



MICHIGAN

OFFICE OF THE AUDITOR GENERAL

AUDIT REPORT



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

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– Article IV, Section 53 of the Michigan Constitution

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Michigan
Office of the Auditor General
REPORT SUMMARY

Performance Audit
Measurement of State Highway Pavement
Conditions
Michigan Department of Transportation

Report Number:
591-0300-11

Released:
March 2012

The Michigan Department of Transportation (MDOT) has direct jurisdiction over Michigan's 9,655-mile State highway system, commonly known as the State trunkline system, which is composed of all the Interstate, U.S.-numbered, and M-numbered routes. MDOT is responsible for measuring the pavement conditions for these State highways. Although the State trunkline system accounts for only 8% of Michigan's 120,000-mile highway, road, and street network, it carries over 50% of all traffic and 70% of commercial truck traffic.

Audit Objective:

To assess the effectiveness of MDOT's efforts in measuring State highway pavement conditions.

Audit Conclusion:

We concluded that MDOT's efforts in measuring State highway pavement conditions were effective. However, we noted three reportable conditions (Findings 1 through 3).

Reportable Conditions:

MDOT, in conjunction with the Transportation Asset Management Council (TAMC), needs to improve its quality control and quality assurance processes for its Pavement Surface Evaluation and Rating (PASER) ratings (Finding 1).

MDOT, in conjunction with TAMC, had not verified that PASER raters were properly trained, had not obtained sufficient support for raters' expense reimbursements, and had not limited

raters' expense reimbursements to amounts provided for in the State's standardized travel regulations (Finding 2).

MDOT did not complete timely quality assurance reviews of distress data used to calculate remaining service life (RSL) for the State trunkline system. Also, MDOT needs to strengthen its overall process to estimate RSL and to assess the accuracy of those estimations (Finding 3).

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Audit Objective:

To assess the efficiency of MDOT's efforts in measuring State highway pavement conditions.

Audit Conclusion:

We concluded that MDOT's efforts in measuring State highway pavement conditions were efficient. However, we noted one reportable condition (Finding 4).

Reportable Condition:

MDOT, in conjunction with TAMC, had not coordinated the rating of the State trunkline system in a cost-effective and consistent manner to eliminate duplication of efforts (Finding 4).

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Audit Objective:

To compile and report selected State highway pavement condition statistics and trends.

Audit Conclusion:

We compiled and reported selected State highway pavement condition statistics and trends. Selected statistics and trends are presented in Exhibits 1 through 7 as supplemental information.

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Agency Response:

Our audit report contains 4 findings and 5 corresponding recommendations. MDOT's preliminary response indicates that it agrees with all 5 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>



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March 8, 2012

Mr. Jerrold M. Jung, Chair
State Transportation Commission
and
Kirk T. Steudle, P.E., Director
Michigan Department of Transportation
Murray Van Wagoner Transportation Building
Lansing, Michigan

Dear Mr. Jung and Mr. Steudle:

This is our report on the performance audit of the Measurement of State Highway Pavement Conditions, Michigan Department of Transportation.

This report contains our report summary; description of agency; audit objectives, scope, and methodology and agency responses; comments, findings, recommendations, and agency preliminary responses; various 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 response subsequent to our audit fieldwork. The *Michigan Compiled Laws* and administrative procedures require that the audited agency develop a plan to comply with the audit recommendations and submit it within 60 days after release of the audit report to the Office of Internal Audit Services, State Budget Office. Within 30 days of receipt, the Office of Internal Audit Services 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,

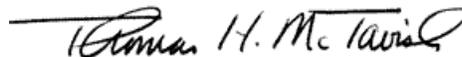

Thomas H. McTavish, C.P.A.
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Description of Agency

The Michigan Department of Transportation (MDOT) was organized under Act 380, P.A. 1965 (Sections 16.450 - 16.458 of the *Michigan Compiled Laws*). MDOT is governed by the State Transportation Commission, which is made up of six members who are appointed by the Governor with the advice and consent of the Senate. The Commission is responsible for establishing policies. MDOT is managed by a director, appointed by the Governor, who is responsible for administering MDOT and implementing the policies established by the Commission. MDOT's mission* is to provide the highest quality integrated transportation services for economic benefit and improved quality of life.

MDOT has direct jurisdiction over Michigan's 9,655-mile (approximately 27,400 lane miles) State highway system, commonly known as the State trunkline system*, which is composed of all Interstate, U.S.-numbered, and M-numbered routes. Although the State trunkline system accounts for only 8% of Michigan's 120,000-mile highway, road, and street network, it carries over 50% of all traffic and 70% of commercial truck traffic. The historical cost of the State trunkline system was approximately \$11 billion as of September 30, 2010.

MDOT is responsible for measuring the pavement conditions of the State trunkline system. Pavement condition data is necessary to help determine maintenance and rehabilitation needs, project future pavement conditions, and identify the impacts of treatments. Also, such data is used to help identify the most cost-effective and optimum maintenance and rehabilitation treatments for the State trunkline system.

MDOT is also responsible for allocating and distributing federal aid to local road agencies in accordance with Act 51, P.A. 1951, to maintain the State's 39,700 miles of federal-aid eligible highways*. Federal-aid eligible highways include not only the State trunkline system but also over 23,000 miles of highways and roads under the jurisdiction of local road agencies.

* See glossary at end of report for definition.

Act 499, P.A. 2002 (Section 247.659a of the *Michigan Compiled Laws*), established the Transportation Asset Management Council (TAMC) within the Commission and charged it with advising the Commission on implementing a Statewide asset management strategy for the federal-aid eligible highway system and, once completed, continuing with the county and municipal systems (non-federal-aid eligible pavements). TAMC consists of 10 voting members appointed by the Commission, 2 of which are from MDOT. MDOT is responsible for providing administrative and technical assistance to TAMC. MDOT receives an annual appropriation to fund TAMC activities.

MDOT administered its highway pavement condition measurement programs in its central office through its Asset Management Division and its Construction and Technology Division. MDOT's regional offices and transportation service centers also conduct reviews of the pavement condition assessments and provide feedback on some of the pavement condition ratings. MDOT's central office expended \$2.2 million, which included \$1.3 million in TAMC administrative costs, during the fiscal year ended September 30, 2010 for measuring State highway pavement conditions.

Audit Objectives, Scope, and Methodology and Agency Responses

Audit Objectives

Our performance audit* of the Measurement of State Highway Pavement Conditions, Michigan Department of Transportation (MDOT), had the following objectives:

1. To assess the effectiveness* of MDOT's efforts in measuring State highway pavement conditions.
2. To assess the efficiency* of MDOT's efforts in measuring State highway pavement conditions.
3. To compile and report selected State highway pavement condition statistics and trends.

Audit Scope

Our audit scope was to examine the Michigan Department of Transportation responsibilities and operations and related records of activities related to measurement of State highway pavement conditions. 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, conducted from May 2, 2011 through September 6, 2011, generally covered the period October 1, 2008 through June 30, 2011.

For purposes of this audit, "State highway" refers to both the State trunkline system and the State's federal-aid eligible highways.

As part of our audit, we compiled and reported supplemental information that relates to State highway pavement conditions (see Exhibits 1 through 7). Our audit was not directed toward expressing an opinion on this information and, accordingly, we express no opinion on it.

* See glossary at end of report for definition.

Audit Methodology

We conducted a preliminary review of MDOT operations related to measurement of State highway pavement conditions to formulate a basis for establishing our audit objectives and defining our audit scope and methodology. This included interviewing MDOT personnel, reviewing applicable State and federal laws and MDOT policies and procedures related to measuring pavement conditions, reviewing industry standards and best practices, and analyzing available data and statistics. We reviewed information technology systems and obtained data file downloads and records used to compile, store, and record State highway pavement condition ratings. We used this data for analyzing State highway pavement condition ratings measured and reported during our audit period.

To assess the effectiveness and efficiency of MDOT's efforts in measuring State highway pavement conditions, we analyzed pavement rating data and reviewed the lane miles rated for the State trunkline system for completeness. We tested ratings for a sample of highway sections by reviewing the results of comparable rating types for consistency and reasonableness. We obtained an understanding of MDOT's methods for estimating and validating remaining service life* (RSL) of its highways, and we tested the RSL estimation and validation process for a selection of highway sections. We obtained an understanding of MDOT's methods for conducting quality assurance* reviews of pavement condition data. We tested a sample of the quality assurance data against supporting documentation and reviewed the timeliness of the collection, quality assurance, and reporting of rating data used to support project planning.

We compiled and reported selected State highway pavement condition statistics and trends, included as Exhibits 1 through 7.

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. To the extent practical, we add balance to our audit reports by presenting noteworthy accomplishments for exemplary achievements identified during our audits.

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

Agency Responses

Our audit report contains 4 findings and 5 corresponding recommendations. MDOT's preliminary response indicates that it agrees with all 5 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 plan to comply with the audit recommendations and submit it within 60 days after release of the audit report to the Office of Internal Audit Services, State Budget Office. Within 30 days of receipt, the Office of Internal Audit Services 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.

COMMENTS, FINDINGS, RECOMMENDATIONS,
AND AGENCY PRELIMINARY RESPONSES

EFFECTIVENESS OF EFFORTS IN MEASURING STATE HIGHWAY PAVEMENT CONDITIONS

COMMENT

Background: Federal regulations provide that states should follow the pavement management guidelines established by the American Association of State Highway and Transportation Officials (AASHTO) in implementing a pavement management system. These guidelines provide that pavement condition assessment begins with collecting data to determine the type, amount, and severity of surface distress, structural integrity, ride quality, and skid resistance of the pavement. Several methods can be used to collect these condition measures, ranging from simple windshield surveys* (manual visual method) to the use of elaborate testing vehicles that measure smoothness, skid resistance, faulting, and cracking in the road surface.

