

TRB Task Force on Transportation Asset Management Report of FY 01 Activity December 2001

Introduction

The TRB Task Force on Transportation Asset Management is a special purpose group created to provide focus to the subject of asset management in transportation. As a task force it works closely with the many other TRB committees charged with specific areas of responsibility that touch on asset management. This first report is intended to outline the task force's activities to date and to provide an outline of how we see our future work developing.

Summary and Conclusions

The Transportation Research Board Task Force on Transportation Asset Management was established to contribute to the overall national effort to promote and develop asset management systems in transportation. As it has defined its charge:

...a major responsibility of the task force will be coordination, bringing the disparate things generated by other committees into the framework of asset management. One of the first initiatives of the task force will be the generation of short and long-term research agendas that will highlight original work to be done under the auspices of the task force, as well as indicating complimentary work being done by other committees. One of the products of the task force will be information or guidance to inform the agendas of other related committees.

As it has approached this charge, the Task Force recognizes that many contributors exist in other committees as well as outside of TRB. Primary among those other contributors is the AASHTO Task Force on Asset Management. That task force has created a strategic plan, defined a research agenda and initiated research through the NCHRP process. Since the two task forces share a number of members, their agendas will be complimentary. In addition to AASHTO and NCHRP, Federal Highways has also made a significant contribution to date in the area, having established an Office of Asset Management, published several informational reports on asset management and participated in sponsoring four national workshops. Finally, research, education and technology transfer programs established by University Transportation Centers at Iowa State and Wisconsin have made contributions to promoting asset management. This is going on in other states through the Local Technical Assistance Program's Technology Transfer efforts.

Within TRB, at least a score of committees carry out some activities that relate to asset management. A major challenge of the task force has been, and will continue to be, establishing contacts with each of those committees and sharing information and work products.

As the task force has begun to define its agenda, the many perspectives and interests that exist within transportation agencies and TRB have become apparent. Aligning those interests to facilitate the full benefit and implementation of asset management is a major challenge. This issue is considered to be important enough to be included as one of six in-depth subgroups being formed by the task force. Members and friends of the task force are invited to volunteer for one or more of these subgroups to define best practices, contacts, implementation needs, and research needs within these topical areas:

- A. Goals and Objectives.
- B. Planning and Programming
- C. Data Management and Analysis
- D. Implementation
- E. Internal Alignment
- F. External Communications

These subgroups will be organized at the 2002 Annual TRB Meeting. They will be charged with responsibilities that include identifying and prioritizing research needs and preparing research problem statements.

In addition to establishing these subgroups, the task force is considering several other outreach activities, all designed to help potential implementers of asset management better understand the many tools that are available.

Glossary

The field of asset management is adrift in terms that are not uniformly defined and understood. The following are some key terms used by the task force and the meaning that we attach to each.

- A. Asset Management:** 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.
- B. Goals and Objectives:** Goals are the outcomes that one might want to be achieved from a transportation facility or service. Typically, goals are stated in very broad terms, such as “safe and reliable transportation.” As broad statements, they can provide a vision of what the agency is attempting to accomplish with its programs, but they are not immediately useful as a tool to guide daily actions. Objectives are the next level of specificity that bridge the gap between the broad and the specific. They are statements of what must be done if the broad goals are to be attained.

- C. Planning and Programming:** Planning and programming are the tools used to define investment strategies. A plan provides a vision for a future service or system and the broad needs and actions that will be required if that vision is to become a reality. Typically, plans are long term in nature, with ten to twenty year time horizons. Programs are short to intermediate in nature, typically five to eight years, and outline the specific investments that will be made to achieve the vision of the plan. As tools for defining investments, plans and programs in the asset management framework must consider all reasonable and possible investments, that is they must include capital, maintenance, and operations issues that impact the vitality of the system or service.
- D. Data Management and Analysis:** Data management and analysis includes the wide range of activities necessary to collect, store, manipulate, and analyze data. Typically, this data includes inventories of current assets and their condition, operational characteristics and use made of those assets. Also included are modeled projections of the future use, condition and operational characteristics of the assets.
- E. Implementation:** Implementation includes many activities that an agency might employ to move an investment plan to reality. For a highway agency or street or road department, this would include engineering functions related to plan development, right-of-way, the preparation of contract documents and the actual construction of facilities. It also includes the deployment of maintenance forces and the operations of the system. In a transit agency, it would include actions related to the maintenance of rolling stock and of fixed facilities, the acquisition of rolling stock and the implementation of planned services.
- F. Monitoring:** Monitoring is closely tied to the data management functions in that it is a set of activities needed to regularly track the progress and condition of the facility or service. Are goals and objective being met? What actions are needed to bring reality into line with the planned or envisioned conditions?
- G. Multi-modalism:** Multi-modal is simply being concerned with more than one means of transport. Ideally, in an asset management context, this means being concerned with all reasonably available options that might contribute to the vision, goals and objectives of the transportation agency. Typical modes considered by most agencies would include personal motor vehicle, commercial, bus (or other public transit), bike and pedestrian.
- H. Intermodalism:** Intermodalism is being concerned with the inter-workings of the various modes as they combine to create a transportation system. Are all of the parts reasonably used and connected to create a whole? Or are connections between modes weak, forcing people to choose options that may not optimize the service of the entire network?

- I. Internal Alignment:** Internal alignment refers to the actions and culture of an organization. Are all of the parts informed of and in agreement with the larger goals of the agency? Are they working in cooperative and complimentary ways? Or are parts of the organization acting from narrow self-interest, reducing the effectiveness of the whole?
- J. External Communications:** External communications refers to an agency's ability to tell its story to bodies outside of the organization. These would include its legislative body, the general public, or specific stakeholders. Does that data exist to present a true picture of the condition of the system or service and of the actions of the agency?

Ongoing National Efforts

Asset management in transportation is a current topic of investigation by a number of national organizations. Significant among these are the American Association of State Highway and Transportation Officials (AASHTO), the National Cooperative Highway Research Program (NCHRP), the Federal Highway Administration (FHWA), and the University Transportation Centers (UTCs).

- A. AASHTO:** AASHTO began its efforts in the mid-1990s when it established a task force on the subject. Since that time, it has:
1. Cooperated with FHWA and other organizations in sponsoring four national workshops. The first of these was a small group of invited participants, who listened to speakers from the private sector describe what they did in the area of asset management. The second and third workshops were also by invitation only and focused largely on peer exchanges among the state departments of transportation. The fourth was an open workshop that attracted people from state, local and federal highway agencies as well as transit providers.
 2. Cooperated with the NCHRP in a study of best practices in asset management across the country and in the development of a soon-to-be-released handbook on asset management.
 3. Created a strategic plan for AASHTO efforts regarding asset management.
 4. Documented research needs in asset management, including:
 - Establishing the effectiveness of asset management implementations
 - Linking strategic management to resource allocation and implementation decisions
 - Policy implications of GASB 34 reporting
 - Incorporation of field sensing and real-time data collection for asset management
 - Database and information management
 - Engineering and economic analysis methods and tools

- Transportation performance measures for asset management
 - Models to analyze multi-modal tradeoffs
 - Maintaining the AASHTO *Guide* on Asset Management
 - Developing and administering a “lead state” model
5. Created, in cooperation with FHWA, a website to facilitate the sharing of information on asset management.
 6. Cooperated with NCHRP in sponsoring research on improved decision tools in asset management.

B. NCHRP: The NCHRP has sponsored two rounds of research projects related to asset management:

1. The first dealt with best practices and the creation of Asset Management Guidelines. Cambridge Systematics is under contract to complete this effort. The contract has been expanded to include the development of a training course on Asset Management
2. The second deals with creating improved decision tools. The request for proposals is still open on these projects.
3. In addition, NCHRP has advertised a project to conduct a summary of State accomplishments in line with GASB Statement 34.

C. FHWA: The FHWA has done several things related to asset management:

1. Created an Office of Asset Management.
2. Cooperated with AASHTO and others in sponsoring four national workshops.
3. Created a primer on asset management, a guide to GASB Statement 34, and other informational documents about asset management activities.
4. Sponsored, or cooperated in sponsoring, several conferences on topics ranging from pavement management to data integration.
5. Sponsored work on new management systems, most notably a tunnel management system.

D. UTCs: At least two UTCs (The Midwest Regional University Transportation Center at the University of Wisconsin-Madison and the Midwest Transportation Center at Iowa State) have variations of asset management as their focus areas. They have done a number of things to further education, research and technical transfer within that area:

1. Changed and improved transportation related educational programs to include more asset management courses.
2. Sponsored research projects on a range of topics from privatization to the improved management of bus fleets.
3. Offered short courses on a range of related topics such as management systems, GASB 34 and improved maintenance practices.
4. Sponsored national and regional workshops on related issues.
5. Created websites containing information on asset management.

