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This manual serves as a step-by-step guide to assist agencies in developing an asset inventory and condition assessment, establishing performance measures and goals, identifying and rating risk, determining lifecycle planning and funding strategies and creating asset management plans and programs using existing and new resources. The manual is structured into eight sections that act as a decision tree.

- Introduction/Background
- What is Asset Management?
- Plans and Programs
- Getting Started
- Software and Data
- Lifecycle Cost Analysis
- Risk Management
- Signs of Success
Navigating the Manual

Navigate through the eight sections using the main tabs in gray located at the top of each page (see diagram at right). Sub-sections are located below the main tabs in blue. Explore these sub-sections, when applicable.

The Content Links provide access to supporting documents and websites to help you throughout the process (see sidebar). Content Links will open new documents or bring you to documents located on external websites.

The Home button navigates to the first page of the manual. Use the Back/Next buttons to step through the manual in either direction. The Section Location indicates your current location within the manual.
Welcome

This manual is a compilation of research and asset management strategies identified as a part of a larger study and Full Report, “Asset Management Guide for Local Agencies,” (3.8 MB) prepared by the Local Road Research Board. Each of the chapters in the Full Report are represented in the eight sections of this Manual. The Full Report can be viewed though a link located in the Content Links (See open book icon to the right).

1. Introduction/Background: Chapters 1, 2, and 10
2. What is Asset Management?: Chapters 3 and 4
3. Plans and Programs: Chapter 5
4. Getting Started: Chapters 6 and 7
5. Software and Data: Chapters 8 and 9
6. Lifecycle Cost Analysis: Chapter 11
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8. Signs of Success: Chapter 13

Select a tab above to begin.
Introduction/Background

This manual serves as a step-by-step guide to assist agencies in developing an asset inventory and condition assessment, establishing performance measures and goals, identifying and rating risk, determining lifecycle planning and funding strategies and creating asset management plans and programs using existing and new resources. The manual is structured into eight sections that act as a decision tree.

This manual demonstrates that the “worst first” approach to asset investment is not sustainable based on the limited financial resources available to local government agencies. A paradigm shift within public and private agencies has begun that is based on sustainable asset investment strategies that use a “mix of fixes.” The Michigan DOT (MDOT) developed a guide, [Which Road to Fix First](#) (2 MB).

The manual will provide step-by-step guidance for local agencies covering everything from “Getting Started” to “Taking Asset Management to the Next Level” and will provide valuable insight and success outcomes on what others have done, what worked, and what lessons have been learned.

For those agencies ready to move on to the development of a Transportation Asset Management Plan (TAMP), reference [Chapter 10: Taking AM to the Next Level](#). AASHTO and MnDOT both provide great guidance documents.
What Is Asset Management?

The goal of asset management is to maximize benefits, reduce risks, and provide satisfactory, financially sustainable service levels to the community.

Within their Asset Management Guide for Cities, Towns and Counties (11.8 MB), the Indiana LTAP identified the following key asset management concepts as defined by the Indiana LTAP.

- Driven by policy
- Based on performance
- Founded on lifecycle needs
- Supported by data
- Defensible

There are many definitions and perspectives of asset management. They are all unique in the words they use and they share some clear and important messages.
What Is Asset Management?

What is the difference between asset management and managing assets?

Assets are essentially anything that provides value. Managing assets (the things we do to assets) can be done with or without a structured organizational strategy and context. An organization gains more value from managing assets within the context of organizational purpose and strategy that steers this activity and becomes Asset Management. So, an agency’s coordinated activities to maximize the value of its assets is the organization’s asset management program.
Benefits of Asset Management?

Creating an AMP allows an agency to properly plan investments and attain optimal asset lifecycles. A proper plan that includes maintenance strategies chosen and applied at the right time results in an overall improved system condition and a slower rate of deterioration.

The benefits of applying asset management principles in your agency include:

- Increased value and return for money spent.
- Improved overall conditions by conducting proactive repairs and maintenance.
- More informed, strategic and defendable decisions through use of data.
- Better communication of funding needs with agency staff, the public, and elected officials.
- Minimized lifecycle costs and thereby optimized the assets performance over its life.
- Improved customer satisfaction.

