Chapter 17

Transportation Asset Management

Introduction

Parts I and II of this report focus on current system condition and performance and future capital investment requirements to achieve specified system performance levels. The report also provides an assessment of the relationship between investment requirements and current spending. The analysis in Parts I and II implicitly assume that transportation investment will be allocated in an effective manner, but does not include an explicit discussion of potential options appropriate for responding to anticipated system conditions and requirements. This Chapter describes transportation asset management (TAM) and provides an overview of recent advances which, when implemented, have the potential to reduce the Nation's highway investment gap.

A new initiative in the transportation community, TAM, provides a framework for the optimal allocation of resources by transportation agencies. When implemented, it will dramatically change the fundamentals of investment decisions. The breakthrough of TAM arises from the fact that the expenditure of funds will (1) be based on trade-off analyses where alternatives are considered across functions, asset classes, and modes; (2) be driven by customer requirements as reflected in performance goals; (3) include economic and engineering considerations; (4) incorporate an extended-time horizon; and (5) be systematic and fact-based.

TAM will lead to the highest possible total return on investment, eventually reducing the gap between what the Nation needs to spend on its transportation assets and what it actually spends. When fully implemented, TAM has the potential to reduce the total life-cycle costs of providing transportation services and improve safety, system reliability, pavement smoothness, and financial performance. The investment requirements presented in this report are consistent with many of the fundamental concepts and principles of TAM.

This chapter is the second in a series of updates on initiatives to advance TAM. Appendix D in the ***1999 C&P Report*** included an assessment of current transportation decision-making processes, identified ways in which asset management principles could be utilized to improve the process, and identified ongoing initiatives by the Association of State Highway and Transportation Officials (AASHTO) and the FHWA related to the implementation of asset management approaches. This chapter looks more narrowly on the FHWA's accomplishments in this area during 2000 and 2001.

Transportation Asset Management: Background

TAM is a strategic approach to managing and investing in transportation infrastructure. It includes all aspects of transportation decision-making, covering operations, maintenance, construction, finance, etc. What differentiates TAM from the traditional approach to managing assets is the decision-making framework. This section expands on the TAM concept.

What is TAM?

TAM is not a specific product or service, but rather a way of doing business that will apply differently from organization to organization. It provides a framework for making decisions in order to use resources efficiently. Assets can take various forms—they can be people, money, information, and physical infrastructure. FHWA is currently focusing on physical assets such as pavements, structures, tunnels, and hardware. Over time, this focus will be expanded to include the full range of transportation assets.

The TAM framework, in broad terms, consists of these elements:

- The establishment of performance expectations consistent with goals, available budgets, and organizational policies. These expectations guide the analytical and decision-making processes.

- The collection of inventory and performance information to determine future system requirements.

- The use of analytical tools and reproducible procedures to provide cost-effective strategies for allocating budgets to satisfy agency needs and customer requirements.

- The presentation of alternative investment options, which are evaluated for consistency with long-range plans, policies, and goals.

- The periodic re-evaluation of the entire process through performance monitoring.

Why TAM?

State and local transportation agencies entered this century facing a series of new and different challenges. The responsibilities of these agencies have shifted in focus from major highway construction projects—primarily the designing and building of the Interstate Highway System—to maintaining, preserving, and improving the effective utilization of the existing system. This shift presents a complex range of challenges as user expectations for the system continue to increase and demand continues to grow. Highways are more congested than ever in many parts of the country. Increasing demand and normal wear and tear subject the system to ongoing deterioration.

Layered on top of these challenges is the impact of reductions in staff that are occurring at the Federal and State levels as a result of government downsizing initiatives and the general aging of the highway workforce. A robust economy during the 1990s also made it difficult for transportation agencies to compete for and retain capable personnel. As transportation agencies lose experienced staff, they are finding that it makes sense to use more systematic approaches that capture corporate memory and expertise and aid in the decision-making process.

Additionally, in States throughout the country, transportation budgets are competing with other budget demands. Furthermore, legislative initiatives are directing transportation funds to activities outside traditional transportation projects.

Despite these changes, the public still expects governmental agencies to preserve and protect the transportation system on which they rely. In fact, public expectations have risen. Today, transportation agencies are expected to communicate and explain their management approaches and results to elected officials and the general public. In addition, they must be fully accountable.

Clearly, a new way of doing business is required to respond effectively to this mix of strong, competing demands. The major shift that is occurring requires and demands a systematic and thorough process. State Departments of Transportation (DOT) and other transportation agencies are moving from constructing new assets to using TAM principles in their business practices to better manage the entire infrastructure.

What are the Key Elements of the TAM Framework?

For a TAM approach to be applied effectively to a transportation system, the following elements are essential:

- A logical decision-making framework that incorporates principles from the disciplines of engineering, economics, and business. The results will reflect a systematic, organized, logical, and reproducible approach.