Other organizations are also involved in ongoing work related to asset management. Included are the APWA, NACE, APTA, and TAC. A detailed survey of their activities and those of other organizations is currently underway. In a number of states, not just Michigan, the Local Technical Assistance Program is taking the lead with local agencies.

The TRB Task Force/Committee

The TRB Task Force was created in 2000. During the past 18 months, the scope has been modified based on the findings of what is needed from a TRB task force or committee. The task force members have decided that a move toward full Committee status would be the most appropriate method for TRB to accommodate the needs for asset management research. The proposed Committee scope has tentatively been defined as:

Transportation asset management is a combination of processes for maintaining, upgrading and operating the assets of a transportation system. The committee brings together practitioners and researchers to consider current asset management practice across all transportation modes, develop research needs and encourage dialog and wide dissemination of information. The committee brings together the disparate information generated by other TRB committees with emerging issues in the framework of asset management.

The key attributes of the scope are the concentration on research in areas of asset management that are not being covered by other groups and the dissemination of information that has been developed. Subject areas that are already being covered, such as state DOT asset management activities, will be evaluated for the experiences they can provide to other groups, but will not be covered in-depth. There appear to be much greater needs in local government and great opportunities to learn from the private sector.

The Committee will also address new issues that are related to asset management. An example is the Government Accounting Standards Board Rule 34 requirement for appropriate financial reporting by state and local governments. The expectation is that the task force will initiate work in areas such as this and then, as appropriate, pass it along to another committee.

What We Know Now and What We Need to Know

At the task force meeting in January of 2001, assignments were made to subcommittees to research the issues of what was known related to asset management and what still needed to be known for asset management to be successful. These subcommittees made their reports in August of 2001.

What We Know Now

What do we know about asset management? Someone or some organization knows just about everything that is needed to make significant progress. The major challenge facing the transportation community is putting these improved processes into wider use.

Using the structure of the on-going NCHRP Project on Best Practices, it is clear that progress has been made on all four components:

- **Goals and objectives** are being established through strategic planning, public involvement, performance measurement and political processes in many agencies. In many cases, these goals and objectives provide meaningful guidance to the agencies and their management teams.
- Improved **planning and programming** processes are in use in a number of agencies. Performance-based plans and programs are helping managers do a better job of incorporating goals and objectives into their decision-making process, providing focus and saving resources.
- **Data systems and analytic models** are also improving and are in widespread use. Many agencies have implemented pavement, bridge, congestion, maintenance, public transportation, safety and other management systems. Many have highly developed GIS applications to support their systems effort. Some are using advanced automated data collections systems.
- **Implementation efforts** are also improving. Innovations in contracting, outsourcing and partnering have improved the implementation efforts in many agencies.

Most individual managers and agencies do not know enough about the many techniques, processes and activities that are important for a successful asset management program. Too many managers are making progress in one, two or three areas. Almost none are making progress in all four. But the techniques are there. They are available. They can be placed into wider use, if managers are aware of them and if they see the benefit. The challenge is for improved information transfer and education, making more people aware of the progress that others have made and the benefits that others have found. (**Appendix One** provides more detail on this analysis)

All of this is not to say that more work should not be done on any of the four elements. All can be improved. But much progress could be made, if existing technologies and practices could simply be made available and adopted by a wider audience.

Several steps might be taken to make this a reality:

- Completing this report and including contacts for follow up.
- Use of an “expert” traveling team to carry the concepts of asset management to management teams around the country.
- Use of TRB, AASHTO and APTA forums to share experiences in asset management

What We Need to Know

To promote and disseminate research in the area of Transportation Asset Management, and encourage the implementation of Asset Management tools, needs must be established for each of the five steps in the asset management process shown in Figure 1. The needs in each of these areas are given in more detail in **Appendix Two**.

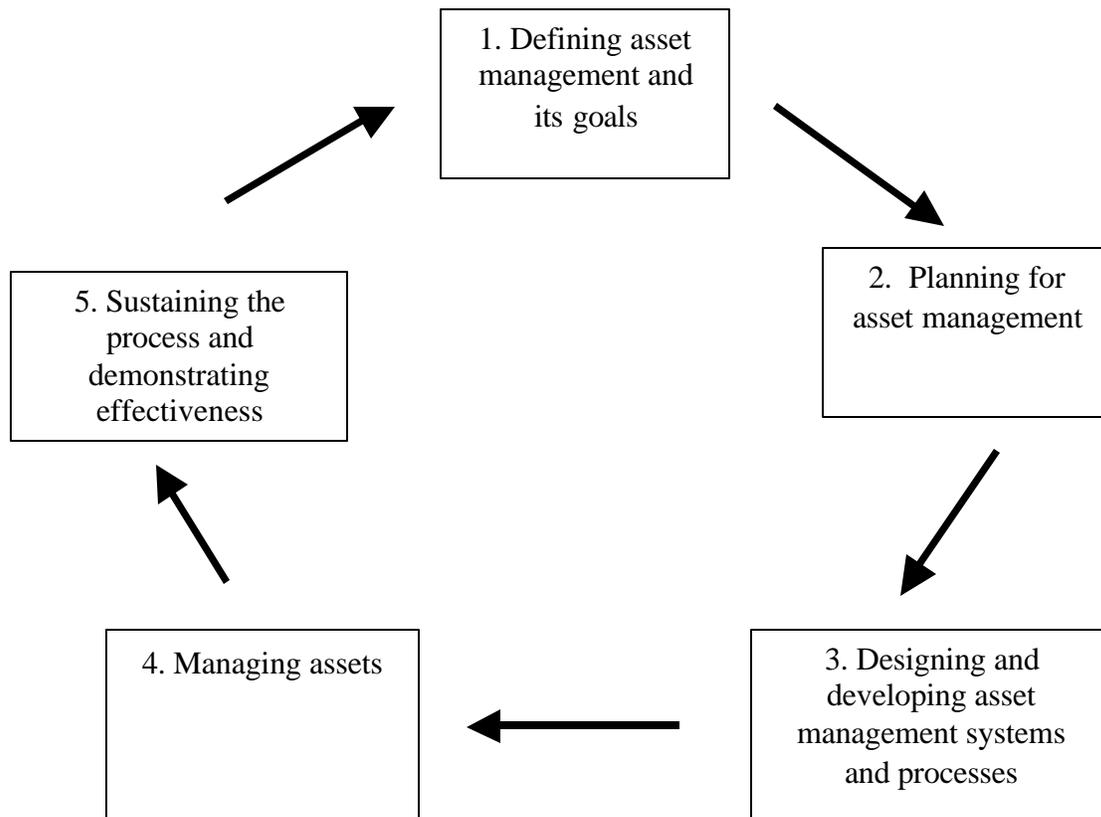


Figure 1. Asset management process

Recommendations: After reviewing the areas in need of research and technical transfer, the following recommendations can be made:

- A. The Transportation Research Board (TRB) should establish a permanent committee on Transportation Asset Management.
- B. The Task Force should support and participate in activities in the following areas:
 1. Defining Asset Management and its Benefits
 - Defining Transportation Asset Management and the roles of engineers, public administrators, and financial managers in this area.
 - Demonstrating the possible benefits of asset management processes and related activities.

Activities

- Conferences and training programs on asset management
 - Synthesis, circulars, web sites and other methods of communicating the state of the practice to transportation agencies
 - Participating in national forums on Transportation Asset Management
2. Technical Aspects of Transportation Asset Management
 - Valuation issues
 - Economic and finance issues
 - Allocating resources among asset categories
 - Establishing and using performance measures

Activities

- Developing Research Problem Statements to develop guidelines, systems, and processes for each of these activities
 - Technical presentations at the TRB Annual Meeting and other conferences
 - Supporting the development of training courses in these areas
3. Sustaining Asset Management and Demonstrating Effectiveness
 - Quantifying the benefits of preventive maintenance
 - Researching efforts that advance the state of the practice

Activities

- Developing Research Problem Statements to develop guidelines, systems, and processes for the needed technical areas
- Conferences and technical sessions that document best practice and lessons learned
- Participating in national forums on Transportation Asset Management

Potential Research Efforts

Both subcommittees of the task force came to very similar conclusions: a great deal is known about the principles of asset management and the greatest needs involve information transfer and training to put existing tools into wider and better use. With this conclusion in mind, the task force is considering, and in some ways moving ahead with, the following research agenda:

- A. Local Government Survey:** Past efforts, such as the 2000 peer exchange workshop that was held in Phoenix, have documented the activities of most states fairly well. Much activity, however, is ongoing within local governments. An effort should be made to survey local governments at the county and city levels to determine what asset management initiatives exist there and to share successes from that sector.