The Michigan Department of Transportation (MDOT) collects pavement condition data on State highways using the following methods:

1. Sufficiency Rating*: This is an annual subjective windshield survey of the State trunkline system performed by a pavement management engineer, accompanied by a driver. This survey rates pavement distress condition and pavement ride on a scale of 1 to 5, with 1 being the best. MDOT has performed Sufficiency ratings on the State trunkline system since 1961. Exhibit 1 presents Sufficiency rating statistics.
2. Pavement Management System Ratings: This is an annual collection of detailed pavement surface data for one half of the State trunkline system. These ratings are performed by a contracted vendor using a specialized vehicle equipped with laser sensors and video cameras. The data is used to calculate the following pavement condition ratings:
 - a. International Roughness Index* (IRI) - An internationally recognized standard measure of pavement roughness based on the amount of vertical deflection along the wheel path on the roadway. Sensor data is collected from laser profilers located in the vehicle's inside and outside wheel paths. The resulting data is used to calculate the IRI. Exhibit 2 presents IRI statistics.

* See glossary at end of report for definition.

The Federal Highway Administration (FHWA), U.S. Department of Transportation, adopted the IRI as a measure for states to use in assessing and reporting highway conditions in the United States. The FHWA uses IRI data in reports describing the overall condition of the nation's highways and forecasting future highway investment needs. However, because the IRI measures only pavement roughness, the FHWA has noted that other measurements of pavement distress, such as rutting and cracking, are needed to fully assess the overall condition of the nation's highways. Variability in IRI measurements can arise from differences in pavement types, equipment used to measure the IRI, and differences in the measurement protocols used. Therefore, the FHWA cautions users of reported IRI data against using the data to make comparisons among states. Exhibit 7 presents the most recent pavement condition ratings by state as reported by the FHWA.

- b. Distress Index* (DI) - A measure that quantifies the level of distress that exists (e.g., cracking) on a pavement section. Video images are taken of the pavement surface on a continuous basis to capture the location and type of distresses. The resulting data is used to calculate a DI for each pavement section. One use of DI is to estimate the remaining service life (RSL) of each pavement section. Exhibit 3 presents RSL statistics.
3. Pavement Surface Evaluation and Rating* (PASER): The Transportation Asset Management Council (TAMC) adopted the PASER rating process as the means to collect pavement condition data on the State's federal-aid eligible highway system as part of its statutory responsibility to implement a Statewide asset management strategy. The PASER rating process is a visual survey method developed by the University of Wisconsin for assessing Statewide pavement conditions on a scale of 1 to 10, with 1 being the worst. MDOT is responsible for providing administrative and technical assistance to TAMC, including performing quality assurance reviews of PASER data, coordinating training, and processing invoices. Exhibit 4 presents PASER statistics.

Pavement conditions reported by rating type are not always comparable because of variations in type of data collected, rating scales, and timing of the data collection. Exhibit 5 presents the 2010 distribution of State trunkline system pavement conditions

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

by rating method. Exhibit 6 presents the 2010 State trunkline system pavements rated as poor and very poor summarized by MDOT region, county, and rating method.

Audit Objective: To assess the effectiveness of MDOT's efforts in measuring State highway pavement conditions.

Audit Conclusion: We concluded that MDOT's efforts in measuring State highway pavement conditions were effective. However, our assessment disclosed three reportable conditions* related to quality control* and quality assurance of PASER data collection, PASER raters and reimbursements, and remaining service life (RSL) (Findings 1 through 3).

Noteworthy Accomplishments: In 2007, AASHTO, the FHWA, and the National Cooperative Highway Research Program sponsored a study entitled "U.S. Domestic Scan Program: Best Practices in Transportation Asset Management." The 2007 scan recognized MDOT as one of the leading state transportation agencies in the practice of asset management.

In 2008, the Pew Center on the States, in conjunction with *Governing* magazine, completed a project to assess the quality of management in state government entitled "Government Performance Project." The 2008 project graded the overall effectiveness of state services in a number of categories, including asset infrastructure management. The Government Performance Project report gave Michigan an "A-" effectiveness grade for the following infrastructure categories: capital planning, project monitoring, maintenance, internal coordination, and intergovernmental coordination.

FINDING

1. Quality Control and Quality Assurance of PASER Data Collection

MDOT, in conjunction with TAMC, needs to improve its quality control and quality assurance processes for its PASER ratings. Such improvements would enhance MDOT and TAMC's quality control and quality assurance processes, thus helping to ensure that the processes are consistent with AASHTO's pavement management guidelines.

* See glossary at end of report for definition.

The pavement management guidelines established by AASHTO provide that it is imperative that quality control and quality assurance procedures be in place to monitor the field collection of pavement condition data by raters. Effective quality control procedures include actions to control the quality of the data collection activities, such as ensuring that personnel responsible for the data collection are properly trained. Effective quality assurance procedures include actions to verify that the data meets quality requirements before it is accepted and used to support pavement management decisions. Such action could include performing independent assurance testing by re-rating a sample of pavement sections and evaluating ratings outside of an expected range.

TAMC policy provides that PASER ratings shall be collected by a team of three raters. The teams consist of a regional MDOT employee, an employee from the applicable regional/metropolitan planning organization* (RPO/MPO), and an employee from the applicable local jurisdiction (county, city, or village). Also, anyone who participates in collecting PASER ratings must attend PASER training in each year that he or she participates.

Our review of MDOT's quality control and quality assurance processes over the PASER rating process disclosed:

- a. MDOT, in conjunction with TAMC, did not ensure that all PASER raters were properly trained before the raters collected pavement condition data.

Our comparison of the raters listed on the submitted time expense logs with training attendance lists disclosed that 9 (15%) of 62 raters in 2009 and 13 (27%) of 48 raters in 2010 did not attend training in the year the raters collected PASER data.

- b. MDOT, in conjunction with TAMC, had not documented its methodology for selecting representative highway sections for its annual quality assurance testing of the PASER ratings. Appropriate documentation would demonstrate that the quality assurance selection process considered the proportion of federal-aid eligible highways within a county, the proportion of the pavement types within a county, and other relevant factors to ensure that the selected

* See glossary at end of report for definition.

highway sections were appropriately representative of all federal-aid eligible highways in the counties and the State.

MDOT's quality assurance process for the PASER ratings included testing the same selected highway sections each year. MDOT informed us that it selected the same highway sections each year to allow MDOT to conduct a quality assurance review of the PASER ratings every other year and to allow MDOT to monitor the condition of the highway over a long period of time to obtain data regarding conditions and longevity of various pavement types. However, MDOT could not provide documentation of the original selection process demonstrating that its original selection of highway sections was and remains representative of all federal-aid eligible highways within the State.

- c. MDOT, in conjunction with TAMC, did not consistently document explanations when the ratings assigned by the PASER raters and the ratings assigned by the quality assurance raters differed by 3 or more condition ratings. For 2010, 2,423 PASER ratings had a quality assurance review. Of these, 152 (6%) PASER ratings differed by 3 or more condition ratings from the quality assurance ratings. Also, for 82 (54%) of the 152 ratings with differences of 3 or more in the condition ratings, the database did not contain explanations for the variances. As a result, MDOT could not demonstrate that the differences were appropriate.

Our analysis of the 2010 PASER ratings compared with the quality assurance ratings when the condition ratings differed by 3 or more noted:

Difference Between PASER and Quality Assurance Ratings	Number of Occurrences	Number of Occurrences Without Variance Explanations
3	93	54
4	22	19
5	15	6
6	10	3
7	12	0
Total	<u>152</u>	<u>82</u>

RECOMMENDATION

We recommend that MDOT, in conjunction with TAMC, improve its quality control and quality assurance processes for its PASER ratings.

AGENCY PRELIMINARY RESPONSE

MDOT agrees with the finding and recommendation and informed us that MDOT will work, in conjunction with TAMC, to improve its quality control and quality assurance processes for its PASER ratings.

FINDING

2. PASER Raters and Reimbursements

MDOT, in conjunction with TAMC, had not verified that PASER raters were properly trained, had not obtained sufficient support for raters' expense reimbursements, and had not limited raters' expense reimbursements to amounts provided for in the State's standardized travel regulations. As a result, MDOT could not document the proficiency of all PASER raters and the validity of all reimbursements for costs incurred to collect PASER rating data.

TAMC policy requires each rating team to submit a time expense log and attend required training to obtain reimbursement for relevant expenses related to collecting PASER data. Relevant expenses include time, travel, and meals associated with the data collection effort.

MDOT reimbursed RPO/MPOs for the relevant expenses incurred by non-MDOT employee rating team members (employees from the applicable RPO/MPO and local jurisdiction) based on annual project authorizations. We determined that MDOT reimbursed RPO/MPOs \$361,245 and \$380,754 in fiscal year 2008-09 and fiscal year 2009-10, respectively, for expenses claimed and submitted by these rating team members. On average, MDOT reimbursed rating teams \$937 per day for expenses incurred by non-MDOT employee rating team members to collect PASER condition data.

