Asset Management Guide for Local Agencies in Michigan

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Table of Contents

Appendix

List of Figures

List of Tables

Acknowledgments

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Cities

City of Detroit – Jose Abraham and Ron Brundidge

City of Gaylord – Joe Duff

City of Gladstone – Robert Johnson and Barry Lund (2007 ed.)

City of Grand Rapids – Rick De Vries

City of Ionia – Tom Wieczorek

City of Kingsford – Tony Edlebeck

City of Livonia – Paul St. Henry

City of Marquette – Arthur Ontto

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City of Monroe – Pat Lewis

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City of Three Rivers – E. Merritt Brown (2007 ed.)

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Counties

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Dickinson County Road Commission – Timothy Hammill, Dave Pajula, and Sandy Lindholm

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Kent County Road Commission – Steve Warren

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Southeast Michigan Council of Governments – Tom Bruff and Edward Hug

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West Michigan Regional Planning Commission – Dave Bee and Steven Stepek

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Michigan Technological University – Terry McNinch and Tim Colling

1.0 Introduction

1.1 OVERVIEW

Asset Management Defined

In Michigan, asset management is defined as "an ongoing process of maintaining, upgrading, and operating physical assets cost-effectively, based on a continuous physical inventory and condition assessment."[1] Asset management consists of a set of business principles and practices for improving resource allocation decisions. It requires a shift from a traditional tactical project management approach to a strategic, comprehensive systems management concept.

Purpose of This Guide

Act 499 of the State of Michigan Public Acts of 2002 encourages all agencies that spend state transportation funds on roads and bridges to implement an asset management approach under the leadership and oversight of the Michigan Transportation Asset Management Council (TAMC) (see Appendix B: Paragraphs 7 & 9). Over the past few years, asset management guidance has been developed at the national level for state departments of transportation. However, very little guidance on implementing asset management has been made available to local agencies. Therefore, the Council developed this guide to recast existing national guidance into a form useful for local agencies in Michigan. The material presented in this guide is based on a series of interviews with local agencies in Michigan. The interviews covered existing asset management practices and helped to identify areas where more guidance was needed.

In addition, materials from a variety of sources have been used to prepare this document. They include the American Association of State Highway and Transportation Officials (ASHTO), *Transportation Asset Management Guide*, information from Council documents and presentations, materials from Michigan's Local Technical Assistant Program (LTAP), National Center for Pavement Preservation, and the Michigan Department of Transportation.

This guide and the accompanying training course will help local officials understand and implement the principles of asset management, and understand the role of the Council and Michigan's asset management legislation.

[1] Act 499 of the State of Michigan Public Acts of 2002, Section 9(a)(1)(a).

1.2 ASSET MANAGEMENT PRINCIPLES

The core principles of asset management are:

- **Performance-Based –** Policy objectives are translated into system performance measures and targets that are used for both day-to-day and strategic management.
- **Decisions Based on Quality Information –** Resource allocation decisions are based on accurate information regarding inventory, condition, and funding availability. Where appropriate, analytical tools provide access to needed information and assist decision-makers.
- **Policy-Driven –** Resource allocation decisions are based on a well-defined set of policy goals and objectives. The objectives reflect desired system condition, levels of service, and safety levels. They may also be tied to economic, community, and environmental goals as well.
- **Analysis of Mix of Fixes, Options and Tradeoffs –** An assessment is made of the Mix of Fixes available to best preserve the system. Decisions on how to allocate funds across types of investments are based on an analysis of how different allocations will impact future performance. Alternative methods for achieving a desired set of objectives are examined and evaluated.
- **Monitoring to Provide Clear Accountability and Feedback –** Performance results are monitored and reported. Feedback on actual performance influences agency goals and resource allocation decisions.

In one form or another all agencies currently are applying aspects of these principles to their decision-making processes. However, no agency is applying all of them. Therefore, to get started, every agency can build on its existing practices as it moves towards implementing an asset management process.

Appendix A includes a copy of the exercises used in the training course that accompanies this guide. The Home Improvement Exercise can help you understand how these principles fit into a real world situation.

1.3 BENEFITS OF ASSET MANAGEMENT

Many public agencies are faced with a severe shortfall in transportation funding. The shortfall may be so severe that they are unable to maintain the current condition of the system, no less improve it. If your agency is in that situation, you may be asking, "Why should we spend any time doing this? Our funding is so limited we just try to keep the snow plowed and the potholes patched." Throwing up your agency's collective hands and saying, "This is the best we can do," becomes a self-fulfilling prophecy.

Agencies struggling to keep their heads above water have even more of a reason to adopt an asset management process. It becomes a way to communicate with

your elected officials and the public about how bad the situation is and that it won't get any better by ignoring it. When times are tough, you need asset management even more.

Applying asset management principles and practices can improve an agency's performance, cost-effectiveness, communication, accountability, and credibility. Specific benefits include:

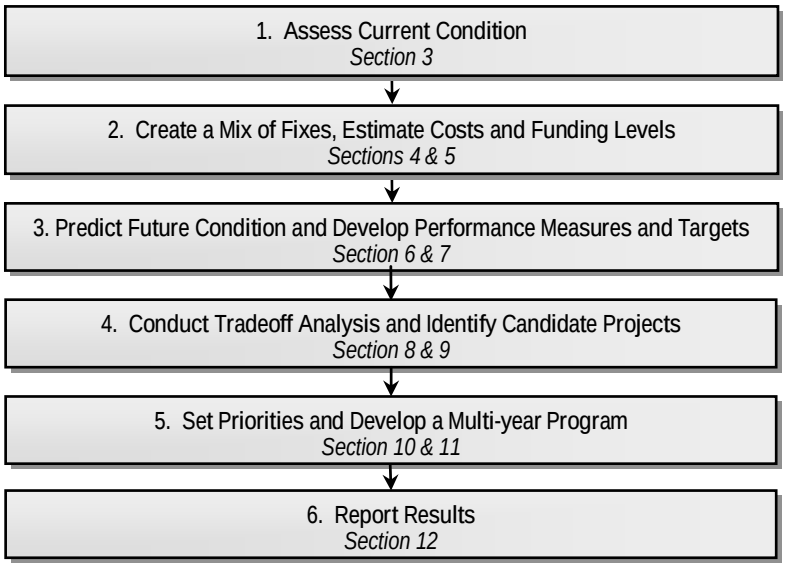
- Lower long-term preservation costs
- Improved service to customers
- Improved cost-effectiveness and use of available resources
- Improved communication with elected officials and the public
- Improved credibility and accountability for decision-making

In order to achieve these benefits, an agency must evaluate its current business practices, establish where significant improvement can be achieved, and develop a plan to institute changes where necessary.

1.4 APPLYING THE PRINCIPLES OF ASSET MANAGEMENT TO THE RESOURCE ALLOCATION PROCESS

Act 499 encourages local agencies in Michigan to implement an asset management process (see Appendix B: Paragraphs 7 & 9). A practical approach to doing this is to apply the principles of asset management to the transportation resource allocation process. The result, illustrated in Figure 1.1, is a rational, strategic process that reflects the Council's vision of asset management implementation.

Figure 1.1 Transportation Asset Management Process



Assess Current Condition

The first step in the process is to assess current condition. Understanding what features an agency owns and the condition they are in is essential for good asset management. Michigan's asset management legislation addresses pavement and bridge conditions.

Create a Mix of Fixes, Estimate Costs and Funding Levels

Next an agency must determine the fixes available that will best preserve the system—***The Right Fix in the Right Place at the Right Time***. This Mix of Fixes may include Capital Preventive Maintenance (CPM) activities that were previously not considered in place of Structural Improvement (SI) such as reconstruction and rehabilitation. Additionally, an agency needs to estimate costs for the treatments under consideration, and project what funding will be available or sought after in future years.

Predict Future Condition and Develop Performance Measures and Targets

Strategic management of physical assets (roads, buildings, vehicles, etc.) is dependent on predicting condition in future years. Computers and software have simplified complex prediction analysis, but other methodologies can be applied using pencil and paper. Next an agency must define the direction it is going and what it is trying to accomplish—its mission and goals. Performance Measures and Targets help the agency communicate these ideas with elected officials and the public and indicate whether or not they are successful.

Conduct Tradeoff Analysis and Identify Candidate Projects

Tradeoff analysis allows an agency to balance the costs and benefits between PM and SI and understand how the tradeoff affects the entire system. For example: Is the PM treatment being applied at the right time and over the appropriate type of distress? If PM is increased by 30% what happens to the overall network condition? If you increase PM, what is sacrificed in your Reconstruction program? After the tradeoff is complete, the agency can begin to identify candidate projects and determine the appropriate scope for each. Candidates represent work that *should* be done. Candidate projects can be generated through a combination of applying rules of thumb to current condition data, input from management systems, public input or through engineering judgment and field inspection.

Set Priorities and Develop Multi-Year Program

It is likely that agencies will not have enough money to perform all the candidate projects developed in the previous step. Therefore, the next step in the process is to prioritize the projects and incorporate them into a three-year program that is updated annually. The prioritization process should be public, transparent, and

centered on the results of the previous steps. The high priority projects are then placed in the agency's multi-year program.

Report Results

The final step is to report the results of the asset management process. Michigan's asset management legislation identifies three reports – a summary of current condition, a three-year program, and a summary of actual spending over the past year that must be submitted. All of this material, however, can also be used by the agency when communicating with its constituents.

1.5 HOW TO USE THIS GUIDE

Michigan has made significant progress in developing resources that can help local agencies improve their asset management practices. Section 2.0 provides an overview of these resources and additional information is available in Appendix G. Resources. The remaining sections describe how local agencies can take full advantage of them. They also provide guidance on incorporating the principles of asset management to help make better resource allocation decisions. This guidance is organized around the transportation asset management process described above.

For each step in this process, a few implementation options are provided. Although they differ in complexity, they are all valid options. When evaluating which option is best for your agency, you should consider a number of factors, including:

- The number of lane miles owned
- The number of bridges owned
- Staff availability
- Compatibility with existing business practices, databases and management systems

Keeping these factors in mind, you can pick the options that work best for your agency and develop a customized asset management process.

The concepts presented in the following sections can be applied to any physical asset – pavements, bridges, sidewalks, culverts, signs, buildings, or equipment. This guide focuses on pavements and bridges because this is the focus of the Council. However, agencies are encouraged to consider how the principles of asset management could be applied in other areas.

2.0 Asset Management in Michigan

2.1 ASSET MANAGEMENT LEGISLATION

Legislative History

In 1998, the Michigan Legislature established the Act 51 Transportation Funding Study Committee. This committee was charged with studying transportation funding issues and making recommendations for improving the way that Michigan's transportation providers maintain, operate, and modernize their facilities and services. As part of its work, the committee consulted with representatives from state and local transportation agencies, stakeholders in the business sector, and the transportation industry in general.

The committee found that it was impossible to assess the level of resources required to support Michigan's transportation system without consistent condition data and a full understanding of how resources currently were allocated. Only then could strategic judgments on the return on investments be made. It was the final report from this committee, "Transportation Funding for the 21st Century," that initially recommended the establishment of a consistent asset management process for Michigan's transportation infrastructure.

One of the most critical concerns raised during the Act 51 Transportation Funding Study Committee's deliberations was that there was a myriad of methodologies being used to evaluate the condition of Michigan's roads. This was especially true when it came to the actual numbers being used to report pavement condition. While the tendency is to compare these different methods, the truth is that they do not measure the same conditions and should not be compared. The Act 51 Transportation Funding Study Committee stressed the need for policy-makers to have one method and one method only.

Legislation was introduced in 2000 to implement many of the recommendations generated by the Act 51 Transportation Funding Study Committee, but the Legislature chose not to act at that time. At the same time, the County Road Association of Michigan (CRAM) and the Michigan Department of Transportation (MDOT) entered into an agreement to develop a pilot project to test the asset management concepts proposed by the committee. The purpose of the pilot project was to develop and test guidelines for collecting, storing, reviewing, and analyzing roadway data. The objectives of the pilot were to:

- Evaluate the use of the Pavement Surface Evaluation and Rating (PASER) system for rating Michigan's road system.
- Determine the time and resources necessary to conduct road condition surveys.
- Evaluate procedures for collecting road condition data .

- Evaluate the potential for the Michigan Geographic Framework to support the process.
- Promote working relationships between agencies involved in asset management activities.

The pilot study recommended a shift away from the traditional needs studies approach, which had been the basis for transportation budgeting since the 1970s. It also clearly showed that the PASER methodology could be implemented on a statewide basis by all transportation agencies. Based on the success of the pilot, CRAM and MDOT jointly developed a new asset management bill for consideration by the State Legislature. With support from all transportation custodians in the State, the bill was passed and signed into law as Act 499 of the Public Acts of 2002. This legislation is included in Appendix B.

Act 499 of the Public Acts of 2002

Act 499 outlines three key elements of asset management for the State of Michigan:

- It established the definition of asset management – "an ongoing process of maintaining, upgrading, and operating physical assets cost-effectively, based on a continuous physical inventory and condition assessment."[2]
- It created the Transportation Asset Management Council (TAMC) under the auspices of the State Transportation Commission.
- It defined the roles and responsibilities of the Council and local road agencies.

In addition, Act 499 implies a number of guiding principles for implementing asset management:

- The methods employed should be cost-effective and efficient.
- The asset management strategy and the implementation of it should be a coordinated, unified effort.
- Wherever possible, existing resources should be used.

[2] Act 499 of the Public Acts of 2002, Section 9(a)(1)(a).

2.2 ROLES AND RESPONSIBILITIES

Transportation Asset Management Council (TAMC)

To help local agencies in Michigan implement an asset management approach, the legislature, through Act 51, created the Transportation Asset Management Council (TAMC). The Council's mission is to:

> *…advise the commission on a statewide asset management strategy and the processes and necessary tools needed to implement such a strategy beginning with the Federal-aid eligible highway system, and once completed, continuing on with the county road and municipal systems, in a cost-effective, efficient manner.*[3]

The Council consists of representatives from the County Road Association of Michigan (CRAM), the Michigan Municipal League, state planning and development regions, MDOT, the Michigan Townships Association, the Michigan Association of Counties, and the Michigan Center for Geographic Information. These agencies were chosen because they either have jurisdictional responsibility for the road and bridge system or are tied in with funding the system. In early 2004, the Council adopted the following goal statement and objectives:

> The Transportation Asset Management Council will expand the practice of asset management statewide to enhance the productivity of investing [in] Michigan's roads and bridges through coordination and collaboration among state and local transportation agencies by:
>
> - Surveying and reporting the condition of roads and bridges by functional classification categories for the State and Regional Planning Areas
> - Assessing completed and planned investments in roads and bridges by the various transportation agencies of the State
> - Supporting the development of appropriate asset management tools and procedures
> - Providing education and training on the benefits of developing road improvement programs through the use of asset management principles and procedures

The Council is also working to implement the recommendations of the Act 51 Transportation Funding Study Committee. This requires moving away from a process that relies on the needs study concepts of identifying system condition

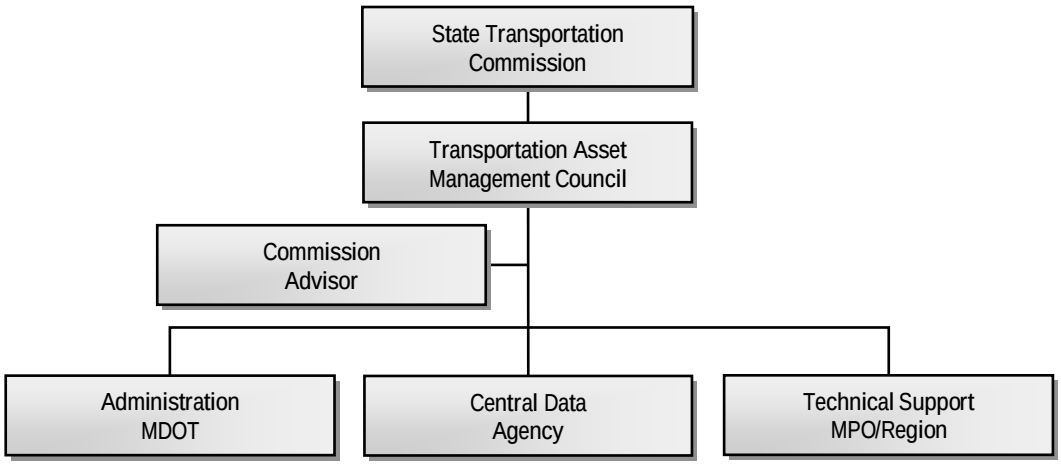
[3] Act 499 of the Public Acts of 2002, Section 9(a)(1)(a).

and service deficiencies, and reducing the identified backlog, to a process that focuses on setting system performance targets and then managing the transportation investment priorities to achieve those expectations. It also requires developing a customer focus by viewing the system the way motorists do (as a whole) not by who owns it. The average motorist does not normally know or care who owns the road. They just want it to be in good condition.

Finally, the Council is working to bring regional planning organizations and metropolitan planning organizations into a more direct partnership with cities and county road commissions. The overall goal is to have all agencies that own roads in Michigan work in cooperation to provide the best system possible.

Figure 2.1 presents the TAMC's organizational chart. The Council was established in order to advise the State Transportation Commission on a statewide asset management strategy. To do this effectively, it must draw support from staff at MDOT, the Michigan Center for Geographic Information (which acts as the central data agency), and Michigan's metropolitan planning organizations and regional planning agencies. The planning agencies provide a link between the Council and over 600 local agencies that play a role in the transportation resource allocation process.

Figure 2.1 TAMC Organizational Chart



Member Agencies

Agencies represented by the Council include MDOT, all local road agencies that receive Act 51 funding, townships, regional planning organizations, and metropolitan planning organizations.

The responsibilities of these agencies are broadly defined in Act 499. The Council has the authority to work through the details of how the responsibilities should be carried out.

Central Data Storage Agency

In the fall of 2003, the Council selected the Center for Geographic Information (CGI) of the Michigan Department of Information Technology to serve as its central data storage agency. The Council wanted an "honest broker" that had no other interests in the data, but rather was focused on storing it and making it available for reports. The CGI is responsible for storing and maintaining the data collected by the Council. The CGI maintains the Michigan Geographic Framework which is a single, statewide geographic information system (GIS) base map.

2.3 TRANSPORTATION ASSET MANAGEMENT COUNCIL ACTIVITIES

In order to fulfill its statutory obligations, the Council identified three critical areas of activity – data collection, education and training, and strategic analysis.

Data Collection

Data plays a critical role throughout the asset management process. In addition, data itself is an important asset to your business. The Council relies on consistent data reporting from the member agencies to both accurately depict current conditions and predict future conditions. Consistent data collection is essential because the Council is charged with combining data from over 600 agencies. The Council has adopted standards for collecting and reporting bridge and pavement condition.

Pavement Data

The Council uses the PASER method for reporting statewide pavement condition. This method relies on a visual inspection of the roadway surface. Initially, the Council has focused on the assessment of Federal aid eligible roads. However, the data collection efforts and asset management reports will eventually address all public roads in Michigan.

Bridge Data

All bridges over 20 feet long in Michigan are inspected on a two-year cycle. Inspection results are stored in MDOT's National Bridge Inventory (NBI) database. At this time, the Council is using NBI results to report on the condition of bridges in Michigan.

Non-condition Data

Opportunities to collect non-condition data will continue to evolve as asset management is implemented further throughout the State. This type of data focuses on the level of service that a network is providing. Traffic flow and safety data are examples of common non-condition data used for asset management. Non-

condition data expand the scope of asset management beyond pavement and bridge preservation and create a more complete picture of how a network is functioning. This more complete picture is helpful since development of candidate projects must respond not only to physical deterioration of assets, but also to needs for safety and traffic improvements.

Education and Training

The Council understands that asset management is a new concept and therefore has decided that educating and training road agencies about asset management is a high priority. The Council has adopted a two-tiered training structure for local agencies in Michigan:

- An introductory overview of asset management and pavement management
- A more advanced class on pavement preservation
- A more advanced class on asset management

The education and training element of the Council is coordinated through the Michigan LTAP, and the various metropolitan planning organizations and regional planning organizations throughout the State.

Introduction to Asset Management and Pavement Management

The introductory course is offered by the Michigan Local Technical Assistance Program (LTAP). The course focuses on the basic principles of asset management, benefits of a capital preventive maintenance approach, and the PASER rating system. LTAP also provides regular courses on the use of RoadSoft GIS (the management system available to Michigan's local agencies) and how it can be applied to managing an agency's program.

Advanced Pavement Preservation

The National Center for Pavement Preservation (NCPP) at Michigan State University offers a course on pavement preservation. This two-day course gives a general overview of the connection between asset management and capital preventive maintenance and then focuses on pavement preservation techniques and strategies.

Advanced Asset Management

This Guide and the companion training course address the advanced asset management training. They provide an overview of asset management principles and explain how these principles can be applied in the context of a resource allocation process that can be used by local governments.

Strategic Analysis

The Council is charged with recommending an asset management strategy for Michigan's transportation system. This strategy requires a shift from a tactical management approach, based on reacting to immediate problems; to a strategic approach, based on a broader, long term view of how the system functions as a whole. The goal is to develop an approach to asset management implementation that relies on the strategic analysis of the present and future transportation system. A critical piece of the strategic process is forecasting future system conditions based on various funding scenarios.

An asset management strategy focuses on the system, regardless of ownership or specific location. Therefore, the Council reports on Michigan's road network by functional class rather than ownership.

3.0 Assess Current Condition

The first step in the resource allocation process is to assess current road and bridge conditions. It is impossible to make sound resource allocation decisions without first understanding what assets your agency owns and their condition. A key element in this process is the selection of condition measures. Condition measures enable agencies to communicate the physical status of a road network to elected officials, determine the financial needs of the system, and identify cost-effective maintenance strategies for individual segments.

3.1 MEASURING PAVEMENT CONDITION

The Council has adopted the Pavement Surface Evaluation and Rating (PASER) system for measuring statewide pavement condition. (The remainder of this section focuses on PASER. A list of other pavement condition measures used by agencies in Michigan is included in Appendix C.)

PASER is a visual survey method used to evaluate the condition of roads. The method was developed by the University of Wisconsin Transportation Information Center to provide a simple, efficient, and consistent method for evaluating road condition. It was initially implemented by local agencies in Wisconsin to evaluate more than 100,000 miles of roadway in less than a year. PASER has since been adopted by the Council as its preferred evaluation system.

