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Transportation Asset Management

*Strategic Workshop
for Department of
Transportation Executives*

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Transportation Asset Management
*Strategic Workshop for Department
of Transportation Executives*

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TDC Partners, Ltd.

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University of Delaware

Sponsored by
Task Force on Accelerating Innovation in the Highway Industry
Transportation Asset Management Committee
Transportation Research Board

In Cooperation with
Joint AASHTO–FHWA–NCHRP International Technology Scanning Program
American Association of State Highway and Transportation Officials Subcommittee on
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Preface

This report was prepared under the sponsorship of the Transportation Research Board (TRB) Task Force on Accelerating Innovation in the Highway Industry, along with the TRB Transportation Asset Management Committee, and in cooperation with the Joint AASHTO–FHWA–NCHRP International Technology Scanning Program. The report summarizes a workshop held in Washington, D.C., in December 2006.

The objective of this workshop was to provide a forum for the exchange of new ideas and developments in the field of asset management, including findings from a recent international scan on the same subject.

TRB *Special Report 249: Building Momentum for Change*, published in 1996, recommended conducting strategic forums for emerging innovation in highway infrastructure. The TRB Task Force on Accelerating Innovation in the Highway Industry—working with AASHTO, FHWA, and industry—elected to conduct this workshop because asset management is of emerging importance to departments of transportation.

The authors of this report are Ted Ferragut, TDC Partners, Ltd., and Sue McNeil, University of Delaware. The views expressed in this publication are those of the authors and do not necessarily reflect the views of TRB and the other sponsors of the workshop series. This report has not been subjected to the formal TRB peer review process.

The technical program for the workshop was developed by the TRB Task Force on Acceleration Innovation in the Highway Industry and the Transportation Asset Management Committee with input from international scan team members and FHWA officials. Contributors included the following:

- **TRB Task Force on Accelerating Innovation in the Highway Industry:** Donald W. Lucas, The Heritage Group, Chair; G. John Kurgan, Michael Baker Jr., Inc.; Pete K. Rahn, Missouri Department of Transportation; Michael M. Ryan, H.W. Lochner, Inc.; Shirley Ybarra, The Ybarra Group; and Ted Ferragut, TDC Partners, LTD., Consultant and Reporter.
- **TRB Committee on Transportation Asset Management:** Sue McNeil, University of Delaware, Chair (also scan team member), and Dave Geiger, FHWA (also scan team member).
- **AASHTO Subcommittee on Transportation Asset Management:** Kirk Steudle, Michigan Department of Transportation (also scan team member), and Lacy Love, North Carolina Department of Transportation (also scan team member).
- **FHWA:** Dennis Merida, FHWA New Jersey Division (also scan team member), and Steve Gaj, FHWA.

The financial sponsorship from the Joint AASHTO–FHWA–NCHRP International Technology Scanning Program was critical to the success of the workshop. Hana Maier of FHWA, Betty Dillon of American Trade Initiatives, and Michael DeCarmine of TRB provided invaluable administrative support for the workshop. In addition, thanks go to the transportation professionals listed in Appendix A, whose participation and efforts were a valuable contribution to the workshop series.

—Donald W. Lucas
Chair, Task Force on Accelerating Innovation in the Highway Industry

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Summary

In April 2005, a team of U.S. executives participating in an International Technology Scanning Program looked at transportation asset management practices in some of the leading countries in the world. The scan clearly showed that these organizations have used asset management data to compete for government resources both inside their agencies and with legislative bodies.

The Transportation Research Board Task Force on Accelerating Innovation believed that these findings, along with several major asset management advancements in the United States, would be worthy of further discussion by U.S. state departments of transportation (DOTs).

The sponsors, along with other asset management organizations and committees, sponsored an executive session on asset management. DOT executives and asset management program managers met with key international officials to discuss advancements in asset management that might be adopted in the United States.

The executive forum was held December 13, 2006, in Washington, D.C. Fifteen DOTs and FHWA were represented, along with officials from the United Kingdom, Canada, New Zealand, and Australia.

Most nations of the world have made significant investments in transportation infrastructure. In the United States alone, such investment is estimated at more than \$1.75 trillion. However, as this infrastructure is used and exposed to natural forces, its condition will deteriorate.

Asset management is a strategic and systematic process of maintaining, upgrading, and operating physical assets effectively throughout their life cycle. It focuses on business and engineering practices for resource allocation and utilization, with the objective of better decision making based on quality information and well-defined objectives.