Our review of TAMC policy and MDOT processes for reimbursing raters disclosed:

- a. MDOT did not have sufficient information to verify whether the raters had received proper training prior to the reimbursement of relevant expenses. Also, MDOT did not collect time expense logs from rating teams for 340 (85%)

of 398 different collection dates and 358 (91%) of 394 different collection dates in fiscal year 2008-09 and fiscal year 2009-10, respectively. Although MDOT obtained invoices from RPO/MPOs requesting reimbursements for collecting data, the invoices did not contain rater names, collection dates, miles rated, and hours worked as required by TAMC policy.

- b. TAMC policy did not require the reimbursement of meals and mileage to be based on the State's standardized travel regulations and rates. Also, TAMC policy did not require information related to the applicable pay rates of the raters. For example, an invoice from one RPO/MPO requested reimbursement of \$1,434 for salaries and benefits and \$1,416 for other expenses. However, the RPO/MPO did not provide sufficient information to support the salaries and benefits amount, such as rater pay rates and days and hours worked. Also, there was no explanation or support for the other expense amount listed.

RECOMMENDATION

We recommend that MDOT, in conjunction with TAMC, verify that PASER raters are properly trained, obtain sufficient support for raters' expense reimbursements, and limit raters' expense reimbursements to amounts provided for in the State's standardized travel regulations.

AGENCY PRELIMINARY RESPONSE

MDOT agrees with the finding and recommendation and informed us that MDOT will work, in conjunction with TAMC, to create a process that ensures the proficiency of the raters and the validity of reimbursements for collecting PASER rating data.

FINDING

3. Remaining Service Life (RSL)

MDOT did not complete timely quality assurance reviews of distress data used to calculate RSL for the State trunkline system. Also, MDOT needs to strengthen its overall process to estimate RSL and to assess the accuracy of those estimations. As a result, MDOT could have used inaccurate and/or unreliable RSL information when prioritizing and selecting pavement projects for rehabilitation or reconstruction.

The pavement management guidelines established by AASHTO provide that various types of models can be used by state highway agencies to predict the RSL for pavements, depending on the goals and needs of the agency. However, the guidelines also state that a reliable model for predicting the RSL of pavements should include complete and accurate data to provide the necessary information to support the model, a method to assess the accuracy of the RSL predictions over time, and consideration of all factors that affect pavement performance.

MDOT uses a logistic regression model, an equation used to predict when a pavement's Distress Index (DI) rating will reach 50, as part of its RSL assignment process for the State trunkline system. A DI rating of 50 is the threshold used by MDOT to estimate when it is most cost-effective to perform rehabilitation or reconstruction. Use of the model requires minimum data elements such as the age of the pavement and historical pavement DI ratings for at least three consecutive rating periods.

Our review of MDOT's process for estimating and validating RSL disclosed:

- a. MDOT did not have complete and current data required to calculate RSL when using its logistic regression model. The MDOT data used to calculate RSL in 2010 did not include the most recent DI ratings (collection years 2008 and 2009) for 9,425 (33%) of the 28,337 lane miles within the State trunkline system. Although MDOT may have had historical DI ratings for three consecutive rating periods for these pavements, thus meeting the minimum requirements for using the model, it did not have the most recent DI ratings. Therefore, MDOT could not ensure that the calculated RSL properly reflected the actual current condition of these pavements.

The incomplete data primarily resulted from a lack of timeliness in MDOT's quality assurance process for distress data. When MDOT calculated RSL for use in its annual project planning process, approximately six months after the submission of all distress data, MDOT had not yet completed its quality assurance reviews of the most recent distress data. For the RSL calculated in 2010, MDOT had not completed quality assurance reviews of distress data collected in 2009 for 1,183 (20%) of 5,925 miles of highway. Also, for the RSL

calculated in 2011, MDOT had not completed quality assurance reviews of distress data collected in 2010 for 2,930 (47%) of 6,195 miles of highways.

MDOT informed us that it did not solely rely on its logistic regression model when estimating RSL and that it used various alternative methods based on industry standards to estimate RSL when it lacked complete data. MDOT also informed us that it made some changes to its database system in early 2011 to help streamline the quality assurance process. According to MDOT, this caused significant delays in completing its quality assurance process for 2010 data.

- b. MDOT did not evaluate its fix life benefit guides* to determine if region specific environmental factors, such as freeze-thaw cycles, precipitation, and annual temperature changes, should be considered when establishing the maximum RSL of pavements. MDOT used standard fix life benefit guides based on pavement type and average daily commercial traffic to determine the maximum RSL when a pavement was constructed or reconstructed. For example, the maximum fix life for a reconstructed concrete pavement with average daily commercial traffic of less than or equal to 3,000 is 25 years. The standard fix life benefit guides did not take into consideration varying climate conditions between regions that could cause the maximum fix life of certain pavements to vary by region. Michigan's climate can vary across certain regions. For example, parts of the Upper Peninsula do not experience the same freeze-thaw cycles as experienced in the Lower Peninsula. Freeze-thaw cycles cause expansions and contractions in road surfaces, which in turn create cracks.
- c. MDOT did not always verify the accuracy of RSL for pavements not recently constructed or reconstructed. When MDOT's calculated RSL differed significantly from the prior year RSL, MDOT did not always evaluate whether the significant variances were appropriate. Instead, MDOT revised the calculated RSL by subtracting one year from the prior year RSL.

For example, in each year from 2007 through 2010, the calculated RSL based on the DI ratings for one pavement section was 0, indicating a potential need

* See glossary at end of report for definition.

for rehabilitation or reconstruction. However, because the RSL for this section was 10 in 2007 based on region feedback, MDOT revised the calculated RSL each year by subtracting one year from the prior year estimate without following up whether the variance was appropriate.

Although MDOT forwarded estimated RSLs to its regions for review, regional review was optional. In the previous example, the region did not provide feedback on the estimated RSL during 2008, 2009, and 2010. Our review of estimated RSLs for one region noted that MDOT estimated RSL for 345 (64%) of its 542 pavement sections by subtracting one year from the prior year RSL. Of these 345 pavement sections, the region did not review 291 (84%) pavement sections.

RECOMMENDATIONS

We recommend that MDOT complete timely quality assurance reviews of distress data used to calculate RSL for the State trunkline system.

We also recommend that MDOT strengthen its overall process to estimate RSL and to assess the accuracy of those estimations.

AGENCY PRELIMINARY RESPONSE

MDOT agrees with the finding and recommendations and informed us that MDOT will continue to improve the timeliness of quality assurance reviews of distress data used to calculate RSL for the State trunkline system. MDOT also informed us that MDOT will strengthen its overall process to estimate RSL and to assess the accuracy of those estimations.

EFFICIENCY OF EFFORTS IN MEASURING STATE HIGHWAY PAVEMENT CONDITIONS

COMMENT

Background: A pavement management system is a set of tools or methods that assists decision makers in finding cost-effective strategies for providing, evaluating, and maintaining pavements in a serviceable condition. Data collection is one of the most costly parts of operating a pavement management system. The methods and type of

data collected are generally different when collecting data for decision making at the network level versus the project level. Network-level data collection involves a collection of large quantities of pavement condition data and typically includes using windshield surveys (manual visual method) and automated methods. These techniques can generally be performed at highway speeds without affecting traffic or posing a hazard to data collection teams. This information is used to assess the overall condition of the network, determine maintenance and rehabilitation strategies, and develop work programs and budgets for the entire network. At the project level, more specific data is typically collected in terms of individual distress identification and severity.

Audit Objective: To assess the efficiency of MDOT's efforts in measuring State highway pavement conditions.

Audit Conclusion: We concluded that MDOT's efforts in measuring State highway pavement conditions were efficient. However, our assessment disclosed one reportable condition related to the coordination of data collection methods (Finding 4).

FINDING

4. Coordination of Data Collection Methods

MDOT, in conjunction with TAMC, had not coordinated the rating of the State trunkline system in a cost-effective and consistent manner to eliminate duplication of efforts. As a result, MDOT used limited resources to collect duplicate pavement condition data for the same highways, some of which MDOT did not use to make project funding decisions. MDOT could save approximately \$386,200 over a two-year period by only collecting data used to make project funding decisions.

The pavement management guidelines established by AASHTO provide that to reduce the cost of implementing a pavement management system, only the minimum data required to assess pavement conditions and make pavement maintenance, rehabilitation, and funding decisions at the network (overall system) level should be collected.

In 1961, MDOT began conducting Sufficiency ratings, a windshield survey of the State trunkline system, on an annual basis. In 2003, MDOT, in conjunction with the TAMC, implemented the PASER rating process, a windshield survey of the federal-aid eligible highway system. Although State statute requires TAMC to

implement a Statewide asset management strategy for the federal-aid eligible highway system, it does not require a specific method to rate the pavement conditions.

The PASER rating process collects rating data on half of the federal-aid eligible highway system each year. Federal-aid eligible highways include not only the State trunkline system but also over 23,000 miles of highways and roads under the jurisdiction of local road agencies. As a result of the two survey methods, half of the State trunkline system is surveyed twice each year.

Our review of the Sufficiency ratings and the PASER ratings identified the following factors to consider when evaluating the rating methods used for the State trunkline system:

- a. MDOT used the Sufficiency ratings, along with estimated RSL, to support project decisions for State trunkline system pavements. MDOT informed us that it never intended to use State trunkline highway PASER ratings for project decisions.
- b. Local road agencies utilize PASER ratings to make project funding decisions for locally controlled federal-aid eligible highways.
- c. The Sufficiency rating process incorporates a thorough inventory analysis of the State trunkline system, including the collection of pavement details such as the most recent improvement types and year, pavement widths, and surface type. The PASER rating process does not collect this type of data.