The Canadian Province of British Columbia has developed an asset management framework, which helps agencies establish a high-level, systematic approach that supports service delivery, asset, and financial sustainability through an asset management process.
Asset Management Plans and Programs

An AMP helps an agency manage its assets, but it’s only one component of a comprehensive asset management program. An asset management program includes formalized activities (policies, objectives, strategies, processes, procedures, governance, etc.) associated with maximizing the value of the asset. The American Public Works Association (APWA) in a document titled "Guide to Successful Asset Management System Development" (April 2018 1.7 MB) indicates that there are four key fundamental components of an asset management program as shown in the image to the right.
Asset Management Policy

This is the high-level direction of the organization or agency that applies to how all assets should be managed. The asset management policy is designed to bridge the gap between various agency departments and employees. An effective asset management policy begins with strong principles that set the framework for the development of the remaining three system components.
Asset Management Objectives

Asset Management Objectives are the refinement of asset management policy that applies to all assets and clearly provides specific direction. Objectives should be specific enough to minimize confusion on expectations. Objectives should be tied to existing organizational objectives in an agency’s strategic plans or master plans. Objectives should be **SMART**: Specific, Measurable, Achievable, Realistic, and Time-bound.
### Strategic Asset Management Plan (SAMP)

The Institute of Asset Management defines a SAMP as providing "documented information that specifies how organizational objectives are to be converted into asset management objectives, the approach for developing asset management plans, and the role of the asset management program in supporting achievements of the asset management objectives." The SAMP is a planning tool to clarify intentions, priorities, and practices to be adopted. It takes a long-term view and considers the combination of organizational needs, stakeholder expectations, and the realities of existing assets and asset management capabilities. It is a broad plan with a specific time horizon associated with implementing asset management policy and objectives. Items to include in the SAMP include:

- Identification of stakeholder needs and expectations
- Identification of the areas of interaction, collaboration, and association with other agency departments and employees
- Refinement of asset management objectives to clarify and minimization of wasted effort
- Identification of employee training needs and certification requirements
- Identification of communication needs, opportunities, and reporting elements and time periods
Asset Management Plans and Programs

Asset Management Plan (AMP)

The final component of an asset management program is the AMP. These are the specific physical infrastructure set of instructions that further refines the implementation of asset management objectives. The details of an AMP need to clarify and identify the following, but are not limited to:

- Roles and responsibilities
- Identification of resources required to complete and maintain the AMP
- Establishment of inventories and timelines to collect data
- Establishment of condition ratings
- Establishment of performance levels of service
- Development of lifecycles
- Identification of risks and opportunities associated with managing the asset
- Prioritization of activities
Getting Started

An agency can begin a basic asset management process with the tools that they already own, including Microsoft Excel spreadsheets, databases, or Geographic Information Systems (GIS). The research is consistent on several things you should do before starting the formal development of an asset management program or one of its four components.

- Find a champion.
- Ask yourself these fundamental questions:
  - What do I want to accomplish?
  - Why is it important?
  - How will I use the information?
  - Where do I start?
  - When do I need to start?
- Set some goals and objectives.
- Start small and keep it simple as you begin.
- Identify quick wins – demonstrate value to your team.

Several excellent resources are readily available that provide direction for how to develop an asset management program and plan.
Getting Started

Creating an Asset Management Program

Creating an Asset Management Plan

The Federation of Canadian Municipalities (FCM) has a very detailed, yet visual, tool to help local governments measure and report progress on creating an Asset Management Program.

The Indiana Local Technical Assistance Program (LTAP) publication "Asset Management Guide" introduces readers to asset management and outlines the five steps involved in developing an effective AMP.

The Asset Management Getting Started Guide published by Saskatchewan Province Transportation Department has a helpful tool with an accompanying video.

Getting Started Toolkit User Guide published by the Alberta, Canada Municipal Affairs Office provides a complete strategy for an agency to begin asset management with the information they already have available. This guide includes descriptions of processes and templates in the form of an editable Microsoft Excel workbook.

The Sustainable Infrastructure Management Program Learning Environment (SIMPLE) website has an intuitive and user-friendly set of online process and practice guidelines, templates, and decision support tools that will simplify the development of AMPs and provide effective implementation guidelines for agencies to assess and drive meaningful improvements in asset management.
Getting Started

The AMP Development Process

The fundamental themes of asset management are outlined in this section and illustrated in this graphic. The sections that follow describe the elements of the themes in greater detail.

Select a fundamental theme of asset management to begin.

Select a secondary tab above to begin.
What is the current state of my assets?

Build Your Asset Inventory: Determine what assets will be inventoried and gather data about asset type, quantity, age, and location. This involves creating a specific asset inventory; not only of the assets themselves, but each characteristic that will be managed with the program along with the level of detail and frequency of assessment. The asset information is typically summarized by asset classes and can be presented in a table or graph format. This section should summarize each asset class, its type, function, and other appropriate descriptors. Age distribution and percent of assets by type are typically used to give the reader a picture of the current system.

