Asset Management Guide for Local Agencies in Michigan

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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). 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 TAMC 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 TAMC documents and presentations, as well as 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 TAMC 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 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 Options and Tradeoffs –** 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

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

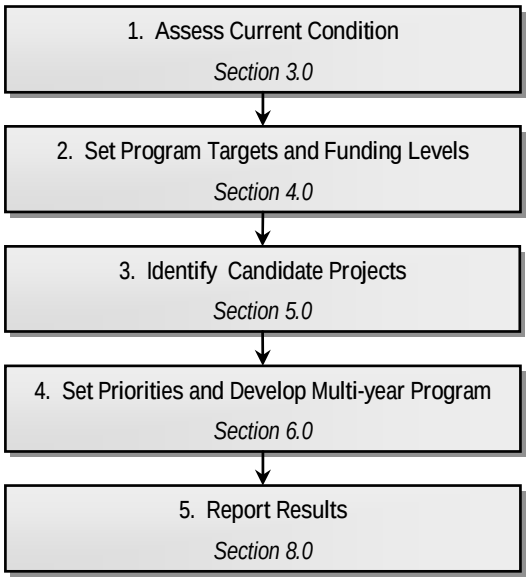
- Lower long-term preservation costs;
- Improved service to customers;
- Improved cost-effectiveness and use of available resources;
- Improved communication with elected officials and the public; and
- Improved credibility and accountability for decision-making.

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. A practical approach to doing this is to apply the principles of asset management to the general resource allocation process illustrated in Figure 1.1. This process reflects the TAMC's vision of asset management implementation.

Figure 1.1 General Resource Allocation Process



Assess Current Condition

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

Set Program Targets and Funding Levels

The second step is to establish program condition targets and preliminary funding levels. For example, how much money should be spent on preventive maintenance versus capital improvements? What pavement condition can be achieved based on this split? An important part of this step is to predict future conditions for various funding levels.

Identify Candidate Projects

The third step is to identify potential projects and to determine the appropriate scope for each. Candidates represent work that should be done. Candidate projects can be generated with management systems, by applying rules of thumb to current condition data, based on 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 of the candidate projects developed in Step 3. Therefore, the fourth step in the process is prioritizing them and incorporate them into a three-year program that is updated annually.

Report Results

The fifth and final step is to report the results of the resource allocation 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.

1.5 HOW TO USE THIS GUIDE

Michigan has made significant progress developing resources that can help local agencies improve their asset management practices. Section 2.0 provides an overview of these 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 resource allocation process described above.

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

- The number of lane miles and bridges owned;
- Staffing availability; and
- Compatibility with existing business practices and tools.

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

The materials presented in the following sections can be applied to any physical assets – pavements, bridges, sidewalks, culverts, signs, buildings, equipment. The guide focuses on pavements and bridges because this is the focus of the TAMC. 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 were 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 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; and
- 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 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; and
- It defined the roles and responsibilities of the TAMC 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; and
- 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, Act 51 created the Transportation Asset Management Council (TAMC). The Council's mission is to:

> Advise the State Transportation Commission on a statewide asset management strategy and the necessary procedures and analytical tools to implement such a strategy on Michigan's highway system in a cost-effective, efficient manner.

The TAMC 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 responsibilities or are in some way tied in with funding the system. In early 2004, the TAMC 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 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; and
> - Providing education and training on the benefits of developing road improvement programs through the use of asset management principles and procedures.

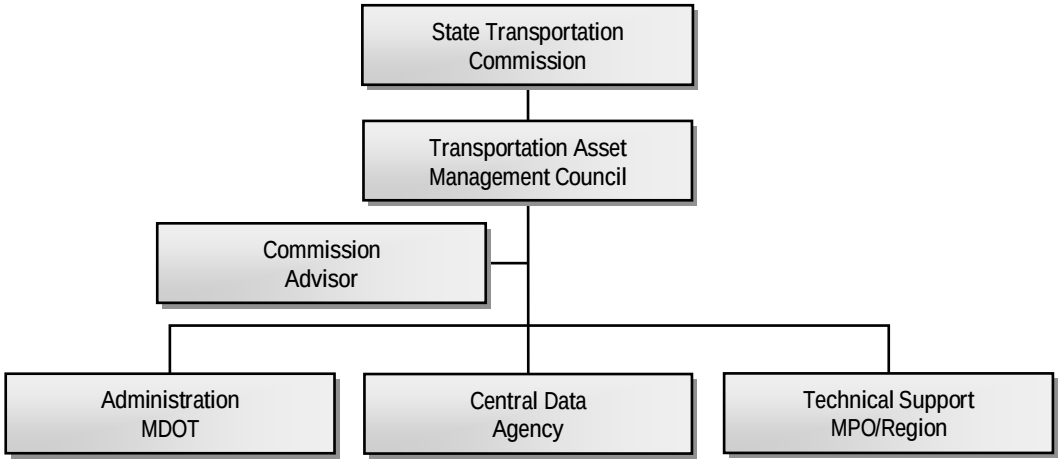
The TAMC also is working to implement the recommendations of the Act 51 Funding Study Committee. This requires moving away from a process that relies on the needs studies concept of identifying system condition and service deficiencies and reducing the identified backlog, to a process that focuses on setting system performance targets and then managing the transportation investment priorities to achieve those expectations. It also requires developing a customer focus by reviewing the system not by who owns it, but by how people drive 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 TAMC 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 TAMC 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 from 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 TAMC 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 TAMC 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 TAMC 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 TAMC selected the Center for Geographic Information (CGI) of the Michigan Department of Information Technology to serve as its

central data storage agency. The TAMC 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 TAMC. 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 TAMC 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 a an important asset to your business. The TAMC relies on consistent data reporting from the member agencies to accurately depict current condition and predict future conditions. Consistent data collection is essential because the Council is charged with combining data from over 600 agencies. The TAMC has adopted standards for collecting and reporting bridge and pavement condition.

Pavement Data

The TAMC uses the PASER method for reporting statewide pavement condition. This method relies on a visual inspection of the roadway surface. Initially, the TAMC 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. The TAMC, at this time, is using NBI results to report on the condition of bridges in Michigan.

Noncondition Data

Opportunities to collect noncondition 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 noncondition data used for asset management. Noncondition 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 TAMC 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; and
- A more advanced class on asset management.

The education and training element of the TAMC is coordinated through 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 Local Technical Assistance Program (LTAP). The course focuses on the basic principles of asset management, benefits of a preventive maintenance approach, and the PASER rating system. LTAP also provides regular courses on the use of RoadSoft and its application 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 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 TAMC 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 which takes a long-term look at how the system as a whole is functioning. 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 TAMC 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 performance measures. Performance 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 SELECT PERFORMANCE MEASURES

Performance measures are numerical representations that attempt to quantify the success of an action in achieving its intended objective. In asset management, performance measures help assess the condition and quality of an asset. Going beyond an asset management context, they also can be used to gauge the effectiveness of an organization. Examples of organizational measures include expenditures per mile, expenditures per capita, and expenditures per work type as a percent 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. (The Data Exercise in Appendix A can help you start to think about what you need to know to support your agency's resource allocation process.) Selected performance measures should meet the following criteria:

- **Feasible** – 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?

Measuring Pavement Condition

The TAMC 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 conditions 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 TAMC 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, 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 nontransportation 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.

The TAMC 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.[3]

[3] 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).

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 cracks. PASER ratings 8, 9, and 10 are included in this category. This category also includes roads that are newly constructed or recently seal coated. They require little or no maintenance.

Capital Preventive Maintenance

Capital preventive maintenance (CPM) is at the heart of asset management. It is the planned set of cost-effective treatments 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 deficiencies. 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. 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. Roads with a PASER rating or 1, 2, 3, and 4 are included in this category. Pavements with these ratings will exhibit deficiencies such as rutting, large holes, alligator cracking, or joints and cracks that are badly spalled. Typical structural improvement activities include major rehabilitation or reconstruction.

To support this reporting effort, the Council has established data collection procedures and reimburses agencies for the costs of the data collection. Therefore, if your agency has not yet selected a pavement condition measure, it should consider adopting the PASER rating method.

Measuring Bridge Condition

The TAMC is using structurally deficient and functionally obsolete status 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 used to determine structurally deficient and functionally obsolete status.

- 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 as structurally deficient.
- A bridge is considered "good" if it is neither structurally deficient nor functionally obsolete.

3.2 DATA COLLECTION

Assessing asset condition requires accurate inventory and condition data. The condition data that is collected should support the selected performance measures. 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 maps in Appendix D).

Pavement condition data is typically collected every one or two years. The approach to collecting pavement data depends on the selected measure. Some measures require nothing more than a windshield survey, such as the PASER method used by the TAMC. Others require vehicles equipped with automated sensing and recording equipment, such as an automatic road analyzer.

The bridge measures used by the TAMC 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.

3.3 ASSESSING CURRENT CONDITIONS

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

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

Another common approach to summarizing condition data is to define "buckets," such as good, fair, poor, and reporting the percent of the network in each. 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 conditions to be understood by nontechnical audiences.

Example – Statewide Pavement Condition

The TAMC 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		Preventive Maintenance		Structural Improvement		Total	
Function	Lane Miles	Percent	Lane Miles	Percent	Lane Miles	Percent	Lane Miles	Percent
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: TAMC 2004 Annual Report.

Example – Statewide Bridge Condition

The TAMC 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%

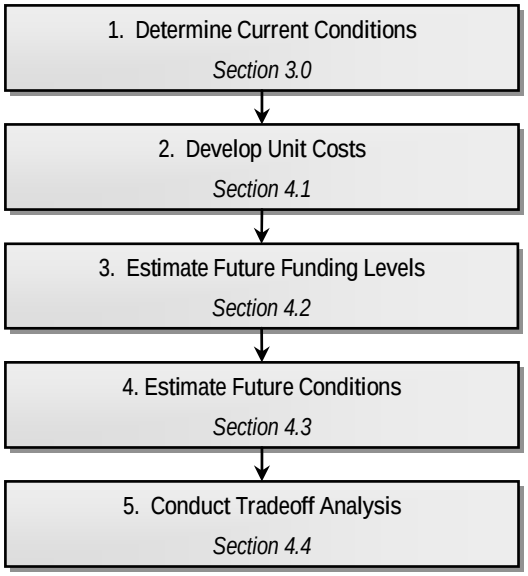
Source: TAMC 2004 Annual Report.

4.0 Set Program Targets and Funding Levels

Now that you have an understanding of the current condition of your assets, the next step is to see how this condition may change in the future for different levels of investment in the system. Using an asset management approach involves setting overall system performance targets in conjunction with funding levels for different program categories. (Program categories are usually based on types of work – for example, routine maintenance, capital preventive maintenance program, and structural improvement.) This should be done prior to looking at specific projects. Once decision-makers agree on program costs and resulting condition, they can evaluate specific projects in terms of their ability to achieve these targets. 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.

Figure 4.1 illustrates a process for setting asset condition targets and preliminary funding levels for different program categories. The main objective of this process is to understand the relationship between costs and condition – if we spend more in specific program areas, what will happen to the condition? If we spend less, what will happen?

Figure 4.1 Framework for Setting Network and Program Targets



4.1 ESTIMATING UNIT COSTS

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

Option 1 – Use Default Unit Costs

If you use a pavement management system, it is likely loaded with default values of activity unit costs. The Federal Highway Administration (FHWA) and the Michigan Department of Transportation (MDOT) also have compiled average unit costs. These costs are provided in Tables 4.1 and 4.2. If you have no cost data of your own, one option is to simply use default unit costs until you can supplement them with actual data.

Table 4.1 Nationwide Average Pavement Costs

Work Activity	Cost per Lane Mile
Reconstruction	
Urban	$18,500
Rural	$13,200
Rehabilitation	
Urban	$14,600
Rural	$9,700
Resurfacing	
Urban	$12,300
Rural	$10,000

Source: Federal Highway Administration's "Highway Statistics 2001."

Table 4.2 Average Pavement Costs in Michigan in 2001

Capital Preventive Maintenance Activity	Cost per Lane Mile
Thin overlay	$5,400
Slurry seal	$3,400
Chip seal	$2,800
Crack seal	$2,600

Source: MDOT.

MDOT has developed guidance for estimating the cost of bridge projects as part of Michigan's Local Bridge Program. Following are guidelines for estimating bridge replacement costs:[4]

- 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; and
- The overall replacement project should cost at least $300,000.

Because unit costs can vary largely from agency to agency, your agency should consider checking the default unit 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 those that would have been estimated using the default unit costs. This can provide some basis for adjusting the unit costs to bring them in line with your experience.

Appendix E presents more detailed unit costs developed by MDOT that local agencies can use to estimate the cost of pavement and bridge projects using default unit costs.

Option 2 – Develop Unit Costs for Your Agency

Using default unit costs is a short-term option. Eventually you will want to update them based on actual cost data. This will increase the confidence in your agency's analysis. 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. Therefore it is recommended that your agency develop customized unit costs.

