 6,356 locally owned bridges requiring inspections at least every two years.*

This is our reissued report on the performance audit of the Bridge Inspection Program, Michigan Department of Transportation. This report contains updated unaudited information on the overall condition ratings of bridges in Michigan (as of March 28, 2010) in Exhibits 2, 3, 4, and 5 but does not change any of the audit's objectives, conclusions, findings, or recommendations.

***Audit Objective:***

To assess the effectiveness of MDOT's efforts to ensure that bridge inspections and load ratings are completed in compliance with selected State and federal requirements.

***Audit Conclusion:***

We concluded that MDOT was not effective in ensuring that bridge inspections and load ratings were completed in compliance with selected State and federal requirements. We noted three material conditions (Findings 1 through 3) and one reportable condition (Finding 4).

***Material Conditions:***

MDOT did not complete or ensure the completion of all scour evaluations and plans of action for scour critical bridges (Finding 1).

MDOT did not ensure that local bridge owners and MDOT regional offices completed some routine bridge inspections and inspections of the underwater structural elements of bridges in a timely manner. In addition, MDOT often did not document its follow-up activity or the rationale for its lack of follow-up activity related to late or potentially late bridge inspections. (Finding 2)

MDOT did not ensure that qualified team leaders (QTLs) complied with MDOT's bridge inspection frequency guidelines at all times. Also, MDOT did not regularly monitor the appropriateness of the bridge inspection frequencies and load ratings for bridges experiencing significant deterioration. In addition, MDOT did not ensure that QTLs adequately described the physical deterioration of poorly rated

bridges in the Michigan Bridge Inspection System (MBIS). (Finding 3)

**Reportable Condition:**

MDOT did not inspect the underside of some bridges with false decking nor did its procedures require this inspection. Also, MDOT did not ensure that all bridges with false decking were correctly identified in MBIS. In addition, MDOT did not ensure that its QTLs correctly reported their inspection results for bridges with false decking into MBIS. (Finding 4)

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**Audit Objective:**

To assess the effectiveness of MDOT's efforts to ensure that bridge inspections are completed by qualified persons.

**Audit Conclusion:**

We concluded that MDOT was moderately effective in ensuring that bridge inspections were completed by qualified persons. We noted one reportable condition (Finding 5).

**Reportable Condition:**

MDOT did not ensure that some inspection team leaders met State and federal QTL requirements (Finding 5).

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**Agency Response:**

Our audit report contains 5 findings and 10 corresponding recommendations. MDOT's preliminary responses indicate that it concurs with all 10 of the recommendations.

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A copy of the full report can be obtained by calling 517.334.8050 or by visiting our Web site at: <http://audgen.michigan.gov>



Michigan Office of the Auditor General  
201 N. Washington Square  
Lansing, Michigan 48913

**Thomas H. McTavish, C.P.A.**  
Auditor General

**Scott M. Strong, C.P.A., C.I.A.**  
Deputy Auditor General



STATE OF MICHIGAN  
OFFICE OF THE AUDITOR GENERAL  
201 N. WASHINGTON SQUARE  
LANSING, MICHIGAN 48913  
(517) 334-8050  
FAX (517) 334-8079

THOMAS H. MCTAVISH, C.P.A.  
AUDITOR GENERAL

May 21, 2010

Mr. Ted B. Wahby, Chair  
State Transportation Commission  
and  
Kirk T. Steudle, P.E., Director  
Michigan Department of Transportation  
Murray Van Wagoner Transportation Building  
Lansing, Michigan

Dear Mr. Wahby and Mr. Steudle:

This is our reissued report on the performance audit of the Bridge Inspection Program, Michigan Department of Transportation. This report contains updated unaudited information on the overall condition ratings of bridges in Michigan (as of March 28, 2010) in Exhibits 2, 3, 4, and 5 but does not change any of the audit's objectives, conclusions, findings, or recommendations.

This report contains our report summary; description of agency; audit objectives, scope, and methodology and agency responses; comments, findings, recommendations, and agency preliminary responses; six exhibits, presented as supplemental information; and a glossary of acronyms and terms.

Our comments, findings, and recommendations are organized by audit objective. The agency preliminary responses were taken from the agency's responses subsequent to our audit fieldwork. The *Michigan Compiled Laws* and administrative procedures require that the audited agency develop a formal response within 60 days after release of the audit report.

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

AUDITOR GENERAL



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## Description of Agency

Title 23, Part 650 of the *Code of Federal Regulations*, hereinafter referred to as the National Bridge Inspection Standards\* (NBIS), requires the Michigan Department of Transportation (MDOT) to inspect, or cause to be inspected, all State-owned and locally owned\* highway bridges\* located on public roads that are fully or partially located within the State. The primary purpose of NBIS is to ensure the safety of the traveling public. NBIS applies to bridges that are at least 20 feet long. Also, Section 254.19a of the *Michigan Compiled Laws* requires MDOT to institute a biennial inspection of all bridges under its jurisdiction. In accordance with these requirements, the Bridge Operations Section within MDOT's Construction and Technology Division administers the Bridge Inspection Program.

NBIS governs the type, timeliness, and scope of bridge inspections and establishes requirements for bridge load ratings\*, qualified team leader\* (QTL) training and education, quality control initiatives, recordkeeping, and other items. The two most common types of inspections are routine\* and underwater\* bridge inspections. Additional types of inspections include fracture critical member\*, hands-on\*, and initial\* inspections. During a routine inspection, QTLs rate a bridge's primary structural elements\*, which include the deck\*, superstructure\*, and substructure\* using the 10-point National Bridge Inventory (NBI) condition rating\* scale.

MDOT's central office and seven regional offices are responsible for inspecting State-owned bridges. MDOT has delegated responsibility for inspecting all locally owned bridges to their respective owners, which include cities, villages, townships, or counties. Although NBIS permits this delegation, NBIS requires that MDOT's program manager ensure local agencies' compliance with NBIS. Both MDOT and local bridge owners use in-house QTLs and private consultant QTLs to conduct their inspections.

MDOT uses its Michigan Bridge Inspection System (MBIS), an Internet-based application, to collect and retrieve bridge inspection and bridge inventory data, and its Michigan Bridge Reporting System to meet various State and federal reporting requirements and its internal information needs.

As of September 30, 2008, MDOT had 3 QTLs located at its central office and 24 QTLs at its regional offices. Also, as of March 28, 2010, MDOT records reflected that there were 4,404 State-owned bridges and 6,356 locally owned bridges that required NBIS inspections at least every two years.

\* See glossary at end of report for definition.

## Audit Objectives, Scope, and Methodology and Agency Responses

### Audit Objectives

Our performance audit\* of the Bridge Inspection Program, Michigan Department of Transportation (MDOT), had the following objectives:

1. To assess the effectiveness\* of MDOT's efforts to ensure that bridge inspections and load ratings are completed in compliance with selected State and federal requirements.
2. To assess the effectiveness of MDOT's efforts to ensure that bridge inspections are completed by qualified persons.

### Audit Scope

Our audit scope was to examine the program and other records of the Michigan Department of Transportation's Bridge Inspection Program. 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. Our audit procedures, primarily conducted from May 2008 through February 2009, generally covered the period October 1, 2006 through December 31, 2008.

We prepared supplemental information presented as Exhibit 1 using unaudited data obtained from MDOT's Web site as of November 3, 2008. We also prepared supplemental information presented as Exhibits 2 through 5 in April 2010 using unaudited MDOT-provided data as of March 28, 2010 from the MDOT Bridge Management System. Our audit was not directed toward expressing a conclusion on this information and, accordingly, we did not audit the information and express no conclusion on it.

### Audit Methodology

We conducted a preliminary review of MDOT's Bridge Inspection Program to formulate a basis for developing our audit objectives and defining our audit scope. Our

\* See glossary at end of report for definition.

preliminary review included interviewing MDOT and Federal Highway Administration\* (FHWA) staff; reviewing applicable State and federal laws, regulations, procedures, guidelines, manuals, and other information; analyzing available records, data, and statistics; examining reports from various internal and external audits and reviews; reviewing quality assurance\* and quality control\* data; and obtaining an understanding of MDOT's internal control\* and operational activities.

To accomplish our first objective, we interviewed MDOT, Michigan Department of Information Technology, and FHWA staff. Also, we reviewed controls over the Michigan Bridge Inspection System (MBIS) and analyzed the completeness of inspection data in MBIS. In addition, we examined selected inspection reports to assess compliance with Section 254.19a of the *Michigan Compiled Laws* and with National Bridge Inspection Standards (NBIS) requirements such as QTL comments, inspection frequency, load ratings, and scour\* and plans of action\* for scour critical bridges\*.

To accomplish our second objective, we assessed whether individuals completing selected inspections met applicable State and NBIS training and education, and/or experience requirements.

When selecting activities or programs for audit, we use an approach based on assessment of risk and opportunity for improvement. Accordingly, we focus our audit efforts on activities or programs having the greatest probability for needing improvement as identified through a preliminary review. Our limited audit resources are used, by design, to identify where and how improvements can be made. Consequently, we prepare our performance audit reports on an exception basis.

### Agency Responses

Our audit report contains 5 findings and 10 corresponding recommendations. MDOT's preliminary responses indicate that it concurs with all 10 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 subsequent to our audit fieldwork. Section 18.1462 of the *Michigan Compiled Laws* and the State of Michigan Financial Management Guide (Part VII, Chapter 4, Section 100) require MDOT to develop a formal response to our audit findings and recommendations within 60 days after release of the audit report.

\* See glossary at end of report for definition.

COMMENTS, FINDINGS, RECOMMENDATIONS,  
AND AGENCY PRELIMINARY RESPONSES

## COMPLIANCE WITH SELECTED STATE AND FEDERAL REQUIREMENTS

### COMMENT

**Background:** National Bridge Inspection Standards (NBIS) were established to ensure the safety of the traveling public. NBIS requires that inspections of bridges be completed in accordance with the inspection procedures in the American Association of State Highway and Transportation Officials (AASHTO) Manual for Condition Evaluation of Bridges (hereinafter referred to as the AASHTO Manual). NBIS also requires that each bridge be rated as to 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, as part of every inspection, the bridge's load rating be reviewed and updated to reflect any changes in the bridge's condition noted during the inspection.

During routine inspections, qualified team leaders (QTLs) assign a National Bridge Inventory (NBI) condition rating to each of the bridge's three primary structural elements. The condition ratings range from 9 (excellent condition) through 0 (failed condition). The lowest rating assigned to each of these three elements serves as the bridge's overall condition rating. Included as Exhibit 1 in the supplemental information section of this report is a map identifying the geographic area comprising each MDOT region. Also, included as Exhibits 2 and 3 are a chart and corresponding table of the overall condition ratings of State-owned bridges, by MDOT region, as of March 28, 2010. In addition, included as Exhibits 4 and 5 are tables of the overall condition ratings of municipality-owned and county-owned bridges, respectively, as of March 28, 2010.

**Audit Objective:** To assess the effectiveness of the Michigan Department of Transportation's (MDOT's) efforts to ensure that bridge inspections and load ratings are completed in compliance with selected State and federal requirements.

