TRANSPORTATION ASSET MANAGEMENT WEBSITE: FINAL REPORT

PB2003-100155

July 2002

Midwest Regional University Transportation Center
College of Engineering
Department of Civil and Environmental Engineering
University of Wisconsin, Madison

Authors: Jason Bittner and Wesley Thimm;
Midwest Regional University Transportation Center, University of Wisconsin, Madison

DISCLAIMER

This research was funded by the Midwest Regional University Transportation Center, the Wisconsin Department of Transportation and the Federal Highway Administration under Project #0092-01-10. The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the information presented herein. This document is disseminated under the sponsorship of the Department of Transportation, University Transportation Centers Program, in the interest of information exchange. The U.S. Government assumes no liability for the contents or use thereof. The contents do not necessarily reflect the official views of the Midwest Regional University Transportation Center, the University of Wisconsin, the Wisconsin Department of Transportation, or the Federal Highway Administration at the time of publication.

The United States Government assumes no liability for its contents or use thereof. This report does not constitute a standard, specification, or regulation.

The United States Government does not endorse products or manufacturers. Trade and manufacturers' names appear in this report only because they are considered essential to the object of the document.

Transportation Asset Management Website at www.mrutc.org

Transportation asset management is a business process and a decision-making framework that covers an extended time horizon, draws from economics as well as engineering, and considers a broad range of transportation resources. The asset management approach incorporates the economic assessment of trade-offs among alternative investment options and uses this information to help make cost-effective investment decisions. Several varied efforts have been undertaken by organizations in the field of asset management. A survey conducted in the fall of 2001 by the Midwest Regional University Transportation Center at the University of Wisconsin-Madison found that many national groups are working to define and refine the meaning of Asset Management.

The table on the right indicates the efforts national organizations are undertaking in Asset Management. This is only a national listing and there are several state and local agencies implementing Asset Management systems currently. However, amidst most of these efforts, people and organizations define Asset Management differently depending upon their perspective. Efforts to clarify roles, create dialogue, and produce innovative research and products are primary. Each operates relatively small sections on larger websites with information related to Transportation Asset Management. No single effort has consolidated this information into a single clearinghouse on the World Wide Web.

Groups with Ongoing Transportation Asset Management Activities

AASHTO: American Assoc. of State Hwy & Trans. Officials
ACPA: American Concrete Pavement Assoc.
APWA: American Public Works Assoc.
ASCE & CERF: American Society of Civil Engineers & Civil Engineering Research Found.
FHWA: Federal Highway Administration
FP²: Foundation for Pavement Preservation
GASB: Governmental Accounting Standards Board
IRF: International Road Federation
LTAP: Local Technical Assistance Program
MRUTC: Midwest Regional Univ. Trans. Center
MTC: Midwest Trans. Consortium
NCHRP: National Coop. Hwy. Research Program
NHI: National Hwy. Institute
NRCC: National Research Council of Canada
PIARC: World Road Federation
OECD: Organization for Economic & Cooperative Development
TRB: Transportation Research Board
UC: University of Cincinnati
UTC: Urban Transportation Center, University of Illinois-Chicago

The Midwest Regional University Transportation Center's mission is to coordinate research; education and technology transfer in the transportation field. Asset management information delivered via a concise yet comprehensive website encourages fulfillment of all three portions of the mission in addition to serving the needs of the larger transportation community.

With funding provided by the Wisconsin Department of Transportation and the University Transportation Centers program of the United States Department of Transportation, staff members at the Midwest Regional University Transportation Center developed a website and clearinghouse of information related to the study and practice of transportation asset management.

Examples of information that appear on this site are include: a section exploring what is asset management, a summary of commonly accepted definitions of

transportation asset management, details on the development of a curriculum involving asset management skills, topics, and techniques, analysis of international efforts in Transportation Asset Management, a calendar of upcoming seminars, workshops, and conferences with asset management themes, current news and information delivered in brief, concise formats, materials on the National Transportation Asset Management Workshop, resources and related sites, state DOT initiatives in the area, an asset management literature review, and ongoing research summaries and results. In addition, a search engine is featured, making the website more user accessible. Other features include a link to the nascent National Community of Practice website initiated by the American Association of State Highway and Transportation Officials (AASHTO) and the Federal Highway Administration (FHWA). Short courses offered at consortium institutions, current student projects and research, regional demographics, and relevant research and teaching interests of scholars in the region round out the website contents.

