



**TRANSPORTATION ASSET
MANAGEMENT FOR LOCAL
GOVERNMENT AGENCIES:
THRESHOLD LEVELS AND
BEST PRACTICE GUIDE**

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Executive Summary

The Federal Highway Administration defines transportation asset management as "a systematic process of operating, maintaining, and upgrading infrastructure cost-effectively." The objective of this report is to help county and municipal-level agencies implement transportation asset management techniques. The report represents a synthesis of the current literature on asset management relevant to local governments as well as a significant contribution to the subject. The report represents an important reference and resource for local government agencies and functions as a synthesis by:

- reviewing and re-presenting the concepts, strategies and tools of asset management,
- identifying other important transportation asset management references and resources for local agencies, and
- documenting the successful implementation of asset management techniques by local governments.

The report makes important new contributions to the field by:

- identifying strategies, such as coordinated maintenance and group purchasing, particularly important for asset management at the local level,
- reviewing commercially available software tools,
- recommending standards of practice for agencies of various sizes, and
- identifying future work important to advancing the state of the practice of asset management at the local government level.

The report was based upon an extensive review of both the academic and professional literature, including online/web resources; a review and meta-analysis of surveys of local agencies on the topic of transportation asset management supplemented by a new, limited survey; a survey of software vendors providing asset management software to county and municipal governments; and the input of practitioners and experts in the field.

The study identified five key factors in successful asset management at the local level. These factors were budget and support, coordinated maintenance, interagency cooperation, data collection, and technology. While some of these factors, such as data collection and budget, have long been recognized as crucial issues in asset management, others, such as coordinated maintenance and interagency cooperation, take on a special significance for local government agencies. The importance of efficiency gains from computer technology were also explored in some depth. In general, the study found that strategies for operational efficiency are of particular importance at the local level and good asset management should not be reduced to optimal resource allocation with adequate preventative maintenance.

The report also establishes standards of practice for agencies depending on whether their population served was small (less than 10,000 persons), medium (10,000 to 100,000 persons), or large (over 100,000 persons). These thresholds of practice distinguish techniques that should comprise a norm of basic asset management for an agency of a given size from other advanced or best practices which may also prove valuable but are not necessarily as essential. This scheme should assist agencies in identifying where their asset management practices may be deficient and help them prioritize their efforts to improve.

In general, however, the key finding of this study, which is reflected in the thresholds, is that most asset management strategies and tools can be fruitfully applied by local agencies almost regardless of size. The magnitude of the potential payoff and the cost of implementation reduce the urgency of some practices for agencies of a particular size, distinguishing best practices from more basic practices which should form a standard. However, most techniques promised at least some significant benefit to agencies of any size.

Advanced tools and techniques, such as commercially available GIS-based management software, are used and praised even by small local agencies in places like Rupert, ID (pop. 5,645) and Ionia, MI (pop. 10,569). Small communities such as Ionia and Alcona County (pop. 11,719) in Michigan have managed to engage in preventive maintenance despite meager budgets. A survey conducted for the Midwestern Regional University Transportation Center by Wittwer (2003) found that as many as 45% of local

government agencies are using laptop computers in data collection and that one in five are using laser devices. The evidence suggests that it is not size or resources but lack of interest and institutional barriers that fossilize the status quo and prevent wider adoption of many asset management techniques.

Education therefore remains of critical importance in promoting good asset management practices among local government agencies. This report endeavors to advance that task by presenting the basic and advanced practices of transportation asset management for local government and providing examples of local agencies across the country that have successfully adopted these practices and the benefits they have experienced. The report concludes by identifying important ongoing and future efforts to provide research and educational literature, appropriate regulatory requirements, training opportunities and standard tools to assist local agencies and help them improve their practice of asset management.

Part I Concepts

Chapter 1: An Overview of Asset Management

1.1 Introduction

The purpose of this guide is to introduce the concepts, strategies and tools of asset management as they might be useful for small agencies responsible for the planning, operation and/or maintenance of transportation infrastructure. The goal is that this report will help small agencies both learn more about asset management and take practical steps to apply it. The guide should also be helpful in documenting the state of the practice of asset management for small agencies, identifying other potentially valuable resources for transportation asset management available to small agencies, and relating some applications of asset management techniques that have proved especially fruitful for some small agencies.

1.2 The Science of Management

One does not have to look outside the realm of transportation to see the incredible impact that innovative strategies and tools can offer.

Perhaps the most famous of all examples of good management is Ford Motor Company's assembly line. When Henry Ford, with the help of Fredrick Taylor, the founder of 'scientific management,' implemented the first assembly line in 1913, the efficiency gain allowed Ford to produce automobiles at a previously unimaginable rate and dramatically lower cost. The assembly line was essentially a simple organizational strategy. It did not require significant new equipment or personnel. The same, or even fewer, less skilled workers could build the same Model T's that Ford had been building since 1907 in a fraction of the time.

As government agencies are facing increasing pressure to do more with less, this guide attempts to outline strategies which, like Ford's assembly line, are capable of resulting in the kinds of dramatic productivity gains to make it possible to meet these challenging demands. The assembly line demonstrates how new technologies and equipment are not always necessary to increase productivity. Sometimes simply changing the way in which things are done can have tremendous effects.

If strategies like Ford's can produce impressive results alone, the same can be said for technology, like Ford's product. The reduction in the cost of travel that was brought about by the automobile transformed society. It not only replaced streetcars and horse-drawn carts, it allowed people amazing new choices of where to live, work, shop, recreate and do business. The increased efficiency of travel lowered the cost of almost all consumer goods which required transportation. It made the contemporary consumer economy possible.

More recently, beyond just transportation, the productivity gains made possible by computers have offered another dramatic example of the potential savings possible from new technologies. Computer technology, in the form of specialized software, also offers tremendous possible efficiency gains for small transportation agencies. This guide reviews a range of software tools currently available to facilitate transportation asset management. Sometimes having the right tool for a particular job can make all the difference.

Ultimately, the greatest gains in productivity and efficiency are accomplished when the right strategy and the right tools are both brought together to achieve an end. Private sector examples like Wal-Mart and Federal Express have begun to inspire public agencies like Ionia, Michigan, and Columbia, Missouri. This guide also relates the experiences of several small agencies that have adopted improved management techniques and tools, so that other agencies can see how they, too, can take concrete steps toward greater efficiency.

1.3 Valuing Assets

This guide presents strategies and tools based on good management science applied to the task of managing transportation assets or infrastructure. This task cannot be considered narrowly as simply the work of maintaining existing infrastructure, although these activities are central to asset management. The task of managing transportation assets also incorporates the balancing of system preservation and capacity expansion, the coordination of activities with other government agencies and private firms, and the application of good business practices to the agency's own work.

The perspective of asset management that informs the coordination of all these activities is firmly rooted in an understanding of the real value of transportation

infrastructure and the service that it provides to the public. In fact, the origins of the term asset, speak to this crucial insight. The word comes from the Latin phrase *ad satis*, which means *sufficiency*, and came to be used by the accounting profession to refer to real property *sufficient* to offset liabilities or debts held by an organization. The recognition of the value of transportation infrastructure and its consideration as an asset, while still a new and different perspective for many, is not simply an academic or theoretical exercise, but of real and growing importance through initiatives such as Governmental Accounting Standards Board

The goal of transportation asset management can be understood in this context as maximizing the real value added to its assets that the public receives from its investment of tax dollars in transportation, or conversely, as minimizing the cost required to provide a certain level of service to the traveling public.

Statement 34 (GASB34) and the interest of investment firms that compute bond ratings for municipalities and other government agencies. The goal of transportation asset management can be understood in this context as maximizing the real value added to its assets that the public receives from its investment of tax dollars in transportation, or conversely, as minimizing the cost required to provide a certain level of service to the traveling public. In this way, the job of managing a transportation agency is not different from an investment banker who works to maximize the return on his client's investments or the value of their portfolio.

This broad, economic perspective has grown historically out of the management of a single asset: pavement. While pavement management still figures prominently, transportation asset management has come to embrace the coordinated management of many other transportation assets including bridges and other structures, pavement

The greatest productivity gains or increased asset value is possible only from the broadest consideration of potential subjects for improvement.

markings, signs, ditches, guardrails and barriers, traffic signals, street lights, sidewalks, transit vehicles or rolling stock, transit guideways / structures / right-of-ways, and vehicle detectors and other Intelligent Transportation System (ITS) equipment. Good management of these assets,

however, also considers the management of the activities and personnel that support these

assets. Remembering Ford’s assembly line, it is easy to imagine circumstances in which the greatest potential for added value to infrastructure assets would come not from different maintenance techniques or better project selection, but simply from better management of maintenance workers or an innovative way of reorganizing their work. The greatest productivity gains or increased asset value is possible only from the broadest consideration of potential subjects for improvement. One of the more important findings of this study, which illustrates this point, is that coordination with the management of other non-transportation assets, especially water and sewer lines, communications infrastructure and other underground utilities in the public right-of-way, is one of the most promising strategies for increasing the value of local transportation assets.

1.4 Success on a Large Scale

The application of management science to the government’s task of managing transportation infrastructure assets began in earnest in the mid-1990s with a series of workshops co-sponsored by the American Association of State Highway and Transportation Officials (AASHTO) and the Federal Highway Administration (FHWA). The first of these workshops, in September of 1996 in Washington, D.C., began to establish asset management as a way of thinking about the way the government goes about its business and how it might do this better. The workshop led to a definition of transportation asset management as “a systematic process of operating, maintaining, and upgrading physical assets cost-effectively,” and added, “It combines engineering and mathematical analyses with sound business practice and economic theory.”

FHWA – AASHTO

Definition of Asset Management

“Asset Management is a systematic process of operating, maintaining, and upgrading physical assets cost-effectively. It combines engineering and mathematical analyses with sound business practice and economic theory.”

The community of practice that grew out of these workshops quickly began to produce both literature documenting their new ideas and experiences and real tangible results. Most of the members of this community of practice were officials from FHWA and state transportation agencies. However, the success of the asset management movement at the state and federal levels has naturally led to new efforts, including this

- Asset Management Success Stories -

Asset Management enabled several agencies to obtain additional funding:

- Jackson County, Missouri, obtained a 30-percent “add back” to budget as a result of asset management information.
- Wisconsin DOT used asset management data to justify a funding request that would result in current conditions being maintained.
- Michigan DOT used a road quality forecasting system to justify an increase in pavement preservation funding.
- Asset management information supported the need for a gas tax increase that was approved recently in Ohio.

Asset management practices produced notable system condition improvements:

- The share of poor pavement in Michigan has been reduced by 11 percent since 1996, and the average remaining life has increased by 26 percent.
- Jackson County, Missouri, has seen a shift from 70 percent of all roads in poor or fair condition in 1992 to 75 percent of all roads currently in fair to excellent.

study, to extend, introduce and encourage the practices of good asset management at the local government level.

The success of renewed and more critical thinking about the way government manages public assets among states and a few early adopting local agencies provides ample motivation for more and smaller local agencies to seriously examine the strategies and tools that proven their value for larger agencies. A recent Transportation Research Circular in 2005 documented how improved asset management had both enabled agencies to obtain additional funding and produce notable improvements in their systems’ conditions (see Table 1). These results amount to great promise for the wider application of asset management techniques at the local government level.

Table 1: Summary of Benefits to Jackson County, MO

Past Methods (1992)	Current Methods (2004)
70% of all roads in poor and fail condition	75% of all roads are in fair to excellent condition
102 people work in maintenance division	70 people work in maintenance division
520 accidents every year	250 accidents every year
800 complaints every year	300 complaints every year
Always have budget problems	Transfer \$1,000,000 every year from maintenance to capital improvement
5% of total maintenance budget is used for preventative maintenance	60% of total maintenance budget is used for preventative maintenance

From “Asset Management in Planning and Operations: A Peer Exchange,” Transportation Research E-Circular, E-C076

1.5 Small Agencies Making Sense of the Big Picture

This guide has been written specifically for small agencies, such as municipal and county governments and their transportation agencies. While much of what has been written on transportation asset management in other contexts may be valuable to small agencies, the focus has often been on state departments of transportation and other large agencies facing significantly different challenges, with significantly different resources. However, over 75% of the nation's nearly 4 billion miles of roadway and over half of its nearly 600,000 bridges belong to county and municipal governments. If the goal is good management of the nation's transportation assets, the tools and techniques of asset management must be brought to the small agencies responsible for managing the majority of the nation's transportation assets.

Over 75% of the nation's nearly 4 billion miles of roadway and over half of its nearly 600,000 bridges belong to county and municipal governments.

This guide presents a variety of both strategies and tools to help small agencies in the task of managing their transportation assets. However, the first aid the guide offers is a conceptual framework for understanding this task itself. This framework will be used to organize the management strategies presented in the guide but is also of value in helping to untangle the key components of the job of transportation asset management which can easily become obscured at the level of practice by the definitions of the various organizations and programs involved.

The model of transportation asset management presented in this guide is structured around the basic questions that must be answered in any coherent attempt at transportation asset management. These are the six basic questions used to structure the process of asset management:

- What are we trying to do?
- How are we doing?
- Can we do better?
- What are we doing?
- How are we doing it?
- How do we know?

If an agency cannot answer these fundamental questions, it cannot effectively manage the public's assets. The quality of an agency's answers to these questions is a good measure of the quality of its asset management practices.

The process of answering these questions defines and clarifies the work of asset management. The process is not linear, but cyclical in nature, with the answer to any question relying on the answer to one or more of the other questions. This is reflected in the fact that the work of transportation asset management is continuous. It is never accomplished, but always in progress. The process of asset management, as conceived through the lens of these fundamental questions, is depicted in Figure 1. The complexity

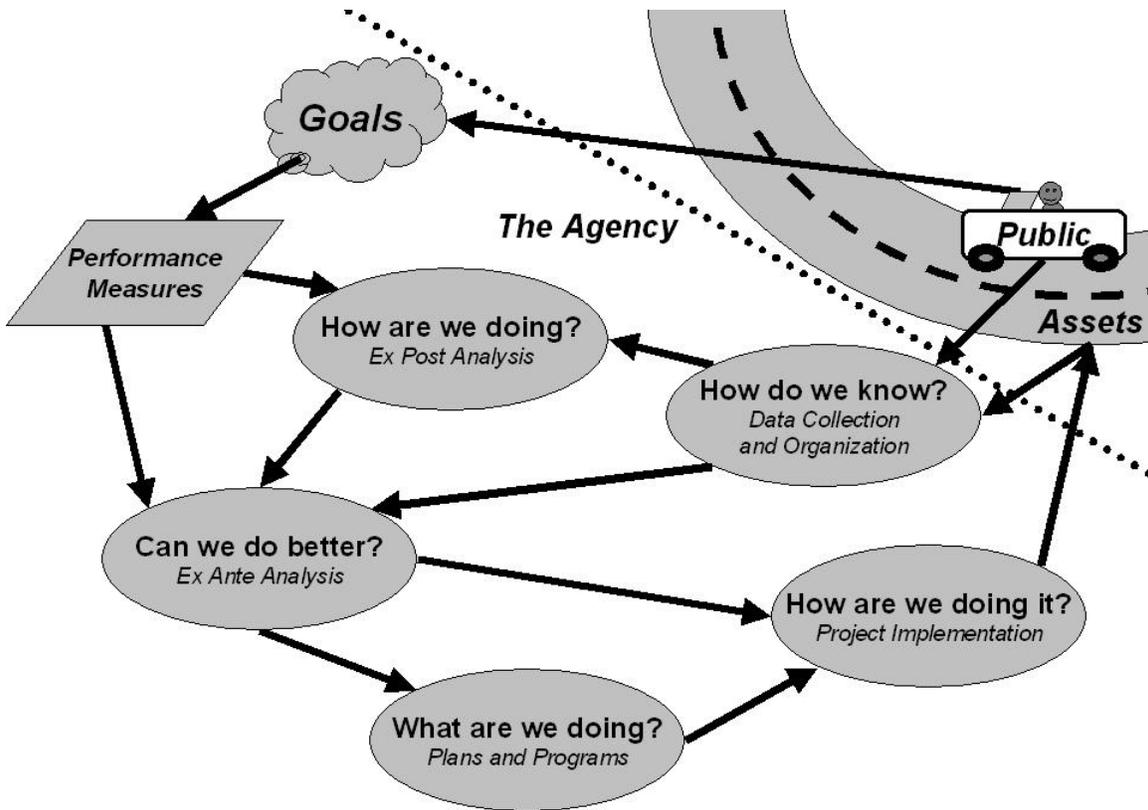


Figure 1: Conceptual Model of Transportation Asset Management

of the figure reflects the complexity of the real process, but can help to relate the key components in the process.

The whole process is driven by policy goals and associated performance measures that answer the question, “What are we trying to do?” The goals come from the public, either directly through their involvement in the process or through their elected and appointed representatives. The goals, once expressed concretely through performance

measures, become the standard with which the agency can evaluate the questions, “How are we doing?” and “Can we do better?”

Perhaps the most neglected question, “How are we doing?” is crucial to process. It provides accountability, gives context and reality to the question “Can we do better?” and allows the agency to learn from its experiences.

The question “Can we do better?” lies at the heart of asset management. Grounded in good data and a realistic appraisal of the status quo and directed by the policy goals of the agency, in the process of answering this question the agency evaluates what is being done and how it is being done, making improvements where possible. The questions “What are we doing?” and “How are we doing it?” follow naturally from the question “Can we do better?” and lead to new or renewed plans and programs and reexamined methods of project implementation.

The whole process is supported by good data collection and organization, which is necessary to answer the question “How do we know?” Data must be collected not only on the conditions of the assets themselves and the level of service they provide, but also from the public who use them.

The first part of this guide, which presents management strategies, is organized using this framework. Strategies to help small agencies answer each question better are examined in different chapters. Software tools designed to help agencies answer one or more of the questions, as well as references and resources providing more information, are presented in the second part of the report. The third part offers real world examples of how some of these strategies and tools have been applied by small agencies, while the fourth and final part presents the findings of this study of transportation asset management for small agencies.

Part II Strategies

Chapter 2: What are we trying to do? Policy Goals and Performance Measures

2.1 The Articulation of Policy in Goals

Different agencies, operating under different charters and legislation, have differing abilities to determine or influence their policy goals. The policy or policies that direct an agency may be expressed in a variety of ways, implicitly or explicitly, in legislation, executive directives, mission statements and/or goal statements. However, all agencies have policy goals, imposed or self-determined, implicit or clearly articulated.

In a framework of good asset management, all of an agency's activities, not just planning decisions, are guided by and evaluated against the agency's policy goals. It is therefore essential that an agency articulate its policy goals in a way that makes them meaningful and useful in directing the activities and decisions of the agency. Even in cases where legislation or other documents will, of necessity, remain the definitive expression of a policy, this does not mean the policy cannot be rearticulated in a goal statement that is readily understandable and useful to its application in practice.

Basic Definitions:

- **Goals** are statements that define the basic aim of a policy.
- **Objectives** are specific aspects of goals to be attained.
- **Performance measures** are observable, quantifiable measures that align with objectives.
- **Performance targets** are specific values of performance measures that provide the level expected to be obtained.

from Transportation Asset Management Guide

2.2 Goals that Work

There are a number of important considerations in what constitutes a good policy goal or set of goals. An agency's set of policy goals together must accomplish three things. First, they must faithfully incorporate all legislative, regulatory or executive mandates with which an agency has been charged. Second, they should clarify the agency's fundamental responsibilities to its customers and owners, the public. And finally, they should establish clear priorities among the agency's various goals and objectives. It may

be helpful to organize the agency's goals in a hierarchical structure or to rank them in importance.

Goals should ideally be oriented toward the attainment of some performance objective directed towards serving the public, such as reducing travelers' delay or motor vehicle crashes or vehicle emissions. They should, in this way, be broad enough to allow for creativity in how they might be achieved. Although they are sometimes imposed on an agency, where possible, agencies should avoid goals that prescribe a method for fulfillment, such as to reduce travelers' delay by adding roadway capacity or to improve pavement quality by repaving roads more frequently.

2.3 Measuring Attainment

It is essential to the ability of goals to actually direct the decisions of an agency that goals, or their objectives, be tied explicitly to quantifiable performance measures which

Example:

- **Goal:** It is a goal of Town of Example to improve existing pavement conditions.
- **Objectives:** Provide motorists with a more comfortable ride, improve safety, increase the value of its transportation assets, etc.
- **Performance measures:** PASER pavement ratings
- **Performance targets:** Increase the percentage of lane miles rated at 6 or higher to 80% by 2015. Reduce by half the number of lane miles rated 3 or lower by 2010.

will allow the agency to evaluate the goal or objective's level of attainment. Moreover, the goal or objective does not reach its full usefulness until is expressed with performance targets. Performance measures should be meaningful at both an aggregate system level as well as at an individual project level, either by adding or averaging. Performance targets should be based on actual present performance levels and take proper account of funding in order to assure realism.

In addition to providing accountability and lending transparency to the process, the identification and development of performance measures and targets to quantify the attainment of

policy goals allows these policy goals of an agency to be used to direct the activities of the agency.