**Audit Conclusion:** We concluded that MDOT was not effective in ensuring that bridge inspections and load ratings were completed in compliance with selected

**State and federal requirements.** Our assessment disclosed three material conditions\*.

- MDOT did not complete or ensure the completion of all scour evaluations and plans of action (POAs) for scour critical bridges (Finding 1).
- MDOT did not ensure that local bridge owners and MDOT regional offices completed some routine bridge inspections and inspections of the underwater structural elements of bridges in a timely manner. In addition, MDOT often did not document its follow-up activity or the rationale for its lack of follow-up activity related to late or potentially late bridge inspections. (Finding 2)
- MDOT did not ensure that QTLs complied with MDOT's bridge inspection frequency guidelines at all times. Also, MDOT did not regularly monitor the appropriateness of the bridge inspection frequencies and load ratings for bridges experiencing significant deterioration. In addition, MDOT did not ensure that QTLs adequately described the physical deterioration of poorly rated bridges in the Michigan Bridge Inspection System (MBIS). (Finding 3)

Our assessment also disclosed one reportable condition\* related to false decking\* (Finding 4).

## **FINDING**

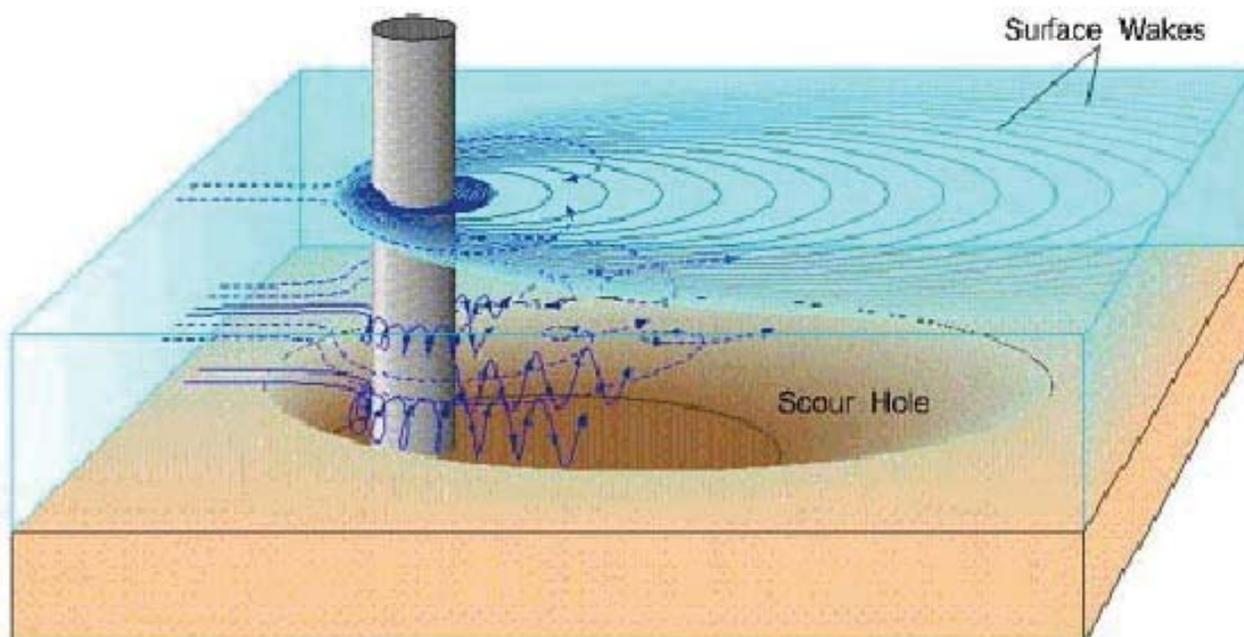
### **1. Scour Evaluations and POAs for Scour Critical Bridges**

MDOT did not complete or ensure the completion of all scour evaluations and POAs for scour critical bridges. As a result, MDOT did not comply with critical safety provisions of NBIS and risked the withholding of federal aid to highway funds.

Scour is the erosion of the streambed or bank around bridge piers and abutments that is caused by flowing water. The following picture shows a scour hole around a bridge pier. As flowing water causes the scour hole to grow, the bridge pier may weaken, become unstable, and cause the bridge to collapse. According to the Federal Highway Administration (FHWA), scour is the most common cause of bridge failure and closure. POAs include intended actions for monitoring both

\* See glossary at end of report for definition.

known and potential deficiencies and addressing critical findings for scour critical bridges. These actions include the installation of scour countermeasures, such as rip-rap (i.e., a bed of stone, broken concrete, or other materials to prevent erosion), increased inspection frequency, plans for bridge closure during flood events, and other countermeasures.



Source: FHWA Bridge Inspector's Reference Manual, Revised December 2006.

In 1988, the FHWA issued a technical advisory that required MDOT to evaluate all highway bridges (both State-owned and locally owned) over water for susceptibility to scour. In 1992, the FHWA required MDOT to complete scour evaluations for all highway bridges over water by January 1997. In accordance with this requirement, MDOT began to complete some scour evaluations and POAs for State-owned bridges. MDOT delegated responsibility for completing scour evaluations and POAs for locally owned bridges to their respective owners. In a 1999 review, the FHWA found that many local bridge owners had not completed their scour evaluations and that neither MDOT nor the local bridge owners had developed required POAs. In 2005, NBIS was revised to include more definitive requirements for completing scour evaluations and POAs. Despite the FHWA's 20 years of efforts to get MDOT to comply with federal scour-related requirements, in February 2008, the FHWA again notified MDOT that a total of over 2,800 scour evaluations and at least 525 POAs still had not been completed. Under the threat of suspension of federal aid to highway funds, the FHWA required that MDOT

complete or ensure the completion of all scour evaluations and POAs by December 31, 2009 and December 31, 2010, respectively.

On July 7, 2008, MDOT contacted the 191 local bridge owners that still needed to complete scour evaluations and/or POAs and informed them of the FHWA's deadlines for their completion. MDOT requested that the bridge owners notify MDOT by August 30, 2008 of their ability or inability to meet the FHWA's deadlines. As of December 12, 2008 (approximately 10 months after the FHWA notified MDOT of its noncompliance with NBIS and 12 months before the final deadline for completing the scour evaluations), MDOT informed us that it had not received responses from 140 (73.3%) of the local bridge owners or followed up with them to determine why they had not responded. MDOT informed us that it planned to follow up with the bridge owners in January 2009. To aid MDOT and local bridge owners in the completion of the POAs, MDOT developed a POA template within MBIS.

As of September 24, 2008, approximately 2,500 (89.3%) of the 2,800 scour evaluations and nearly all of the POAs were still outstanding. To comply with NBIS and thereby help to ensure the safety of the traveling public and ensure the continued receipt of federal aid to highway funds, MDOT must make the completion of the scour evaluations and POAs a priority.

### **RECOMMENDATION**

We recommend that MDOT complete or ensure the completion of all scour evaluations and POAs for scour critical bridges.

### **AGENCY PRELIMINARY RESPONSE**

MDOT concurs with the recommendation.

MDOT stated that it has been aggressively pursuing completion of scour evaluations by December 31, 2009. Therefore, MDOT stated that its response should be read in conjunction with the report finding to ensure that the report reader has an understanding of the current conditions.

MDOT stated that it mitigates or replaces scour critical bridges whenever possible. Also, MDOT stated that in the past five years, it has rehabilitated (with scour mitigation) or replaced over 450 bridges on river crossings. In addition, MDOT

stated that it placed countermeasures on 99 MDOT bridges that were previously scour critical. Further, MDOT stated that, out of the total of MDOT's remaining 386 bridges rated scour critical, 104 have rip-rap placed to protect the bridges' foundations or river channel. MDOT stated that it currently has 24 scour evaluations to complete on its system.

MDOT stated that local agencies currently have 223 scour critical bridges, of which 17 have rip-rap placed to protect the bridge foundation or river channel. Also, MDOT stated that countermeasures were placed to improve 121 local agency bridges that were previously scour critical. In addition, MDOT stated that local agencies currently have 1,454 scour evaluations to complete on their system.

MDOT stated that it has already taken the following actions in regard to scour critical bridges:

1. MDOT developed scour evaluation procedures, which are published in MDOT's drainage manual.
2. MDOT developed a "Scour Critical Bridge" report in the Michigan Bridge Reporting System (MBRS) to better ensure that all bridge owners manage their scour evaluation needs. The report provides up-to-date information from the Michigan bridge database showing scour evaluation and POA needs for all bridge owners.
3. MDOT developed a POA report within the MBIS that is used by all bridge owners to prepare POAs for their scour critical bridges.
4. MDOT provided technical advisement to all bridge owners on doing scour evaluations and preparing POAs.
5. MDOT provided guidance and instruction for doing scour evaluations and POAs in the form of Bridge Advisories that are available on MDOT's bridge operations Web site.
6. MDOT partnered with the Local Technical Assistance Program to put on a workshop for local agency bridge owners on how to do scour evaluations and prepare POAs.

7. MDOT followed up with all local agencies to confirm that they understand the requirements and they have plans to meet the prescribed deadlines.

In regard to the audit recommendation, MDOT stated that it will take the following actions:

- (1) MDOT will complete the remaining 24 scour evaluations on its system by December 31, 2009 and prepare POAs by December 31, 2010, as agreed to with the FHWA.
- (2) MDOT will monitor the progression of all local agency bridge owners to complete all of the 1,454 remaining scour evaluations on their systems by December 31, 2009 and prepare POAs by December 31, 2010.

In addition, MDOT will hold local agencies that do not meet the deadlines in noncompliance and MDOT will work with the Department of Attorney General to review MDOT's options to ensure that local agency bridge owners complete scour evaluations and POAs, as required.

## **FINDING**

### **2. Inspection Timeliness**

MDOT did not ensure that local bridge owners and MDOT regional offices completed some routine bridge inspections and inspections of the underwater structural elements of bridges in a timely manner. In addition, MDOT often did not document its follow-up activity or the rationale for its lack of follow-up activity related to late or potentially late bridge inspections. As a result, the local bridge owners and MDOT were not in compliance with State law and NBIS. MDOT's failure to ensure compliance with NBIS could result in the FHWA's withholding of federal funds and/or approval of further projects in Michigan.

Section 254.19a of the *Michigan Compiled Laws* requires MDOT to institute a biennial inspection of all bridges under its jurisdiction. Similarly, NBIS requires that MDOT routinely inspect, or cause to be inspected, all highway bridges at regular intervals not to exceed 24 months. NBIS also requires that the underwater structural elements of bridges that cannot be inspected during routine inspections by wading or by boating and probing be inspected at regular intervals not to exceed

60 months. In addition, NBIS requires local bridge owners and MDOT regional offices to enter bridge inspection results into MBIS within 180 days and 90 days of the bridge inspection date, respectively.