Cost estimates for routine maintenance activities can be estimated by dividing the 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 unit costs for activities such as crack sealing, concrete joint resealing, and shoulder resurfacing.

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

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[4] MDOT, Local Bridge Program Deadline for Applications – June 15, 2005.

- Divide the total reconstruction or resurfacing budget from the previous year by the total number of lane miles reconstructed or resurfaced; or
- Define a typical cross-section of reconstructed road segments, including lane widths, pavement depths, curbs, sidewalks, etc. 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.

4.2 ESTIMATING FUTURE FUNDING LEVELS

Understanding the implications of funding decisions on the resulting 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. Therefore estimating future funding levels is an important step in any asset management process. Funding levels should be estimated for the period corresponding to the multi-year program under development – which must be at least three years.

Option 1 – Assume Consistent Funding Levels

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

Example – Estimating ACT 51 Road Funds

Table 4.3 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 4.3 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; and
- 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 nontransportation 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 13 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 project.
- **Transfers from major roads to local roads.** The maximum allowable transfer from major to local roads has historically been legislatively mandated. However, new legislation has been passed which eliminates this restriction if an agency implements an asset management process that includes the following activities:
  - Conduct periodic system condition inventories;
  - Identify needs by forecasting system condition based upon reliable rates of deterioration;
  - Establish strategic goals and objectives, and performance measures;
  - Evaluate investment scenarios based upon forecasted conditions and achievement of goals and objectives;
  - Develop and implement a multi-year investment program; and
  - Routinely monitor the performance of system improvements.

Example – Ionia's Street Funding Strategy

In the late 1980s most of the City of Ionia's 26 route miles of streets needed to be reconstructed. Based on an analysis of utility plans and construction records, the city identified outdated sewer systems as the major cause of the worst segments. It was not feasible to address the poor street condition in a timely fashion based on historical funding levels. Therefore in 1989, Ionia instituted a city income tax in order to fund road reconstruction projects. Ionia used this revenue source to reconstruct all of its roads between 1989 and 2002, replacing the inadequate sewers as needed. After this period of major construction, Ionia was able to lower its transportation spending to previous levels. It also started to focus its resources on routine maintenance and capital preventive maintenance in order to maximize the useful life of the new roads. For example, Ionia cleans all of its drainage facilities annually so that its roads drain properly.

4.3 PREDICTING FUTURE CONDITION AS A FUNCTION OF INVESTMENT LEVEL

The future condition of transportation infrastructure depends on how much an agency is able to invest in maintenance, rehabilitation, and reconstruction. 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. Agencies that are not able to make sufficient investments to maintain or improve conditions face a higher price tag in the future to address facility needs, as well as potentially unacceptable levels of service to road users. Therefore, it is important for agencies to develop the capability to understand the relationship between funding levels and condition – and then use the results within the resource allocation process. While many agencies currently do not have this capability, it is not difficult to implement. This section presents realistic options for local agencies to analyze future pavement and bridge conditions.

Pavement Analysis

Option 1 – Implement a Pavement Management System

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

- Maintain an inventory of roads and their condition;
- Estimate the current "health" of a roadway network;
- Predict the "future health" of the network;
- Optimize alternative repair and funding strategies;
- Promote communication within the agency; and
- 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 proper maintenance;
- Make decisions for you; or
- Provide all the answers.

There are many different PMS available from a multitude of vendors. Table 4.4 includes a sample of available systems. All of these systems have been reviewed by the TAMC (or are used by TAMC members) and found to be very good systems. Your agency would be well served using any of them.

Table 4.4 Available Pavement Management Systems

Vendor	Product(s) Name	Web Site	Example Agencies Using This System
American Public Works Association	MicroPaver	www.apwa.net	Kent County, Grand Rapids, Gladstone, 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, Livingston County
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 Applications and Data Management Subcommittee.

In December of 1995, the TAMC chose RoadSoft for use in developing its statewide strategy. RoadSoft is an attractive option for many local agencies in Michigan. This system is distributed free of charge by the Michigan Technological University. It has an active user community, and it uses the PASER data required by the TAMC for reporting purposes. Implementing RoadSoft requires the following tasks:

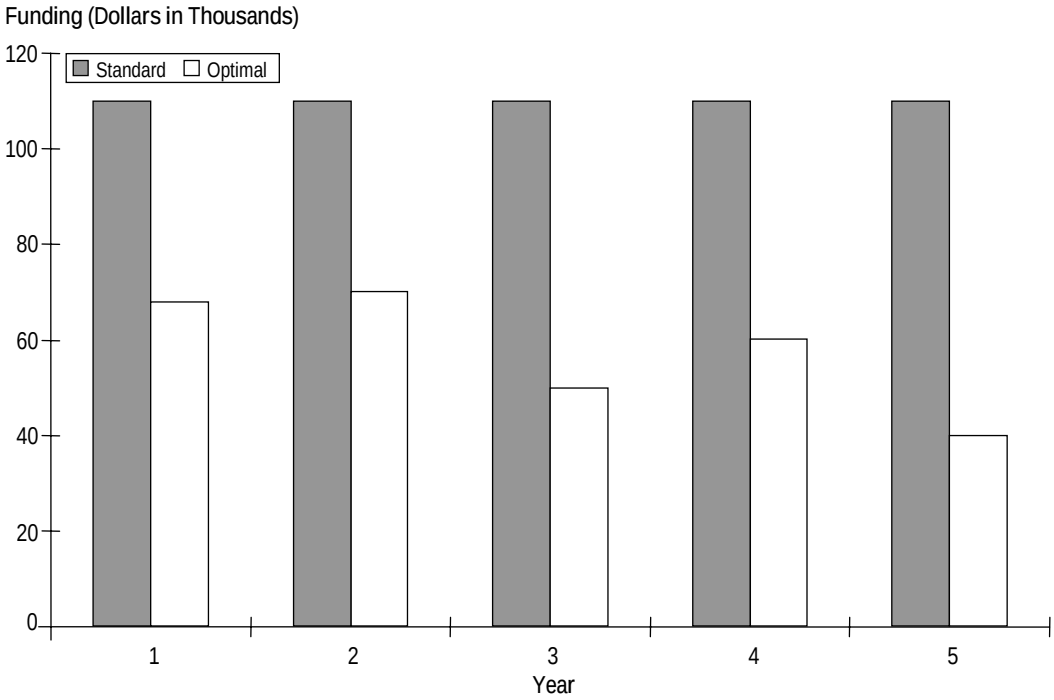
- Enter PASER ratings from at least two consecutive inspection cycles;
- Indicate the width and pavement type for all road segments; and
- Update the default unit costs models.

PASER ratings and inventory data are both available from the Michigan Geographic Framework.

Example – Evaluating Future Conditions with RoadSoft

RoadSoft estimates remaining service life (RSL) over time based on current condition data and information on available funding levels. For example, Figure 4.2 defines the annual budget for two funding strategies.

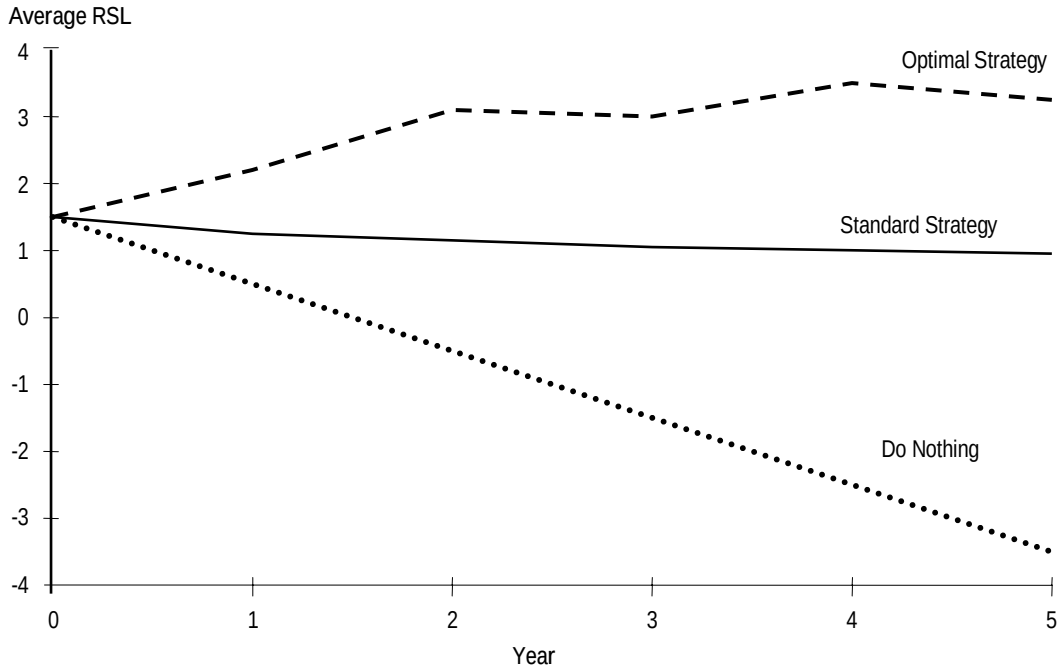
Figure 4.2 Defining Funding Scenarios



Source: Michigan Tech Transportation Institute RoadSoft Brochure

Figure 4.3 shows the resulting impact on RSL for those budgets. It also shows the impact of doing nothing. The two figures show that the standard strategy will result in no change in the average RSL over the next five years. They also show that the optimal strategy will improve the average RSL even though it costs significantly less than the standard strategy. Doing nothing results in a negative average RSL, which means that the majority of roads will be beyond their useful life and will require total reconstruction.

Figure 4.3 Future Pavement Condition for Three Funding Levels



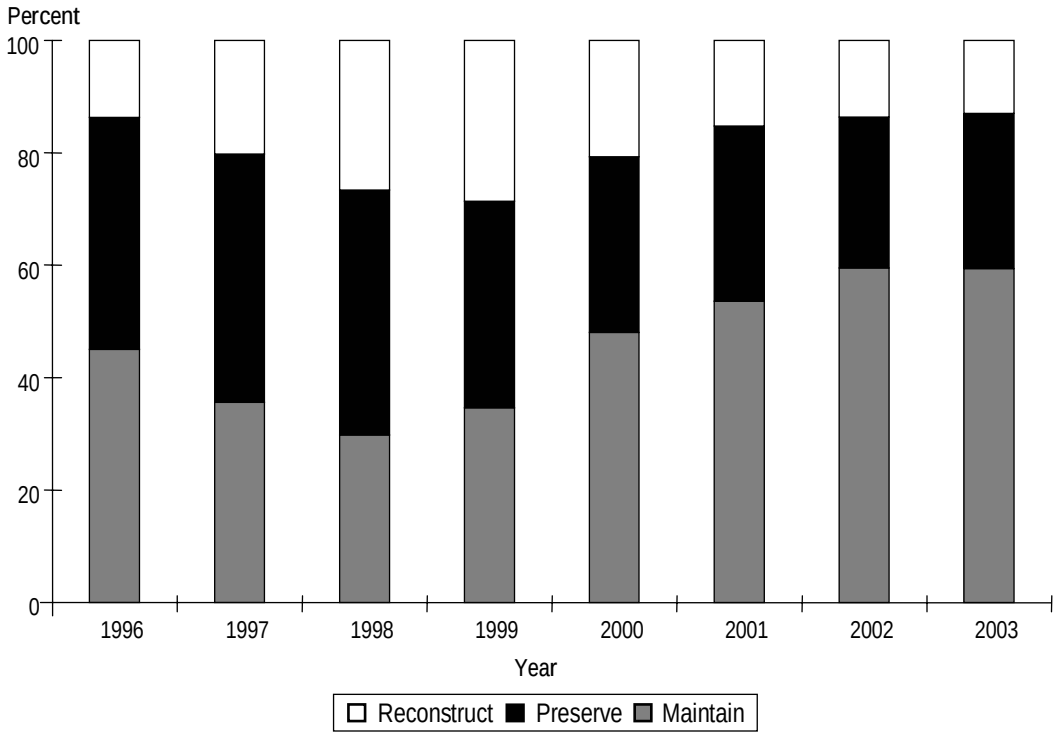
Source: Michigan Tech Transportation Institute RoadSoft Brochure.

Example – Analyzing Future Pavement Conditions with MicroPaver

Another popular system developed by the U.S. Army Corps of Engineers is MicroPaver. This system requires more detailed data than RoadSoft and is used by several agencies in Michigan.

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 dominated by expansion projects in the early to mid 1990s, 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 4.4 presents a trend analysis of pavement condition.