Based on cost data provided by MDOT, we estimated that MDOT expended approximately \$40 per mile in collecting PASER data and approximately \$12 per mile in collecting Sufficiency rating data. In total, MDOT expended approximately \$666,200 during fiscal years 2009-10 and 2008-09 performing windshield surveys of the State trunkline system. Coordinating the rating of the State trunkline system to collect only the data used to make project funding decisions would reduce the cost of rating the condition of the State trunkline system by approximately \$386,200 over a two-year period.

RECOMMENDATION

We recommend that MDOT, in conjunction with TAMC, coordinate the rating of the State trunkline system in a cost-effective and consistent manner to eliminate duplication of efforts.

AGENCY PRELIMINARY RESPONSE

MDOT agrees with the finding and recommendation and informed us that MDOT will work, in conjunction with TAMC, to coordinate the rating of the State trunkline system in a cost-effective and consistent manner to eliminate duplication of efforts.

SELECTED STATE HIGHWAY PAVEMENT CONDITION STATISTICS AND TRENDS

COMMENT

Audit Objective: To compile and report selected State highway pavement condition statistics and trends.

Audit Conclusion: **We compiled and reported selected State highway pavement condition statistics and trends.** Selected statistics and trends are presented in Exhibits 1 through 7 as supplemental information.

SUPPLEMENTAL INFORMATION

Exhibit 1 - Sufficiency Rating Statistics

Exhibit 1 presents a trend analysis, based on the Michigan Department of Transportation's (MDOT's) Sufficiency rating data, of the percentage of State trunkline system pavements rated as excellent, good, and fair and the percentage of State trunkline system pavements rated as poor and very poor from calendar years 1996 through 2010. It also presents a breakdown of State trunkline system pavement conditions based on the Sufficiency rating for 2010. The Sufficiency rating method uses the following measurement scale:

Rating	Description
1 = Excellent	None or very little pavement deterioration.
2 = Good	Some initial deterioration not yet requiring appreciable amounts of maintenance.
3 = Fair	Occasional deterioration requiring routine maintenance operations.
4 = Poor	Frequent occurrence of surface deterioration requiring more extensive maintenance and/or reconstruction.
5 = Very Poor	Extensive surface deterioration. Warrants reconstruction soon.

MDOT's performance goal is to improve or sustain 90% of State trunkline system pavements in fair or better condition. However, based on the annual Sufficiency rating results, MDOT did not meet its 90% performance goal in any of the 15 calendar years from 1996 through 2010.

The Sufficiency rating method is a windshield survey (manual visual method) unique to MDOT, and although other states may use windshield survey methods, variances may exist in the type of data collected and the measurement scales. Therefore, the Sufficiency rating results are not comparable with rating results from other states.

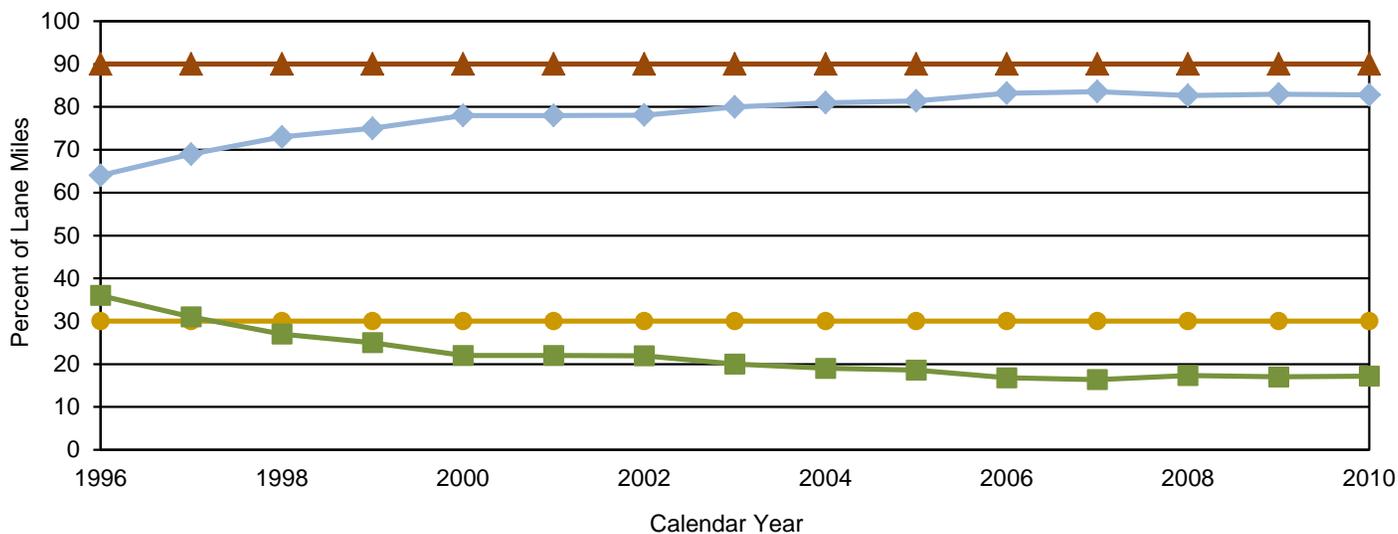
MDOT also uses Sufficiency rating data to assess the State trunkline system pavement conditions for financial reporting purposes. Governmental Accounting Standards Board (GASB) Statement No. 34, *Basic Financial Statements - and Management's Discussion and Analysis - for State and Local Governments* allows the State to not report depreciation expense on selected infrastructure assets as long as the State maintains an up-to-date inventory of eligible infrastructure assets; performs condition assessments of the assets; summarizes the results using a measurement scale; estimates the annual amount to maintain and preserve the assets at the condition level established and disclosed by the State; and documents that the assets are being preserved approximately at, or above, the established condition level.

The State established a standard that no more than 30% of State trunkline system pavements shall be rated as poor or very poor based on Sufficiency ratings for purposes of meeting GASB Statement No. 34 requirements (GASB reporting condition level). The State has met this standard for calendar years 1998 through 2010.

Other states use various methods and standards in assessing pavement condition levels for purposes of GASB Statement No. 34 as allowed. Therefore, the GASB Statement No. 34 standards used by MDOT are also not comparable with the GASB standards used by other states.

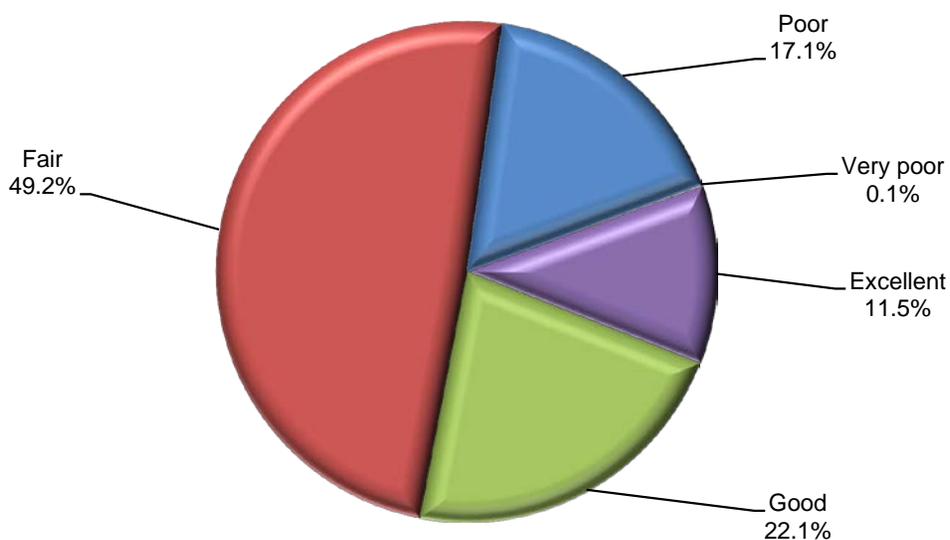
MEASUREMENT OF STATE HIGHWAY PAVEMENT CONDITIONS
Michigan Department of Transportation (MDOT)
Sufficiency Rating Statistics

State Trunkline System Pavement Conditions
Based on Sufficiency Ratings by Calendar Year
Calendar Years 1996 Through 2010



- ▲ Performance goal
- ◆ Rated as excellent, good, and fair
- GASB reporting condition level
- Rated as poor and very poor

2010 State Trunkline System Pavement Conditions
Based on Sufficiency Ratings



Source: MDOT's Sufficiency rating data for calendar years 1996 through 2010.