We analyzed MDOT's bridge inspection data from October 1, 2006 through September 24, 2008 and noted that local bridge owners and MDOT regional offices had not completed a total of 1,046 (9.6%) of 10,934 routine bridge inspections in a timely manner. We also noted that local bridge owners and MDOT regional offices had not completed or had not timely completed a total of 112 (58.9%) of the 190 underwater bridge inspections that should have been or were completed during the period. As can be seen in the following table, 975 (84.2%) of the 1,158 late inspections were for locally owned bridges and 183 (15.8%) were for State-owned bridges:

Number of Months Late	Number of Late Inspections for Locally Owned Bridges	Number of Late Inspections for State-Owned Bridges	Total Number of Late Inspections
1 to 3 months	714	116	830
4 to 6 months	142	20	162
7 to 12 months	28	6	34
13 to 24 months	15	5	20
25 to 36 months	7	3	10
More than 36 months	69	33	102
Total Late Inspections	975	183	1,158

MDOT informed us that to help ensure the timely completion of required inspections, every other month it identified the local bridges with inspection due dates that had passed and for which no inspection results had been entered into MBIS. MDOT stated that it contacted (generally by telephone) the owner of each bridge with an inspection due date that was less than 90 days from the date of MDOT's identification process to inquire about the status and urge the completion of the required inspection. In addition, MDOT informed us that it sent a noncompliance letter to the owner of each bridge with an inspection due date that was more than 90 days from the date of MDOT's identification process. The noncompliance letter informed the bridge owner that MDOT would restrict the

bridge owner's access to federal transportation funding for new road and bridge projects until the bridge owner completed the required inspection and entered the results into MBIS. The letter also informed the bridge owner that its continued noncompliance with NBIS could result in MDOT withholding State highway funds from the bridge owner. MDOT informed us that it intermittently sent additional noncompliance letters to bridge owners with past due inspections until the bridge owners completed the required inspections and entered the results into MBIS.

We reviewed MDOT's inspection follow-up activities and noted that MDOT did not adequately document its follow-up actions or its rationale for deviating from the follow-up process. For example, MDOT frequently failed to document the date, contact person, or outcome of its telephone calls to local bridge owners. Also, MDOT did not document why it often elected not to send noncompliance letters to, or place federal funding holds on, bridge owners. In addition, MDOT did not maintain documentation of when it started and removed the federal funding holds that it did place on local bridge owners. Our review also disclosed that MDOT had not established a process for withholding payment of State highway funds and, consequently, had never done so.

As shown in the preceding table, local bridge owners completed a large majority of the past due inspections within six months of the inspections' due date. To reduce or eliminate the "inspection date creep" (i.e., bridge owners delaying the completion of inspections until after the required due date) that appears to be occurring with local bridge owners, MDOT could automatically place all allowable funding restrictions on local bridge owners as soon as it learns that an inspection has not been completed by its due date or the results have not been entered into MBIS within required time frames. This could include placing restrictions on federal funding for existing road and bridge projects and not only new projects as MDOT currently does. With date-certain and stronger consequences, local bridge owners will have more incentive to ensure that inspections are completed and entered into MBIS within required time frames.

MDOT informed us that its regional offices were solely responsible for ensuring the timely inspection of the State-owned bridges in their respective geographic areas and, as such, MDOT had not established procedures to follow up on the regional offices' late inspections. MDOT also informed us that many of the late inspections

for State-owned bridges were caused by staffing vacancies at MDOT regional offices.

## **RECOMMENDATIONS**

We recommend that MDOT ensure that local bridge owners and MDOT regional offices complete routine bridge inspections and inspections of the underwater structural elements of all bridges in a timely manner.

We also recommend that MDOT document its follow-up activity or the rationale for its lack of follow-up activity related to late or potentially late bridge inspections.

## **AGENCY PRELIMINARY RESPONSE**

MDOT concurs with the recommendations.

MDOT is very cognizant of the importance of the inspection schedule and getting bridge condition data entered into the bridge database in a timely manner. MDOT stated that, in 2002, it committed to build two Web-based inspection and management applications: MBIS and MBRS. Since their rollouts in 2004 and 2005, the systems have reduced the time it takes inspectors to document observed conditions, improved quality of the database, and allowed the data from inspections to become available sooner. MBIS was awarded the AASHTO Francois Award for Innovation in 2005, and MDOT stated that it continues to utilize and enhance the systems to ensure timeliness of bridge inspections. MDOT believes that it is also important to note that the FHWA determined that Michigan's Bridge Inspection Program is in substantial compliance with NBIS.

MDOT stated that, in 2008, it added special inspections to MBIS and new reports were generated regarding these inspections. The special inspections include fracture critical inspections, underwater inspections, fatigue sensitive inspections, and other special inspections. MBIS sorts bridges according to inspection due date so bridge inspection team leaders know which bridges are coming due for inspection, and it also sends automated e-mails to all bridge owners 90 days before a bridge inspection is due. MDOT stated that it enhanced the inspection date fields in MBIS to improve MDOT's ability to track inspection due dates for special inspections.

MBIS provides reports that document the inspection schedule and routine inspections that are due in the next three months. MDOT stated that it runs a noncompliance check for local agencies every two months. This report is reviewed for data discrepancies and a noncompliance letter is sent to those who are more than 90 days past due for the inspection. The noncompliance letter notifies the agency that they are in noncompliance with NBIS and that they are restricted from using federal aid to fund upcoming road and bridge projects. When there is an apparent data error or the agency is overdue less than 90 days, MDOT contacts the local agency to correct the situation. NBIS allows 180 days after the inspection date for local agencies to enter the inspection data into the database, but MDOT stated that it proactively begins the review process 60 days after the inspection due date to ensure that local agencies are compliant by the data input deadline. In many cases, the local agency has completed inspection work on time, but has not yet entered the information into the database due to working on load rating or other data evaluation. MDOT sends additional delinquency notices to bridge owners on an intermittent basis until the bridge inspections are completed.

To further enhance inspection timeliness and documentation of follow-up, MDOT stated that it will do the following:

1. MDOT will provide Bridge Inspection Reports to senior management, including the chief operations officer, region engineers, and highway operations bureau directors by December 31, 2009 for appropriate follow-up and corrective action as warranted. The reports provided to senior management will identify for each bridge the inspection due date, actual inspection date, date the bridge condition data was entered into the database, and any bridge with increased inspection frequency.
2. MDOT will include special inspections such as fracture critical inspections and underwater inspections in MBRS inspection timeliness reports.
3. MDOT will review the automated inspection coming due notification process within MBIS and will enhance the level of detail provided in the notifications to all bridge owners.

4. MDOT will add automated e-mails for advance notification to all bridge owners for upcoming fracture critical inspections, underwater inspections, and fatigue sensitive detail inspections.
5. MDOT will hold local agencies that do not meet the bridge inspection and data entry deadlines in noncompliance and MDOT will work with the Department of Attorney General to review MDOT's options to ensure that routine bridge inspections and inspections of the underwater structural elements of local agency bridges are completed in a timely manner.
6. MDOT will establish an as-needed contract for bridge inspections that will be used for doing NBIS required bridge inspections when a local agency is more than six months late for a bridge inspection.
7. MDOT will review and strengthen its follow-up procedures to ensure documentation of MDOT's follow-up.

### **OFFICE OF THE AUDITOR GENERAL EPILOGUE**

In a May 29, 2008 letter, the FHWA notified MDOT that its bridge inspection program was in substantial compliance with NBIS, with the exception that MDOT was not in compliance with NBIS scour-related provisions. Although the letter provided positive feedback to MDOT, the FHWA expressed concern with the need for more frequent inspection of bridges in poor condition and posted for reduced weight limits, bridge inspection condition ratings that were inconsistent with MDOT rating criteria, underwater inspections, bridge file documentation, and other areas for local agency inspections. In addition, the FHWA stated that the load rating of local bridges has and continues to be a longstanding concern that will require MDOT to take aggressive actions for future NBIS compliance. A May 18, 2007 FHWA letter to MDOT regarding the 2006 NBIS review cited many of the same concerns. The FHWA's conclusions consider aspects of the program reviewed and knowledge of MDOT program improvement efforts currently underway.

### **FINDING**

#### **3. Inspection Frequencies, Load Ratings, and QTL Comments**

MDOT did not ensure that QTLs complied with MDOT's bridge inspection frequency guidelines at all times. Also, MDOT did not regularly monitor the

appropriateness of the bridge inspection frequencies and load ratings for bridges experiencing significant deterioration. In addition, MDOT did not ensure that QTLs adequately described the physical deterioration of poorly rated bridges in MBIS. As a result, MDOT did not comply with NBIS and some bridges with significant deterioration were not inspected as frequently as necessary and may have had inappropriate load ratings. Also, without adequate descriptions of bridge deterioration in MBIS, bridge inspectors would not have information needed during subsequent bridge inspections. Ensuring that deteriorating bridges are fully inspected with sufficient frequency and are properly load rated are critical to maintaining the safety and confidence of the traveling public.

In response to NBIS and AASHTO Manual requirements, MDOT established guidelines for determining inspection frequencies and reevaluating load ratings for bridges with significant deterioration. However, MDOT did not ensure compliance with these guidelines. Notwithstanding, MDOT's program manager informed us that he asked QTLs to document, in MBIS, the reason for deviating from MDOT's guidelines.

We reviewed the most current routine bridge inspection reports completed between October 1, 2006 and September 24, 2008 for a total of 50 bridges (both State-owned and locally owned) whose overall condition rating dropped to a score of 4 or below (poor or worse than poor condition) or by at least 2 points on the 10-point NBI condition rating scale and noted:

- a. QTLs did not increase the inspection frequency for 9 (18.0%) locally owned bridges with significant deterioration or document the reason for leaving the inspection frequencies unchanged. If the QTLs had followed MDOT's guidelines, the QTLs would have increased the inspection frequencies from 24 months to between 6 months or less and 15 months. After bringing the results of our testing to MDOT's attention, MDOT requested the immediate reinspection of 2 of the 9 bridges. Also, MDOT informed us that it would request that QTLs increase the inspection frequency for at least 2 other bridges. We were not aware of any follow-up action that MDOT planned to take related to the other 5 bridges.

NBIS requires that MDOT inspect, or cause to be inspected, all highway bridges in accordance with the AASHTO Manual and at regular intervals not to

exceed 24 months. NBIS also requires that MDOT establish criteria for increasing the inspection frequency of individual bridges based on factors such as known deficiencies, age, and traffic characteristics.

The bridge in the following photograph received an overall NBI rating of 3 (serious condition with local failures possible) and was assigned a standard inspection frequency of 24 months during its June 2007 routine inspection. However, based upon the physical deterioration described in the inspection report, the inspector should have increased the inspection frequency to between 6 and 9 months in accordance with MDOT's inspection frequency guidelines.

Photograph of Closed Willoughby Street Bridge, Ingham County



Photograph taken by Office of the Auditor General staff.

Subsequent to our audit fieldwork, the local bridge owner completed the next regularly scheduled routine inspection and, because of the bridge's advanced deterioration, closed it immediately. Although we are not aware of any accidents or injuries caused by the bridge's advanced deterioration, it did unnecessarily increase the potential for them and the corresponding liability to the State and the bridge owner.

In another instance, the locally owned bridge in the following photograph was assigned an overall NBI rating of 2 (critical condition - advanced deterioration of deck, superstructure, or substructure) in June 2007 and an improper 24-month inspection frequency. Based upon MDOT's bridge inspection frequency guidelines, the inspection frequency should have been no more than 6 to 9 months.