The Midwest Regional University Transportation Center, with the help of Staff from the University of Illinois—Chicago and CH2M Hill, has begun this survey process. Over the winter months of 2001-2002 about seventy local governments will be asked to take part in a telephone survey and respond to questions about how they manage their assets. The results of this survey will be published. Depending upon the results, some follow-up may be made as well, documenting best practices. This will start capturing the rich experience of local governments in asset management.

- B. The Benefits of Asset Management:** Why should a public manager undertake the effort of implementing an asset management program? That question is asked far too often. An effort to answer it can be done in two ways: the first would attempt to compare the experience of successful asset management users to similar agencies that do not use asset management and draw quantitative conclusions as to the benefits derived by the users of asset management. The second approach is more qualitative. It involves interviewing some asset management users and getting their perception of the benefits they have gotten from the system. While not as rigorous as the first, the qualitative approach is much simpler to do and to understand. It may also lend itself to much easier communication. The Midwest Regional University Transportation Center is undertaking this study, with conclusions expected in the early summer of 2002.
- C. Internal Alignment Best Practices:** As should be clear from the “what we know and need to know” reports in this paper, asset management is made up of many processes, conducted by many different people in an organization. Successful implementation of asset management requires that all of the participants within an organization carry out their processes in a complementary manner. They all must have a common vision, and they must freely share information with other participants in an organization.

The failure of management systems in many states is a testament to this reality. Too often pavement management systems become the territory of pavement experts and bridge management systems, of bridge experts. The result is often that the systems are not used by organizations to make real investment decisions. The wealth of information that they could contribute is lost and investments are too often suboptimized.

Whether it is called management processes, or organizational culture, or simply the stuff that makes an organization work as a single unified entity, the ingredient that causes internal alignment to take place is critical. The graphic in Figure 3 outlines how the components of an asset management system might work within an organization. The various ways that this happens in organizations should be the subject of research efforts.

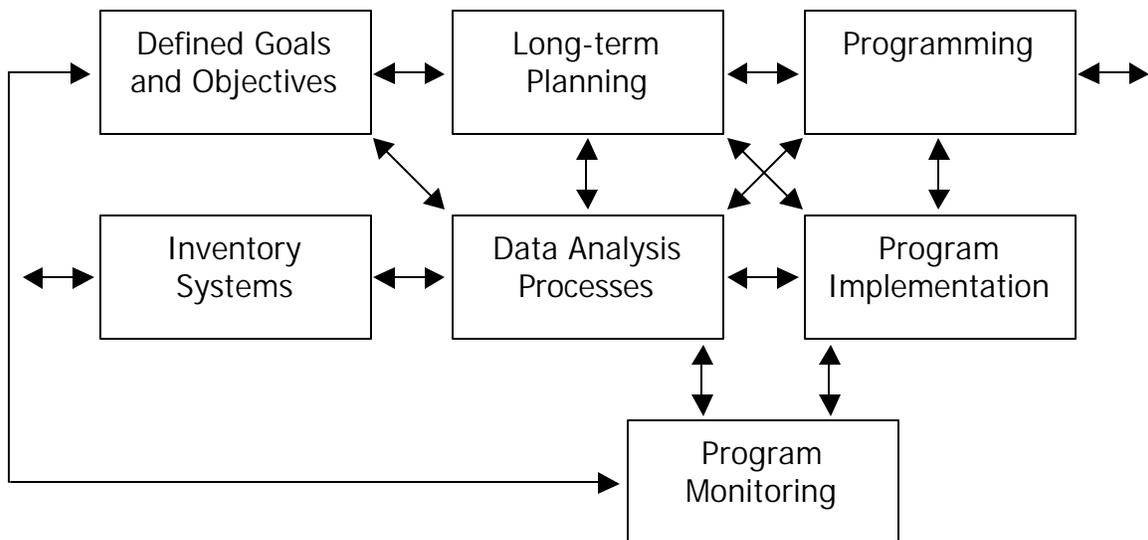


Figure 3. Asset Management System Information Flow

In the first case, all of the components may be present, but they are unorganized and uncoordinated. The products of one do not flow into another. The managers of one do not talk to the managers of another. In the second, the flow exists, communications exist, and the entire process works to maximize the agency's investments.

Two studies are now underway that may contribute some information on this topic. The first is the best practices and guidebook being compiled by Cambridge Systematics for the NCHRP. It is due in early 2002 and should provide some insights into how successful agencies have implemented asset management and brought the organization along to understand and support it. The University of Illinois—Chicago is doing the second study for the Midwest Regional University Transportation Center. It deals with best practices in moving strategic planning goals into an agency's decision-making processes. To the extent that strategic plans can be used to bring about organizational alignment, this study should provide insights into the problem.

Additional work will almost certainly be required on this subject.

Potential Outreach Efforts

A major focus of the task force will be on outreach. Transportation managers must have the opportunity to understand the progress that has been made in the area of asset management and to learn from the experience of others. To make this a reality, a number of techniques will be used:

- A. National Forums:** The task force will continue to have a considerable presence at the annual TRB meeting. Either independently, or in cooperation with other committees, the task force will sponsor programs at this meeting. Some of the other committees with which it might partner include the following.

A1A04	Transportation Education and Training
A1A07	Strategic Management
A1C06	Social and Economic Factors in Transportation
A1C07	Transportation Planning Applications
A1D01	Statewide Multi-modal Transportation Planning
A1D04	Public Involvement in Transportation
A1D06	Transportation Programming, Planning and System Evaluation
A1D08	Urban Transportation Data and Information Systems
A1D09	Statewide Transportation Data and Information Systems
A2B01	Pavement Management Systems
A2B06	Pavement Monitoring, Evaluation and Data Storage
A2B08	Highway Traffic Monitoring
A2C01	General Structures
A3B01	Safety Management
A3C01	Maintenance and Operations Management

A3C02	Transit Fleet Maintenance
A3C05	Pavement Maintenance
A3C06	Structures Maintenance and Management
A3C09	Winter Maintenance
A5003	Information Systems and Technology
A5009	Intelligent Transportation Systems
A5012	Technology Transfer
A5015	Spatial Data and Information Systems
A5016	National Data Requirements and Programs
A5T57	Task Force on Sustainable Transportation Evaluation and Indicators

B. Traveling Teams: Not all agencies and employees who could benefit from the experience of a national forum can make the trip. For those agencies and people, the task force will organize traveling teams of practitioners and researchers who can give short training courses in an agency’s offices or in conjunction with other conferences. These teams will operate with a nominal expense and would be very effective in spreading the ideas of asset management.

C. TRB Circulars: Another method that the task force will use is writing TRB circulars to provide references and information to managers who might be embarking on an effort to install or improve an asset management program. These short, readable publications should be of great use to practitioners.

Topical Subgroups

The task force will also initiate topical subgroups to explore in greater depth some of the key issues discussed above. Task force members and friends will be asked to volunteer for one of these groups:

A. Goals and Objectives: Goals are the outcomes that one might want to be achieved from a transportation facility or service. Typically, goals are stated in very broad terms, such as “safe and reliable transportation.” As broad statements, they can provide a vision of what the agency is attempting to accomplish with its programs, but they are not immediately useful as a tool to guide daily actions. Objectives are the next level of specificity that bridge the gap between the broad and the specific. They are statements of what must be done if the broad goals are to be attained.

B. Planning and Programming: Planning and programming are the tools used to define investment strategies. A plan outlines a vision for the future of a service or system and the broad needs and actions that will be required if that vision is to be attained. Typically, plans are long term in nature, with ten to twenty year time horizons. Programs are short to intermediate in nature, typically five to eight years, and outline the specific investments that will be made to achieve the vision of the plan. As tools for defining investments, planners and program managers in the asset management framework must consider all reasonable and possible

investments, that is they must include capital and maintenance and operations issues that impact the vitality of the system or service.

- C. Data Management and Analysis:** Data management and analysis includes the wide range of activities necessary to collect, store, manipulate, analyze and use data. Typically, this data includes inventories of current asset and the condition, operational characteristics and use made of those assets. Also included are modeled projections of future use, condition and operational characteristics of the assets.
- D. Implementation:** Implementation includes many activities an agency might employ to move an investment plan to reality. In the highway arena, it would include engineering functions related to plan development, right-of-way, the preparation of contract documents and the actual construction of facilities. It also includes the deployment of maintenance forces and the operations of the system. In a transit agency, it would include actions related to the maintenance of rolling stock and of fixed facilities, the acquisition of rolling stock and the implementation of planned services.
- E. Internal Alignment:** Internal alignment refers to the actions and culture of an organization. Are all of the parts informed of and in agreement with the larger goals of the agency? Are they working in cooperative complimentary ways? Or are parts of the organization acting from narrow self-interest, reducing the effectiveness of the whole?
- F. External Communications:** External communications refers to an agency's ability to tell its story to bodies outside of the organization. This might include its legislative body, the general public, or specific stakeholders. Does that data exist to present a true picture of the condition of the system or service and of the actions of the agency?