Chapter 3: How are we doing? Accountability, Objectivity & Learning

3.1 Self-Awareness

Sometimes fundamental insights are as important as the latest research. The wisdom of the ancient Greek maxim, “Know thyself,” attributed to Socrates, is not to be lost today. One of the greatest challenges of transportation asset management today is the need for agencies to know and understand their own operations and performance. This goes beyond the challenge of data collection. Good management requires not only that an agency can provide an inventory of its assets and their condition, but that the agency understands the state of the system in its care reflected in the data. The well managed agency can clearly connect the agency’s own expenditures, activities and programs to the challenges revealed by their data, and identify and articulate trends in the state of the system and the agencies own operations. Agency managers that do not know, offhand, how well their agency is doing cannot be maximizing their efficiency and effectiveness.

Many agencies operate with little corporate memory of their activities and how things have improved or deteriorated over time. Agencies like this are like animals that are not fully self-aware. The goal of good asset management is that agencies operate not instinctively and reactively like animals, but with the self-awareness – the memory, reasoning and planning – of which humans are capable.

This short chapter is included in order to emphasize the need for corporate self-awareness on the part of transportation asset management agencies and on basic strategies for achieving it.

3.2 Annual/Quarterly Reports

One of the most basic tools for improving the self-awareness and self-understanding of an agency are regular annual or quarterly reports. The practice of producing such reports is standard in the private sector, but much more uncommon in the public sector, especially at the local government level. However, the wisdom and utility of the practice which motivates its use in the business world apply equally well in the public sphere. The investment of resources in producing such reports is not a waste, but a real

investment of potentially great value when it communicates information clearly, as in Figure 2.

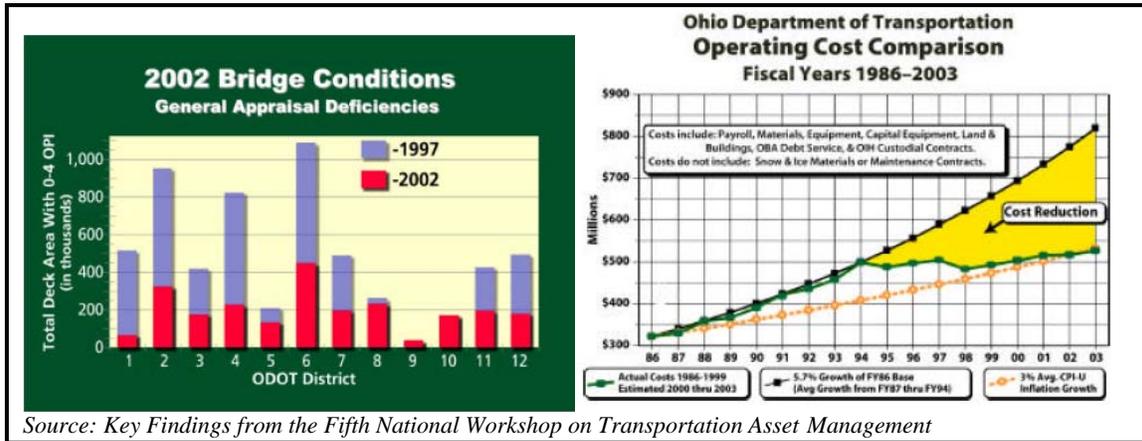


Figure 2: Examples of Costs and Asset Conditions from an Ohio DOT Report

An annual or quarterly report is not simply a document of financial accounting, but a report on the activities, challenges and accomplishments of the organization. Agencies already face many reporting requirements from accounting standards such as GASB 34, to the National Bridge Inventory System or state conditions reporting legislation in states like Michigan and Wisconsin. However, the challenge of producing an annual or quarterly report is to produce a synthesis. Reports should include some financial accounting of the expenditures of the organization, but they should present these in the context of what needs these expenditures address and what these expenditures are accomplishing. The report of an agency responsible for maintaining transportation infrastructure should include a tracking of agency expenditures along with a tracking of system conditions, making use of the performance measures identified by the agency for quantifying the attainment of its goals. Ideally, an annual report would break out the agencies costs not only in terms of personnel, equipment and materials but also on spending associated with preventative maintenance, planned corrective maintenance, and unplanned/emergency maintenance. It should compare the network conditions, in terms of the number of signs

From the “Key Findings from the Fifth National Workshop on Transportation Asset Management”

“Many county officials noted that the availability of asset management information improved the understanding of their boards in making decisions, often protecting needed funding for maintenance and operations.”

and signals and miles of pavement and ditches in various conditions, with the corresponding numbers for the previous year. It should record the activities of the agency over the time period, the miles of pavement resurfaced, the number of signs replaced, the number of service requests answered, etc., highlighting special or major projects.

A report with this sort of meaningful content and coverage serves three purposes. It provides accountability, objectivity and the opportunity for learning:

- Most basically, reports educate and provide accountability to both the public and to funding or other bodies to which the agency is responsible. In this way reports can improve the perception of the agency and promote a more accurate understanding of the challenges and accomplishments of the agency and their associated costs. This sort of transparency can lead to a greater willingness to invest needed funds in maintaining infrastructure.
- The process of quantifying and reporting agency costs, activities and system conditions also introduces a certain objectivity to an agency's self-awareness. Objective performance measures and spending figures can reduce the tendency of politics to skew reality and instead offer a real defense for responsible officials as well as powerful ammunition for use against irresponsible officials.
- Finally, the accumulation of a series of historical reports over a period of time provides an invaluable tool for learning what actually works and what does not through ex post analysis (discussed further in the next section). The value of this knowledge base is incalculable in improving an agency's cost-effectiveness.

Many local government agencies are always short on time and resources and the temptation to skimp on reporting that is not required by law is not insignificant. Responsible managers must avoid this temptation. Reporting should not be viewed as optional, even where law does not require it. It is essential to good management, and it is worth the investment of resources – as evidenced by private sector practice.

3.3 Ex Post Evaluation

Perhaps the relevant adage to this section is that of a more contemporary philosopher, George Santayana, who wrote, “Those who cannot remember the past are condemned to

repeat it.” It seems obvious that one of the best ways to improve an agency’s efficiency is to study the effectiveness of its past activities and adjust its future activities accordingly. However, this simple technique, based on “ex post,” or “after the fact,” analysis is often sadly underutilized. The technique offers too great a potential reward to continue to be ignored by responsible managers.

The lack of adequate investment in studying and learning from the past is evident when it is compared to the time and energy invested in planning for and forecasting the future. In many agencies, there is a considerable imbalance in the resources devoted to analysis of the past versus analysis of the future. The imbalance is understandable in terms of the various legal requirements that agencies face which require the production of long-range plans and other planning activities and the lack of similar requirements for study of the past. However, the lack of legal requirements is not a lack of reason to study the past.

As with forecasting and planning, the lack of data often poses a challenge to ex post evaluation. However, where investments are being made in the collection and organization of data, the extra effort to conduct historical analysis of it is minimal compared to the benefits it can produce. Ex post analysis can identify maintenance techniques that are particularly effective or ineffective. It can reveal the repeated failure to anticipate particular types of needs and the key to avoiding the pitfall in the future. It can help identify productive individuals for advancement or commendation and underproductive workers in need of motivation. It can similarly help an agency track its contractors and learn over time which firms deliver quality work on time and within budget and which firms do not. The savings that such knowledge represent are more than justification for investing time in a bit of digging and studying of the past.

3.4 Answering the Question

Good asset managers can answer the question, “How are we doing?” They know exactly how things have improved or deteriorated recently and can point to the relevant facts that explain why. This self-knowledge is essential. It is impossible to answer the question, “Can we do better?” without knowing the status quo first. Investments in the production of regular reports and in historical ex post analysis are a clear path to this secure position for facing the future.

Chapter 4: Can we do better? Analysis & Planning

4.1 Introduction

The question, “Can we do better?” lies at the heart of good transportation asset management and all management science, in fact. Identified goals and performance measures, and an understanding of the status quo, addressed in the previous chapters, are prerequisites for answering this question, and data collection and use which is discussed in the following chapter also must underpin any answer, but it is this question upon which good asset management hinges.

Those responsible for asset management must invest the necessary resources to answer this question. Lou Holtz, the famous Notre Dame football coach, once said, “No one ever maintained anything well,” to emphasize that a program that is not trying to improve is doomed to deteriorate. If local government agencies do achieve good asset management and in fact, prove the saying wrong in the sense that they maintain their assets well, it will not be because of a business-as-usual attitude but because they have invested in answering the question, “How can we do better?” Taking the time to answer this question is well worth the pay-off.

It is impossible to provide one-size-fits-all solutions or pre-packaged answers to this question for all local government agencies. Each agency must answer the question for itself, based on its self-understanding of its particular situation. However, this chapter is intended to help local agencies in this task by presenting important strategies to consider, strategies which have proven valuable and effective either for other local governments in their transportation asset management or in other more general settings. The chapter is divided into two major sections that reflect two very broad categories of strategies for improving an agencies cost-effectiveness or way of doing business. These two categories are

- Improved resource allocation, and
- Improved operational efficiency.

These two categories can also be thought of as improved answers to the basic questions:

- What are we doing?
- How are we doing it?

This chapter will examine specific issues and strategies for answering each question, in turn. Applying these strategies and finding the answers for a particular agency remain the challenge for each agency.

What are we doing? – Resource Allocation

4.2 Tradeoffs and Alternatives, Challenges and Constraints

The two fundamental challenges of resource allocation are identifying the alternative projects and programs in which resources can be invested and quantifying or evaluating in some way the tradeoffs between investing more in one alternative and less in another. Prudent resource allocation for transportation asset management should consider tradeoffs both at a programmatic level – between capital investment and maintenance investments, between preventative maintenance and corrective maintenance, even between transportation investment and water/sewer or other infrastructure investments – as well as at the project level – between resurfacing one street or patching another.

The consideration of options for resource allocation and the ability to minimize costs to maintain a certain overall level of service are limited both by funding constraints and minimum level of service requirements for individual components of the system. For instance, the resource allocation between capital investment and maintenance is sometimes pre-established for an agency by its funding sources. Even more frequently, there are major institutional barriers to shifting funds back and forth between different public works, such as transportation and water infrastructure, even where it can be demonstrated as advantageous. These constraints present a major challenge to improving resource allocation and many asset managers are therefore tempted to neglect their responsibility for resource allocations.

However, the limits posed by funding and other constraints and the impossibility of perfection are not an excuse for a lack of any improvement. Local government agencies, such as Ionia, Michigan, have improved their resource allocation by coordinating and breaking down barriers between different public works, while other, even small local governments like Alcona County, Michigan, have been able to find ways

to invest, even if modestly, in cost-saving preventative maintenance. Part of the key is often simply to move from the assumption that something cannot be done to asking how it can be done.

Good asset management means investing in “the right fix at the right time” as Michigan’s widely successful transportation asset management program has stressed. Even if an agency is limited in its ability to shift funding between programs at a strategic level, it can often significantly improve its asset management and decrease its long-term costs if it can improve its tactical resource allocation in its project selection and scheduling. The following two sections investigate two important strategies for improving resource allocation, primarily at the tactical level of project selection and scheduling.

4.3 Beyond Tomorrow: the Life-cycle Perspective and Preventative Maintenance

One of the key strategies for cost-savings in transportation asset management is adequate use of preventative maintenance to ensure the maximum service life for the minimum total investment. The perspective of the life-cycle of an asset, which considers the total costs to maintain the asset at a level of service over the entire life of the asset, allows managers to see and quantify the benefits of preventative maintenance and other up-front investments which save money in the long run.

Life-cycle cost analysis has become something of a buzz word or catch phrase in asset management, but it is often not well understood or implemented. However, the basic principles are not overly complex. The two key principles are including the cost over entire life-cycles and taking account of the cost of capital through the economic practice of discounting future costs. The principle of discounting is sometimes confusing when it is first encountered by those not familiar with it, but it is simply recognition of the value of time with respect to money. Consider if you were offered a gift of \$1,000 tomorrow or \$1,000 in ten years. Which would you choose? The economist would suggest you choose to take the money tomorrow, because it is worth more than the money ten years from now for two reasons. Most people realize that money now is worth more than money ten years from now because inflation decreasing the buying power of a dollar over time. However, the driving fact behind the economist’s principle of discounting is that the money now is worth more than the same amount ten years from

now because if you take the money tomorrow you could invest it in a security such as a savings bond and in ten years, have earned considerable interest. In practice, this discounting future costs can allow a manager to evaluate tradeoffs between different construction designs and maintenance plans, as illustrated in the following example.

4.3.1 Example of Life-cycle Cost Savings of Preventative Maintenance

Consider the cost of maintaining a one-mile stretch of pavement over thirty years. Assume that the cost of resurfacing the roadway is \$75,000 and the cost of preventative maintenance such as crack sealing ranges from \$2,000 to \$4,000 depending on the condition of the pavement. If the expected life of the pavement is ten years without any preventative maintenance and three applications of preventative maintenance can extend the life of the pavement by five years, the resulting total cost for maintaining the roadway without preventative maintenance, ignoring inflation and discounting, is \$225,000 while the cost with preventative maintenance is \$166,000, as shown in Table 2.

Table 2: Thirty Year Maintenance Costs

Year	0	5	9	10	12	15	20	24	27	30	Total
Replacement Only	\$75,000			\$75,000			\$75,000			\$75,000	\$225,000
Preventative Maintenance	\$75,000	\$2,000	\$2,000		\$4,000	\$75,000	\$2,000	\$2,000	\$4,000	\$75,000	\$166,000
NPV Rep. Only	\$75,000	\$0	\$0	\$55,807	\$0	\$0	\$41,526	\$0	\$0	\$30,899	\$128,232
NPV Prevent. Maint.	\$75,000	\$1,725	\$1,533	\$0	\$2,806	\$48,140	\$1,107	\$984	\$1,801	\$30,899	\$88,994

If inflation and the cost of capital are both also considered by applying the Office of Management and Budget’s recommended thirty year real discount rate for cost-effectiveness of 3%, the costs become \$128,232 for deferred maintenance and \$88,994 with preventative maintenance. Without taking into account the effect of discounting, the preventative maintenance appears to offer a savings of 26%, but after discounting, the real anticipated savings are actually 31%.

$$NPV_{MRC} = \sum_{y=0}^{YSL} \frac{Cost_y}{(1+d)^y}$$

where

NPV_{MRC} = Net Present Value of Maintenance and Replacement Costs

YSL = Years of Service Life

$Cost_y$ = Maintenance or Replacement Cost in year y

y = Year, counting from zero at the present

d = Discount rate, expressed as a number (not percent)

Figure 3: Formula for Net Present Value

The value including the discounting factor is called the net present value (NPV) or sometimes the present worth. It can be computed relatively simply by applying the discount factor like a compounding annual interest rate, as shown in Figure 3. Often instead of computing the net present value of maintenance over a set period of time, due to complications with the remaining service life at the end of the period, the net present value of maintenance and replacement of an asset will be used to evaluate life cycle costs. This is a very conservative way of estimating benefits of investments to extend the service life of an asset and using a set analysis period is preferred. In the example above, the net present value of maintenance and replacement for deferred maintenance is \$55,807 while the preventive maintenance cost is \$54,203 because it fails to account for the value of the additional five years service life provided by the preventive maintenance approach – the \$1,604 or 3% difference represents only the savings from cost deferral.

4.3.2 Usefulness of Life-cycle Cost Analysis

Although it is often touted for its ability to quantify the benefits of preventive maintenance, the perspective of life-cycle cost analysis is an important tool with many applications in asset management. The technique should also be used in evaluating construction design alternatives and other tradeoffs. Different pavement types and thicknesses can have significant impacts on the service life and life-cycle costs of a roadway and similar tradeoffs exist for other assets. Some studies (Small et al., 1989) have suggested that simply adopting or applying new design standards requiring thicker

pavements could reduce maintenance costs by as much as 15% to 20% in the long run. Life-cycle cost analysis is invaluable in this and many other decisions asset managers face. It is only in the context of life-cycle cost analysis that managers can fairly evaluate tradeoffs between preventative maintenance, improved design standards and other competing investments to identify the most cost-effective strategy for allocating their limited resources.

4.4 Triggers and Decision Trees

While life-cycle cost analysis can reveal opportunities for great savings, one of its drawbacks is the moderate level of effort/complexity involved. Although life-cycle cost analysis has been made easier in some cases by automation, some agencies have adopted simpler decision rules or strategies for identifying or selecting the “right fix at the right time,” particularly for more routine, everyday decisions about maintenance strategy. These rules sometimes are developed from the findings of life-cycle cost analysis and then generalized for simplicity. They may not always select quite as cost-effective maintenance projects or actions as a specific life-cycle cost analysis, but they have the advantage of saving the agency in analysis/management costs.

The two most common forms of decision rules are performance measure trigger values which lead to a pre-specified action and decision trees which suggest what maintenance action, if any, should be taken based on a hierarchy of questions. Figure 4 presents an example of a proposed decision tree for responding to cracking in flexible pavements. An excerpt from the Canadian National Guide to Sustainable Municipal Infrastructure at right shows how trigger values are presented and used in Canada.

Trigger values are usually associated with specific pavement preservation treatments (such as sealing cracks in asphalt concrete pavement or sealing joints in concrete pavement) and are related to the need to apply a preservation treatment at the right time to be effective, or before the pavement reaches a condition where a different, more expensive treatment would be required. For example, City of Regina guidelines recommend the range of PCI to be 50 to 70 for overlays, 30 to 50 for partial reconstruction, and < 30 for total reconstruction.
- from the Canadian National Guide to Sustainable Municipal Infrastructure

Trigger values and decision trees are generally not meant to be applied as immutable rules, but as recommendations to aid good engineering judgment in producing good decisions. Used as such, however, they

can complement formal life-cycle cost analysis and prove a valuable approach to answering the question of what an agency should be doing, particularly on a day-to-day basis.

4.5 Tools and Learning

Although life-cycle cost analysis and decision rules are the primary strategies to aid asset managers in answering the questions of resource allocation, activity selection and scheduling, these strategies are not applied in a vacuum. In practice, tools and strategies for learning, like ex post analysis, are essential to good resource allocation decisions.

Many computerized management systems incorporate and automate either life-cycle cost analysis or some form of decision rules. The automation of these techniques can be essential to making them truly helpful tools for cost-savings for local governments. This is an important advantage of some commercially available software suites over others and over most in-house, agency developed software tools. Several specific tools with these analytic abilities are presented in Chapter 6.

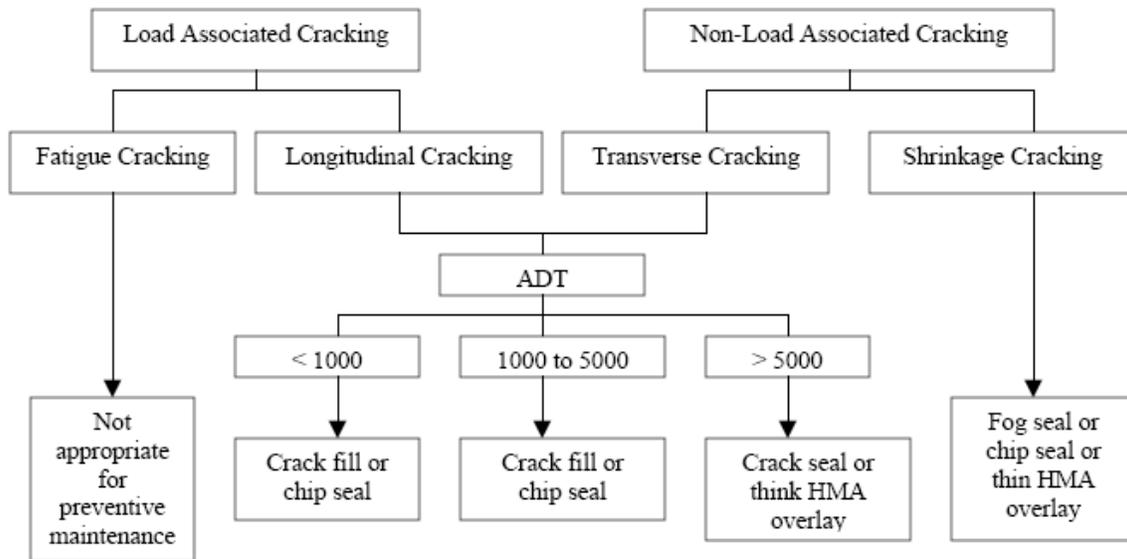


Figure 4: Example Decision Tree for Cracking (source: Hicks, 1997)

The application of life-cycle cost analysis relies heavily on the ability to predict the deterioration of asset conditions and the cost of various maintenance actions. In order for life-cycle cost analysis to produce the most accurate results, it must be based on good condition forecasts and cost estimates. Although both condition forecasts and cost

estimates can be produced in a variety of ways, it is important that whatever techniques or models are used, that they are consistent with and where possible incorporate the agency's own experience with past asset conditions and costs. This is one of many critical applications of ex post analysis.

It is the combination of the right strategies – life-cycle cost analysis, decision rules, ex post analysis – and tools to implement and aid the application of these strategies that together allow an agency to select “the right fix at the right time.”