The PASER method is ideal for local agencies because it is one of the easiest evaluation methods to implement and is relatively inexpensive in comparison to other rating methods. PASER uses 10 separate ratings to evaluate the surface distress of the pavement. Ratings are assigned based on the pavement material (asphalt, concrete, sealcoat, gravel, etc.) and the types of deterioration that are present.

While PASER is a subjective evaluation method, it is based on sound engineering principles. It also is easy to communicate to non-transportation officials and the general public. Motorists consciously and subconsciously rate the condition of the road they are driving, so the idea of a 1-10, visual rating is easily understood. If your agency has not yet selected a pavement condition measure, it should consider adopting the PASER rating method.

The Council groups the 10 ratings into three categories based upon the type of work that is required for each rating – routine maintenance, capital preventive maintenance, and structural improvement.[4]

Routine Maintenance

Routine maintenance is the day-to-day, regularly scheduled activities to prevent water from seeping into the surface such as street sweeping, drainage clearing, gravel shoulder grading, and sealing of tight cracks. PASER ratings 8, 9, and 10 are included in this category. 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.

[4] The category descriptions are consistent with those in the TAMC's 2004 Annual Report. The photos are from the University of Wisconsin Transportation Information Center's PASER Manual for Asphalt Roads (2002).

Capital Preventive Maintenance

Capital preventive maintenance (CPM) is at the heart of asset management. It is the planned set of cost-effective treatments applied to an existing roadway that retards further deterioration and maintains or improves the functional condition of the system without significantly increasing the structural capacity. The purpose of CPM is to protect the pavement structure, slow the rate of deterioration, and/or correct pavement surface distress. PASER ratings 5, 6, and 7 are included in this category. Roads in this category still show good structural support, but the surface is starting to deteriorate. Asphalt pavements with these ratings will exhibit distress such as: longitudinal and transverse cracks greater than ¼", crack raveling, transverse cracks 10' to 40' apart, first signs of block cracking, etc. CPM is intended to address pavement problems before the structural integrity of the pavement has been severely impacted.

Structural Improvement

Structural improvement is the category of roads requiring some type of repair to improve the structural integrity of the pavement. PASER ratings 1, 2, 3, and 4 are included in this category. Asphalt pavements with these ratings will exhibit distress such as: rutting greater than ½" deep, cracking in the wheel path, severe block cracking, alligator cracking, and longitudinal and transverse cracks with severe erosion. Typical structural improvement activities include major rehabilitation or reconstruction.

3.2 MEASURING BRIDGE CONDITION

The Council is using the measurements of *structurally deficient* and *functionally obsolete* to report bridge condition statewide. These measures are based on condition data collected as part of the federally mandated National Bridge Inventory (NBI) program.

NBI ratings are recorded for major bridge elements and reported on a scale of 1 to 10, with 10 being the best. These ratings are combined to determine if a bridge is *structurally deficient* or *functionally obsolete*.

- A bridge is *structurally deficient* if it has an NBI rating of 4 or less for the substructure, superstructure, bridge deck, or culverts.
- A bridge is *functionally obsolete* if it has an NBI rating of 3 or less for the deck geometry, vertical and horizontal under clearances, or approach roadway alignment.

- If a bridge meets the requirements for both *structurally deficient* and *functionally obsolete*, it is categorized only as *structurally deficient.*
- A bridge is considered "good" if it is neither *structurally deficient* nor *functionally obsolete.*

3.3 DATA COLLECTION

Assessing asset condition requires accurate inventory and condition data. The condition data collected should support the selected performance measures (see Section 7.0). Inventory data is publicly available through metropolitan planning organizations and regional planning organizations. If your agency does not know what the PASER ratings are for your roads, contact your regional planning organization (see Appendix D. Michigan Planning Organizations).

Pavement condition data is typically collected every one or two years. The approach to collecting pavement data depends on the selected measure. Visual methods, such as PASER, are subjective, but based on sound engineering principles. Statistical sampling methods, such as that used in MicroPaver, identify random samples of pavement which are then manually surveyed to identify all distress types, their severity levels and quantities. New, high-tech methods require vehicles equipped with automated sensing and recording equipment, such as an automatic road analyzer. The recorded data and images are either manually reviewed after collection or processed through a computer algorithm to create a summary of distress.

The bridge measures used by the Council rely on data collected during NBI bridge inspections. Federal regulations require agencies to collect NBI data on all structures over 20 feet in length on a two-year cycle using field inspections. Therefore, if your agency is responsible for bridges, it already collects this information as part of its existing bridge inspection program.

3.4 ASSESSING NETWORK CONDITIONS

Assessing current conditions involves translating condition data into a form that is useful for decision-makers. Options include:

- **Averages –** For example, the average remaining service life by road function.
- **Running Totals –** For example, the total number of *structurally deficient* bridges by road function.
- **Distributions –** For example, the percent of lane miles with PASER rating above 7 by road function.

Another common approach to summarizing condition data is to group road segments by condition, such as good, fair, poor, and report the percent of the network in each group. This approach gives agencies a good idea of the overall

distribution of conditions, and can help them identify likely future spikes in rehabilitation needs. It also enables non-technical audiences to understand condition distribution.

Example – Statewide Pavement Condition

The Council is using three work categories (based on PASER ratings) for reporting statewide pavement condition data.

- **Routine Maintenance –** PASER Rating of 8 to 10
- **Capital Preventive Maintenance –** PASER Rating of 5 to 7
- **Structural Improvement –** PASER Rating of 1 to 4

Table 3.1 presents a summary of pavement condition in Michigan. Notice that the results are presented by road function rather than ownership or location. This breakdown enables decision-makers to understand the condition of the network in terms of its functionality.

Table 3.1 Summary of Pavement Condition on Federal Aid Eligible Roads in Michigan 2004

	Routine Maintenance		Capital Preventive Maintenance		Structural Improvement		Total	
Function	Lane Miles	Percent of System	Lane Miles	Percent of System	Lane Miles	Percent of System	Lane Miles	Percent by Function
Arterials								
Freeway	3,213	3%	6,122	7%	646	1%	9,981	11%
Non-Freeway	7,987	9%	21,496	23%	2,580	3%	32,063	34%
Collectors	11,677	12%	32,031	34%	8,273	9%	51,981	55%
Total	22,878	24%	59,649	64%	11,499	13%	94,026	100%

Source: Adapted from TAMC 2004 Annual Report.

Example – Statewide Bridge Condition

The Council reports statewide bridge condition based on the percent of bridges which are *structurally deficient*, *functionally obsolete*, and good. Table 3.2 presents a summary of bridge condition in Michigan.

Table 3.2 Summary of Bridge Condition on Federal-Aid Eligible Roads in Michigan 2004

	Structurally Deficient		Functionally Obsolete		Good	
Function	Bridges	Percent	Bridges	Percent	Bridges	Percent
Arterials	664	16%	598	14%	2,871	69%
Collectors	447	15%	374	12%	2,232	73%
Statewide	1,111	15%	972	14%	5,103	71%

Source: TAMC 2004 Annual Report.

4.0 Create a Mix of Fixes

4.1 UNDERSTANDING THE MIX OF FIXES CONCEPT

The days of "Reconstruct, Reconstruct and Reconstruct" are over—the resources no longer exist. This reality requires that agencies do everything they can to maximize the service life of every pavement. Applying a Mix of Fixes (a variety of repair types) is in effect implementing the principles of asset management when that mix places a heavy emphasis on capital preventive maintenance.

The Mix of Fixes approach is the centerpiece of an effective capital preventive maintenance and reconstruction strategy; keep the good roads good by applying ***the Right Fix, in the Right Place, at the Right Time***. Decades of pavement research and analysis by numerous agencies, large and small, have shown that the Worst First approach, focused only on reconstruction, is a losing proposition.

The following concepts must be understood if your agency is to engage in a discussion of the Mix of Fixes.

Remaining Service Life (RSL)

RSL is the time in years from the present when the pavement reaches the point where distresses are structural in nature (PASER rating less than or equal to 4) and capital preventive maintenance treatments are no longer beneficial. Reconstruction, rehabilitation or structural overlay become the only effective options. RSL does not represent the time to complete failure (PASER 1).

Critical Distress Point (CDP)

The CDP is the point at which the pavement distress changes from needing capital preventive maintenance to needing structural improvement (the transition from PASER 5 to PASER 4).

Extended Service Life (ESL)

ESL is the time in years added to the current RSL based on the type of fix used. It does not represent the longevity of the treatment.

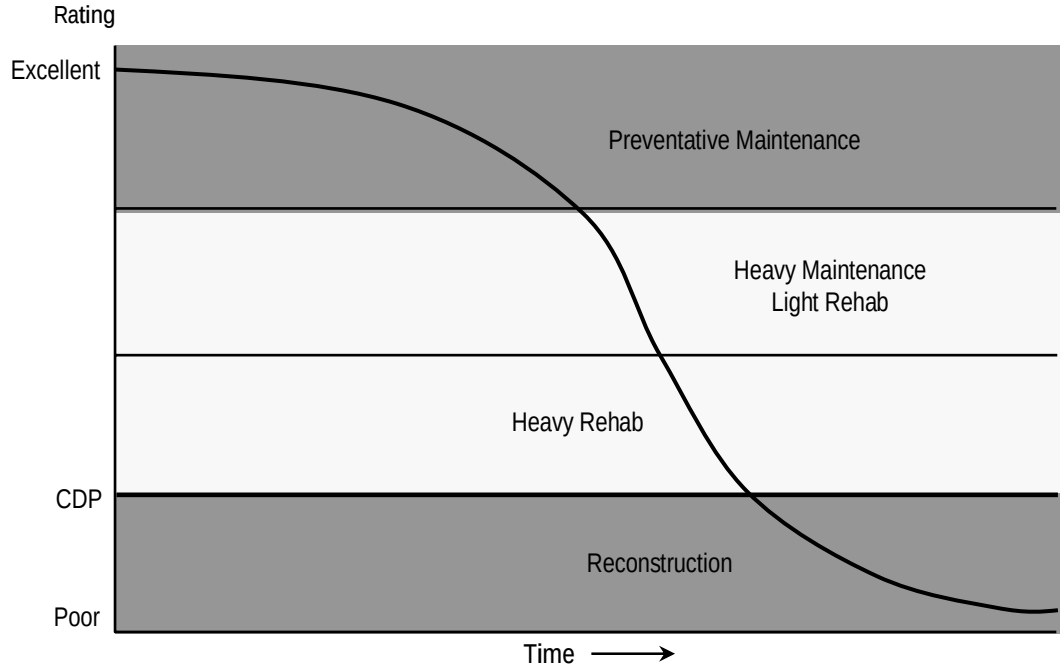
Risk and the Cost of Deferring Maintenance

Every time your agency decides to defer capital preventive maintenance on a good or fair pavement, it risks having the condition of that pavement slip to the next, more costly, treatment category. When funds are directed to reconstruction, think about which good and fair roads are being sacrificed. Consider the adage, "Pay me now, or pay me more, later."

4.2 THE WINDOW OF OPPORTUNITY

Figure 4.1 illustrates the concept of a window of opportunity in which certain types of treatments are feasible. The curved line shows how a pavement deteriorates over time. There are certain points along the curve at which different types of work activities are no longer feasible. These points define the windows of opportunity. There is a point at the bottom of the steep part of the curve (CDP) that is particularly important. It is where capital preventive maintenance is no longer feasible. Beyond this point, reconstruction and rehabilitation are the only feasible treatments. For example, a sealcoat placed on a surface rated as a PASER 3 because of severe alligator cracking is doomed to fail. That surface needs structural improvement. This concept of a window of opportunity is the basis for Table 4.1.

Figure 4.1 Window of Opportunity



4.3 USING CPM TO EXTEND PAVEMENT LIFE

Capital preventive maintenance treatments extend the life of a pavement by keeping it in good or fair condition for as long as possible. Table 4.1 provides sample treatments for each PASER rating, its corresponding RSL, and the ESL resulting from the treatment.

Table 4.1 Impact of Asphalt Pavement Treatments on RSL

PASER Rating	Equivalent RSL (Years)	Recommended Treatment	Extended Service Life (Years)
1	0	Total reconstruction	Up to 15
2	0	Rehabilitation with extensive base repairs	Up to 14
3	0	Patching with major overlay	7 to 14
4	0	Structural overlay of two inches or more	8 to 12
5	1-2	Non-structural overlay less than 2"	4 to 11
6	3-4	Sealcoat	3 to 10
7	5-6	Routine crack filling	1 to 3
8	7-9	No maintenance required	0
9	10-13	No maintenance required	0
10	14	No maintenance required	0

Source: Michigan Tech Transportation Institute

NOTE: These default values may or may not represent your agency's experience. The Extended Service life gained varies depending on a variety of elements such as: traffic levels, soil conditions, drainage, weather, materials used during construction, appropriate timing of the treatment, and previous treatments applied.

Example – The Value of a Mix of Fixes

The Michigan Local Technical Assistance Program (LTAP) compiled two different work strategies based on costs from counties in the U.P. to illustrate the benefits of a Mix of Fixes. Figure 4.2 illustrates a strategy that consists of a crush and shape rehabilitation every 14 years. In this scenario, the pavement deteriorates for 14 years and then a crush and shape rehabilitation is performed. This rehab brings the condition back up to excellent. The pavement is then left to deteriorate again for another 14 years. This strategy results in a total cost over 28 years of $150,000. The condition after 28 years is lower than the fair threshold.

Figure 4.2 Pavement Strategy 1—Rehabilitation at 14 years

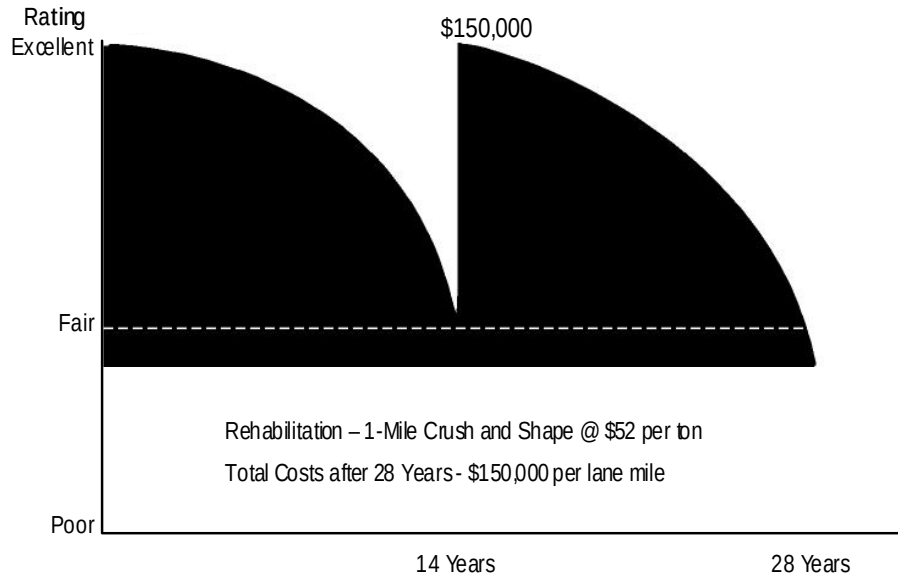
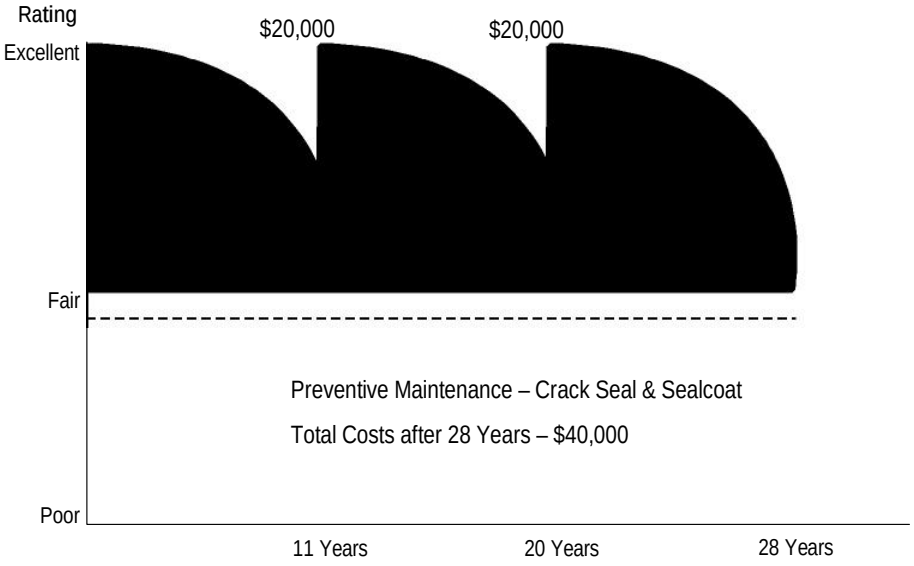


Figure 4.3 illustrates the implications of using a crack seal & sealcoat 11 years after reconstruction and again 9 years later. This approach results in a total cost over 28 years of $40,000. The resulting condition is higher than fair.

Figure 4.3 Pavement Strategy 2—Crack Seal & Seal Coat at 11 year. and 20 year.



4.4 THE MIX OF FIXES AS A MANAGEMENT TOOL

Capital preventive maintenance (CPM) lies at the heart of a sound asset management program and is perhaps the single most influential component in a network repair strategy. CPM treatments generally extend the service life of a given pavement by 3 to 10 years, depending on the specific treatment, traffic characteristics, environmental impacts, etc.

A comprehensive CPM program allows an agency to manage pavement condition by extending the remaining service life of the original pavement and thereby postponing costly reconstruction activities. A significant benefit of a CPM program is that it gives managers better control over future network conditions and funding needs. By controlling future network conditions, decision makers can better anticipate routine maintenance and structural improvement work loads, safety deficiencies, capacity demands and service levels.

5.0 Estimate Project Costs and Funding Levels

Now that you have an understanding of the current condition of your assets and the concept of the Mix of Fixes, the next step is to estimate project costs and funding levels. This information comprises the fiscal constraints under which you must operate your program. Additionally, this information will provide you with a baseline from which to explore alternative scenarios later in the process, such as various combinations within the Mix of Fixes and increases or decreases in funding.

5.1 ESTIMATING PROJECT COSTS

The first step in the process of relating dollars to condition is to develop good estimates for the average project costs of different types of work. Options for estimating unit costs are described below.

Option 1 – Use Default Project Costs

If your agency doesn't have reliable cost data, one option is to simply use default project costs until you can supplement them with actual data. Most pavement management systems come loaded with default values for project costs. The Michigan Department of Transportation (MDOT) has compiled average capital preventive maintenance costs (see Table 5.1).

Table 5.1 Average Capital Preventive Maintenance Costs in Michigan in 2001

Capital Preventive Maintenance Activity	Cost per Lane Mile
Thin overlay	$66,000
Slurry seal	$66,000
Chip seal	$39,000

Source: MDOT

MDOT has developed guidance for estimating the cost of bridge projects as part of Michigan's Local Bridge Program (see Appendix G. Resources). The following are guidelines for estimating bridge replacement costs:

- The average cost per square foot of bridge deck should be at least $135.
- The average cost per 100 lineal feet of roadway approach should be $20,000.
- The overall replacement project should cost at least $300,000.

Project costs can vary largely from agency to agency. Your agency should consider checking the default project costs against benchmarks developed by similar agencies in your area. Alternatively, with a small amount of effort you can take a few sample projects that have recently been completed and compare their actual costs to the default project costs. This can provide some basis for adjusting the project costs to bring them in line with your experience.

You can also use the Project Estimator and Average Unit Price Library in the Michigan Engineers Resource Library (MERL). This tool is used by agency engineers and consultants throughout Michigan (see Appendix G. Resources).

Option 2 – Develop Project Costs for Your Agency

Using default project costs is a short-term option. Construction costs can vary significantly from region to region based on market conditions such as the number of qualified contractors and the availability of materials. Eventually you will want to update the default costs with actual cost data. This will increase the confidence in your agency's analysis.

Cost estimates for routine maintenance activities can be estimated by dividing maintenance expenses from the previous year by the number of lane miles maintained. This calculation will result in a routine maintenance cost per lane mile.

Cost estimates for pavement capital preventive maintenance activities generally require more effort to develop. However, the maintenance divisions of local agencies are traditionally very knowledgeable of the costs incurred for specific repairs. Local knowledge provides an excellent starting point for developing project costs for activities such as crack sealing, chip sealing, concrete joint repair, surface overlays, rehabilitation and reconstruction.

Cost estimates for structural improvement and new construction can be developed as follows:

- Divide the total reconstruction or resurfacing budget from the previous year by the total number of lane miles reconstructed or resurfaced.
- Define a typical cross-section of reconstructed road segments, including lane widths, pavement depths, curbs, etc. You can do this using the Project Estimator in MERL (see Appendix G. Resources). Items such as sidewalks,

driveway aprons, signal hardware, etc., are not normally participating items. But, if most of your projects disturb these types of facilities and you will be responsible for replacement, then consider including those costs. Perform a detailed quantity takeoff of the required materials based on the standard cross section, and apply average bid costs from the previous year.

Unit costs for bridge replacement and rehabilitation costs are typically calculated per square foot of deck area for different types of bridges based on historic project data.

5.2 ESTIMATING FUTURE FUNDING LEVELS

Estimating funding levels is an important step in the asset management process. Understanding the implications of funding decisions on the resulting pavement conditions will enable your agency to establish meaningful condition targets and investment levels. This type of information is most beneficial when it reflects realistic projections of available funding. Funding level estimates should correspond to the multi-year program being developed. Under Michigan Act 51 that must be at least three years.

Option 1 – Assume Consistent Funding Levels

Most agencies have accurate records of their previous transportation receipts and expenditures. Act 51 funds typically account for 50 to 60 percent of transportation funds for local agencies. That allocation is fairly stable, so it provides an excellent starting point for estimating future funding levels.

Example – Estimating ACT 51 Road Funds

Table 5.2 illustrates one approach to estimating Act 51 funds. The table includes three years of actual Act 51 allocations for the City of Elsie. Based on this information it is possible to calculate an average annual increase. The average increase can then be applied to the 2003 expenditures in order to estimate the available funds in 2004. In this example, the estimated 2004 funds are equal to \$79,474 x 1.038 = \$82,494.