Exhibit 2 - International Roughness Index (IRI) Statistics

Exhibit 2 presents a trend analysis of the State trunkline system ride quality from collection years 2001 through 2010 based on the IRI. It also presents a breakdown of 2009 and 2010 State trunkline system pavement conditions based on the IRI data. The IRI is an internationally recognized standard measure of pavement roughness adopted by the Federal Highway Administration (FHWA) as a measure for states to use in assessing and reporting highway conditions in the United States. A rapid-travel profiler vehicle equipped with laser sensors located in the inside and outside wheel paths is used to take measurements and calculate the IRI for every 0.1 mile of pavement section. The IRI is calculated based on the amount of vertical deflection along the wheel path of the roadway. MDOT calculates a pavement section's roughness as the average of the two wheel paths' individual IRI values (known as the Mean Roughness Index). The lower the IRI number, the smoother the pavement. The Michigan Department of Transportation (MDOT) has adopted the following general quality ranges for the IRI:

Rating	Description
Good	IRI less than 95 inches per mile
Fair	IRI between 95 and 170 inches per mile
Poor	IRI greater than 170 inches per mile

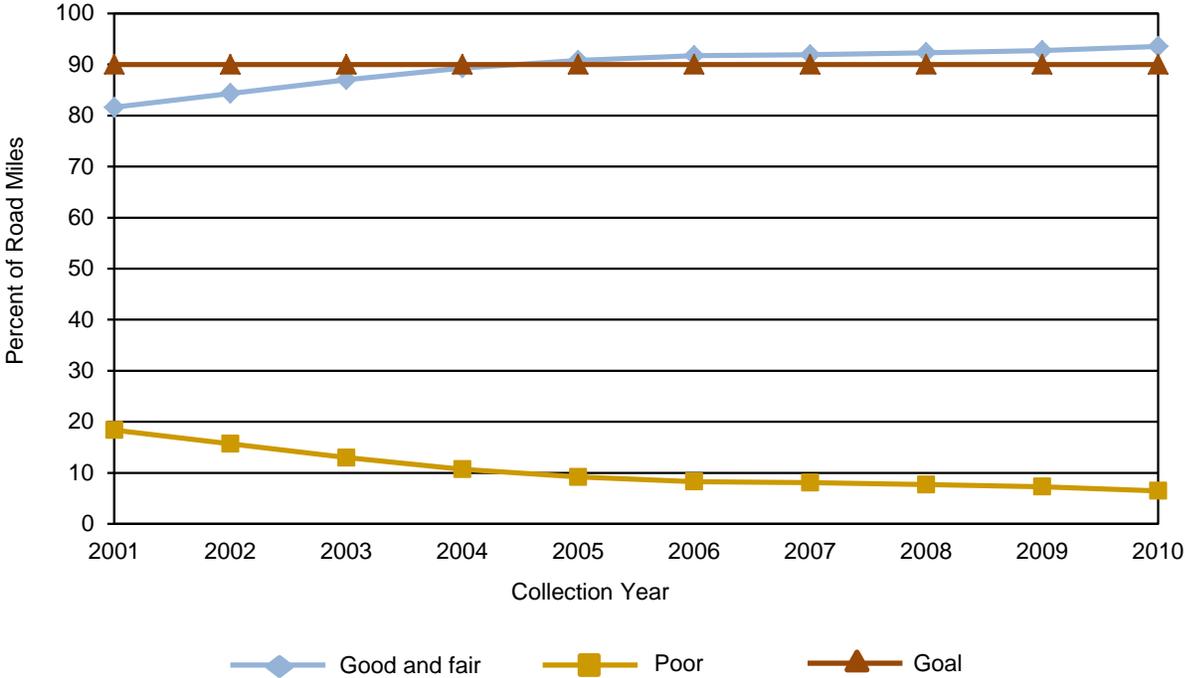
MDOT's performance goal is to improve or sustain 90% of State trunkline system pavements in fair or better condition based on the IRI. MDOT met its 90% performance goal in collection years 2005 through 2010 based on the IRI.

MDOT collects IRI data each year for all highways on the national highway system, as required by the FHWA, and for half of all other highways on the State trunkline system. The IRI data used to prepare the pie chart included the most recent IRI ratings for each highway pavement section during collection years 2009 and 2010.

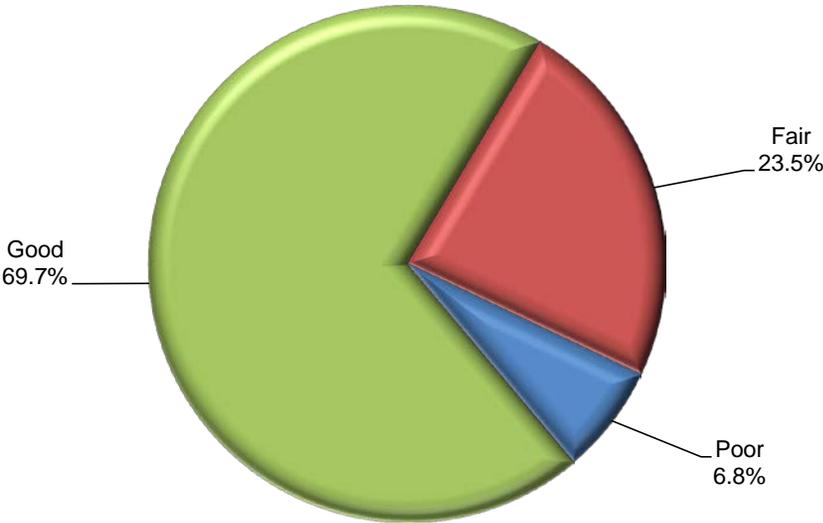
The IRI ratings presented in Exhibit 2 are only for Michigan's State trunkline system and are not comparable to the ratings reported for all of Michigan's public roads or to the ratings presented for other states in Exhibit 7. States are required to report IRI data to the FHWA; however, states vary in their protocols for measuring the IRI and the extent to which they rely on the IRI to make pavement project decisions. For example, Wisconsin uses a scale of 0 to 5, with an IRI of 2.69 or greater defined as "poor" and its policy is to ensure that no more than 15% of its roads receive a "poor" IRI assessment (source: State of Wisconsin Comprehensive Annual Financial Report for the fiscal year ended June 30, 2010).

MEASUREMENT OF STATE HIGHWAY PAVEMENT CONDITIONS
Michigan Department of Transportation (MDOT)
International Roughness Index (IRI) Statistics

State Trunkline System Ride Quality
Based on IRI Data by Collection Year
Collection Years 2001 Through 2010



State Trunkline System Ride Quality
Based on 2009 and 2010 IRI Data



Source: MDOT's IRI data for collection years 2001 through 2010.

Exhibit 3 - Remaining Service Life (RSL) Statistics

Exhibit 3 presents a trend analysis of the percentage of State trunkline system pavements rated as good and fair based on the RSL of those pavements. It also presents a breakdown of the 2010 State trunkline system pavement conditions based on RSL. RSL is defined as the estimated number of years until it is no longer cost-effective to perform preventive maintenance on a pavement section. MDOT's estimated RSL in 2010 for new pavement varied depending on the type of pavement (e.g., concrete versus asphalt) and the average daily commercial traffic occurring on the highway and could range from 13 to 25 years. For example, new concrete pavement with average daily commercial traffic of less than 3,000 vehicles was expected to last 25 years. The Michigan Department of Transportation (MDOT) has adopted the following general quality ranges for RSL values:

<u>Rating</u>	<u>Description</u>
Good	8 years or more
Fair	3 to 7 years
Poor	2 years or less

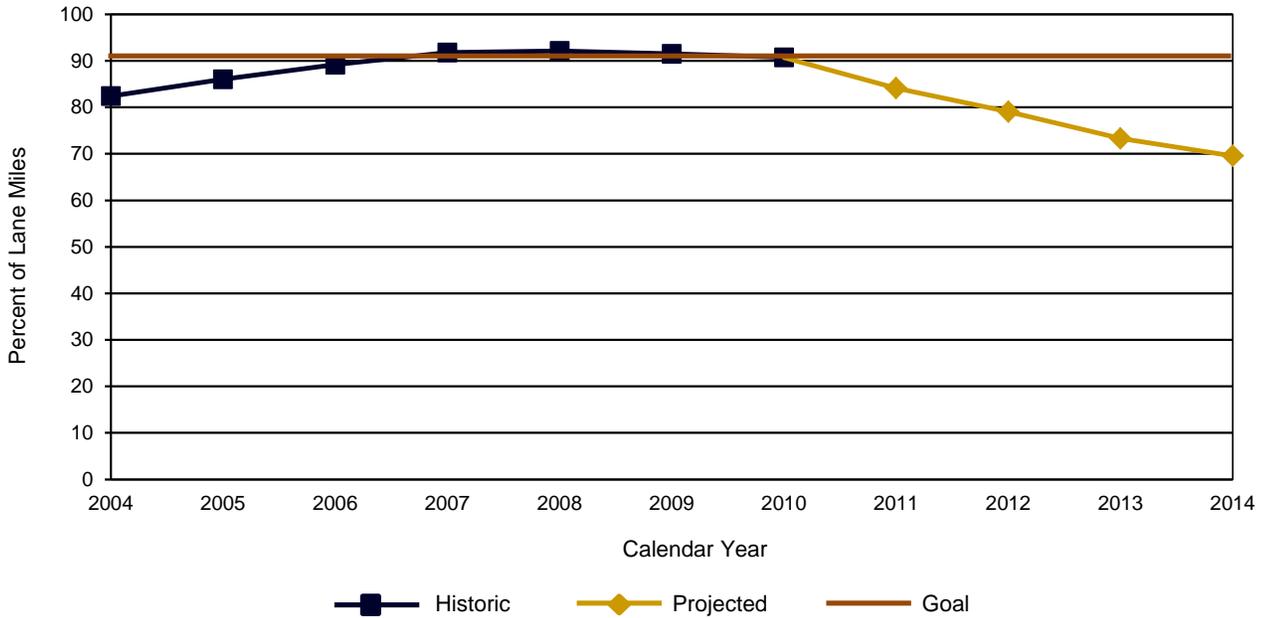
MDOT's performance goal is to improve or sustain 90% of State trunkline system pavements in fair or better condition based on RSL. MDOT met its 90% performance goal in calendar years 2007 through 2010 based on the RSL results.