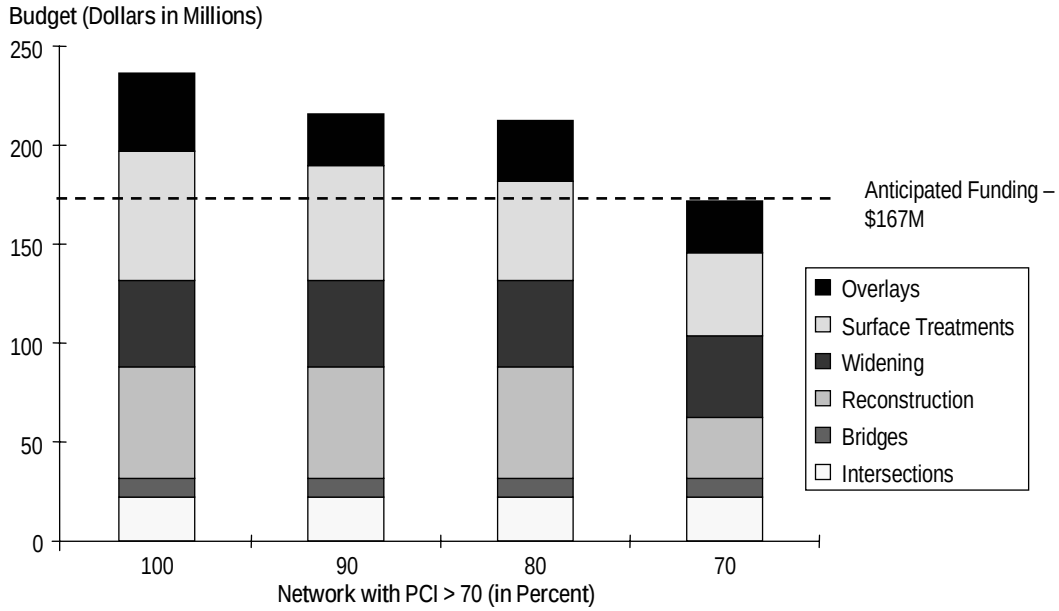
Figure 4.4 KCRC Road Distribution Over Time



The data shows the percent of the network requiring the following work activities – reconstruct, preserve, or maintain. The network is segmented into these categories based on a pavement condition index (PCI).

Figure 4.5 presents four alternative budget scenarios and indicates the implications of each for future pavement condition.

Figure 4.5 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, bridges, and pavement reconstruction are held constant, while the amounts allocated to surface treatments and overlays increases with the overall funding level.

Option 2 – Spreadsheet Analysis

Another option for evaluating future pavement performance is to develop a simple spreadsheet based on the models used by more sophisticated pavement management systems. This type of analysis requires the following steps:

1. Record existing pavement condition ratings for each pavement segment.
2. Select a work activity for each segment from a few standard options – either "do nothing" or a treatment appropriate for the type of pavement and current condition.
3. Adjust the current condition (or remaining life) in each year based on the selected work activity (use rules of thumb for the condition after the fix is completed, and the average life or life extension gained for each type of fix).
4. Calculate the network average for each year.
5. Apply unit costs to the work activities selected to calculate the required level of funds associated with the network average condition.
6. Repeat steps 1 through 5 for different sets of work activity choices.

Tables 4.5 and 4.6 recommend a treatment for each PASER rating and show its impact on remaining service life (RSL). RSL defines a point at which it is no longer cost-effective to perform capital preventive maintenance activities. At this point, major rehabilitation or replacement is necessary. Note that the time range in the last column represents the number of years of extended life, not the longevity of the treatment.

These tables provide default values for remaining service life and extended service life. **Depending on a variety of elements such as traffic levels, soil conditions, weather, materials used during construction, and previous work done on a segment of road, your agency may not experience these extended years of service.**

Table 4.5 Impact of Asphalt Pavement Treatments on RSL

PASER Rating	Equivalent RSL (Years)	Recommended Treatment	Extended Service Life (Years)
1	0	Total reconstruction	Up to 25
2	5	Reconstruction with extensive base repairs	Up to 25
3	8	Patching with major overlay	5 to 10
4	11	Structural overlay of two inches or more	5 to 10
5	13	Sealcoat or nonstructural overlay less than two inches	3 to 5
6	16	Sealcoat	3 to 6
7	20	Routine crack filling	4 to 6
8	23	No maintenance required	0
9	24	No maintenance required	0
10	25	No maintenance required	0

Source: PASER Manual.

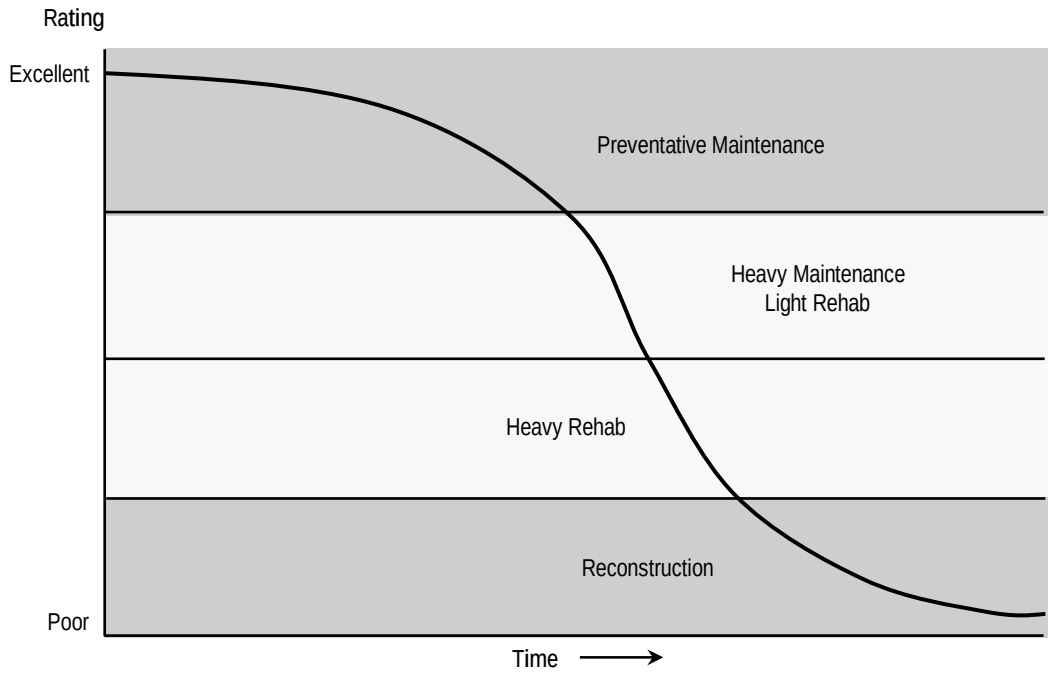
Table 4.6 Impact of Concrete Pavement Treatments on RSL

PASER Rating	Equivalent RSL (Years)	Recommended Treatment	Extended Service Life (Years)
1	0	Total reconstruction	Up to 35
2	3	Recycle and/or rebuild pavement	7 to 15
3	6	Full depth patching with some full slab replacement	3 to 10
4	10	Some full depth repairs, grinding, and/or asphalt overlay	3 to 5
5	14	Grinding with some partial depth patching or joint repairs	3 to 5
6	17	Joint and crack sealing	3 to 5
7	20	Surface scaling, seal open joints, other routine maintenance	Up to 3
8	25	No maintenance required	0
9	30	No maintenance required	0
10	35	No maintenance required	0

Source: PASER Manual.

Figures 4.6 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 where different types of work activities become no longer feasible. These points define a window of opportunity. For example, there is a point on the steep part of the curve where maintenance and light rehabilitation work is no longer feasible. Beyond this point, heavy rehabilitation is recommended until the point at which only reconstruction is feasible. This concept of a window of opportunity is the basis for the recommendation treatments presented on the previous page.

Figure 4.6 Window of Opportunity



Example – Analyzing Future Conditions with a Spreadsheet

Figure 4.7 illustrates how a spreadsheet can be used to analyze future pavement conditions. In this example, PASER ratings for four asphalt road segments were translated to equivalent RSL based on Table 4.5. In Year 1, a project was selected for each segment. The number of years added to the service life for each project also was taken from Table 4.5. Based on the current RSL and the added service life, the end RSL was calculated for each segment. If the selected action was "do nothing," it was assumed that the RSL would decrease by one year. The process was then repeated for Year 2. In this example, the average RSL increases from 17 in 20 over the two-year period.

Figure 4.7 Spreadsheet Analysis of Future Pavement Conditions

Road	Current RSL (years)	Year 1			Year 2		
		Work	ESL	End RSL	Work	ESL	End RSL
Main Street	11	2" Overlay	8	19	Do Nothing	0	18
Park Avenue	13	Do Nothing	0	12	Seal Coat	4	16
Central Avenue	20	Do Nothing	0	19	Crack Filling	5	24
Elm Street	24	Do Nothing	0	23	Do Nothing	0	22
Average RSL	17			18.25			20

4.4 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 basic tradeoff question is "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. The end result of this analysis is an allocation that best meets your agency's transportation condition and performance objectives.

Many of these decisions represent "apples to oranges" comparisons. However, as transportation professionals, you must make these decisions all the time. Structured tradeoff analysis simply provides a means for making these 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 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.
- **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.
- **Capital versus Preventive versus Maintenance –** An optimal asset management strategy typically includes a mix of routine maintenance, preventive maintenance activities, and long-term capital improvement projects. Management systems can help determine the most appropriate mix of fixes for your agency's road network.

Example – The Value of a Mix of Fixes

The Michigan Local Technical Assistance Program (LTAP) analyzed three different work strategies for pavements in Houghton and Keweenaw Counties to illustrate the benefits of a mix of fixes. Figure 4.8 illustrates a strategy that consists of an overlay every 15 years. In this scenario, the pavement deteriorates for 15 years and then an overlay is performed. The overlay brings the condition back up to excellent. The pavement is then left to deteriorate again for another 15 years. This strategy results in a total cost over 30 years of $80,000. The condition after 30 years is slightly lower than the fair threshold.

Figure 4.8 Pavement Strategy 1
Overlay Every 15 Years

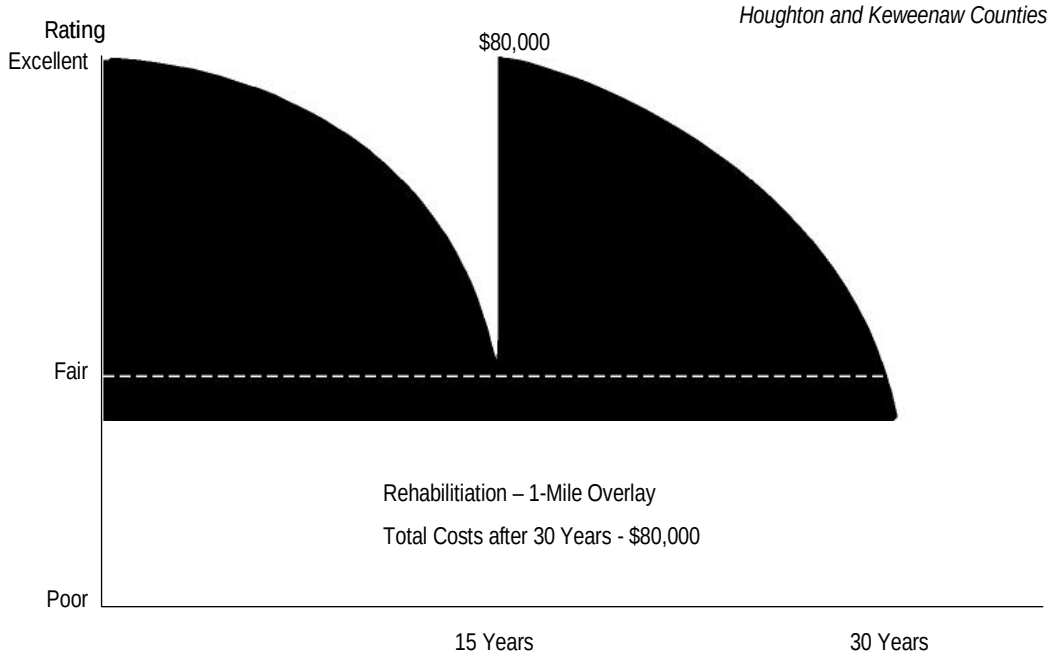


Figure 4.9 illustrates the implications of using a sealcoat every 10 years. This approach results in a total cost of $40,000. The resulting condition rating is slightly higher than fair.