Each of these subgroups will attempt to find agencies with good practices within their topic, share the experiences and define further research questions. Table 1 indicates a preliminary assessment of which TRB Committees might be most appropriate for each subgroup (**Appendix Three** includes the scope for each Committee). Organizational meetings will happen after the January 2002 TRB meeting.

With information from the subgroups and additional deliberation from the task force members, the task force will define its longer-range plan and a research and outreach niche that will complement other ongoing efforts.

**Table 1. Initial Estimate—Relationship of Transportation Asset Management Committee/
Task Force Activities to Other TRB Committees
(for Discussion Purposes Only—2002 Annual TRB Meeting)**

Committee	Goals and Objectives	Planning and Programming	Data Management and Analysis	Implementation	Internal Alignment	External Communications
A1A04 - Transportation Education and Training	O					S
A1A07 - Strategic Management	S			O	S	O
A1C06 - Social and Economic Factors of Transportation				S		
A1C07 - Transportation Planning Applications		S			O	
A1D01 - Statewide Multimodal Transportation Planning	O	S			O	
A1D04 - Public Involvement in Transportation		S				S
A1D06 - Transportation Programming, Planning and Systems Evaluation	O	S		S?	O	
A1D08 - Urban Transportation Data and Information Systems		O	S			
A1D09 - Statewide Transportation Data and Information Systems		O	S			
A2B01 - Pavement Management Systems	O		S	S	O	
A2B06 - Pavement Monitoring, Evaluation and Data Storage			S	S		
A2B08 - Highway Traffic Monitoring			S			
A2C01 - General Structures			S			
A3B01 - Transportation Safety Management				S	O	
A3C01 - Maintenance and Operations Management				S	O	
A3C02 - Transit Fleet Maintenance				S		
A3C05 - Pavement Maintenance			S	S		
A3C06 - Structures Maintenance and Management			S	S		
A3C09 - Winter Maintenance			S	S		
A5003 - Information Systems and Technology				S	O	
A5009 - Intelligent Transportation Systems			S			
A5012 - Technology Transfer					O	S
A5015 - Spatial Data and Information Science			S			
A5016 - National Transportation Data Requirements and Programs	S			S	O	S
A5T57 - Task Force on Transportation and Sustainability			S			

S = Significant connection between expected activities of the Transportation Asset Management Committee/Task Force in this area and the interests of the TRB Committee.

O = Some overlap in expected activities.

Appendix One

What Do We Know?

To answer this question, some structure of the concept was needed. That structure was found in the ongoing National Cooperative Highway Research Program (NCHRP) research project to identify the best practices of asset management among transportation agencies. As part of this effort, researchers developed an asset management model that includes four main components or macro-activities. These include:

1. establishing goals and objectives;
2. preparing plans and programs;
3. collecting and analyzing data; and
4. implementing programs.

Using this model, the TRB subcommittee further defined the processes that make up each main component. The following represents the results of that effort.

Establishing Goals and Objectives, includes:

- Strategic planning
- Public input
- Legislative direction
- Performance measurement
- Other techniques for defining goals and objectives

Preparing Plans and Programs, generally includes:

- Performance based planning at the system level
- Performance based programming
- Other applicable planning and programming techniques

Collecting and Analyzing Data, generally includes:

- Automated inventory systems
- Automated condition collection systems
- Well-developed GIS applications integrated into data system
- Well-developed GPS systems integrated into data systems
- Remote sensing technologies integrated into data systems
- Data mining techniques in use to tap information gathered through ITS or similar systems
- Management Systems (Pavement, Bridge, Congestion, Safety, Others) well integrated into investment decisions
- Management systems integrated to allow analysis of several system features simultaneously, and
- Other data collection and analysis issues

Implementing Programs, generally includes:

- Creative use of the private sector

Use of innovative contracting techniques
Integration of construction and operations planning processes
Use of advanced project scheduling techniques
Integration of planning, design and construction processes
Other program implementation issues

Within this framework, the issue of what we know centers, not on asset management itself, but rather on the components that comprise asset management. With this approach, it is clear, that a great deal is known about asset management, and a great deal is being done to move the concepts forward into general practice. It is also clear that few transportation agencies have pulled all of the elements together to form a comprehensive asset management program.

To compile this information several sources were used. The first was the input from subcommittee members. Another was a review of DOT websites. Finally, the information generated from the Volpe Research effort conducted in 1999 in preparation of the *Asset Management Peer Exchange: Using Past Experiences to Shape Future Practices* was reviewed.

This report has been developed to provide a review of DOTs that are either incorporating the elements of asset management into their processes, or at the very least have the components in place to emphasize the concepts within their existing operations. Since many state DOTs have not formally adopted the asset management model, research included searches not only for the main components defined by NCHRP, but also the micro-processes further defined by the Task Force, as previously discussed.

Overall Implementation

Only a handful of state Departments of Transportation have made any real progress in integrating the concepts of asset management into their daily planning and programming operations. The following states are among the leaders.

- The *Michigan DOT* has defined its asset management process to include: strategic plans, data collection, management systems, performance measures and standards, alternatives analysis, decision-making and program development, plan implementation, monitoring and reporting, internal operations. Recognizing that training of existing and new employees was critical to this effort, they also developed a “Transportation Asset Management” primer for employees to refer to in their daily activities.

As with many states, Michigan has incorporated a variety of management systems into their operations and decision-making processes. But their efforts have extended utilization of the existing management systems to develop a Transportation Management System that integrates six sub-systems into one analytic tool. The six sub-management systems include bridge, congestion, intermodal, pavement, public transit, and safety.

- In 1999, the *Arizona Department of Transportation* (ADOT) reported that it was in the early stages of developing an integrated asset management system. Some of the existing management systems to be incorporated into this effort included financial, procurement, transportation planning, equipment, transit, bridge, pavement, congestion, safety, licensing, and maintenance.
- The *Florida Department of Transportation's* Asset Management process is a holistic approach used for decision-making, investment analysis, and management of transportation assets. It is the entire process from programming and planning to preservation of the state system; characterized by a solid policy framework, measurable objectives, and continuous performance monitoring designed to result in sound investment decisions with a customer focus. The Asset Management concepts of data supported decision making, management systems, strong relationships between condition and performance, and an emphasis on tradeoff and investment analysis are integral components of daily business at the Department.
- The *New York State DOT* (NYSDOT) has also made significant efforts to comprehensively incorporate asset management into their decision framework. In 1997, the Commissioner established an internal task force charged with developing a concept plan for further implementation of asset management. The plan (Blueprint for Developing and Implementing an Asset Management System) was completed in early 1998 and provided for the entire department a comprehensive definition of asset management and identified a series of short and long term recommendations for extending the department's existing asset management system. Presently, the department is focusing on identifying approaches to tackling certain of the more technical requirements of a full blown asset management system, including asset valuation and optimization methods to support sound decision making regarding its multi modal assets.
- Within the *South Carolina Department of Transportation* (SCDOT), an Asset Manager position was created in 1998. The Asset Manager along with top management identified key assets of the Department. The duties of Asset Manager entail integrating all of the Department's assets to gain maximum utilization and determine the life cycle events of the assets. Those assets include infrastructure such as roads, bridges, right of way, SCDOT Support buildings, and radio towers. Efforts to further integrate asset management principals include publishing the Annual Accountability Report; a comprehensive measure of SCDOT's performance, which includes a detailed accounting of the Department's mission, objectives and strategic planning. This report shows the progress made at SCDOT during the past year, and measures how SCDOT compares with other departments of transportation across the United States. Finally, the goals and objectives defined by SCDOT in their strategic planning efforts are developed to be consistent with the priorities set by Governor Jim Hodges in the *Envision South Carolina* Business Plan.

- Another example, cited by a committee member, is not a transportation facility or agency. It is the Infrastructure Capital Assets Management Program developed for the *Montgomery Water Works and Sanitary Sewer Board*, Towassa Plant, Montgomery AL.

Defining Goals and Objectives

An important element of asset management and decision-making processes is the establishment of goals and objectives within an agency. Several agencies have developed methodologies to define what is most important in their efforts to maintain and enhance a facility or service.