How are we doing it? – Operational Efficiency

4.6 Coordinated Maintenance and Interagency Cooperation

The research supporting the development of this guide found that many of the most promising strategies for improving operational efficiency fell under the category of coordinated maintenance and interagency cooperation. Coordination and cooperation can be helpful both between agencies of a single government, such as between a city's transportation and water/sewer departments, and between agencies of neighboring, nearby, or hierarchical governments, as in cooperation between neighboring counties or the state DOT and local transportation agencies. The advantage and cost savings to local agencies can come from the elimination of duplicate efforts, economies of scale and the ability of cooperatives to invest in activities or equipment that none of the individual constituents could afford alone. Five important strategies are highlighted here (as well as in the Findings of this report). These strategies include coordinated maintenance, shared software, group purchasing, equipment sharing, and data / information sharing.

4.6.1 Coordinated Maintenance

One of the distinguishing aspects of transportation asset management at the local level as well as one of the most promising sources of cost savings lies in the entanglement of local transportation assets with other infrastructure systems. Water-wastewater infrastructure and private utilities frequently make use of the same right-of-ways as local roadways. Maintenance and expansion of these systems has often lead to the deterioration of pavements where cutting and patching occurs. Everyone has heard stories of a road being repaved only to be cut open the next week. Even if these stories

are overblown, they give some sense of the real waste of resources that can occur when the cutting occurs even a year or more after the re-pavement and no one notices.

Coordinated Maintenance:
Ionia, MI
“Ignoring the underlying infrastructure issues will only be reflected in the surface conditions, whether through line repairs, settling or collapsing pipes and manholes, and other relevant factors.”
 Thomas Wieczorek, City Manager,
 Ionia, MI

The difficulty of sharing the public right-of-way, however, can become the opportunity to share costs. If institutional hurdles can be overcome, the benefits of coordinated maintenance activities can be tremendous. To achieve maximum savings, the coordination must include all the systems sharing public right-of-ways. The direct involvement of representatives of private utilities in the planning process represents a best practice. However, the

coordination of public water-wastewater-stormwater projects and transportation projects alone can produce great benefits.

Ideal coordination can occur when the managers of all systems have a good sense of the remaining service life and anticipated maintenance needs of all of their assets. In that situation, maintenance and replacement activities can be optimally coordinated so that if, for instance, a sewer line will need to be replaced in seven years and the road above it will need to be reconstructed in five, the sewer line can be scheduled to be replaced when the road is repaved and prevent the destruction of the roadway only two years after its reconstruction. While systematic coordination of

Coordinated Maintenance:
Racine, WI
“On our major street projects we are replacing the sewers as needed or anticipated to be needed during the life of the paving project based on a condition assessment.”
 Richard M. Jones, Commissioner of
 Public Works, City of Racine, WI

this kind requires real cost and effort in data collection and planning, this cost is minute compared to the cost of not coordinating activities.

Moreover, any Geographic Information System (GIS) software, and especially asset management software with a GIS component, can significantly reduce the cost of this coordination, if it allows the data for all infrastructure systems to be managed in the same computer system. If roadway and sewer inventories, for instance, are maintained in separate paper files or incompatible computer databases, the coordination of maintenance requires considerable time and effort; whereas, if both agencies can see the conditions of

or even anticipated projects for each other's infrastructure, much of the work of coordination is already done.

4.6.2 Shared Software

Rather than each agency maintaining its own system, sharing GIS and asset management software between both transportation and water agencies can result in savings both on the cost of the software/computer system as well as by facilitating cost-saving coordinated maintenance. The opportunity for transportation agencies looking to invest in new asset management software to share that cost with water-wastewater agencies is also enhanced by the U.S. Environmental Protection Agency's proposed CMOM (capacity, management, operations and maintenance) regulations which would require asset management programs for municipal sanitary sewer systems in order to renew their National Pollutant Discharge Elimination System (NPDES) permit under the Clean Water Act.

4.6.3 Group Purchasing

Shared software costs may result in relatively minor cost savings in the scope of a transportation agency's budget, but applied more broadly to group purchasing, in general, the potential for cost savings also expands. Particularly for small agencies, there can be significant benefits from purchasing asphalt, concrete, fuel or other materials in larger quantities with other neighboring agencies or through an arrangement from the state DOT, rather than an individual customer.

**Group Purchasing:
*Ashland County, WI***

“In Ashland County, the county, towns, cities, and villages jointly buy culvert pipes, road signs, grader blades, cutting edges, gravel, and fuel. Bulk culvert purchases cut the costs almost in half for these agencies.”

Stidger and Djekich, 2005

4.6.4 Equipment Sharing

Sharing equipment is also an important strategy for cost savings through interagency cooperation. An article by Stidger and Djekich in *Better Roads* gives examples of the success of this approach by local agencies in Wisconsin and draws several conclusions. The article found that sharing maintenance equipment could be very advantageous to small agencies if there was flexibility in scheduling the equipment's use (no emergency maintenance/repair equipment) and there was tolerance of some imbalance in the usage

Equipment Sharing:***Sharon, WI***

“The town of Sharon and the village of Sharon jointly purchase brush chippers. The original \$6,000 machine cost was evenly split. The two agencies contribute to an equipment repair, maintenance, and replacement fund based on paying an hourly fee when the equipment is used. After some years of use, the first chipper was replaced with a \$9,000 machine, using the fund.”

Stidger and Diekich. 2005

between the sharing agencies, so long as both benefit. They found that the importance of written agreements varied. It was vitally important in many cases, but there were also other successful cases in which the interagency agreements were completely informal.

4.6.5 Data / Information Sharing

The sharing of data and experiences was one of the most frequently cited forms of interagency cooperation. Several software vendors relayed their experience that user conferences were extremely popular and important to their clients. Case studies also attested to the value of sharing data between different public works agencies within a local government and among transportation agencies within a state or region. Despite the emphasis on information in contemporary culture, it is easy to overlook its value in practice, whether the information is hard data or the less tangible, but valuable experiences of other agencies. The importance of sharing data between agencies within a local government has already been stressed, but sharing transportation data with peer agencies in a region can also be valuable if it allows a region to develop deterioration curves or other models specific to its particular climate, soils, etc. Soft information, including lessons learned by peer agencies, can also be of tremendous value, as case studies in this report may illustrate.

Data Sharing

“Sharing of information among departments and establishing common data bases is an effective way to reduce the costs associated with the implementation of asset management system and improve the quality of management information.”

From “Key Findings from the Fifth National Workshop on Transportation Asset Management”

4.7 Innovative Contracting and Construction Techniques

Innovative contracting and construction techniques have received much attention by state and federal transportation agencies and some experiments have revealed promising results. Although many of these strategies are untested at the local government level,

they hold promise for cost-savings in the future as contractors and others become familiar and comfortable with new approaches. New and emerging strategies that may soon be helpful at the local level include design-build contracting, performance-based bidding, outsourcing and project bundling, and total closure construction/maintenance.

4.7.1 Design-Build Contracting

Design-build (DB) contracts combine the procurement of design services and construction work in a single instrument. Although still an emerging practice and limited by legal issues in some states, they are growing in popularity. Many design-build contracts have been for large projects such as freeway construction, major airport expansions and transit system capital expansions, but the technique has been used successfully for projects as simple as pavement overlays. Although still mostly limited to the realm of state DOTs, some local governments, ranging from large cities like New York and Chicago to mid-sized cities like Milwaukee, Nashville and Portland and even including a few more modest sized governments like Greenville County, South Carolina, and Reno, Nevada, have also begun to make use of the practice. The promise of design-build contracts is that they allow time savings because construction can begin before design is complete and cost-savings from better coordination between design and construction teams.

Design Build:

A 1992 study documented the following impacts of DB contracts on project schedule and budget

- DB projects are completed 21 percent faster than traditional design-bid-build (DBB) projects.
- Initial costs of DB projects are 4.6 percent higher than DBB costs.
- Cost growth due to claims and change orders for DB projects is 4.7 percent less than for DBB projects.

from Transportation Asset Management Guide

4.7.2 Performance Based Contracting

A wide variety of techniques for performance-based bidding have been proposed or used to save transportation agencies time and money while ensuring that private contractors provide an acceptable level of service in their work. Proposed techniques include performance specifications, cost plus time bidding, best-value bidding, lane rental, life-cycle cost bidding, incentive contract clauses, and warranty periods. An excerpt from the Transportation Asset Management Guide (FHWA, 2002) offers an overview of the

various techniques. While legal issues restrict some forms of contracting in some areas, many of these simple changes in procurement strategies cost local government agencies only the hassle of changing the way they do business and can save considerable amounts.

Performance-Based Bidding Techniques:

- **Performance specifications** are an alternative to traditional prescriptive specifications that enable bidders the flexibility to propose innovative solutions. Performance specifications require bidders to meet a defined level of service or quality without stating how to meet these criteria.
- **Cost plus time bidding** (also referred to as A+B bidding) requires bidders to submit a time bid (e.g., number of calendar days until completion) in addition to a traditional cost bid. When evaluating the total cost of the proposals, the owner uses the time bids to estimate the user costs associated with each proposal. This arrangement encourages bidders to minimize time to completion.
- **Best-value bidding** is used to select contractors based on a combination of lowest cost and bidder qualifications or technical merit of a proposal.
- **Lane rental**, like cost plus time bidding, encourages contractors to minimize construction impacts on road users. Contractors are charged a “rental fee per-lane per time” to occupy the roadway throughout the project.
- **Life-cycle cost bidding** is an alternative to traditional lowest cost bidding. In this approach, the owner evaluates bids based on the projected costs over the entire life of a project.
- **Incentive contract clauses** provide contractors with monetary awards for achieving defined performance and schedule benchmarks throughout the course of a project.
- **Warranty periods** enable an owner to guarantee the performance of a new facility for a given time. Warranty provisions on National Highway System projects are limited to specific features (e.g., pavement, structures, etc.) and may not include routine maintenance.

from the Transportation Asset Management Guide, 2002.

4.7.3 Outsourcing and Project Bundling

Although outsourcing can sometimes be a highly charged term, it is simply another way of talking about the use of private contractors. Almost all agencies, from the largest to the smallest, make use of private contractors for some work. Outsourcing, or making use of private contractors rather than performing work in-house, is an important asset management strategy for operational efficiency and cost-savings when private contractors can provide a service or accomplish an activity more efficiently than the agency could

itself. Despite corporate overhead and profit, specialization, economies of scale and other factors sometimes allow private firms to contract to provide work for less than a public agency could do it, itself. Private contracting is an important strategy for overcoming limitations of an agency's own staff and for resourcing short-term or infrequent staffing needs. Two keys to ensuring private contracting benefits the public agency are the ability to monitor and evaluate the performance of the private contractor and the explicit consideration and assignment of risk (i.e., who will pay if something goes wrong).

Outsourcing can also sometimes be made even more profitable for an agency by bundling several projects together in a single contract. The bundling can lead to cost savings for the contractor, some of which they are willing to pass back to the agency, and the bundling, by increasing the value of the contract and decreasing the number of contracts, can make bidders more aggressive in trying to ensure they offer a low bid, more effectively leveraging private sector competition in favor of the public agency.

4.7.4 Total Closure

The final strategy for improved efficiency is fast-track construction utilizing total closure of a facility. The practice is growing in popularity and has been used successfully by state agencies in Indiana, California, Michigan, and Tennessee as well as by some local government agencies for projects ranging from minor bridge replacements to reconstruction of urban interstates. Closures can be as short as overnight or a weekend or as long as several months. Completely closing a facility to traffic, while costing travelers through longer travel times, can dramatically improve construction safety and decrease construction costs and times.

4.8 Tools and Technology

One of the most widespread and effective strategies for improving operational efficiency is investment in computerized tools and technology. Both computerized field devices as well as more traditional computer systems can offer tremendous efficiency gains to local government agencies. The use of computerized field technology in data collection is considered in the next chapter, and an in-depth look at computerized management systems is included in Chapter 6.

Chapter 5: How do we know? Data Collection & Organization

5.1 Building on the Ground Truth

Data supports all the activities and decisions of asset management. In order to ensure decisions lead to optimal resource allocations and activities are performed with efficiency, a local government agency's data must be complete, current, accurate and accessible. Without good data, asset managers are at best blind if not the proverbial fool who attempts to build his house on sand. Good data provides the solid foundation for good asset management. Data collection carries a cost and this can pose a challenge for local agencies, but it is a necessary cost that cannot be avoided without jeopardizing the entire enterprise.

5.2 Complete Data

The first hallmark of good data is that it is complete. Agencies responsible for asset management bear the responsibility for collecting and maintaining a great deal of data. The extent of the data required by an agency can be described in terms of categories and coverage. The agency must maintain data in three broad categories:

- asset information,
- cost information, and
- public input.

In each of these categories, the agency must be able to give a complete accounting. For asset data, which includes information about an asset's location, condition, usage and history, the completeness requires an asset inventory that includes all the assets in the agency's jurisdiction. For cost information, completeness is not only measured by accounting standards, which require all spending to be accounted for, but also requires that all the agency's projects and activities can be associated with their costs. This is sometimes accomplished by using a computerized management system to track projects in parallel with the agency's official accounting which may be performed by another department. For public input, completeness certainly does not require polling the entire

population but does require that an agency track its service requests and should entail periodic polls or surveys of a representative sample of the population. The absence of this latter data can lead to a distorted sense of the public's perception or approval of the agency and its work, if the only input the agency ever receives from the public is complaints and service requests. Periodic customer satisfaction surveys are also an opportunity to educate the public about the accomplishments and ongoing work of the agency.

***The Challenge of Data:
Oakland County, MI***

“There was significant staff interest in having highly accurate location information – for example, for signs and signals – but only limited interest in regular condition assessments. Further, there was reluctance to accept that condition data must be kept up to date if it is to have lasting value.”

Wittwer et al., 2004

5.3 Current Data

Data collection must be regular in order to ensure its value. The Canadian National Guide to Sustainable Municipal Infrastructure states that, “Monitoring of the network condition should be done about every second year for high traffic volume facilities and about every third year for local roads and streets.” This guideline seems to be in line with the good practice of the governments of Kent County, Michigan, Jefferson City, Missouri, and Redmond, Washington. The national survey of local government agencies

From the “Key Findings from the Fifth National Workshop on Transportation Asset Management”

“Condition monitoring and maintenance of asset inventory data are essential to maintaining the validity of the asset management system, and require particular management commitment.”

conducted for the Midwest Transportation Consortium by Misra et al. (2003) found that just over half of the agencies inspected their pavement assets on a two-year cycle or more frequently. That number rose to almost two-thirds for inspection on a three year cycle or more frequently. However, this suggests that one in three local government agencies currently does not collect data on their pavement

assets frequently enough. There may also be a hidden problem with respect to the coverage, in addition to the frequency, of data collection efforts, as the survey did not inquire whether the data collection covered all the agency's assets.

The necessary frequency of inspection for most other assets is less clear. Most agencies that reported an inspection frequency for signs and signals ranged from three to

five years. The problem for many assets besides pavement is simply that they are not inspected on any regular basis at all. The exception is bridges, which are all inspected very regularly for safety reasons, in conformity with the legal requirements of the Federal Highway Administration's National Bridge Inspection Standards (23 CFR 650). It is important, in this case, that the conditions data collected for safety also be put to good use in asset management. The goal of bridge maintenance from the standpoint of asset management is not simply to ensure that conditions do not deteriorate to such an extent as to threaten safety, but that conditions are maintained at an acceptable level at the lowest possible cost. This goal of cost minimization may suggest preventative maintenance for bridges long before maintenance would be legally required to ensure safety.

“Monitoring of the network condition should be done about every second year for high traffic volume facilities and about every third year for local roads and streets.”

from the Canadian National Guide to Sustainable Municipal Infrastructure

5.4 Accurate Data

The accuracy of data requires standards for measuring the information collected. These standards take the form of both metrics, indices or scales and quality control /quality assurance measures.

The scales and systems for measuring the conditions of assets varied greatly. The Pavement Surface Evaluation and Rating System (PASER) and Pavement Condition Index (PCI) were the most commonly used standards for pavement conditions, but were only two among many systems. Some agencies found more detailed ratings or objective instrument measurements useful for ensuring accuracy, precision and consistency in their conditions assessments. Other agencies used very simple, more subjective five or three-level ratings (good, fair, poor) with great success. It is clear that different methods of measurement offer different advantages. There is no one system which is necessarily the best for every agency's needs.

Evidence suggests that methods for assuring that data systems are used correctly are far more important than the system used. Local agencies often cited training of the staff responsible for data collection as one of most crucial ingredients to ensure good data. Training can be provided in-house, by software or equipment providers or by organizations such as the National Highway Institute. Opportunities for training can

readily be found using online internet resources (such as those presented in Chapter 7). The key is that these opportunities are taken advantage of – the investment in training is well worth avoiding the risk that data collection efforts produce inaccurate data and are wasted or misguide the agency. Another important quality assurance measure is data consistency checking. Many computerized management systems include database consistency logic which largely automate this process and can help to easily identify data entry/collection errors.

5.5 Accessible Data

The final key to good data is accessibility. Data that is not at hand cannot be helpful. Commercially available computerized management systems are an incredibly valuable help in this task and are making possible a level of data accessibility that was previously impossible. Some systems allow quality control to take place in the office on data that is going on in the field at the same time, help workers locate assets in the field

Data Accessibility:

Oakland County, MI

“One such accomplishment was the conversion of available plans, drawings, aerial photography, and other documents to Adobe Acrobat computer files. This relatively inexpensive step dramatically improved staff access to data formerly stored in a basement file room.”

From “Key Findings from the Fifth National Workshop on Transportation Asset Management”

and generally allow a level of near-seamless interconnection between all of an agencies systems and operations. Reaching this level often requires work to integrate various different legacy systems that hold data captive and limit its usefulness. However, even much simpler steps like scanning paper files to make them available for search and viewing by computers can have great benefits, as attested in the case of Oakland County, Michigan. The key is to make sure that data is available to the people who can use it in a form that is ready to use.

5.6 Assembling the Jigsaw Puzzle: Tools and Cooperation

While there is no disputing the challenge that data collection presents to local governments, there is some evidence that progress is actually being made thanks to the help of new technologies. Laptop computers, laser devices for measuring pavement conditions, and Global Positioning System (GPS) devices are revolutionizing data

Benefits of Data:***Ionia, MI***

“Project selection has benefited without question because the choices have been based on hard, empirical data that is not selective to whims but rather to facts.”

Thomas Wiczorek,
City Manager, Ionia, MI

collection and making it possible to collect more accurate and precise data at a faster pace than was ever imaginable before. The survey conducted for the Midwestern Regional University Transportation Center by Wittwer (2003) found that 45% of local government agencies were using laptop computers in data collection and one in five were using laser devices. As these and other new technologies

continue to spread in use and decrease in cost, they can help agencies meet the challenge of maintaining current data on their assets. Even for very small agencies, for which the investment in equipment may not be merited, there can still be benefits from these technologies by sharing equipment or contracting for data collection by private firms or other nearby public agencies.

Part III Tools

Chapter 6: Review of Software Tools

6.1 Introduction

In the introduction, a distinction was made between strategies and tools, and examples given to demonstrate how both can be of great help in improving an agency's efficiency and productivity. This section focuses on focuses on tools, specifically, commercially available software to assist local agencies with asset management. Other tools and technologies are clearly important to good asset management. Construction equipment is clearly as or more important than computer software for maintaining and improving the value of public assets. However, while there are important new strategies emerging for the ownership and use of these tools such as those reviewed in Chapter 4, new or alternative construction equipment itself does not currently promise to be as significant a source of improved productivity compared to the productivity gains from computers and computer technology, which are still just beginning to be realized for purposes of asset management in the public sector.

Computer software and technology has the capability to facilitate the work of everyone involved in the task of asset management from maintenance workers in the field, through the use of handheld GPS devices, to analysts and policy makers in the office with a computer on their desk. This section focuses on computer software, as opposed to hardware, such as GPS devices, as the particular type and use of GPS technology often depends on the software with which it is being used. A review of GPS tools could also be valuable to small agencies, but was beyond the scope of this guide.

This chapter reviews the current use of software by local government agencies, attempts to categorize the capabilities of available software and their potential for assisting agencies in the task of asset management, and presents of the results of a survey of asset management software developers/vendors conducted as part of the research supporting this guide. Agencies should be able to gain some sense of how peer agencies are using software, what potentials for increased productivity software offers, and some of the tools available to them on the market, their functionality and current use.

6.2 Current Use

Evidence from recent surveys show the use of computerized tools is becoming more common among local government agencies for purposes of asset management. However, software use is far from ubiquitous or comprehensive where it is in use. Meta-analysis of two recent surveys¹ of over 70 municipal and county governments across the country revealed that just over 80% of local government agencies were using some computerized tools for asset management, but nearly one in five agencies still relied solely on paper files. One of the surveys also revealed that only approximately half of the software in use by these local agencies included the ability to identify and prioritize projects to maximize achievement of the agency’s strategic goals. Anecdotal evidence suggests even fewer could compare and coordinate projects for different types of assets and that many agencies seem to know very little about the way their tools work, how they predict future asset conditions or prioritize competing projects.

Meta-analysis of two recent surveys of over 70 municipal and county governments across the country revealed that just over 80% of local government agencies were using some computerized tools for asset management, but nearly one in five agencies still relied solely on paper files.