Figure 4.9 Pavement Strategy 2
Seal Coat Every 10 Years

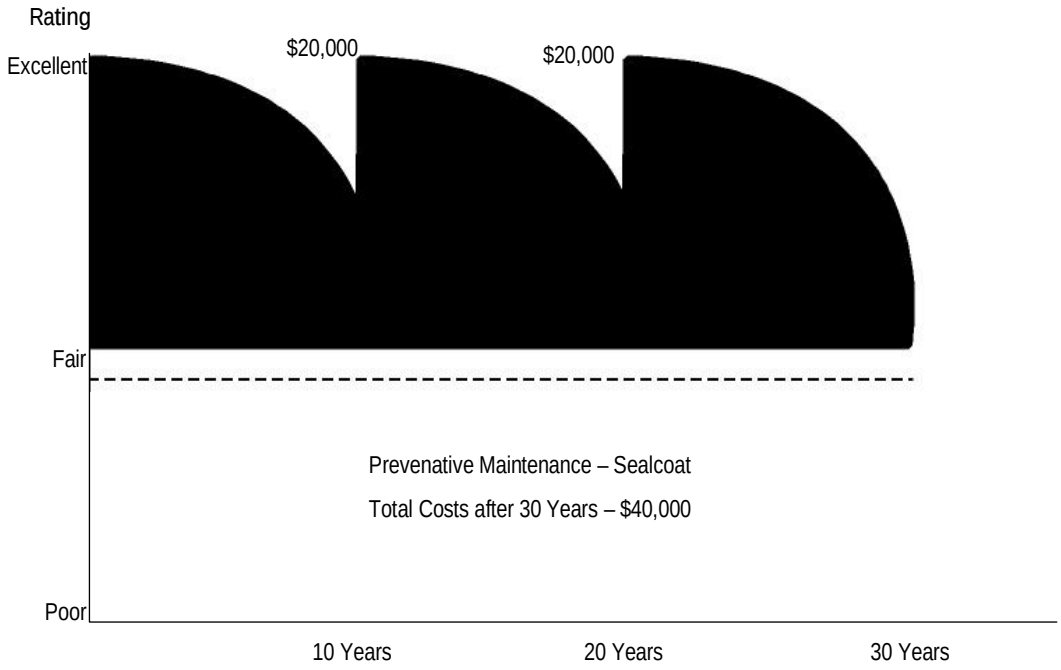
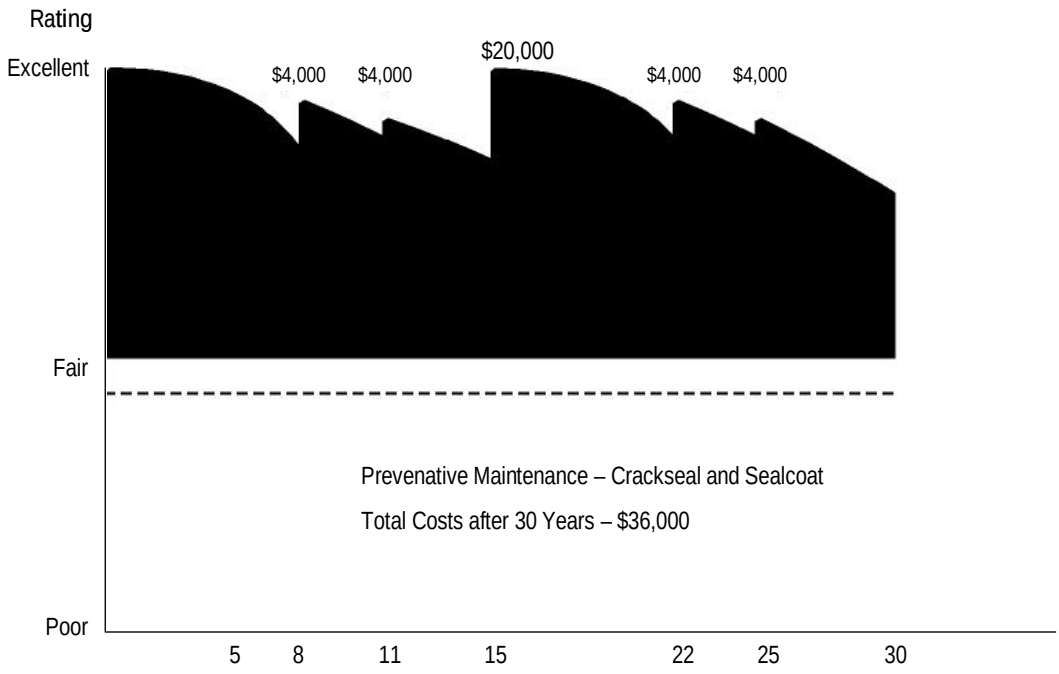


Figure 4.10 illustrates a strategy that consists of a mix of fixes. This approach results in a total cost of $36,000. The resulting condition is halfway between excellent and fair. This strategy results in the lowest overall cost and the highest overall condition.

Figure 4.10 Pavement Strategy 3
Mix of Fixes



Option 1 – Use Management System Results

If your agency uses management systems for earlier steps, the resulting charts and graphs can support tradeoff analysis. These types of reports provide context for decision-makers working to determine appropriate funding levels.

Option 2 – Use 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 – however 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 4.7 requires the following steps:

- Identify major goal areas, such as pavement preservation, bridge preservation, traffic improvements, safety, etc.
- Define one or more performance measures for each area. In this example the performance measure is the percent of major and local roads in good condition.
- Determine current condition.
- Evaluate the impact of various funding levels on each measure. In this example, the resulting condition in year 10 has been evaluated for three funding scenarios – continuation of last year's budget, increasing this budget by 10 percent, and decreasing the budget by 10 percent.

Based on this information, decisions makers can select that funding scenario that they prefer. This is an example of a major versus local tradeoff.

Table 4.7 Sample Tradeoff Template

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

Option 3 – 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

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

- Our first priority is to continue funding routine maintenance at previous levels. The remaining transportation funds will be used for bridge and pavement preservation.
- 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 40 percent of the major street funds to the local street program. This transfer is possible because an asset management process has been implemented. The focus of our local street program will be capital preventive maintenance activities.

4.5 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

The Public Works Department of the City of Gladstone has been successful in making the case for additional funds to their elected officials. After analyzing the condition of its pavements using the Paver 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; $140,000 of which 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 Council.

Staff found that when elected officials do not have a fixed amount of money in mind for transportation projects, they will only fund them 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 needs to its elected officials.

The Tradeoff Exercise in Appendix A provides another example of how the results of a tradeoff analysis can be used to help make the case to elected officials.

4.6 SETTING PERFORMANCE TARGETS

Ideally, one of the results of a tradeoff analysis is a set of condition targets. Targets turn policies into guidance for project prioritization. For example, it may be an agency's policy to preserve pavement conditions. To support this policy, it may select PASER ratings as a performance measure. The next step is to establish a specific performance target, such as "maintain all streets with a PASER rating of 6 or higher." In this example, decision-makers now have specific guidance on how to allocate transportation resources in a way that is in line with the agency's goal.

Table 4.8 presents a sample of targets set by local agencies in Michigan. In addition to clearly stating the condition that an agency wants to achieve, targets also should indicate a timeframe. Will this target be achieved next year? In five years? It is good practice to have both short- and longer-term targets. Longer-term targets help to highlight the need for sustained investment in infrastructure, and encourage attention to preventive maintenance in addition to fixing the facilities that currently are in poor condition.

Table 4.8 Performance Target Examples

Target	Agency
All streets with pavement condition index (PCI) > 20	Gladstone
Average PCI > 70	Grand Rapids
All streets with PASER rating ≥ 5	Ionia
Seventy percent of network with PCI > 70	Kent 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?
- Or are we simply maintaining the current condition?

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

- Establish a threshold for "poor" pavement based on a level of roughness that is noticeable to road users. Minimize the percent of the network in poor 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, or emergence of information or factors not previously considered when the initial targets were established, such as dramatic changes in available funds.

5.0 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 with management systems, by applying rules of thumb to current condition data, based on 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 recommended projects, and then conduct field visits to review and potentially adjust the recommendations.

Option 2 – 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 5.1 presents RoadSoft's default thresholds and recommended work activities. If your agency does not have a work policy, this table can be used as a starting point.

Table 5.1 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 nonstructural 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 3 – Establish a Capital Preventive Maintenance Program

Agencies often operate within tight budget constraints. In this environment, it is important to optimize the performance of their existing system. 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, MDOT estimates that $1 invested in capital preventive maintenance will save from $4 to $6 in future reconstruction costs.[5]

Option 4 – Solicit Stakeholder Input

Another approach that is used by many agencies (often in combination with one of 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.

[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.

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 one of the following 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 and Field Inspections

The final option is to use engineering judgment based on field inspections as well as the engineer's local knowledge of other needs. 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 the entire road.

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 operational and safety concerns that may exist.

6.0 Set Priorities and Develop Multi-Year Program

The next step in the resource allocation process is to prioritize candidate projects and develop a multi-year program. A fundamental goal of any asset management effort is to apply the right fix at the right time in the right place. 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 6.1 shows an example of what a program for road construction projects looks like. It was developed by the Cass County Road Commission, and is posted on their web site: www.casscoroad.com.

Table 6.1 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.

6.1 FEDERAL AID PORTION OF THE PROGRAM

The Federal aid portion of local transportation programs is governed by the Safe, Accountable, Flexible, and Efficient Transportation Equity Act: a Legacy for Users (SAFETEA-LU) of 2005. SAFETEA-LU outlines 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.

6.2 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 nonvoting 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; and
- 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 are to:

- Rate the applications for local bridge funds;
- Work together to create a three-year bridge plan of projects for their region; and
- Oversee the progress being made toward bringing the planned projects to contract.

Detailed instructions for applying to the Local Bridge Program are provided on MDOT's web site – http://www.michigan.gov/mdot/0,1607,7-151-9625_25885-113373-,00.html.

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.

6.3 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.

One common approach is to ensure that the program is consistent on an overall basis with the management system recommendations. For example, RoadSoft recommends the amount 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 6.2.

Table 6.2 Example RoadSoft Recommendations

Work Category	Treatment	Lane Miles
Reconstruction	Reconstruct	5
Preventive maintenance	Seal coat	10
Preventive maintenance	Crack sealing	20

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 4.5 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. On the other hand, given traffic volumes, soil conditions, etc. using less than two inches my be sufficient for a period of years. 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.

6.4 PRIORITIZING CANDIDATE PROJECTS

Regardless of whether management systems were used or not, agencies should evaluate candidate projects in terms of the targets developed earlier in the resource allocation process. They also should 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 versus 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, Figure 6.1 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?

Figure 6.1 High-, Medium-, Low-Project Prioritization Template

	Pavement Condition	Traffic Volume	Economic Growth
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. It is not a "black box" that provides definitive answers as to which project is best. 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 6.3 identifies the factors used to identify priorities.

Table 6.3 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

Factor	Score	Description
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)
Nonmotorized	0-3	Nonmotorized 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, subregional, or local priorities based on the point total for each asset in the system. From this prioritized list, SEMCOG determines how it will distribute its anticipated funding for the coming program by percentages. 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.

6.5 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.

The following is practical approach for developing a local transportation program. This process can be followed within each program area (e.g., pavement or bridge). Funding levels for the program areas will have been developed in previous steps (see Section 4.0).

- Assemble a list of ranked candidate projects.
- Start at the top of the list and select the highest-ranked project.
- Subtract the cost of this project from the available budget.
- If there is enough money left over for the next project on the list, select it and subtract its cost from the remaining budget.
- If there is not, move down the list until another project can be funded with the remaining balance.
- 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. In future plans, the GCMPC plans to implement a needs-based program developed between MDOT, local agencies, and the general public.

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 2025 long-range plan:

- Maintains or sustains the existing transportation system;
- Improves or makes the system more efficient; and
- 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.

7.0 Putting It All Together

This section presents two examples of the entire resource allocation 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.

7.1 RESOURCE ALLOCATION 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. RoadSoft is inexpensive and easy to use.

Assess Current Condition

- The agency surveys and rates all of its roads using the PASER system.

Set Program Targets and Funding Levels

- To determine available funding, the agency looks at historical funding levels and considers the costs of large projects that already are underway. Based on these values, the agency estimates its annual budget for the next three years.
- The agency uses RoadSoft to determine an optimal preservation strategy based on its annual budget. 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, and
  - Lane miles of structural improvement.

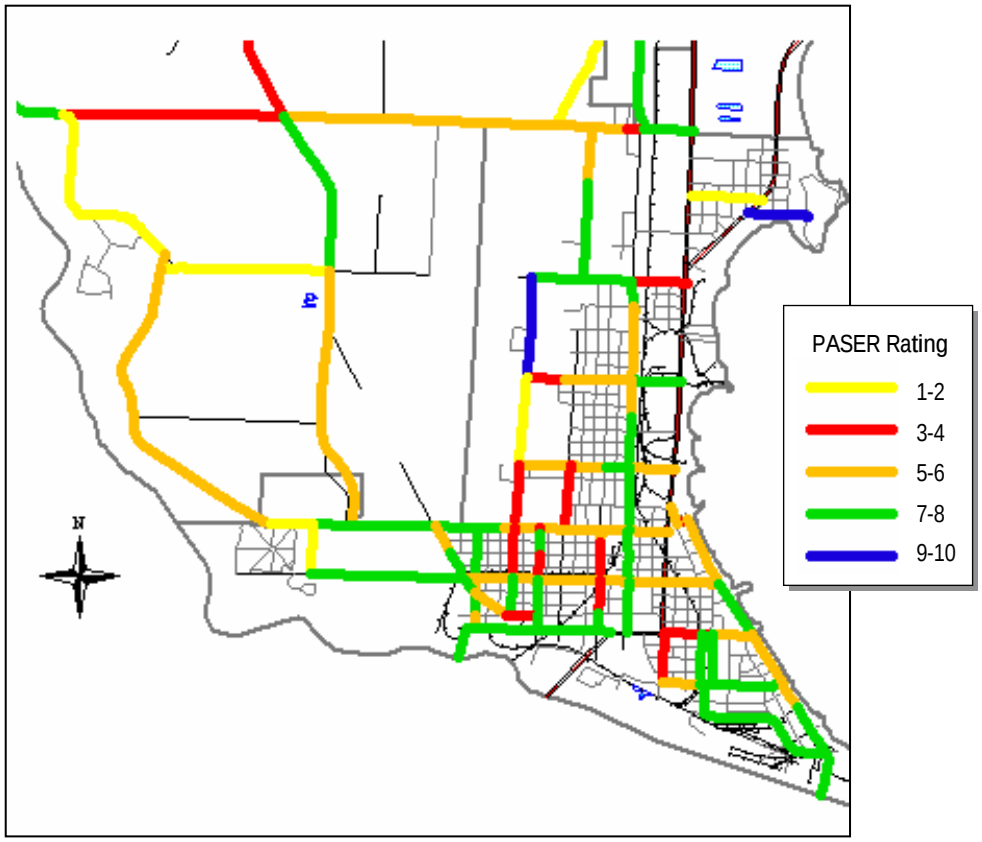
  A target condition in terms of the average remaining service life for the network also is calculated and discussed with the elected officials.