Background

For the purposes of developing a website, it is important to recognize the wide variety of definitions and concepts that are integrated into perceived examples for discussion. The Federal Highway Administration has defined asset management with respect to transportation as a business process and a decision-making framework that covers an extended time horizon, draws from economics as well as engineering, and considers a broad range of assets. Other organizations offer a variety of additional descriptive language from computer programs to specialized formulas and strategies for implementation. Some take a holistic approach; others focus on individual management systems. The asset management approach incorporates the economic assessment of trade-offs among alternative investment options and uses this information to help make cost-effective investment decisions.

In order to effectively offer a transportation asset management resources website, a broad approach is best. The website does not limit the discussion of asset management to follow a specific definition or set of principles. This approach provides the greatest source of clearinghouse activities.

Asset management has come of age because of

- changes in the transportation environment,
- changes in public expectations, and
- extraordinary advances in technology.

The advent of increasingly powerful computer systems has made the practice of asset management possible. These computer systems not only put sophisticated analytical tools at a transportation staff's fingertips, but also allow agency officials to perform "what if" analyses that in turn facilitate discussions with other stakeholders.

The establishment of a comprehensive Transportation Asset Management Website serving as a resource and directory for ongoing national efforts may work to provide practitioners with the tools and information necessary to implement TAM- in an expedient manner. In addition, the website will serve as an educational and technology

transfer tool, displaying upcoming courses offered, activities, seminars, workshops, conferences, and sample curriculum.

Work on the Transportation Asset Management website initiated in the summer of 2001. Researchers included graduate students, undergraduate student hourly employees, and key staff personnel. Initial components of the website were launched in conjunction with the 4th National Transportation Asset Management Workshop held September 23-25, 2001.

Website Features

The domain for accessing the information is embedded in the website for the Midwest Regional University Transportation Center at www.mrutc.org. This site offers a variety of information about the University Transportation Centers Program as well as serving as the primary location for information related to the state of the practice of transportation asset management.

Description of Featured Web Pages and Information

Search Engine

The research team elected to use the free Google® interface to provide search services on the website. This search capacity allows website users access to specific information on the website and can search through various formats. Documents on the website are available in HTML, Microsoft Word, and Adobe formats. This variety makes standard text searches difficult. The Google® interface made the variety of information accessible.

Community of Practice

The American Association of State Highway and Transportation Officials sponsored the creation of a Community of Practice Website, launched in 2001-2002. The asset management website created under this research project has partnered with the AASHTO sponsored site at http://assetmanagement.transportation.org/tam/aashto.nsf/home. This prevents a duplication of effort. Specific sections are available for interactive dialogue and discussion. They are:

a. Asset Management 101

b. AASHTO Guide for Asset Management

c. Innovation and Success

d. Pavement Management Systems

e. Bridge Management Systems

f. Tunnel Management Systems

g. Roadway Hardware Management Systems

h. Maintenance Management Systems

i. Transportation Preservation

j. Integration of Data and Management Systems

k. Engineering Economic Analysis Tools

l. Research

m. GASB 34

n. AASHTO Asset Management Task Force

o. Asset Management at the Transportation Research Board

Staff at the Midwest Regional University Transportation Center is responsible for the moderation of the Research section of the Community of Practice Website. In addition, a variety of resource information is available.

Transportation Asset Management Conference Summary

One of the largest areas of the website is devoted to the 4th National Transportation Asset Management Workshop: Taking the Next Step in Transportation Asset Management. The workshop was held during September 2001 and featured over 275 participants. The website provided complete information on the presentations, session notes, and photographs. A workshop summary is to be published in the *International Journal of Transport Management*, an Elsevier Publication. This summary will be available through a secured part of the asset management website on mrutc.org following publication of the journal.

Resources and Related Sites

The website includes links to off-site publications, resources, and other materials collected detailing and documenting efforts in Asset Management. Among the documents that are included on the website are summaries of all relevant research, a complete bibliography of asset management publications and articles, links to ongoing International Efforts in Transportation Asset Management, a link to the Electronic Dialogue for Transportation Operations, and several other materials. Several essential documents and publications on the subject are not available electronically. This material is also going to be available through the development of a library on asset management, accessible through the website at a future point in time.

Information is available from a number of organizations, including area Departments of Transportation, the American Association of State Highway and Transportation Officials, the National Cooperative Highway Research Program, the American Society of Civil Engineering, Federal Highway Administration, the Turner-Fairbank Transportation Research Laboratory, National Consortium on Remote Sensing in Transportation for Infrastructure (NCRST-I), the Transportation Research Board, the Midwest Transportation Consortium, and others.