- Engineering, economic, performance, and behavioral models and associated data inputs that provide the means to identify optimal investment strategies.

- An effective means for transmitting the information required by stakeholders (ranging from legislators to front-line practitioners) vertically throughout the organization. Information must also flow horizontally across functions, asset classes, and modes.

- Known customer expectations along with the organizational structures, practices, policies, and budgets unique to each agency and legislative environment. Performance goals provide a way for transportation agencies to respond to the public's interest in how well their assets are being managed.

- The ability to conduct "What if?" analyses. This provides the means of weighing and articulating the agency and user impacts of choosing one alternative over another.

- Fact-based dialogue among all interested parties, where relevant, objective, and credible information is available to all parties in the decision-making process.

Appendix D in the ***1999 C&P report***, referenced earlier, contains a more complete description of the elements of the TAM framework, and presents an example of a generic asset management system.

Transportation Asset Management: 2000-2001 Accomplishments

This document focuses on activities undertaken by FHWA's Office of Asset Management, many of which are executed in partnership with other organizations. Cooperative arrangements with organizations such as the American Association of State Highway and Transportation Officials (AASHTO), the Transportation Research Board (TRB), industry associations, and academic organizations are a top priority of the Office. In fact, "partnership" is a guiding theme in the work the Office undertakes. The mission of the Office of Asset Management, established in 1999, is to provide leadership and expertise in the development and application of TAM. Products are delivered through technical assistance and training services. The Office's services are available to all State and local transportation agencies.

The mission of Office of Asset Management consists of three major areas. The first is to develop, refine and promote management systems for pavements, bridges, and other highway assets. The second is to develop, recommend, and advance engineering economic analysis and evaluation tools, data integration and management approaches, and other TAM techniques for use by State DOTs. The third is to develop and promote programs to reduce the deterioration and improve the overall quality and performance of the highway system.

During 2000 and 2001, a variety of research, development, training, technology deployment, technical support, and outreach initiatives have been undertaken and completed by the office. We have identified four overarching themes: (1) ensuring the availability of necessary data and information; (2) developing innovative analytical tools and techniques, and business processes and practices; (3) teaching, training, and bringing awareness to the people that will influence final investment decisions, and (4) providing assistance in deploying the tools, techniques, and processes. Deployment activities will be forthcoming as the tools, techniques, and business processes become available.

Details of individual projects and initiatives undertaken by the Office are given below:

Data and Information

- Developed an implementation strategy for new standards to measure pavement roughness, rutting, and faulting. These pavement distress standards were approved by AASHTO during FY 2000 and were presented at several workshops throughout the country.

- Initiated a contract that will demonstrate and document how a State can use its pavement management system to monitor the real-life performance of its pavement network. The project is designed to track the performance of critical pavement parameters and to demonstrate the importance and the advantages of linking all databases with pavement information electronically.

Analytical Tools and Techniques and Business Processes and Practices

- Developed a prototype and conducted a pilot evaluation of the Highway Economic Requirements System-State Level (HERS-ST), a variation of the HERS model used to produce the highway investment requirements in this report. (See Chapter 7 and Appendix A). State representatives participating in the pilot project explored the appropriateness of using the HERS application in program development, trade-off analysis, "needs" estimation, and for addressing new standards issued by the Governmental Accounting Standard Board (GASB). Based on positive input from the HERS-ST pilot participants, the FHWA has initiated development of HERS-ST Version 2.0 which will be significantly more user-friendly and will accept a broader array of State-supplied data. The software, with training, will be distributed to State officials in late 2002.

- Participated in the design, development, and testing of PONTIS 4.0. This new version of the bridge management software is now available and being deployed to States and other agencies. The NBIAS model used to produce the bridge investment requirement estimates in this report is a derivative of PONTIS. (See Chapter 7 and Appendix B).

- Developed Life-Cycle Cost Analysis instructional software designed to support evaluation of alternative pavement design decisions based on total agency and user life-cycle costs. This model will account for uncertainty in cost and performance, and provide outputs for the use of risk-analysis in decision-making.

- Initiated a contract to develop a first-generation guide and management system for highway and transit tunnels. The project is currently underway and will (1) establish an inventory of highway and transit tunnels in the United States, (2) develop detailed guidance for inspecting and rating the condition of tunnel components, (3) establish preservation and rehabilitation strategies, (4) develop a prototype database system, and (5) establish procedures for integrating tunnel management systems with bridge management systems and TAM decision-making frameworks.

- Investigated, with AASHTO, the feasibility of developing a management system for roadway hardware including guardrails, signs, crash cushions, signals, and similar items on and adjacent to highways.