Identify and Scope Candidate Projects

- The agency uses the mapping feature of RoadSoft to review PASER ratings. When analyzed in terms of the recommended actions listed in Table 4.3, this map identifies candidate projects. (Table 4.3 recommends an appropriate work activity for each PASER rating.) For example, Figure 7.1 illustrates this

functionality for the City of Menominee. Segments with a PASER rating of 1 to 2 represent candidates for reconstruction.

Figure 7.1 Reviewing Candidate Projects



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

Set Priorities and Develop Multi-Year Program

- Agency staff use this information to develop a list of projects and define a set of factors for determining which segments should be included in the program. The agency considers traffic levels and coordination with planned utility work. In addition, the City Council has placed a high priority on neighborhood revitalization. So the agency factors that goal into the consideration.
- The agency selects the final projects to include in the multi-year program. The only restrictions in selecting projects are that 1) each project represents an appropriate activity for a segment's current PASER rating, and 2) the sum of lane miles in each work category is consistent with the overall preservation strategy developed earlier.

7.2 RESOURCE ALLOCATION 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

- The agency surveys and rates all of its roads using the PASER system. Condition data is entered into a spreadsheet.
- It estimates the remaining service life on the roads based on the resulting PASER ratings using Table 4.5.

Set Program Targets and Funding Levels

- To determine available funding, the agency looks at historical funding levels and considers the costs of large projects that already are underway. Based on these values, the agency estimates its annual budget for the next three years.
- The agency estimates unit costs for common activities based on previous expenses.
- The agency identifies its most critical road segments based on traffic volumes and the function of the road. These road segments will be given priority over noncritical segments when programming projects.
- Working with elected officials, the agency establishes a minimum condition for the critical segments. A target PASER rating of 6 or higher is set for all of these segments.

Identify and Scope Candidate Projects

- The agency identifies projects required to meet the condition target for the critical road segments. This is done by using the recommended treatments in Table 4.5.
- The agency identifies candidate projects for noncritical segments based on PASER ratings. The agency uses Table 4.5 to estimate the added service life for each candidate project.

Set Priorities and Develop Multi-Year Program

- The agency first funds projects required to maintain the target condition on its critical segments.
- If there are sufficient funds after these projects are selected, projects on the noncritical segments are funded. The agency prioritizes these projects based an analysis of mix of fixes and determines that it should focus on segments with PASER ratings of 5 to 7.
- The agency estimates the resulting average remaining service (RSL) for each year based on current condition data and the estimated effectiveness of the selected projects. Estimated effectiveness is estimated in terms of extended service life (ESL). The resulting RSL at the end of the year for a segment is the original RSL plus the ESL of any treatments. If no treatment is done, the original RSL decreases by one – the segment has one less year of service life. This analysis is illustrated in Table 7.1.

Table 7.1 Sample Custom Pavement Analysis Spreadsheet

			Year 1			Year 2			Year 3		
Segment	Present PASER Raring	Present RSL (Years)	Work	ESL (Years)	End RSL (Years)	Work	ESL (Years)	End RSL (Years)	Projects Completed	ESL (Years)	End RSL (Years)
Critical						-	-		-	-	
1	5	13	2 inch overlay	10	23	Fill cracks	5	22	-	-	21
2	7	20	-	-	19	-	-	24	-	-	23
3	8	23	-	-	22			21			20
Average RSL		18.7			21.3			22.3			21.3
Noncritical											
4	6	16	-	-	15	-	-	14	Sealcoat	4	18
5	5	13	-	-	12	1.5 inch overlay	5	17	-	-	16
6	2	5	-	-	4	-	-	3			2
Average RSL		11.3			10.3			11.3			12.0

Note: All pavements are asphalt.

- After the agency completes this custom analysis, it will have a simple tool that can be used to evaluate the effectiveness of its multi-year program. Program evaluation is as simple as tracking the actual projects and actual conditions and comparing them to the projects and conditions listed in the table. If the two lists are consistent, the agency has successfully implemented its program. If the two are different, the agency should review its analysis to determine if it was completed incorrectly or if other external factors altered program delivery. If external factors were the cause, the agency should find a way to incorporate them into resource allocation cycles.

8.0 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 –** Total mileage of the road network and a summary of pavement and bridge conditions.
- **Record of Work –** List of transportation maintenance, operational or improvement activities performed in the previous year with locations and associated costs.
- **Multi-Year Program –** List of work planned for the next three years, with locations and associated costs.

The TAMC has established formats for these reports. (For example, it has adopted standard reporting categories for reporting work activities. The activities in each of these categories are listed in Appendix F.) The condition report is developed by the TAMC on behalf of each agency. It consists of the Act 51 certified miles reported annually to MDOT and the PASER ratings collected annually and coordinated by metropolitan planning organizations and regional planning organizations. The Council also has developed an Internet-based data entry system that supports the reporting process.

The TAMC uses this information to prepare annual report for the State Transportation Commission, the Legislature, and the transportation committees of the House and Senate. In addition to enabling the TAMC to fulfill its reporting obligations, these reports are valuable tools that can support your agency's asset management process.

8.1 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 TAMC 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.

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

The Record of Work also can 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 also can provide a means for comparing actual costs to estimated costs. Unit 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 assumes five miles of roads will be reconstructed annually, but only three miles have been reconstructed in each of the past two years, adjustments to the target or the current multi-year program should be made.

8.3 MULTI-YEAR PROGRAM

The Multi-Year Program lists specific projects that your agency anticipates completing over the next three years.

Michigan's asset management legislation describes a plan that is developed through an asset management process, such as the process described throughout this guide, and that it is consistent with an agency's goals and objectives. It is recommended 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, 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 TAMC will be able to generate more accurate assessments of future pavement and bridge conditions. Analysis of multi-year programs also will 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.

8.4 TAMC ASSET INVESTMENT REPORTING SYSTEM

The Michigan Center for Geographic Information (CGI), under contract with the TAMC, 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. It has a number of features that will minimize the effort required to enter data, such as map-based navigation and a drop-down list of standard work activities. 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. Figures 8.1, 8.2, and 8.3 illustrate the reporting system.

Figure 8.1 Reporting System – Login Screen

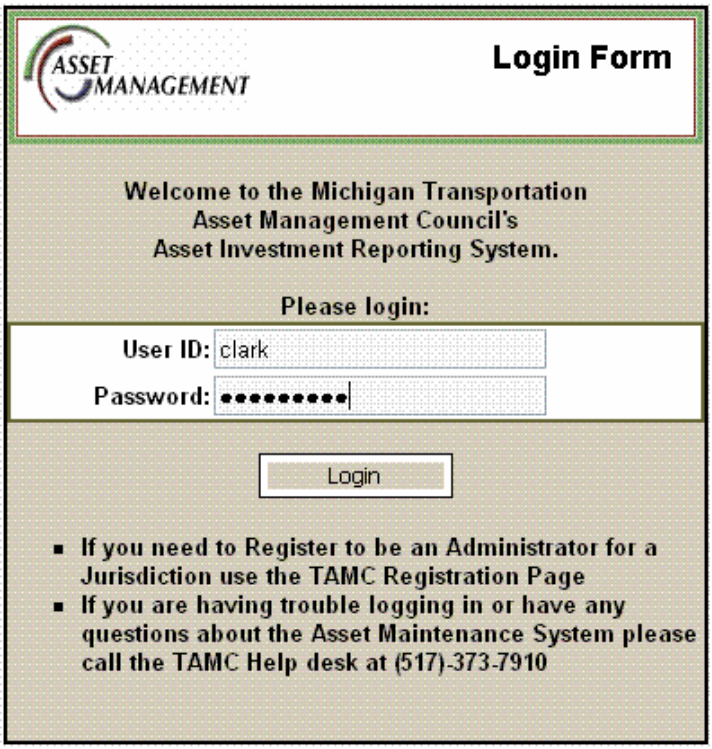


Figure 8.2 Reporting System Interface

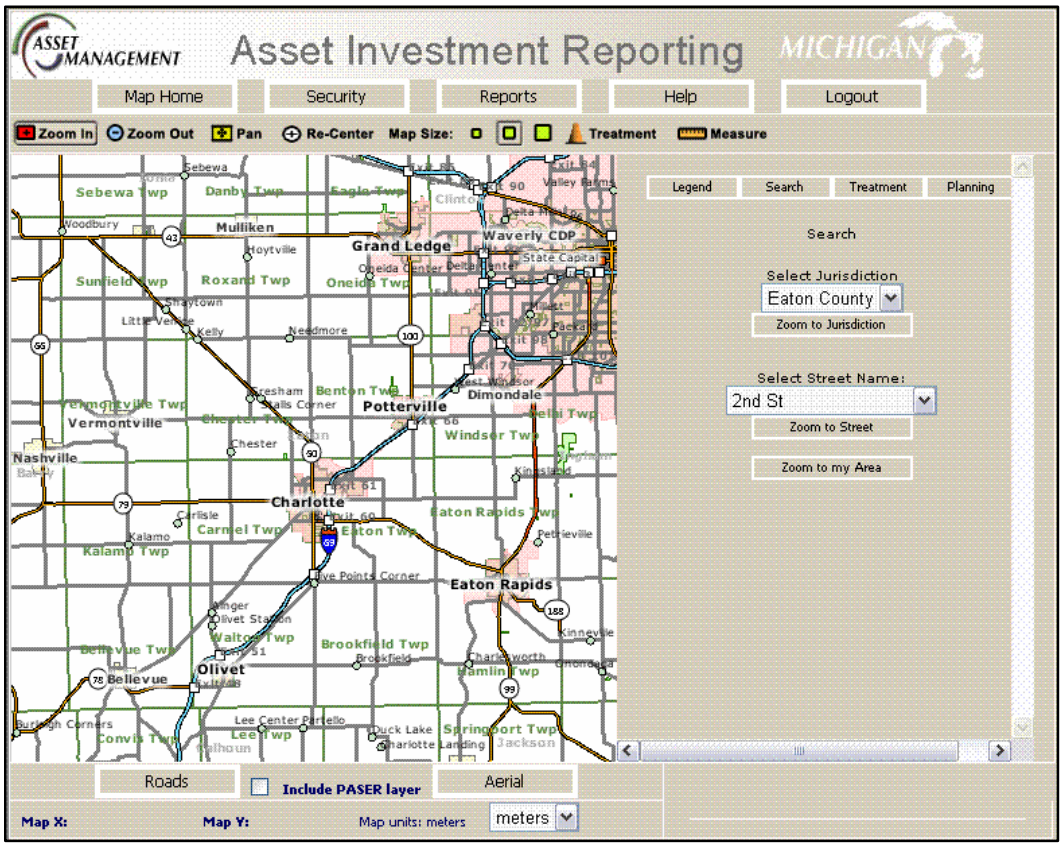
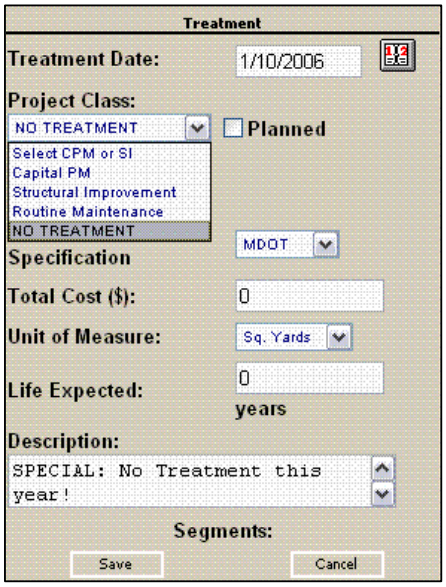


Figure 8.3 Form for Defining Treatments



Each agency should have a point person for logging in and using the system. Only this person will be able to enter and modify data for that agency. The reporting system currently is operational, and your agency should be using it enter data. It will evolve over time, but any data that is entered will be rolled forward – you will not have to start over when new versions become available. Further guidance on how and when to submit the asset management reports will be provided to all agencies through their respective metropolitan planning organization or regional planning organization.