- For example, the *Montana DOT's* transportation planning section uses the Department's long-range, multi-modal transportation plan (TranPlan 21) to define their high priority goals and objectives as well as to demonstrate progress or completion of initiatives within the biennium.
- The *Michigan DOT* has developed three inter-related plans as part of its strategic planning process. These include: the *Business Plan* (for internal processes), the *Michigan Transportation Policy Plan* as the guiding document for public sector investments in transportation facilities property segments and services, and the *State Long Range Plan* which documents the DOT state transportation goals, objectives, actions necessary to provide and maintain state transportation assets. Ensuring that they are inter-related enables the DOT to work toward development of plans and programs that meet internal and external customer goals and needs.
- The *Wisconsin DOT* has used a strategic change event that occurs every two to three years for the purposes of reviewing and evaluating the Department's mission, and goals. Selected DOT staff representing a broad cross-section of all divisions and levels within the Department is invited to participate and provide their input into the development and refinement of the DOT's strategic direction. The results of this meeting are then shared with employees unable to attend to further disseminate the results of the effort and gain additional support and buy-in into department changes.
- The *Maine DOT* drafted its strategic passenger transportation plan, *Explore Maine*. As a strategic plan, it defines the planning framework to explore opportunities to provide integrated transportation options and explore development of alternative modes of transportation with efforts directed toward reducing personal vehicle use to support tourism in the state.
- *Minnesota DOT* has adopted a strategic management approach that includes an on-going process of learning and adaptation to guide the department through changing and uncertain environment towards the realization of its defined mission and vision. Using this approach Minnesota DOT drafted their Strategic Plan 2000.

The Plan's strategic direction, mission and vision identify values central to the asset management program.

Another key aspect of the asset management program is public input, a process by which the views and values of the public (or publics) are gathered and included in the planning process of an agency.

- In 1994, *Arizona DOT (ADOT)* established the Citizen's Transportation Oversight Committee to facilitate citizen involvement in DOT decision-making for freeway planning and construction. They also use strategic planning to define and unify goals and strategies into an integrated system that includes measurements at all levels.
- The *Ohio DOT (ODOT)* established the Transportation Review and Advisory Council (TRAC) to provide input into department transportation decisions. Members include the ODOT Director, transportation interests, business and or economic development interests.
- The *Maine DOT* has established Regional Transportation Advisory Committees (RTACs) to better understand regional needs outside of the Metropolitan Planning Organization areas. RTAC membership is comprised of local and state officials, and citizens of region.
- The *Pennsylvania DOT* has developed Customer Advisory Boards (CABs) in an effort to continually involve their customers in transportation operations. The CABs are formed at the county level to meet local needs, while focusing on customer interests. As advisory boards, they meet periodically and serve in a variety of ways from providing input and feedback to conducting surveys or sponsoring community events.
- The *Wisconsin DOT* developed a four-stage public outreach process during drafting of its multi-modal long-range plan *Translinks 21*. The process is based upon the goal of ensuring that public involvement is garnered early and often throughout the planning process. The four stages are designed to reflect the plan development process from defining the scope of the plan, through alternatives evaluation, to the draft plan review and final plan development stages.

Establishing **performance measures** can also be a powerful tool for defining goals and objectives. Several states have made real progress in this area:

- *Pennsylvania DOT* has recently completed a process of developing performance measures for most of its programs and activities.
- *Minnesota DOT* uses several hundred measures that are placed within a hierarchy. MNDOT's top management uses some performance measures, but most are more

useful for mid-level program managers.

- The *New Mexico Department of Highways and Transportation* has also developed a large number of measures that are grouped into hierarchies for use by different levels of management.

In a few cases, **legislative direction** has provided the impetus and support to state DOTs to adopt and integrate aspects of the asset management model.

- *Arizona's Legislature* enacted the Priority Programming Law; established to provide guidelines for use by the State Transportation Board and ADOT when prioritizing road improvements and projects. The Law is designed to ensure that the Board and Department establish a program that is responsive to citizen needs throughout the state while remaining secure from special interest pressure. Criteria that must be considered when preparing the program include: safety factors, user benefits, continuity of improvements, social factors, land use, aesthetic factors, conservation factors, life expectancy, recreational factors, availability of state and federal funds, other relevant criteria.
- *Michigan's Transportation Funding Study Committee* identified several key goals including in their 1998 report to the DOT, specifically, using a long term planned asset management approach on statewide basis when making decisions for transportation.
- *Maine's Legislature* passed the Sensible Transportation Policy Act in 1991 in response to the regulations defined under ISTEA. The Act requires that the DOT define alternatives, work to minimize impacts on the environment, ensure that public involvement processes are in place throughout the various initiatives, and promote diverse transportation options to meet needs of all citizens.

Planning and Programming

Informed investment decisions within a DOT are integral to the efficient and appropriate use of funding. As a result, the preparation of plans and programming efforts to establish investment plans is critical to effective management of a state agency's limited resources.

In addition to developing an investment plan, performance based planning at the system level is a key element in the asset management model. System-level performance based planning enables transportation professionals to determine needs and desired future outcomes based on established service goals and modeled performance within a long-term view.

- The *Florida DOT* has determined that asset management begins with a strong statutory policy framework documented in the 20-year Florida Transportation Plan. Using this long-range plan as a framework, a more detailed Program and Resource Plan is drafted to set forth specific operating policies and performance measures that guide the development of each program. The Program and Resource

- Plan is developed with a ten-year plan containing program funding levels and financial and production targets that are balanced to anticipated revenues. A five-year listing of projects; the Work Program, is developed annually based on the Florida Transportation Plan, Program, and Resource Plan, extensive district and public involvement, and ultimately decision making by a strong executive committee at the Department.
- **Michigan DOT** has developed a Strategic Investment Plan for Trunk-line Bridges, a long-range plan for investing in the trunkline bridge Network. This plan for trunkline bridges proposes a statewide investment strategy integrating rehabilitation, replacement, capital scheduled maintenance (CSM) and capital preventive maintenance (CPM) in a “proper mix” relative to the existing network condition. The Department has developed an integrated network management strategy to help achieve the network condition goals most effectively. Recognizing that regular and preventive maintenance relates to bridge longevity, the recommended strategy places a new emphasis on scheduled maintenance and a much higher emphasis on preventive maintenance. The strategic plan proposes a more balanced approach in the statewide application of CPM, rehabilitation and replacement in a managed attempt to address the needs of “good” bridges as well as the needs of “poor” bridges. The strategic plan further includes the need to address 100% of the structures of critical concern, expanding the traditional rehabilitation or replacement of bridges on a “worst first” basis.
 - Similarly, the **Washington DOT** has adopted a long range Systems Plan that identifies needed investments over twenty years on all infrastructure elements of the State Highway System and State Ferry System. This plan sets objectives for the performance of the system, and analyzes current and future use and condition data to determine system deficiencies, and identifies solutions to those deficiencies. The plan relies on the pavement and bridge management systems to determine investment needs for these infrastructure elements.
 - A non-transportation example is **Brigham Young University’s** Capital Reinvestment Program

Another decision-making tool important to an integrated decision-making approach is performance based programming. This includes the selection of projects in a mid-term view to attain the service goals defined for the program.

- **Montana DOT** has incorporated performance based programming into their efforts. This process is designed to develop an optimal investment plan and measure progress in moving toward strategic transportation system goals by enabling transportation staff to make informed decisions. In general, the process looks at the DOT’s highest needs and is able to provide informational guidance to the Department’s executive staff in addressing statewide needs.
- **Florida DOT** has implemented a Maintenance Rating Program. Under this program, determination of state highway maintenance condition is based on a

sampling process that rates five primary categories of highway environment three times a year. The items rated are the roadway (potholes etc.), roadside (shoulders), vegetation and aesthetics (mowing, litter removal), traffic services (signs, lighting), and drainage (ditches). Each category is rated and the overall maintenance condition is calculated.

- A state statute that requires a systematic, data-driven priority setting process for selecting projects on the state highway system guides *Washington DOT's* priority programming process. This process selects projects in program areas based on the systems plan objectives. The program areas include maintenance, traffic operations, preservation, and improvements (further defined as congestion relief, safety, economic initiatives, and environmental retrofit). Each area has its own priority setting formulas. Priority setting for pavement and bridge preservation is based on a least life-cycle cost based on the pavement and bridge management systems. Priority formulas in the improvement area are largely based on net benefit.
- Over the last 10 years, the *New York DOT* has developed and strengthened a formal and highly structured biennial process that produces a 12-year transportation program that is closely tied to the development of shorter term TIPs and the STIP. The foundation for the update process is the establishment, at the Commissioner's level, of strategic transportation goals relating to all of the department's major assets, the determination of regional funding allocations, and the individual efforts of its regions to program the available funds to achieve the goals within an integrated and multi modal capital and maintenance program. The management systems provide an essential tool for this process.
- *Michigan DOT's* Five Year Road & Bridge Program project selection process is based on the department's model Road Quality Forecasting System (RQFS), which predicts the condition of the trunk-line system based on various levels of investment and the most appropriate improvement types selected.