#### Holes in the Bridge Deck of the Open Van Atta Road Bridge, Ingham County



Photograph taken by Office of the Auditor General staff.

Included as Exhibit 6 in the supplemental information section of this report are additional photographs of both of the aforementioned bridges. All of the photographs were taken in August 2009.

- b. QTLs did not reevaluate the load ratings for 3 (6.0%) locally owned bridges with significant deterioration or document the reason for not doing so. A comment in 1 of the 3 inspection reports stated that an engineer may need to reevaluate the bridge posting; however, the reevaluation was not completed.

The AASHTO Manual requires that a bridge's load rating be reevaluated when changes to the bridge's physical condition may have affected the existing load rating. A load rating determines the safe load-carrying capacity of a bridge and is critical for ensuring its safe use and arriving at posting and permit decisions.

- c. QTLs did not enter detailed comments into MBIS describing the physical deterioration that caused the QTLs to lower the NBI rating(s) on one or more of the primary structural elements of 8 (16.0%) locally owned bridges. This information is necessary for assessing the condition of the bridges over time and, correspondingly, for making important maintenance and inspection frequency decisions.

The AASHTO Manual requires that QTLs document all signs of distress and deterioration observed during an inspection so that subsequent inspectors can readily make a comparison of condition.

### **RECOMMENDATIONS**

We recommend that MDOT ensure that QTLs comply with MDOT's bridge inspection frequency guidelines at all times.

We also recommend that MDOT regularly monitor the appropriateness of the bridge inspection frequencies and load ratings for bridges experiencing significant deterioration.

We further recommend that MDOT ensure that QTLs adequately describe the physical deterioration of poorly rated bridges in MBIS.

### **AGENCY PRELIMINARY RESPONSE**

MDOT concurs with the recommendations.

MDOT stated that it requires the use of its bridge inspection frequency guidelines. However, the infinite variety of conditions encountered during inspection will always require the inspector to use engineering judgment and discretion in the application of the rules. The FHWA rules and regulations and commentary in the AASHTO Manual document that it takes considerable judgment by the bridge inspector or engineer to determine appropriate inspection frequency or need to load rate a bridge. When determining the inspection frequency, the inspector takes into consideration many factors including the condition of the bridge, the type of the bridge, the redundancy of the structural supports, the deterioration rate of the bridge elements, and the type of deficiencies that could be expected. MDOT stated that, by December 31, 2010, it will work with the FHWA to clarify and strengthen the bridge inspection frequency guidelines to ensure that inspectors

clearly understand, in a consistent manner, when the conditions warrant increased inspection frequencies.

Regarding the appropriateness of bridge inspection frequencies and load ratings for bridges experiencing significant deterioration, MDOT concurs that oversight is important, and that it has a quality control/quality assurance program that aids in ensuring this. MDOT stated that it regularly monitors inspectors' compliance with AASHTO's requirement for documenting bridge deterioration. MDOT requires quality control checks that are followed up by quality assurance checks to regularly monitor inspectors' compliance with AASHTO's requirement for documenting bridge deterioration. Quality control is done by the bridge engineers, as prescribed by the NBIS, and quality assurance is currently done by MDOT central office and by consultant contract under MDOT direction. MDOT stated that quality assurance reviews continue to be performed to help ensure the timeliness and accuracy of bridge inspection frequencies and to help ensure that inspections adequately describe the physical condition of the bridge.

MDOT stated that, to further enhance its monitoring of State and local agency bridge inspection frequencies and load ratings, by April 1, 2010 MDOT will provide bridge inspection reports to senior management, including the chief operations officer, region engineers, and highway operations bureau directors, for appropriate follow-up and corrective action as warranted. The reports provided to senior management will identify for each bridge the inspection due date, actual inspection date, date the bridge condition data was entered into the database, and any bridge with increased inspection frequency.

MDOT has procedures in place to help ensure that inspectors adequately describe the physical deterioration of poorly rated bridges in MBIS. Condition ratings are required by NBIS, are used nationwide, and provide a uniform way to describe the physical condition of specific bridge elements. In addition, all of the ratings required by the FHWA must be entered into the inspection application MBIS before the computer will allow the report to be saved. MDOT stated that, by April 1, 2010 it will review the feasibility of enhancing MBIS so that it will identify and flag those bridges that warrant comment and help ensure that the inspector does not unintentionally leave a comment field blank.

## **FINDING**

### **4. False Decking**

MDOT did not inspect the underside of some bridges with false decking nor did its procedures require this inspection. Also, MDOT did not ensure that all bridges with false decking were correctly identified in MBIS. In addition, MDOT did not ensure that its QTLs correctly reported their inspection results for bridges with false decking into MBIS.

As can be seen in the following photograph, false decking consists of plywood sheeting laid on timbers that are supported on each end by a bridge's beams. Use of false decking is an accepted method of preventing broken concrete from deteriorating bridges from falling onto traffic until more permanent repairs can be made.

Photograph of Underside of Bridge With Partial False Decking



Photograph provided by MDOT staff.

As part of its comprehensive guidelines for completing bridge inspections, the AASHTO Manual requires that QTLs examine both the top and underside of bridges for indications of deterioration or distress. Generally, to inspect the underside of a bridge with false decking, MDOT would have to remove some or all

of the bridge's false decking. However, MDOT's Michigan Structure Inventory and Appraisal Coding Guide (hereinafter referred to as the Michigan Coding Guide), which provides QTLs with guidance on rating the condition of a bridge's various components, states that if the bottom surface of a bridge cannot be observed because of false decking, the QTL should not rate it and document the reason for not rating it in the applicable comments field within MBIS. Consistent with this guidance, MDOT's program manager informed us that MDOT would typically inspect the underside of bridges with false decking during separate detailed inspections and not as part of its routine bridge inspections. However, MDOT's program manager informed us that MDOT had not conducted any of these detailed inspections.

Using MDOT bridge inspection data, we identified 86 bridges that were coded within MBIS as having full or partial false decking on the date of their last routine inspections and 19 bridges with false decking that were not correctly coded as such within MBIS. Our analysis of the inspection data for all 105 bridges disclosed:

- a. MDOT QTLs did not inspect and rate the underside of 25 (23.8%) bridges. Also, the QTLs did not document their reasons in MBIS for not inspecting the underside of 14 (56.0%) of the 25 bridges, as required by the Michigan Coding Guide.
- b. MDOT QTLs did not fully inspect the underside of 5 (4.8%) bridges; however, the QTLs rated the undersides of these bridges in MBIS and noted that their ratings were based on prior inspection reports or other visible parts of the decks. The prior inspections had been completed between 9 and 17 months earlier.
- c. MDOT QTLs rated the underside of 8 (7.6%) bridges; however, the QTLs documented in MBIS that all or most of the underside of these bridges were not visible because of false decking. The MDOT QTLs did not indicate what served as the basis for their ratings.
- d. MDOT QTLs rated the underside of 67 (63.8%) bridges; however, the QTLs did not document whether the false decking was removed for the inspections. Given that MDOT informed us that it generally did not remove false decking as part of its routine bridge inspections and had not conducted any detailed

inspections, it is unclear how the QTLs were able to inspect and rate the underside of these bridges.

MDOT informed us that it has been using false decking since the mid-1990s. In addition, our analysis of bridge inspection data identified instances when it appeared that individual bridges had false decking in place for up to 11 consecutive years. In many instances, the bridges with false decking were located in high-traffic metropolitan areas. Given these conditions, to help ensure the safety of the traveling public, MDOT should remove a sufficient amount of false decking from bridges during the routine inspection process to provide for the complete inspection of the underside of them.

In its 2006 review of MDOT's Bridge Inspection Program, the FHWA recommended that MDOT develop and implement procedures for the inspection of the underside of bridges fitted with false decking. In its 2008 follow-up to this review, the FHWA again made this recommendation. Although MDOT had not developed this written procedure, MDOT informed us that it planned to begin conducting detailed inspections of the underside of some of these bridges in spring 2009.

## **RECOMMENDATIONS**

We recommend that MDOT inspect the underside of bridges with false decking and establish procedures requiring this inspection.

We also recommend that MDOT ensure that all bridges with false decking are correctly identified in the MBIS.

We further recommend that MDOT ensure that its QTLs correctly report their inspection results for bridges with false decking into MBIS.

## **AGENCY PRELIMINARY RESPONSE**

MDOT concurs with the recommendations. MDOT stated that each year the FHWA trained, experienced bridge engineers conduct NBIS reviews. MDOT also stated that although this report has found that MDOT procedures need strengthening in certain areas, overall, MDOT was found to be in substantial compliance with NBIS.

The placement of false decking is done by MDOT specifically to protect the safety of the motoring public. False decking is put in place if there is potential for concrete to separate from the underside of a bridge. Less than 2% of MDOT bridges have false decking, and it is important to note that false decking does not need to be removed to ensure the integrity of the bridge. The structural integrity of a bridge is not at risk because of false decking, and the structural integrity of the bridge is not compromised because concrete has or may separate from the bridge.

The audit indicated that five bridges were rated even though MDOT did not inspect the underside of the bridges. It is important to note that bridges with false decking can be rated. Many times, false decking does not cover the entire deck bottom. Therefore, these bridge decks can be appropriately assessed by using visible portions and other components as provided for in the Bridge Inspectors Reference Manual and MDOT's bridge rating guidelines.

Also, if false decking is placed on a bridge, the deck bottom surface is automatically rated as deficient and that individual rating is incorporated in the overall rating of the bridge. All MDOT bridges have an inspection frequency appropriate for the condition of the bridge, and some bridges actually are inspected at more frequent intervals depending on the bridge rating, to ensure safety of the motoring public. In addition, even when false decking exists on a bridge, the bottom flange of the beams can be inspected, and since false decking is typically placed over the traveled lanes, the inspector typically can view the beams' ends where most deterioration occurs. In addition, determination of the condition of a bridge deck can be made from the top surface of the deck as well as the bottom surface.

The NBIS and AASHTO Manual discuss the various types of bridge inspections. The NBIS and AASHTO Manual do not specifically address false decking; however, the QTL uses engineering judgment in assessing the overall condition and integrity of the bridge deck and the level of inspection required. To determine the overall condition of the bridge deck, other components of the deck are used to reach an overall condition rating as provided for in the Bridge Inspectors Reference Manual and MDOT's bridge rating guidelines. The inspector takes into consideration the condition of the bridge, the type of bridge, the amount of traffic crossing over the bridge, the redundancy of the structural supports, the deterioration rate of the bridge elements, and the type of deficiencies expected.

False decking should be removed when the QTL has determined the removal is necessary to assess the overall safety of the structure.

In addition, although separately rating the bottom of the bridge deck is not an NBIS or an AASHTO Manual requirement, MDOT has developed a "bottom of the deck rating" as a Michigan-specific tool to assist in the overall required deck assessment. This is in compliance with the Appraisal Coding Guide referenced in the audit.