Assess the Current Conditions: The condition of each asset must be measured or otherwise quantified. Whenever possible, seek and use an existing data standard to determine asset condition and avoid the cost of creating your own standard. Some examples are Good/Fair/Poor; numeric such as 0-100; Pass/Fail; compliance with an industry standard (ADA); and functional or non-functional (technology). The level of effort to complete this step will vary based on financial and staffing constraints as someone must perform the condition surveys or judge the existing condition. Create realistic expectations for completing this step that considers time and resources available. Conducting the condition survey accomplishes several things, including creating a baseline for measuring improvements and the ongoing measurement of program trends. The inventory should also report inspection methodology used and the date range when the condition survey was conducted.

Determine Remaining Life and Value: Remaining life is the period remaining until asset performance deteriorates to the point of insufficient service. The residual value, sometimes called the salvage value, is the estimated value of a fixed asset at the end of its useful life. It is assumed that the asset has reached the end of its useful life and is in the condition the asset was expected to be replaced. As a general rule, the longer the useful life of an asset, the lower its residual value.

Example: simple determination of % remaining life; asset constructed in 1989 with a useful life of 50 years

Determine % remaining life

\[ \text{% remaining life} = 1.0 - \left( \frac{\text{physical life consumed}}{50} \right) \]

40% remaining life = 1.0 – (30 years (in service) / 50 years useful life)

The remaining value formula is derived by multiplying the percentage of asset life remaining by the original value of the asset, as in:

Remaining value formula = Original value of asset * percentage of value remaining

Determine Replacement Cost and Date: Including the current estimated asset value and replacement value helps illustrate the significance of an asset or asset class and the importance of managing the remaining life of the asset effectively.
What is the required level of performance?

Performance Target Level of Service: After the condition of each asset is known, the agency can create performance goals, standards, and measures that are often described as performance target level of service such as those shown below.

According to the AASHTO Transportation Asset Management Guide: A Focus on Implementation (June 2013), the “level of service can be considered to be a set of standards, and like any standards, their achievement should be measured and tracked. As achievement of a standard is often called performance, it is relevant to distinguish between the condition and performance of an asset:

- An asset’s performance is directly related to its ability to provide the required level of service.
- Its condition is an indication of its physical state, which may or may not affect its performance.

An asset can fail through either inability to perform adequately or inadequate condition. Performance of an asset can usually be measured in terms of availability, reliability, capacity, and delivery of other agreed levels of service, whereas condition is measured by factors such as cracking, potholes, loss of friction, corrosion, delamination, and roughness.”

In preparing an AMP, the agency sets performance target levels of service for each asset class. This manual provides references on how to set strategies, goals and targets using a variety of tools and benchmarks. For example, a pavement rating system, such as Pavement Surface Evaluation Rating (PASER) used by the Indiana DOT, can be used to set a performance target level of service for a road network and the AMP can show historical trends of how the conditions are changing over time.
What is the required level of performance?

This Guidebook provides the following reference links on how to set strategies, goals, and targets using a variety of tools and benchmarks.

- Transportation Research Board; Guide to Level of Service (LOS) Target Setting for Highway Assets

- City of Alberta Canada; Getting Started / Toolkit User Guide; Chapter 2

- National State Auditors Association; Best Practices in Performance Measurement

- Chapter 3 of MnDOT’s Transportation Asset Management Plan (2019)
  - [http://www.dot.state.mn.us/assetmanagement/tamp.html](http://www.dot.state.mn.us/assetmanagement/tamp.html)
What assets are critical to sustain performance?

Assign a Risk Rating: The international standard ISO 31000 defines risk as “the effects of uncertainty on objectives.” Risk can reduce the effectiveness of an agency and creating a risk management program can reduce threats to the public. Risk management complements asset and performance management. It also helps an agency develop mitigation strategies and achieve their strategic objectives. Risk management may take place on two fronts: 1) the assessment and identification of the potential risks and 2) the management and control of the potential risk. Each area, when not done well, is a contributor to ineffective asset management.

Some examples of agency risks are:

- Economic
- Fraud or malfeasance
- Health and safety
- Information
- Litigation
- Natural disasters
- Operational
- Political
- Regulatory

Many agencies develop a risk register that itemizes the risks, describes the likelihood of a risk occurring, and identifies the impacts of each risk and potential mitigation strategies for an asset class. This refinement of your AMP can occur at any time during your plan development.

For more information and links to example risk registers, refer to the Risk Management section.
What are the best O&M and CIP strategies?

**Determine Appropriate Maintenance**: Age-based and condition-based maintenance (CBM) strategies triggers maintenance when the age or condition or performance of an asset exceeds an upper limit, drops below a lower limit, or trends in a prescribed manner. A CBM policy necessitates uniform condition inspections at regular intervals. An important factor to consider in determining the optimal maintenance policy is the likelihood and consequence of asset failure.