Table 5.2 Estimating Act 51 Allocations

2001	2002	2001-2002 Increase	2003	2002-2003 Increase	Average Annual Increase	Estimated 2004 Funds
\$73,724	\$77,826	5.6%	\$79,474	2.1%	3.8%	\$82,494

Source: Annual Report Michigan Transportation Fund, Fiscal Years 2001, 2002, 2003

Option 2 – Estimate Potential Funding Variations

Once a funding estimate has been developed based on previous spending records, additional funding scenarios can be developed by estimating how much this figure may realistically increase or decrease over time. In many cases, three funding options can provide a good snapshot of the potential funding environment:

- Continuation of the current budget (from Option 1)
- Five to 10 percent more
- Five to 10 percent less

Option 3 – Evaluate Potential for Supplemental and New Funding

Many local agencies have the potential to tap into other funding sources. If successful, funding from these sources would be above and beyond the budget determined in Option 1. Understanding these options also will help establish the percent increase and decrease used in Option 2.

Following is a list of potential sources of additional transportation funding:

- **Transportation Economic Development Fund** (TEDF) is a state program that funds projects expected to impact economic development. The program is divided into five categories:
  - TEDF Category A provides funds for projects that help generate jobs or prevent jobs from leaving the State. These funds are available competitively to the state, cities, and counties.
  - TEDF Category C distributes Federal funds for projects that relieve congestion in developing areas. These funds are distributed by formula to Michigan's five largest counties: Wayne, Oakland, Macomb, Genesee, and Kent.
  - TEDF Category D distributes Federal funds for projects that improve rural roads to all-season standards.
  - TEDF Category E provides funds for projects that improve roads in forested areas.
  - TEDF Category F provides funds for projects that improve roads in cities in rural counties to all-season standards.
- **Michigan's State Infrastructure Bank** provides low interest loans for transportation improvements. For more information, contact MDOT's State Infrastructure Bank coordinator.
- **Local Contributions** are given to county road commissions from county general governments, cities, villages, and townships. These contributions vary greatly in size and from county to county. For example, some communities contribute funds to their county road commission on a project by project

basis while in other counties the road commissions require matching funds from the local community for major projects within the community.

- **General Funds** represents a city/village or county's non-transportation funding. In some cases, elected officials have the option of moving money from the general fund into the transportation budget.
- **Utility Funds** can be used for road improvement projects if a utility project is programmed that disrupts a road in need of repair. When the roadway is replaced on top of the utility work, improvements can be made instead of just replacing the roadway in kind.
- **Millages** are levied by a number of Michigan county general governments and some townships and cities exclusively for road projects.
- **Bonds** can be sold in order to pay for large transportation projects. The sale of bonds by a county must be approved by the County Board of Commissioners. Bonds also can be paid for with millages. Further information on bonding requirements is provided in Section 247.668c of Michigan Act 51. Cities also have the ability to bond for road projects.
- **Transfers from major streets to local streets.** Recent legislation eliminates the previous transfer restriction provided an agency implements an asset management process. Public Act 338 of 2006, Section (6) states,

  A city or village shall not transfer more than 50% of its annual major street funding to the local street system unless it has adopted and is following an asset management process for its major and local street system.

The Council has defined an asset management process to include the following activities:

- Conducting periodic system condition inventories
- Identifying needs by forecasting system condition based upon reliable rates of deterioration
- Establishing strategic goals, objectives, and performance measures
- Evaluating investment scenarios based upon forecasted conditions and achievement of goals and objectives
- Developing and implement a multi-year investment program
- Routinely monitoring the performance of system improvements

Example – City of Three Rivers Funding Strategy

The City of Three Rivers, population 7800, is the smaller of the two cities in St. Joseph County, a mostly agricultural county in Southern Michigan. Due to its geographic setting, repeated freeze/thaw cycles during the winter lead to rapid deterioration and heaving of its streets and sidewalks. Prior to 1994, the City followed a "Worst First" policy, repairing streets and sidewalks when residents

complained. These projects usually imposed assessments of 25 to 100% depending on the situation. This strategy led to a scattering of good pavement and sidewalk amid a patchwork of repairs and deterioration all over town with no contiguity for safe pedestrian and/or compliance with the Americans with Disabilities Act (ADA).

In 1994, the City benefited from a county wide, one-mill levy that was apportioned per Act 51. They initiated a program to upgrade gravel streets to asphalt and began rebuilding segments that had been untouched, except for patching, going back as far as the 1920's.

In 2001, the City Manager asked the Engineering Department to develop a plan that would address the improvement needs of 13.5 miles of major streets, 31 miles of local streets and 100 miles of sidewalk. The City Finance Director noted that a 15-year sanitary bond issue was coming due and that the City might be able to "sell" the voters on a millage renewal in support of street and sidewalk improvement.

The City Manager, Finance Director and City Engineer all made presentations at public meetings, public hearings and to civic organizations to allay fears concerning the honest and efficient utilization of the funds. Guidelines were drafted on how to deal with outstanding special assessments and a 4-person advisory committee was proposed to oversee the Engineer and the improvement program. Voters approved the millage renewal by a 400 vote margin (10%).

Since 2003, the City has adopted a Mix of Fixes approach to maintain, upgrade and replace streets. Several miles of street have been rebuilt and many miles have been upgraded by applying a various fixes such as: infra-red heat and reroll, overband crack sealing, slurry seal, microsurfacing, overlay, mill and fill and complete reconstruction. Over 24 miles of sidewalks have been improved to ADA standards. Additionally, this process has gained the City Administration a great deal of credibility with its citizens.

6.0 Predicting Future Condition

The future condition of transportation infrastructure depends on how much an agency is able to invest in routine maintenance, capital preventive maintenance and structural improvement. Typically, the work required to achieve an idealized condition costs far more than agencies can afford to pay. However, deferred maintenance can be costly. As facilities age, they tend to deteriorate more rapidly and often end up costing as much as 10 times more to repair. Agencies that are not able to make sufficient investments to maintain or improve conditions face a higher price tag in the future, as well as potentially unacceptable levels of service for road users. Therefore, it is important for agencies to consider the Mix of Fixes approach—***The Right Fix, in the Right Place, at the Right Time***—and develop the capability to understand the relationship between repair strategies, funding levels and condition (this is usually done through the use of a management system). While many agencies currently do not use a management system and hence lack the capability, it is not difficult to implement. This section presents realistic options for local agencies to analyze future pavement and bridge conditions.

6.1 IMPLEMENT A PAVEMENT MANAGEMENT SYSTEM

Pavement management systems (PMS) support the entire resource allocation process, including the prediction of future pavement conditions. Specifically, they can help you:

- Maintain an inventory of roads and their condition
- Estimate the current condition of a roadway network
- Predict the future condition of the network
- Optimize alternative repair and funding strategies
- Guide your agency to make good decisions
- Promote communication within the agency
- Promote communication with the public

Despite these benefits, simply having a PMS does not mean that your agency is practicing good asset management. For example, a PMS cannot do the following:

- "Sell" itself to public and elected officials
- Replace engineering judgment
- Substitute for a proper capital preventive maintenance program

- Make decisions for you
- Provide all the answers

There are many different PMS available from a multitude of vendors. Table 6.1 includes a sample of available systems. All of these systems have been reviewed by the Council (or are used by Council members) and have been found to be very good systems. Your agency would be well served using any of them.

Table 6.1 Available Pavement Management Systems

Vendor	Product(s) Name	Web Site	Example Agencies Using This System
APWA and University of Illinois	MicroPaver	www.apwa.net www.tac.uiuc.edu	Kent County, Grand Rapids, Ann Arbor
AgileAssets, Inc.	AgileAssets	www.trdi.com	-
CartéGraph Systems Inc.	PAVEMENTview PAVEMENTview Plus	www.cartegraph.com	Detroit, Livonia, Royal Oak
Deighton Associates Limited	dTIMS	www.deighton.com	-
GBA Master Series, Inc.	Street Master	www.gbamasterseries.com	-
Michigan Technological University	RoadSoft-GIS	www.roadsoft.org	Ionia, Ypsilanti, Kingsford, Gladstone, Alcona CRC, Washtenaw CRC, Marquette CRC & others
Hansen	PAVEMENT MANAGEMENT	www.hansen.com	Troy
Stantec Consulting Inc.	Super Pavement Management System (PMS)	www.stantec.com	Oakland County, Southfield, Farmington Hills

Source: TAMC Data Management Subcommittee

In December of 2005, the Council chose RoadSoft for use in developing its state-wide strategy. RoadSoft is an attractive option for many local agencies in Michigan—there are currently over 230 agency users. This system is funded through MDOT and developed, distributed and supported by Michigan Tech University at no cost to Michigan agencies. RoadSoft uses the PASER Condition Rating System, the same system used by the Council for reporting purposes. It has an active user community that meets several times a year (meetings and web seminars) to discuss functionality and future development direction (see Appendix G. Resources).

Implementing RoadSoft requires the following tasks:

- Entering PASER ratings for roads in your jurisdiction
- Indicating the width and pavement type for all road segments
- Updating the default treatment project cost models

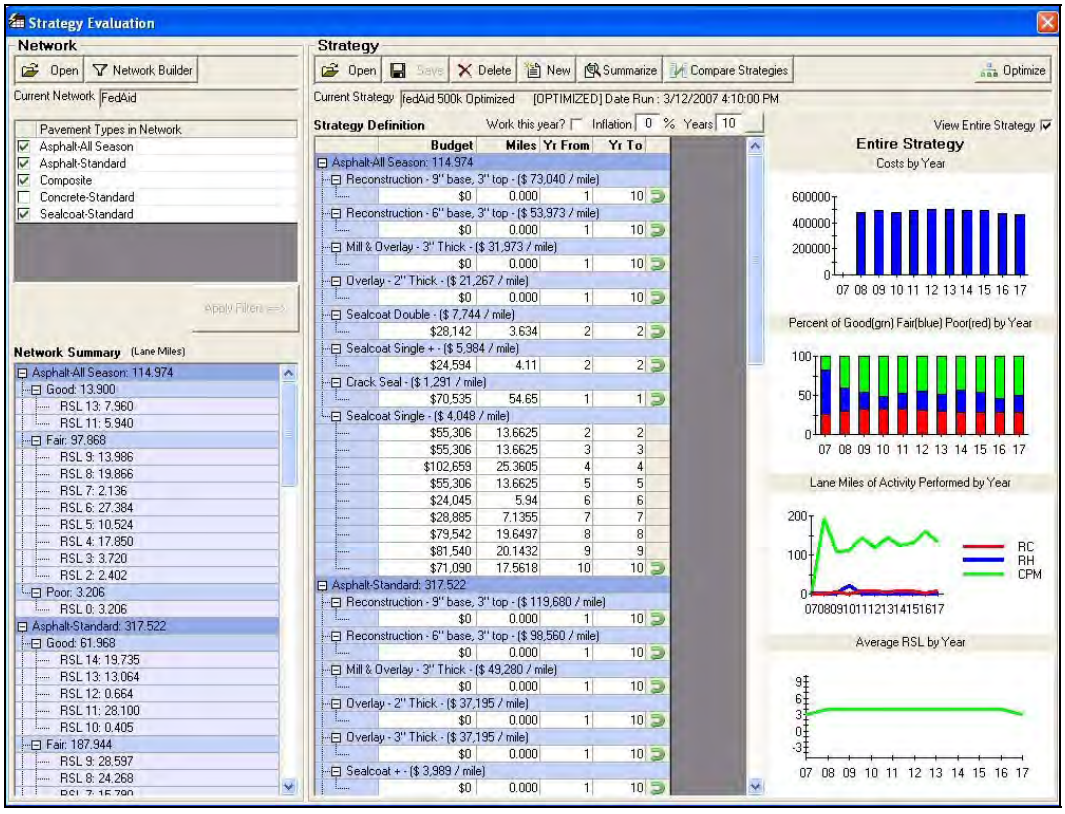
PASER ratings and inventory data for the federal aid system collected as part of the 2003-2007 TAMC Data Collection process are available from your Regional Planning Organization.

Example – Predicting Future Conditions Using RoadSoft

RoadSoft uses PASER surface condition ratings to develop its pavement deterioration curves. The curves are used to estimate remaining service life (RSL) for the network under consideration. RSL is then combined with repair types and costs, and agency funding levels to predict future possible performance in terms of average RSL.

Figure 6.1 shows the resulting impact on Costs; Percent of Good, Fair and Poor; Lane Miles of Activity; and Average RSL for a specific level of funding and particular selection of fixes.

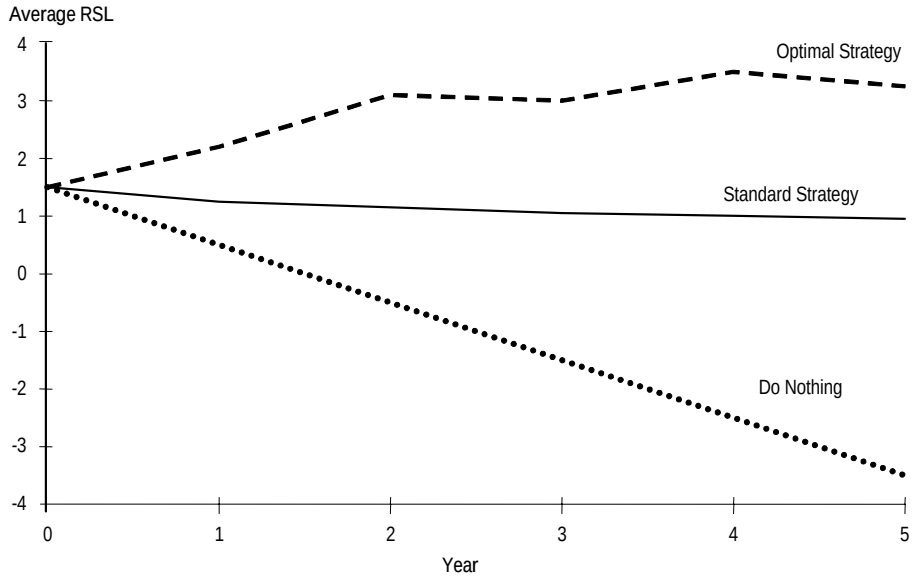
Figure 6.1 Future Network Pavement Condition at Specific Funding Level and Mix of Fixes Using RoadSoft



Source: RoadSoft Output

Figure 6.2 shows the result of running for two strategies: a) standard (heavy on reconstruct) and b) optimized (some reconstruct and heavy on capital preventive maintenance). It also shows the impact of doing nothing, which results in negative RSL, meaning that the majority of roads will quickly drop below the critical distress point (CDP) and require reconstruction or rehabilitation. The figure shows that the standard strategy will result in a loss of average RSL over the next five years; whereas the optimal strategy will improve the average RSL.

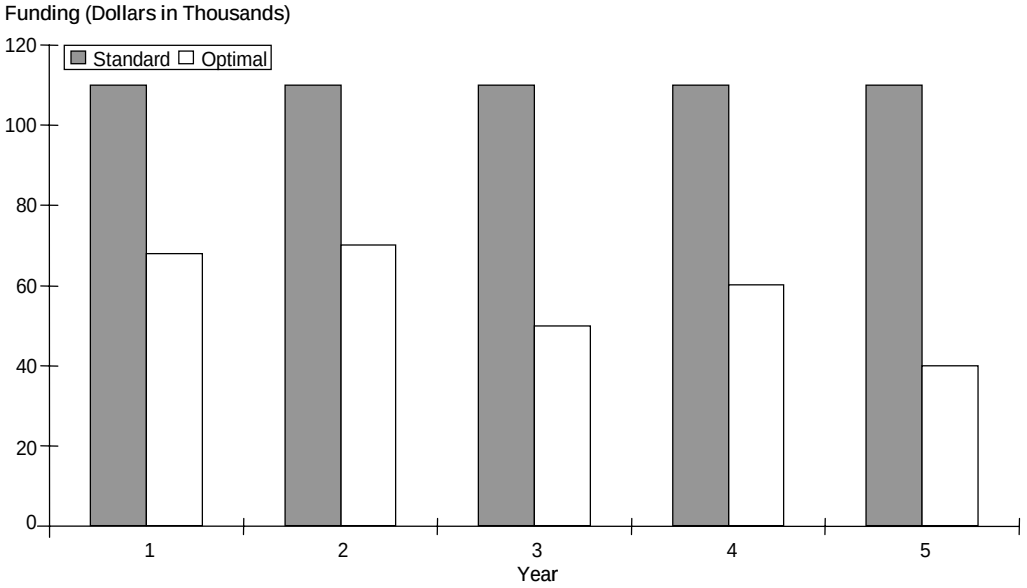
Figure 6.2 Comparing Funding Scenarios



Source: RoadSoft Output

Figure 6.3 shows the comparative budgets for the two strategies. Even though the optimized strategy costs less than the standard strategy, the results are far better.

Figure 6.3 Defining Funding Scenarios



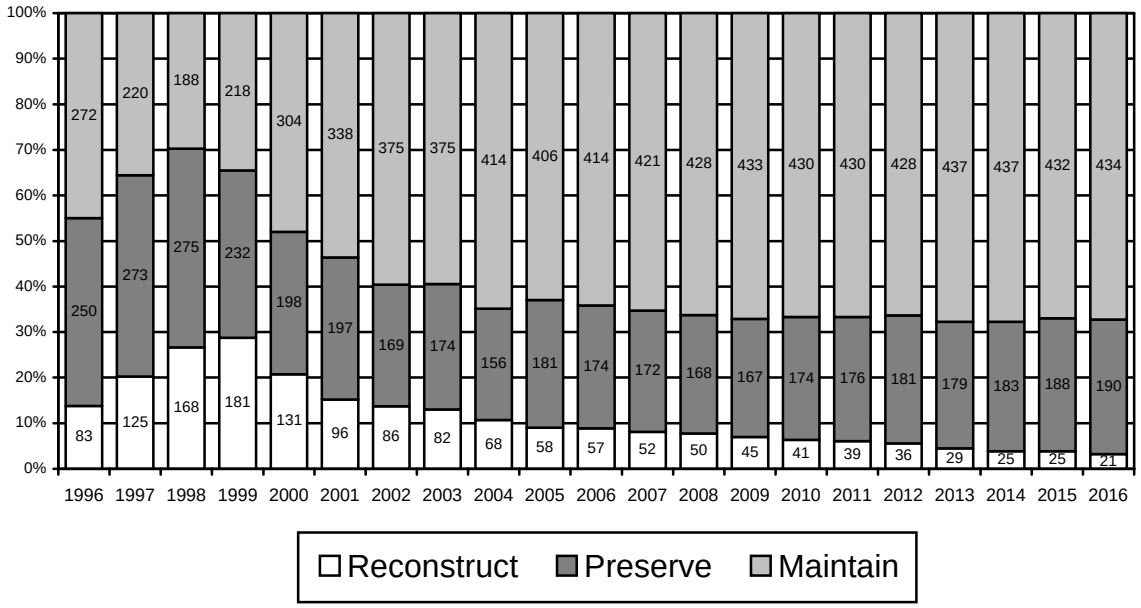
Source: RoadSoft Output

Example – Predicting Future Pavement Conditions Using MicroPaver

Another popular system used by several agencies in Michigan is MicroPaver. Developed by the U.S. Army Corps of Engineers, this system requires more detailed condition data than RoadSoft.

In 1995, the Kent County Road Commission (KCRC), in cooperation with the Grand Valley Metropolitan Council, adopted MicroPaver for use on its primary road system (630 miles). After a period in the early to mid 1990's that was dominated by expansion projects, the KCRC noticed a decline in the condition of its primary roads and decided to reemphasize system preservation. KCRC uses MicroPaver to assess pavement condition, evaluate individual road segments, identify improvement projects, and evaluate investment options. For example, Figure 6.4 presents a trend analysis of pavement condition.

Figure 6.4 KCRC Road Distribution Over Time

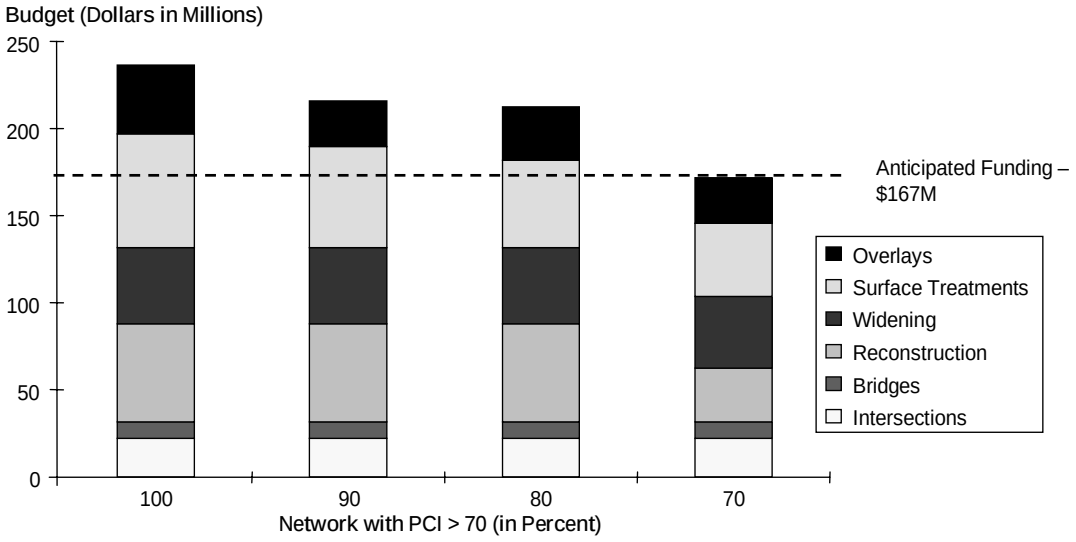


Source: Kent County Road Commission

The data shows the percent of the network requiring the following work activities: reconstruction, preservation, and maintenance. The network is segmented into these categories based on a pavement condition index (PCI).

Figure 6.5 presents four alternative budget scenarios and indicates the implications of each for future pavement condition.

Figure 6.5 KCRC Future Pavement Condition



Source: Kent County Road Commission

The performance measure used for this analysis is the percent of the network with a PCI greater than or equal to 70. In each scenario, the funding for intersections and bridges is held constant, while the amounts allocated to surface treatments, overlays and pavement reconstruction increase with the overall funding level.

6.2 IMPLEMENT A SPREADSHEET ANALYSIS

Another option for predicting future pavement condition is a spreadsheet analysis—this can also be done with pencil and paper. The *Quick Check of Highway Network Health* developed by the National Center for Pavement Preservation (NCPP) is an understandable methodology that can be used by agencies large and small. The Quick Check (see Appendix G. Resources) uses the number of lane-miles in your network, the ESL lost every year to deterioration, the ESL gained from treatments, and the quantity and cost of treatments performed.

Assume you have 220 lane-miles in your network. If you did absolutely no work on your road network over the course of one year the system would deteriorate (at a minimum) 220 lane-mile-years (one year for each lane-mile). If you apply treatments and structural improvements (adding ESL), you gain lane-mile-years. The difference between what the network loses through deterioration and what

it gains through improvement indicates whether the agency is gaining ground or losing ground.