MDOT stated that, in recent years, it has taken an aggressive approach to repair or replace bridges with poor bridge decks. In the past ten years, MDOT has rehabilitated or replaced over 1,500 bridges. As a result of this strategy, bridge condition has increased 11% since 1998 as shown in Figure 1. The number of bridges in good/fair condition in the Metro Region has increased over 21% as shown in Figure 2. Metro Region is where the majority of bridges with false decking are located.

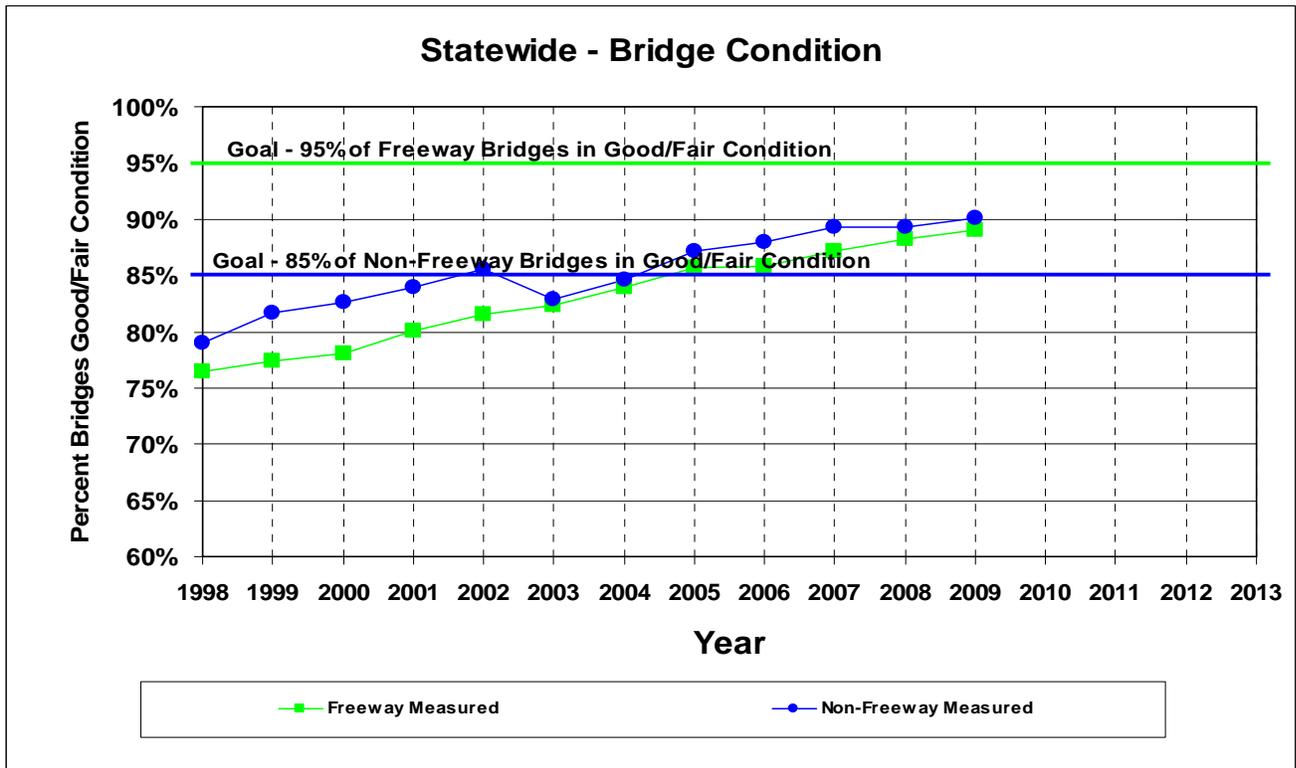


Figure 1 - Condition Improvement of MDOT Bridges

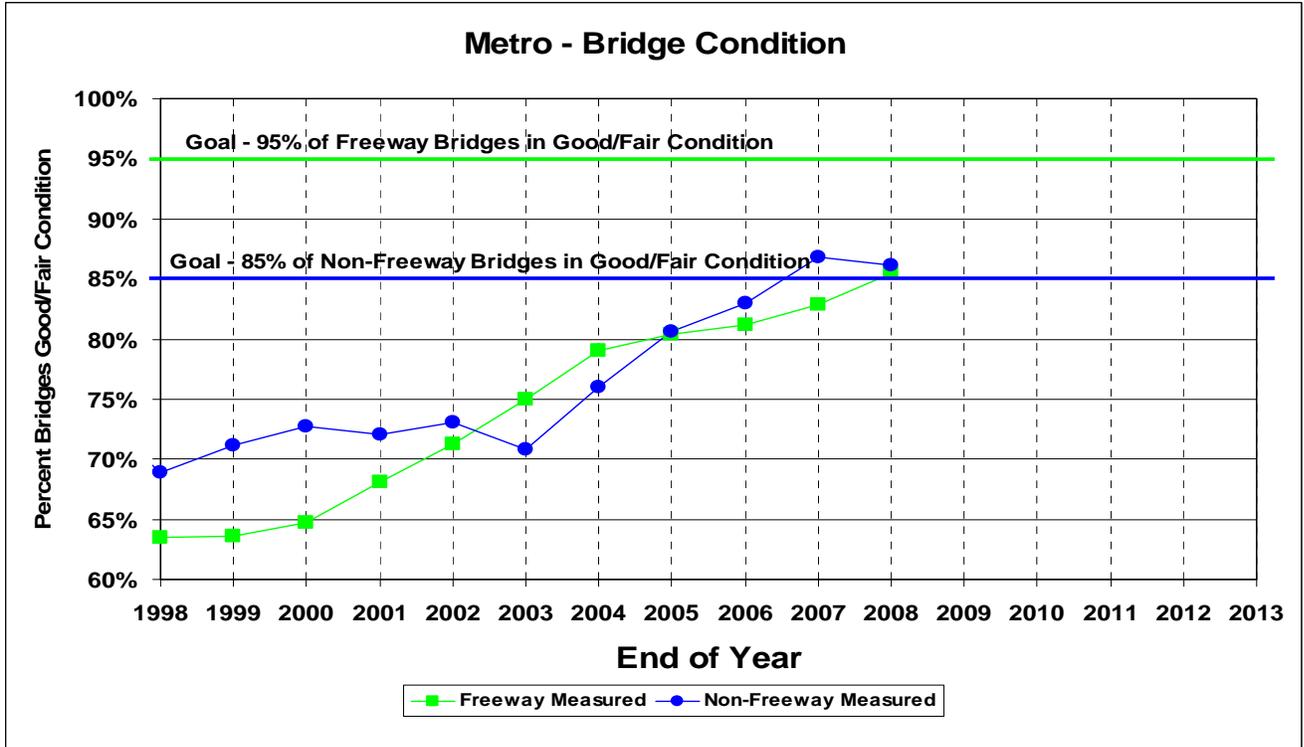


Figure 2 - Condition Improvement of Metro Region Bridges

MDOT stated that it continues to pursue a strategy to improve all bridge decks and remove the false decking. Also, MDOT stated that its five-year plan is aggressively addressing false decking and, in recent years, MDOT has made the following enhancements to the bridge inspection program to identify bridges with false decking and to assess the condition of the bottom side of bridge decks:

1. Although not required by federal regulations, in 2007 MDOT added a deck bottom surface rating to better evaluate bridge decks. Because the typical inspection cycle is two years, during the time of the audit, the bridge database and comment fields for all bridges were not completely updated using the new rating.
2. Although not required by federal regulations, in 2007 MDOT added a specific inventory item and condition rating for false decking. Again, because the typical inspection cycle is two years, during the time of the audit, the bridge database and comment fields for all bridges were not completely updated using the new condition rating.

3. MDOT created a program that provides funding to do in-depth bridge inspections. These in-depth inspections of bridges would include all bridges having significant false decking. The program, initiated in fiscal year 2007-08, is funded at \$1.6 million. The program will continue into fiscal year 2009-10 funded at \$2 million.
4. MDOT developed alternate false decking methods that will better facilitate future bridge inspections, such as the use of mesh material, as shown in Figure 3. By April 1, 2010, MDOT will place the alternate false decking, using mesh material, on several bridges and will evaluate the performance and effectiveness of the method.
5. MDOT's Metro Region has hired a consultant to identify all bridges having false decking within the Region and show the location of the false decking on the bridge. This work is scheduled to be complete by November 1, 2009.



Figure 3 - Alternate False Decking Method that Facilitates Bridge Inspection

To further enhance the inspection of bridges with false decking and ensure that bridge inspectors correctly report inspection results, MDOT stated that it will also do the following:

- (1) MDOT will continue to populate the smart flag condition rating for false decking in MDOT's MBIS and has also instructed inspectors to document the area of false decking placed on the bridge. This process will be completed by December 31, 2010.
- (2) MDOT will indicate on the inspection report if a portion of the false decking was removed to facilitate bridge inspection. This process will be completed within the two-year inspection cycle.
- (3) MDOT will provide bridge inspection reports to senior management, including the chief operations officer, region engineers, and highway operations bureau directors, by April 1, 2010 for appropriate follow-up and corrective action as warranted. The reports provided to senior management will identify information for each bridge, such as the inspection due date, actual inspection date, date the bridge condition data was entered into the database, any bridge with increased inspection frequency, and whether the bridge has false decking or not.
- (4) MDOT will clarify and strengthen the use of the request for action process to indicate need for removal of false decking to facilitate bridge inspection. Though not part of NBIS, MDOT has a process inspectors use to communicate action items for bridge structures. The request for action process establishes a higher priority than a standard work item and the inspector uses a form to describe the tasks and directs it to the individual with the responsibility to perform the activity. In using this process for the removal of false decking, the inspector documents the needed time frame on the form and attaches supporting documents needed to complete the task.

### **OFFICE OF THE AUDITOR GENERAL EPILOGUE**

In a May 29, 2008 letter, the FHWA notified MDOT that its bridge inspection program was in substantial compliance with NBIS, with the exception that MDOT was not in compliance with NBIS scour-related provisions. Although the letter provided positive feedback to MDOT, the FHWA expressed concern with the need

for more frequent inspection of bridges in poor condition and posted for reduced weight limits, bridge inspection condition ratings that were inconsistent with MDOT rating criteria, underwater inspections, bridge file documentation, and other areas for local agency inspections. In addition, the FHWA stated that the load rating of local bridges has and continues to be a longstanding concern that will require MDOT to take aggressive actions for future NBIS compliance. A May 18, 2007 FHWA letter to MDOT regarding the 2006 NBIS review cited many of the same concerns. FHWA's conclusions consider aspects of the program reviewed and knowledge of MDOT program improvement efforts currently underway.

The inspectors for 4 of the 5 bridges identified in part b. documented in MBIS that all or most of the underside of the bridges were not visible because of false decking. Consequently, the inspectors used the prior inspection reports as the basis for their assigned ratings. The inspector for 1 of the 5 bridges documented that the rating for the underside of the bridge was made based on the parts of the bridge deck that were visible. There was no indication of how much of the underside of the bridge was visible to the inspector. Notwithstanding our findings, during its 2006 NBIS review, the FHWA also expressed concern with MDOT not inspecting the underside of bridges with false decking and recommended that it develop and implement procedures to do so. Also, the bridge program engineer for FHWA's Michigan division informed us that he had verbally mentioned this to MDOT during prior NBIS reviews. In addition, although not specifically addressed during its 2007 NBIS review, the FHWA's bridge program engineer informed us in February 2009 that MDOT's inspection of bridges with false decking continues to be a concern.