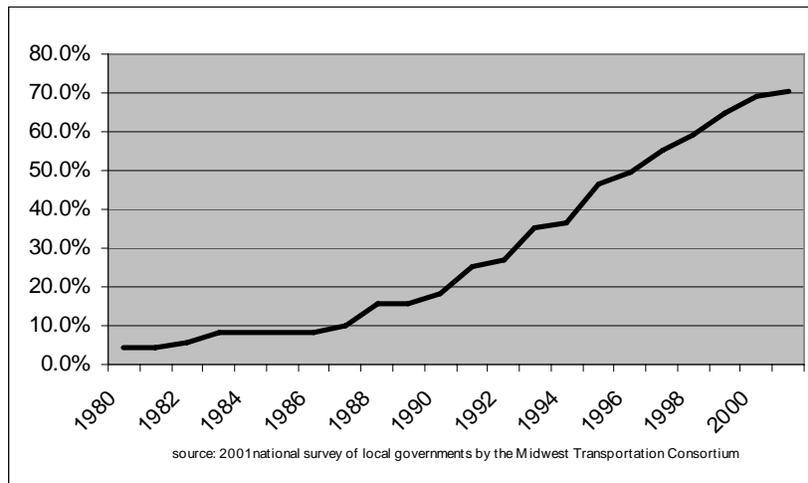


Figure 5: Percentage of Local Governments Using Computerized Tools for Transportation Asset Management

¹ From a 2001 survey of local governments across the nation by the Midwest Transportation Consortium and a 2003 survey of municipal governments by the University of Wisconsin-Madison for the Midwest Regional University Transportation Center.

Evidence from the Midwest Transportation Consortium survey in 2001 documents the increase in software use, from less than 1 in 5 agencies before 1990 to at least four times that figure now. This growth in the use of software to support asset management (displayed in Figure 5), coupled with the growth in the availability of computers and software, is an encouraging trend, and resulted in real productivity gains and cost savings. However, there are still very substantial improvements possible for most agencies, not only for those still using a paper system rather than an electronic one. Many agencies' use of computer software remains limited to a spreadsheet or simple database inventory of assets. Such agencies can potentially reap tremendous benefits by investing in software with functionality designed to support their data collection, analysis and maintenance work.

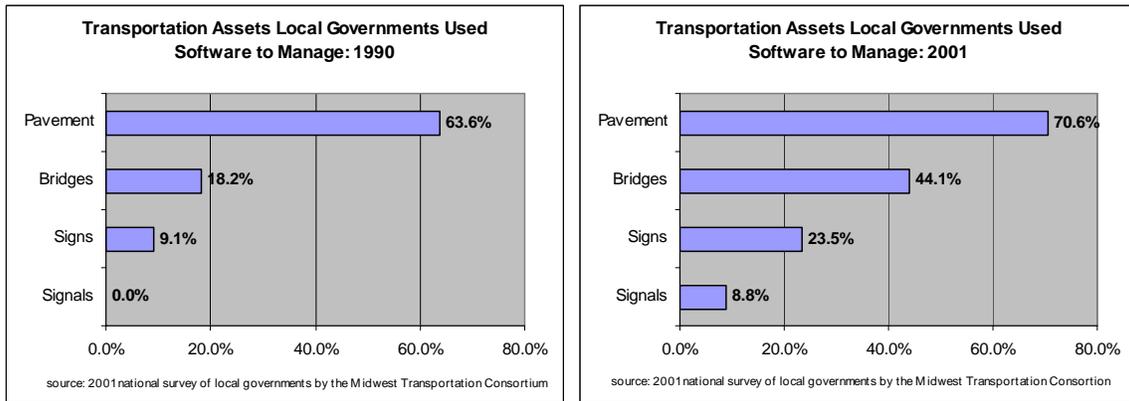


Figure 6: Use of Transportation Asset Management Software

The same survey also documents the evolution of the tools and the practice of transportation asset management that emerged largely from pavement management, but has become increasingly broad in the assets it incorporates and coordinates, as illustrated in Figure 6. While some agencies were using software to help manage bridges and roadway signs by 1990, they were relatively uncommon and in the majority of cases this software was not integrated with software for pavement management. Whereas, by 2001, the use of asset management software for both pavement and other assets had become more commonplace.

6.3 Usefulness

The tremendous gains in productivity and efficiency that computer software can offer fall into two broad, general categories:

- improving how the agency works: making the agency's operations more efficient and cost-effective, and
- improving what the agency does: helping the agency better allocate its resources and invest in more fruitful work projects and programs.

Both paths can be very profitable, helping an agency ultimately do more with less. While most available software packages make some attempt to facilitate both improved operations and resource allocation, many focus more on one or the other. An agency looking to improve its existing systems or acquire new software tools should consider how much it wants to invest and how much it expects to gain in streamlined operations versus optimal resource allocations. The priority will vary from agency to agency, as some agencies responsibilities may be skewed towards planning and resource allocation or project/program implementation. However, all agencies should consider the importance of both types of improvements, and the value of investing in the approach they may more frequently overlook. It is not difficult to imagine a planning agency primarily concerned with resource allocation that fails to recognize the potential for huge savings from more efficient data collection, or an engineering department that overlooks the productivity gains from optimal scheduling or selection of projects.

Looking in more detail, these two broad strategies can be understood as they are accomplished by more specific functionalities of software packages. There are many ways that the functionality of the various available software packages could be organized or presented, but for the purposes of this guide, eight core functionalities were identified. Many of the key differences between the available tools can be understood by considering their functionality in these eight areas:

- Asset inventory,
- Data collection,
- Data organization and presentation,
- Prediction of future conditions,
- Identification, prioritization and scheduling of projects,
- Project tracking/coordination,

- Public input, and
- Record-keeping.

The ability to maintain an **inventory of assets**, to record at a minimum, their location (for fixed assets) and condition, lies at the foundation of all asset management. All asset management software packages offer (and even generic spreadsheet and database tools can provide) this functionality, in some way, but differences exist in the flexibility of what data can be stored, the ability and ease of making queries, the data storage formats, and the ability to interface with other databases and other data formats. Most software can incorporate inventories of assets of many different types, however, there are some differences, regarding whether the inventory can include both fixed and non-fixed assets, and whether all assets must be linked to roadway right-of-ways. One important functionality, which is not yet standard across all the available packages, is the ability, using relational databases, to relate information about assets and their condition with other information the system manages, such as past, present and future work projects or complaints and service requests from the public. Being able to analyze the connection between work projects to asset conditions or public complaints makes possible a level of accountability to the public that is hard to imagine without the aid of computers.

Most asset management software now also facilitates **data collection** by providing a way to update or link the asset inventory to data collected by GPS enabled tools in the field. However, there are great differences in the GPS devices supported as well as differences such as whether data collected in the field is directly linked to and immediately available in the asset inventory using wireless internet technology or whether the data must be physically brought back to the office and uploaded to the inventory. There are also important differences in whether a software's GPS functionality is prepackaged, readily implemented by the agency, or requires varying amounts of customization of the software by the developer. In some cases there is a clear trade-off between the need to customize the software and range of devices that can be supported. These are all important issues to consider because the increased efficiency of data collection (often greatly reducing or even eliminating data entry, along with data

entry errors) is one of the most important ways asset management software can save agencies money and increase productivity.

The value of data, of course, lies its ability to be used, and much of the usefulness of asset management software derives from its ability to **organize, summarize and present data** in ways that make it more readily usable for an agency. Embedded in and built upon the actual asset inventory, itself, is a great deal of functionality in most software packages to facilitate its use. Three of the most important tools for presenting data are reports, maps and pictures. Many of the available software suites provide extensive functionality for generating reports, but the precise content and degree of flexibility of these reports varies. Compatibility with or the integration of GIS also adds immense value to the data inventory by allowing the visualization and geographic analysis of assets and their conditions. GIS software can greatly facilitate the creation of data-rich maps of tremendous value not only for the agency's own analysis and use but in communicating information to the public or legislative/funding bodies. The ability to attach digital photos, images or video to records in the asset inventory database can also greatly enrich the data.

The automated **prediction of the future conditions of assets** is another very important functionality of software and one which varies considerably in its sophistication between competing software. Different software employs different forecasting techniques for different assets. Some simply apply predetermined or user-specified life-spans for a class of assets. Others apply models of varying sophistication, such as deterioration curves for pavements, some of which can take better account of a variety of factors including an asset's age, usage, location, level of past maintenance and other important factors. The accurate prediction of future asset conditions is a prerequisite to any meaningful attempt to prioritize projects to optimize resource allocations or simply conduct sensitivity analyses to examine tradeoffs between investments in different asset types or programs. The incorporation of this task in a software package can allow agencies to make more consistent forecasts of asset conditions for more assets than would be possible otherwise with almost no effort. The value that this can add for an agency is not an insignificant contribution that software programs offer.

Perhaps the greatest variety can be found among available software's ability and methodology for **identifying, prioritizing and scheduling projects**. Techniques for optimizing resource allocation should at the very least consider minimization of full life-cycle costs, which of course, requires accurate cost estimation. Cost estimation, like predicting future asset conditions, varies among software from applying simple user-defined unit costs to fairly sophisticated models of project costs. Some advanced software packages can consider not only cost minimization but also minimizing certain environmental impacts such as vehicle emissions or maximizing user benefits such as travel time savings, vehicle operating costs savings and accident cost savings. Many programs can impose budget constraints, and some of the most analytically sophisticated tools can also impose geographic equity or environmental justice constraints, although this tends to require at least some customization of the software. Another extremely valuable functionality provided by some, but not all of the available tools, is the ability to optimize resource allocation and prioritize projects across asset categories, between projects for different asset types, taking into account the benefits of coordinated maintenance stressed in Chapter 4. Even software packages which do not have any built-in functionality for prioritizing projects can assist in this task by presenting the information on current and future asset conditions in a way that makes the task easier and more straightforward, and this may be all that it is necessary for very small agencies. However, the more assets being managed and the more alternative projects and programs competing for funds, the greater are the benefits of analytic tools of this type.

Another functionality provided by some, but not all, of the available software, is the ability to **generate work orders and track projects**. This functionality is primarily oriented towards expediting the operations of an agency by reducing paperwork and connecting accounting or financial management with asset management. However, the ability to track past, current and future programmed projects can be valuable for many purposes. Among the many uses, the ability to track the performance (delivery delays and budget overruns) and identify the best and worst contractors can be particularly valuable.

Connected to the previous functionality, some software offers functionality to facilitate interaction with the public by **incorporating public complaints or service**

requests into the same system, tagging them to assets and/or to projects. Tools like this can decrease response times to public requests, sometimes enabling service requests taken by phone or internet in the central office to be instantly relayed to service personnel nearby in the field.

The final functionality offered in different ways by most of the available software is some form of organized, efficient **record keeping** for the agency. Various software packages automatically create historical records of an agency's assets and/or the agency's activities. Both historical asset conditions and agency activities are valuable, and in combination are particularly so when it allows an agency to track the improvement or degradation of assets over recent years and relate that the agency's funding and activities over the same period. This kind of information can be important in justifying funding and in allowing the agency to learn how it might improve in its mission.

No software provides the best functionality in all eight areas. Some focus exclusively on a few areas, while others make some attempt to offer functionality in all of the areas. Finding the most valuable software tool for a particular agency requires the agency to judge which of these areas are most promising or important in helping it in its particular mission and with its particular responsibilities. However, in this process of consideration, agencies should not think too narrowly about their mission or be too quick to limit what they might do based on what they have always done in the past. One of the great benefits of these computerized tools is that they allow agencies to do things in some cases that they could not even consider doing before. Agencies should also consider the potential usefulness of a tool to other agencies and the possibility of making an inter-agency investment, such as between a city's transportation and water/wastewater departments.

6.4 Software Survey

A survey of software providers was conducted as a part of the development of this guide. The purpose of the survey was to explore the state of the practice and present small agencies some sense of the tools available to them. The survey is not comprehensive, and there are a number of important national and regional software vendors who are not represented in the survey but may be important for an agency to consider when looking to

acquire software. The survey does, however, present many of the most widely used software packages and should represent the range of tools available on the market.

From the “Key Findings from the Fifth National Workshop on Transportation Asset Management”

- The majority of local government users need “off- the-shelf” products for asset management. They generally lack the staff time and skills needed to tailor tools to fit their specific situation or the funds to hire consultants to do the job.
- Tools adequate to meet the needs of smaller jurisdictions may be relatively unsophisticated... Asset-management “systems” may be based on simple spreadsheets as well as sophisticated database management packages, to match the needs and resources of the agency.

The survey questionnaire attempted to explore both a software package’s functionality and its market. The results of the survey have been condensed so that they could be presented in a clear and readily understandable way that facilitates the comparison of the available tools and how they differ. The unfortunate limitation of this approach is that sometimes important and rich information in response to a survey question had to be reduced to bring out the basic information. For that reason alone, this survey cannot replace, but only supplement an agency’s search for an appropriate software tool.

Any agency using the results of this survey to assist them in selecting a software package should be aware of the limitations of the survey. A responsible agency will want to contact several vendors directly, possibly including vendors not included here, in order to get a richer and clearer picture of a software’s functionality and the licensing options available to them. Hopefully this survey will offer important help to an agency in this task, in providing some sense of the market and suggesting some of the important questions to ask. When considering investments in software systems, small agencies may also consider the option of developing in-house applications based on readily available spreadsheet or database software. However, agencies should weigh carefully such a project’s requirements on the skill and time for their staff and the limitations of functionality as well as cost savings.

The results of the survey are presented here in six tables. The first table presents the basic corporate and contact information for the participating software vendors and the pricing of their products. To the extent possible, the prices represent the price for the one

(the first) license, but some of the vendors only offer multi-user or site licenses. When comparing, it is important to consider that the cost of additional licenses invariably decreases, sometimes precipitously. The second table explores the market which each software serves.

The third table presents the data collection, organization and presentation functionality including its level of GPS compatibility and GIS integration. The fourth table explores which inventory, conditions forecasting and coordination functionalities each software package offers for different asset types. The fifth table presents the analytic functionality of the different software and the extent of their ability to optimize resource allocation. The sixth and final table presents the project tracking and public input functionality of software designed to assist and simplify agency operations.

Table 3: Corporate Information and Pricing

Company Name	Azteca Systems, Inc.	Bentley Systems, Inc.	Bernardin, Lochmueller & Associates, Inc.	Deighton Associates
Product Name	Cityworks	Bentley ProjectWise	SRMS™	dTIMS CT
Website	www.azteca.com	www.bentley.com	www.blainc.com	www.deighton.com
Contact	Tom Palizzi		Dean Munn	Richard Baumgartner
Mailing Address	11075 South State Street, Suite 24, Sandy UT 84070	Exton, PA	6200 Vogel Rd. Evansville, IN 47715	112 King St. E Bowmanville, ON, CAN L1C15
Phone	801-523-2751	1-800-BENTLEY	800-423-7411	905-697-2644
Experience	Since 1996	10 years	12 years	20 years
Last Update	June 2005	2005	available Q3 2006	v8 this summer
License* low	\$7,995	\$15,000 (for a 5 user setup)	\$7,000	\$15,000
License high	\$40,970		\$25,000	\$60,000
Maintenance Support	\$1,750 to \$9,210	varies	\$2,500	10% of license \$850/yr and up

*License prices are for a single license except where noted.

Table 4: Corporate Info and Pricing (continued)

Company Name	GBA Master Series, Inc. (gbaMS)	Hansen Information Technologies	Michigan Tech University - Local Technical Assistance Program	Vulcan Traffic Management Services
Product Name	GBA Master Series®	Hansen 8 web app / Version 7 client server application	RoadSoft GIS®	VIMMS 2000
Website	www.gbams.com	www.hansen.com	www.roadsoft.org	www.vulcaninc.com/plt8hom.htm
Contact	Jim Graham	Mitch Bradley	Tim Colling, P.E.	Jennifer Johnson
Mailing Address	10561 Barkley, Suite 500 Overland Park, KS 66212	11092 Sun Center Dr, Rancho Cordova, CA, 95670	309 Dillman Hall Houghton, MI 49931	PO Box 1850 Foley, AL 36536
Phone	(800) 492-2468	(800) 821-9316	906-487-2102	888-846-2801 Ex1951
Experience	20 years	23 years	12 years	21 years
Last Update	July 2005	semi-annual updates	Feb. 2006	Dec. 2005
License* low	\$2,000	v7 \$4,000 / v8 \$4,500	Free to Michigan users	\$2,445
License high	\$4,500	v7 \$10,000 / v8 \$122,000	\$1,000 outside the state	\$6,210
Maintenance Support	20% of the license	20% of the license	6hrs included, more on hourly rate, free for MI	\$695 to \$1,395

Table 5: Market Information

Company Name	Azteca Systems, Inc.	Bentley Systems, Inc.	Bernardin, Lochmueller & Associates, Inc.	Deighton Associates
Product Name	Cityworks	Bentley ProjectWise	SRMS™	dTIMS CT
Total Users	250 in US & abroad		Approximately 15	>260 in 17 countries
% of total users are public agencies	90%	60%	100%	80%+
% of public users: DOTs / regional / federal agencies	< 25%	60%	none	50%
% of public users: county / municipal agencies	75%	25%	100%	50%
% of public users managing roadway assets	30%	60%	100%	85%
% of public users managing transit assets	small percentage	20%	none	< 10%
% of public users managing water /sewer assets	50%	40%	none	< 5% but growing
Largest Transport. Client	Nassau Co, NY - pop. 1.3 million	U.S. Army Corps of Engineers	pop. 200,000	New Zealand – 4 million
Smallest Transport. Client	Rupert, ID - pop. 5,645	To numerous to list, typically small municipalities or governments	pop. 20,000	Hazelwood, MO - pop. 26,000
Reference Client	Edmond, OK	Available upon request. See website.	Warrick County, IN	Hazelwood, MO

Table 6: Market Information (continued)

Company Name	GBA Master Series, Inc. (gbaMS)	Hansen Information Technologies	Michigan Tech University - LTAP	Vulcan Traffic Management Services
Product Name	GBA Master Series®	Hansen 8 web app / Version 7 client server app	RoadSoft GIS®	VIMMS 2000
Total Users	Approximately 200	Approximately 300	280	< 500
% of total users are public agencies	93%	95%+	100%	95%
% of public users: DOTs / regional / federal agencies	none	10%	10%	10%
% of public users: county / municipal agencies	100%	90%	85%	85%
% of public users managing roadway assets	26%	44%	90%	95%
% of public users managing transit assets	N/A	none	N/A	none
% of public users managing water /sewer assets	75%	76%	N/A	none
Largest Transport. Client	pop. 350,000	Caltrans (California DOT) pop. 36 million	27,000 miles of roadway	pop. 2.2 million
Smallest Transport. Client	pop. 12,000	Monterey, CA - pop. 30,000	<100 miles of roadway	pop. 10,300
Reference Client	Augusta-Richmond County, GA	Monterey, CA	Alcona County, MI	Odessa, TX

Table 7: Data Collection and Organization

Company Name	Azteca Systems, Inc.	Bentley Systems, Inc.	Bernardin, Lochmueller & Associates, Inc.	Deighton Associates
Product Name	Cityworks	Bentley ProjectWise	SRMS™	dTIMS CT
GPS compatibility	out-of-the-box integration	generic interface provided	out-of-the-box integration	customizable compatibility
Which GPS devices?	Trimble, Leica, Garmin, TopCon & any ESRI compatible			
Error Checking / database consistency logic	Yes	No	Yes	Yes
User Can Add Fields	Yes	Yes	Yes	Yes
Automaticly Saves Asset History	Yes	Yes	Yes	Yes
Attach digital images?	Yes	Yes	Yes	Yes
GIS	fully integrated with ESRI, but requires ESRI license	integrated	integrated	compatible
Which GIS software?	ESRI	ESRI, MapInfo, Integraph	Caliper: Maptitude, TransCAD	ESRI, Integraph, etc.
Reports	Yes	Yes	Yes	Yes

Table 8: Data Collection and Organization (continued)

Company Name	GBA Master Series, Inc. (gbaMS)	Hansen Information Technologies	Michigan Tech University - LTAP	Vulcan Traffic Management Services
Product Name	GBA Master Series®	Hansen 8 web app / Version 7 client server app	RoadSoft GIS®	VIMMS 2000
GPS compatibility	Not directly. You can collect data with GPS and then import data.	customizable compatibility	out-of-the-box integration	customizable compatibility
Which GPS devices?			Any (with standard NEMA 0183 output & serial/USB cord)	Most Latitude and Longitude devices, but not State Plane Datum
Error Checking / database consistency logic	Yes	Yes	Yes	Yes
User Can Add Fields	Yes	Yes	Yes	No, but user has comment fields.
Automatically Saves Asset History	Yes	only through inspection records	Yes	Yes
Attach digital images?	Yes	Yes	Not currently, but planned for future	Yes
GIS	compatible	compatible	integrated	integrated
Which GIS software?	ESRI, Autodesk	v7 ESRI &Integrgraph / v8 ESRI (Integrgraph & AutoDesk soon)	ESRI compatible	ArcInfo, ESRI, MapInfo, Pepperwhite and Tiger Maps
Reports	Yes	Yes	Yes	Yes