Data Collection and Analysis

Data collection is a key element of the asset management model, and is recognized as the important corporate resource that it is. For any asset management process to work properly, appropriate data must be collected, maintained, and analyzed. Several DOTs have developed systems and processes to collect and analyze data to assist in managing a facility or service.

- *Michigan DOT* established the Michigan Architecture Project, which defines standards for data collection, including: modeling, naming, quality assurance, configuration management and procedures. Data from the Financial Obligation System, Project Information System and/TMS are part of the Project. Additionally, the Department has located a Permanent Traffic Recorders (PTRs)

System to conduct traffic counts at strategic locations throughout the state; designed to assist in the investment decision-making processes.

- Another non-transportation example is *US Air Force* Utility Assets Database used for component item life-cycle estimations and estimates of replacement costs in order to plan capital renewal program investments. (Developed from the Commercial Unit Prices Book, and company proprietary information of Talisman Partners and CH2M Hill.
- The *Maine DOT* has incorporated the use of ARAN © (Automated Road Analyzer) which helps to assign pavement condition ratings based upon gathered data and related analyses. This information is used to predict future deterioration and make recommendations on pavement investments. Maine DOT has also developed a Multi-modal Needs and Deficiencies process that considers inventory demand forecast and functional standards and local, state and regional and federal goals and policy objectives. This system represents an inventory of the existing state system, and includes data related to usage, characteristics and conditions.
- The *New York State DOT* has designed and implemented a modern and integrated program and project level automated system for both developing and implementing the comprehensive transportation program. The combined elements of this system constitute the single database used to manage the department's investment decisions.
- Efforts by the *Minnesota DOT* to collect condition data have included initiatives to collect data that show the delay and accident information provided by the traveler information center is reliable. Additionally, collection efforts also include analysis of collected data to demonstrate that ramp queue wait time signs have an effect on traffic.
- The *Wisconsin DOT* has begun collecting pavement condition information using an automated van that photographs the pavements at highway speeds. Pavement experts then rate the pavements, using digital photos.

Well-developed **GIS Applications integrated into data systems** can encompass a wide range of possibilities. A few agencies have developed GIS based systems to integrate management systems and databases.

- Headed by the Michigan Information Center, *Michigan DOT* partnered with several agencies and departments to develop the Michigan Geographic Framework Program. The program is designed to produce GIS based information for the roadways in the state. Development of this program allows for integration of data across agencies and departments through common addressing reference systems. The Department expects to have this program fully integrated with its Transportation Management System by 2001. Version 1 of Framework was completed and released in December 2001.

- **Maryland DOT's** Highway Information Services Division maintains a road inventory database, which includes current data inventory of the highway system with integration with the Traffic Monitoring System data. Information is drafted and disseminated using GIS Implementation and development. Products from these analyses include Traffic Volume Maps, Traffic Trends reports, and Traffic Counts.
- **Arizona DOT** is developing a base mapping system using Geographical Information Systems (GIS) technology. This system will allow the overlay of roadway characteristics, accident history, planned projects, locations of environmental importance, roadway features and their conditions, etc. Further, Arizona has developed ATIS (Arizona Transportation Information System) to disseminate data via maps online. The system includes a base map of roads and streets for the entire state.
- Another non-transportation example is a system used by the **Honolulu Board of Water Supply** project that uses GIS extensively, with a database and records to update the inventory and perform a comprehensive condition assessment. This system was then integrated into a common database for future RFIP planning. Use of the comprehensive database of condition assessment, project creation and project prioritization criteria for all sections to conduct a Long Range Facilities Repair and Replacement program Utility Survey and in the development of the Fiscal year 2002-2007 budget.

Management systems are decision support tools that can be used to enhance the planning and asset management processes. The following DOTs are examples of the integration of management systems into the decision-making processes.

- The **Wyoming DOT** is currently instituting a GIS system with the hopes of graphically representing the results of the different Management Systems. WYDOT's Planning Program is also tasked with the integration of the various Management Systems in the future. (Can't access this portion of their website, appears to be down (7/27/01) - From 1999 report, need to find out what have done since)
- **Georgia DOT** maintains and analyzes condition evaluations using their management systems for pavements (PACES and MMS), bridges (BIMS and MMS), equipment (Fleet Anywhere), and facilities (FM). PACES – Pavement Condition Evaluation System enables staff to rate and evaluate statewide roadway conditions statewide. Using this tool, the DOT is able to prioritize its resurfacing program, roadway maintenance program, and shoulder-widening program.
- The **Minnesota DOT** established a Management Systems Integration Committee in 1996 to develop a work plan to integrate the Department's pavement management system (PMS), and bridges on and off Federal-aid highways (BMS), highway safety (SMS), traffic congestion (CMS), public transportation facilities

and equipment (PTMS), intermodal transportation facilities and systems (IMS) and the Traffic Monitoring System (TMS). The committee was charged with the following: 1) defining the management system data to be integrated, 2) determining how the information from the management systems will be used in the planning process, and 3) developing a process for integrating the management systems so that wise investment decisions can be made. Efforts to develop the intermodal management system will include assuring that it is coordinated with the PMS, PTMS, CMS and traffic monitoring system.

- **Wisconsin DOT** developed the Meta Management System to incorporate the management systems required under ISTEA. Although not specifically designed to integrate each individual management system, Meta-Manager is used by the department to analyze physical deterioration, safety, conduct congestion modeling, evaluate improvement alternatives, assess costs, develop priorities, and define budget needs.

Implementation

Program implementation is simply carrying out program of investments as effectively as possible to attain the goals established for the system.

Creative use of the private sector has been done in a few places to enhance the program delivery process.

- **Washington DC** has used a private contractor to maintain routes in its NHS Asset Preservation
- The **Delaware DOT** is a member of the TMA Delaware, a Transportation Management Association. The TMA is a collective non-profit organization of private corporations and public agencies dedicated to achieving reductions in traffic congestion, improving mobility and air quality, and educating employers and their employees about transportation alternatives. Membership in the Transportation Management Association of Delaware (TMA Delaware) is open to all companies or agencies, public or private, located in the State of Delaware. Our membership includes a variety of private sector businesses, management companies, developers and transportation professionals, as well as public agencies and local government entities.

Use of innovative contracting techniques is becoming more widespread, giving agencies a wider range of tools to use in their efforts.

- **Arizona DOT** implemented a Partnering Program. This program is a teamwork oriented construction management method that attempts to eliminate adversarial relationships between ADOT and construction contractors. It incorporates the Total Quality Management precepts into the process of contract performance. The precepts include: conformance requirements, prevention, zero defects, and strict

attention to costs associated with non-conformance. Performance measures are in the form of cost savings in dollars used and time resources allocated.

- ***Pennsylvania DOT's*** use of its Agile Maintenance Enterprise (AME) approach is founded on partnerships within which all participants contribute in some way. Partnering decisions are based on common sense. The Agility Agreement is an umbrella-type agreement, outlining opportunities for partners to share resources during the life of the agreement. Once an Agility Agreement is in place, parties to the agreement consider possible exchanges drawing from the list or menu of activities on the agreement.
- ***Arizona, Colorado and Utah*** are among the leaders in the use of design-build applications in transportation.
- ***Wisconsin*** has used warranty provisions in many of its contracts.

Appendix Two

What Do We Need to Know?

1. Defining Asset Management and Its Goals			
In Terms Of:	We Need to Know:	For What Market Segment?	We Can Achieve This By:
Defining Transportation Asset Management	What we mean by the term Transportation Asset Management	All transportation agencies, with the recognition that there may be differences in some of these areas for each type of agency or organization	<ul style="list-style-type: none"> • Developing a concise definition of asset management that improves on AASHTO's definition. This definition is proposed: "Transportation asset management is a process for managing transportation assets to maximize their value to the agency while meeting or exceeding performance criteria." • Supporting task forces, committees, research efforts, and syntheses on current or best practices
Setting Goals	What fundamental goals should be established for asset management		<ul style="list-style-type: none"> • Working with AASHTO and TRB committees to establish goals for the various types of agencies expected to practice asset management
Building on Lessons Learned	What we can learn from our experiences in pavement management and bridge management		<ul style="list-style-type: none"> • Documenting lessons learned from efforts over the past 30 years, including a) why more agencies aren't using these systems, b) factors that impacted implementation efforts, c) successes and mistakes learned, d) roles of academia and industry in the effort, e) institutional issues that haven't been addressed, and f) an assessment of past training efforts
Defining Roles	The roles of engineers, public administrators, and accounting in asset management efforts		<ul style="list-style-type: none"> • Sponsoring a panel discussion or other type of forum that examines the roles of engineering, public administration, accounting, and other groups in asset management
Learning from Private Industry	What we can learn from private industry to help public sector efforts in asset management		<ul style="list-style-type: none"> • Identifying private industry efforts in this area that have successfully used asset management techniques and documenting the reasons behind their success