**Lifecycle Planning and Prioritization**: This section of the AMP highlights an agency’s process for managing asset lifecycle; a strategy for managing a group of assets, maintaining a specific level of service and performance, and minimizing cost. The value in selecting the best maintenance strategy is not just lower maintenance cost. Other potential benefits are lower total asset lifecycle cost and greater asset availability, reliability, and performance. In some cases, the greater benefit of one maintenance strategy over the other lies in the cost avoidance.

Lifecycle planning includes a description of the process behind the management of each asset as well as how data supports and informs decisions. Lifecycle planning is done at the asset group, or sub-group level, and considers the following for each asset type:

- Replacement cost
- Expected performance or condition assessment over time (by asset or individual component)
- Desired level of performance and risk associated with loss or reduction in the performance of the asset
- Maintenance strategies and impact on deterioration rate
- Maintenance costs
- Sustainability and environmental considerations of maintenance, rehabilitation, and replacement
What are the best O&M and CIP strategies?

For more information, refer to LRRB Report Manual 2016-34B, which is a Systems Preservation Guide that serves as a step-by-step guide to help address transportation system preservation needs of an agency. The purpose of the System Preservation Guide is to demonstrate useful methods to address preservation needs at the local level. www.dot.state.mn.us/research/TS/2016/201634B.pdf (1.7 MB)

The manual is structured into five areas that act as a decision tree and is a compilation of research and system preservation strategies identified as part of a larger study (Systems Preservation Guide: A Planning Process for Local Government Management of Transportation Networks) prepared by the LRRB. www.dot.state.mn.us/research/TS/2016/201634A.pdf (30.9 MB)

For each asset, starting with the most critical, ask four questions to help determine a maintenance strategy:

- What does this asset do?
- What happens if it fails for any reason from negligence to catastrophic?
- What is the probability of failure?
- What is the best maintenance policy or strategy that balances the on-going cost of the maintenance strategy, the risk, and the associated benefits?

Once the optimal maintenance policy or strategy is determined, use it to build your Maintenance Manual. The Maintenance Manual can be a guidebook or simply an embedded table with specific itemized lists of instructions on how to keep each asset or asset type at or above desired performance standards.

Content of a Maintenance Manual

- **What**: The inventory of assets that must be maintained
- **How**: The types of maintenance tasks
- **When**: The intervals at which each asset is to be maintained. Also called the maintenance schedule.
- **Who**: The skill levels required for each maintenance task.

**Determine Appropriate Capital Improvement Program**: Use the data compiled, including inventory, condition, age, performance target service levels, risk, and available and anticipated funding, to create a strategic plan for maintenance and replacement of an asset or group of assets. Consider “how much money do I have to invest?” in determining the performance target service level and investment plan for future annual expenditures that are realistic.

With respect to funding annual maintenance activities to achieve performance target service levels, start with the most critical assets to sustain performance, determine the optimum maintenance requirements for each of these assets, and then allocate the available resources (both financial and human) required to implement the annual maintenance plan.
What is the best funding strategy?

Financial Plan and Investment Strategies: In the financial and investments strategies section of an AMP, an organization should describe existing revenue sources and trends, inflation, investment strategies, potential new revenue enhancements (bonds, federal and state grants or loans, franchise fees, wheelage tax, and local option sales tax), and funding gaps that prevent achieving performance targets. Outline the allotment of capital assets and public funding according to the prioritized list of projects. The plan should include the source of the funding as well, whether it is from a government grant or from the agency’s own funds.

The AASHTO Transportation Asset Management Guide Executive Summary also provides information and resources for financial planning and performing lifecycle and risk analysis. The information provided in the document is targeted at states but could also be used by local agencies in considering the components of their plan.

An AMP can evolve into a long-term financial planning tool that will help you identify what your priorities are, what you can or cannot afford, and any challenges or obstacles in order to realize your desired performance levels of service. It will help your agency look beyond the annual budgeting process and supplement it with a long-term management plan.

With budget constraints likely to remain tight for the foreseeable future, a long-term financial plan will help an agency determine which objectives are feasible, which are the most important, and if you are going to be able to maintain your priority assets over the long term.

Paying for needs identified in a Capital Improvement Program (CIP) can pose a financial burden for any agency. It is challenging because nobody likes to raise taxes or rates. Each agency will approach financial planning and funding for infrastructure assets based on what it deems to be in its best interest.