8.5 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 TAMC, MPOs can assist in the reporting process by continuing to play a strong role in the following areas:

- Assure data collection quality.
- Training communities on the proper procedures for reporting.
- Provide strong administrative oversight during the reporting process.
- Assist agencies with the development of the reports, or complete the reports for them if they are not capable or willing. (There is no disincentive in the law for noncompliance. This model allows for oversight and compliance without the TAMC appearing to pressure local agencies.)

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, RPO's 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 TAMC, are well positioned to provide the same reporting support described above for the MPOs.

9.0 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.

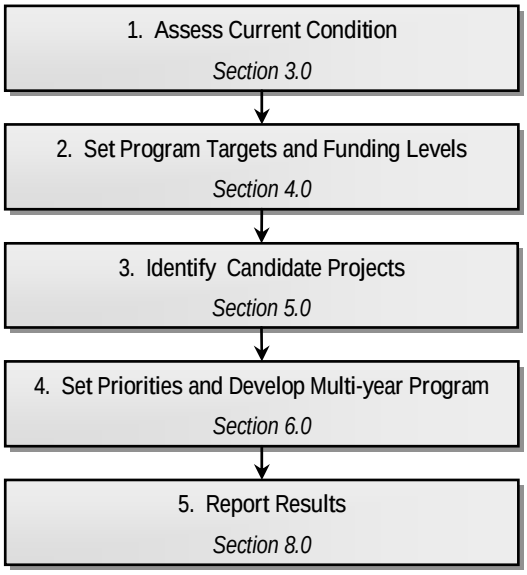
The core principles of asset management are:

- **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 Options and Tradeoffs** – 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 generalized resource allocation process illustrated in Figure 9.1.

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

Figure 9.1 Generalized Resource Allocation Process



9.1 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 TAMC 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 State Transportation Commission on a statewide asset management strategy and the necessary procedures and analytical tools to implement such a strategy on Michigan's highway system in a cost-effective, efficient manner.

In order to fulfill its statutory obligations, the TAMC 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.

9.2 TAKING ADVANTAGE OF EXISTING RESOURCES

A theme behind many of the ideas described in the guide is that you should look for opportunities to take advantage of existing resources. For example, the TAMC has developed standards for collecting and reporting on pavement and bridge condition data. The Council will reimburse your agency for the costs of collecting pavement data, and the bridge condition measures rely on data already being collected as part of the Federal National Bridge Inventory program. If you follow these guidelines 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. RoadSoft supports many steps in the resource allocation process illustrated above. It is distributed free of charge the Michigan Technological University. It has an active user community, and it uses the PASER data used by the TAMC for reporting purposes. 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 TAMC has developed a web-based system to facilitate the asset management reporting process. The system currently is operational, and agencies should be using it to enter data. 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 right fix at the right time in the right place. The end result is an optimal spending of transportation resources. Several organizations in Michigan have researched and promoted the use of a mix of fixes and capital preventive maintenance strategies to achieve this objective. For example, Michigan State University's National Center for Pavement Preservation offers a course on advanced pavement management, and MDOT estimates that $1 invested in capital preventive maintenance will save from $4 to $6 in future reconstruction costs. Your agency should draw upon these resources to help train your staff on the benefits of preventive maintenance and to help make the case for asset management to elected officials.

9.3 GETTING STARTED

Several of Michigan's cities and county transportation agencies, in one form or another, already are 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 start to identify opportunities for improvement.

Data Exercise. The Data Exercise in Appendix A was developed for the training course that accompanies this guide. It asks participants to determine the top five questions that need to be answered in order to allocate transportation resources effectively. Once these questions have been identified, participants are asked to identify data needed to answer these questions, potential data sources, and challenges collecting data that is not yet available. To support solid transportation investment decisions the asset management process requires good, consistent data about the condition of and service provided by existing infrastructure. The results of this exercise could serve as a blueprint for improving resource allocation at your agency.

Self-Assessment Exercise. The Self-Assessment Exercise in Appendix G 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 exercises described above are powerful tools that can help you on your way. However, 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 staff from your agency to learn more about the material presented in the guide from a trained instructor, discuss the implications for your agency, and formally complete all of the exercises in Appendix A. For information regarding the course, contact your metropolitan planning organization or regional planning organization.

9.4 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, performance-based?
- Can it be more efficient by considering options and tradeoffs?

- Can it be more effective by applying the right fix at the right time in the right place?
- Can it communicate better with its constituents and elected officials by setting performance goals and not 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. Implementing the essential individual pieces requires "bringing asset management home" to the front lines by focusing on the responsibilities of individual units and on the specific benefits of these activities. Eventually, a comprehensive transportation asset management program can be institutionalized throughout an agency as an improved "way of doing business." Achieving this environment requires a sustained and consistent commitment. This guide provides guidance on the initial steps required to tailor a systematic asset management improvement initiative for your agency. Many of these activities can be performed with the resources that you currently have, and all of them will help you build momentum for this support.

A. Training Course Exercises

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

You just bought a house that you are planning to live in for awhile. Assume that the house has all of the same characteristics as your own house, except where otherwise noted. There are several home improvement projects that you would like to complete over the next five years, in addition to routine maintenance activities. Your total budget for this work is $5,000 annually. You also have been preapproved for a home equity loan of $50,000. If you take out this loan, your payment will be $2,500 annually in future years (note that this is half of your annual budget).

Assignment

Review the list of projects listed below. Your assignment is to develop a list of specific projects that you would want to complete over the next five years. Some factors to consider in developing your project list include:

- The urgency of the project – Can it wait until next year?
- Return on your investment; and
- Your family's greatest needs and desires.

It also is important to budget any emergency repairs that could arise in the coming year.

Routine Maintenance

House Cleaning – $50 / month

Garden Care, Lawn Mowing, Snow Removal – $25 / week

Interior Painting – $100 / room

Chimney Sweeping – $100 / year

Window Washing – $100

Capital Preventive Maintenance

Roof Repairs – $1,000 (The roof is 18 years old and has a life span of 15 to 20 years. This work can add up to five years to its useful life. Replacing the roof would cost $5,000.)

Exterior Painting – $2,000 (the house was last painted 7 years ago; a high-quality paint job can last up to 10 years, but the quality of the existing paint is unknown.)

Repave Driveway – $1,500

Furnace Rehabilitation – $1,000 (The furnace is 13 years old and has a life span of 12 to 18 years. This work will delay replacement of the furnace for several years. Replacing the furnace would cost $4,000.)

Structural Improvement

Kitchen Renovation – $20,000

Bathroom Renovation – $10,000

Family Room Addition – $12,000

New Landscaping – $5,000

Swimming Pool – $10,000

Central Air Conditioning – $4,000

As you develop your list of projects, also consider the following questions:

- What is your vision for your house in five years? (Remember, you will still be living there in five years.)
- What factors are you using to make your decisions?
- Which factors matter more than others?
- What information do you need to make these decisions?
- Whose opinions must you consider?

BUDGET TEMPLATE

Year	Project	Cost	Notes

DATA EXERCISE

The goal of this exercise is to identify data needed to make resource allocation decisions for you agency's road network. A multidisciplinary team has been assembled to make sure several points of view are considered. The group contains representatives from the following groups:

- Engineering / maintenance staff;
- General management / finance staff; and
- Elected officials.

Assignment

1. Break into groups and assign roles. At least one person in each group should play each of the above roles.
2. Identify the top five questions that need to be answered in order to make resource allocation decisions. Example include:
   - How many miles of pavement and how many bridges are we responsible for?
   - What is the current condition of our pavements? Where are the worst roads?
   - How much are we currently spending?
   - What is our anticipated budget over the next few years?
   - What is the optimal mix of routine maintenance, capital preventive maintenance, and structural improvement investments based on our goals and objectives?
   - What projects are schedule for next year? Are you going to fix that dangerous intersection in my ward? Why are we spending money on pavements that look like they're in good condition?
   - Will our program save us money in the long run?
   - What impact will our program have on road conditions? How will it enhance our other objectives, such as economic growth, neighborhood enhancement, and quality of life?
3. Identify the information required to answer these questions. Identify existing data sources.
4. If there is no current source for a required type of data, list the challenges involved in collecting it?
5. Use the following template to record the results of your discussion.

DATA EXERCISE TEMPLATE

Question	Data Needs	Data Sources	Challenges
1.			
2.			
3.			
4.			
5.			

PROGRAM TRADEOFF EXERCISE

By implementing an asset management approach, your agency has attained relatively good road conditions. Funding for these programs currently is $180,000 annually.

The City Council/Township Board is now debating transferring funds from the general fund to the transportation budget. This transfer would increase your current transportation budget by a third. It would bring your agency's capital program funding up to $240,000 annually starting in 2006 and continuing through at least 2010. Your task is to help prepare a presentation to the City Council/Township Board to help make the case for this increase.

Because your agency has implemented an asset management process, it has information on historic funding levels and condition trends. It also has the capability to predict future conditions for various funding options. These capabilities are critical for you to be able to make your case to the City Council/Township Board.

Historical Funding and Performance

(Note: To simplify this analysis, all budgets are reported in constant dollars. Don't worry about inflation – simply use the dollar figures as given.)

Historical funding levels and observed performance measures for pavements and bridges are shown in Figures A.1 and A.2. These figures also indicate current performance targets.

A tabulation of funding levels in 1992-2005 is given in Table A.1.

Major Roads – Since 1992, annual funding levels for major roads have ranged from $85,300 to $120,000. Performance is measured in terms of the percent of the roads in good condition. While there is a lag between project completion and the next round of condition reporting, assume that the data in Figure A.1 has been adjusted so that the graph represents the resulting performance after all projects in that year have been completed.

Local Roads – Since 1992, annual funding levels for local roads have ranged from $42,700 to $60,000. Performance also is measured in terms of the percent of roads in good condition.

Impacts of a Potential Budget Increase

You have analyzed a number of scenarios to demonstrate the potential impact of a budget increase on major and local road preservation. The results of this analysis are summarized in Figures A.3 and A.4. These graphs show expected performance over time for various annual budgets. For example, if the funding level in 2005-2010 for pavements is $100,000 annually, then approximately 65 percent of major roads are expected to be in good condition in 2010. If the

funding is $180,000 annually, 80 percent of major roads are expected to be in good condition in 2010.

Assignment

Prepare "slides" (using flipcharts) that help make the case for the proposed budget increase. Include information on how the resources would be allocated if the transfer is approved? In addition, because there is still a chance that the transfer will not be approved, include at least one slide in your presentation that discusses what mix of investments you would propose if the budget was held constant, and what logic your team used to arrive at this strategy.

You will have 45 minutes to analyze the situation and develop your team's slides. Each team will have 5 minutes to present its case.

If you feel you need additional information to prepare an effective presentation, please indicate so on the slides and insert what you would regard as reasonable values.