2. Planning for Asset Management			
In Terms Of:	We Need to Know:	For What Market Segment?	We Can Achieve This By:
Technology Transfer	More information about capital planning and financing	Local agencies, MPOs, and state highway agencies, private industry, college/graduate students in Civil/Transportation Engineering	<ul style="list-style-type: none"> • Developing training programs that emphasize the economic aspects of transportation asset management • Developing training programs for practitioners that emphasize preservation concepts • Developing guidelines on asset management • Developing guidance to agencies to link asset size to their investment in asset management tools • Encouraging colleges and universities to develop curricula and programs aimed at teaching the concepts of asset management to individuals in engineering, urban planning, and public administration • Identifying and publicizing continuing education courses in programs that teach asset management concepts.
	How agency staff can be better stewards of their assets		
	Time and resource requirements to implement an asset management system		
	Required capabilities		
Barriers or Impediments to Implementation (including institutional issues)	Factors that keep agencies from success in adopting asset management principles	State highway agencies, local agencies, utility companies, extraction (mining and timber) industries, telecommunication companies, international consulting firms	<ul style="list-style-type: none"> • Conducting surveys of current practices and hurdles/barriers that agencies must overcome • Providing panel discussions at TRB and other conferences in which agency representatives can participate in discussions on these issues, including constraints and opportunities for overcoming impediments to applying asset management concepts • Developing materials that document success stories (at all levels – state, local, and private) that focus on the use
	What types of innovative project delivery practices and project business practices are being used to facilitate asset management		
	What types of innovative project delivery practices and project business practices are being used to facilitate asset management		

	<p>What agencies have been successful in this area and the benefits they have realized</p>		<p>local, and private) that focus on the use of technological advances and/or innovative practice and address the needs of specific audiences (decision makers, management, engineers, accountants, and so on) and measure (qualitatively or quantitatively) the benefits achieved through the implementation</p> <ul style="list-style-type: none"> • Identifying agencies that subcommittee members are familiar with and document their efforts in a TRB session, TRB Circular, and through Internet sites and/or videos • Identifying and characterizing the asset management market as it now exists overseas and domestically – focusing on the major players, their functional activities, their typical sponsors, the type of services they provide, and how these various players interact to serve the customers of asset management. This could be done through a series of panel discussions involving representatives of the various players as well as sponsoring a market survey of asset management participants
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3. Designing and Developing Asset Management Systems and Processes			
In Terms Of:	We Need to Know:	For What Market Segment?	We Can Achieve This By:
Data Requirements	What performance measures should/are being used to assess asset condition	All transportation agencies	<ul style="list-style-type: none"> • Sponsoring technical sessions at TRB or other technical conference • Sponsoring a circular on the state of the practice
Level of Service Issues	What levels of service should agencies and organizations provide their customers (the traveling public)		<ul style="list-style-type: none"> • Supporting synthesis of ongoing research on the subject • Conducting research on ways to better define customer needs and expectations • Conducting research on ways to quantify customer needs
	What measures are needed to verify that an agency is practicing good asset management		
	What are effective measures of sustainable infrastructure and how these measures can be used to promote better asset management practices		
Integration of Systems	What links are being established between asset management and other management systems	<ul style="list-style-type: none"> • Conducting surveys of current approaches being used in practice • Developing paper sessions at TRB or other research-oriented conferences • Providing panel discussions at TRB and other conferences in which both user and provider representative can participate. This is a key area of investigation, given the opportunity to apply the productivity benefits of technology to achieving the full benefits of asset management • By keeping the differences between various markets in mind in all technology transfer efforts • Reviewing capabilities of existing systems and evaluating their role in an integrated asset management process • Interacting with TRB committees on information systems to determine appropriate platforms and architecture for systems in the future 	
	What are reasonable expectations from asset management		
	Which component(s) of data and/or systems integration present the greatest challenge and/or stumbling block to agencies		
	What new software programs will be needed to support asset management efforts		
	How requirements differ between various markets		

4. Managing Assets			
In Terms Of:	We Need to Know:	For What Market Segment?	We Can Achieve This By:
Asset Preservation	Whether assets need to be grouped by deterioration functions (such as concave, convex, straight line, and step) to be equated to depreciation (The logic is that some assets, like signs, deteriorate in a step function and/or can disappear in an accident or as a result of theft)	All transportation agencies	<ul style="list-style-type: none"> • Developing synthesis of current practices, surveys, panel discussions, and TRB sessions • Developing guidelines on the relationship between deterioration and depreciation
Asset Valuation	What information is needed by agencies attempting to value their assets	All transportation agencies	<ul style="list-style-type: none"> • Developing information on how to determine the financial and economic value of transportation assets • Documenting case studies of agencies in other countries that are known to have successfully applied techniques for valuing assets over a period of time • Providing guidance on how to rectify differences in financial and economic value • Providing guidance that accounts for investments in assets that increase their value rather than decrease value • Developing guidelines on the valuation of complex assets • Developing synthesis of current practices for dissemination through technology transfer efforts • Developing guidelines that can be used by engineers to assist in valuing transportation assets based on both engineering and economic requirements • Developing guidelines that document how asset management information can be used to satisfy GASB 34 requirements
	Whether the valuation of complex assets (bridges, buildings, equipment fleets, and plants) should be handled in disaggregated or aggregated form		
	How other transportation sectors, such as railroads and pipelines, have handled asset evaluation, since these companies have had to report to shareholders over time and therefore should have existing methodologies for asset valuation		
	How we can value assets using an approach that meets the rigors of accounting practice without compromising engineering principles		
	What links exist between asset valuation and GASB 34?		
Economic Issues	What economic issues are emerging	All transportation agencies	<ul style="list-style-type: none"> • Providing panel discussions at TRB and other conferences in which agency representatives can participate • Developing guidelines on the use of economic factors in asset valuation
	How economic factors (such as salvage value and user costs) get incorporated into asset management and whether deterioration the same as depreciation		

Financial Issues	What financial issues are emerging. These can be either constraints or opportunities for doing asset management.		<ul style="list-style-type: none"> • Providing panel discussions at TRB and other conferences in which representatives of infrastructure organizations and funding organizations can participate
Allocating Resources	How funds should be allocated between asset restoration, safety, aesthetics, and other categories and/or modes		<ul style="list-style-type: none"> • Developing guidelines on establishing and evaluating trade-offs between resource allocations
Making Decisions Across Infrastructure Categories	How tradeoffs for different types of infrastructure assets are being assessed		<ul style="list-style-type: none"> • Inviting panel discussions on the subject • Surveying international agencies to document best of practice • Preparing a synthesis of ongoing research on the subject
Progress Monitoring and Tracking (Performance Measures)	What information is needed to make decisions regarding the preservation of transportation assets (such as condition, age, costs, relative importance)		<ul style="list-style-type: none"> • Inviting panel discussions on the subject • Surveying international agencies to document best of practice • Preparing a synthesis of ongoing research on the subject

5. Sustaining the Process and Demonstrating Effectiveness			
In Terms Of:	We Need to Know:	For What Market Segment?	We Can Achieve This By:
Feedback	How well the asset management recommendations are improving the preservation of transportation assets	All transportation agencies	<ul style="list-style-type: none"> • Monitoring results and using the information to enhance asset management models • Encouraging agencies to develop a feedback loop to improve decision-making processes as part of technology transfer efforts
Measuring Results	Whether the expenditures in capital and maintenance providing adequate benefits		<ul style="list-style-type: none"> • Supporting research to develop processes and systems that help agencies and organizations quantify the results of their asset management efforts
	Whether the agency is providing an adequate level of service		<ul style="list-style-type: none"> • Encouraging agencies to support research efforts through grants, pooled fund studies, and so on • Developing research problem statements that support the areas of need
Research	How we can foster research programs in this area that advance the state of practice		<ul style="list-style-type: none"> • Documenting lessons learned from the pavement management, bridge management, and maintenance management areas in terms of both successes and failures • Documenting best practice in successful agencies through circulars, presentations, internet, and videos
Sustainability	What issues must be addressed to ensure that asset management efforts are integrated into decision processes and sustained over time		

Appendix Three Scopes of Related Committees

A1A04 Transportation Education and Training

Scope: The scope of this committee includes the improvement of communications among the academic community, the private and public sectors, and governmental agencies involved with academic training in the transportation field and the development of improved educational and training programs at all academic levels and for professional and pre-college education. The committee will be concerned with the present status of education in transportation, with new developments and innovations, with future personnel needs, and with professional training and development.