So, how should local agencies program infrastructure asset investments to meet their documented level of service and performance targets? Asset management principles suggest the following:

Preserve what you have in a smart way. In other words, maximize the value of your current assets by minimizing their lifecycle cost. Use the AMP to prioritize lower cost, high benefit maintenance and preservation treatments that extend the life of the assets and minimize lifecycle cost. These projects should be programed first using available funding streams. Neglecting to fund these will cost the agency considerably more in the long term as illustrated in Figure 4.1. Assets that have reached or are approaching their useful life and need replacement should be programed next with any remaining funding. New or enhancement projects then compete for remaining funds and new revenue. Again, the AMP will help agencies make data driven funding decisions. Policy makers, administrators and finance directors can plan future budgets to meet performance targets. Funding shortages are identified so that agencies can determine strategies to fully fund the most important projects. Agencies have several options to pay for these projects including applying for grants, increasing revenue (taxes, fees, assessments etc.) or financing projects using capital bonding. The agency will need to weigh the drawbacks and benefits of pay as you go versus increasing revenue or financing using capital bonding. A combination of pay as you go and financing is often the best approach depending on market conditions.

The League of Minnesota Cities (LMC) and the Association of Minnesota Counties (AMC) both provide guidance to their members on local agency funding options for capital improvements.

How to begin implementation?

**Implement, Accountability, and Process Improvements:** Asset Management Plan creation typically concludes with a discussion of implementation, accountability, and continuous improvements. This section can convey priorities and highlight the implementation strategy of the organization. Major priorities can be summarized by referencing the condition, performance, lifecycle, risk, and funding data developed in earlier sections of the plan. This section provides an opportunity to document implementation timelines, share lessons learned, and provide the vision for the future state of the system.

**Report Results:** Measure and record data to quantify results and track condition and progress over time. Monitor results of condition surveys for each asset over time to justify a continued path or encourage modifications of the AMP. Periodically report the results to stakeholders (preferably not less than annually).

*The Local Agency Guidelines for Developing an Asset Management Process and Plan* (2.6 MB) (published by Michigan LTAP) provides good insight into this element of the plan.
Asset Management Information Systems

Before considering the purchase of asset management software, it is important to remember that asset management is not something that can be purchased. Asset management is not a software application: it is the process of using data, tools, and standard practices to more effectively manage assets. An Asset Management Information System (AMIS) is a collection of hardware, software, data, and processes that support asset management business processes. An AMIS is used to collect, process, store, and analyze information about assets; develop sound maintenance and rehabilitation strategies; and schedule, track, and manage work. Systems can range in sophistication, functionality, and price from simple spreadsheets that list assets and their condition ratings to more complex, graphical systems with data maintenance, simulation, optimization, and reporting capabilities as illustrated in the figure, to the right, developed by the Indiana LTAP.

The common functional elements of an AMIS are:

- Asset inventory
- Asset condition, performance, and utilization tracking
- Asset condition and performance prediction
- Treatment selection
- Resource allocation
- Work planning and tracking support
- Database
- Links to geospatial features
- Field data collection system

Sophistication Level: Simple
- Modeling and analysis capabilities are limited
- Addition of GIS allows for customized maps
- Investment Level: $?

Sophistication Level: Moderate
- Has some basic capabilities to model future conditions
- Provides a variety of simple analysis scenarios and reporting methods
- Investment Level: $$$?

Sophistication Level: Advanced
- Uses agency-specific models to predict future conditions
- Provides the most robust analysis and reporting capabilities
- Investment Level: $$$$$?
Do I Need Asset Management Software?

Software Considerations

The Federation of Canadian Municipalities has prepared a guide: Questions to ask before your municipality considers asset management information system software (584 KB).

The process of asset management deals with many thousands of records, and software can organize the data and help predict asset deterioration. This can be used to make data-driven decisions. It is important to note that software does not make decisions; its purpose is to inform the decision-maker. By incorporating financial data, software tools can allow users to explore the relationship between cost and performance.

Before considering the purchase of asset management software, consider the following:

- Organization
- Needs and goals
- Existing resources
- Budget

If you decide to purchase software, evaluate the following:

- End-user experience
- Flexibility/expandability
- Mobile capabilities
- Data extraction/integration
- Work order/stakeholder request management
- Inspection/condition ratings
- GIS integration
- Analysis/reporting
- Staff training and user groups
- Technical support

Asset management systems and software can help your agency accomplish many of your asset management program goals and objectives, but it cannot make decisions for you!
Data Management

Before an asset inventory is created, consider how data will be managed and stored. Several options are available and represent a range of costs and sophistication. Asset management relies on accurate and up-to-date data, and it is important to establish protocols to ensure data consistency, integrity, and security. Using GIS in conjunction with each tool for location and mapping allows spatial data such as condition data, maintenance activities, and work orders, to be stacked, displayed, retrieved, analyzed, and presented in an interactive graphical map display. Data quality has a direct influence on project and maintenance treatment recommendations, especially its consistency and reliability. Because it is so important, use a quality control process to check for routine data errors.