Table 9: Assets Managed

	Company	Azteca	Bentley	BLA	Deighton Assoc.
Asset Type	Product Name	Cityworks	Bentley ProjectWise	SRMS™	dTIMS CT
Pavement	Inventories	X	X	X	X
	Est. Monetary Value	X			X
	Est. Remaining Life	with add'l. system	X	X	X
	Recommends Actions	with add'l. system		X	X
	Coordination	with add'l. system		X	X
Signs	Inventories	X	X	X	X
	Est. Monetary Value	X			X
	Est. Remaining Life	with add'l. system	X		X
	Recommends Actions	with add'l. system		X	X
	Coordinates Actions	with add'l. system			X
Sidewalks	Inventories	X	X	X	X
	Est. Monetary Value	X			X
	Est. Remaining Life	with add'l. system	X		X
	Recommends Actions	with add'l. system		X	X
	Coordinates Actions	with add'l. system		X	X
Pavement Markings, Guardrails, Barriers	Inventories	X	X	X	X
	Est. Monetary Value	X			X
	Est. Remaining Life	with add'l. system	X		X
	Recommends Actions	with add'l. system			X
	Coordinates Actions	with add'l. system			X
Traffic Signals and Street Lights	Inventories	X	X	X	X
	Est. Monetary Value	X			X
	Est. Remaining Life	with add'l. system	X		X
	Recommends Actions	with add'l. system			X
	Coordinates Actions	with add'l. system			X
Bridges & other Structures	Inventories	X	X	X	X
	Est. Monetary Value	X			X
	Est. Remaining Life	with add'l. system	X		X
	Recommends Actions	with add'l. system			X
	Coordinates Actions	with add'l. system			X
Transit Vehicles / Rolling Stock	Inventories	X	X	X	
	Est. Monetary Value	X			
	Est. Remaining Life	with add'l. system	X		
	Recommends Actions	with add'l. system			
	Coordinates Actions	with add'l. system			
Transit Guideways / ROW / Structures	Inventories	X	X	X	X
	Est. Monetary Value	X			X
	Est. Remaining Life	with add'l. system	X		X
	Recommends Actions	with add'l. system			X
	Coordinates Actions	with add'l. system			X
Stormwater / Wastewater / Potable Water Lines	Inventories	X	X	X	X
	Est. Monetary Value	X			X
	Est. Remaining Life	with add'l. system	X	stormwater only	X
	Recommends Actions	with add'l. system		stormwater only	X
	Coordinates Actions	with add'l. system		stormwater only	X
Private Utilities	Inventories	X	X	X	X
	Est. Monetary Value	X			X
	Est. Remaining Life	with add'l. system	X		X
	Recommends Actions	with add'l. system			X
	Coordinates Actions	with add'l. system			X
Parks & Playgrounds	Inventories	X	X	X	X
	Est. Monetary Value	X			X
	Est. Remaining Life	with add'l. system	X		X
	Recommends Actions	with add'l. system			X
	Coordinates Actions	with add'l. system			X

Table 10: Assets Managed (continued)

Asset Type	Company	gbaMS	Hansen	Mich Tech LTAP	Vulcan TMS
	Product Name	GBA MasterSeries®	Hansen 7 / 8	RoadSoft GIS®	VIMMS 2000
Pavement	Inventories	X	X	X	
	Est. Monetary Value		X	X	
	Est. Remaining Life		X	X	
	Recommends Actions	X	in development	X	
	Coordinates Actions		in development	X	
Signs	Inventories	X	X	X	X
	Est. Monetary Value		X		X
	Est. Remaining Life		X		X
	Recommends Actions		in development		X
	Coordinates Actions		in development	X	X
Sidewalks	Inventories	X	X	X	X
	Est. Monetary Value		X		X
	Est. Remaining Life		X		X
	Recommends Actions		in development		X
	Coordinates Actions		in development	X	X
Pavement Markings, Guardrails, Barriers	Inventories	X	X	X	X
	Est. Monetary Value		X		X
	Est. Remaining Life		X		X
	Recommends Actions		in development		X
	Coordinates Actions		in development	X	X
Traffic Signals and Street Lights	Inventories	X	X		X
	Est. Monetary Value		X		X
	Est. Remaining Life		X		X
	Recommends Actions		in development		X
	Coordinates Actions		in development		X
Bridges & other Structures	Inventories	X	X	X	
	Est. Monetary Value		X		
	Est. Remaining Life		X		
	Recommends Actions		in development		
	Coordinates Actions		in development	X	
Transit Vehicles / Rolling Stock	Inventories	X	X		
	Est. Monetary Value		X		
	Est. Remaining Life		X		
	Recommends Actions		in development		
	Coordinates Actions		in development		
Transit Guideways / ROW / Structures	Inventories	X	X		X
	Est. Monetary Value		X		X
	Est. Remaining Life		X		X
	Recommends Actions		in development		X
	Coordinates Actions		in development		X
Stormwater / Wastewater / Potable Water Lines	Inventories	X	X	X	X
	Est. Monetary Value		X		X
	Est. Remaining Life		X		X
	Recommends Actions	X (for wastewater)	in development		X
	Coordinates Actions		in development	X	X
Private Utilities	Inventories	X	X		X
	Est. Monetary Value		X		X
	Est. Remaining Life		X		X
	Recommends Actions		in development		X
	Coordinates Actions		in development		X
Parks & Playgrounds	Inventories	X	X		X
	Est. Monetary Value		X		X
	Est. Remaining Life		X		X
	Recommends Actions		in development		X
	Coordinates Actions		in development		X

Table 11: Resource Allocation / Analysis

Company Name	Azteca Systems, Inc.	Bentley Systems, Inc.	Bernardin, Lochmueller & Associates, Inc.	Deighton Associates
Product Name	Cityworks	Bentley ProjectWise	SRMS™	dTIMS CT
Computes Avg Maint. Costs	No	Yes	Yes	Yes
Avg Life-Spans	No	Yes	Yes	Yes
Identify Potential Projects	Yes	Yes	Yes	Yes
Deterioration Models	No	No	Yes, in new release	Yes
Forecast Budget Needs	No	No	Yes	Yes
Budget needs to achieve various levels of service	No	No	Yes	Yes
Prioritize Projects	Not automatically	Yes	Yes	Yes
Cross-asset Optimization	No	Yes	No	Possible
Coordinated Maintenance	No	Yes	Yes	Yes
Life-cycle cost Estimation	No	Yes	Yes	Yes
Cost Estimation	User supplied unit costs	User supplied unit costs	User supplied unit costs or models	User supplied unit costs
User Benefits	No	No	No	Yes, safety, mobility, op.costs
Environmental Impacts	No	No	No	Some
Budget Constraints	No	No	Yes	Yes
Equity Constraints	No	No	Yes	Yes
Other Criteria	No		traffic volume, % heavy vehicles	user-defined objective function

Table 12: Resource Allocation / Analysis (continued)

Company Name	GBA Master Series, Inc. (gbaMS)	Hansen Information Technologies	Michigan Tech University - LTAP	Vulcan Traffic Management Services
Product Name	GBA Master Series®	Hansen 8 web app / Version 7 client server app	RoadSoft GIS®	VIMMS 2000
Computes Avg Maint. Costs	Yes	Yes	Yes	Yes
Avg Life-Spans	Depends on data stored	Yes	Yes	Yes
Identify Potential Projects	Facilitates User Judgment	Facilitates User Judgment	Yes	Yes
Deterioration Models	Only for pavements and sanitary sewers (v.6.72)	v7 Yes / v8 Coming late '06	For pavement	Applies user defined life cycles
Forecast Budget Needs	Only for pavement & sanitary sewers	Yes	Yes	Yes
Budget needs to achieve various levels of service	Not automatically	In development - expected in 2nd quarter of 2007	Yes	Yes
Prioritize Projects	Only for pavement & sanitary sewers	Not automatically	Pavement projects only	No
Cross-asset Optimization	No	with configuration	No	No
Coordinated Maintenance	No	No	Yes	No
Life-cycle cost Estimation	No	with configuration	Yes	No
Cost Estimation	User supplied unit costs	User supplied costs by activity	User supplied unit costs	User supplied unit costs
User Benefits	No	No	No	No
Environmental Impacts	No	with configuration	No	No
Budget Constraints	Yes	Yes	Yes	No
Equity Constraints	No	Yes	No	No
Other Criteria		benefit/cost	remaining service life	No

Table 13: Maintenance & Financial Management

Company Name	Azteca Systems, Inc.	Bentley Systems, Inc.	Bernardin, Lochmueller & Associates, Inc.	Deighton Associates
Product Name	Cityworks	Bentley ProjectWise	SRMS™	dTIMS CT
Track Public Complaints / Requests	Yes	Yes	No	No
Generates Work Orders	Yes	Yes	Yes	No
Project Tracking	Yes	Yes	Yes	No
Records Project Histories	Yes	Yes	Yes	No
Tracks Project Delivery Performance	Yes	No	No	No
Tracks Costs by Personnel, Materials, & Equipment	Yes	Possible	No	No
Identifies Funds by Source	Yes	No	No, but could be added	No

Table 14: Maintenance and Financial Management (continued)

Company Name	GBA Master Series, Inc. (gbaMS)	Hansen Information Technologies	Michigan Tech University - LTAP	Vulcan Traffic Management Services
Product Name	GBA Master Series®	Hansen 8 web app / Version 7 client server app	RoadSoft GIS®	VIMMS 2000
Track Public Complaints / Requests	Yes	Yes	No	Yes
Generates Work Orders	Yes	Yes	Not currently, planned for late '06	Yes
Project Tracking	Yes	Yes	Yes	Yes
Records Project Histories	Yes	Yes	Yes	Yes
Tracks Project Delivery Performance	Yes	Yes	Yes	Yes
Tracks Costs by Personnel, Materials, & Equipment	Yes	No	No	Yes
Identifies Funds by Source	Yes	Yes	No	Yes

6.5 Conclusion

As the cost of computer hardware and software has fallen dramatically over the past decade, the cost savings from increased productivity allowed by computer technology has impacted every sector of the economy. Some local governments have kept pace with this revolution in managing their transportation assets, while others have fallen behind. At this point, it is the cost of not investing in computer technology that an agency must weigh.

Sophisticated software tools are never a replacement for good staff or good analysis, but they can sometimes greatly improve an agency's productivity. These tools are not the solution to every problem, but their functionality is steadily expanding. The software does not do its users' jobs for them, but can allow them to do their jobs better, more efficiently and cost effectively.

Chapter 7: Additional Resources and Information

7.1 Introduction

The effort to produce this report included an extensive review of academic and professional literature and websites relevant to transportation asset management, and asset management by local governments, in particular. This chapter presents some of the most valuable resources for local governments interested in learning more about asset management. The references for this report provide a more extensive list of relevant work, but this chapter provides a summary of the content and usefulness of some of the most important sources of information available.

7.2 Websites

The following websites were identified as particularly valuable. They provide a wealth of instantly accessible information directly and by providing links to or downloads of important documents. They are an important source of information for identifying opportunities for training, and they connect the asset management community online.

www.mrutc.org

The website of the Midwest Regional University Transportation Center provides information on research and training opportunities in transportation asset management.

assetmanagement.transportation.org

Transportation Asset Management Today is a website and bulletin board hosted by the American Association of State Highway and Transportation Officials (AASHTO). Although partially out-of-date, and not highly trafficked, it does provide a forum for asset managers to interact, post questions, and exchange information. The events calendar has remained up-to-date and is valuable for finding training opportunities.

www.fhwa.dot.gov/infrastructure/asstmgmt

The Federal Highway Administration (FHWA) website for their Office of Asset Management outlines the federal government's efforts to practice, encourage, and

support transportation asset management. It includes in-depth case studies of asset management at the state DOT level, the *Asset Management Primer*, and the various related FHWA primers that followed from it.

www.infraguide.ca

The website of Canada's network of experts in public infrastructure management (Federation of Canadian Municipalities, Canadian National Research Council, Infrastructure Canada, Canadian Public Works Association, etc.) provides an extensive and growing library of publications documenting best practices in public infrastructure management as well as its own infrastructure asset management guide for municipal governments.

www.countyengineers.org

The site for the National Association of County Engineers is not focused on asset management, per se, but in practice is a valuable site with a wealth of links and information on recent and pending relevant legislation.

www.ltapt2.org

The website of the Local Technical Assistance Program (LTAP) can be valuable in identifying services provided by centers in each state. Some offer training or conferences. Others, such as Michigan's center, provide software.

www.amsna.org

The Asset Management Source for North America is a for-fee subscription service providing information on general public sector asset management training, conferences, publications, and legislation.

www.wcha.net

The Wisconsin County Highway Association includes a valuable resources page of interest well beyond Wisconsin, as well as an important forum for agencies within the state.

7.3 Publications

The publications presented here were identified as other important references in transportation asset management for local governments. They are key works defining presenting the field of transportation asset management, its tools and strategies.

- The Primer Series – produced by the FHWA, these documents cover the key topics in transportation asset management including data integration, economic analysis and GASB 34. One of the original works on the subject, the Asset Management Primer provides a valuable overview of transportation asset management in thirty pages.
- Infrastructure Management: Integrating Design, Construction, Maintenance, Rehabilitation, and Renovation – this book by Hudson, Haas, and Uddin is one of very few textbooks devoted to the topic of infrastructure management, and includes good coverage of transportation.
- InfraGuide: The National Guide to Sustainable Municipal Infrastructure – is composed of both a general infrastructure asset management guide for municipalities and a series of publications on best-practices in infrastructure management. Although authored by and for Canadian municipalities, it is also a valuable reference for local government agencies in the United States and abroad. Two of its publications, Timely Preventative Maintenance for Municipal Roads – A Primer and Roads and Sidewalks: Priority Planning and Budgeting for Pavement Management and Rehabilitation, are particularly worthy of attention.
- International Infrastructure Management Manual, 2006 Edition – a valuable reference guidebook on all branches of public sector asset management, the new edition is more truly international with special sections for different countries, including the U.S. and Canada. Considerable focus is devoted to the local government level.
- Transportation Asset Management Guide – represents an authoritative review and presentation of the theory and practice of transportation asset management at the state and federal level. It is a valuable reference for county, municipal and other small agencies, but focuses on state departments of transportation and does not address issues that occur at the local level.

Part IV Case Studies

Chapter 8: Case Studies of Transportation Asset Management by Local Governments

8.1 Introduction

Experience is often of far more value than theory when it comes to making something work. For that reason, this chapter presents the experience of nine local governments in their attempts to systematize and improve their asset management. The collection of case studies presented here was gathered from many sources including conference proceedings, annual reports of state agencies, and software vendors. The views presented in these case studies should be considered in light of their origins, but hopefully, presenting the experiences of a variety of communities, developed for a variety of purposes will be useful to other communities. Much can be learned from these case studies, and their content was an important source for the specific findings of this report, but perhaps the most important theme for other local government officials who may read this is there are many promising options for improving asset management which have proven successful elsewhere.

8.2 Kent County, Michigan

The following case study for Kent County, Michigan, was prepared as part of the 2003 Annual Report of Michigan's Transportation Asset Management Council.

The majority of public roads in Michigan are under the jurisdiction of local governments. If the benefits of asset management are to be realized statewide, then it is imperative that the tools and procedures of asset management be utilized by local road agencies. Consequently, it is the intent of the Council to highlight agencies that are utilizing the principle of asset management in order to encourage other agencies to employ such methods.

The Kent County Road Commission's (KCRC) experience in asset management began in 1995 with an annual process of surveying pavement conditions on the primary road system for a new pavement management system. That effort significantly expanded the organization's ability to assess needs on a systems level and to forecast the impact of

various investment alternatives. As a result, KCRC stepped up its investments in system preservation and the affect of that decision is illustrated on the accompanying chart.

In the mid-1990s, the trend in the condition of KCRC’s primary road system was headed in the wrong direction. The miles of roads needing reconstruction were increasing per year while the roads considered needing only routine maintenance were declining. Leading up to that period, KCRC had completed many miles of expansion projects in response to a rapidly growing local economy and population. Annual surveys of road conditions, however, revealed the need to re-emphasize system preservation.

Since 1995, KCRC has more than doubled annual investments in its overlay and seal coat program. With the information generated by the pavement management system, KCRC has the ability to forecast the affect of its investment decisions. The accompanying chart demonstrates that ability and shows improving conditions on the primary road system due to increased investment in system preservation. This trend continues through 2008 with projects included in KCRC’s current Five Year Improvement Program.

The Kent County Road Commission, in cooperation with the Grand Valley Metro Council (GVMC) transportation-planning program, adopted Micropaver as the area’s official pavement management system. This program evaluates road segments according to a PCI, which is used by GVMC to determine project eligibility for the Transportation Improvement Program (TIP). Various improvement types are associated with three PCI ranges.

Table 15: Kent County Pavement Action Triggers

Improvement Need	PCI Range
Routine Maintenance	71-100
Preservation	46-70
Resurface / Reconstruction	0-45

KCRC uses Micropaver to initially identify improvement projects and to evaluate different investment options. The Road Commission’s philosophy is to insure that

adequate investments are being made to preserve the primary road system as major expansion, construction, and reconstruction projects are considered.

To do so, a six-step planning process is followed each year as part of the annual budget cycle.

1. **Survey Conditions:** One-third of the roads on the primary road system are surveyed annually and the database is updated to reflect completed improvement projects.
2. **Determine Current Needs:** A comprehensive list of primary road needs is produced annually using a variety of indicators including PCI, existing and projected traffic volume, and all-season condition.
3. **Select and Package Projects:** Staff from Planning, Engineering, and Maintenance review the needs list and cooperatively identify potential projects for the upcoming five year period.
4. **Analyze Future Conditions:** Based upon the projects selected in Step 3, future conditions are forecast to determine if system performance objectives are being achieved.
5. **Update Improvement Program:** The Five-Year Improvement Program is updated as part of the process of developing the annual budget.
6. **Monitor Performance:** As projects are implemented, the condition of select segments are surveyed annually to more precisely determine the performance of various improvement strategies.

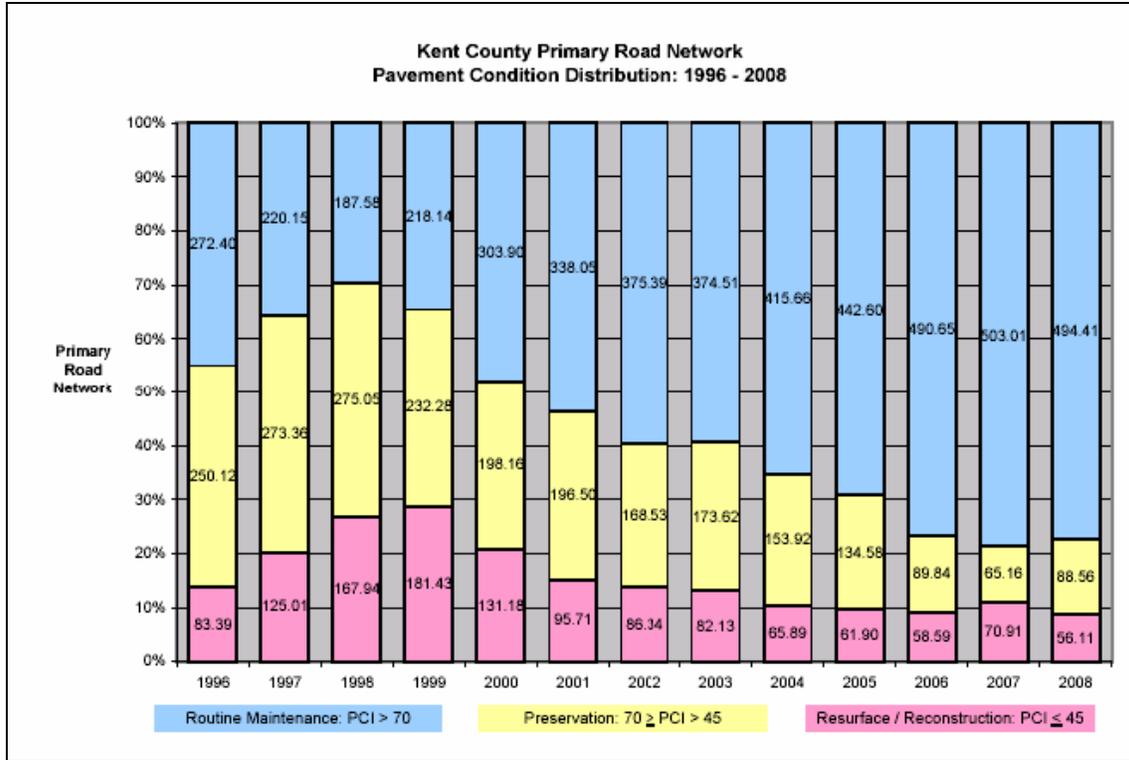


Figure 7: Historic and Forecast Pavement Conditions in Kent County, MI

Asset management has become ingrained in the Kent County Road Commission’s overall planning and annual budgeting processes. It is a fundamental process of systematically assessing the future of present decisions. With that in mind, it obviously has application in many other functions in this, or any other organization. At this time, KCRC has completed condition surveys on the county’s local road system is looking forward to other applications as well.

Any questions about Kent County Road Commission’s experience in Asset Management may be directed to Steve Warren, KCRC Deputy Director, or Roger Belknap, Transportation Planner.

8.3 Ionia, Michigan

The following case study for Ionia, Michigan, was prepared as part of the 2004 Annual Report of Michigan’s Transportation Asset Management Council.