The graph in Exhibit 3 includes forecasted pavement conditions based on pavement improvement strategies and projects, using the investment levels contained in MDOT's 2010 - 2014 Five Year Transportation Program. According to MDOT, Statewide combined pavement conditions were projected to decline to approximately 84% in good and fair condition during 2011 and decline further to approximately 70% in good and fair condition during 2014.

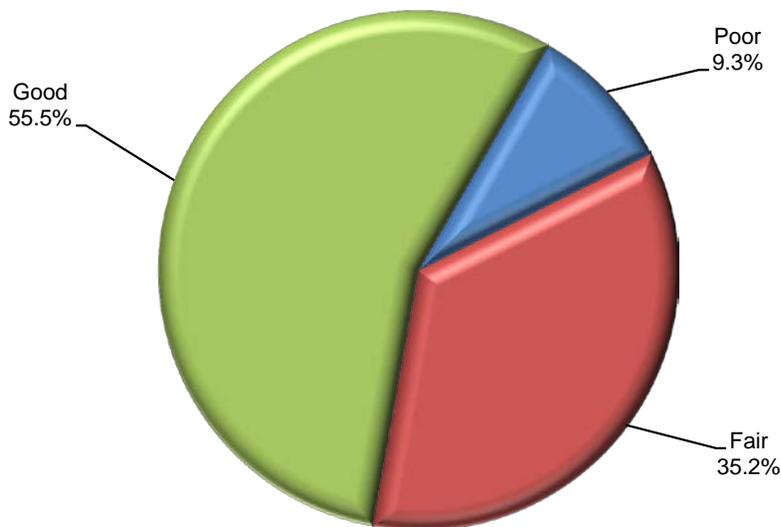
Because states use various types of models to predict RSL for its pavements based on goals and needs, RSL goals and quality ranges are not comparable across states.

MEASUREMENT OF STATE HIGHWAY PAVEMENT CONDITIONS
Michigan Department of Transportation (MDOT)
Remaining Service Life (RSL) Statistics

State Trunkline System
Percent in Good and Fair Condition (RSL of More Than Two Years)
Calendar Years 2004 Through 2014



2010 State Trunkline System Pavement Conditions
Based on RSL



Source: MDOT's RSL data for calendar years 2004 through 2010.

Exhibit 4 - Pavement Surface Evaluation and Rating (PASER) Rating Statistics

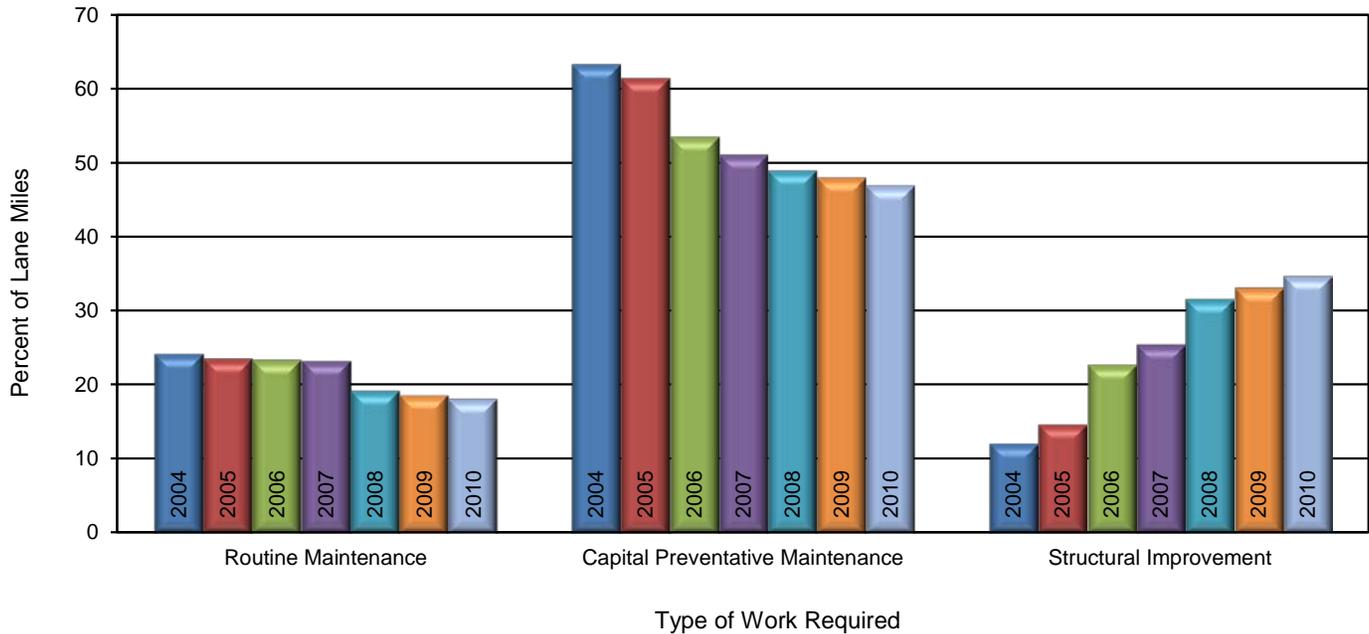
Exhibit 4 presents a trend analysis of the percentage of Michigan's federal-aid eligible highway pavements needing routine maintenance, capital preventive maintenance, and structural improvement based on the PASER rating results from calendar years 2004 through 2010. It also presents a breakdown of Michigan's federal-aid eligible highway pavements based on the PASER ratings for 2010. The Transportation Asset Management Council (TAMC) requires raters to assess surface conditions of the federal-aid eligible highways based on the amount, type, and severity of pavement distress using a standard rating scale of 1 to 10, with a rating of 1 being the worst. In addition to assessing surface conditions, a given rating also indicates a recommendation for remedy or action needed. For reporting purposes, the rating results from the 1 to 10 rating scale were grouped by TAMC using the following categories based on the type of work required for each rating:

Rating	Description
8 to 10	Routine maintenance: This category includes roads that are newly constructed or rehabilitated, have received a structural overlay, or were recently seal coated. They require little or no maintenance.
5 to 7	Capital preventive maintenance: This category includes roads that still show good structural support, but the surface is starting to deteriorate. They require treatments to slow the rate of deterioration and/or correct pavement surface distress.
1 to 4	Structural improvement: This category includes roads requiring some type of repair to improve the structural integrity of the pavement, such as major rehabilitation or reconstruction.

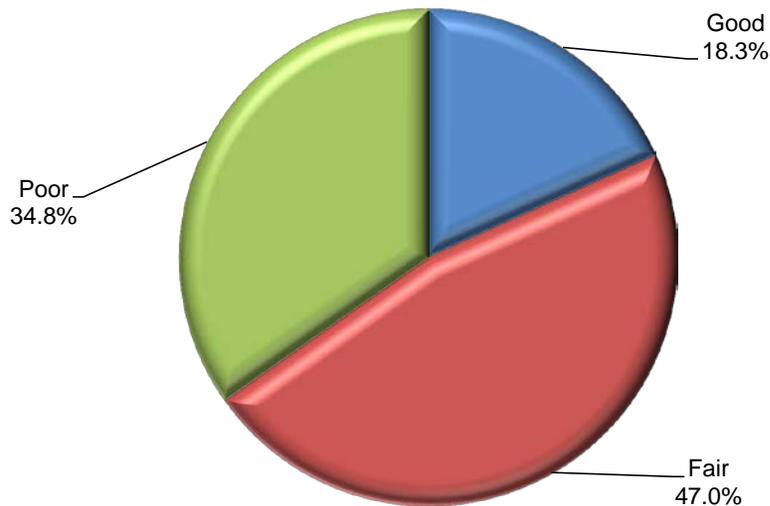
The PASER ratings presented in Exhibit 4 are for Michigan's federal-aid eligible highways and are not comparable with the ratings presented in Exhibits 5 and 6 for the State trunkline system.

MEASUREMENT OF STATE HIGHWAY PAVEMENT CONDITIONS
Michigan Department of Transportation (MDOT)
Pavement Surface Evaluation and Rating (PASER) Rating Statistics

Federal-Aid Eligible Highway Pavement Conditions
Based on PASER Data
Calendar Years 2004 Through 2010



2010 Federal-Aid Eligible Highway Pavement Conditions
Based on PASER Ratings



Source: MDOT's PASER data for calendar years 2004 through 2010 and the Transportation Asset Management Council 2010 Michigan Roads and Bridges Annual Report.

Exhibit 5 - 2010 Distribution of State Trunkline System Pavement Conditions by Rating Method

Exhibit 5 presents a comparison of the percentage of State trunkline system pavements in excellent and good condition, fair condition, and poor and very poor condition based on the Sufficiency rating, International Roughness Index (IRI), remaining service life (RSL), and Pavement Surface Evaluation and Rating (PASER) rating in 2010.