Full Contents Review of Website (All Pages)

What is Asset Management?

A brief description of asset management is available on an introductory webpage. It indicates that transportation infrastructure is vital to the economic well being of the individual states and the nation. However, limited budgets, coupled with increasing demand on the transportation network, continue to pose pressing challenges to state transportation decision-makers. A comprehensive process is needed to assist these decision-makers in evaluating investment options for operating and maintaining transportation facilities. Asset management systems are emerging as the vehicles to meet this challenge.

Currently, most transportation agencies are managing individual assets without taking a comprehensive view among these assets and evaluating all the tradeoffs that must be made to assure a program of projects result in the most benefit to the customer. Quantification of these tradeoffs is at the heart of asset management methodology. 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. Asset management systems are goal-driven and, like the traditional planning process, include components for data collection, strategy evaluation, program selection, and feedback. The asset management model explicitly addresses integration of decisions made across all program areas. Its purpose is simple -- to maximize benefits of a transportation program to its customers and users, based on well-defined goals within available resources.

Transportation Asset Management Definitions

One of the single largest problems with Transportation Asset Management is defining what that word actually means. We define it as "simply bringing relevant data and analytic tools together with systematic implementation processes to ensure that the defined goals of the system are attained as efficiently as possible."

Transportation managers have been establishing system goals, analyzing system conditions, making investment decisions and implementing projects since the beginning of transportation agencies. The challenge is to help those managers understand how meaningful system goals can be established to meet the needs and desires of the traveling public; to help them gather and use the most relevant information; to help them use the best analytic tools; and to help them understand the most efficient implementation processes.

Here are just a few of the many definitions offered for asset management:

> Asset management is a systematic process of maintaining, upgrading, and operating physical assets cost-effectively. It combines Engineering principles with sound business practices and economic theory, and it provides tools to facilitate a more organized, logical approach to decision-making. Thus, asset management provides a framework for handling both short- and long-range planning. (AASHTO and FHWA)

Asset management is a systematic process for maintaining, upgrading and operating the physical assets of a transportation system. Asset management employs engineering principles, economic theory, sound business practices, and information systems to determine short and long term resource allocations. (Transportation Research Board)

An asset is a physical component of a facility which has value, enables services to be provided, and has an economic life greater than twelve months. Assets management is a methodology to efficiently and equitably allocate resources amongst valid and competing goals and objectives. (American Public Works Association)

Assets Management is a methodology to efficiently and equitably allocate resources amongst valid and competing goals and objectives. (American Public Works Association)

Asset management is the programmed approach to operating, preserving, and restoring physical assets to meet predetermined standards. (VMS, Inc)

Asset management is the systematic process of maintaining, upgrading, and operating assets, combining engineering principles with sound business practices and economic rationale. (UK Highways Ministry)

Asset Management—management system to achieve an organization's business objectives and cost effectively manage assets throughout the life cycle of:

- Identification of need for an asset
- Design and planning
- Acquisition and, as necessary, enhancement of assets
- Asset utilization including operation, maintenance, and improvement
- Disposal of assets (Booz, Allen & Hamilton)

The sum of all those activities related to an asset's life that result in a safe and efficient intermodal transportation system that contributes to the social and economic well being of its benefactors. (Darrel Rensink, Iowa DOT)

An integrated set of processes and systems to achieve optimal and cost-effective use of assets throughout their service life, including identification of the need for an asset, acquisition enhancement of assets, utilization-operation, maintenance, and improvement, and disposal of assets. (David Ekern, Minnesota DOT, 1999)

The core components of asset management are data collection, preservation, economic analysis, management orientation, and integration. (FHWA)

Transportation Asset Management Model Curriculum Development

This section of the website focuses on the development of a model for asset management instruction, including the development of a course in Transportation infrastructure management.

Asset and infrastructure management in the field of transportation is steadily gaining attention among transportation research scholars, as well as among transportation engineers and administrators. The area is becoming recognized as a unique sub-discipline of civil engineering; however, few undergraduate or graduate programs include a curriculum in this area.

The development of a curriculum for higher education in transportation asset management is needed. The website focuses on the curriculum content and interdisciplinary and institutional arrangements for delivering the curriculum. In addition to information on the development of courses in Civil Engineering, this part of the website will include links to the newly developed Transportation Management and Policy graduate program at University of Wisconsin-Madison and the Infrastructure Asset Management program through the University of Cincinnati. Presentations and articles on the growing demands facing the transportation profession with respect to asset management are also included in this section of the website.