The City of Ionia has undertaken a comprehensive asset management planning process covering most of its infrastructure, including streets, water and sewer lines, and

fire hydrants. City Manager Tom Wieczorek provided the following synopsis of their efforts.

During a department planning program in 1998, all department managers for the City agreed that existing mapping systems, record systems, and improvement processes were not working effectively. The big problem? Since 1972, when the last aerial maps were compiled, much of the city had changed both in terms of construction as well as drainage. There was not one location to find maps; rather, one had to search through various departments, records, storage racks, and other locations to find answers to what would otherwise be simple questions.

At the same time, the City's computer system was found to have more than its share of problems. Like most communities, what had been a few computers in isolated departments had later been tied together (somewhat) with a variety of platforms, servers, and programs; not all of which would communicate with each other.

From that meeting came a comprehensive study that outlined how the city would move technology wise for the next five years, with the finished product including a Geographic Information System with linkage of all city data bases on a common framework and across departments. Also from that study, departments embarked on a self-assessment process that would, preferably, end with accreditation of the various city disciplines.

The accreditation models all begin with self-assessment of current operations and, depending on the model, develop a strategic process designed around goals and objectives to provide for continuous improvement. The process manages the assets of the departments in a more effective way, comparing them against national and international objectives and standards, so that a more effective (both cost and quality) organization results. The fire model is probably the most grueling and far-reaching; the APWA model is less onerous but very detailed which is evidenced by the fact only five agencies have been accredited to date.

The State of Michigan, about this time, also embarked on an asset management process for roads, mandating that entities receiving funds would manage the resources as assets – strategically rather than tactically. This was incorporated into the city's process.

The GIS photography took place in 1999-2000 with ortho-digital photos shot to an accuracy of 4 inches using ground coordination methods that included painting water valve boxes, manholes, storm grates, and shut-off valves. All property records were incorporated into the GIS system as well as a new city-wide reappraisal and assessment program. Layers were brought into the system with roads being the first; water, sewer, and storm sewers. Also added have been trees, road signs, street lights, and other items in the road rights-of-way.

Three years ago we first began rating the roadways and ultimately went to RoadSoft and the PASER system. We only trained three people at the start; we are in the process of now training all Public Works and Public Utilities personnel on the RoadSoft, GIS, PASER, and Asset Management.

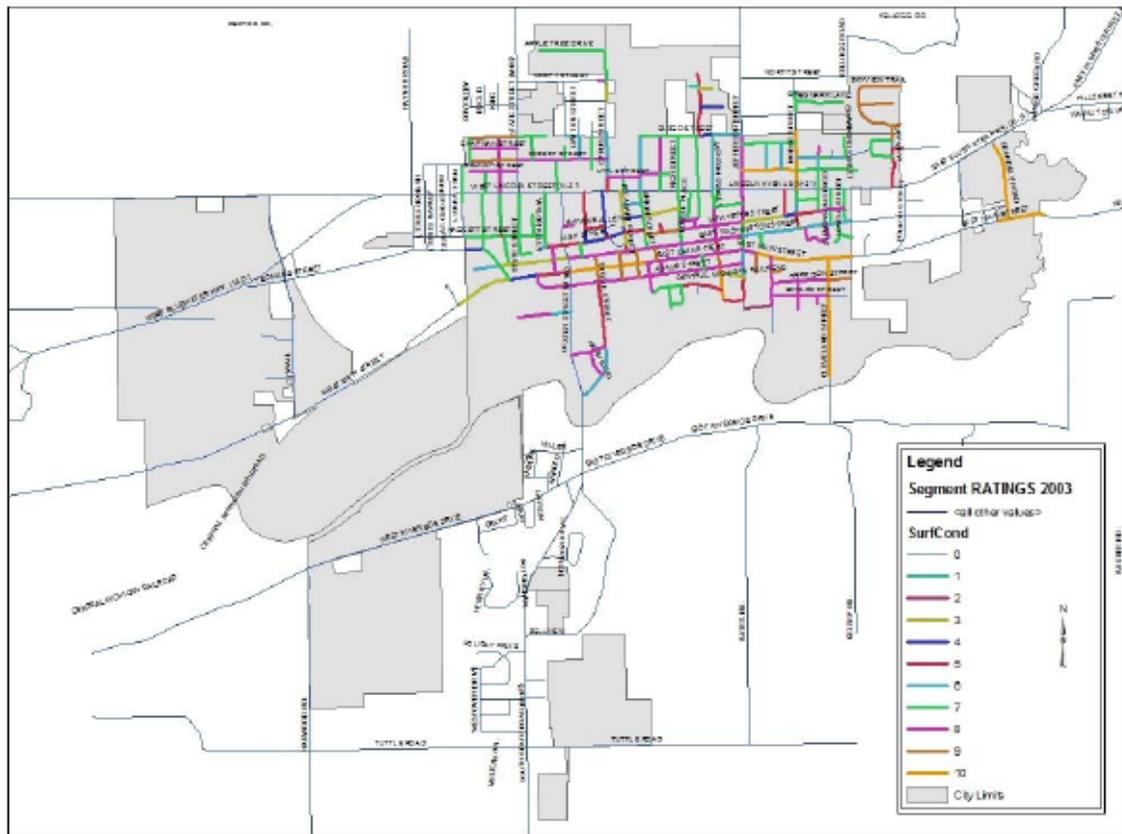


Figure 8: GIS Map of PASER Pavement Ratings for Ionia, MI

One of the first things that we noticed was the older water, sewer and areas that had either undersized or no storm sewer also had bad curbs, gutter, and road surfaces. We

went underground, videotaping all sewers in 1/3 of the city during 2003. This produced our Asset Management Strategy that would rebuild 1/3 of the city during the 2003-2004 years. We have since videotaped an additional 1/3 to 1/2 of the City which is serving as the basis for a complete rebuild of all of the underground utilities and roadways in the “middle” portion of the City as well as along state highways M-21 and M-66. When complete in 2006, more than 2/3 of the City will have been completely rebuilt. Plans are also taking shape for the 2006-2008 year to complete the underground rebuild which will result in all roadways being in good to excellent condition; all curb and gutter and storm drainage in good to excellent; and all water and sewer being ductile iron and copper leads rather than galvanized and cast iron (all lead pipes and connections have been taken out of the system during the last seven years).

Also this year, all sidewalks will be incorporated into the Asset Management System. The City completed more than \$1 million in sidewalk repairs and upgrades in 2004 and the system will be maintained using the PASER concrete programs as well as GIS data. Lastly, the City’s parks and river trail system is being rated for the first time (including the Ionia Fairgrounds that is a city park) with those assets planned for improvements on a long-term approach.

The 2005 goals include training all staff in the concepts of AM, GIS, and PASER while also adding a new 800 MHz radio system, vehicle tracking, and GPS positioning on trucks and equipment. This radio system is operational; the radios should be installed by June of 2005; and the AVL and other portions during the summer months. The AVL is currently used and has been debugged by the City’s Dial-A-Ride bus system and has shown that times for transport have been reduced by as much as 7 minutes in many cases.

8.4 Hillsborough County, Florida

The following case study for Hillsborough County, Florida, was one of several prepared as part of the Key Findings from the Fifth National Workshop on Transportation Asset Management which occurred in September and October of 2003 in Atlanta, Georgia, and Seattle, Washington.

Hillsborough County Florida has developed the Hillsborough Asset Management System (HAMS). Hillsborough County, in west central Florida, is home to the city of Tampa.

HAMS currently includes transportation and stormwater components, and incorporates asset valuations to comply with GASB Statement 34. Assets are broadly categorized as linear or point features. Data collection relies on mobile mapping technology using camera equipped vans, manual field observations with GPS technology, and other specialized technology. The entire system is GIS based and uses proprietary and public domain components for inventory and inspection data management.

Asset condition is rated on a simple three-level scale (good, fair, poor or unknown) unless a more sophisticated system has been put in place. Pavements, for example, are rated using surface condition, roughness, and structural sufficiency in accordance with procedures outlined in its pavement management system. The asset inventory includes a wide range of components for which the county is responsible, ranging from pavements and culverts to manholes and sidewalk handrails.

The asset management system includes deterioration models, management activity definitions, decision and prioritization models, budget analysis, and reporting to support integrated decision-making about how to most effectively manage the county's assets.

Maintenance management, including production of work orders and schedules, accounts for an important segment of the asset management application. For pavements, the system considers activities ranging from crack sealing to micro-surfacing and ultra-thin bonded asphalt overlays to resurfacing and full reconstruction. A neighborhood servicing program enhances the system's responsiveness to citizens' concerns.

Benefit cost analysis is used to establish priorities among proposed asset improvement activities. Benefits assessed for roadway improvements include savings from the reduction in vehicle accidents and delays. Improvements are grouped into logical packages for prioritization and programming of funds; for example, sidewalk improvements are associated with public schools within the county's jurisdiction, and schools are ranked against one another in the final programming.

The management system maintains a comprehensive estimate of asset values using discounted replacement cost data. The current adjusted value of the county's roadway, bridge, and railroad crossing assets exceeds \$5.8 billion. Hillsborough County's use of the modified approach to meeting the requirements of GASB Statement

34 has been accepted by rating agencies and arguably has strengthened the agency's commitment to providing adequate revenue for accelerated investments in stormwater and transportation capital improvement programs.

8.5 Cole County, Missouri

The following case study for Cole County, Missouri, was one of several prepared as part of the Key Findings from the Fifth National Workshop on Transportation Asset Management which occurred in September and October of 2003 in Atlanta, Georgia, and Seattle, Washington.

Cole County Public Works Department, in Jefferson City, MO moved from managing its assets based on the knowledge and memories of agency staff to a systematic approach. As staff retirements occurred, the knowledge of the county's assets was being depleted and the management system was threatened. There was no "back-up" to retain information from past decisions and to pass along such information to new managers.

The introduction of GASB Statement 34 provided added impetus for change in the county's asset management practices. County staff explored existing "canned" software packages that might facilitate the initial inventorying and condition assessment of the county's transportation assets. The packages considered had broad scopes—for accommodating varieties of assets—and were flexible, with "bells and whistles" to support various functions. Purchasing such a package would offer technical support to the county staff during management system implementation. However, the packages were costly, complicated, and would require periodic staff training to keep up with new capabilities as the software packages are upgraded. The county decided instead to devise its own package, with the help of the local university. Missouri University graduate students were employed to gather the initial data.

The system, designed to be simple to develop and use, was based on a spreadsheet model, with inventory data collected using inexpensive GPS devices purchased at a local electronics store. The most complex task was designing the unique identifier "tag" to be used to designate specific assets. A five-digit identifier was adopted.

Roadway types and other characteristics were defined using existing county procedures. A visual inspection was made of pavement condition, with ratings assigned on a five point scale from "excellent" (5) to "failed" (1). Specific pavement distress and

drainage conditions were also recorded. Drainage structures, traffic signage, and guardrail were also inventoried and rated for condition. Bridges were inventoried but not rated, because the state department of transportation rates all “off system” bridges every two years.

The inventory is updated by re-assessing about one-third of the county’s roads each year. Agency construction inspection staff conducts the ratings using a condition rating manual.

The system is used to evaluate upcoming maintenance needs by reviewing conditions and using standard performance prediction curves. Analyses are made of the estimated costs to maintain or improve system components with current maintenance techniques and to extend or prolong service life with different maintenance techniques. These estimates are used in developing “long term” (3-5 years) maintenance projections and capital improvement programming.

The county’s financial staff initially had agreed with public works staff that the “modified approach” to GASB 34 compliance would be adopted. That plan changed, however, when the county commission and auditor decided that the conventional historic cost-and-depreciation approach would be required. Values of the asset inventory were estimated using construction cost data for 2001 to develop unit replacement costs for major pavement types. Estimated current values were then computed by applying reduction factors reflecting observed condition; e.g., the value of a segment in “fair” condition was calculated as 67.5 percent of the new-construction replacement cost. The current value of the county’s road assets totaled nearly \$134.7 million.

Valuing Assets:
Cole County, MO

“The current value of the county’s road assets totaled nearly \$134.7 million.”

From “Key Findings from the Fifth National Workshop on Transportation Asset Management”

The system provides information that increases the agency’s accountability for the performance of the county’s assets. Because of the system, the agency has found that taxpayers grow accustomed to a particular level of service and expect it to be maintained. The system helps the county address this issue by providing a basis for discussing tax rates to assure funding of maintenance will be adequate for the expected levels of service desired by the public.

8.6 Redmond, Washington

The following case study for Redmond, Washington, was one of several prepared as part of the Key Findings from the Fifth National Workshop on Transportation Asset Management which occurred in September and October of 2003 in Atlanta, Georgia, and Seattle, Washington.

The City of Redmond, Washington has developed a transportation asset management strategy with particular regard for compliance with GASB Statement 34 reporting requirements. Redmond is unusual among the local government participants in that its roadway system is relatively young and its council is inclined to allocate funds for improvements in excess of amounts that can readily be spent (e.g., because of limited ability to acquire rights of way).

Besides the streets themselves, the street system includes signs, curbs and gutter and the right-of-way. These assets were being tracked in the city's GIS system prior to the onset of GASB Statement 34 considerations. Streetlights and traffic signals are reported separately using their own asset listing. Hiking and biking trails are also included among the transportation assets the Public Works Department manages and are also managed in a separate module.

Redmond's transportation asset management system currently has four principal elements: a geographic information system (GIS), a pavement management system, a park trail tracking system, and a project cost system. Considerable effort was devoted to strategic planning when the system was established, and subsequently to education and training of the GIS, engineering, and financial technicians who maintain the system. Similarly, considerable effort is put into keeping the information system current and compatible with the county's financial reporting system, particularly with respect to capital projects, contributed assets (e.g., facilities or rights of way), and abandoned assets.

Every two years the city contracts with the Northwest Pavement Management Association to rate the entire street system. The contractor "walks the streets" of Redmond and assesses condition according to state standards reflecting the number of potholes, alligator cracking and other cracks. Based on a rating of 100 to represent perfect conditions, the city's roads typically have an average rating of approximately 83.

Using these ratings, an analysis is made to estimate the remaining years of life of particular streets and the system in its entirety. The information was used to determine the monetary value of the street system for initial GASB 34 compliance.

Once the value of the current assets was established, the city undertook to put in place a process to keep this information current. The public works department has assigned a staff member to monitor all capital projects, which includes substantial resurfacings. This staff person is charged with reporting the value of new or improved infrastructures to the GIS group based on the total project cost as the projects are completed. The value of infrastructure contributed to the city or abandoned is estimated by the construction division and reported to this staff person, who then relays the asset information to the GIS team.

By building on existing management systems and involving all staff who would be responsible for providing and maintaining data, the city was able to beat GASB 34 financial reporting requirement deadlines, without imposing much stress on the organization.

8.7 Alcona County, Michigan

The following case study for Alcona County, Michigan, was one of several prepared as part of the Key Findings from the Fifth National Workshop on Transportation Asset Management which occurred in September and October of 2003 in Atlanta, Georgia, and Seattle, Washington.

Alcona County (MI) Road Commission's experience with asset management is closely tied to the Michigan Local Technical Assistance Program (LTAP) Center.

Alcona County, located in northeastern Michigan's lower peninsula, is largely rural and contends with snowy winters. The county has an area of 720 sq mi and a population of about 11,000. The commission's 32 employees manage 760 miles of road and 24 bridges with an annual budget of about \$4 million.

The commission's limited staff and financial resources preclude significant expenditures on management tools and the effort required to maintain such tools. The agency nevertheless shares with larger commissions the need to operate its road system efficiently and seeks to maximize the return on the county's road investments. With the assistance of Michigan's LTAP Center, the commission has implemented a roadway

asset-management system based on the RoadSoft platform and a field data collection system using laptop computers. RoadSoft software, which provides geographic information system (GIS) and road management system (RMS) capabilities, was initially developed by Michigan's LTAP Center to help agencies meet previously issued (and since repealed) federal requirements for pavement management systems.

Pavement condition is assessed using the Pavement Surface Evaluation and Rating System (PASER) visual inspection system. The system was designed for local use since it is easily understood, simple to explain, and can be easily implemented by agency personnel. Condition rating factors are based on visual observations, knowledge of the road, and some understanding of the road's history (for example, the year of last reconstruction). The road commission has found the system to be a reliable basis for maintenance planning, although ratings assigned in the middle ranges of condition are more difficult to make and may vary somewhat from observation to observation.

The condition rating is independent of pavement type and does not depend on the importance of the road within the county network. Despite the difficulties associated with making ratings in the middle condition ranges, there is little variation in the ratings by inspectors with similar training and knowledge. Most inspectors' ratings are reported to be within one condition level (on a 1 to 9 rating scale).

The commission has established a standardized set of strategies for treating pavement sections when current and forecasted conditions indicate that action is warranted. Sealcoats and spray injection patching are used, for example, when significant distress occurs in pavements reconstructed within the past six to eight years. Standard deterioration curves have proved adequate for maintenance scheduling. The management system as a whole has been a valuable and affordable tool for the commission and provides the information needed by the commission's board of directors, which focuses on the county's entire system. The commission's employees work to maximize the number of miles of roadway in good condition or better using the pavement management system. The system has helped legislators and members of the public serving on township boards and road committees understand maintenance alternatives and the consequences of failures to take appropriate maintenance actions.

The commission works with townships in the county to complete road condition assessments in their areas and to develop deterioration curves from historical data on pavements in service. The management system is then used to support development of alternatives for addressing existing and projected road deterioration. Commission staff develop cost estimates for maintenance activities and used the information to develop a feasible program for addressing road needs. The information can also be used to project the revenue needed to maintain the roads at various condition levels.

The Alcona County Road Commission has found that the management system, in addition to being easy to explain and usable with limited staff and financial resources, has been useful in promoting public understanding of the task of managing the county's roadway assets and thereby enhancing taxpayer support for the commission's work. The commission has been able to argue effectively that timely preventive maintenance can extend roadway lifetime and improve overall performance.

The commission nevertheless has encountered some problems in developing and using the management system. Budgets available for preventive maintenance activities inevitably are limited. Even if this were not the case, and despite the system's theoretical arguments to the contrary, the commission has found that preventive maintenance cannot produce a "perpetual road" that never requires reconstruction. Finally, the system does not take into account the cost to road users of traffic disruption caused by preventive maintenance activities, which diminish the public's willingness to pay for preventive maintenance.

8.8 Columbia, Missouri

The case study presented below was prepared by Hansen Information Technologies who provided software and support to the City of Columbia, Missouri, to aid in their effort to improve their transportation asset management.

Located midway between St. Louis and Kansas City, the City of Columbia was ranked by *Money Magazine* as one of the nation's most livable cities for the past six years. Columbia is mid-Missouri's largest city with a population of 84,531 residents. Columbia provides a pleasant balance between refined urban services, numerous state parks, forests and gently rolling hills.

In the early 1990s, the City of Columbia's Public Works Department began to take notice of several infrastructure issues that had gained a great deal of national attention. The Department decided to take an approach to infrastructure and resource management with an integrated network system that is now at the heart of many of the Department's operations.

When Jim McKinnon, the City's Street Superintendent, first started working for the City in 1992, the Street Division purchased its first computer for use by field personnel. Upon the arrival of the Division's first computer, supervisors recognized the value of a spreadsheet program that was included in the software package. At that time, the Division had several dated documents that provided rough estimates of the cost for activities such as the overlay or seal coat of a street. The employees felt the old cost estimates were not competitive with bids from private sources. They agreed to work together to try to find ways to reduce the costs of in-house overlay and seal coat operations, and used the new spreadsheet to accurately track the costs.

During this same period of time, the Division purchased "cheap" pavement software from a list of resources provided by the University of Kansas Transportation Center. "The software and a pavement-rating manual cost the Division less than fifty dollars," McKinnon said. "The software was extremely limited. The pavement rating system was usable, but somewhat cumbersome and confusing. However, it did provide the incentive for us to begin the inventory of our streets."

It seemed to Division personnel, that with some planning, it would be possible to integrate a pavement management system with a "user defined" infrastructure management system. "The assumption being, that if you needed to manage pavements more efficiently, then you should manage the resources that maintain pavement more efficiently," McKinnon said.

After an extensive search, the City of Columbia licensed its first maintenance management software system in February 1994 from Hansen Information Technologies. Staff transferred information from the pavement maintenance database into the new system, created a minimum number of codes for the user defined system, and began analyzing maintenance data that would support maintenance activity scheduling. For the

first time, the Division had accurate records for multiple activities. This provided a tool that they employed to compare their costs with those of outside sources.

Then in 1998, the Division upgraded its software to Hansen's Version 7 system. The Division had a full inventory of street segments and traffic signals, and continued building the inventory of street signs, pavement markings, and storm water facilities. All equipment, vehicles, materials, and employee records reside in the new system, which provides accurate information on the cost of doing business. As a result, reports and cost analyses that in the past required days or sometimes weeks to assemble, are now produced in minutes. As of February 2001, the Division owns and operates a SQL server dedicated to infrastructure management. "This acquisition allows expansion of asset data, provides quicker responses to queries, and will ease the process of integrating GIS functions with the asset management system," McKinnon said. The system is phenomenal. Since it is 'user defined,' the flexibility is unbelievable," McKinnon said. "The system has helped the City from a cost-saving stand point." The system was implemented as a tool for the City's operations in the Street, Stormwater, Maintenance and Traffic Divisions.