The Quick Check process requires the following steps:

1. Determine the number of lane-miles in your network.
2. Build a summary of the following:
    a. the treatments you plan to apply in the coming season
    b. treatment cost per lane mile
    c. the ESL gained by the treatment
    d. the number of lane miles treated
3. Use a spreadsheet (or paper and pencil) to calculate the lane-mile-years gained and total cost of the applied treatment.
4. Total up the lane-mile-years gained by all the treatments and the applied treatment costs. Total treatment costs should reflect your current treatment budget or proposed budget. Compare the lane-mile-years gained against the lane-mile-years lost for your network. Are you gaining ground or losing ground?
5. If you come up short, consider changing the Mix of Fixes. You can run different treatment scenarios and see the impact that capital preventive maintenance has on the overall network condition.

Example – Predicting Future Conditions Using the NCPP Quick Check

Figure 6.6 uses actual data from a local agency in Michigan (prorated to keep the agency anonymous) and the NCPP approach applied to the local agency situation. This agency has 625 lane-miles in its network. Therefore, each year the network will deteriorate 625 lane-mile-years. Their challenge is to overcome the deterioration with extended life gained through treatment.

Notice that the treatments gained 204 lane-mile-years (ESL), but at the same time the system lost 625 lane-mile-years (RSL), for a net loss of 421 lane-mile-years. They are losing ground fast—only recovering 30% of a year's deterioration!

Consider these observations about the example:

- 84% of the budget is being devoted to only 1.8% (10 lane-miles) of the system.
- Crack sealing was done on only 6 lane-miles—on a 625 mile network! Cracks are being ignored, which directly leads to deterioration requiring more expensive treatment.
- They are only getting 2 years of ESL from Non Structural Overlays—very little "bang for the buck". Is this a case of the wrong fix in the wrong place at the wrong time?

This example clearly shows that a strategy devoting the majority of resources to structural improvement (worst first) contributes to a downward spiral of overall network condition. In each succeeding year it will become more costly to reverse that trend. Implementing a more aggressive CPM program would go a long way towards keeping the good roads good and overcoming the annual deficit of lane-mile-years. Most likely they also need to make the case for an increase in resources.

Figure 6.6 Spreadsheet Prediction of Future Pavement Conditions Using the NCPP "Quick Check" Approach (625 Lane-Mile Network)

Programmed Activity	Fixed cost per lane mile	ESL Years	# of Lane Miles of Fix	Lane Mile Years	Total Cost
Reconstruction	$530,000	15	4	60	$2,120,000
Rehabilitation	$170,000	14	6	84	$1,020,000
Mill & Overlay	$68,000	8	5	40	$340,000
Non Struc. Overlay	$32,000	2	7	14	$224,000
Crack Seal	$4,800	1	6	6	$28,800
Totals				**204**	**$3,732,800**

204 lane-mile-years gained — 625 lane-mile-years lost = a deficit of 421 lane-mile-years

7.0 Performance Measures and Performance Targets

An asset management approach requires that an agency has policies in place that articulate the agency's road network goals. Performance Measures and Performance Targets are the tools by which an agency communicates its efforts and gauges its success. Measures and targets should be developed **prior** to conducting tradeoffs and selecting projects.

Using this "top-down," performance-based, strategic approach can help focus the debate on the big picture and improve agency accountability with elected officials and the public.

7.1 SELECT PERFORMANCE MEASURES

Performance measures are quantifiable representations that measure an agency's outputs, quality of its assets, efficiency, or cost-effectiveness. They should be related to an agency's mission and not simply measure one-time or short-term activities.

General examples include:

- Distribution of road network condition (PASER, PCI, RSL)
- Average response time to address maintenance needs and complaints
- Number of fatal and severe injury crashes per million miles traveled
- Agency expenditures or maintenance expenditures per mile
- Expenditures per work type as a percentage of total expenditures

Performance measures strengthen both external accountability and internal agency decision-making. External accountability is improved by using performance measures to provide a clear and compelling rationale for budget requests and to regularly communicate progress on achieving stated policy objectives. Internal agency effectiveness is enhanced through the use of performance measures to provide a technical basis for decisions.

It is recommended that local agencies select at least one measure for road condition and one for bridge condition. In addition, agencies should consider supplementing these condition measures with measures that reflect other priorities such as traffic movement and safety.

When selecting performance measures, ask yourself—*does this performance measure actually measure our desired outcome?*

Performance measures should meet the following criteria:

- **Feasibility –** Is the measure feasible to monitor with sufficient accuracy and reliability given available resources?
- **Easy to Communicate –** Is the measure meaningful to decision-makers and the general public?
- **Forecastable –** Is it possible to forecast the value of the measure?

7.2 SETTING PERFORMANCE TARGETS

Performance Targets turn policies into guidance for prioritizing projects. For example, if an agency's policy is to preserve pavement condition, it may select PASER rating distribution as a performance measure and establish a specific performance target, such as "85% of the network will be at PASER 6 or better." Decision-makers can then allocate transportation resources in a way that is in line with the agency's performance target—thereby achieving the policy.

In addition to clearly stating the condition that an agency wants to achieve, targets should also indicate a timeframe. Will this target be achieved next year? In five years? It is good practice to have both short- and long-term targets. Long-term targets highlight the need for sustained investment in infrastructure and direct attention to capital preventive maintenance in addition to replacing the facilities that currently are in poor condition.

General examples include:

- 65 percent of network road miles at PASER 6 or better by 2012
- Increase network RSL by 5 percent every year
- Reduce the RSL lost each year to no more than 30%

Table 7.1 presents a sample of targets set by local agencies in Michigan.

Table 7.1 Performance Target Examples

Target	Agency
Average PCI > 70	Grand Rapids
All streets with PASER rating ≥ 5	Ionia
Seventy percent of network with PCI > 70	Kent County
Average PASER rating of 8 by 2012	Calhoun County
Every gravel road is brined, full length, twice each year	Calhoun County

Agencies should consider the following types of questions when setting performance targets:

- What percentage of funding is going to various work categories?
- Are we investing in transportation at a sufficient level?
- Are we making sufficient improvements in the system to improve its overall condition?
- Are we simply maintaining the current condition?

The following are examples of approaches used by transportation agencies to establish performance targets:

- Establish a threshold for "poor" or "good" pavement based on PASER ratings, RSL or PCI index, or a level of roughness that is noticeable to road users. Minimize the percent of the network in poor condition, or maximize the percent of the network in good condition.
- Use a management system to determine a long-term optimal network condition distribution. Use this analysis to set goals for either average condition or percent of the network above a given threshold condition level.
- Base goals on maintaining a steady-state condition distribution in order to avoid future peaks in preservation or replacement needs that would be difficult to address given a relatively constant level of funding. These goals are expressed in terms of the percentage of the network in different condition ranges.
- Establish separate goals for different portions of the road network to reflect different functions and degrees of importance (e.g., major versus local streets).

Agencies should periodically adjust targets based on the degree of progress made, changes in policy or priorities, dramatic changes in available funds or emergence of information or factors not previously considered when the initial targets were established.

8.0 Conduct a Tradeoff Analysis

An asset management approach involves tradeoff analysis between treatment options and network needs. It also includes setting system performance targets for the network in conjunction with funding levels for different program categories, such as treatment types—routine maintenance, capital preventive maintenance, and structural improvement. Tradeoff analysis and setting of performance targets should be done ***prior*** to looking at specific projects. Using this "top-down," performance-based, strategic approach can help focus the debate on the big picture and improve agency accountability with elected officials and the public. As you work your way through this process you are, in effect, building your capital preventive maintenance and structural improvement strategy

8.1 CONDUCT TRADEOFF ANALYSIS

Whether formally communicated or not, your agency makes decisions every day on how best to allocate transportation resources. This section describes examples of common transportation tradeoffs and provides options for making these decisions in a transparent, defensible manner.

What is a Tradeoff?

The heart of the asset management process is capital preventive maintenance. The challenge is determining the most effective tradeoff within the Mix of Fixes that will comprise CPM. How much money should your agency spend on one type of work as compared to another? Answering this question requires your agency to understand the consequences of alternative funding strategies for maintenance and reconstruction. The end result of this analysis is an allocation that best meets your agency's transportation condition and performance objectives.

Additionally, there are other types of tradeoffs that must be made during the decision-making process. Many of these tradeoffs represent "apples to oranges" comparisons. However, as transportation professionals, you must make these tradeoffs all the time. Structured tradeoff analysis simply provides a means for making decisions based on the best available information. It also will provide your agency with a tool for working with elected officials to reach mutual agreement on policies, funding levels, and condition targets.

Examples of the types of tradeoffs your agency may consider include the following:

- **Routine Maintenance versus Capital Preventive Maintenance versus Structural Improvement –** An optimal asset management strategy typically includes a combination of routine maintenance, capital preventive maintenance, and structural improvement projects. Management systems can help determine the most appropriate selection of fixes for your agency's road network.
- **Routine Maintenance versus Other Transportation Work –** Many agencies allocate funds for routine maintenance before any other work is considered. Often, this allocation is based on a continuation of historic funding levels.
- **Transportation Work versus Other Community Services–** In most communities the funds received from Act 51 disbursements are insufficient to pay for overall street needs. In fact on an annual basis, 60% of the agencies statewide receive $200,000 or less from Act 51. On average it costs $150,000 per lane mile for crush and shape, a common fix used by many local agencies. Consequently, many communities are faced with supplementing their Act 51 funds with General Fund monies or special assessments as a way to keep up with deterioration. In these times of severe budget strains on local governments, street repairs are placed in competition with police, fire and other local services.
- **Preservation versus Traffic Improvements –** This tradeoff addresses the amount of money allocated to preserving the existing transportation system versus the amount allocated to improve traffic condition. Options for traffic improvements include adding lanes, reconfiguring intersections, and improving traffic signal operations.
- **Pavement versus Bridge –** Because bridge rehabilitation and replacement projects are significantly more expensive than similar pavement projects, agencies often adopt a strategy in which they first spend the money required to keep their bridges in a holding pattern until major federally funded projects are feasible. The remainder of the budget is then allocated to pavements.
- **Sub-Network or Geographic Distribution –** This tradeoff represents the division of spending between groups of assets, such as between the major and local roads, among townships, between primary and secondary corridors, or between one ward and another.

Option 1 - Compare Analysis Results in a Tradeoff Matrix

A tradeoff matrix provides a mechanism for formally structuring the results of an analysis of future conditions. These matrices do not make decisions for you. They provide you with the relevant information required for you to make the best decision possible. Developing a tradeoff matrix such as the one illustrated in Table 8.1 requires the following steps:

1. Identify major goal areas, such as pavement preservation, bridge preservation, capacity improvements, economic development, safety, neighborhood revitalization, etc.
2. Define one or more performance measures for each area. In these examples two performance measures are used: a) the percent of roads in good, fair and poor condition, and b) the percent of major and local roads in good condition.
3. Determine current performance level.
4. Enter the output from your various funding and Mix of Fixes scenarios.

If your agency uses a management system, take advantage of its strategy analysis and strategy optimization features. The resulting output with charts and graphs for a variety of funding levels and Mix of Fixes can support your tradeoff analysis. These types of reports provide context for decision-makers working to determine appropriate funding levels.

If your agency uses a spreadsheet system, simply repeat the process for a variety of funding levels and Mix of Fixes scenarios to estimate possible future conditions.

Based on this information, decision makers can select the funding scenario that they prefer.

Example – Mix of Fixes Tradeoff by Strategy

The example in Table 8.1 uses a management system or spreadsheet output to show the tradeoff within the Mix of Fixes for: a) static funding, and b) a 10% increase in funding. If the performance target is to increase the percentage of roads in good condition, then the 100% SI Budget yields best results. This success, however, leads to a decrease of the percentage in Fair and an increase in the percentage in Poor—a serious problem. Alternatively, devoting a significant portion of the budget to CPM and PM holds the percentage of roads in Good condition steady, increases the percentage in Fair and reduces the percentage in Poor Note: this output is representative of RoadSoft output, but is only used for illustrative purposes and does not represent a specific case.

Table 8.1 Mix of Fixes Strategy Tradeoff Matrix

Scenario	% Budget SI	% Budget CPM	% Budget PM	Performance in Year 5		
				% Good	% Fair	% Poor
Current Strategy	100%	0%	0%	10%	55%	35%
Static Funding #1	100%	0%	0%	12%	40%	48%
Static Funding #2	50%	40%	10%	10%	65%	25%
+10% Funding #1	100%	0%	0%	12.2%	40%	47.8
+10% Funding #2	50%	40%	10%	11%	70%	19%

Example – Mix of Fixes Tradeoff by Network Subset

The example in Table 8.2 uses a management system or spreadsheet output to show the resulting condition 10 years out for major and minor roads. The analysis used three funding scenarios: a) continuation of last year's budget, b) increasing this budget by 10 percent, and c) decreasing the budget by 10 percent.

Table 8.2 Network Subset Tradeoff Matrix

Road Network	Performance Measure	Current Performance	Performance in Year 10		
			Last Year's Funding	+10 Percent	-10 Percent
Major	% Good	75%	80%	85%	65%
Local	% Good	55%	50%	55%	45%

Option 2 - Describe the Tradeoffs

If your agency does not yet have the capability to perform quantitative tradeoff analysis, it is still helpful to develop a system-level strategy for making tradeoffs, and document the logic behind this strategy. This will provide guidance for selecting projects later in the resource allocation process, and enable your agency to communicate its policies to elected officials and the public. If your current decision-making process is largely based on consideration of individual projects, this will move you in the direction of looking at the system as a whole and thinking strategically about priorities.

This option may only be appropriate for agencies that have responsibility for limited road mileage and a very small number of bridges. For larger networks it is impossible to know if the decisions will result in the best use of transportation resources without some type of formal analysis. Therefore, this should be considered an interim approach until more formal analysis capabilities are developed.

Example – Documenting a Resource Allocation Process

The following is an example of how an agency may document its resource allocation process:

- Our first priority is to fund capital preventive maintenance at an adequate level. The remaining transportation funds will be used for routine maintenance and reconstruction.
- We have two bridges that require significant rehabilitation work. However, we cannot afford major rehabilitation projects at this time. We will use a holding strategy for them until Federal funds become available for larger projects. The remaining funds will be spent on pavement preservation.
- There are a number of segments on our major street network that require reconstruction or resurfacing. There are not sufficient funds to fix them all at this time. We will address segments with high traffic volumes first.
- Overall, our major streets are in better condition than our local streets. Therefore we will transfer 60 percent of the major street funds to the local street program. This transfer is possible because an asset management process has been implemented by the city per Michigan Public Act 338 of 2006. The focus of our local street program will be capital preventive maintenance activities.

8.2 MAKING THE CASE TO ELECTED OFFICIALS

The process of identifying program targets and funding levels should be done cooperatively with elected officials who are ultimately responsible for resource allocation decisions. Open communication with elected officials may eventually make requests for additional financial support easier. In addition, obtaining agreement on targets and funding levels will help your agency move towards a more merit-based approach to project prioritization.

Example – Making a Request for Additional Funds

In 2003, the Public Works Department of the City of Gladstone was successful in making the case for additional funds to their elected officials. After analyzing the condition of its pavements using the MicroPaver pavement management system (PMS), the Department found that Gladstone needed to invest $180,000 annually over the next 10 years in order to address current deficiencies.

However, even at this rate of spending, the overall pavement condition would continue to decline for five years before it started to improve. To stop this decline immediately, the PMS identified an annual budget of $250,000. Staff estimated that a more realistic value for annual funding was $220,000, of which $140,000 would come from Act 51 funds. In order to make the case to fund the remaining balance locally, agency officials presented their plan to the City Commission. The Commission adopted a special assessment to raise the needed funding. The assessment is imposed per lineal foot of property road frontage. The Commission holds a public meeting annually in which resident opinions can be heard regarding the assessment. The assessment was renewed in 2004, 2005, and 2006.

The Gladstone DPW staff found that when elected officials do not have a fixed amount of money in mind for transportation projects, they will only fund these projects after all other expenses have been covered. Therefore, the agency devised a plan to reverse this thinking by providing officials with a long-term estimate of how much money would be needed annually to achieve the desired condition. Without measuring the performance of its system and setting condition targets, Gladstone would not have been able to clearly present its case to its elected officials.

9.0 Identify Candidate Projects

The next step in the annual resource allocation process is to develop candidate projects. Candidate projects represent work that **should** be done. They will be prioritized in the next step of the process and the highest priority projects will be added to the multi-year program. Candidate projects can be generated through a combination of applying rules of thumb to current condition data, input from management systems, public input or through engineering judgment and field inspection.

Option 1 – Use Management Systems

Most pavement management systems will recommend appropriate work candidates. While methods vary across systems, typically the selection of work candidates is based on current or projected conditions, functional class or traffic level and pavement type. Many agencies that use pavement management systems print a report of the projects that meet their strategy criteria and then conduct field visits to review and potentially adjust the recommendations.

Option 2 – Establish a Capital Preventive Maintenance Program

Agencies often operate within tight budget constraints. In this environment, it is important to optimize the performance of the existing system—keeping the good roads good. Agencies can move towards this objective by dedicating a portion of the budget to fund capital preventive maintenance activities. Based on a life-cycle cost analysis, studies estimate that $1 invested in capital preventive maintenance will save from $4 to $6 in future reconstruction costs.[5]

Option 3 – Apply Rules of Thumb

While management systems speed up the process of identifying candidate projects for large networks, agencies with smaller networks can apply this same logic using a simple table. For example, Table 9.1 presents PASER default thresholds and recommended treatment activities. If your agency does not have a treatment policy, this table can be used as a starting point.

[5] Life-cycle costs analysis involves tabulating costs throughout an asset's entire life, and applying a discount rate to estimate the present value of this cost stream. It is a critical aspect of asset management for big projects over $1 million.

Table 9.1 Recommended Treatments by PASER Rating

	Recommended Treatment	
PASER Rating	Asphalt Pavements	Concrete Pavements
1	Total reconstruction	Total reconstruction
2	Reconstruction with extensive base repairs	Recycle and/or rebuild pavement
3	Patching with major overlay	Full depth patching with some full slab replacement
4	Structural overlay of two inches or more	Some full depth repairs, grinding, and/or asphalt overlay
5	Sealcoat or non-structural overlay less than two inches	Grinding with some partial depth patching or joint repairs
6	Sealcoat	Joint and crack sealing
7	Routine crack filling	Surface scaling, seal open joints, other routine maintenance
8	No maintenance required	No maintenance required
9	No maintenance required	No maintenance required
10	No maintenance required	No maintenance required

Source: PASER Manual.

Option 4 – Solicit Stakeholder Input

Another approach that is used by many agencies (often in combination with the other options) is generating candidate projects based on stakeholder input. Stakeholders include all parties outside of the agency that have an interest in the transportation program, such as the public, elected officials, and partner agencies. This option looks beyond just the physical condition of the assets and generates projects based on the needs of the community such as: economic development, new residential development, traffic safety concerns, etc. Care should be taken that recommendations meet the criteria of your improvement plan, performance targets, etc.

Example – Reaching out to Partner Agencies

An example of an agency that gathers public input while generating potential projects for their transportation plan is the Road Commission of Oakland County (RCOC). As part of its strategic planning process, RCOC travels to all of the communities in Oakland County to discuss their transportation needs. In each community, the agency holds a strategic planning meeting with the residents to identify projects they would like completed in the next transportation program. RCOC sorts these projects into categories: capacity improvements, road paving, resurfacing and reconstruction, spot safety and drainage, traffic management, gravel roads, and general maintenance. The projects in each category are then sorted based on general recommendations by the communities. For example, during recent strategic planning meetings, community leaders indicated that

system preservation and rehabilitation should be given a higher priority than system expansion. Consequently, RCOC focused its efforts on system preservation for that strategic plan.

Option 5 - Engineering Judgment, Field Inspections & Project Coordination

Regardless of the process used to identify candidate projects, the final step is to use engineering judgment based on field inspections, local knowledge of other needs and coordination with other types of projects. For example, there may be drainage, pedestrian safety, or traffic flow concerns that should be considered along with pavement condition in formulating a candidate project. The need to coordinate with utility projects also is an important consideration. For example, if a major water main is to be replaced along a street, it may make sense to reconstruct that street rather than another in similar condition.

Bridge inspections will generally yield inspector recommendations as to appropriate actions to be taken – based on observed physical condition as well as an understanding of the bridge's importance to the network, and any operational or safety concerns that may exist.

10.0 Set Priorities and Develop Multi-Year Program

The next step is to prioritize candidate projects and develop a multi-year program. This is where you blend the fundamental goal of asset management—applying ***The Right Fix, in the Right Place, at the Right Time,*** with agency and community priorities. The multi-year program documents the results of this process.

Michigan's asset management legislation calls for agencies to develop a three-year program that is updated annually. Often, agencies use a "rolling program" – which involves reviewing and updating the projects in the first two years of the existing three-year program and then selecting projects for the new third year.

Table 10.1 shows an example of what a program for road construction projects looks like. It was developed by the Cass County Road Commission.

Table 10.1 Cass County Road Commission Primary Road Construction Program – 2005

The following roads will be sealcoated:			
Calvin Center Road	Mason Street to Mt. Zion Street	3.02 Miles	$40,166
Decatur Road	Dutch Settlement Street to Marcellus Highway	2.01 Miles	$26,733
Pokagon Highway	Oak Grove Road to Cassopolis Village Limit	1.61 Miles	$21,413
Mason Street	Kessington Road to Union Road	1.67 Miles	$17,451
The following roads will have a two-inch recap with gravel shoulders applied:			
Wilbur Hill Road	Hampshire Street to Beeson Street	1.00 Miles	$58,240
Matthews Street	Wilbur Hill Street to Dowagiac City Limit	0.44 Miles	$27,818
White Temple Road	M-60 to Shattuck Road	1.63 Miles	$94,945
Barron Lake Road	Cook Street to Kansas Street	2.36 Miles	$142,871

There are three components of a local agency's transportation program:

1. **Federally Funded Projects –** Projects that use Federal funds must go through the statewide transportation programming process.
2. **Bridge Projects –** Bridge projects must go through Michigan's Local Bridge Program.
3. **All Other Transportation Projects –** These projects are funded completely with state and local funds and can be selected at the discretion of the local agency.

10.1 FEDERAL AID PORTION OF THE PROGRAM

The Federal aid portion of local transportation programs is governed by federal statute and resulting regulations. These outline a planning and programming process for all transportation projects that use Federal funds. This process assures that the programmed projects address identified needs, conform to air quality guidelines, and address multimodal concerns. It also assures that the public has an opportunity to comment on the selected projects.