Figure A.1 Historic Major Road Funding and Performance

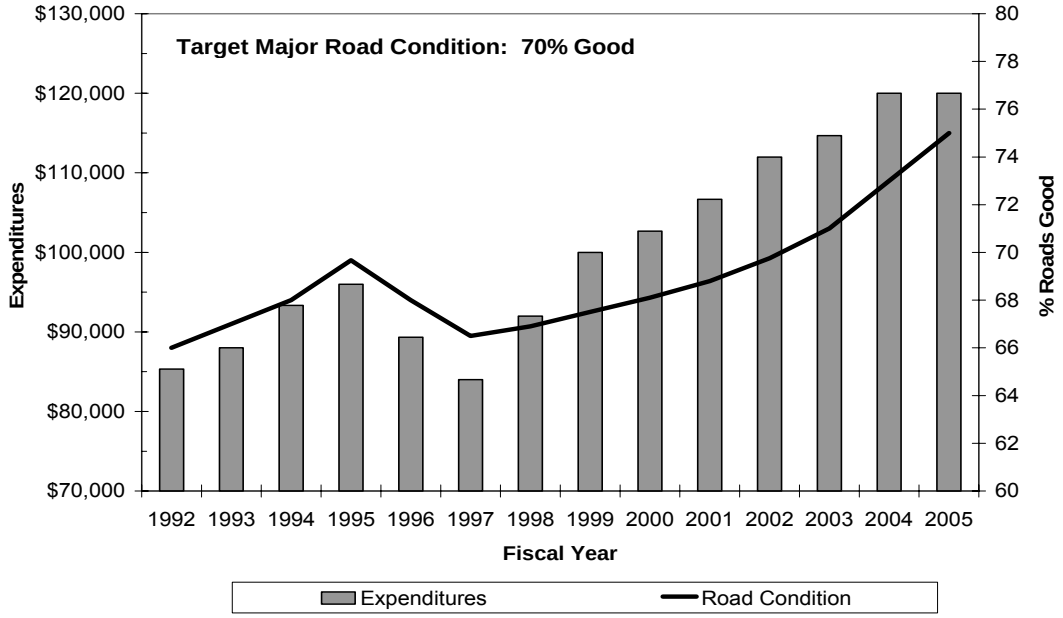


Figure A.2 Historic Local Road Funding and Performance

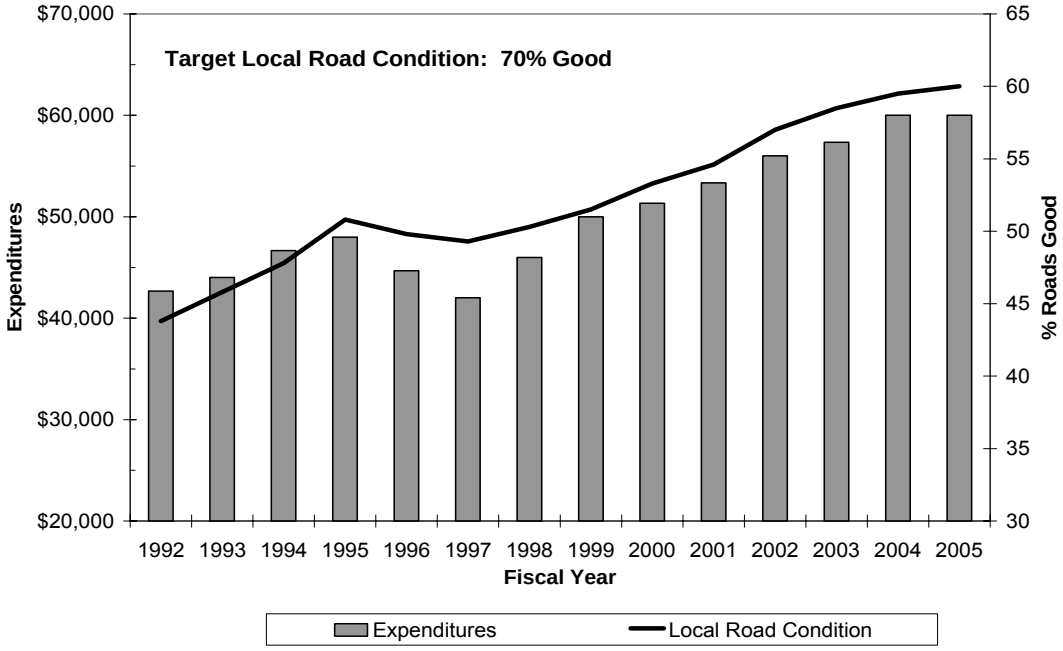


Table A.1 Annual Budget Levels (Thousands Dollars)

Year	Major Roads	Local Roads	Total
1992	85.3	42.7	128
1993	88.0	44.0	132
1994	93.3	46.7	140
1995	96.0	48.0	144
1996	89.3	44.7	134
1997	84.0	42.0	126
1998	92.0	46.0	138
1999	100.0	50.0	150
2000	102.7	51.3	154
2001	106.7	53.3	160
2002	112.0	56.0	168
2003	114.7	57.3	172
2004	120.0	60.0	180
2005	120.0	60.0	180

Figure A.3 Future Major Road Condition versus Annual Budget

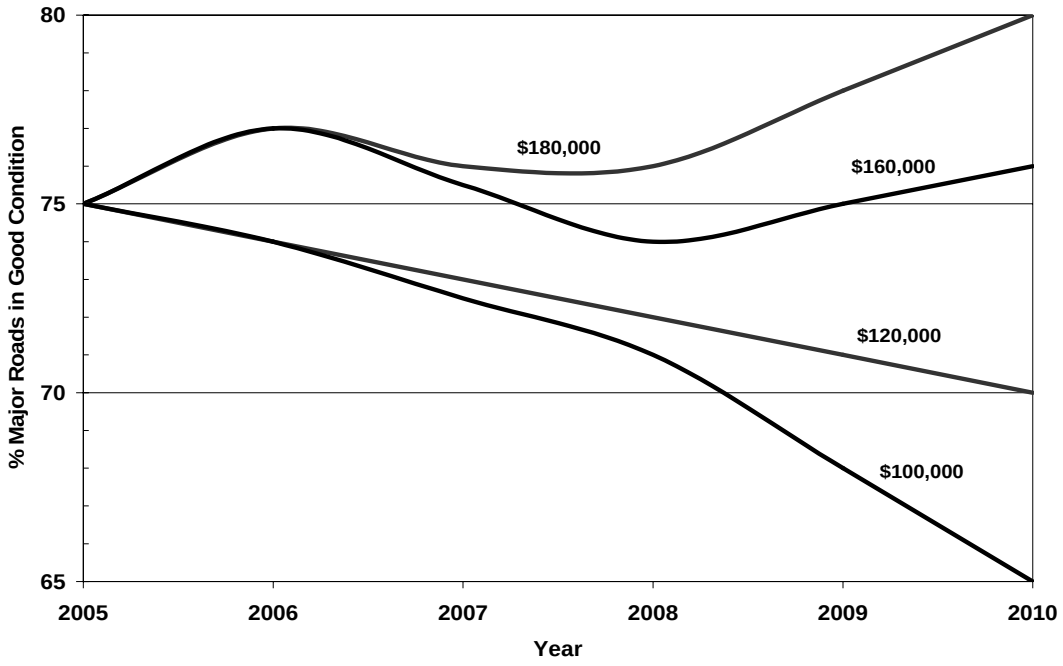
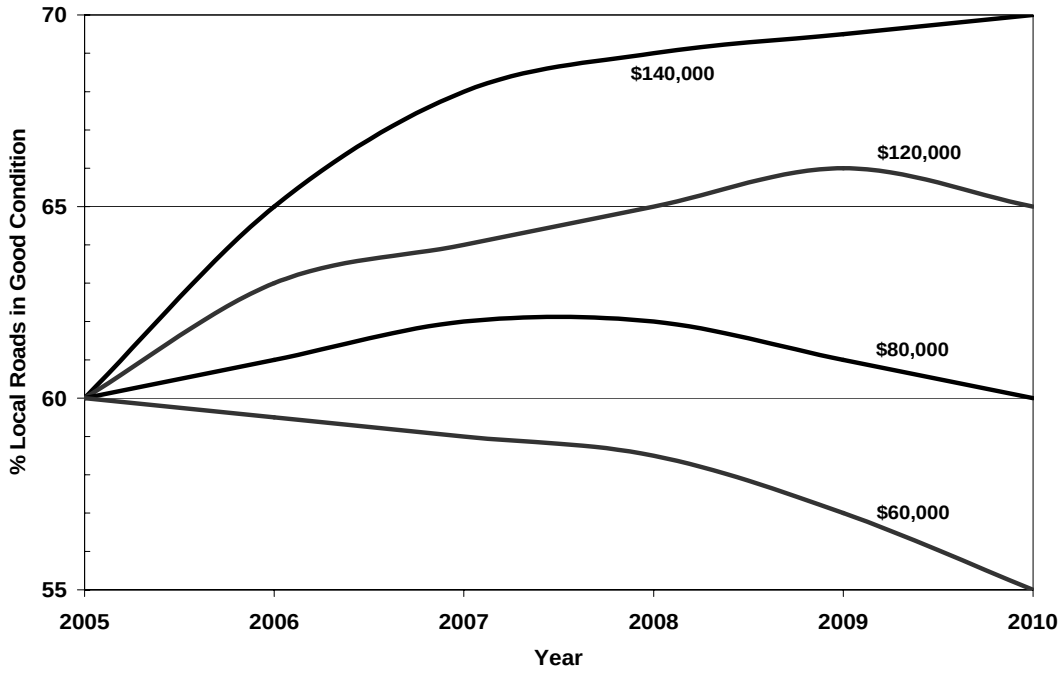


Figure A.4 Future Local Road Condition versus Annual Budget



B. Michigan's Asset Management Legislation

STATE TRUNK LINE HIGHWAY SYSTEM (EXCERPT) ACT 51 OF 1951

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. Nonvoting 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 nonvoting 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 Measures Used in Michigan

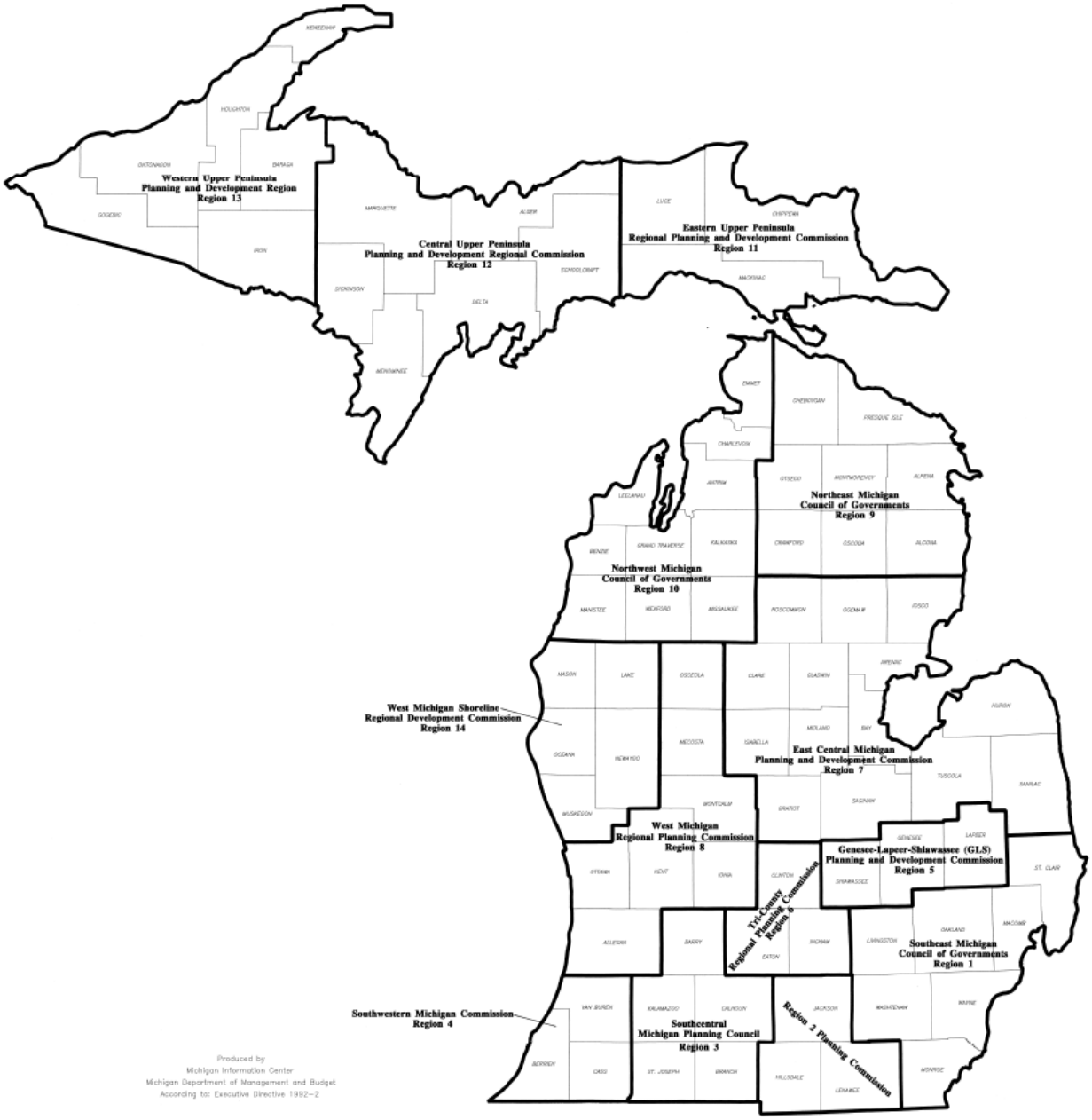
There are several valid options for measuring pavement condition. The following table describes a number of methods currently in use by local agencies in Michigan. Each of these has pros and cons, including the level of effort required for data collection, the ease with which it can be explained to nontechnical 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 Options

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.	Several
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