While there was excitement regarding the system, there were some obstacles. For instance, "It was difficult to develop an inventory of assets, and to incorporate new codes with old terminology in order to create a user-friendly system," McKinnon said. "It also took time to familiarize employees with the new methods of operation."

Nearly every Street division deals with the question of how to plan critical activities in a manner that assures they do not get overlooked and evolve into a crisis. "Hansen's system provides records that can help develop 'scheduled activities' to reduce the occurrence of some of these crises," McKinnon said. The City of Columbia's system contains approximately 8,000 scheduled activities (spread over a multi-year period) that have helped to reduce employee call-outs, unexpected overtime and last minute change-ups. "Planning becomes much easier when there are accurate records to help project needs," McKinnon added.

With the new system in place, Columbia's asset management system underwent a review by an external auditing firm. The Division is now capable of providing cost and asset data required to become compliant with the Governmental Accounting Standards

Board (GASB) Statement 34, “Modified Approach.” Statement 34 requires all current and long term assets and liabilities to be reported within the balance sheets of governmental financial statements. “It is safe to say that agencies that have, or are implementing an asset management system from Hansen Information Technologies, will be well prepared for the changes that GASB 34 will require,” McKinnon said.

The City of Columbia’s new system supplies information that makes it possible to experiment and refine practices, resulting in more effective and efficient performance. These increases in efficiency have freed up funds that are used in a variety of ways to better serve the community. “Efficiency is always a great plus in allowing us flexibility with our funds,” McKinnon added.

In addition, the City of Columbia is one of seven agencies in the world that is accredited by the American Public Works Association. “Hansen provided the base for many answers to questions that were asked during the accreditation process,” McKinnon said. “We have had excellent support from Hansen. Anytime we have problems or questions they are very helpful. They are a great company to work with,” McKinnon concluded.

8.9 Edmond, Oklahoma

The following case study of Edmond, Oklahoma, was prepared by Azteca Systems to showcase their work with the city to develop and provide tools to support their efforts to modernize their asset management.

Located in central Oklahoma, Edmond is a suburban neighbor to Oklahoma City. The city's history dates back to the early 1800's when the area was used for cattle ranching and a natural stopover point along the Chisholm Trail. Later, the area became a water stop along the Santa Fe railroad route. Edmond was settled in 1889 and today is a thriving city and home to more than 70,000 residents.

In 1996, the city of Edmond Oklahoma recognized the need to better manage their Public Works and Utilities infrastructure. At the direction of the city manager, the Information Technology Department was tasked to find an integrated system that could be used citywide. With an emphasis on using a GIS-based approach, city staff sought a solution that would utilize GIS data as a backbone to a variety of departmental

applications as outlined in the city's overall GIS Implementation Plan (PlanGraphics and Black & Veatch).

The city wanted solutions that could be deployed in multiple departments, yet share data across the enterprise, easily and efficiently. They wanted a system that was truly integrated with GIS and could be leveraged to help maintain their GIS investment.

City Manager, Leonard Martin had the foresight of an integrated GIS-based asset and maintenance management system that would not only utilize the inherent capabilities of GIS, but also leverage the data created and maintained by city staff – both internally and externally.

In 1997, the Environmental Systems Research Institute (ESRI) responded to the city's RFP offering a suite of applications to meet the city's needs. These included ESRI's leading GIS products and Azteca Systems Cityworks. The city awarded portions of the contract for data conversion and Permitting / Development Review to other firms. The selected applications were required to communicate and function in an enterprise environment.

At that time, Cityworks had not yet been deployed for streets, traffic, storm water and electric systems management. In a unique arrangement, the city partnered with Azteca Systems to guide the development of data models and specific application capabilities to meet the needs for these disciplines. Using a three phase implementation, the city worked closely with Azteca Systems to implement the customer call and work order systems followed by the database design and deployment for streets, traffic and storm water. Cityworks for Electric was deployed in the third phase.

Cityworks and PERMITS Plus were interfaced to allow for smooth flow of data between applications in such a way to automate the city's existing business process. Today, the city is able to process requests for service from citizens quickly and efficiently. The work order process is continuously refined as staff explores and discovers the flexibility of Cityworks, adapting both the software and their processes to streamline the day-to-day business activities.

Cityworks is used to manage water, wastewater, storm water, streets and traffic, and electric systems. Together with Accela's PERMITS Plus, the city is able to access

more information about the maintenance of infrastructure through the city, enabling more informed better decision-making.

Edmond has been recognized by ESRI, receiving the coveted Special Achievement in GIS award at the 1999 ESRI International User Conference and the Founders Award, presented by the South Central Arc Users Group in 2002.

8.10 Fayetteville, Arkansas

The case study of Fayetteville, Arkansas, presented below, was prepared by Hansen Information Technologies and presents the integration and automation of public services which can be accomplished through the use of well-designed software tools.

Located in the foothills of the Ozark Mountains, the City of Fayetteville, Arkansas, is a vibrant community of more than 58,000. The City provides services to a base population of more than 250,000 including an extensive parks and recreation system. For the past 15 years, Fayetteville has taken steps to meet the needs of its growing population and to modernize its services.

The City needed a software solution that users could easily navigate and would provide a single point of entry for commonly used data. Standardization was both a technology and strategic driver for the City. "Fayetteville wanted a system that was robust enough to meet the City's current needs and one that could be easily expanded in the future as required," said Ted H. Webber, CPA, PGM, and Director of Special Projects. "More importantly, we needed a system that would help us standardize the way we collect and use data."

In February 2002, the City of Fayetteville selected Hansen's Permitting, Public Works and Call Center solutions to manage its assets, work orders, inspections, water, sewer, street, plant and customer service activities. The City uses Hansen to maintain 4,500 valves, 1,000 miles of pipe, 11,000 manholes, 1,000 miles of main that service more than 31,200 accounts, and nearly 300 miles of road. The City issues approximately 820 building permits per year, performs 27,700 associated inspections, and receives 33,100 calls a year.

The City replaced several non-integrated systems with the Hansen software, making it easier to track work orders, equipment and inventory items, as well as

streamline customer service requests and problem reports for both internal and external customers.

"It was important that our solution enabled us to watch over our resources, track costs and maximize investment in our existing systems like GIS and telecom, said Webber. "With Hansen's solution, we can interface with those systems and others like Microsoft Office because creating interfaces between systems and Hansen is straightforward. We can standardize on Crystal Reports. And Hansen's solutions are easy to understand and straightforward to implement."

In addition, the system will generate building permits, requests for building inspections by type, and certificates of occupancy. Required monthly and quarterly reports will also be easier to prepare on a timely basis.

The City's new system will be used by approximately 200 users and will give them the ability to manage work activities and track customer calls from initial contact to problem resolution. The system will integrate with the City's award winning Geographic Information System (GIS) database that displays various components of water lines, sewer lift stations, water storage towers and city streets. The Hansen software will also enable an interactive dialogue with its constituents by providing seventy-six problem types that citizens can use to report problems or request services through the City's website.

"Our internal communications became better which allowed the City to present a more unified message to our constituents," said Webber. "We present a more efficient City government to our citizens when we are being asked to do more with less."

Part V Findings

Chapter 9: Key Findings for Local Governments

9.1 Introduction

The Federal Highway Administration defines transportation asset management as "a systematic process of operating, maintaining, and upgrading infrastructure cost-effectively." The objective of this report is to help county and municipal-level agencies implement transportation asset management techniques. The development of this study was supported by research in three areas of investigation. These three primary efforts were:

- an extensive review of both the academic and professional literature, including online/web resources, with special attention given to case studies of asset management in local governments;
- a review and meta-analysis of surveys of local agencies on the topic of transportation asset management supplemented by a new, limited survey; and
- a survey of software vendors providing asset management software to county and municipal governments.

Earlier chapters reviewed and re-presented the concepts, strategies and tools of transportation asset management with a focus on the techniques of most value to local government agencies. Throughout the work and especially in Chapter 8, which presented a collection of case studies from various sources, the report has documented the successful implementation of asset management techniques by local governments. In Chapter 7 the report identified other important resources and references on asset management for local agencies.

This chapter concludes the report by summarizing some of the most important findings of the study and offering important new contributions to the subject of transportation asset management at the local level. The next section briefly reviews the reasons for concerted efforts by all transportation agencies, regardless of size, to implement the principles and practices of transportation asset management. Section 9.3 highlights several of the most important factors in their successful implementation at the

level of local government. Section 9.4 recommends standards of practice for agencies of various size, and the final section identifies important areas for future work to support good asset management at the local government level.

9.2 Reasons for Transportation Asset Management

Survey responses, case studies and the literature identified a wide variety of motivating factors for local government agencies to formalize, improve and invest in their transportation asset management process. Reasons identified included:

- budgetary pressure and the need to do more with less,
- increasing challenges resulting from aging infrastructure,
- legal mandates in certain states such as Michigan and Wisconsin,
- GASB Statement 34 and a desire for good accounting practices and public accountability,
- the success and encouragement of state departments of transportation and neighboring local agencies with new approaches to managing their assets,
- the desire and opportunity to take advantage of new technologies – computer databases, GIS, GPS, etc., and
- a desire to improve the quality of service provided to the public.

Any or all of these factors can provide the impetus to a local government to reconsider its transportation asset management. Although legislative mandates and budgetary concerns are frequently cited as driving factors, there are also many agencies that have undertaken steps to improve their asset management without facing either of these pressures. The desire to take advantage of technology, the success and encouragement of other agencies and the desire to better serve the public are also important positive forces behind increased attention to asset management.

9.3 Key Factors in Successful Asset Management by Local Agencies

Reviewing the literature, especially case studies, and surveys of local agencies, several key factors in successful asset management were identified. Good asset management, at any level, of course, requires attention to many activities and incorporates many tools and

techniques. However, the most salient issues in asset management for local agencies could be grouped under five major topics:

- Budget and Support,
- Coordinated Maintenance,
- Interagency Cooperation,
- Data Collection, and
- Technology.

Each of these major topics figured prominently in the experience of many local agencies. They represent both the greatest challenges and opportunities for local governments attempting to practice good asset management. Some of these issues, such as data collection, are also very significant at the state and national level, but others, such as coordinated maintenance and interagency coordination take on special significance at the local level. Each of the topics are examined in the following sections.

Many other topics addressed elsewhere in this guide, such as life-cycle cost analysis and preventative maintenance or reporting and ex post analysis, could also be highlighted on the basis of their tremendous potential for long-term cost savings and improved management. However, the focus here is deliberately limited to the strategies and tools with value that has been proven to be of importance in the experience of local governments to date.

9.3.1 Budget and Support

One of the most frequently cited issues by local agencies in their efforts to improve their asset management was the need for support from the agency's leadership and the elected officials to which they are responsible, particularly making the necessary budgetary commitments to ensure good asset management. The success of any program of asset management relies heavily on this support. This does not mean that generous funding is necessary for good asset management – one of the key goals of asset management is to do more with less – and many local agencies have greatly improved their asset management without increasing their budget. However, it does require that those in positions of authority that are responsible for important administrative decisions and the allocation of

resources must be committed, themselves, to good asset management processes and be willing to invest in programs and technologies to improve the agency's practice. In particular, decision makers must understand the value of investments in focused data collection, preventative maintenance strategies and supportive technologies. Attempts to save money by foregoing investments in these areas can effectively blind and cripple an agency, leading to far higher costs in the long run. The need for patience to see long-term benefits can be difficult for officials with relatively short election cycles.

While the need to secure the support of decision makers presents a challenge, it is not insurmountable. The practice of good asset management with the support and budget available can lead to increased support and funding for other aspects of asset management which may be initially less popular. The first step toward asset management's goal of decreasing the cost and increasing the value the public's infrastructure is to educate the public and its representatives to the value of public infrastructure assets. The reality and seriousness of the challenges facing the agency must be made clear, and asset management techniques must be presented as a promising and proven method for rising to meet these challenges.

A critical component to this effort is the involvement of both internal and external stakeholders who should receive regular reports on the condition of the system and jointly develop policy goals with the agency. Clear and regular reports on the success or failure of current programs and the improvement or deterioration of infrastructure conditions can be a powerful and persuasive tool to educate decision makers and the public to the value of new initiatives or to the need for them. Agreed upon policy goals, based on quality information, can then provide real guidance and support to the agency in both funding and directing its work.

9.3.2 Coordinated Maintenance

One of the distinguishing aspects of transportation asset management at the local level as well as one of the most promising sources of cost savings lies in the entanglement of local transportation assets with other infrastructure systems. Water-wastewater infrastructure and private utilities frequently make use of the same rights-of-way as local roadways. Maintenance and expansion of these systems has often led to the deterioration of pavements where cutting and patching occurs. Everyone has heard stories of a road

being repaved only to be cut open the next week. Even if these stories are overblown, they give some sense of the real waste of resources that can occur when the cutting occurs even a year or more after the re-pavement and no one notices.

The difficulty of sharing the public right-of-way, however, can become the opportunity to share costs. If institutional hurdles can be overcome, the benefits of coordinated maintenance activities can be tremendous. To achieve maximum savings, the coordination must include all the systems sharing public rights-of-way. The direct involvement of representatives of private utilities in the planning process represents a best practice. However, the coordination of public water-wastewater-stormwater projects and transportation projects alone can produce great benefits.

Coordinated Maintenance:
Ionia, MI

“Ignoring the underlying infrastructure issues will only be reflected in the surface conditions, whether through line repairs, settling or collapsing pipes and manholes, and other relevant factors.”

Thomas Wiczorek, City Manager,
Ionia, MI

Ideal coordination can occur when the managers of all systems have a good sense of the remaining service life and anticipated maintenance needs of all of their assets. In that situation, maintenance and replacement activities can be optimally coordinated so that if, for instance, a sewer line will need to be replaced in seven years and the road above it will need to be reconstructed in five, the sewer line can be scheduled to be replaced when the road is repaved and prevent the destruction of the

roadway only two years after its reconstruction. While systematic coordination of this kind requires real cost and effort in data collection and planning, this cost is minute compared to the cost of not coordinating activities.

Moreover, any GIS software, and especially asset management software with a GIS component, can significantly reduce the cost of this coordination, if it allows the data for all infrastructure systems to be managed in the same computer system. If roadway and sewer inventories, for instance, are maintained in separate paper files or incompatible computer databases, the coordination of maintenance requires considerable time and effort; whereas, if both agencies can see the conditions of or even anticipated projects for each other’s infrastructure, much of the work of coordination is already done.

9.3.3 *Interagency Cooperation*

Coordinated maintenance naturally leads to the topic of broader opportunities for cooperation between government agencies. Cost-saving opportunities exist between different agencies of a single local government, as in the case of coordinated maintenance, but also between neighboring local government agencies and with state and regional agencies.

Beyond coordinated maintenance, four other areas of cooperation have already proven valuable in the experience of local government:

- shared software,
- group equipment / materials purchasing,
- equipment sharing and
- data / information sharing.

All of these opportunities to share costs are also an opportunity to save costs for both agencies. All four of these strategies, along with examples of their success in local agencies, are presented in Section 4.6. Agencies which employed these techniques and overcame institutional barriers were able to harness economies of scale in purchasing materials, invest with neighboring agencies in shared equipment they could ill-afford alone, and eliminate duplicate or overlapping data collection efforts. These experiences of real local governments are reason for believing that interagency cooperation is one of the most important and promising strategies for reducing the costs of asset management at the level of local government.

Group Purchasing:
Ashland County, WI

“In Ashland County, the county, towns, cities, and villages jointly buy culvert pipes, road signs, grader blades, cutting edges, gravel, and fuel. Bulk culvert purchases cut the costs almost in half for these agencies.”

Stidger and Djekich, 2005

No agency is alone without allies in its mission to provide and preserve infrastructure for the public. The tools, materials, activities and information crucial to infrastructure maintenance and asset management are all capable of being shared. This opportunity for cooperation is an opportunity for real cost savings.

9.3.4 Data Collection

The task of data collection that captures the condition and service provided by the existing transportation system is crucial to the success of asset management at any level. Without accurate and up-to-date information about the infrastructure it manages, an agency often does its maintenance work blindly, guided by political influences, feeling its way along with public service requests, or relying vaguely on memory and the way things used to be. It is possible to maintain public assets this way, but it is not efficient. Investing in adequate data collection has a significant pay-off in the cost-effectiveness of an agency's work.

**The Challenge of Data:
Oakland County, MI**

“There was significant staff interest in having highly accurate location information – for example, for signs and signals – but only limited interest in regular condition assessments. Further, there was reluctance to accept that condition data must be kept up to date if it is to have lasting value.”

Wittwer et al., 2004

Gaining and maintaining support and adequate budget for data collection was frequently identified as one of the great challenges of asset management for county and municipal transportation agencies. The need for data collection to be ongoing and continuous to keep asset conditions data up-to-date was often particularly difficult for some agencies. However, it is essential to any cost-effective asset management. It is impossible to know what really needs to be fixed or when without conditions data. Taking maintenance action before they are truly warranted can waste tax dollars, while the more common deferring of maintenance until infrastructure is crumbling can greatly increase the cost of maintaining the system. Performing infrastructure maintenance without collecting system-wide conditions data first is no less imprudent than a doctor prescribing treatments or even performing surgery without conducting diagnostic tests first – it may be necessary in certain emergency situations – but it is grossly irresponsible as a general practice.

Data collection must be regular in order to ensure its value. A two to three year inspection cycle is clearly the standard for pavement assets. The cycle of bridge inspection is dictated by federal safety regulations. The length of the cycle for inspecting other assets is less clear, but the key challenge for these assets is generally not ensuring

an optimal frequency of inspection, but any regular inspection cycle at all. Importantly, without regular system condition monitoring, the success or failure of various “fixes” in terms of extended service life cannot be evaluated and alternative strategies cannot be implemented and tested.

Agencies with successful data collection programs did not all inspect assets on the same schedule, but they had a schedule. Similarly, they did not all use the same scales or measures for evaluating the conditions of assets, but they used a system consistently. Given the costs of data collection, it is crucial that the data collected support the performance measures identified by the agency, be feasible to collect and support improved predictive capabilities for the agency in the future.

While the challenge to local government agencies was significant, many agencies also related great efficiency gains in data collection from laptop computers, laser devices for measuring pavement conditions, and GPS devices. The challenges of data collection are great, but the tools with which agencies face them are rapidly improving to help local governments meet these challenges.

Benefits of Data:

Ionia, MI

“Project selection has benefited without question because the choices have been based on hard, empirical data that is not selective to whims but rather to facts.”

Thomas Wieczorek,
City Manager, Ionia, MI

9.3.5 Technology

New technology offers hope not only for more efficient data collection but for almost every aspect of asset management. Computer technology is not a luxury to make life easier; it is an essential tool for efficient agency operations. One of the great challenges of management is to determine the proper balance of investment in personnel and equipment or labor and capital. The advent of computer technologies has shifted the optimal balance toward a greater investment in equipment – both personal computers as well as computerized field devices such as GPS locators and laser sensors. Good asset managers are responding to the changing environment and investing in technology.

Computer systems for tracking and forecasting asset conditions and managing maintenance operations can be relatively simple spreadsheet programs in the case of very small agencies or very sophisticated specialized software like the suites presented in Chapter 6. There are many advantages of specialized software, but they must be weighed

against their cost. Some investment is necessary, however. Successful agencies inevitably invested significant resources (relative to their size) in computer systems whether they developed their own simple system or bought a commercial one.

Computer systems have the potential to directly improve an agency's resource allocation and both computer systems and computerized field devices can directly improve the efficiency of an agency's operations. However, one of the most important impacts of technology on transportation asset management is its indirect ability to lead agencies to reexamine the way they are doing business – what they are investing in, how they collect and use data, and how they make decisions. New technology can be both a driving and enabling force in improving asset management, and wise managers are taking advantage of this and using new technology to renew and revitalize the entire operations of agencies.

9.4 Recommended Thresholds of Practice

One of the goals of this project was to produce thresholds of applicability for various asset management strategies and tools, based on the size of a county or municipality. This section presents recommended thresholds of good practice for local agencies of various sizes. However, the key finding of this study, which is reflected in the threshold recommendations, is that most asset management strategies and tools can be fruitfully applied by local agencies almost regardless of size. The magnitude of the potential payoff and the cost of implementation reduce the urgency of some practices for agencies of a particular size, distinguishing best practices from more basic practices which should form a standard. However, most techniques promised at least some significant benefit to agencies of any size.

Advanced tools and techniques, such as commercially available GIS-based management software, are used and praised by small local agencies in places like Rupert, ID (pop. 5,645) and Ionia, MI (pop. 10,569). Small communities such as Ionia and Alcona County (pop. 11,719) in Michigan have managed to engage in preventive maintenance despite meager budgets. A survey conducted for the Midwestern Regional University Transportation Center by Wittwer (2003) found that as many as 45% of local government agencies are using laptop computers in data collection and that one in five are using laser devices. The evidence suggests that it is not size or resources but lack of

interest and institutional barriers that fossilize the status quo and prevent wider adoption of many asset management techniques.