If a Federally funded candidate project falls within a Metropolitan Planning Organization (MPO) area, local agencies must work with the MPO to program it. Once programmed, it will appear in the MPO's Transportation Improvement Program (TIP).

If a Federally funded candidate does not fall within an MPO area, local agencies must coordinate with a Rural Task Force to program it. Once programmed, these projects will appear in Michigan's Statewide Transportation Improvement Program (STIP).

Developing the Federal aid portion of local transportation programs requires agencies to participate in the STIP or TIP process.

10.2 BRIDGE PORTION OF THE PROGRAM

The bridge portion of local transportation programs is governed by Michigan's Local Bridge Program. This program was created by state legislation in 2004. The goal of this legislation was to help local agencies analyze bridge projects. The legislation outlines a process for allocating Local Bridge Funds and describes the responsibilities of the Local Bridge Advisory Board (LBAB) and the seven Regional Bridge Councils (RBC).

The LBAB is an eight member board that is responsible for the oversight of the Local Bridge Program. The board consists of three members representing counties, three members representing cities and villages, and two members from MDOT. The MDOT members are non-voting members who supply technical information and administrative support to the board. The responsibilities of the LBAB include:

- Responding to emergency situations involving local bridges
- Allocating funds to the regions
- Ensuring that the RBCs are following established guidelines

The purpose of the RBCs is to develop a three-year bridge program for maintaining and rehabilitating the bridges in their regions. The seven RBCs each represent a region of the State of Michigan. Each RBC is comprised of five members; two representatives of counties in the region, two representatives of cities and villages in the region, and one member from MDOT's local agency bridge staff. The primary responsibilities of the RBCs include:

- Rating the applications for local bridge funds
- Working together to create a three-year bridge plan of projects for their region
- Overseeing the progress being made toward bringing the planned projects to contract

Contact information for the Local Bridge Program is provided in Appendix G. Resources.

Agencies should consider asking their bridge inspectors to include a prioritized list of projects for the next three years in the standard bridge inspection reports. Multiple versions of this list could be developed. For example, one version may assume that money is available for a large rehabilitation project, while the other assumes that this money is not available and that only less expensive stop gap measures are feasible. These reports can be incorporated into applications for the local bridge program and for the STIP/TIP process.

10.3 CONSISTENCY WITH MANAGEMENT SYSTEM RECOMMENDATIONS

If management systems are used to set performance targets and funding levels, it is important to maintain some level of consistency with these recommendations during the programming process. Otherwise, the value of using the systems is lost, and the credibility of the programming process can suffer. This does not mean, however, that agencies must always follow the specific recommendations produced by these systems. There are many considerations in project programming that management systems may not account for such as: economic development, residential development in previously rural areas, traffic congestion, or traffic safety issues.

One common approach is to ensure that the program is consistent on an overall basis with the management system recommendations. Using RoadSoft, an agency can develop and optimize strategies that recommend the amount of each

type of work that should be completed each year in order to achieve a certain condition target. An example of this type of output is illustrated in Table 10.2.

Table 10.2 Example RoadSoft Recommendations

Work Category	Treatment	Lane Miles
Structural Improvement	Reconstruct	4
Structural Improvement	Resurface	8
Structural Improvement	Rehabilitation	13
Capital Preventive Maintenance	Chip Seal	37
Capital Preventive Maintenance	Skip Patch	2
Capital Preventive Maintenance	Crack Seal	36

This process allows the agency to follow the overall management system's recommendations (e.g., do 10 lane miles of seal coating) while still having the flexibility to select specific project locations.

In addition to ensuring consistency of the program with the management system recommendations at an overall or network level, it also is important to ensure that treatment selections at particular locations are consistent with the treatment policies used in the management system. For example, Table 9.1 indicates that an asphalt road segment with a PASER rating of 4 should have a structural overlay of 2 inches or more. If your program is systematically including thinner overlays for segments with PASER ratings of 4 (perhaps to stretch the available funds further) this should serve as a red flag. From a pavement management standpoint, this approach is throwing good money down a hole and violates the principle of ***the Right Fix in the Right Place at the Right Time***. On the other hand, there could be situations such as: limited traffic volumes, or exceptional soil conditions, where using less than two inches may be sufficient for a period of years, or when this treatment is used as a band-aid to hold things together for a couple years until reconstruction can take place. The knowledge of the local engineer is crucial in this regard.

Some management systems will generate an entire multi-year program with specific projects and recommended timings. One way to take advantage of this capability while maintaining flexibility for programming is to use a three-year window for the recommended projects. When building the program, the agency may juggle the timing for a project within the three-year window based on the available budget and competing projects. This allows managers to build the multi-year program in a way that is consistent with management system recommendations while still meeting funding and project coordination constraints.

10.4 PRIORITIZING CANDIDATE PROJECTS

Regardless of whether management systems are used or not, agencies should evaluate candidate projects in terms of the targets developed earlier in the resource allocation process. They should also consider other factors that go beyond improving the condition of the system (e.g., safety considerations). A clear and defensible prioritization process will enable agencies to explain to its stakeholders why it has selected one project over another.

Following are two options for prioritizing projects. Each option can be applied to all components of the program – Federal aid, bridge, and other. Even though Federal aid projects must go through the STIP or TIP process, and bridge projects must go through the Local Bridge Program, local agencies can use these techniques to evaluate project candidates before they are submitted for consideration in these programs.

Option 1 – Scoring Methods

Some agencies use scoring or ranking methods to prioritize projects. For example, Table 10.3 presents a template for evaluating candidate projects. Each project is ranked high, medium, or low based on a set of clearly defined criteria:

- **Pavement Condition –** To what degree is the project warranted based on the current condition of the pavement?
- **Traffic Volume –** What is the traffic level in the project location?
- **Economic Growth –** What impact will the project have on economic growth?

Table 10.3 High, Medium, and Low Project Prioritization Template

	Pavement Condition Priority	Traffic Volume Priority	Economic Growth Priority
Candidate 1	Low	High	High
Candidate 2	High	High	Low
Candidate 3	High	Medium	Medium

This approach helps characterize the degree to which each candidate project supports key agency goals. In this example, is it clear whether or not Candidate 1 is better than Candidate 2? Decision-makers still need to apply their judgment in selecting the final projects to implement.

Example – SEMCOG Priority Corridors

The Southeast Michigan Council of Governments (SEMCOG) uses a variation of this approach when developing its regional transportation plan. SEMCOG prioritizes corridors before considering specific projects. During the subsequent project

selection process, projects on high-priority corridors take precedence over those on secondary corridors. Table 10.4 identifies the factors used to identify priorities.

Table 10.4 SEMCOG Corridor Prioritization Factors

Factor	Score	Description
Bridge	0-3	Deficient bridges per mile scaled to a maximum of 3
Safety	0-3	High-crash intersections per mile scaled to a maximum of 3
Congestion	0-3	Percent congestion scaled to a maximum of 3
Pavement	1-3	One for collectors
		Two for non-trunkline arterials or trunklines (freeways and arterials)
		Three for trunklines currently in poor condition
Freight	0-3	One for corridors designated as truck routes
		One for corridors connecting to ports, airports or intermodal facilities
		One for corridors serving high-priority regional freight movements
Transit	0-3	Transit ridership by category (1: < 5,000 riders per day, 2: 5,000 to 9,999 riders per day, 3: >10,000 riders per day)
Non-motorized	0-3	Non-motorized weight scaled to a maximum of 3 (based on accessibility, volume, traffic crashes, connectivity, shoulder width, and bicyclist preference)
Volume	1-3	Volume by category (1: <10,000 vehicles per day, 2: 10,000 to 29,999 vehicles per day, 3: >30,000 vehicles per day)
Density	0 or 3	Three for corridors intersecting traffic analysis zones with household density >3.0 or job density >4.0
Activity Centers	0 or 3	Three for corridors intersecting one-half-mile buffer around identified activity centers
Special Populations	0 or 3	Three for corridors intersecting block groups with significant environmental justice or elderly populations

Source: SEMCOG 2030 Regional Transportation Plan for Southeast Michigan.

Once these prioritization factors are applied to the transportation system, needs are ranked as either regional, sub-regional, or local priorities based on the point total for each asset in the system. From this prioritized list, SEMCOG determines by percentages how it will distribute its anticipated funding for the coming program. As local agencies develop the Federal aid portion of their transportation program, it is important for them to maintain consistency with the practices of their local planning organization.

Option 2 – Coordination with Utility Work

Another option for prioritizing road projects is to coordinate them with utility work. Understanding the condition of water and sewer networks and plans for updating them can help agencies allocate their resources more cost-effectively. For example, if a water main needs to be replaced in the near future, it would be

better to hold off on pavement work in that location until all work can be done at the same time.

Example – Marquette Program Development

In developing its transportation program, the City of Marquette evaluated the condition of every street using the PASER system. It also identified the age of water mains, sanitary sewers, and storm sewers. Projects were then prioritized based on a combination of these factors. Roads with older water and sewer systems were a given a higher priority than roads with similar pavement conditions that had newer utilities or no utilities.

10.5 BUILDING A PROGRAM

Once candidate projects have been ranked, the next step is to compare the projects with the available funds and select projects for the final multi-year program. Agencies should first review previously programmed projects. These projects should be reevaluated in light of the current condition assessment and progress towards performance targets. Adjustments should be made as necessary and new projects should be added for the final year. Funding levels for the program areas have been developed in previous steps (see Section 5.0).

The following is a practical approach for developing a local transportation program. This process can be followed within each program area (e.g., pavement or bridge):

1. Assemble a list of ranked candidate projects.
2. Start at the top of the list and select the highest-ranked project.
3. Subtract the cost of this project from the available budget.
4. If there is enough money left over for the next project on the list, select it and subtract the cost from the remaining budget.
5. If there is not enough money for the next project on the list, move down the list until another project can be funded with the remaining balance.
6. Continue this process until all available funds for the program category have been used.

Example – Generating and Prioritizing Projects

The Genesee County Metropolitan Planning Commission (GCMPC) has developed a formal project selection and prioritization process for use in its long-range planning process. The first step in this process is to identify potential projects. Projects are identified through the use of six management systems including the Highway Network Model, which can apply threshold values outlined by the agency to determine areas of need. Additional projects were identified by talking with local communities about their concerns regarding the transportation system.

Next, the GCMPC prioritizes projects based on criteria outlined for the long-range plan. The following set of criteria was applied to prioritize projects for the 2030 long-range plan:

- Maintains or sustains the existing transportation system
- Improves or makes the system more efficient
- Expands the transportation system

Finally, the GCMPC applies financial constraints to the identified projects. These constraints are based on the availability of funding for the project, the funding allocated for the type of projects in setting priorities for the long-range plan, and the commitment of local matching funds for the projects. Based on these steps, the GCMPC is able to create a program that outlines a program of projects, both by fiscal year and by funding category that the agency can present to its constituents. In the future, the GCMPC plans to implement a needs-based program developed between MDOT, local agencies, and the general public.

11.0 Putting It All Together

This section presents two examples of the entire transportation asset management process. The first focuses on the use of a management system. The second describes how an agency could follow the same steps without the help of a management system. For simplicity, the examples focus only on asphalt pavement projects.

11.1 ASSET MANAGEMENT USING A MANAGEMENT SYSTEM

Management systems are helpful tools for program development irrespective of the size of an agency or the size of the network under its jurisdiction. Several local agencies have begun to use management systems as part of their program development process. This example illustrates how RoadSoft could be used to support the resource allocation process.

Assess Current Condition

- Survey and rate all roads in the network using the PASER system and the RoadSoft Laptop Data Collector.
- Develop deterioration curves or use the defaults provided in RoadSoft.
- Review Remaining Service Life (RSL) output for reasonableness.

Assess Your Mix of Fixes

- Assess the capital preventive maintenance treatments that are available to your agency and adjust the default ESL and treatment triggers in your agency's version of RoadSoft.
- Consider treatments that you have not used before as a way of getting more "bang for the buck".

Estimate Project Costs and Funding Levels

- Use the default project costs in RoadSoft.
- Or you can estimate project costs by referring back to previous projects, discussing with neighboring agencies or by costing out an "average" project using tools such as the MERL (see Appendix G. Resources).
- Examine your agency's historic funding and consider large projects that are underway or scheduled. Discuss whether funding in the future might remain the same, increase, or decrease.

Predict Future Pavement Condition

- Use the Pavement Strategy Analysis feature in RoadSoft to predict future pavement condition.

Develop Performance Measures and Targets

- Work within your agency, with elected officials and your constituents to develop meaningful performance measures that relate closely to your agency's mission and goals.
- Develop performance targets that will indicate when you succeed or fall short of your agency's mission and goals.

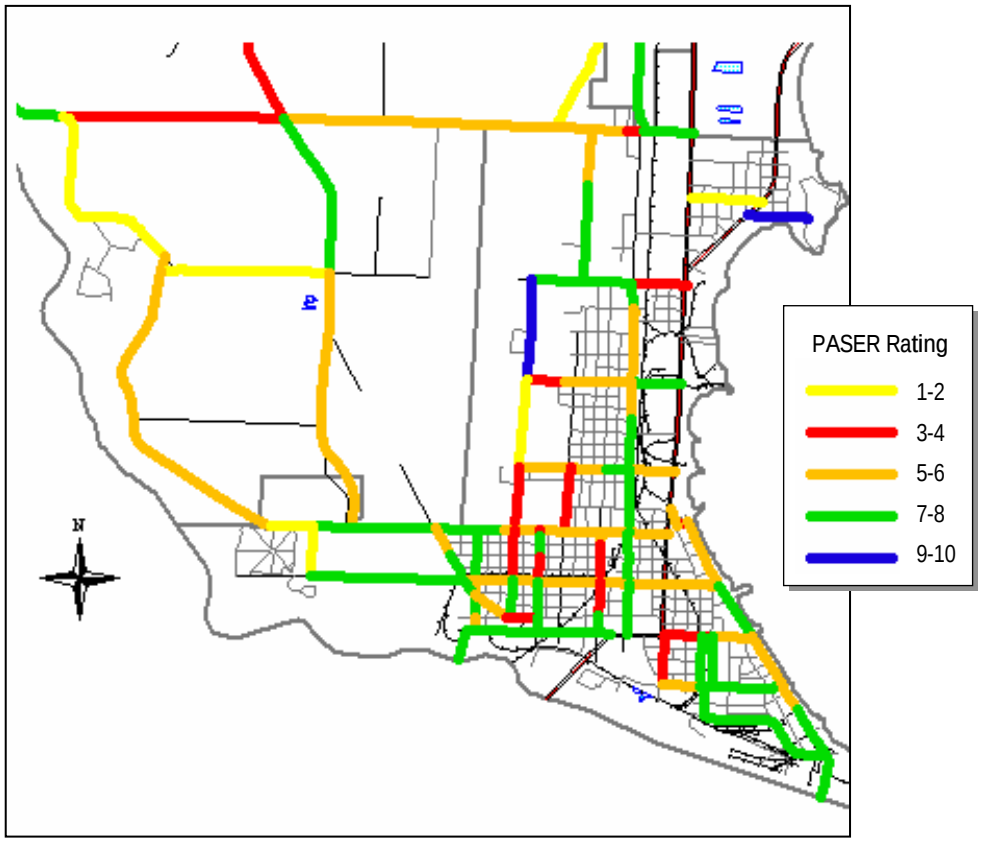
Conduct a Tradeoff Analysis

- Use RoadSoft to determine an optimal preservation strategy based on the annual budget or to run alternative scenarios based on funding increases or decreases. The results of this analysis are recommendations for how much work should be performed annually in each of three work categories:
  - Lane miles of routine maintenance
  - Lane miles of capital preventive maintenance
  - Lane miles of structural improvement
- Develop a tradeoff matrix that includes factors which are critical to your agency's policy objectives.
- Conduct the tradeoff process in an explicit and transparent way (put it on paper). If you are later challenged regarding the results of the tradeoff process, a documented, transparent process will allow you to defend the outcome.
- Consider how your selections will impact the condition of the entire network.

Identify Candidate Projects

- Use your RoadSoft output to identify projects that meet the criteria for the treatments you plan to apply. Remember, ***The Right Fix, in the Right Place, at the Right Time.***
- Use the legend feature of RoadSoft to display current PASER ratings on the road system map. When analyzed in terms of the recommended actions listed in Table 9.1, this map can be a starting point for identifying candidate projects. For example, Figure 11.1 illustrates this functionality for the City of Menominee.

Figure 11.1 Reviewing Candidate Projects



Source: Central Upper Peninsula Planning and Development Regional Commission (CUPPAD).

Set Priorities and Develop a Multi-Year Program

- Gather input from shareholders as a way to understand the priorities in the context of the community.
- Use this information to define a set of factors for determining which segments should be included in the program. The agency should consider traffic levels, previously applied treatment history and coordination with planned utility work. In addition, if the agency has placed a high priority on neighborhood revitalization or economic development, those goals should also be taken into consideration.
- Use one of the manual prioritization methodologies described. Do it on paper like the tradeoff process. This will keep your process explicit and transparent
- Select the final projects to include in the multi-year program. The only restrictions in selecting projects are:
  - Each project represents an appropriate activity for a segment's current PASER rating, RSL and previous maintenance history

  - The sum of lane miles in each work category is consistent with the overall preservation strategy developed earlier.
- Build your multi-year program by balancing out the following: pavement condition, project costs, your selection of fixes and candidate projects against your funding, program objectives, performance targets and prioritized needs.
- Use the Pavement Strategy Analysis feature to immediately see the impact of your prioritization and treatment decisions.

11.2 ASSET MANAGEMENT WITHOUT A MANAGEMENT SYSTEM

This example illustrates a method of developing a multi-year program without the use of a management system. This is a practical option for agencies that manage a relatively small network of roads. In this situation, the program can be developed based on the agency's detailed understanding of the condition of their network and of the needs of their communities.

Assess Current Condition

- Survey and rate all of the roads in the network using the PASER system.
- Enter condition and segment length data into a spreadsheet.

Assess Your Mix of Fixes

- Assess the capital preventive maintenance treatments that are available to your agency and determine the ESL you can expect to get from each.
- Consider treatments that you have not used before as a way of getting more "bang for the buck".

Estimate Project Costs and Funding Levels

- Estimate project costs by referring back to previous projects, discussing with neighboring agencies or by costing out an "average" project using tools such as the MERL (see Appendix G. Resources).
- Examine your agency's historic funding and consider large projects that are underway or scheduled. Discuss whether funding in the future might remain the same, increase or decrease.

Predict Future Pavement Condition

- Use a methodology such as the NCPP "Quick Check" to gain some basic insight into the impact that your selection of treatments will have on the future condition of the network.

Develop Performance Targets

- Work within your agency, with elected officials and with your constituents to develop meaningful performance measures that relate closely to your agency's mission and goals.
- Develop performance targets that will indicate when you succeed or fall short of your agency's mission and goals.

Conduct a Tradeoff Analysis

- Develop a tradeoff matrix that includes factors which are critical to your agency's policy objectives.
- Conduct the tradeoff process in an explicit and transparent way (put it on paper). If you are later challenged regarding the results of the tradeoff process, a documented, transparent process will allow you to defend the outcome.
- Consider how your selections will impact the condition of the entire network.

Identify Candidate Projects

- Identify projects that meet the criteria for the treatments you plan to apply. Remember, ***The Right Fix, in the Right Place, at the Right Time.***

Set Priorities and Develop a Multi-Year Program

- Gather input from shareholders as a way to understand the priorities in the context of the community.
- Use this information to define a set of factors for determining which segments should be included in the program. The agency should consider traffic levels, previously applied treatment history and coordination with planned utility work. In addition, if the agency has placed a high priority on neighborhood revitalization or economic development, those goals should also be taken into consideration.
- Use one of the manual prioritization methodologies described. Do it on paper like the tradeoff process. This will keep your process explicit and transparent.
- Select the final projects to include in the multi-year program. The only restrictions in selecting projects are:
  - Each project represents an appropriate activity for a segment's current PASER rating, RSL and previous maintenance history
  - The sum of lane miles in each work category is consistent with the overall preservation strategy developed earlier.

- Build your multi-year program by balancing out the following: pavement condition, project costs, your selection of fixes and candidate projects against your funding, program objectives, performance targets and prioritized needs.
- Use the NCPP "Quick Check" process to immediately see the impact of your prioritization and treatment decisions.

12.0 Reporting Results

The final step in the resource allocation process is to report results. Michigan's asset management legislation ***requires*** a series of annual reports:

- **Condition Report –** The Council reports total mileage of the road network and a summary of pavement and bridge conditions.
- **Record of Work –** The Council reports on transportation maintenance and operational or improvement activities with locations and associated costs as reported by agencies that were performed in the previous year.
- **Multi-Year Program –** Per Act 51, agencies report a list of work planned for each budget category for the next three years, with locations (where possible) and associated costs.

The Council has established formats for these reports. It has adopted standard reporting categories for reporting work activities (see Appendix E. TAMC Reporting Categories). The statewide condition report is developed by the Council. It consists of the Act 51 certified miles reported annually to MDOT and the PASER ratings collected annually in coordination with the metropolitan planning organizations and regional planning organizations. The Council also has developed an Internet-based data entry system that supports the reporting process.

The Council uses this information to prepare an annual report for the State Transportation Commission and the Legislature. In addition to enabling the Council to fulfill its reporting obligations, your agency's involvement in the process of preparing these reports can be valuable in supporting your own asset management process.

12.1 CONDITION REPORT

The Condition Report answers two basic questions:

1. What facilities does your agency own?
2. What condition are they in?

This report can help your agency evaluate the effectiveness of previous preservation strategies and serves as a starting point for the next year's resource allocation cycle. For example, understanding the current condition of a particular street will enable you to identify activities that are most appropriate from an engineering point of view. Extending this analysis to the entire network will enable you to maximize the impact of limited budget resources.

Consistent condition reports from both local agencies and MDOT enable the Council to communicate the status of Michigan's transportation network. They

also enable the Council to evaluate the adequacy of future transportation funding for achieving statewide condition targets.

12.2 RECORD OF WORK

The Record of Work is a summary of all work performed on the transportation system during the previous year and the costs of this work. **The Record of Work report is not the same as an agency's Act 51 Financial Reports. The two are different and separate reports.**

This report allows the Council to report on the work being done to maintain, operate, and improve Michigan's roads and bridges and document the benefits of these investments. It also provides the Council with data required to determine if statewide performance targets can be met.