METROPOLITAN PLANNING ORGANIZATIONS

Insert map from following file: -2005 MAB_2.pdf

E. Detailed Default Unit Costs

Preliminary Pavement Unit Costs by Region – Compiled by MDOT

Item	Description	Unit	Region 1 and 2	Region 3, 4, and 5	Region 6 and 7
2050010	Embankment, CIP	Cyd	$4.30	$4.27	$2.55
2050011	Embankment, LM	Cyd	$8.63	$7.35	$5.23
2050016	Excavation, Earth	Cyd	$5.15	$2.98	$6.18
2050023	Granular Material, Cl II	Cyd	$6.70	$8.00	$6.64
2050024	Granular Material, Cl II	Cyd	$10.23	$10.23	$10.23
2050040	Subgrade Undercutting, Type I	Cyd	$4.98	$7.39	$4.91
2050041	Subgrade Undercutting, Type II	Cyd	$10.25	$11.89	$14.93
3010002	Subbase, CIP	Cyd	$6.87	$9.50	$8.51
3020008	Aggregate Base, 3 inch	Syd	$5.00	$5.00	$5.00
3020010	Aggregate Base, 4 inch	Syd	$3.49	$2.49	$3.02
3020012	Aggregate Base, 5 inch	Syd	$3.78	$3.19	$3.21
3020016	Aggregate Base, 6 inch	Syd	$4.07	$3.88	$3.39
3020018	Aggregate Base, 7 inch	Syd	$9.98	$9.98	$9.98
3020020	Aggregate Base, 8 inch	Syd	$4.45	$4.81	$11.01
3020022	Aggregate Base, 9 inch	Syd	$6.31	$6.31	$6.31
3020026	Aggregate Base, 10 inch	Syd	$5.37	$5.37	$5.37
3020028	Aggregate Base, 11 inch	Syd	$5.56	$5.56	$5.56
3020030	Aggregate Base, 12 inch	Syd	$5.74	$5.74	$5.74
3020050	Aggregate Base, Conditioning	Syd	$1.44	$0.65	$4.57
3030001	Open-Graded Dr Cse, 4 inch	Syd	$3.20	$3.27	$2.96
3037011	Open-Graded Dr Cse, 6 inch	Syd	$6.12	$6.12	$6.12
3037011	Open-Graded Dr Cse, 16 inch	Syd	$9.02	$9.02	$9.02
3030020	Geotextile Separator	Syd	$0.88	$0.83	$0.91
3040001	Rubblized Pavt Operation	Syd	$3.79	$1.24	$2.78
3050002	HMA Base Crushing and Shaping	Syd	$0.98	$1.04	$0.91
4040041	Underdrain, Pipe, Open-Graded, 4 inch	Ft	$3.10	$3.10	$6.44
4040043	Underdrain, Pipe, Open-Graded, 6 inch	Ft	$3.79	$3.57	$3.96
4040055	Underdrain, PDS, Open-Graded, 12 inch	Ft	$4.60	$4.60	$4.60
4040057	Underdrain, PDS, Open-Graded, 18 inch	Ft	$3.69	$2.81	$2.50
4040059	Underdrain, PDS, Open-Graded, 24 inch	Ft	$2.95	$2.95	$2.95
4040061	Underdrain, Subbase, 4 inch	Ft	$5.92	$3.78	$6.11
4040063	Underdrain, Subbase, 6 inch	Ft	$2.66	$4.46	$6.45
4040083	Underdrain, Subgrade, Open-Graded, 6 inch	Ft	$6.20	$6.20	$6.20
5020003	Cold Milling HMA Surface	Syd	$0.62	$0.95	$1.87
5020004	Cold Milling Conc Pavt	Syd	$2.04	$1.54	$6.14
5020015	Joint and Crack, Cleanout	Ft	$2.00	$1.38	$1.37
5020020	Pavt Joint and Crack Repr	Ft	$4.50	$4.78	$3.69
5020021	Pavt Joint and Crack Repr	Ft	$6.67	$3.64	$4.97
5020025	Hand Patching	Ton	$64.21	$35.34	$40.34
5020030	HMA, 2C	Ton	$33.47	$34.50	$31.05
5020031	HMA, 3C	Ton	$33.87	$41.20	$34.08
5020032	HMA, 4C	Ton	$34.50	$38.09	$35.24
5020033	HMA, 11A	Ton	$32.92	$32.82	$32.89
5020034	HMA, 13A	Ton	$32.92	$32.82	$32.89
5020035	HMA, 36A	Ton	$32.92	$32.82	$32.89
5020036	HMA, 36B	Ton	$32.92	$32.82	$32.89
5020037	HMA, 2E03	Ton	$32.92	$32.82	$32.89
5020038	HMA, 2E1	Ton	$37.75	$35.67	$34.18

Item	Description	Unit	Region 1 and 2	Region 3, 4, and 5	Region 6 and 7
5020039	HMA, 2E3	Ton	$36.00	$36.00	$36.00
5020040	HMA, 2E10	Ton	$37.60	$37.60	$37.60
5020041	HMA, 2E30	Ton	$34.00	$34.00	$34.00
5020042	HMA, 2E50	Ton	$42.50	$42.50	$42.50
5020043	HMA, 3E03	Ton	$32.92	$32.82	$32.89
5020044	HMA, 3E1	Ton	$37.75	$35.67	$34.18
5020045	HMA, 3E3	Ton	$39.68	$42.30	$39.47
5020046	HMA, 3E10	Ton	$35.51	$41.50	$37.50
5020047	HMA, 3E30	Ton	$42.00	$42.00	$42.00
5020048	HMA, 3E50	Ton	$42.50	$42.50	$42.50
5020049	HMA, 4E03	Ton	$32.92	$32.82	$32.89
5020050	HMA, 4E1	Ton	$38.04	$33.62	$32.15
5020051	HMA, 4E3	Ton	$36.43	$41.88	$41.97
5020052	HMA, 4E10	Ton	$42.11	$41.44	$37.92
5020053	HMA, 4E30	Ton	$42.81	$42.81	$42.81
5020054	HMA, 4E50	Ton	$43.64	$43.64	$43.64
5020055	HMA, 5E03	Ton	$35.35	$35.35	$35.35
5020056	HMA, 5E1	Ton	$38.46	$33.91	$35.27
5020057	HMA, 5E3	Ton	$41.23	$39.88	$44.49
5020058	HMA, 5E10	Ton	$36.61	$44.40	$40.35
5020059	HMA, 5E30	Ton	$44.19	$43.58	$47.62
5020060	HMA, 5E50	Ton	$43.64	$43.64	$43.64
5027031	Gap-Graded Superpave	Ton	$53.80	$53.80	$53.80
5027031	HMA Separator Layer	Ton	$27.80	$27.80	$27.80
5020061	HMA Approach	Ton	$52.34	$53.35	$67.38
6020100	Conc Pavt, Nonreinf, 6 inch	Syd	$12.24	$12.24	$12.24
6020101	Conc Pavt, Nonreinf, 6 1/2 inch	Syd	$13.26	$13.26	$13.26
6020102	Conc Pavt, Nonreinf, 7 inch	Syd	$14.28	$14.28	$14.28
6020103	Conc Pavt, Nonreinf, 7 1/2 inch	Syd	$15.30	$15.30	$15.30
6020104	Conc Pavt, Nonreinf, 8 inch	Syd	$16.32	$16.32	$16.32
6020105	Conc Pavt, Nonreinf, 8 1/2 inch	Syd	$17.34	$17.34	$17.34
6020106	Conc Pavt, Nonreinf, 9 inch	Syd	$18.36	$18.36	$18.36
6020107	Conc Pavt, Nonreinf, 9 1/2 inch	Syd	$27.00	$27.00	$27.00
6020108	Conc Pavt, Nonreinf, 10 inch	Syd	$23.48	$23.48	$23.48
6020109	Conc Pavt, Nonreinf, 10 1/2 inch	Syd	$19.95	$19.95	$19.95
6020110	Conc Pavt, Nonreinf, 11 inch	Syd	$19.72	$19.72	$19.72
6020111	Conc Pavt, Nonreinf, 11 1/2 inch	Syd	$24.85	$24.02	$25.91
6020112	Conc Pavt, Nonreinf, 12 inch	Syd	$18.68	$18.41	$19.04
6027011	Conc Pavt, Nonreinf, 12 1/4 inch	Syd	$15.60	$15.60	$15.60
6027011	Conc Pavt, Nonreinf, 12 1/2 inch	Syd	$19.10	$19.10	$19.10
6020150	Conc Pavt, Ovly, Finishing and Curing	Syd	$3.84	$3.84	$3.84
6020151	Conc Pavt, Ovly, Furnishing and Placing	Cyd	$44.50	$44.50	$44.50
6020200	Joint, Contraction, Cp	Ft	$6.32	$4.83	$8.19
6020201	Joint, Contraction, C3p	Ft	$4.11	$2.20	$6.00
6020202	Joint, Contraction, C	Ft	$13.52	$13.5	$13.52
6020204	Joint, Contraction, C3	Ft	$7.00	$7.00	$7.00
6030015	Diamond Grinding Conc Pa	Syd	$4.14	$8.09	$5.85
6030038	Pavt Repr Operation	Ea	$1,152.23	$1,152.23	$697.73

Template for Developing Bridge Cost Estimates

An electronic version of this template and a list of unit cost assumptions is available on MDOT's web site: www.michigan.gov/mdot/0,1607,7-151-9625_24768_24772-,00.html

Work Item	Quantity	Units	Unit Cost	Total
New Bridge				
Multiple spans, Concrete (add demo and road approach and traffic control)		SFT	$110.00	
Multiple spans, Steel (as above)		SFT	$145.00	
Single span or over water (as above)		SFT	$145.00	
Pedestrian Overpass (abutment to abutment) (includes demo, add traffic control)		SFT	$215.00	
Other				
New Superstructure				
Concrete (includes removal of old super and new railing, add traffic control and approach)		SFT	$75.00	
Steel (as above)		SFT	$110.00	
Over Water (add to new superstructure cost)		SFT	$20.00	
Other				
Widening				
Added portion only. _____ feet of width (add road approach widening)		SFT	$145.00	
Other				
New Deck				
Includes removal of old deck and new railing (add traffic control and approach)		SFT	$42.00	
Other				
Demolition				
Entire bridge, grade separation		SFT	$24.00	
Entire bridge, over water		SFT	$28.00	
Other				
Superstructure Repair				
Concrete Deck Patch (includes hand chipping)		SFT	$40.00	
HMA Cap (no membrane – add bridge rail, if required)		SFT	$1.50	
HMA Overlay with WP membrane (add bridge rail, if required)		SFT	$4.50	
Removal of Concrete Wearing Course or HMA Overlay		SFT	$1.00	
Epoxy Overlay		SYD	$42.00	
Shallow Overlay (includes joint replacement and hydro, add bridge rail, if required)		SFT	$17.00	
Deep Overlay (includes joint replacement and hydro, add bridge rail, if required)		SFT	$18.00	
PCI Beam End Repair ($2,000-$4,000 per beam end)		EA	$3,000.00	
Repair Structural Steel (per beam end)		EA	$6,400.00	
Paint Structural Steel		SFT	$7.00	
Partial Painting		SFT	$10.00	
Pin and Hanger replacement (includes temporary supports)		EA	$4,800.00	
Other				

Work Item	Quantity	Units	Unit Cost	Total
Substructure Repair				
Pier repair (measured x 2) Replace unit if spalled area > 30 percent		CFT	$180.00	
Pier repair over water (measured x 2)		CFT	$200.00	
Pier replacement		CFT	$50.00	
Abutment repair (measured x 2)		CFT	$180.00	
Temporary Supports for Substructure Repair		EA	$1,500.00	
Slope Protection repairs		SYD	$60.00	
Other				
Miscellaneous				
Expansion or Construction Joints (includes removal)		FT	$380.00	
Bridge Railing, remove and replace		FT	$135.00	
Thrie Beam Railing retrofit		FT	$24.00	
Deck Drain Extensions		EA	$200.00	
Scour Countermeasures		LSUM		
Other				
Roadwork				
Approach Pavement, 9 1/2" RC (add C & G, GR, Slope, Shldr.) 40' each end		SFT	$9.00	
Approach Curb and Gutter (18' each quad.)		FT	$35.00	
Guardrail Anchorage to Bridge (<40')		quads	$1,200.00	
Guardrail, Type B or T (beyond GR anchorage to bridge, <200')		FT	$15.00	
Guardrail Ending (end section)		EA	$1,430.00	
Roadway Approach work (beyond approach pavement)		LSUM		
Utilities		LSUM		
Other				
Traffic Control				
Part Width Construction		LSUM		
Crossovers		EA		
Temporary Traffic Signals		set	$15,000.00	
RR Flagging		LSUM		
Detour		LSUM		
Other				
Contingency (10 to 20 percent) (use higher contingency for small projects)		%		
Mobilization (Five percent maximum)		%		
Inflation (assume three percent per year, beginning with 2005)		%		
CONSTRUCTION TOTAL (does not include PE and CE)				

F. TAMC Reporting Categories

In order to maintain consistent reporting of planned and actual work throughout the State, the TAMC has approved a list of categories to be used for the Record of Work and Multi-Year Program. Following is a list of reporting categories approved by the TAMC. The following descriptions are consistent with the categories presented in the TAMC's 2004 Annual Report.

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 where 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 with 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 a capital preventive maintenance activity 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 or 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 nonstructural overlays;
- Bituminous shoulder ribbons;
- Ultrathin overlay;
- Full depth concrete;
- Partial depth concrete pavement repairs;
- Cape seal, slurry seal, 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 where 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 where 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:

- Installation of new culverts, wash checks, baffles, drains, sewers, and catch basins on old or new roads or streets;
- Adding 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 upgrading;
- 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.

G. 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 nontraditional 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.				

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 – Northeastern 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