Education therefore remains of the utmost importance in promoting good asset management practices among local government agencies. This report has endeavored to advance that task by presenting the basic and advanced practices of transportation asset management for local government and providing examples of local agencies across the country that have successfully adopted these practices and the benefits they have experienced. This cause can be further advanced by continued efforts to involve local agencies in workshops, conferences and short courses on asset management.

The thresholds of practice presented here are thus meant not to limit the scope of agencies' asset management programs but rather to give some sense of the priority which agencies of various size might place on adopting various techniques. Techniques identified as best practices, while potentially of significant value, may be regarded as less urgent as techniques identified as recommended standards of practice.

In developing these thresholds, various measures for an agency's size were considered, including its population served, lane miles serviced, annual budget, number of staff, annual vehicle miles of travel, monetary asset values, among others. However, while all of these factors are relevant, more elaborate schemes were difficult to justify, and in the end, a simple, more defensible set of recommended thresholds were identified on the basis of whether the population served was small (less than 10,000 persons), medium (10,000 to 100,000 persons), or large (over 100,000 persons). For each of these sizes, a determination was made for each strategy or tool presented in this guide whether it represented a recommended best practice, a recommended standard practice, an existing standard practice, or was not recommended for that category of agency. These determinations were based on the review of case studies and literature, meta-analysis of survey data regarding the asset management practices of local governments together with a new, small-sample survey of local governments, and ultimately reflect the judgment of the authors with input from reviewers. The thresholds are presented in Table 16.

Table 16: Recommended Thresholds of Practice

	Small Pop. < 10,000	Medium Pop. 10,000 to 100,000	Large Pop.> 100,000
Goals and Performance Measures	SP	XP	XP
Goals as PM Targets	BP	SP	SP
Annual/Quarterly Reporting	BP	SP	SP
Ex Post Evaluation	BP	SP	SP
Resource Allocation Tradeoff Analysis	BP	BP	SP
Life-cycle Cost Analysis	BP	SP	SP
Triggers and Decision Trees	BP	SP	SP
Coordinated Maintenance	SP	SP	SP
Shared Software	SP	SP	SP
Group Purchasing	SP	BP	BP
Equipment Sharing	SP	BP	NR
Data/Information Sharing	SP	SP	SP
Design-Build Contracting	BP	BP	BP
Performance Based Contracting	BP	BP	BP
Private Contracting / Outsourcing	XP	XP	XP
Project Bundling	BP	BP	BP
Total Closure Construction	BP	BP	BP
GPS devices	SP	XP	XP
Computerized Asset Inventory	SP	XP	XP
GIS software	BP	SP	XP
Optimization/Prioritization software	BP	BP	SP
Maintenance/Financial Management software	BP	SP	XP
BP – Recommended Best Practice; SP – Recommended Standard Practice; XP – Existing Standard Practice; NR – Not Recommended			

While the selection of the best practices for a particular local agency will inevitably depend on the peculiar abilities and limitations of that agency, these thresholds should give some indication of what represents a reasonable standard for an agency of a particular size as well as possibilities for further improvements. An agency evaluating or looking to improve its asset management practices should first focus on the implementation of all the existing and recommended standard practices and then identify best practices which they anticipate might prove particularly beneficial in their circumstances. There is no such thing as perfect practice, only the challenge of doing better.

This report should be a valuable resource to agencies in implementing the recommended techniques and raising the standard of practice. All of the practices

included in these recommendations are presented in this report as well as resources and references for learning more (see Chapter 7).

9.5 The Future of Asset Management at the Local Level

While this report has laid the groundwork and provided a foundation for renewing the practice of transportation asset management at the local level, identifying standards of practice and techniques of particular promise for local government agencies, more work is called for from many parties to bring the successes of state agencies like Michigan and Ohio's DOTs to municipalities and counties across the country.

More research is needed to document best practices and benefits of some techniques, particularly coordinated maintenance with water/sewer infrastructure and private utilities, group purchasing and equipment sharing. These techniques, which are not as significant at the state and federal level, have received little attention to this point, but their importance to asset management at the local level requires that they be investigated more seriously and attempts be made to educate local governments about these techniques.

Transportation asset management at the local level could also be helped by legislative action or regulatory action by FHWA or state DOTs with authority over local government agencies. One of the simplest and most promising actions of this type would be the requirement of annual reports accounting for an agency's use of its funds, detailing its investments in its infrastructure and recording the resulting condition of its assets over time. Some states such as Wisconsin and Michigan have already adopted legislation to require the reporting of asset conditions with notable effect on the asset management of their local agencies. More comprehensive reporting requirements which would integrate these sort of condition reporting requirements with financial reporting and programming could yield an even greater improvement in asset management at the local level. Requirements for ex post evaluation of federally or state funded projects or programs, similar to those that have been incorporated in the Federal Transit Administration's New Starts program, could also yield great benefits, promoting preventive maintenance and identifying promising and unsatisfactory techniques to be expanded or abandoned.

Continued assistance must also be provided to local agencies to help them improve their asset management techniques. Two of the most important forms of

assistance that are currently benefiting local agencies and should be further promoted are the Local Technical Assistance Programs (LTAP) and asset management workshops, short courses and training sessions.

The LTAP programs have already been of tremendous help in some regions in providing tools to local government for improving their asset management. The value of providing tools such as PASER, IRIS, and RoadSoft is hard to underestimate in promoting good asset management by local agencies. In addition, training opportunities are critical to addressing the basic

Recommendations for Future Work:

- *Further research and educational efforts in coordinated maintenance, group purchasing and equipment sharing*
- *Promotion of appropriate regulatory requirements including annual reporting of spending and asset conditions and ex post evaluation of state or federally funded projects and programs*
- *Continued and expanded support of LTAP programs*
- *More frequent and regular opportunities for training in asset management throughout the country*

educational / knowledge barriers preventing the spread of asset management techniques. Just as improved asset management at the state level has been facilitated by the development of a community of practice which emerged from the FHWA/AASHTO workshops, local governments will benefit from regular opportunities to share their experiences and learn from each other and experts in the field.

Ultimately, the responsibility for improving asset management at the local level lies with local government agencies themselves. Local government agencies must resist the temptation to be blinded by a mentality of business-as-usual and take the initiative to examine and improve their practice. However, the more assistance they can be given in the form of research and educational literature, appropriate regulatory requirements, training opportunities and standard tools, the easier it will be for local agencies to overcome the institutional hurdles and inertia which threaten to impede their progress.

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Appendices

Appendix A: Self-Assessment Tool for Local Agencies

This appendix includes a short survey with questions designed to help local government agencies identify particular areas of strength or weakness in their transportation asset management. The major groupings of questions correspond with the topics of various chapters in this report: Policy - Chapter 2; Accountability - Chapter 3; Resource Allocation & Operational Efficiency - Chapter 4; Data Collection and Organization - Chapter 5; and Technology - Chapter 6. Agencies with an average score of 2.0 or less in any of these sections should devote special attention to the content of the corresponding chapter.

Statement of Practice	Strongly Disagree	Disagree	Agree	Strongly Agree
Policy				
Our agency has clearly defined policy goals.	1	2	3	4
Our agency has official performance measures for evaluating progress toward our goals.	1	2	3	4
Our agency can articulate its goals as target values of its performance measures.	1	2	3	4
Accountability				
Our agency can document the current conditions of its assets.	1	2	3	4
Our agency can document changes in the conditions of its assets over time.	1	2	3	4
Our agency regularly reports on the conditions of its assets and the agency's actions to preserve them.	1	2	3	4
Our agency regularly evaluates the effectiveness of programs and projects using hard data.	1	2	3	4

Statement of Practice	Strongly Disagree	Disagree	Agree	Strongly Agree
Resource Allocation				
Our agency can document the tradeoffs of investing more or less in its various programs.	1	2	3	4
Our agency considers alternative methods or 'fixes' for problems.	1	2	3	4
Our agency has a consistent and defensible process of project identification and selection.	1	2	3	4
Our agency considers the long-term costs of the way it operates using life-cycle costing techniques.	1	2	3	4
Our agency has established trigger values of performance measures resulting in various actions.	1	2	3	4
Operational Efficiency				
Our agency coordinates its maintenance with the maintenance of relevant water/sewer infrastructure and private utilities which share its right-of-way.	1	2	3	4
Our agency purchases materials and equipment in bulk with other agencies to reduce costs.	1	2	3	4
Our agency reduces its costs through joint ownership and shared use of equipment with nearby agencies.	1	2	3	4
Our agency shares data with other departments in its local government.	1	2	3	4
Our agency shares data with the state and other local transportation agencies.	1	2	3	4
Our agency uses performance-based contracting.	1	2	3	4
Our agency makes appropriate use of private contractors.	1	2	3	4
Our agency considers design-build contracting, total closure construction and other innovative methods.	1	2	3	4
Data Collection and Organization				
Our agency has complete information on its assets, its spending/costs, and the public's satisfaction.	1	2	3	4
Our agency collects data on all its assets regularly, in cycles of three years or less for pavements.	1	2	3	4
Our agency has quality control/quality assurance procedures to assure the accuracy of its data.	1	2	3	4
Our agency's data is readily accessible to everyone who needs it.	1	2	3	4

Statement of Practice	Strongly Disagree	Disagree	Agree	Strongly Agree
Technology				
Our agency uses GPS devices, laptops, and other appropriate technology for data collection.	1	2	3	4
Our agency maintains its asset inventory, locations and conditions data, on computers.	1	2	3	4
Our agency uses GIS software.	1	2	3	4
Our agency uses software with predictive and optimization capabilities.	1	2	3	4
Our agency uses software that coordinates our work, tracking projects, public complaints and agency spending.	1	2	3	4

Appendix B: Survey Instruments and Participants

This study included two surveys, one survey of local government agencies and one survey of management software vendors. The individual responses to the surveys remain confidential, but the participants and instruments are presented here. The authors are grateful to all who participated in both surveys.

Survey of Local Government Agencies

- Daniel Fedderly, Wisconsin County Highway Association
- Ken Frahm, City of Appleton, Asst. City Engineer
- Bill Hanlos, City of Manitowoc, Director of Public Works
- Richard Jones, City of Racine, Commissioner of Public Works
- Richard Leffler, Florence County Highway Commission
- Walt Raith, East Central Wisconsin Regional Planning Commission
- Thomas Wieczorek, City of Ionia, City Manager

Survey of Software Vendors

- Azteca Systems, Inc.
- Bentley Systems, Inc.
- Bernardin, Lochmueller & Associates, Inc.
- Deighton Associates, Ltd.
- GBA Master Series, Inc.
- Hansen Information Technologies
- Michigan Technical University Local Technical Assistance Program
- Vulcan, Inc., Traffic Management Services

MIDWEST MUNICIPAL AND COUNTY TRANSPORTATION AGENCY SURVEY

May 2005

Transportation Asset Management Thresholds *Helping Local Agencies Use Transportation Asset Management Principles*

Midwest Regional University Transportation Center Project ID: 05- 01

The Transportation Center at Northwestern University is working with Cambridge Systematics and the Midwest Regional University Transportation Center (MRUTC) to assess the benefits and obstacles of implementing principles of Asset Management at the county and municipal levels. The FHWA defines transportation asset management as "a systematic process of operating, maintaining, and upgrading infrastructure cost-effectively." While the Asset Management concept applies to all areas of managing transportation infrastructure, the focus of this research project is in the area of pavement management.

We are calling upon your experience and expertise in the area to form the basis of our investigation. By completing the following survey, you will help us learn how

different jurisdictions are planning for and managing their roadway systems. Further description of the project can be found on the last page of this survey.

I. Agency Description

The first set of questions will help us classify your agency.

Agency name:

MPO/ Regional Membership (if any):

Person filing survey:

Job Title:

Q1. What is the estimated population living in your jurisdiction?

Q2. Please fill in the tables below with the approximate mileages your agency manages.

Road Classification	Mileage Managed
Arterial	
Collector	
Local	

Road Classification	Mileage Managed
Urban	
Rural	

Q3. What is your agency's annual budget?

Q4. Are you familiar with the concept of Asset Management?

II. Condition Assessment and Data Collection/Management

This set of questions concerns data collection practices.

Q1. Do you assess the condition of your pavements on a regular basis?

Q2. If yes to Q1 , how often do you assess the condition of your pavements?

Q3. Briefly describe the data collection process at your agency including the percent of system surveyed on a yearly basis and the use of any tools such as PDA's.

Q4. From what other sources, e.g., a state or MPO database, does your agency have access to condition data ?

Q5. Which of the following benefits do you receive from conducting condition assessments? Circle all that apply.

Cost Savings

Better Accountability

Improved Communications

Higher Levels of Service

Valuable Data Provided

Q6. Which of the following obstacles do you face in conducting condition assessments? Circle all that apply.

Implementation Costs

Employee Training Requirements

Time-Consuming

Data Needs

Specialized Software Requirement

Q7. Which of the following technologies (if any) does your agency use to archive inventory, cost, and condition data? Please circle all that apply.

Paper Records Computerized Database (i.e. MS EXCEL) Asset
Management System

GIS/GPS

Other (explain here):

IV. Management, Planning and Life-Cycle Cost Analysis

This set of questions concerns how your agency plans future actions on its network.

Q1: How does your agency use condition assessment information for:

1a: Policy Development?

1b: Planning and Programming?

1c: Program/Project Delivery?

Q2: Do you perform life-cycle cost analysis?

Q3a: If yes, how often are the recommendations implemented?

Q3b: In what instances are the recommendations not used or followed?

Q4: What system and project cost/performance measures do you track?

V. Impacts of Legislation on Asset Management Practices

This set of questions concerns how legislation has impacted your agency's asset management practices.

Q1. What activities does your agency participate in to comply with GASB-34?

Q2. What, if any, difficulties has your agency encountered in compliance with GASB-34?

Q3. In what ways, if any, has GASB-34 helped your agency?

Q4. How do the reporting requirements for the Federally Mandated Highway Performance Monitoring System (HPMS) impact your agency?

Q5. In what ways, if any, does your agency benefit from a regional or state-wide Traffic Monitoring System (TMS) or congestion management system (CMS)?

Q6. What local state or federal laws or initiatives impact your agency's transportation asset management practices?

V. Final Questions and Comments

Q1. In what ways, if any, does your agency practice asset management?

Q2. What strengths does your agency possess in terms of asset management?

Q3. How could your agency improve its asset management practices?

Q4. What benefits has asset management provided to your agency?

Q5. What obstacles has your agency faced in employing asset management?

Q6. Write any final comments here.

Please contact Suzanne Childress, Northwestern University research associate, at suzannechildress@yahoo.com with any questions or comments.

THANK YOU FOR COMPLETING THIS SURVEY

MIDWEST MUNICIPAL AND COUNTY TRANSPORTATION AGENCY SURVEY

May 2005

Transportation Asset Management Thresholds *Helping Local Agencies Use Transportation Asset Management Principles*

Midwest Regional University Transportation Center Project ID: 05- 01

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We are calling upon your experience and expertise in the area to form the basis of our investigation. By completing the following survey, you will help us learn how different jurisdictions are planning for and managing their roadway systems.

Agency name:

MPO/ Regional Membership (if any):

Person filing survey:

Job Title:

Q1. What is the estimated population living in your jurisdiction?

Q2. What is your agency's annual budget?

Q3. Do you assess the condition of your pavements on a regular basis?

Q4. If yes to Q4 , how often do you assess the condition of your pavements?

Q5. Which of the following technologies (if any) does your agency use to archive inventory, cost, and condition data? Please place an X by all that apply.

Paper Records
 Management System

Computerized Database (i.e. MS EXCEL)

Asset

GIS/GPS

Other (explain here):

Q6. Do you perform life-cycle cost analysis?

Q6a: If yes, how often are the recommendations implemented?

Q6b: In what instances are the recommendations not used or followed?

Q7. What system and project cost/performance measures do you track?

Q8. What, if any, difficulties has your agency encountered in compliance with GASB -34?

Q9. In what ways, if any, has GASB-34 helped your agency?

Q10. Are you familiar with the concept of Asset Management? If you are not, you may ignore the rest of the survey.

Q11. What strengths does your agency possess in terms of asset management?

Q12. How could your agency improve its asset management practices?

Q13. What benefits has asset management provided to your agency?

Q14. What obstacles has your agency faced in employing asset management?

Q56. Write any final comments here.

Please contact Suzanne Childress, Northwestern University research associate, at suzannechildress@yahoo.com with any questions or comments.

THANK YOU FOR COMPLETING THIS SURVEY

Vendor Survey

Asset Management Guide for Small Agencies

Midwest Regional University Transportation Center & Northwestern University

Section 1: Market

1. Company Name
2. Software Suite Name
3. Would you like to include a contact person for your software?
4. Can I have your corporate
 - a. phone number
 - b. website
 - c. address
5. What is the cost/range of costs for a license?
6. What is the annual cost of support?
7. Does purchase of a license/maintenance agreement include any training? If not, do you offer training and at what cost?
8. What if any other concurrent software does your software require (specific operating system, database software, GIS software)?
9. Are there any additional start-up costs?
10. How many organizations use your software?
11. How many years has your software been in use?
 - a. When was the last update?
12. Does your company serve private clients, public clients, or both?
13. If both, what percentage of your total clientele are public agencies?
14. Roughly what percentage (or approximately how many, if you prefer) of your public clients use your software to manage roadway assets (streets, roads, bridges, signs, signals, etc.)?
15. Roughly what percentage (or approximately how many, if you prefer) of your public clients use your software to manage public transit assets (buses, rolling stock, rail infrastructure)?

16. Roughly what percentage (or approximately how many, if you prefer) of your public clients use your software to manage water / wastewater infrastructure?
17. Roughly what percentage (or approximately how many, if you prefer) of your public clients are state DOT's, regional or federal agencies?
18. Roughly what percentage (or approximately how many, if you prefer) of your public clients are county or municipal governments?
19. Can you give some indication of the size of your largest current client?
20. Can you give some indication of the size of your smallest current client?
21. Can you provide any customer references?

Section 2: Functionality

22. Would you characterize your software as out-of-the-box or custom-developed for each client?
23. Would you characterize your software as asset management software, maintenance management software, both, or in some other way?
24. Can your software be used with handheld GPS devices?
 - a. Which GPS devices?
 - b. Would you characterize this functionality as 'customizable compatibility' or 'out-of-the-box full integration'?
25. Does your software include any data entry error checking/database consistency logic?
26. Does your software allow the user to enter additional recordable fields?
27. Does your software automatically record/store the history of an asset's condition attributes when they are updated?
28. Would you characterize your software as 'fully integrated with' or 'compatible with' GIS?

- a. Which GIS software(s)?
 - b. Does your software include GIS functionality, or does its GIS compatibility/integration require a separate GIS software?
29. Does your software generate standard / custom reports?
30. If a road is renamed, do other assets associated with it (signs, lights, etc.) have to be manually renamed/recreated?
31. If an intersection is added/relocated/removed does the position of assets associated with the roadway have to be manually adjusted?
32. Does your software product have provisions for attaching digital image and/or digital photos to each asset record?
33. Please indicate which functionalities your software provides for each type of asset.

Asset	Inventories, including location (for fixed assets) and condition	Estimates Monetary Value	Estimates Remaining Useful Life	Recommends Maintenance / Replacement Actions	Coordination between Recommended Maintenance / Replacement Actions
Pavement					
Markings					
Guardrails / Barriers					
Signs					
Traffic Signals					
Street Lights					
Sidewalks					
Parks & Playgrounds					
Bridges & other Structures					
Transit Vehicles / Rolling Stock					
Transit Guideways / ROW / Structures					

Asset	Inventories, including location (for fixed assets) and condition	Estimates Monetary Value	Estimates Remaining Useful Life	Recommends Maintenance / Replacement Actions	Coordination between Recommended Maintenance / Replacement Actions
Stormwater / Wastewater / Potable Water Lines					
Private Utilities					

34. Is your software able to compute
 - a. average maintenance costs for a category of assets?
 - b. average life-span for a category of assets?

35. Can your software estimate anticipated funding needs?

36. Can your software estimate anticipated funding needs to maintain various levels of service from assets?

37. Can your software identify potential projects?

38. Does your software include deterioration models or other predictive capabilities?

39. Are costs estimated using user-supplied unit costs, or is cost-estimation model based?

40. Can your software prioritize projects?
 - a. Does this prioritization consider cross-asset optimization?
 - b. Does your software capture benefits of coordinated maintenance?
 - c. Does the prioritization include estimation of benefits to users? Which benefits?
 - d. Does the prioritization incorporate environmental impacts?
 - e. Does the prioritization allow for budget constraints?
 - f. Does the prioritization allow for geographic equity (environmental justice) constraints?
 - g. Does the prioritization consider full life-cycle costs?
 - h. What other elements are important in the criteria/methodology is used for the prioritization?

41. Can your software track comments/complaints/service requests from the public?

42. Can work orders be prepared from your software?

43. Can work projects be tracked with your software?

44. Can historical records of work projects be kept?
 - a. Can these include performance evaluations of the delivery? (on time, on budget, work quality)
45. Are costs broken out by personnel, materials, and equipment?
46. Can project funds be broken out by source?
47. How extensive is your on-screen help?
48. What is your average response time to support questions?

Section 3: Wrap-Up

49. Are there any other selling points of your software you'd like to mention, particularly those that distinguish you from your competitors?
50. Are there any other questions we should be asking?

THANKS FOR PARTICIPATING!