The Record of Work can also benefit your agency. First it can help improve your accountability with elected officials and the public – did we do the things we said we would do? It can also provide a means for comparing actual costs to estimated costs. Project cost estimates for common activities can be adjusted for use in future programming cycles. Finally, it can assist in tracking progress towards your agency's performance targets. For example, if your current pavement condition target is to have 85% of your roads at a PASER rating of 6 or better, but the Record of Work for the past three years indicate 81%, 79% and 77%, you are falling farther from your target every year. Therefore, adjustments to the target or the current multi-year program should be made.

12.3 MULTI-YEAR PROGRAM

The Multi-Year Program lists specific projects that your agency anticipates completing over the next three years. When projects have not yet been identified, budget categories, such as "Crack Sealing," are reported.

Michigan's asset management legislation requires a plan that is developed through an asset management process (such as the process described throughout this guide) and that is consistent with an agency's goals and objectives. It is required that the program be updated annually by adding a new third year to insure that it is consistent with the changing condition of the transportation network over time. This type of program is called a rolling program – each year adjustments are made to years 1 and 2, and a new year 3 is added.

An asset management approach requires a long-term view of asset condition and funding availability. Development of a multi-year program encourages a shift towards a more strategic and less reactive approach to project selection. For example, a longer planning horizon may result in a focus on capital preventive maintenance in an attempt to delay the expense of future structural improvement projects. The benefits of this strategy would not be evident if the programming process considered only one year at a time.

With information on planned transportation projects, the Council will be able to generate more accurate assessments of future pavement and bridge conditions. Analysis of multi-year programs will also enable the Council to gauge the progress local agencies are making in the implementation of asset management principles and highlight areas in which more guidance and training are necessary.

12.4 TAMC INVESTMENT REPORTING SYSTEM

The Michigan Center for Geographic Information (CGI), under contract with the Council, has developed an Internet-based application that will greatly simplify the annual reporting process. The tool will enable any local agency to login and edit information within its jurisdiction.

Each jurisdiction must register once to use the system.

Figure 12.1 Reporting System – Registration Page

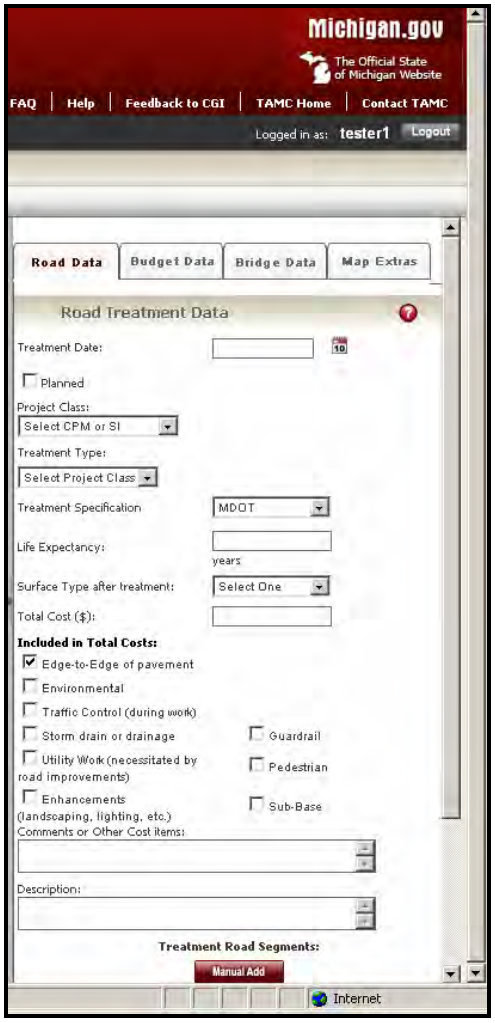
Each jurisdiction is responsible for ensuring that their data is entered correctly. Each agency should have an appointed person for logging in and using the system. Each user must login to use the system.

Figure 12.2 Reporting System Interface

The tool has map navigation features and functionality for selecting road segments on which to report treatment data (see Figure 12.2). The tool also enables the user to view the PASER data collected in their area for the current year and previous years.

The application is designed to accept location based capital preventive maintenance or structural improvement investments for the current year or "planned" future projects for both roads and bridges. The application also accepts future planned expenditures rolled up by treatment type (see Figure 12.3 for examples of data entry forms).

Figure 12.3 Forms for Data Input



Once all information is entered, the application will automatically generate the required reports and store the results in a central location. All reporting will be done on a statewide and regional basis. No individual jurisdictional information will be reported. The reporting system currently is operational, and your agency should be using it to enter data. All jurisdictions can view, edit and generate

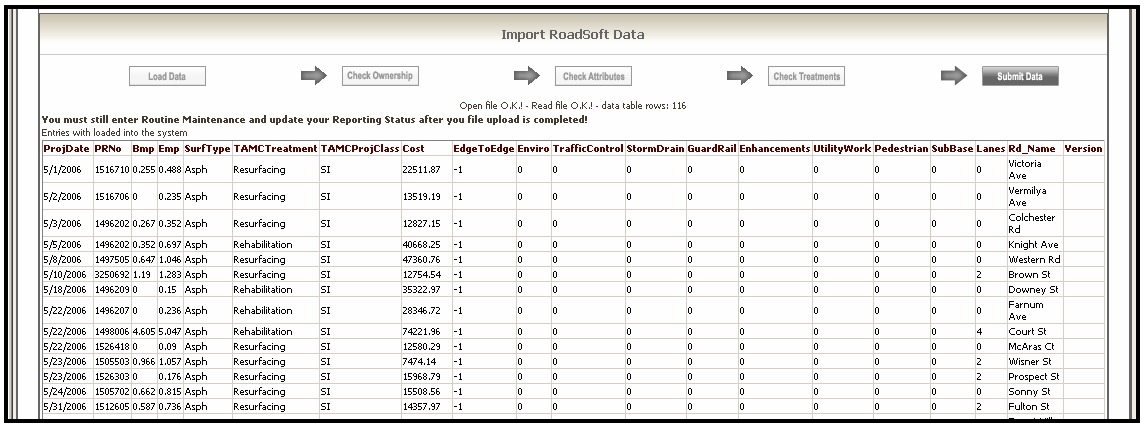
reports for all their data entered at any time. Regional organizations can also view reports for all jurisdictions within their area of responsibility.

The TAMC Investment Reporting Tool will evolve over time, but any data that is entered will be rolled forward. Users will not have to start over when new versions become available.

Using RoadSoft to Submit Your Investment Data

For RoadSoft users, there is a function within RoadSoft to prepare, export and email your investment and forecasting data to CGI. Please refer to your RoadSoft user's guide for more information. There is also a new RoadSoft data import function (see figure 12.4) within the TAMC IRT. RoadSoft users are still responsible for registering with the TAMC Investment Reporting Tool and it is recommended that they verify their data in the tool after it is submitted and loaded by CGI.

Figure 12.4 RoadSoft Data Import



ProjDate	PRNo	Bmp	Emp	SurfType	TAMCTreatment	TAMCProjClass	Cost	EdgeToEdge	Enviro	TrafficControl	StormDrain	GuardRail	Enhancements	UtilityWork	Pedestrian	SubBase	Lanes	Rd_Name	Version
5/1/2006	1516710	0.255	0.488	Asph	Resurfacing	SI	22511.87	-1	0	0	0	0	0	0	0	0	0	Victoria Ave	
5/2/2006	1516706	0	0.235	Asph	Resurfacing	SI	13519.19	-1	0	0	0	0	0	0	0	0	0	Vermilya Ave	
5/3/2006	1496202	0.267	0.352	Asph	Resurfacing	SI	12827.15	-1	0	0	0	0	0	0	0	0	0	Colchester Rd	
5/5/2006	1496202	0.352	0.697	Asph	Rehabilitation	SI	40668.25	-1	0	0	0	0	0	0	0	0	0	Knight Ave	
5/8/2006	1497505	0.647	1.046	Asph	Resurfacing	SI	47360.76	-1	0	0	0	0	0	0	0	0	0	Western Rd	
5/10/2006	3250692	1.19	1.283	Asph	Resurfacing	SI	12754.54	-1	0	0	0	0	0	0	0	0	2	Brown St	
5/18/2006	1496209	0	0.15	Asph	Rehabilitation	SI	35322.97	-1	0	0	0	0	0	0	0	0	0	Downey St	
5/22/2006	1496207	0	0.236	Asph	Rehabilitation	SI	28346.72	-1	0	0	0	0	0	0	0	0	0	Farnum Ave	
5/22/2006	1498006	4.605	5.047	Asph	Rehabilitation	SI	74221.96	-1	0	0	0	0	0	0	0	0	4	Court St	
5/22/2006	1526418	0	0.09	Asph	Resurfacing	SI	12580.29	-1	0	0	0	0	0	0	0	0	0	McAras Ct	
5/23/2006	1505503	0.966	1.057	Asph	Resurfacing	SI	7474.14	-1	0	0	0	0	0	0	0	0	2	Wisner St	
5/23/2006	1526303	0	0.176	Asph	Resurfacing	SI	15968.79	-1	0	0	0	0	0	0	0	0	2	Prospect St	
5/24/2006	1505702	0.662	0.815	Asph	Resurfacing	SI	15508.56	-1	0	0	0	0	0	0	0	0	0	Sonny St	
5/31/2006	1512605	0.587	0.736	Asph	Resurfacing	SI	14357.97	-1	0	0	0	0	0	0	0	0	2	Fulton St	

12.5 WORKING WITH PLANNING ORGANIZATIONS

Michigan's asset management legislation defines the three asset management reports described above. Given the scope of the reporting requirements and the number of agencies required to submit reports, it will be challenging to provide the coverage and consistency envisioned in the legislation. For example, the proposed reporting protocol would require all 617 reporting agencies to appoint a single point of contract to enter or change data in the CGI data entry application. Michigan's metropolitan planning organizations (MPO) and regional planning organizations (RPO) offer technical and administrative expertise that could help streamline and expedite the reporting process. The ideal reporting model would ensure local control of the transportation planning process while enabling local agencies to take full advantage of these planning resources.

Federal planning regulations require Michigan's MPOs to play a significant role in the transportation planning processes. The MPO areas contain a number of

the cities, villages, and counties in the State. All communities in these areas, whether members or not, are represented by the MPO under Federal law in the selection of projects and the distribution of Federal transportation funds. As members of the Council, MPOs can assist in the reporting process by playing a strong role in the following areas:

- Assuring data collection quality
- Training communities on the proper procedures for reporting
- Providing strong administrative oversight during the reporting process
- Assisting agencies with the development of the reports, or complete the reports for them if they are not capable or willing

RPOs play a similar role already in several communities outside the MPO boundaries. RPOs are enabled by executive order and represent many cities and villages and all counties in rural areas. They provide a forum for cooperation during the transportation planning process in these areas. The Central Upper Peninsula Planning and Development Regional Commission (CUPPAD), the West Michigan Regional Planning Commission (WMRPC), and the Northeastern Michigan Council of Governments (NEMCOG) are good examples of organizations already providing some of these functions.

While not explicitly part of the Federal planning guidelines, RPOs help fulfill a clause in a recent Federal law requiring states to consult with local officials outside of urban areas when prioritizing federally funded transportation projects. In Michigan, Rural Task Forces coordinate these projects. However, in many areas the RPOs play a strong participatory and, in some cases, an administrative role in Task Force operations. Therefore, the RPOs, as a member of the Council, are well positioned to provide the same reporting support described above for the MPOs.

13.0 Conclusions

Asset management is "an ongoing process of maintaining, upgrading, and operating physical assets cost-effectively, based on a continuous physical inventory and condition assessment."[6] Asset management consists of a set of business principles and practices for improving resource allocation decisions. It requires a shift from a traditional tactical project management approach to a strategic, comprehensive systems management concept.

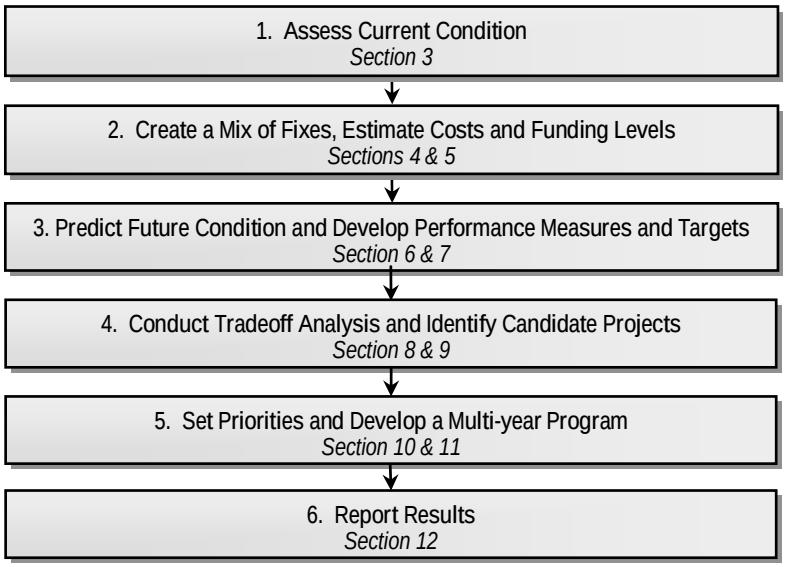
The core principles of asset management are:

- **Performance-Based –** Policy objectives are translated into system performance measures that are used for both day-to-day and strategic management.
- **Decisions Based on Quality Information –** Resource allocation decisions are based on accurate information regarding inventory, condition, and funding availability. Where appropriate, analytical tools provide access to needed information and assist decision-makers.
- **Policy-Driven –** Resource allocation decisions are based on a well-defined set of policy goals and objectives. The objectives reflect desired system condition, levels of service, and safety levels. They also may be tied to economic, community, and environmental goals as well.
- **Analysis of Mix of Fixes, Options and Tradeoffs –** An assessment is made of the Mix of Fixes available to best preserve the system. Decisions on how to allocate funds across types of investments are based on an analysis of how different allocations will impact future performance. Alternative methods for achieving a desired set of objectives are examined and evaluated.
- **Monitoring to Provide Clear Accountability and Feedback –** Performance results are monitored and reported. Feedback on actual performance influences agency goals and resource allocation decisions.

This guide presents several ideas for applying these principles to improve resource allocation at your agency. The materials are organized around the Transportation Asset Management Process illustrated in Figure 13.1.

[6] Act 499 of the State of Michigan Public Acts of 2002, Section 9(a)(1)(a).

Figure 13.1 Transportation Asset Management Process



13.1 TRANSPORTATION ASSET MANAGEMENT COUNCIL

To help local agencies implement an asset management process, Michigan's asset management legislation created the Transportation Asset Management Council (TMAC). The Council consists of representatives from CRAM, the Michigan Municipal League, state planning and development regions, MDOT, the Michigan Townships Association, the Michigan Association of Counties, and the Michigan Center for Geographic Information. The Council's mission is to:

> *…advise the commission on a statewide asset management strategy and the processes and necessary tools needed to implement such a strategy beginning with the Federal-aid eligible highway system, and once completed, continuing on with the county road and municipal systems, in a cost-effective, efficient manner.*

In order to fulfill its statutory obligations, the Council is conducting work in the following three critical areas:

1. **Data Collection –** Establishing procedures for collecting pavement and bridge condition data, and compiling data for statewide reports
2. **Education and Training –** Developing and promoting asset management training materials aimed at local agencies in Michigan
3. **Strategic Analysis –** Developing a statewide asset management strategy for Michigan's transportation system

13.2 TAKING ADVANTAGE OF EXISTING RESOURCES

A theme behind many of the concepts described in this guide is that you should look for opportunities to take advantage of existing resources. For example, the Council has developed standards for collecting and reporting pavement and bridge condition data. The Council reimburses agencies for their trained personnel participating in the annual TMAC data collection on the federal aid system. Bridge condition data is already being collected as part of the National Bridge Inventory program. If you take advantage of existing efforts and look for opportunities to incorporate the results as you allocate resources, you will be well on your way to implementing an asset management approach.

Another resource is the RoadSoft pavement management system, which supports many steps in the resource allocation process illustrated above. The system is funded through MDOT and developed, distributed and supported by Michigan Tech University at no cost to Michigan agencies. The system uses the PASER data required by the Council for reporting purposes. It has an active user community that meets several times a year (meetings and web seminars) to discuss functionality and future development direction. For all of these reasons, if your agency does not yet have a pavement management system, it should strongly consider implementing RoadSoft.

Working with the Michigan Center for Geographic Information, the Council has developed a web-based system to facilitate the asset management reporting process. The system will evolve over time, but any data that is entered will be rolled forward – you will not have to start over when new versions come on-line. Additional help on using this system is available through the metropolitan planning organizations and regional planning organizations.

A fundamental goal of an asset management approach is to apply the ***the Right Fix, in the Right Place, at the Right Time***. Studies estimate that $1 invested in capital preventive maintenance will save from $4 to $6 in deferred reconstruction costs. The end result is an optimal spending of transportation resources.

There is a wide range of educational opportunities in Michigan that will help you and your staff understand the benefits of capital preventive maintenance and in turn prepare your agency for making the case for asset management to your elected officials and the public. The following are just some of the opportunities available:

- The Council sponsors the Michigan Transportation Asset Management Conference, several Michigan Asset Management Workshops and a number of Introduction to Asset Management for Elected Officials sessions annually.
- The Michigan LTAP, at the Michigan Tech Transportation Institute, offers a variety of RoadSoft trainings at locations statewide and via the Internet, and provides other resources on the RoadSoft web site.

- Michigan State University's National Center for Pavement Preservation (NCPP) offers a course on advanced pavement management and has a wealth of materials on capital preventive maintenance on their web site.

13.3 GETTING STARTED

Several of Michigan's cities and county transportation agencies, in one form or another, are already applying aspects of asset management to their decision-making processes. However, no agency is applying all of them. Therefore every agency can build on its existing practices as it moves towards implementing a comprehensive asset management process. This guide provides peer experiences and tools to help you on your way as you begin to identify opportunities for improvement.

Bringing It All Together (see Appendix A.)

Home Improvement Exercise

The Home Improvement Exercise uses a situation that most people are familiar with—taking care of a home—so it is suitable for stakeholders of all backgrounds from elected/appointed decision makers, to engineering staff to taxpaying constituents. The exercise demonstrates that the concepts of asset management are applied every day in all types of situations.

Data Exercise

Asset management focuses on data and concepts. Implementing an asset management process in your agency requires that both the data and concepts be explained to a wide variety of audiences—professional planners/engineers, budget/finance/managers, county/city/township boards, and the public/press. Giving serious thought to the information included in any asset management presentation is the key to success. This exercise will help you consider some of the choices that need to be made.

NCPP Quick Check of Highway Network Health

The NCPP Quick Check is an excellent tool for explaining to elected/appointed decision makers and taxpaying constituents the benefits of capital preventive maintenance and the cost of deferring capital preventive maintenance. For agencies not currently using a pavement management system, the Quick Check can provide valuable insight into your current road improvement program and demonstrate the need for using a management system.

Self-Assessment Exercise

The Self-Assessment Exercise in Appendix F was developed for inclusion in the AASHTO Transportation Asset Management Guide. It is designed to help

agencies identify their strengths and weaknesses and also can be used to help structure an agenda for asset management planning. The exercise is designed as a quick diagnostic tool that yields an overall impression of where your agency is now using asset management practices. It is recommended that several staff from an agency complete the exercise individually and then meet to discuss and compare the results. Keep in the mind that the exercise was originally developed for use by state departments of transportation, so some of the items may not be directly applicable to local agencies. However, it is still a useful tool in that it clearly defines several aspects of an asset management approach and provides a structure for evaluating your agency.

Asset Management Training Course

The very best way for your agency to get started now is to take the training course that accompanies this guide. The course provides an opportunity for management and decision makers from your agency to learn more about the material presented in the guide from a trained instructor, discuss the implications for your agency, and meet with colleagues from other agencies faced with similar challenges. For information regarding the course, contact the Michigan Local Technical Assistance Program (see Appendix G. Resources).

13.4 FINAL THOUGHTS

Given the pressures presently facing all transportation agencies to deliver services more efficiently and effectively, and considering the applicability of asset management to help your agency address these pressures, think about the answers to the following questions:

- Can your agency be more proactive and strategic – comprehensive, long-term, policy-driven and performance-based?
- Can it be more efficient by considering options and tradeoffs?
- Can it be more effective by applying the ***Right Fix in the Right Place at the Right Time***?
- Can it communicate better with its constituents and elected officials by setting performance goals and measuring results?

Applying the framework presented in this guide and coordinating subsequent improvement efforts requires a broad perspective of your agency's organizational, institutional, and technological environments. This guide provides direction on the initial steps required to tailor a systematic asset management initiative for your agency. Many of these activities can be performed with the resources that you currently have or with efforts currently underway. Implementing the individual pieces of the program requires you to "bring asset management home" to the front lines of your agency by focusing on the responsibilities of individual units and on the specific benefits of these activities.

Achieving this environment requires a sustained and consistent commitment. Eventually, your efforts will yield a comprehensive transportation asset management program institutionalized throughout your agency as an improved "way of doing business."

Appendix

A. Bringing It All Together

The exercises included in this Appendix were developed for the training course that accompanies this guide. They provide the opportunity for you to apply the concepts described throughout the guide to real world situations.

HOME IMPROVEMENT EXERCISE

Day-to-Day Asset Management – you do it all the time!

You have just purchased a house in a neighborhood that is on the rebound. Great location—a park across the street, walking distance to the grocery store, drugstore, some restaurants, etc.—and through traffic has been redirected, so the area has actually become "peaceful."

It was listed in the real estate guide as "Needs some work." The price was right, so you jumped in. Your goal is to live in the house for the next 15 years and have it gain as much value as possible while meeting your living needs.

You do a quick condition evaluation of the major elements in the house to identify areas that need improvement. Based on your assessment, you find that there is work that needs to be done in order to preserve your investment and allow you to move in.

After making the down payment, you still have about $10,000 in savings to devote to repairs. Due to your overall reduced housing expense, you expect to have about $10,000 available each year for the next few years.

Assuming all these repairs were deemed necessary, how would you prioritize the work in order to achieve the following objectives?

1. Preserve your investment in the house
2. Minimize out of pocket expenses
3. Maximize the value of the house and the repairs you make

Use the *Worksheet* and the list of *Work that Needs to Be Done* on the following pages to prioritize the work. Separate the items by year 1, year 2, year 3, etc. Include justification as to why you selected one repair over another.

After you have completed your priority list, refer to the *Home Improvement Exercise Guide* (page A-7) to assess your choices.