International Asset Management Efforts

Several international efforts have been undertaken in the realm of Transportation Asset Management. The website focuses on these and provides readers with links and information on accessing further details on the programs. Some examples are Canada, Kuwait, the United Kingdom, and Australia. Brief descriptions from the website are below:

Canada

The Transportation Association of Canada recently released their Primer on Highway Asset Management Systems. The goal of this publication is to introduce the concepts of asset management, outline its potential benefits, and describe how an asset management system may be successfully planned and implemented.

Canada's roads, streets and highways are major capital assets that are essential to achieving their social and economic goals. Canada's assets represent billions of dollars in replacement value alone, and the ongoing cost required to build, maintain and operate the road network are considerable. Asset management provides a business framework for infrastructure and financial managers to effectively manage their roadway system.

The TAC Final Report: A National Agenda for Technological Research and Development in Road and Intermodal Transportation holds a great deal of additional information on Canada's current progress and activities. Section B addresses the trends, opportunities and needs, as well as specific priority research and development projects related to Canadian asset management.

Australia/New Zealand

There are about 750 road controlling agencies in Australia, with a total road length of 800,000km. Annual spending on operation, maintenance and additions to the road network is about US $4b. Arterial roads comprise 16% of the total length, carry 75% of total travel, and attract 60% of total spending. Per capita, Australia is the world's most intensive user of road freight, with 6,000 tonne-km per capita per annum. Freight travel in Australia is predicted to double in the next 15 years. The estimated written down value of the Australian road system is about US$80b (excluding land under roads), or approximately US$4,000 per capita.

Australian research and development in road network asset management: Austroads (the association of Australian and New Zealand road authorities) has the lead role in Australia in improving asset management practice in road networks. The Austroads Asset Management Reference Group (AMRG) plans and manages road network asset management research and development, in close liaison with corresponding work on pavement technology.

The 1997 Austroads "Strategy for Improving Asset Management Practice" lists 38 priority research and development actions for cooperative effort in Australia and New Zealand. Current activity includes development of standard guidelines for road condition measurement, refinement of models to predict road deterioration, accelerated testing and long term monitoring (LTPPM) to support the prediction of works effects, and correlation of road condition measures with community expectations specifically for local roads carrying low volumes of high mass vehicles. Work to improve understanding of the interaction between heavy vehicle loading and pavements is in the early stages.

Status and recent developments:

- The principles of asset management and pavement management are widely recognized in Australia, and the use of integrated information, predictive and optimizing systems is increasing.
- Major Australian road agencies began reporting the financial value of their road infrastructure assets in the late 1980s, and since 1997 all major road agencies have recognized road assets in annual financial statements.
- A protocol is in place to support harmonized modeling of road user costs among road agencies across Australia. The protocol recognizes harmonization as dynamic in nature, and allows for continuous improvement on a coordinated basis.
- The concept of road hierarchies (fitness for purpose) is entrenched among the major road agencies, and is spreading among smaller road agencies.

Kuwait

Facing an aging infrastructure system and harsh weather conditions, Kuwait's Ministry of Public Works implemented a computerized management system in 1997. The system allows the Ministry to manage their capital and maintenance planning functions more cost effectively. The first steps in this process were to acquire data acquisition equipment and to initiate organizational changes. The KIMMS system uses state of the

art technology (including GIS) to identify, prioritize and plan for infrastructure related expenditures.

United Kingdom

United Kingdom's Department of the Environment, Transport and Regions has developed guidelines for the implementation of best practices in Asset Management.

The publication Modernizing Local Government Capital Finance Paper, Chapter 4 – Encouraging Best Practice in Asset Management describes the Government's efforts to see local government authorities make better use of their infrastructure assets

Calendar of Upcoming Transportation and Asset Management Conferences, Workshops

This section of the website contains a variety of links to various conferences and workshops that have focused on Transportation Asset Management and Transportation management issues. Past workshops are also included for additional information.

National Transportation Asset Management Workshop Website

On September 23-25, 2001, the Midwest Regional University Transportation Center hosted the 4th National Transportation Asset Management Workshop: Taking the Next Step in Asset Management. The workshop was the largest on the subject ever held in North America and sponsored by the Federal Highway Administration, American Public Transportation Association, National Association of County Engineers, American Association of State Highway and Transportation Officials, Transportation Research Board, Midwest Transportation Consortium, Wisconsin Department of Transportation, Urban Transportation Center at University of Illinois-Chicago and others. The event attracted over 270 people at the Concourse Hotel and Governor's Club in Madison, Wisconsin.