Training, Education, and Awareness

- Developed a Web site called "Communities of Practice for Asset Management" in partnership with AASHTO. This interactive Web site consists of eight areas addressing specific aspects of TAM.

- Conducted a peer-exchange workshop in cooperation with AASHTO on GASB's *Statement 34, Basic Financial Statements—and Management's Discussion and Analysis—for State and Local Government.* GASB-34 calls for State, local, and municipal governments to report the original cost of infrastructure constructed or improved since 1980, and, for each reporting year, the cost of using the assets.

- Organized jointly with the AASHTO Task Force on Asset Management a Data Integration Forum and Peer Exchange intended for information management practitioners in transportation agencies.

- Developed new National Highway Institute (NHI) training courses on "Engineering Applications for Pavement Management Systems", "Use of Critical Path Methods for Estimating Scheduling and Timely Completion", Pavement Preservation: The Preventative Maintenance Concept", and "Pavement Preservation: Selecting Pavements for Preventative Maintenance". Initiated a contract to develop a new NHI course on TAM. This course will be a companion to the upcoming *AASHTO Guide to Transportation Asset Management.* Initiated development of an executive-level Engineering Economic Analysis course for transportation managers.

- Published the *Asset Management Primer*, the *GASB 34 Primer*, the *Data Integration Primer* and the *Data Integration Glossary for Asset Management.* Published and distributed state-of-the practice CD-ROMs, videotapes, and other materials on pavement preservation techniques.

- With the National Partnership for Highway Quality, identified and promoted concepts, activities, and technologies to improve the quality of planning, design, construction, and maintenance of the Nation's highways.

- Provided leadership and technical support to the Transportation Curriculum Coordination Council (TCCC), which consists of representatives from various regional technician training and certification groups, the private sector, FHWA, and NHI.

- Participated in pooled-fund studies and provided technical support on the safety and mobility of the highway system during construction and maintenance, including control of hazardous wastes and application of innovative technologies for work zone traffic control and safety; accelerated construction; and use of new materials, practices, and methods.

The initiatives described above underscore the progress that FHWA's Office of Asset Management has made between 2000–2001 in providing products, information, tools, training, and technical support. These products and programs are valuable to State DOTs as well as our other transportation partners.

Related Activities

As indicated earlier, partnerships are crucial for TAM concepts and practices to gain widespread acceptance. Working with partners minimizes the potential of duplicating efforts and allows the leveraging of limited funds. Key partnerships with the Office of Asset Management have been formed with AASHTO, TRB, the National

Partnership for Highway Quality, the Foundation for Pavement Preservation, and other industry associations. The Office of Asset Management also participates in the National Research and Technology, (R&T), Partnership Forum, which was established by FHWA, AASHTO, and TRB to coordinate research and technology activities.

The Office works jointly with AASHTO committees to include the Committees/Subcommittees on Highways, Bridges and Structures, Maintenance, Construction Quality, Transportation Finance, and the Transportation Asset Management Task Force. The Office assisted the AASHTO Task Force on TAM in revising their 1998 TAM Strategic Plan. The plan now includes five key goals:

- Develop partnerships with public and private entities having an interest in and commitment to TAM.
- Develop and document an understanding of TAM and how it can be used by member States.
- Promote the development of TAM tools, analysis methods, and research topics.
- Communicate with and inform the leadership and member States on the use of TAM.
- Assist member States as they assess and implement TAM within their State.

Under the auspices of the National Cooperative Highway Research Program, an applied research program managed by TRB that focuses on the research requirements of State DOTs, the Office of Asset Management has been working with AASHTO since early 2000 to develop a *Guide to Asset Management*. The guide will provide States with assistance, guidance, and tools for comprehensive TAM.

The Office participates with the Asset Management subgroup of the National Research and Technology, (R&T), Partnership Forum, which was established by FHWA, AASHTO, and TRB to coordinate research and technology activities. In FY 2001, the Office contributed to the Forum by identifying major research theme areas, reviewing existing R&T programs related to TAM, comparing current activities to future requirements to determine gaps and duplications of effort, prioritizing research gaps and identifying high priority areas, and establishing opportunities for partnering on current and future research.

The Office is actively involved with the TRB Task Force on Asset Management, which sponsored four sessions on Asset Management at the January 2001 TRB Annual Meeting and held two meetings to develop a research agenda for future TRB and Asset Management efforts. The Task Force recommended establishing a permanent TRB Committee on TAM to take part in activities in the following areas:

1. Defining TAM and its benefits.
2. Technical aspects of TAM.
3. Coordinating with other organizations.
4. Sustaining TAM and demonstrating effectiveness.

The Task Force plans to produce a document describing the state-of-the-practice in TAM.
In addition, future plans include research into the possibilities of applying TAM to other areas of the transportation field such as transit.