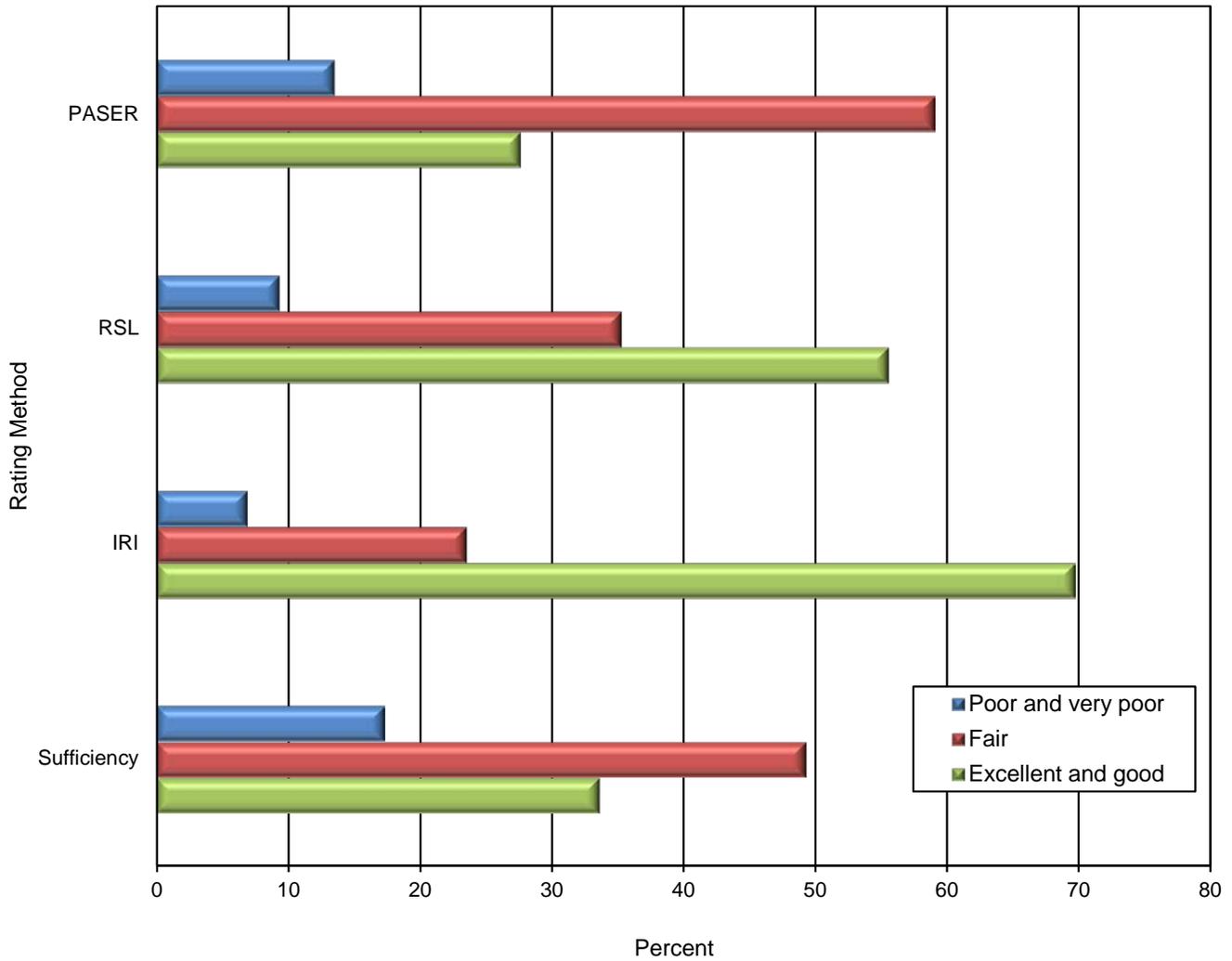
The Sufficiency ratings, RSL, and PASER ratings are based on the percentage of lane miles. The IRI ratings are based on the percentage of roadway miles.

IRI and PASER ratings data is collected for half of the highways each year. Therefore, 2009 and 2010 data is combined to report the most recently collected data for all State trunkline system sections.

The PASER ratings are presented for the State trunkline system only and are not comparable with the ratings presented in Exhibit 4 for all federal-aid eligible highways.

Rating methods are not always comparable because of the differences in what is measured (e.g., distress versus ride quality), rating scales, and timing of the ratings.

MEASUREMENT OF STATE HIGHWAY PAVEMENT CONDITIONS
Michigan Department of Transportation (MDOT)
2010 Distribution of State Trunkline System Pavement Conditions by Rating Method



Source: MDOT's Sufficiency rating data (2010), IRI data (2009 and 2010), RSL data (2010), and PASER data (2009 and 2010).

Exhibit 6 - 2010 State Trunkline System Pavements Rated as Poor and Very Poor
Summarized by MDOT Region, County, and Rating Method

Exhibit 6 presents a comparison of the percentage of State trunkline system pavements rated as poor and very poor, summarized by Michigan Department of Transportation (MDOT) region and county, based on the Sufficiency rating, International Roughness Index (IRI), remaining service life (RSL), and Pavement Surface Evaluation and Rating (PASER) rating in 2010.

The Sufficiency ratings, RSL, and PASER ratings are based on the percentage of lane miles. The IRI ratings are based on the percentage of roadway miles.

IRI and PASER ratings data is collected for half of the highways each year. Therefore, 2009 and 2010 data is combined to report the most recently collected data for all State trunkline system sections.

The PASER ratings are presented for the State trunkline system only and are not comparable with the ratings presented in Exhibit 4 for all federal-aid eligible highways.

Rating methods are not always comparable because of the differences in what is measured (e.g., distress versus ride quality), rating scales, and timing of the ratings.

MEASUREMENT OF STATE HIGHWAY PAVEMENT CONDITIONS
Michigan Department of Transportation (MDOT)
2010 State Trunkline Highway Pavements Rated as Poor and Very Poor
Summarized by MDOT Region, County, and Rating Method

MDOT Region	County	Sufficiency	IRI	RSL	PASER
Statewide Ratings		17.2%	6.8%	9.3%	13.4%
Bay	Arenac	22.0%	2.6%	7.8%	2.8%
	Bay	31.2%	9.3%	29.7%	26.2%
	Clare	11.7%	2.5%	1.5%	14.9%
	Genesee	13.9%	11.0%	19.9%	10.4%
	Gladwin	8.1%	1.5%	0.3%	19.8%
	Gratiot	8.9%	3.7%	15.9%	1.9%
	Huron	27.8%	1.7%	11.3%	24.7%
	Isabella	15.7%	3.9%	2.9%	5.1%
	Lapeer	12.0%	13.2%	3.3%	2.1%
	Midland	21.0%	6.1%	17.6%	24.7%
	Saginaw	33.8%	14.1%	11.0%	20.3%
	Sanilac	20.3%	1.9%	11.5%	21.7%
Tuscola	21.7%	3.2%	16.2%	18.8%	
Bay Region - Overall		20.7%	6.9%	13.2%	16.1%
Grand	Ionia	28.2%	4.2%	4.8%	29.1%
	Kent	5.3%	8.3%	2.3%	2.5%
	Mecosta	24.1%	4.4%	8.7%	24.0%
	Montcalm	10.2%	2.7%	8.9%	22.8%
	Muskegon	7.2%	4.6%	1.5%	13.7%
	Newaygo	2.1%	0.9%	0.0%	3.5%
	Oceana	18.6%	5.7%	14.6%	32.1%
	Ottawa	9.1%	9.6%	7.8%	8.7%
Grand Region - Overall		11.2%	6.0%	5.1%	13.4%
Metro	Macomb	13.2%	12.9%	6.2%	6.9%
	Oakland	23.0%	15.8%	7.1%	12.7%
	St. Clair	14.2%	9.7%	19.5%	8.2%
	Wayne	8.8%	13.7%	11.0%	10.8%
Metro Region - Overall		14.1%	13.6%	10.0%	10.4%

This exhibit continued on next page.

MEASUREMENT OF STATE HIGHWAY PAVEMENT CONDITIONS
Michigan Department of Transportation (MDOT)
2010 State Trunkline Highway Pavements Rated as Poor and Very Poor
Summarized by MDOT Region, County, and Rating Method
(Continued)

MDOT Region	County	Sufficiency	IRI	RSL	PASER
North	Alcona	5.9%	0.1%	0.0%	3.1%
	Alpena	6.2%	1.7%	1.4%	0.3%
	Antrim	26.1%	2.2%	27.4%	7.0%
	Benzie	23.6%	5.0%	18.5%	23.2%
	Charlevoix	30.7%	5.3%	34.6%	19.7%
	Cheboygan	24.0%	3.9%	10.9%	14.2%
	Crawford	5.2%	0.7%	36.1%	1.3%
	Emmet	31.5%	24.0%	13.8%	27.5%
	Grand Traverse	19.7%	5.8%	0.8%	17.4%
	Iosco	21.6%	3.2%	25.5%	4.3%
	Kalkaska	16.1%	1.0%	18.6%	27.4%
	Lake	33.9%	0.6%	3.2%	49.5%
	Leelanau	29.2%	9.2%	23.9%	29.4%
	Manistee	21.7%	3.1%	4.3%	31.3%
	Mason	0.0%	1.5%	0.0%	21.1%
	Missaukee	27.4%	0.4%	7.1%	23.1%
	Montmorency	0.0%	0.4%	0.7%	9.6%
	Ogemaw	21.0%	4.7%	7.0%	5.1%
	Osceola	13.0%	1.3%	0.0%	26.2%
	Oscoda	0.8%	0.3%	26.6%	9.9%
Otsego	4.9%	1.3%	0.0%	2.7%	
Presque Isle	0.4%	0.3%	14.5%	21.3%	
Roscommon	17.7%	0.7%	7.9%	8.9%	
Wexford	13.3%	2.5%	10.3%	15.8%	
North Region - Overall		16.5%	3.3%	12.0%	15.8%
Southwest	Allegan	22.5%	10.2%	4.3%	12.9%
	Barry	26.8%	4.0%	10.8%	39.9%
	Berrien	38.7%	11.4%	28.6%	7.6%
	Branch	22.2%	2.9%	0.3%	35.5%
	Calhoun	20.6%	10.4%	7.7%	29.6%
	Cass	56.6%	11.9%	39.3%	34.0%
	Kalamazoo	27.5%	9.4%	7.4%	20.3%
	St. Joseph	23.7%	4.9%	9.7%	62.5%
	Van Buren	42.5%	5.1%	18.8%	10.3%
Southwest Region - Overall		31.0%	8.6%	15.0%	24.5%

This exhibit continued on next page.