Home Improvement Exercise Worksheet

Make notes on why you select a particular project. Separate year 1, 2 & 3.

Project by Priority: **Price & Justification:**

1. _____ _____
2. _____ _____
3. _____ _____
4. _____ _____
5. _____ _____
6. _____ _____
7. _____ _____
8. _____ _____
9. _____ _____

Home Improvement Exercise
Work that Needs to Be Done

A. Improve Drainage: Runoff is currently draining from the yard towards the house and seeping into the basement, which periodically floods. General grading of the surrounding yard will direct drainage away from the house, prevent the basement from flooding, prevent foundation damage over time and make the basement usable. This project alone will not fix all the flooding problems due to runoff from the roof (see F below).
Cost of grading: $3000.

B. Landscape: This has been ignored for many years. Grade the area to remove dips, low spots and holes in the yard. Bring in topsoil and install foundation plantings, a new lawn and other landscape features that add to curb appeal and overall value of the property.
Cost of landscaping: $10,000

C. New Windows: The windows date back to the 1950s. Installing new windows will reduce heat loss and add to the overall comfort of the house. This project will result in a savings of approximately $600 per year in reduced heating costs when compared to just fixing the missing and broken windows.
Cost of window replacement: $8000

D. Fix Windows: Many of the storm windows have cracked or missing panes. Blowing rain leaks in around the sills, cold air leaks in during the winter, and hornets are getting in and taking up residence. Repairing the glass will result in a savings of approximately $150 per year.
Cost to fix window panes: $200

E. Fix Leaky Roof: Several areas of the roof leak, even during a light rain. In two small spots the leaks have damaged the walls and in one spot, leaks have damaged the floor.

a. Overlay the existing shingles with a new layer using the existing structural elements. This option is only available if this project is completed very soon (Selected as first or second priority) because the structural components of the roof will degrade to the point where an entire new roof will be the only option. Life expectancy is 10 years.
Cost to overlay roof: $5000

b. Do a complete **Tear-Off** of the shingles, replace bad sheeting and install new shingles. Life expectancy is 20 years.
Cost for new roof: $20,000

F. Install Gutters: Runoff from the roof is seeping into the soil around the foundation and making the basement walls wet. Even if the site grading is completed (see A above), the lack of gutters will continue to make the basement walls wet, which over time will damage the foundation.
Cost to replace gutters and downspouts: $1000

G. Replace Floor Covering: The existing floor coverings are serviceable, but in poor condition. Replacement would make the house much more pleasant to live in.
Cost to install new floor covering: $5000

H. Build a Garage: The original garage was torn down years ago. Having a place to park the car during the freezing rain and snow storms would be a welcome convenience. Additionally, there is limited storage space in the house and no workspace for do-it-yourself home improvement projects.
Cost to build a garage: $20,000

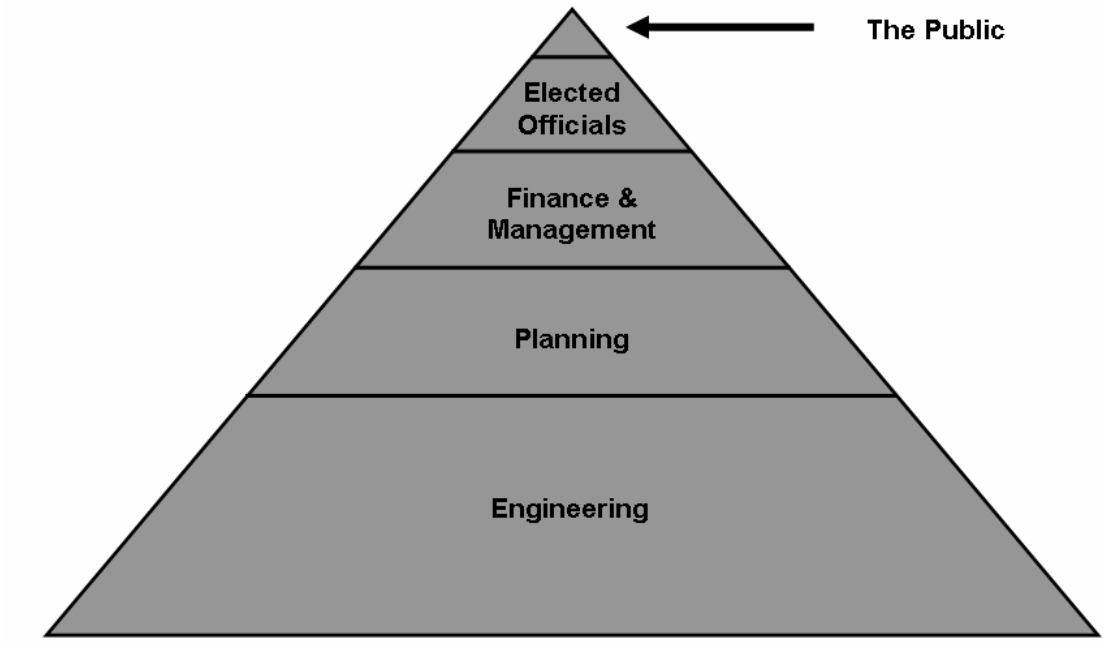
I. Replace Furnace: The existing furnace is an old, inefficient fuel oil model, but it keeps on running. The furnace repairman says that parts are still available and he can keep it working for a few more years. A new 95% + efficient natural gas furnace will save approximately $500 per year in heating costs and eliminate repair costs on the old furnace.
Cost to replace furnace: $5000

DATA EXERCISE

As you have come to realize, asset management is a data intensive activity. Now that you have gathered all of this information, you need to "package" it in a way that will effectively tell your story to stakeholders and constituents. One of the biggest challenges in doing this is deciding which data and concepts should be presented and which should be skipped. That decision is dictated by the audience to which you are presenting. If you are not selective about the data you present you can overwhelm one audience or bore another; in the end your message is lost.

In this exercise consider what data you think would be most important for each of five different audiences: professional planners/engineers, budget/finance/managers, county/city/township boards, and the public/press. Make a list of the data and concepts you think each audience needs to see in order to be convinced that adopting an asset management approach makes the most sense for your agency. Then select one of those audience lists and put together a short presentation that uses adequate data and concepts.

The following diagram may help you visualize the amount of data that you should consider for each audience.

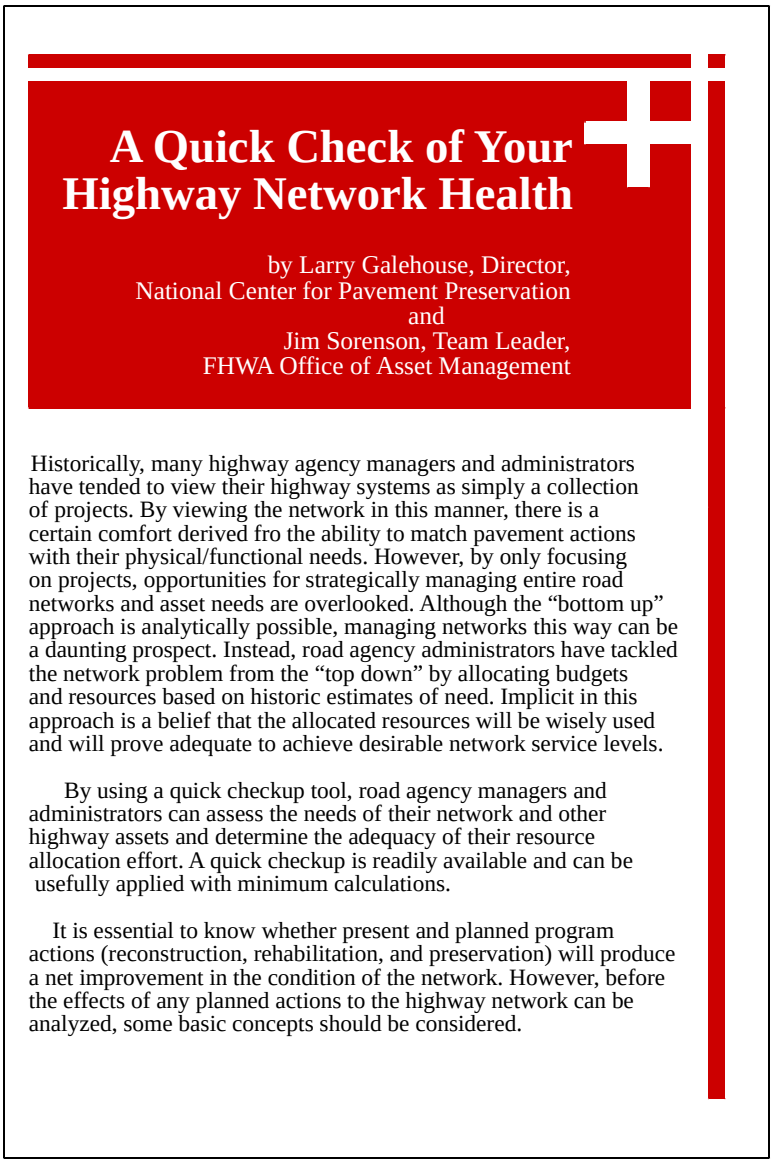


NCPP QUICK CHECK OF HIGHWAY NETWORK HEALTH

The NCPP Quick Check is an excellent tool for explaining to elected/appointed decision makers and taxpaying constituents the benefits of capital preventive maintenance and the cost of deferring capital preventive maintenance. For agencies not currently using a pavement management system, the Quick Check can provide valuable insight about your current road improvement program and demonstrate the need for using a management system.

Use the Quick Check manual supplied at the Asset Management Workshop or download it from the NCPP web site at:

http://www.pavementpreservation.org/library/getfile.php?journal_id=798



A Quick Check of Your Highway Network Health

by Larry Galehouse, Director,
National Center for Pavement Preservation
and
Jim Sorenson, Team Leader,
FHWA Office of Asset Management

Historically, many highway agency managers and administrators have tended to view their highway systems as simply a collection of projects. By viewing the network in this manner, there is a certain comfort derived fro the ability to match pavement actions with their physical/functional needs. However, by only focusing on projects, opportunities for strategically managing entire road networks and asset needs are overlooked. Although the "bottom up" approach is analytically possible, managing networks this way can be a daunting prospect. Instead, road agency administrators have tackled the network problem from the "top down" by allocating budgets and resources based on historic estimates of need. Implicit in this approach is a belief that the allocated resources will be wisely used and will prove adequate to achieve desirable network service levels.

By using a quick checkup tool, road agency managers and administrators can assess the needs of their network and other highway assets and determine the adequacy of their resource allocation effort. A quick checkup is readily available and can be usefully applied with minimum calculations.

It is essential to know whether present and planned program actions (reconstruction, rehabilitation, and preservation) will produce a net improvement in the condition of the network. However, before the effects of any planned actions to the highway network can be analyzed, some basic concepts should be considered.

HOME IMPROVEMENT EXERCISE FOLLOW-UP GUIDE

Education Goals

- Introduce the concept of asset management and the decision making process.
- Demonstrate that everyone uses asset management principles in their everyday lives.
- Introduce the idea of having an inventory of assets, asset condition and the necessity of those two items in the asset management process.
- Introduce the principle of treatment cost effectiveness.
- Introduce the concept of "the cost of waiting" when evaluating maintenance to be deferred.

General Rules of Asset Management in a Resource Limited Environment

- When presented with a choice, always select the project with the lowest cost per unit of improvement or time of payback.
- First, select projects that will stop or prevent damage to the asset.
- Second, select projects that have the potential to save money in the future.
- Third, select projects that add functionality or value to the asset.

Prioritization Based on Basic Asset Management Principles

Some projects have the potential to save money in the long run by reducing losses, others are necessary to prevent further damage to the asset, and still others add value and functionality to the asset. The temptation is to quickly select projects that have a high "WOW" factor, such as building a new garage or finish landscaping since these greatly change the outward appearance of the house. However, it is irresponsible to add new features to the house when the basic structure is not being maintained and is rapidly deteriorating from damage.

E.a. Roof Overlay: Roof repair is the highest priority because damage to the rest of the asset will result if the repair is not made. An Overlay has a cost effectiveness of $4000/10 years = $400 per year; a Tear Off $10,000/20 year = $500 per year. Costs per year are not that far apart and total re-roof lasts longer, but the Overlay solves the current problem and frees up $6000.

D. Fix Windows: This project will keep water damage from degrading the asset and will make the house livable by stopping insects and cold drafts. It will also allow the house to be heated—even with the old furnace. At $200, this almost pays for itself the first year.

A. Improve Drainage: This will keep the basement from flooding and prevent the foundation from degrading—critical to the asset. It may also make the space usable.

F. Install Gutters: This will stop damage to the foundation—critical to preserving the asset.

Note: The above repairs just about take care of your first year budget.

I. Replace Furnace: This project reduces energy costs and has a time of payback of 10 years.

C. New Windows: This project reduces energy costs but has a payback of 40 years. Do half one year and half the next?

G. Replace Floor Coverings: This adds to livability of the house, but is not critical and has a relatively high cost.

H. Build a Garage: This adds new functionality to the asset, but comes at a high cost.

B. Landscape: This adds resale value through ascetics, but is high in cost.

Apply the Home Improvement Exercise to Your Road Network

In the world of roadway management, setting priorities is not always as cut and dry as in the home improvement example. In the example, the constituents probably all had the same interests and objectives, whereas a city, village or county road commission is challenged with a diverse group of constituents with differing interests and objectives—sometimes in direct conflict.

The basic concepts, however, remain the same. The General Rules of Asset Management are adjusted based on social, economic and political needs. For example if an agency has goals that address the need for improving capacity, expanding the road network for economic development or changing the function on parts of the network, those needs must be rectified with the general rules above. You should not, however, simply toss the General Rules out the window. That approach continues the deteriorating spiral that most agencies find themselves in today, a spiral that is expensive and painful to stop.

In the house example you used some common features of a transportation asset management system:

- An inventory of assets (you inventoried the house when you purchased it)
- An assessment of their condition (you inspected the house when you purchased it and documented conditions)
- A list of projects, project costs and cost/life benefits (the list of projects provided)
- A management goal (to live in the house for the next 15 years and have it gain as much value as possible while meeting your living needs)
- Project selection policies (preserve first, minimize cost, and maximize value)

"Bang for the Buck"

There are a variety of treatments that can be applied to a pavement to extend its life. Treatment costs range from low to high and they provide different service life under given conditions. Agencies using an asset management approach must evaluate all the treatment options at their disposal, based on cost of the treatment and the added service life it provides. The goal is to repair pavements using the treatments that provide the greatest service life to cost ratio—greatest "bang for the buck".

Capital Preventive Maintenance

There is a class of pavement management treatments called Capital Preventive Maintenance (CPM). CPM is the planned set of cost-effective treatments applied to an existing roadway that retards further deterioration and maintains or improves the functional condition of the system without significantly increasing the structural capacity. The purpose of CPM fixes is to protect the pavement structure, slow the rate of deterioration, and/or correct pavement surface distress. As you have seen in the Home Improvement Exercise, CPM is at the heart of asset management. These projects can also be viewed as projects that save money in the long run because pavements that are not treated early with CPM will require exponentially more expensive structural treatment later—the "cost of waiting."

B. Michigan's Asset Management Legislation: Act 499 of 2002

247.659a Definitions; transportation asset management council; creation; charge; membership; appointments; staff and technical assistance; requirements and procedures; technical advisory panel; multi-year program; funding; records on road and bridge work performed and funds expended; report.

Sec. 9a.

(1) As used in this section:

(a) "Asset management" means an ongoing process of maintaining, upgrading, and operating physical assets cost-effectively, based on a continuous physical inventory and condition assessment.

(b) "Bridge" means a structure, including supports erected over a depression or an obstruction, such as water, a highway, or a railway, for the purposes of carrying traffic or other moving loads, and having an opening measuring along the center of the roadway of more than 20 feet between undercopings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes where the clear distance between openings is less than one-half of the smaller contiguous opening.

(c) "Central storage data agency" means that agency or office chosen by the council where the data collected is stored and maintained.

(d) "Council" means the transportation asset management council created by this section.

(e) "County road commission" means the board of county road commissioners elected or appointed pursuant to Section 6 of Chapter IV of 1909 PA 283, MCL 224.6, or, in the case of a charter county with a population of 2,000,000 or more with an elected county executive that does not have a board of county road commissioners, the county executive for ministerial functions and the county commission provided for in section 14(1)(d) of 1966 PA 293, MCL 45.514, for legislative functions.

(f) "Department" means the state transportation department.

(g) "Federal-aid eligible" means any public road or bridge that is eligible for Federal aid to be spent for the construction, repair, or maintenance of that road or bridge.

(h) "Local road agency" means a county road commission or designated county road agency or city or village that is responsible for the construction or maintenance of public roads within the State under this act.

(i) "Multi-year program" means a compilation of road and bridge projects anticipated to be contracted for by the department or a local road agency during a three-year period.

(j) "State planning and development regions" means those agencies required by section 134(b) of title 23 of the United States Code, 23 U.S.C. 134, and those agencies established by Executive Directive 1968-1.

(2) In order to provide a coordinated, unified effort by the various roadway agencies within the State, the transportation asset management council is hereby created within the state transportation commission and is charged with advising the commission on a statewide asset management strategy and the processes and necessary tools needed to implement such a strategy beginning with the Federal-aid eligible highway system, and once completed, continuing on with the county road and municipal systems, in a cost-effective, efficient manner. Nothing in this section shall prohibit a local road agency from using an asset management process on its non-Federal-aid eligible system. The council shall consist of 10 voting members appointed by the state transportation commission. The council shall include two members from the county road association of Michigan, two members from the Michigan municipal league, two members from the state planning and development regions, one member from the Michigan townships association, one member from the Michigan association of counties, and two members from the department. Non-voting members shall include one person from the agency or office selected as the location for central data storage. Each agency with voting rights shall submit a list of two nominees to the state transportation commission from which the appointments shall be made. The Michigan townships association shall submit one name, and the Michigan association of counties shall submit one name. Names shall be submitted within 30 days after the effective date of the 2002 amendatory act that amended this section. The state transportation commission shall make the appointments within 30 days after receipt of the lists.

(3) The positions for the department shall be permanent. The position of the central data storage agency shall be non-voting and shall be for as long as the agency continues to serve as the data storage repository. The member from the Michigan association of counties shall be initially appointed for two years. The member from the Michigan townships association shall be initially appointed for three years. Of the members first appointed from the county road association of Michigan, the Michigan municipal league, and the state planning and development regions, one member of each group shall be appointed for two years and one member of each group shall be appointed for three years. At the end of the initial appointment, all terms shall be for three years. The chairperson shall be selected from among the voting members of the council.

(4) The department shall provide qualified administrative staff and the state planning and development regions shall provide qualified technical assistance to the council.

(5) The council shall develop and present to the state transportation commission for approval within 90 days after the date of the first meeting such procedures and requirements as are necessary for the administration of the asset management process. This shall, at a minimum, include the areas of training, data storage and collection, reporting, development of a multi-year program, budgeting and funding, and other issues related to asset management that may arise from time to time. All quality control standards and protocols shall, at a minimum, be consistent with any existing Federal requirements and regulations and existing government accounting standards.

(6) The council may appoint a technical advisory panel whose members shall be representatives from the transportation construction associations and related transportation road interests. The asset management council shall select members to the technical advisory panel from names submitted by the transportation construction associations and related transportation road interests. The technical advisory panel members shall be appointed for three years. The asset management council shall determine the research issues and assign projects to the technical advisory panel to assist in the development of statewide policies. The technical advisory panel's recommendations shall be advisory only and not binding on the asset management council.

(7) Beginning October 1, 2003, the department, each county road commission, and each city and village of this State shall annually prepare and publish a multi-year program, based on long-range plans, and developed through the use of the asset management process described in this section. Projects contained in each local road agency's annual multi-year program shall be consistent with the goals and objectives of the local road agency's long-range plan. A project, funded in whole or part, with state or Federal funds, shall be included in any local road agency's multi-year plan.

(8) Funding necessary to support the activities described in this section shall be provided by an annual appropriation from the Michigan transportation fund to the state transportation commission.

(9) The department and each local road agency shall keep accurate and uniform records on all road and bridge work performed and funds expended for the purposes of this section, according to the procedures developed by the council. Each local road agency and the department shall annually report to the council the mileage and condition of the road and bridge system under their jurisdiction and the receipts and disbursements of road and street funds in the manner prescribed by the council, which shall be consistent with any current accounting procedures. An annual report shall be prepared by the staff assigned to the council regarding the results of activities conducted during the preceding year and the expenditure of funds related to the processes and activities identified by the council. The report also shall include an overview of the activities identified for the succeeding year. The council shall submit this report to the state transportation commission, the legislature, and the transportation committees of the house and senate by May 2 of each year.

History: Add. 1957, Act 262, Eff. July 1, 1957; – Am. 1972, Act 327, Imd. Eff. January 3, 1973; – Am. 1978, Act 444, Imd. Eff. October 10, 1978; – Am. 1982, Act 438, Eff. January 1, 1983; – Am. 1987, Act 234, Imd. Eff. December 28, 1987; – Am. 1998, Act 308, Imd. Eff. July 29, 1998; – Am. 2002, Act 499, Imd. Eff. July 3, 2002

Compiler's Notes: For transfer of powers and duties of the transportation needs study committee to the state transportation commission and abolishment of the committee, see E.R.O. No. 1997-6, compiled at § 247.691 of the Michigan Compiled Laws. For transfer of powers and duties of the citizens advisory committee to the director of the department of transportation and abolishment of the committee, see E.R.O. No. 1997-6, compiled at § 247.691 of the Michigan Compiled Laws.

Popular Name: McNitt Act.

Popular Name: Michigan Transportation Fund Act.