## **COMPLETION OF INSPECTIONS BY QUALIFIED PERSONS**

### **COMMENT**

**Audit Objective:** To assess the effectiveness of MDOT's efforts to ensure that bridge inspections are completed by qualified persons.

**Audit Conclusion:** We concluded that MDOT was moderately effective in ensuring that bridge inspections were completed by qualified persons. Our assessment disclosed one reportable condition related to QTL requirements (Finding 5).

## **FINDING**

### **5. QTL Requirements**

MDOT did not ensure that some inspection team leaders met State and federal QTL requirements. As a result, some inspection team leaders did not have the requisite training for completing routine inspections.

A QTL must possess a detailed knowledge of the structural components of a bridge to effectively evaluate a bridge's physical and functional condition, which is one of the expected outcomes of a routine bridge inspection. Because these inspections are critical to ensuring bridge safety, it is imperative that MDOT ensure that all inspection team leaders meet State and federal QTL requirements.

To qualify as a QTL, NBIS requires an individual to successfully complete an FHWA-approved comprehensive bridge inspection training\* course and meet other education and/or bridge inspection experience requirements. Effective January 2008, MDOT also required QTLs to have at least 24 hours of continuing bridge inspection-related training within the preceding five-year period. As a means to ensure that inspection team leaders met the aforementioned requirements, in January 2008, MDOT began requiring QTLs to certify in MBIS that they met all applicable QTL training and education and/or inspection experience requirements. However, MDOT did not require bridge owners to request and maintain documentation of the team leaders' training and education and/or experience.

In fiscal years 2006-07 and 2007-08, a total of 130 individuals had either completed or supervised the completion of a total of 11,045 bridge inspections. We reviewed the training, education, and bridge inspection experience of 33 of these individuals and noted:

- a. In one (3.0%) instance, an inspection team leader had not taken an FHWA-approved comprehensive bridge inspection training course and, therefore, did not meet NBIS's QTL requirements. From March 2007 through July 2007, the individual served as the QTL for 66 routine bridge inspections.

\* See glossary at end of report for definition.

- b. In one (3.0%) instance, MDOT could not document that an inspection team leader had taken an FHWA-approved comprehensive bridge inspection training course and, therefore, did not know if the individual met NBIS's QTL requirements. During fiscal year 2007-08, the individual served as the QTL for 48 routine bridge inspections.
  
- c. In two (6.1%) instances, inspection team leaders had not completed the 24 hours of bridge inspection-related training during the immediately preceding five-year period and, therefore, did not meet MDOT requirements for completing or supervising the completion of routine bridge inspections. One of the inspection team leaders had completed 8 hours of training during the period, and the other inspection team leader had not completed any training. The two inspection team leaders completed a total of 38 inspections after the 24-hour training requirement became effective.

### **RECOMMENDATION**

We recommend that MDOT ensure that inspection team leaders meet State and federal QTL requirements.

### **AGENCY PRELIMINARY RESPONSE**

MDOT concurs with the recommendation.

MDOT stated that it now has procedures in place to help ensure that only those who meet the NBIS requirements for a QTL perform bridge inspections. To ensure that QTLs meet State and federal bridge inspector training requirements, MBIS requires inspectors to enter their credentials once a year. This automated validation ensures that the inspectors have access to only the documents and forms that they are qualified to complete. NBIS requires bridge owners to have the inspection done by qualified staff, and it is the bridge owner's responsibility to confirm the inspector's credentials at the time they retain them to do the inspection work. When local agency bridge owners are found to be using staff with expired credentials, federal funding can be withheld by MDOT until the agency has the required staff.

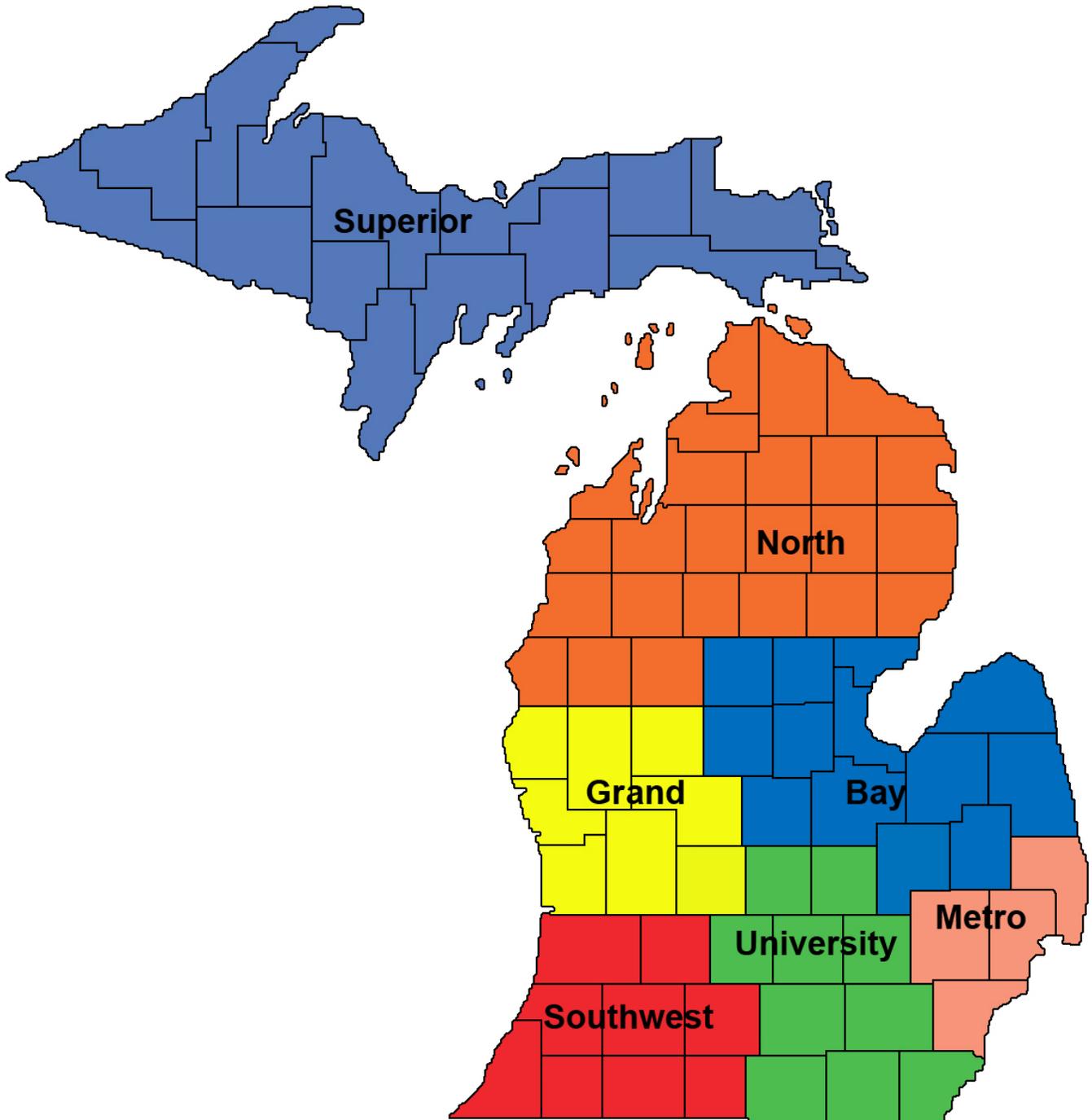
In the instances (a. through c.) noted in the finding, MDOT stated the following:

- a. This was not an MDOT inspector. This individual is a registered professional engineer who had been doing bridge inspection for local agencies for many years prior to the change in the regulations. In accordance with the FHWA "Questions and Answers on the National Bridge Inspection Standards 23 *CFR* 650 subpart C", (<http://www.fhwa.dot.gov/bridge/nbis/index.htm#7>), Q309-6, the FHWA does allow for long serving, highly qualified engineers to have a waiver to the requirement for this comprehensive training course. MDOT declined to exercise the FHWA exception and denied the inspector's request for waiver; however, MDOT did grant a time extension for the engineer to complete the training and performed independent quality control on the individual's work until the training requirements were met. The independent quality control was performed on 15 (25%) of 60 bridges inspected by the engineer. This individual has since decided not to take the bridge inspection class and his name has been removed from the MBIS application, preventing data entry.
- b. This inspector worked for MDOT and had the requisite credentials and training to work as a QTL; however, this individual left MDOT and MDOT did not retain the training records. While MDOT cannot now provide documentation, this person met the QTL requirements while working for MDOT. In addition, the inspector was employed by the Pennsylvania Department of Transportation as a bridge inspector prior to working for MDOT.
- c. In the two instances noted, one was an MDOT inspector and now has the training, credentials, and certifications to fully meet the NBIS requirements. In the other instance, the inspector was a local agency employee. During a standard quality assurance check, the local agency employee was found to have incorrectly entered the number of hours of recurrent training by using course work that did not apply to bridge inspection. The situation was brought to the attention of the city administration and the federal funding was suspended. The local agency has since hired a qualified consultant to complete inspections until the staff attends the required training.

By April 1, 2010, MDOT will develop a process to ensure the retention of all records pertaining to the QTL qualification.