Data and Accessibility

Data collection and maintenance can be one of the most expensive and time-consuming parts of developing an asset management program. Timely and accurate data collection is critical to success.

Before proceeding with data collection, ask the following questions:

- What is the quality of existing data?
- What deficiencies need to be corrected/updated?
- What is your budget and schedule?
- What is the immediate need?
- What will be the future use/analysis of the data?
- How and by whom will data be uploaded, maintained, and updated?

The most important thing to know about assets is their condition. Objective condition ratings serve as a valuable tool for two purposes: collected data allows the user to monitor condition over time and the data can be used to communicate performance to agency leadership and constituents. Regardless of the system, methodology, or tool you choose, strive to keep your data current. Avoid collecting information that is difficult to maintain or not useful in making treatment or investment decisions. It is better to do a good job maintaining a small amount of useful information about the asset than having a comprehensive inventory that is constantly out of date, because an agency does have the resources to keep it current.
Lifecycle Cost Analysis

The focus of infrastructure asset funding has been shifting towards system preservation and the development and use of an asset management program by local agencies has and will continue to provide opportunities for decision-makers and policymakers to make more informed long-term investment decisions.

The American Society of Civil Engineers, in a paper titled, *Maximizing the Value of Investments Using Lifecycle Cost Analysis* (2.6 MB), states that “Lifecycle cost analysis is a data-driven tool that provides a detailed account of the total costs of a project over its expected life.”

The United States Department of Transportation published a *Lifecycle Cost Analysis Primer* (2 MB) that provides a background for users to investigate the use of lifecycle cost analysis to evaluate alternative asset investment options.

Preservation strategies and activities are different from traditional maintenance and rehabilitation activities. Traditional approaches address existing deficiencies, and many preservation activities are performed before deficiencies occur. Preservation activities delay the degradation of the asset’s value and increase the useful life of the asset. Lifecycle Cost Analysis provides a means to evaluate the economic effectiveness of preservation activities through total lifecycle costs comparisons.
Lifecycle Cost Analysis

Incorporating Lifecycle Cost Analyses into Your Asset Management Program

What is the full cost of investing in an asset? It is the total cost of the asset and can include, design, construction, operations, maintenance, and disposal. Comparing project design alternatives by just the initial costs can lead to shortsighted decisions.

The opportunities for lifecycle cost reduction are typically greatest in the planning stage where many of the factors such as scoping, option evaluation, and design section, that affect lifecycle costs are decided. After the asset is built, the focus becomes managing and maintaining the asset; doing the right work at the right time to get the best value in terms of asset performance and the services the asset delivers. The figure, displayed to the right, “Asset Lifecycle Costs and Decision-Making Opportunities” by AASHTO contrasts the total accumulated life-time costs of a typical asset with the opportunities for lifecycle cost reduction.
Lifecycle Cost Analysis

Lifecycle planning considers the following for each asset type:

- Replacement cost
- Expected performance or condition assessment over time
- Desired level of service, and risk associated with loss or reduction in service
- Maintenance strategies and impact on deterioration rate
- Maintenance costs

The [AASHTO Transportation Asset Management Guide](https://www.trb.org/Files/Publications/928651221_082121_FINAL.pdf) Executive Summary and the figure to the right outlines a process for conducting lifecycle planning.
Risk Management

The International Organization for Standardization defines risk as “the effects of uncertainty on objectives.”

Risk can reduce the effectiveness of an agency and the decisions it makes. By creating a risk management program, an agency can reduce threats to the public. Risk management complements asset and performance management. It also helps an agency develop mitigation strategies and achieve their strategic objectives.

The [AASHTO Transportation Asset Management Guide](https://www.aashto.org/publications/transportation-asset-management-guide) and the figure to the right, illustrates the relationship between strategic objectives, asset management, and performance management with risk management being at the center of the three.
Risk Management

Many agencies develop a risk register that itemizes the risks, describes the likelihood of a risk occurring, and identifies the impacts of each risk and potential mitigation strategies for an asset class. The AASHTO Transportation Asset Management Guide included the table below as a way to model risk likelihood and consequence for an agency:

<table>
<thead>
<tr>
<th>LIKELIHOOD</th>
<th>Insignificant</th>
<th>Minor</th>
<th>Significant</th>
<th>Major</th>
<th>Catastrophic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Rare</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td>Rare</td>
<td>Low</td>
<td>Low</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Seldom</td>
<td>Low</td>
<td>Moderate</td>
<td>Moderate</td>
<td>High</td>
<td>Extreme</td>
</tr>
<tr>
<td>Common</td>
<td>Moderate</td>
<td>Moderate</td>
<td>High</td>
<td>Extreme</td>
<td>Extreme</td>
</tr>
<tr>
<td>Frequent</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
<td>Extreme</td>
<td>Extreme</td>
</tr>
</tbody>
</table>

Figure 12.2 Risk Likelihood and Consequence Categories. Source: AASHTO Transportation Asset Management Guide: A Focus on Implementation (June 2013)

In addition, AASHTO has published the “AASHTO Guide for Enterprise Risk Management” and a free Quick Guide that provides a useful overview of risk management for transportation. It can be found online.