A1A07 Strategic Management

Scope: The committee is concerned with the identification of long-range external and internal issues and trends and their implications for transportation organizations; with the processes and structures organizations use to consider these implications and to plan, implement, and measure strategic change; and with the policies, decisions, and institutional structures and relationships that result from this strategic change.

A1C06 Social and Economic Factors of Transportation

Scope: All direct and indirect social and economic effects of transportation systems both within the transportation corridor and within the larger regions affected, including those bearing on present and future transportation needs and services.

A1C07 Transportation Planning Applications

Scope: This committee is concerned with the application of new or improved transportation planning methods and techniques and their practical application at the regional, corridor, and site level of analysis.

A1D01 Statewide Multimodal Transportation Planning

Scope: The committee acts as an information exchange and promotes research in all the technical and institutional aspects of comprehensive multimodal statewide transportation planning. The committee will also be concerned with the identification and clarification of the interrelationship of state resource development planning and programming.

A1D04 Public Involvement in Transportation

Scope: To develop a conceptual framework for integrating public involvement into the continuing transportation planning process, and to address specific planning and policy questions that have been encountered by transportation agencies in achieving greater public involvement.

A1D06 Transportation Programming, Planning and Systems Evaluation

Scope: The committee's activities involve consideration of factors related to identifying needs and transportation goals, establishing programs and plans to achieve these objectives and prioritizing scheduling transportation projects. Included in these activities are the development of economic and systematic methods for identifying and evaluating transportation system and investment alternatives and their impact on local, regional and national economic vitality and productivity.

A1D08 Urban Transportation Data and Information Systems

Scope: This committee is interested in the design, collection, analysis, and reporting of transportation supply and demand data needed to support urban and metropolitan transportation planning efforts. In particular, the committee is interested in developing the data requirements of new and innovative techniques for measuring and monitoring the performance of metropolitan transportation systems; and in evaluating changes in demographic and urban travel characteristics. In terms of household and other transportation surveys, the committee is concerned with the analysis, reporting, archiving, and dissemination of results and data products. The committee is interested in the effective use of census and other federal, secondary data sources in metropolitan transportation planning. The committee is concerned with advancements in information systems and information technology for the improved dissemination and sharing of knowledge about metropolitan transportation systems and urban travel behavior.

A1D09 Statewide Transportation Data and Information Systems

Scope: The scope includes research and technology transfer activities pertaining to statewide transportation planning data and information systems for all modes of transportation. A primary concern is the capability of information systems to integrate various transportation-related data sources into a strategic multimodal information database for statewide transportation planning. The committee serves as a forum for discussion of current planning data activities.

A2B01 Pavement Management Systems

Scope: This committee is concerned with the development, evaluation, integration and application of existing and new systems of pavement management and the component concepts and models for all types of pavements. This includes the development, assessment and application of new and existing methods and procedures directed toward a better understanding and description of pavements as a whole and the interrelationships among all factors which influence pavement behavior and performance and which must be taken into consideration in making pavement management decisions, including such factors as loads, environment, strategy alternatives, economics, construction and maintenance.

A2B06 Pavement Monitoring, Evaluation and Data Storage

Scope: This committee is concerned with the development of concepts, systems and procedures for the acquisition and processing of data regarding the functional and mechanistic performance of pavements and with the processing, storage and use of the acquired data for better pavement management such as the analysis of pavement behavior as related to past and present conditions and with a view to future performance.

A2B08 Highway Traffic Monitoring

Scope: This committee is concerned with all aspects of research in the fields of in-motion weighing, counting, and classification of highway vehicles. Its stimulation and dissemination functions may extend to dynamic vehicle axle loadings and automatic vehicle identification, as well as other areas to improve the accuracy of vehicular flow estimates; it will also extend into the application of weigh-in-motion technology and the utilization of data therefrom in the design and reconstruction of pavements and structures.

A2C01 General Structures

Scope: The committee is concerned with the factors that affect the physical behavior, service life, economy, appearance and safety of bridges and structures for transportation systems, and the accounting of these factors and their interactions in design procedures and criteria. The specific objectives of this committee shall include the advancement of new knowledge as it relates to: application of vehicular and environmental loadings; structural movement, safety aspects, operation, maintenance, and natural phenomena; economic considerations including optimization, automation of designs and systems building; aesthetics; and other structure appurtenances. The committee shall also be concerned with the development of new design concepts and systems.

A3B01 Transportation Safety Management

Scope: The committee will be concerned with the development and coordination of integrated safety management programs to reduce death and injury on transportation systems. Areas of concern include: (1) the advancement of safety management systems, (2) research and technology to improve safety, and (3) models of safety delivery systems.

A3C01 Maintenance and Operations Management

Scope: This committee is concerned with all aspects of the management of the maintenance and operations of highway transportation facilities.

A3C02 Transit Fleet Maintenance

Scope: This committee is concerned with all maintenance aspects of public transportation fleets, including heavy rail, light rail, bus, paratransit, and new technology fleets.

A3C05 Pavement Maintenance

Scope: This committee is concerned with factors causing deterioration and corrective measures involved in improving the surface and/or subsurface condition of degraded or slippery pavements and shoulders.

A3C06 Structures Maintenance and Management

Scope: This committee is concerned with failures and corrective methods and materials employed in strengthening, rehabilitating, and repairing bridges, box culverts, tunnels, retaining walls, and other structures of a similar or related nature. This committee is also concerned with the management of such structures, including maintenance, rehabilitation, and replacement planning.

A3C09 Winter Maintenance

Scope: This committee is concerned with all aspects of snow and ice removal and fog control, including storm warnings; snow accumulation and drift prevention; organization for snow and ice removal; snow and ice removal equipment; plowing and disposal procedures; drainage of melting snow and ice; pavement heating systems; materials for dispersing fog or removing or disbanding snow and ice; fundamental aspects of fog control, ice adhesion, and heat transfer as they influence operation and control of traffic under adverse winter conditions.

A5003 Information Systems and Technology

Scope: This committee is concerned with reviewing and assessing the current state-of-the-art in the development and application of computer technologies to problems in the transportation engineering (planning, analysis, and design) field for productivity improvements. Areas of emphasis include: (1) computer systems' user interfaces (i.e., interactive graphics, knowledge based, etc.) and data portability (i.e., neutral files); (2) utility of computer technologies use in the transportation field; (3) encouragement of common semantics and standards use in the transportation field; (4) demonstration programs to augment and supplement work presently under way; (5) facilitating and monitoring technology transfer between transportation organizations, vendors and universities in the role of "user advocate;" and (6) evaluating the impact of computer technologies on transportation organizations, including the productivity gains provided.

A5009 Intelligent Transportation Systems

Scope: This committee is concerned with ITS systems level issues. Such systems include technologies that integrate the provision of information to travelers about road and transit conditions with monitoring, guiding, and/or controlling the operation of vehicles. Activities focus on the broad technological, institutional, economic and planning aspects of the development and implementation of ITS systems. The committee also serves as a focal point for coordination of ITS related activities of other standing committees.

A5012 Technology Transfer

Scope: This committee is concerned with information exchange and research on the processes and methods for technology transfer, and assisting the Transportation Research Board and other TRB committees in their role as an agent for technology transfer.

A5015 Spatial Data and Information Science

Scope: The scope of this committee includes all aspects of the spatial, locational and temporal data used in transportation. The committee is interested in both research into and applications of this information and its associated information systems, commonly referred to as Geographic Information Systems in Transportation (GIS-T). The committee will provide a focal point for and promote coordination of GIS-T activities within the TRB committee structure. Relevant activities include the application of spatial data and spatial sciences across the entire domain of transportation information systems.

A5016 National Transportation Data Requirements and Programs

Scope: The scope of this committee includes the development of nationwide and international data on transportation needed to support decision making, and data-related research in all sectors of transportation. All aspects of data development are of interest including: design, collection, analysis, reporting, funding, administration, dissemination, and coordination of statistical programs. Of particular interest is the coordination of transportation statistical programs with non-transportation programs; coordination between national level and other programs, including international, private, state, and local systems; and the structuring of statistical standards and criteria that guide the development of comprehensive transportation programs.

A5T57 Task Force on Transportation and Sustainability

Scope: To advance the understanding of how transportation and sustainability relate and how transportation can contribute to achieving sustainability for economic growth, social equity and a healthy environment. The task force will provide a forum to foster understanding of the evolving knowledge regarding sustainability and the elements of transportation that are contributing to long-term environmental disturbances. The task force will identify research needed to advance the evolving knowledge of the effects of transportation systems on sustainability. It will consider how the topic will best be addressed within the Transportation Research Board, and what liaisons should be made with other groups.