# SUPPLEMENTAL INFORMATION

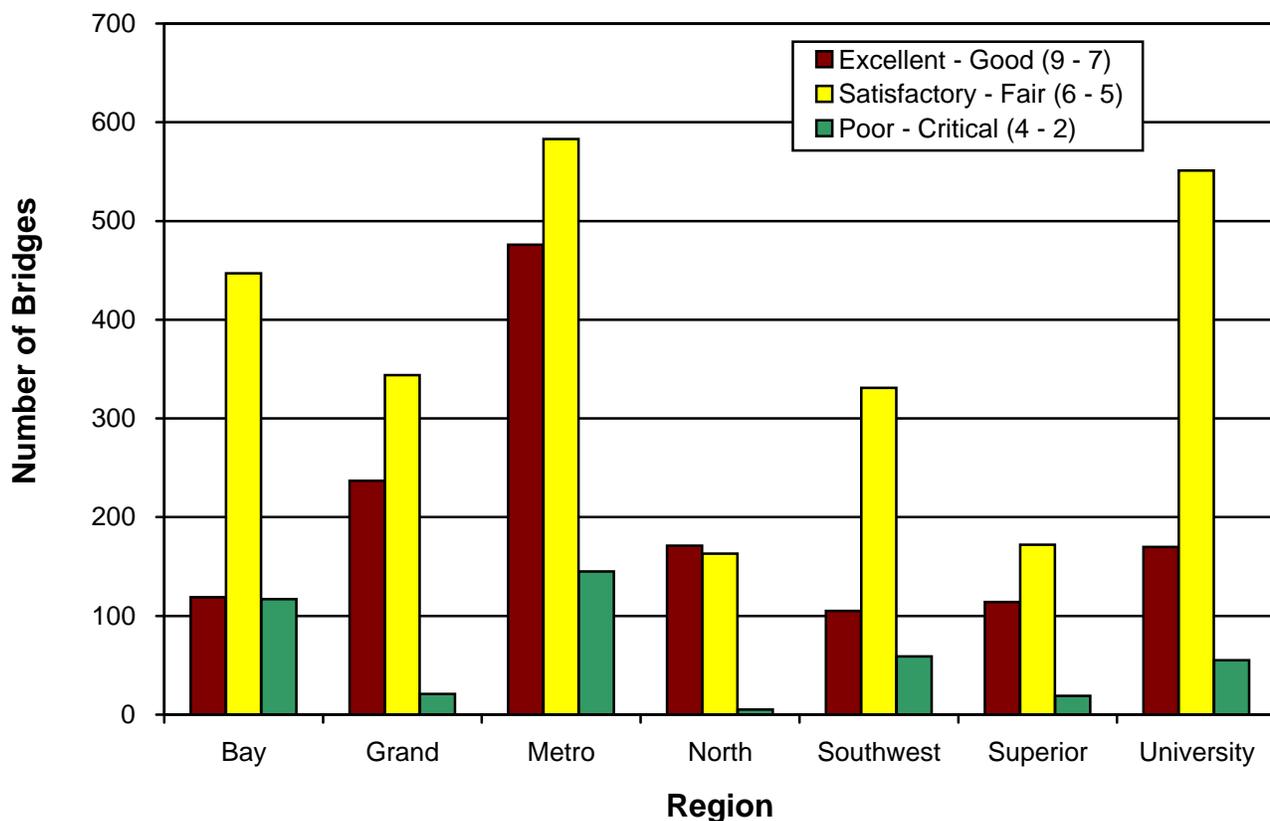
BRIDGE INSPECTION PROGRAM  
Michigan Department of Transportation (MDOT)  
Map of MDOT Regions  
As of November 3, 2008



Source: [www.michigan.gov](http://www.michigan.gov)

**BRIDGE INSPECTION PROGRAM**  
Michigan Department of Transportation (MDOT)

Chart of Overall Condition Ratings of State-Owned Bridges by MDOT Region  
As of March 28, 2010



Source: The Office of the Auditor General prepared this exhibit based on MDOT-provided data as of March 28, 2010 from the MDOT Bridge Management System.

BRIDGE INSPECTION PROGRAM  
Michigan Department of Transportation (MDOT)

Overall Condition Ratings of State-Owned Bridges by MDOT Region  
As of March 28, 2010

MDOT Region	Excellent - Good (9 - 7)	Satisfactory - Fair (6 - 5)	Poor - Critical (4 - 2)	Total Bridges
Bay	119	447	117	683
Grand	237	344	21	602
Metro	476	583	145	1,204 *
North	171	163	5	339
Southwest	105	331	59	495
Superior	114	172	19	305
University	170	551	55	776
Total	<u>1,392</u>	<u>2,591</u>	<u>421</u>	<u>4,404</u>

\* This count excludes 2 bridges in the Metro region recently added to the MDOT Bridge Management System that have not yet been rated.

Source: The Office of the Auditor General prepared this exhibit based on MDOT-provided data as of March 28, 2010 from the MDOT Bridge Management System.

BRIDGE INSPECTION PROGRAM  
Michigan Department of Transportation (MDOT)

Overall Condition Ratings of Municipality-Owned Bridges  
As of March 28, 2010

Municipality	Excellent - Good (9 - 7)	Satisfactory - Fair (6 - 5)	Poor - Critical (4 - 2)	Total Bridges
Adrian	1	6	0	7
Alanson	1	0	0	1
Albion	6	2	1	9
Algonac	0	5	0	5
Allegan	1	2	0	3
Allen Park	0	2	0	2
Alma	1	1	1	3
Alpena	1	1	0	2
Ann Arbor	6	6	2	14
Armada	3	0	1	4
Auburn Hills	4	1	0	5
Augusta	0	2	0	2
Baldwin	0	0	1	1
Bangor	1	3	0	4
Baroda	1	1	0	2
Barryton	1	0	0	1
Battle Creek	16	1	1	18
Bay City	0	2	1	3
Beaverton	0	1	0	1
Belding	3	1	0	4
Bellaire	1	1	0	2
Bellevue	1	1	0	2
Benton Harbor	4	4	1	9
Bessemer	0	1	0	1
Beverly Hills	4	1	0	5
Big Rapids	2	0	1	3
Bingham Farms	1	0	0	1
Birch Run	0	1	0	1
Birmingham	10	1	0	11
Bloomfield Hills	3	0	0	3
Boyne City	2	0	0	2
Brooklyn	0	1	0	1
Buchanan	1	0	0	1
Burr Oak	2	0	0	2
Burton	6	1	3	10
Byron	1	3	0	4
Cadillac	3	2	1	6
Caro	1	0	0	1
Caspian	4	0	0	4
Cedar Springs	0	1	0	1
Cement City	1	0	0	1
Central Lake	0	1	0	1
Centreville	1	0	0	1
Cheboygan	1	0	0	1
Clare	0	1	0	1
Clio	1	0	0	1
Coldwater	2	4	0	6

**BRIDGE INSPECTION PROGRAM**  
Michigan Department of Transportation (MDOT)

Overall Condition Ratings of Municipality-Owned Bridges  
As of March 28, 2010  
(Continued)

Municipality	Excellent - Good (9 - 7)	Satisfactory - Fair (6 - 5)	Poor - Critical (4 - 2)	Total Bridges
Columbiaville	0	1	1	2
Concord	1	1	0	2
Constantine	0	1	0	1
Coopersville	2	1	1	4
Corunna	1	0	0	1
Croswell	1	1	0	2
Crystal Falls	0	1	0	1
Custer	1	0	0	1
Dearborn	3	1	0	4
Dearborn Heights	7	7	0	14
Detroit	12	22	6	40
DeWitt	1	1	0	2
Dimondale	1	0	0	1
Douglas	0	0	1	1
Dowagiac	4	2	0	6
East Lansing	1	2	0	3
Eaton Rapids	0	3	1	4
Elk Rapids	1	0	0	1
Escanaba	3	1	0	4
Ewart	1	0	0	1
Fairgrove	1	0	0	1
Farmington	1	1	0	2
Fenton	2	2	2	6
Ferrysburg	1	1	0	2
Flint	9	14	9	32
Flushing	0	1	0	1
Fowlerville	2	0	0	2
Freeport	0	1	0	1
Fruitport	1	1	0	2
Gibraltar	5	2	1	8
Goodrich	1	0	1	2
Grand Blanc	3	1	0	4
Grand Haven	1	0	0	1
Grand Rapids	11	7	4	22
Grandville	2	2	0	4
Greenville	3	0	0	3
Hart	0	0	1	1
Hastings	0	0	1	1
Hersey	1	0	0	1
Hesperia	2	0	0	2
Holland	2	3	1	6
Hopkins	1	0	0	1
Howard City	1	1	0	2
Hubbardston	2	0	0	2
Hudson	0	2	0	2
Hudsonville	2	1	1	4
Inkster	1	0	0	1

BRIDGE INSPECTION PROGRAM  
Michigan Department of Transportation (MDOT)

Overall Condition Ratings of Municipality-Owned Bridges  
As of March 28, 2010  
(Continued)

Municipality	Excellent - Good (9 - 7)	Satisfactory - Fair (6 - 5)	Poor - Critical (4 - 2)	Total Bridges
Iron River	5	1	0	6
Ironwood	2	0	0	2
Ishpeming	3	0	1	4
Ithaca	1	0	0	1
Jackson	4	7	4	15
Kalamazoo	15	3	1	19
Keego Harbor	0	1	0	1
Kent City	1	1	2	4
Kentwood	9	1	0	10
Lake Orion	2	0	0	2
Lansing	9	8	1	18
Lapeer	6	4	3	13
Lawrence	2	1	0	3
Leslie	0	0	1	1
Lincoln Park	2	3	4	9
Linden	2	0	0	2
Litchfield	1	0	0	1
Livonia	0	2	0	2
Ludington	0	0	1	1
Luna Pier	1	0	0	1
Lyons	0	1	0	1
Manchester	0	1	1	2
Manistee	0	1	0	1
Maple Rapids	0	1	0	1
Marine City	0	0	1	1
Marion	0	0	1	1
Marquette	1	1	0	2
Marshall	0	2	2	4
Mason	1	1	0	2
Mattawan	0	1	0	1
Menominee	0	1	1	2
Metro Airport	7	7	2	16
Michigan State University	0	2	0	2
Middleville	0	0	1	1
Midland	6	3	2	11
Milan	1	1	0	2
Milford	3	1	0	4
Millersburg	0	1	0	1
Monroe	0	3	2	5
Morenci	1	0	1	2
Morley	1	0	0	1
Mount Clemens	0	1	1	2
Mount Pleasant	1	1	1	3
Muir	0	1	0	1
Munising	0	1	0	1
Muskegon	1	1	1	3
Nashville	1	0	0	1

**BRIDGE INSPECTION PROGRAM**  
Michigan Department of Transportation (MDOT)

Overall Condition Ratings of Municipality-Owned Bridges  
As of March 28, 2010  
(Continued)

Municipality	Excellent - Good (9 - 7)	Satisfactory - Fair (6 - 5)	Poor - Critical (4 - 2)	Total Bridges
Negaunee	0	1	0	1
New Baltimore	0	2	1	3
New Buffalo	0	1	0	1
New Haven	1	0	0	1
New Lothrop	1	1	0	2
Newaygo	1	0	0	1
Niles	0	2	1	3
North Muskegon	1	0	0	1
Northville	2	1	0	3
Norton Shores	4	1	0	5
Novi	2	1	1	4
Olivet	1	1	0	2
Ortonville	1	1	1	3
Otsego	2	0	0	2
Ovid	1	1	0	2
Owosso	0	1	0	1
Paw Paw	2	1	0	3
Petoskey	2	1	0	3
Pinconning	1	0	0	1
Plainwell	1	2	1	4
Pontiac	4	5	1	10
Port Austin	0	1	0	1
Port Huron	1	1	0	2
Portage	2	0	1	3
Portland	1	2	0	3
Powers	1	0	0	1
Ravenna	1	0	0	1
Reed City	0	1	0	1
Rochester	4	0	0	4
Rochester Hills	4	0	0	4
Rockford	1	0	2	3
Rogers City	1	0	0	1
Rose City	1	0	0	1
Saginaw	3	3	1	7
Saline	2	1	0	3
Sanford	0	1	0	1
Saranac	4	1	0	5
Sault Ste. Marie	3	1	3	7
Sebewaing	2	0	1	3
Shepherd	1	0	0	1
South Haven	0	1	0	1
Southfield	6	6	2	14
Sparta	0	1	1	2
St. Clair Shores	3	1	0	4
St. Joseph	0	1	0	1
St. Louis	3	0	0	3
Standish	1	0	0	1

**BRIDGE INSPECTION PROGRAM**  
Michigan Department of Transportation (MDOT)

Overall Condition Ratings of Municipality-Owned Bridges  
As of March 28, 2010  
(Continued)

Municipality	Excellent - Good (9 - 7)	Satisfactory - Fair (6 - 5)	Poor - Critical (4 - 2)	Total Bridges
Stephenson	2	1	0	3
Sterling Heights	9	1	1	11
Stevensville	1	0	0	1
Swartz Creek	1	1	0	2
Sylvan Lake	0	1	0	1
Tawas City	0	4	0	4
Taylor	3	1	0	4
Tecumseh	1	3	1	5
Three Oaks	0	1	0	1
Three Rivers	2	5	0	7
Traverse City	2	3	2	7
Trenton	0	2	0	2
Troy	3	5	0	8
Ubyly	1	1	0	2
Union City	0	2	0	2
Utica	1	0	0	1
Vassar	0	1	0	1
Vernon	0	3	0	3
Wakefield	3	0	0	3
Walker	1	1	2	4
Warren	2	2	0	4
Watervliet	0	2	0	2
Wayne	2	2	0	4
West Branch	2	2	0	4
Westland	1	2	1	4
Williamston	1	0	1	2
Wolverine	1	1	1	3
Wolverine Lake	1	0	0	1
Woodhaven	1	0	0	1
Wyoming	5	2	2	9
Yale	0	1	1	2
Ypsilanti	0	1	4	5
<b>Total</b>	<b>400</b>	<b>307</b>	<b>113</b>	<b>820</b>
Percentage of Total	48.8%	37.4%	13.8%	100.0%

Source: The Office of the Auditor General prepared this exhibit based on MDOT-provided data as of March 28, 2010 from the MDOT Bridge Management System.