This Guidebook provides the following reference links on how to conduct a risk management analysis and develop a register for your agency.

- Chapter 5 of MnDOT’s Transportation Asset Management Plan (2019)
  - [http://www.dot.state.mn.us/assetmanagement/tamp.html](http://www.dot.state.mn.us/assetmanagement/tamp.html)

- Page 17 of the Transportation Research Board’s NCHRP08-36(126)
  - [http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP08-36(126)_FR.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP08-36(126)_FR.pdf)
Signs of Successful Implementation

What makes an Asset Management Program successful? The answer may be as simple as tracking the condition of an asset over time and watching its condition and value change based on investment and maintenance strategies.

Ongoing communication is essential to the success of an asset management program and plan. Asset management implies change and change in an organization can be difficult to manage. Getting management and staff commitment is essential for the successful adoption of asset management philosophy and principles. For the people within an organization to cooperate and participate in change it is vital they understand the reasons and benefits of the change.

Communication is important because of the involvement of different disciplines and levels within an organization that typically have different perspectives about the agency assets. Asset management policies, practices, and procedures when effectively explained can take some of the mystery out of how and why asset investment decisions are made. Goals and strategies must be clearly articulated using terms that are meaningful to stakeholders.

Documenting the asset inventory and current conditions and estimating future conditions based on alternate investment strategies and performance measures leads to transparent decisions. Public confidence in an agency’s performance is achieved by reporting results, accomplishments and failures, and documenting progress toward established goals.

The asset management program should clearly communicate:

1. What we are doing?
2. Why we are doing it?
3. How we plan get it done?
4. Where we intend to do it?
5. When will it be accomplished?

How can you measure the success of your asset management initiative?

NCHRP Report 866, “Return on Investment in Transportation Asset Management Systems and Practices” outlines a framework for developing the Return on Investment (ROI) resulting from Asset Management Plan implementation. This NCHRP included costs associated with those systems, including initial system purchase, improvements to an existing asset management system, and enhancement of an agency’s data collection and reporting methods.
Signs of Successful Implementation

Consider the following checklist:

- Did your agency achieve the expected benefit from creating an asset management program and plan?
  - You decided to do this for a reason! Did you achieve the specific benefit(s) you envisioned and set forth in your asset management program objectives?

- Did your agency take the right approach to developing an asset management program and plan?
  - Asset management implies change and change in an organization can be difficult to manage. During the process staff relationships may have become strained and the organization may have experienced some level of chaos. Did everyone eventually pull in the same direction or were the asset management advocates always having to push the initiative forward? Did the approach build a stronger team and organization that will enable future collaboration?

- Was your data credible and current?
  - The merits of being able to objectively review and consider different asset investment options that are based on credible and current data builds staff and public confidence in your agency’s decisions.

- Did you monitor and report the performance results of the asset(s)?
  - Performance results should be monitored and reported for both impacts and effectiveness. Are the investment decisions you made showing performance and condition trends heading in the right direction? If not, why not? If so, what must you do in going forward to maintain those trends?

- Has your agency been able to sustain the change to data-driven, performance-based decision-making that comes from asset management?
  - The last metric when looking at how to measure success is how the change “gets made and stays made”. Is your agency’s “new normal” for allocation of resources one that is data-driven, performance-based decision-making? Is it in regular use across the organization?

**Delivering a sustainable change is the overall legacy of your asset management program and plan!**
Definitions: (1 of 2)

Asset management definitions can be found in almost any of the documents referenced in this guidebook. The terms and meaning given by the respective authoring source is fairly consistent but the words vary slightly from source to source. Listed below are two examples to illustrate this point: first definitions as defined by the American Water Works Association (AWWA), followed by the definitions from APWA.

American Water Works Association (AWWA) Asset Management Definitions

**Asset Management Plan (AMP):** A written representation of the intended approach for the management of infrastructure assets over their lifecycle based on the organization’s understanding of service level requirements. A key purpose of AMPs is to drive longer term thinking and planning and ensure the organization is operating in a financially sustainable manner.