United States Representative Tom Petri, Federal Highway Administration Office of Infrastructure Director King Gee, former Wisconsin Department of Transportation Secretary Terry Mulcahy, New Mexico State Highway and Transportation Department Secretary Pete Rahn, Dane County Executive Kathleen Falk, and Dr. Donald Kettl of the La Follette School of Public Affairs spoke to the workshop participants in general sessions along with more than 50 other speakers, who presented in parallel sessions. Participants attended session tracks that included Establishing Goals and Performance Measures, Using and Integrating Data, and Planning and Implementing Asset Management Programs. The participants heard presenters from state, local, and transit system operators.

Presentations and summary materials are available on the website.

Resources and Related Sites

As previously indicated the resources section of the website includes a number of links to information and materials that are very useful to researchers. A description of the literature review is appended to this report.

Similar State Department of Transportation Initiatives

Washington State Department of Transportation

Several state efforts are highlighted on the website. In 1996, Washington State Department of Transportation (WSDOT) initiated the Maintenance Accountability Program (MAP), which is designed to provide "a comprehensive planning, measuring, and managing process" enabling WSDOT to communicate to key customers the impact of policy and resource allocation decisions on the level of service delivered. The MAP Manual provides an overview of the program's development and structure.

MAP assesses conditions of state highways based on a random selection of 2,200 highway segments of .10 miles (528 feet) each. The MAP Program Field Manual includes a detailed description of the rating system. After the roads are rated, highway conditions are then reported among key internal and external constituents. The program's website includes an example report.

In conjunction with the development of the MAP, WSDOT also conducted customer surveys in 1995 and 2000.

California Department of Transportation State of the Pavement Report and Integrated Maintenance Management System

CalTrans evaluates state highways for current and anticipated level of service to the traveling public based on ride quality and structural condition. Results from the 1999 State of the Pavement Report are available online. The department is also currently implementing the new Integrated Maintenance Management System (IMMS), which will replace the department's current Maintenance Management System.

Links to related programs at other state DOTs are also included. Some examples are Arizona, Florida, Maine, Idaho, Kansas, North Carolina, Oregon, and Virginia.

Asset Management Literature Review

A formal literature review is included with an annotated bibliography on the website. A full text copy is also available.

Asset Management News

Current news stories and developments are added to the website on a regular basis. Recent summaries include information on the Mississippi Valley Conference of AASHTO and information on the release of important studies and Requests for Proposals. This information is updated frequently and old information is removed and archived from the website.

Conclusion & Lessons Learned

The wide array of information available (both reliable and unreliable) is difficult to catalogue and consolidate in a single resource. Competing institutions and organizations would like to champion the cause and include information on their own website. In this instance there was a duplication of effort as both the AASHTO sponsored

Community of Practice website and the proposed bulletin board developed through this research project were to be offered at the same time. In the end, the ability to consolidate services and use the website sponsored through AASHTO and FHWA made the most sense to reach the largest number of people. The National Dialogue on Highway Operations also needs to feed into this website.

The ability to link to materials on a variety of websites makes the central control of the material essential. State Departments of Transportation have collected and amassed very user friendly interfaces, but often the material is not organized in a fashion that makes the resources at other states accessible to its users. The consolidation of information on a single site – through the Midwest Regional University Transportation Center is a good tool to make the website a resource for researchers, practitioners, faculty, and students.

Short courses and their offering schedule are incredibly challenging to update regularly. The newly sponsored National Highway Institute course will be a good alternative to the variety and dispersed locations of current course covering asset management related topics. Currently courses are offered by some Local Technical Assistance Programs, universities, and private sector consultants. Often these courses target particular local audiences and needs and therefore are difficult to discover and keep updated on a website.

Additional information that may be of use to further iterations of the website's development includes a directory of professionals in asset management. This directory would include consultants, academics, department of transportation practitioners, and contractors. The goal would be to organize a "one stop shopping" approach to the leading professionals in the asset management effort. This directory would not only include individuals, but also the organizational affiliation of each listed.

The Asset Management website provides a useful resource to researchers, practitioners, students, and academics alike. The growing efforts of organizations like AASHTO and TRB to consolidate resources and organize activities make a website such as this one extremely effective. The state of the practice is enhanced by the information, links, and commentary provided on the website.