MEASUREMENT OF STATE HIGHWAY PAVEMENT CONDITIONS
Michigan Department of Transportation (MDOT)
2010 State Trunkline Highway Pavements Rated as Poor and Very Poor
Summarized by MDOT Region, County, and Rating Method
(Continued)

MDOT Region	County	Sufficiency	IRI	RSL	PASER
Superior	Alger	11.8%	2.4%	0.0%	6.7%
	Baraga	10.7%	0.4%	0.0%	4.0%
	Chippewa	12.1%	4.3%	2.4%	12.1%
	Delta	4.5%	4.1%	0.0%	4.4%
	Dickinson	26.8%	5.8%	1.1%	2.5%
	Gogebic	22.1%	4.5%	0.0%	5.2%
	Houghton	11.3%	8.6%	4.5%	11.7%
	Iron	22.9%	2.5%	2.4%	11.0%
	Keweenaw	5.4%	26.9%	0.0%	0.0%
	Luce	0.0%	0.0%	0.0%	0.0%
	Mackinac	7.5%	1.0%	7.4%	5.4%
	Marquette	9.3%	8.7%	1.9%	2.0%
	Menominee	20.2%	2.0%	9.5%	12.0%
	Ontonagon	2.9%	1.0%	0.0%	0.0%
Schoolcraft	2.0%	0.3%	0.0%	14.1%	
Superior Region - Overall		11.0%	4.1%	2.3%	6.6%
University	Clinton	11.4%	5.7%	5.6%	4.6%
	Eaton	26.3%	5.2%	7.9%	12.1%
	Hillsdale	7.1%	3.1%	4.7%	0.6%
	Ingham	19.8%	12.3%	9.6%	16.3%
	Jackson	17.1%	8.8%	11.1%	14.6%
	Lenawee	13.7%	5.0%	1.7%	5.6%
	Livingston	18.2%	2.3%	0.4%	7.9%
	Monroe	6.0%	8.8%	5.0%	1.3%
	Shiawassee	14.2%	6.1%	3.4%	9.1%
	Washtenaw	21.6%	11.7%	6.4%	9.7%
University Region - Overall		16.2%	7.4%	6.0%	8.5%

Source: MDOT's Sufficiency rating data (2010), IRI data (2009 and 2010), RSL data (2010), and PASER data (2009 and 2010).

Exhibit 7 – 2008 Pavement Condition Ratings by State

Exhibit 7 presents a summary of pavement conditions by state as reported by the Federal Highway Administration (FHWA), U.S. Department of Transportation, for the 2008 reporting year.

The road condition ratings are based on annual data provided to the FHWA through state departments of transportation and include condition ratings for all of the nation's public roads. States are required to report International Roughness Index (IRI) data to the FHWA for the Interstate system, other principal arterials, rural minor arterials, and the national highway system regardless of functional system. The IRI is also recommended by the FHWA for measuring all other functional classifications because the IRI uses a more standardized and objective measurement methodology. However, the FHWA allows the reporting of the Present Serviceability Rating (PSR), a subjective measure of ride quality, where the IRI is not available.

The FHWA User's Guide related to these highway statistics explains that users need to account for variability in the index data reported by states. Variability in IRI measurements can arise from differences in pavement types, the equipment used to measure the IRI, and differences in the measurement protocols used. Also, because the PSR is reported where the IRI is not available, the ratings may not be consistent or comparable among states.

Exhibit 2 presents IRI data only for Michigan's State trunkline system and Exhibit 7 presents IRI data for all of Michigan's public roads. Therefore, the ratings are not comparable.

MEASUREMENT OF STATE HIGHWAY PAVEMENT CONDITIONS
Michigan Department of Transportation
2008 Pavement Condition Ratings by State

State	Very Good	Good	Fair	Mediocre	Poor	Not Reported
Alabama	12%	39%	39%	6%	3%	0%
Alaska	2%	18%	39%	21%	8%	12%
Arizona	34%	23%	29%	7%	3%	3%
Arkansas	3%	21%	52%	20%	5%	0%
California	3%	14%	42%	22%	19%	0%
Colorado	11%	31%	45%	9%	3%	1%
Connecticut	32%	12%	42%	10%	4%	0%
Delaware	1%	44%	40%	9%	7%	0%
District of Columbia	0%	0%	4%	16%	80%	0%
Florida	24%	40%	32%	3%	1%	0%
Georgia	47%	25%	19%	6%	2%	0%
Hawaii	1%	5%	48%	22%	25%	0%
Idaho	6%	33%	26%	31%	4%	1%
Illinois	22%	27%	35%	12%	4%	0%
Indiana	16%	40%	34%	7%	4%	0%
Iowa	10%	29%	45%	10%	6%	0%
Kansas	6%	41%	20%	26%	6%	0%
Kentucky	7%	28%	61%	3%	1%	0%
Louisiana	3%	30%	39%	15%	12%	1%
Maine	4%	39%	36%	12%	9%	0%
Maryland	6%	25%	35%	15%	19%	0%
Massachusetts	54%	8%	24%	10%	4%	0%
Michigan	29%	18%	31%	8%	14%	0%
Minnesota	26%	34%	32%	6%	1%	0%
Mississippi	2%	18%	62%	14%	4%	0%
Missouri	4%	15%	54%	17%	10%	1%
Montana	12%	52%	29%	4%	3%	0%
Nebraska	27%	31%	32%	7%	3%	0%
Nevada	39%	24%	28%	5%	5%	0%
New Hampshire	10%	25%	44%	11%	9%	0%
New Jersey	3%	7%	40%	21%	28%	1%
New Mexico	20%	20%	30%	23%	6%	2%
New York	3%	26%	45%	11%	14%	1%
North Carolina	5%	39%	47%	5%	3%	0%
North Dakota	20%	35%	36%	8%	1%	0%
Ohio	26%	37%	31%	5%	2%	0%
Oklahoma	2%	20%	45%	14%	18%	0%
Oregon	18%	36%	38%	7%	1%	0%
Pennsylvania	4%	21%	49%	15%	11%	0%
Rhode Island	9%	17%	45%	18%	11%	0%
South Carolina	3%	27%	57%	8%	5%	0%
South Dakota	25%	21%	36%	11%	7%	0%
Tennessee	26%	38%	28%	4%	4%	0%
Texas	5%	24%	59%	9%	3%	0%
Utah	6%	24%	61%	7%	1%	0%
Vermont	5%	19%	40%	19%	17%	0%
Virginia	13%	31%	48%	6%	2%	0%
Washington	21%	27%	39%	8%	4%	0%
West Virginia	3%	19%	48%	13%	16%	0%
Wisconsin	10%	24%	47%	8%	9%	1%
Wyoming	8%	40%	44%	7%	1%	0%
Total United States	14%	27%	41%	11%	7%	0%

Source: Federal Highway Administration, U.S. Department of Transportation.

GLOSSARY

Glossary of Acronyms and Terms

AASHTO	American Association of State Highway and Transportation Officials.
Distress Index (DI)	A measure that quantifies the level of distress that exists (e.g., cracking) on a pavement section.
effectiveness	Success in achieving mission and goals.
efficiency	Achieving the most outputs and outcomes practical with the minimum amount of resources.
federal-aid eligible highway	Those highways defined by federal regulations as eligible for federal assistance.
FHWA	Federal Highway Administration.
fix life benefit guide	A guide developed by MDOT to provide an estimate of the number of years that a particular pavement fix type is expected to provide, excluding any future preventive maintenance treatments.
GASB	Governmental Accounting Standards Board.
International Roughness Index (IRI)	A standardized mathematical function of a pavement section's longitudinal profile that is used, in part, to summarize surface roughness in relation to overall ride quality.
MDOT	Michigan Department of Transportation.
mission	The main purpose of a program or an agency or the reason that the program or the agency was established.

Pavement Surface Evaluation and Rating (PASER)	A visual survey of the condition of the surface of the road developed by the University of Wisconsin that rates the condition of various types of pavement distress on a scale of 1 to 10.
performance audit	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.
PSR	Present Serviceability Rating.
quality assurance	Actions necessary to verify that pavement data meets quality requirements before it is accepted and used to support pavement management decisions.
quality control	Actions necessary to control the quality of pavement data collection activities.
regional/ metropolitan planning organization (RPO/MPO)	An organization that represents the transportation planning process in specific regions (RPOs) or in urbanized areas (MPOs).
remaining service life (RSL)	An estimate of the remaining time, in years, until a pavement's most cost-effective treatment is either major rehabilitation or reconstruction.
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 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.

State trunkline system	Michigan's State highway system, which is composed of all Interstate, U.S.-numbered, and M-numbered routes.
Sufficiency rating	A subjective windshield survey of the State trunkline system performed by an MDOT pavement management engineer.
TAMC	Transportation Asset Management Council.
windshield survey	A manual visual survey of pavement conditions performed by people directly involved in the observation or measurement of pavement properties without the benefit of automated equipment.