An AMP typically includes levels of service, current performance, future demand, risk management, lifecycle management plans (e.g., Maintenance Plan, rehabilitation and replacement plan), and financial forecasts. (AWWA, 2018)

**Asset Management Program:** A formalized, systematic set of practices to implement the AMP within the organization, with a focus on developing asset management capabilities within the organization. The program typically includes the cohesive development, implementation, and integration of people, processes, and information systems. (AWWA, 2018)

**Asset Management Policy:** A formal document for organizational leadership (Board of Directors, Executive Management) to signal their commitment and priorities for an asset management program and provide clear direction as to the appropriate focus and the anticipated levels of asset management practice and engagement. (AWWA, 2018)

**Organizational Strategic Plan:** A formal document to communicate the organizational vision, mission, goals, objectives, Levels of Service, and the strategic actions necessary to achieve those goals. Typically, the business need or drivers for an asset management program would be stated within the organizational strategic plan. (AWWA, 2018)

**Asset Management Strategy:** A long-term optimized approach to management of the assets, derived from, and consistent with, the organizational strategic plan and the asset management policy. The strategy converts the organizational strategic plan and asset management policy into a high-level, long-term asset management action plan and/or asset management program with well-defined and measurable asset management objectives and key performance indicators. (AWWA, 2018)
American Public Works Association (APWA) Asset Management Definitions

**Asset**: Anything that provides value or potential value.

**Asset Management**: Activities associated with maximizing the value of an asset. In the case of municipal asset management associated with physical infrastructure, these are the activities associated with maximizing the value from physical infrastructure for stakeholders.

**Asset Management Policy**: This is the high-level direction of the organization that applies to how assets (physical infrastructure in this case) should be managed.

**Asset Management Objectives**: The refinement of asset management policy that applies to all assets and clearly provides specific direction.

**Asset Management Plan (AMP)**: Specific physical infrastructure (or infrastructure class) set of instructions that further refines the implementation of asset management objectives.

**Strategic Asset Management Plan (SAMP)**: A broad plan with a specific time horizon associated with implementing asset management policy and objectives.

**Asset Management System**: The formalized activities (policies, processes, and procedures) associated with maximizing the value of the asset. The difference between this and asset management is the subtle recognition that some activities cannot be formalized but have an impact on the value obtained from the asset.
Resources: (1 of 2)

AASHTO
- AASHTO Transportation Asset Management Guide A focus on Implementation

Alberta, Canada
- Getting Started Toolkit User Guide

American Public Works Association (APWA)
- Guide to Successful Asset Management System Development

American Society of Civil Engineers (ASCE)
- https://www.asce.org

American Water Works Association (AWWA)

Federal Highway Administration (FHWA)
- FHWA: Generic Work Plan for Developing a TAMP

Federation of Canadian Municipalities

Harvard Business Review

Institute of Asset Management (IAM)
- Institute of Asset Management (IAM)

Institute of Public Works Engineering Australia
- www.ipwea.org/home

Indiana Department of Transportation (IDOT)
- Asset Management Guide
Resources:

**International Organization for Standardization (ISO)**
- ISO 55000 Standards for Asset Management
  - [https://www.iso.org/standard/55089.html](https://www.iso.org/standard/55089.html)

**Local Road Research Board (LRRB)**
- [https://lrrb.org/media/reports/TRS1603.pdf](https://lrrb.org/media/reports/TRS1603.pdf)
- LRRB website

**Michigan Department of Transportation (MDOT)**
- [Transportation Asset Management Plan Technical Guide](http://www.dot.state.mn.us/assetmanagement/tamp.html)

**Minnesota Department of Transportation (MnDOT)**
- [Transportation Asset Management Plan](https://www.dot.state.mn.us/assetmanagement/tamp.html)
- [Transportation Asset Management Plan Technical Guide](http://www.dot.state.mn.us/assetmanagement/tamp.html)

**MN2050**
- [https://www.wilder.org/wilder-research/research-library/mn2050-state-infrastruc-ture](https://www.wilder.org/wilder-research/research-library/mn2050-state-infrastruc-ture)

**National Cooperative Highway Research Program (NCHRP)**
- [www.tamptemplate.org](http://www.tamptemplate.org)
- [https://docs.lib.purdue.edu/intpubs/118/](https://docs.lib.purdue.edu/intpubs/118/)

**Purdue University (Indiana LTAP)**
- [Asset Management Getting Started Guide](https://www.youtube.com/watch?v=agP0LCPL4nw)

**Saskatchewan, Canada**
- [Asset Management Getting Started Guide](https://www.youtube.com/watch?v=agP0LCPL4nw)

**Southern Cross University**
- Brunetto, Xerri and Nelson, Southern Cross University 2014

**Water Environment Research Foundation**
- [http://simple.werf.org/](http://simple.werf.org/)