**BRIDGE INSPECTION PROGRAM**  
Michigan Department of Transportation (MDOT)

Overall Condition Ratings of County-Owned Bridges  
As of March 28, 2010

County	Excellent - Good (9 - 7)	Satisfactory - Fair (6 - 5)	Poor - Critical (4 - 2)	Imminent Failure - Failed (1 - 0) *	Total Bridges
Alcona	13	8	3	0	24
Alger	14	5	8	0	27
Allegan	62	51	27	0	140
Alpena	12	7	2	0	21
Antrim	6	2	1	0	9
Arenac	16	24	6	0	46
Baraga	29	8	5	0	42
Barry	8	10	6	0	24
Bay	23	43	10	0	76
Benzie	6	6	1	0	13
Berrien	51	35	15	0	101
Branch	28	32	17	0	77
Calhoun	27	38	18	0	83
Cass	11	7	10	0	28
Charlevoix	4	2	2	0	8
Cheboygan	16	9	4	0	29
Chippewa	26	22	7	0	55
Clare	21	14	6	0	41
Clinton	42	46	29	0	117
Crawford	8	9	3	0	20
Delta	17	25	12	0	54
Dickinson	14	9	0	0	23
Eaton	68	17	9	2	96
Emmet	3	7	4	0	14
Genesee	25	59	35	0	119
Gladwin	26	15	3	0	44
Gogebic	21	27	11	0	59
Grand Traverse	13	3	1	0	17
Gratiot	51	40	26	0	117
Hillsdale	38	38	15	0	91
Houghton	24	7	2	0	33
Huron	114	44	4	0	162
Ingham	15	31	20	0	66
Ionia	28	23	16	0	67
Iosco	12	13	5	0	30
Iron	10	7	3	0	20
Isabella	51	29	34	0	114
Jackson	31	22	8	0	61
Kalamazoo	25	28	6	0	59
Kalkaska	3	3	3	0	9
Kent	111	54	6	0	171
Keweenaw	2	1	0	0	3
Lake	5	12	5	0	22
Lapeer	34	42	15	0	91
Leelanau	0	1	0	0	1
Lenawee	133	31	9	0	173
Livingston	37	30	21	0	88

**BRIDGE INSPECTION PROGRAM**  
Michigan Department of Transportation (MDOT)

Overall Condition Ratings of County-Owned Bridges  
As of March 28, 2010  
(Continued)

County	Excellent - Good (9 - 7)	Satisfactory - Fair (6 - 5)	Poor - Critical (4 - 2)	Imminent Failure - Failed (1 - 0) *	Total Bridges
Luce	16	3	0	0	19
Mackinac	11	7	3	0	21
Macomb	139	29	37	0	205
Manistee	6	11	4	0	21
Marquette	29	31	28	1	89
Mason	6	12	14	0	32
Mecosta	9	10	5	0	24
Menominee	32	23	15	0	70
Midland	28	28	19	0	75
Missaukee	10	12	13	0	35
Monroe	58	66	45	0	169
Montcalm	41	26	11	0	78
Montmorency	8	3	0	0	11
Muskegon	19	28	12	0	59
Newaygo	14	23	17	0	54
Oakland	45	21	14	0	80
Oceana	29	13	8	0	50
Ogemaw	6	2	1	0	9
Ontonagon	16	5	5	0	26
Osceola	27	10	7	0	44
Oscoda	5	5	1	0	11
Otsego	2	0	0	0	2
Ottawa	91	40	4	0	135
Presque Isle	15	6	4	0	25
Roscommon	4	7	1	0	12
Saginaw	115	66	24	2	207
Sanilac	106	30	5	0	141
Schoolcraft	7	7	3	0	17
Shiawassee	58	36	10	0	104
St. Clair	87	99	29	0	215
St. Joseph	29	47	17	0	93
Tuscola	149	50	5	0	204
Van Buren	27	28	6	0	61
Washtenaw	41	32	33	0	106
Wayne	115	109	8	0	232
Wexford	8	4	3	0	15
<b>Total</b>	<b>2,742</b>	<b>1,925</b>	<b>864</b>	<b>5</b>	<b>5,536</b>
Percentage of Total	49.5%	34.8%	15.6%	0.1%	100.0%

\* Bridges either are not in service or are temporarily supported.

Source: The Office of the Auditor General prepared this exhibit based on MDOT-provided data as of March 28, 2010 from the MDOT Bridge Management System.

BRIDGE INSPECTION PROGRAM  
Michigan Department of Transportation  
Photographs of Bridges  
August 2009

Support Beam on Closed Willoughby Street Bridge, Ingham County



Severely Deteriorated Rail Support on Willoughby Street Bridge, Ingham County



BRIDGE INSPECTION PROGRAM  
Michigan Department of Transportation  
Photographs of Bridges  
August 2009  
(continued)

Large Hole in the Bridge Deck of the Van Atta Road Bridge, Ingham County



Photographs taken by Office of the Auditor General (OAG) staff.

# GLOSSARY

## Glossary of Acronyms and Terms

<b>AASHTO</b>	American Association of State Highway and Transportation Officials.
<b>AASHTO Manual</b>	AASHTO Manual for Condition Evaluation of Bridges.
<b>bridges</b>	A structure including supports erected over a depression or an 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.
<b><i>CFR</i></b>	<i>Code of Federal Regulations.</i>
<b>comprehensive bridge inspection training</b>	Training that covers all aspects of bridge inspection and enables inspectors to relate conditions observed on a bridge to established criteria.
<b>condition rating</b>	The result of the assessment of the functional capability and the physical condition of bridge components by considering the extent of deterioration and other defects.
<b>deck</b>	The portion of the bridge that directly carries traffic.
<b>effectiveness</b>	Program success in achieving mission and goals.
<b>false decking</b>	Plywood sheeting laid on timbers that are supported on each end by a bridge's beams. False decking is used to prevent broken concrete from a deteriorating bridge from falling onto traffic.
<b>FHWA</b>	Federal Highway Administration, U.S. Department of Transportation.

<b>fracture critical member</b>	A steel member in tension, or with a tension element, whose failure would probably cause a portion of the bridge or the entire bridge to collapse.
<b>fracture critical member inspection</b>	A hands-on inspection of a fracture critical member or member components that may include visual and other nondestructive evaluation.
<b>hands-on inspection</b>	An inspection within arms length of a bridge component.
<b>initial inspection</b>	The first inspection of a bridge as it becomes a part of the bridge file to provide relevant structural and other data to determine baseline structural conditions.
<b>internal control</b>	The plan, policies, methods, and procedures adopted by management to meet its mission, goals, and objectives. Internal control includes the processes for planning, organizing, directing, and controlling program operations. It includes the systems for measuring, reporting, and monitoring program performance. Internal control serves as a defense in safeguarding assets and in preventing and detecting errors; fraud; violations of laws, regulations, and provisions of contracts and grant agreements; or abuse.
<b>load rating</b>	The determination of the safe load-carrying capacity of a bridge using bridge plans and supplemented by information gathered from a field inspection.
<b>locally owned bridge</b>	A bridge owned by a local governmental agency. This may be a city, village, township, or county.
<b>material condition</b>	A reportable condition that 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.

<b>MBIS</b>	Michigan Bridge Inspection System.
<b>MBRS</b>	Michigan Bridge Reporting System.
<b>MDOT</b>	Michigan Department of Transportation.
<b>Michigan Coding Guide</b>	MDOT's Michigan Structure Inventory and Appraisal Coding Guide.
<b>National Bridge Inspection Standards (NBIS)</b>	Federal regulations (specifically, Title 23, Part 650 of the <i>Code of Federal Regulations</i> ) establishing requirements for inspection procedures, frequency of inspections, qualifications of personnel, inspection reports, and preparation and maintenance of bridge inventory records.
<b>NBI</b>	National Bridge Inventory.
<b>performance audit</b>	An economy and efficiency audit or a program audit that is designed to provide an independent assessment of the performance of a governmental entity, program, activity, or function to improve program operations, to facilitate decision making by parties responsible for overseeing or initiating corrective action, and to improve public accountability.
<b>plan of action (POA)</b>	A plan to monitor known and potential deficiencies and to address critical findings.
<b>primary structural elements</b>	A bridge's deck, superstructure, and substructure.
<b>qualified team leader (QTL)</b>	An individual in charge of an inspection team responsible for planning, preparing, and performing the field inspection of a bridge.

<b>quality assurance</b>	The use of sampling and other measures to ensure the adequacy of quality control procedures in order to verify or measure the quality level of the entire bridge inspection and load rating program.
<b>quality control</b>	Procedures that are intended to maintain the quality of a bridge inspection and load rating at or above a specified level.
<b>reportable condition</b>	A matter that, in the auditor's judgment, 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 objectives of the audit; 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.
<b>routine bridge inspection</b>	A regularly scheduled inspection consisting of observations and/or measurements needed to determine the physical and functional condition of a bridge, to identify any changes from initial or previously recorded conditions, and to ensure that the structure continues to satisfy present service requirements.
<b>scour</b>	Erosion of streambed or bank material caused by flowing water. Scour is often considered to be localized around piers and abutments of bridges.
<b>scour critical bridge</b>	A bridge with a foundation element that has been determined to be unstable for the observed or evaluated scour condition.
<b>substructure</b>	The portion of the bridge that supports the superstructure and distributes all bridge loads to the ground surface.

**superstructure**

The portion of the bridge that supports the deck and connects one substructure element to another.

**underwater bridge  
inspection**

Inspection of the underwater portion of a bridge substructure and the surrounding channel, what cannot be inspected visually at low water level by wading or by boating and probing and generally requires diving or other appropriate techniques.