C. Pavement Condition Measures Used in Michigan

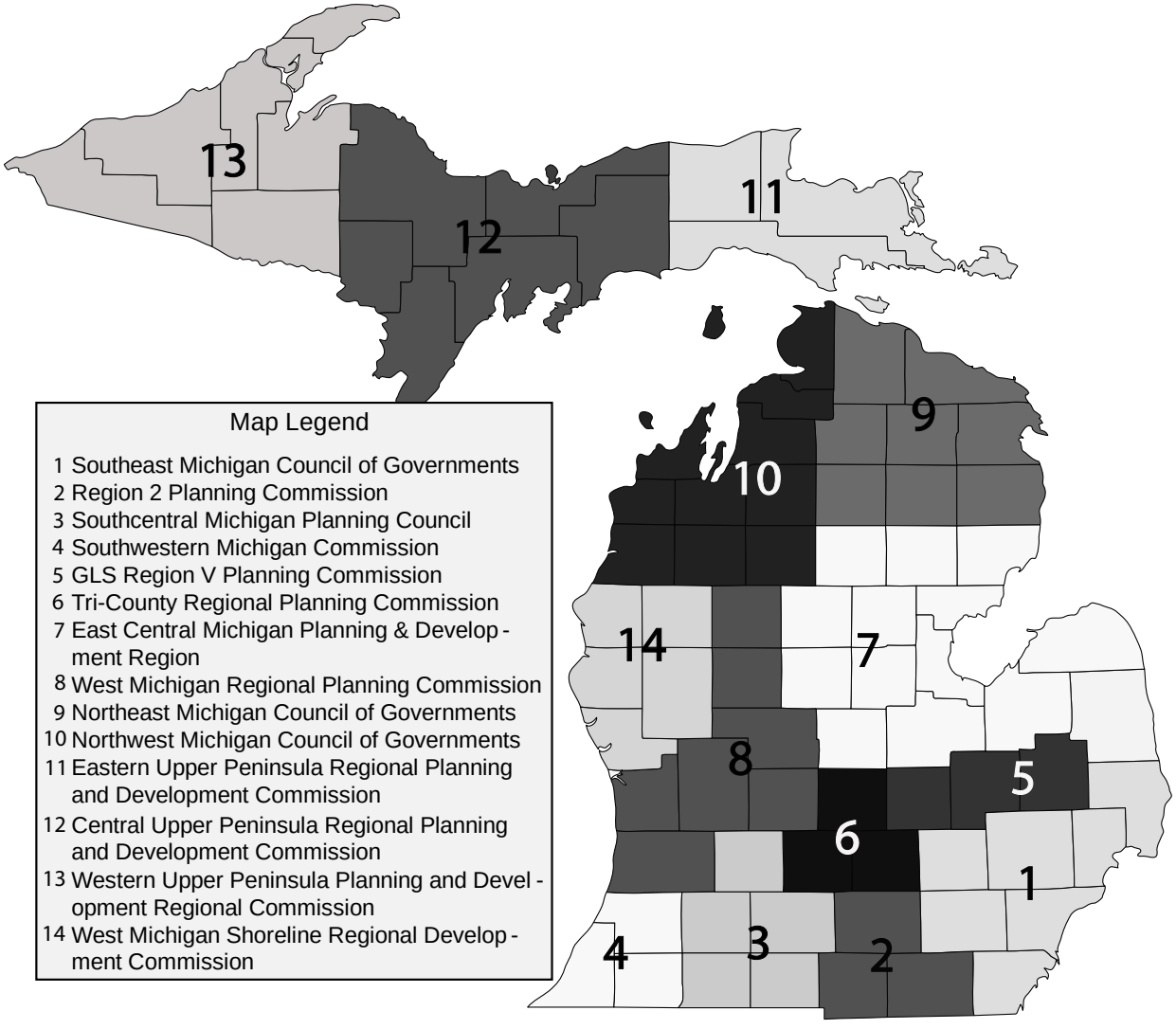
There are several valid options for measuring pavement condition. The following table describes a number of methods currently in use by local agencies in Michigan. Each of these has pros and cons, including the level of effort required for data collection, the ease with which it can be explained to non-technical audiences, and the level of analysis that can be done with it. Your agency should work to identify the measure that best fits its needs.

Pavement Condition Measures

Condition Measure	Description	Agency
Distress Index (DI)	Based on a visual observation of pavement surface condition. Used to determine the recommended pavement fix or rehabilitation type. Measured on a scale of 0-100; with 0 being the best condition.	Michigan DOT
Overall Condition Index (OCI)	Based on a combination of surface condition, roughness, and structural sufficiency indices. Measured on a scale of 0-100; with 100 being the best condition.	Detroit
PASER Rating	Based on visual observation of pavement surface condition. Measured on a scale of 1 to 10; with 10 being the best condition.	Over 240 agencies in Michigan & the TMAC
Pavement Condition Index (PCI)	Based on a visual survey of the pavement. Measured on a scale of 0 to 100, with 100 being the best condition.	Kent County, Livonia, Grand Valley Metro Council, Grand Rapids, Gladstone
Pavement Quality Index (PQI)	Based on a combination of DI (see above) and present serviceability index (PSI), which is a measure of surface roughness. Measured on a scale of 0.0 to 4.5 and translated into categories ranging from "very good" to "very poor."	Oakland County

D. Michigan's Planning Organizations

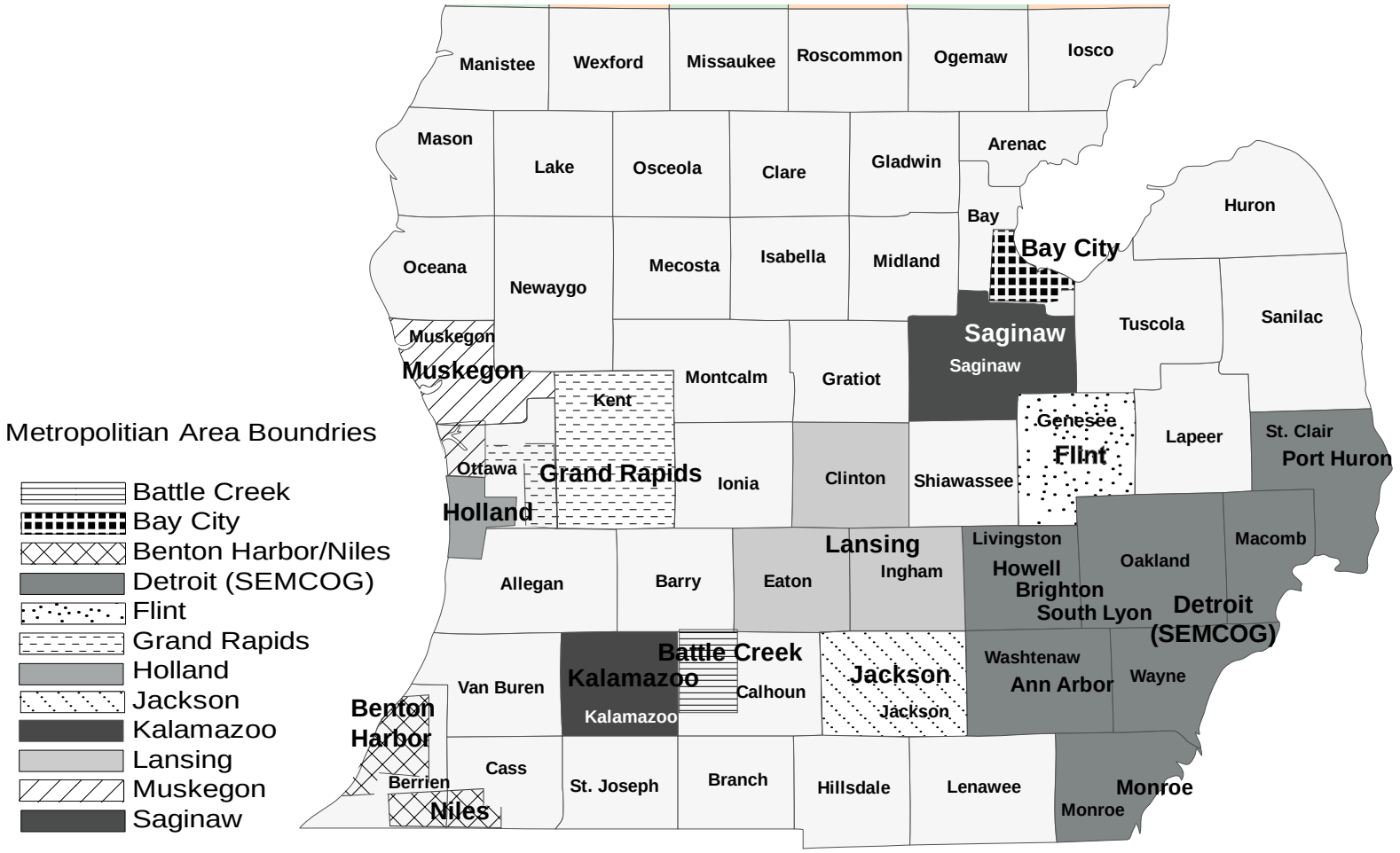
PLANNING AND DEVELOPMENT REGIONS



Map Legend

1 Southeast Michigan Council of Governments
2 Region 2 Planning Commission
3 Southcentral Michigan Planning Council
4 Southwestern Michigan Commission
5 GLS Region V Planning Commission
6 Tri-County Regional Planning Commission
7 East Central Michigan Planning & Development Region
8 West Michigan Regional Planning Commission
9 Northeast Michigan Council of Governments
10 Northwest Michigan Council of Governments
11 Eastern Upper Peninsula Regional Planning and Development Commission
12 Central Upper Peninsula Regional Planning and Development Commission
13 Western Upper Peninsula Planning and Development Regional Commission
14 West Michigan Shoreline Regional Development Commission

METROPOLITAN PLANNING ORGANIZATIONS



E. TAMC Reporting Categories

In order to maintain consistent reporting of planned and actual work throughout the State, the Council has approved the following list of categories to be used for the Record of Work and Multi-Year Program.

ROUTINE MAINTENANCE

Routine maintenance includes actions performed on a regular or controllable basis or in response to uncontrollable events upon a roadway. Work activities or actions considered to be routine maintenance are those in which the benefit or effective service life of the work does not last beyond the next fiscal year, the work would not significantly change the surface rating of the road, or the work would rarely require acquisition of right-of-way or site-specific design. Work activities considered to be routine maintenance include, but are not limited to:

- Placing new aggregate on an existing gravel or stone surface to replace original material worn off;
- Patching and repairing roadway surface of bituminous, concrete, or brick;
- Snow and ice removal;
- Grading a gravel road;
- Cleaning streets and associated drainage;
- Unplugging drain facilities;
- Mowing roadside;
- Control of roadside brush and vegetation;
- Reconditioning of bituminous surfaces of any length section by scarifying when new material is added which increases the existing bituminous surface less than three-quarter inch;
- Dust layers, sprinkling, and flushing;
- Repairing storm damage; and
- Emergency management of road closures that result from uncontrollable events.

CAPITAL PREVENTIVE MAINTENANCE

Capital preventive maintenance means a planned strategy of cost-effective treatments to an existing system and its appurtenances that preserve assets by retarding roadway deterioration and maintaining functional condition without

increasing structural capacity. Work activities and actions that are included as capital preventive maintenance activities are those that extend the life of the asset, but do not change the original design, function, or purpose of the asset. The primary purpose of the work is to repair the incremental effects of weather, age, and use. The useful service life or benefits extend beyond the next fiscal year, and the work may restore some structural capacity of the road, but it does not substantially increase the loading allowed. Work activities in this category include but are not limited to:

- Micro-surfacing;
- Chip sealing;
- Concrete joint resealing and crack sealing;
- Concrete joint repair and surface spall repair;
- Filling shallow pavement cracks;
- Patching concrete;
- Shoulder resurfacing;
- Concrete diamond grind;
- Dowel bar retrofit;
- Bituminous overlays;
- Restoration of drainage;
- Overband crack filling;
- Surface milling and non-structural overlays;
- Bituminous shoulder ribbons;
- Ultrathin overlay;
- Full depth concrete;
- Partial depth concrete pavement repairs;
- Cape seal, slurry seal, or fog seal;
- Cold milling;
- Hot-in-place bituminous recycling;
- Skip patching;
- Profile milling;
- Concrete pavement restoration;
- Underdrain outlet repair and cleaning;

- Surfacing of shoulders with materials of higher quality than adjacent roadsides; and
- Extending old culverts and rebuilding headwalls.

STRUCTURAL IMPROVEMENT

Structural improvement includes any activity that is undertaken to preserve or improve the structural integrity of an existing roadway. The structural improvement category includes those work activities in which the safety or structural elements of the road are improved to satisfy current design requirements. Structural improvement does not include new construction on a new location of a roadway, a project that increases the capacity of a facility to accommodate that part of traffic having neither an origin nor destination within the local area, widening of a lane width or more, or adding turn lanes of more than one-half-mile length. Structural improvement activities include, but are not limited to:

- Reconstruction – Any construction in which the road is totally reconstructed by reditching, new subgrade, subbase, and surface at the same location;
- Resurfacing – Resurfacing pavements with minor base repair, minor widening, and resurfacing the existing width. The thickness would be more than one and one-half inches;
- Rehabilitation – These fixes include two or three courses of hot mix asphalt overlays, concrete patching and diamond grinding, crush and shape with bituminous overly, rubblize and multiple course HMA overlay, and unbonded concrete overlays;
- Gravel Surfacing – Placing three inches or more of new aggregate on an existing gravel road;
- Paving Gravel Road – All costs expended to place a hard surface on an existing gravel road;
- Rebuilding short sections of roadway to super-elevate curves, to improve grades, to lengthen horizontal curves, and to improve sight distances;
- Adding auxiliary turning lanes or passing lanes of more than one-half mile in length; and
- Replace culverts.

EXPAND AN EXISTING OR NEW ASSET

This category includes the construction of new roadway on a new location, and/or the addition of lanes to increase the capacity for through traffic. It also includes any new road that has been constructed that is not in the current

inventory, or a new road constructed on a new alignment that replaces an existing facility. Work activities in this category include but are not limited to:

- Install new culverts, wash checks, baffles, drains, sewers, and catch basins on old or new roads or streets;
- Add a lane to an existing road of more than one-half-mile long;
- Reconstruct and add lane(s) over one-half-mile long;
- Interchange, redesign and upgrade;
- Relocate an existing route;
- Construct new roadway in a new location; and
- Construct a new interchange.

RETIRING AN ASSET

Work activities in this category include but are not limited to:

- Closing, abandoning or converting to private use a public road; and
- Selling a roadway to an authority or other non-Act 51 government agency.

F. AASHTO Transportation Asset Management Guide Self-Assessment Exercise

PART A. POLICY GUIDANCE

Do Policies Support Improved Asset Management Practice?

		Fully Disagree ←			→ Fully Agree
Policy guidance enables good asset management practice		**1**	**2**	**3**	**4**
A1.	Policy guidance supports preservation of existing assets.				
A2.	Policy guidance encourages decisions based on cost-effectiveness or benefit/cost analysis.				
A3.	Policies support a long-term, life-cycle view.				
A4.	Policy guidance considers customer perceptions and expectations.				
A5.	Our customers contribute to the formulation of policy goals and objectives.				
Strong framework for performance-based resource allocation		**1**	**2**	**3**	**4**
A6.	Well-defined policy goals and objectives guide our resource allocation process.				
A7.	Our policies enable us to pursue performance-based resource allocation.				
A8.	Goals and objectives are linked to specific performance measures and project evaluation criteria.				
Proactive role in policy formulation		**1**	**2**	**3**	**4**
A9.	Polices are developed with an understanding of the budget required to achieve them.				
A10.	We work with political leaders to understand funding options and their expected consequences on system performance.				

PART B. PLANNING AND PROGRAMMING

Do Resource Allocation Decisions Reflect Asset Management Principles?

		Fully Disagree ←			→ Fully Agree
Consideration of alternatives in planning and programming		**1**	**2**	**3**	**4**
B1.	Our long-range plan considers modal alternatives to meet system deficiencies.				
B2.	Tradeoffs between *capital and maintenance* alternatives are explicitly considered for system preservation.				
B3.	Tradeoffs between *capital and operations* alternatives are explicitly considered for improving traffic mobility.				
Performance-based planning and a clear link between policy, planning, and programming		**1**	**2**	**3**	**4**
B4.	Our long-range plan is consistent with current policy goals and objectives.				
B5.	The plan includes strategies that are consistent with realistic projections of future revenues.				
B6.	The plan provides clear and specific guidance for our capital program development process.				
B7.	Our planning and programming processes are periodically reviewed and updated.				
Performance-based programming process		**1**	**2**	**3**	**4**
B8.	Programming criteria are consistent with policy objectives and defined performance measures.				
B9.	Programs are consistent with realistic projections of future revenues.				
B10.	Programs are based on realistic estimates of project costs, benefits, and impacts on system performance.				
B11.	Project selection is primarily based on relative merits and the proposed project's impact on performance targets.				
B12.	Our preservation program is based on life-cycle cost analyses rather than on worst-first strategies.				
B13.	Levels of service for system maintenance are well-defined.				

PART C. PROGRAM DELIVERY

Do Program Delivery Processes Reflect Industry Good Practices?

		Fully Disagree ←			→ Fully Agree
Consideration of alternative project delivery mechanisms		**1**	**2**	**3**	**4**
C1.	We periodically evaluate non-traditional delivery options (e.g., maintenance outsourcing, intergovernmental agreements, design-build, design-build-maintain, etc.).				
C2.	Outstanding performance in meeting schedule, quality, and cost objectives is recognized and rewarded.				
Effective program management		**1**	**2**	**3**	**4**
C3.	The scope of a completed project is always consistent with the project's original objectives.				
C4.	Well-defined performance measures are used to track project scope, schedule, and budget.				
C5.	We have a formal process for approving project changes and program adjustments.				
C6.	When adding projects or changing a project's schedule, we consider the effects on the delivery of other projects.				
C7.	*Agency executives and program managers* feel they are sufficiently updated on program delivery status.				
C8.	*External stakeholders and policy-makers* feel they are sufficiently updated on program delivery status.				
Cost tracking and estimating		**1**	**2**	**3**	**4**
C9.	We have confidence in our construction cost estimates.				
C10.	We have confidence in our cost estimates for maintenance activities and programs.				

PART D. INFORMATION AND ANALYSIS

Do Information Resources Support Asset Management Practice?

		Fully Disagree ←			→ Fully Agree
Effective and efficient data collection		**1**	**2**	**3**	**4**
D1.	We have a complete and up to date inventory of our major assets.				
D2.	We collect timely, accurate, and useful infrastructure *condition data* (e.g., for pavements, bridges, rest areas, etc.).				
D3.	We collect timely, accurate, and useful system *performance data* (e.g., for mobility, congestion, safety, etc.).				
D4.	We regularly collect customer perceptions of asset condition and performance.				
D5.	We continually seek to improve the efficiency of data collection.				
Data integration and access		**1**	**2**	**3**	**4**
D6.	Decision-makers can quickly obtain all of the information they need.				
D7.	Agencywide geographic referencing standards have been developed.				
D8.	Maps showing needs/deficiencies for different asset classes and planned and programmed projects are readily available.				
D9.	We have standards that promote the consistent treatment of data and guide the development of future applications.				
Management system models based on actual data		**1**	**2**	**3**	**4**
D10.	Actual cost data is used periodically to update our management systems' *cost estimation models*.				
D11.	Actual data regarding changes in asset condition over time are used periodically to update our systems' *deterioration models*.				
Use of decision-support tools		**1**	**2**	**3**	**4**
Decision-support tools are used to:					
D12	Calculate and report actual system performance				
D13	Identify system deficiencies or needs				
D14	Rank candidate projects for the capital program				
D15	Forecast future system performance for a proposed program of projects				
D16	Forecast future system performance for various investment levels.				
System monitoring and feedback		**1**	**2**	**3**	**4**
D17.	Actual system condition is compared to projected targets for our *preservation program*.				
D18.	Actual system performance is compared to projected targets for our *capital improvement program*.				
D19.	Actual system condition and performance are compared to projected targets for our *maintenance and operations programs*.				
D20.	Performance measures relevant to customer/stakeholder satisfaction are periodically reported.				

G. Resources

Michigan Asset Management Council

http://www.michigan.gov/mdotamc

Contact information for Council members, Council meeting schedules, agendas and minutes, Annual Reports to the Transportation Commission, etc.

Michigan Bridge Program Web site

http://www.michigan.gov/mdot/0,1607,7-151-9625_25885-113373-,00.html

Michigan Tech Transportation Institute

Michigan's Local Technical Assistance Program

http://www.michiganltap.org/

A wide variety of technical assistance and training for county road commissions, cities, villages, contractors and consultants throughout Michigan.

For more information call 906-487-2102.

RoadSoft GIS Roadway Infrastructure Management System

http://www.roadsoft.org/

Complete Asset Management GIS software suite including modules for Pavement, Strategy Analysis and Optimization, Culverts, Signs, Guard Rails, Pavement Markings, Crashes, and GPS Data Collector.

To request the software or for technical support call 906-487-2102.

Michigan Engineer's Resource Library

http://www.michiganltap.org/software/merl/index.html

Access to the Project Estimator for Engineers Preliminary Estimates, Average Unit Costs, Pay Item Codes, Bid Analysis and Local Project Management.

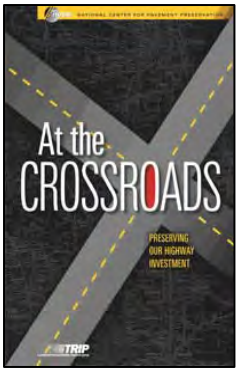
To request the software or for technical support call 906-487-2102.

National Center for Pavement Preservation

http://www.pavementpreservation.org/

NCPP has a storehouse of information about preserving pavements.

Contact them for copies of the "At the Crossroads" publication (shown right) on preserving our highway investment.



H. Glossary of Acronyms

AASHTO – American Association of State Highway and Transportation Officials

CGI – Center for Geographic Information

CRAM – County Road Association of Michigan

CPM – Capital Preventive Maintenance

CUPPAD – Central Upper Peninsula Planning and Development Regional Commission

DI – Distress Index

GCMPC – Genesee County Metropolitan Planning Commission

GIS – Geographic Information System

HI – Health Index

KCRC – Kent County Road Commission

LBAB – Local Bridge Advisory Board

LCC – Life-Cycle Cost

LTAP – Local Technical Assistance Program

MDOT – Michigan Department of Transportation

MTF – Michigan Transportation Fund

MPO – Metropolitan Planning Organization

NBI – National Bridge Inventory

NCHRP – National Cooperative Highway Research Program

NCPP – National Center for Pavement Preservation

NEMCOG – Northeast Michigan Council of Governments

OCI – Overall Condition Index

PASER – Pavement Surface Evaluation and Rating

PCI – Pavement Condition Index

PMS – Pavement Management System

PQI – Pavement Quality Index

RBC – Regional Bridge Council

RCOC – Road Commission of Oakland County

RPO – Regional Planning Organization

RSL – Remaining Service Life

SAFETEA-LU – Safe, Accountable, Flexible, and Efficient Transportation Equity Act

SEMCOG – Southeast Michigan Council of Governments

STIP – Statewide transportation improvement program

TAMC – Transportation Asset Management Council

TEDF – Transportation Economic Development Fund

TIP – Transportation Improvement Program

WMRPC – West Michigan Regional Planning Commission