The scan team identified several overarching themes from the scan:

- Agencies are moving away from “worst first.”
- The focus is on preservation first.
- Agencies recognize data as an asset.
- Asset management supports enhanced communication.
- Asset management provides a strong justification for funding.
- Asset management is implemented through a variety of organizational structures.
- Agencies use performance measures.

Participating DOTs presented their state of the practice of asset management, ranging from relatively mature to just getting started. Nearly all of the DOTs have implemented an inventory program, adding new elements and refining those already in existence. Most admitted they need to work on refining information and simplifying its presentation.

Many DOTs voiced interest in presenting the asset management information to legislators to show the impact of funding improvements or shortfalls on the network. Many are using the information to justify additional revenue, though not always successfully.

Many also expressed a desire to show the significance of preservation, admitting it is important but not glamorous. Other DOTs were at the point of developing techniques to show trade-offs from funding in specific program areas and showed significant interest in the Missouri software.

Several DOTs were looking for ways to show trade-offs among programs—pavements versus bridges versus safety programs, for example. This presents a difficult challenge.

The United Kingdom has a long history of asset management. Officials credit it with influencing decisions on preservation strategies and public financing initiatives.

Alberta, Canada, is reaping great financial benefits from new oil revenue. Officials publish an annual business plan that uses performance measures, outcomes, and targets identified in a 3-year plan. They merge all public works into this document, not just transportation. They also have a comprehensive data retrieval system with advanced optimization tools. Admittedly, however, they still have institutional issues such as legislative desire for new facilities over preservation that under finance this key element of their systems.

New Zealand uses performance measures as the foundation for asset management, with funding dependent on the asset management plan, levels of service, agreements on performance, and annual and 10-year forecasts. The plans are based on a hierarchy of performance measures ranging from the vision to strategic to operational and tactical measures.

Asset management has a growing role in public–private partnerships, as shown on the CityLink project in Australia. CityLink is a toll road that also includes communications assets. Although most of the assets are new, the facility does have some old structures. From the beginning the focus has been on managing the whole package, including the initial asset, operation, and maintenance. This includes development, delivery, management, and operation, with the investor acting as an active participant in all stages. TransUrban, the operator of the system, developed a comprehensive asset management system to manage the facilities, including many older structures.

The DOTs and international guests discussed many detailed questions, including the following:

- Was it more dollars or better use of dollars that improved the system?
- Was industry a key partner in supporting asset management approaches?
- How is risk identified?
- How are benchmarks and performance standards established? What is “good” and “bad?”
- Are the data collected too much or too little, or is the collection effort too expensive?
- Do spikes in construction funding always lead to a spike in preservation needs?

FHWA, in partnership with AASHTO, has extensive resources to help DOTs progress in asset management.

Most states at the workshop reported that the next step is continued implementation with a focus on external presentation of information. The forum provided many resources and ideas, and Florida, Michigan, Ohio, and Utah indicated they are willing to provide technical assistance, information, and contacts.

While the major goal of the executive forum was to exchange information, several key topics for future program development surfaced from the discussion:

- Successful case studies to address external use of asset management information between DOTs and elected officials;
- Methods to show that preservation funding is as critical as or more critical than new construction to demonstrate its value to elected officials;

- Methods to show trade-offs between funding and system performance, again to demonstrate to elected officials the value of additional finances. Missouri DOT has a system that could be considered in other states;
- Better methods to show funding trade-offs between assets such as pavements and bridges; and
- Continuing exchanges between DOT executives as much of the application of asset management in the near future is one of education and story telling.

Background

In April 2005, a team of U.S. executives participated in an International Technology Scanning Program looking at transportation asset management practices in some of the leading countries in the world (Figure 1). The scan clearly showed that these organizations have used asset management data to compete for government resources both inside their agencies and with legislative bodies.

The Transportation Research Board's (TRB) Accelerating Innovation Task Force (AFH35T) believed that these findings, along with several major asset management advancements in the United States, would be worthy of further discussion by U.S. departments of transportation (DOTs).

The task force, along with other asset management organizations and committees, sponsored an executive session on asset management. DOT executives and asset management program managers met with key international officials to discuss advancements in asset management that might lead to growth in asset management applications in the United States.

The executive forum was held on December 13, 2006, in Washington, D.C. Fifteen DOTs and FHWA were represented, along with officials from the United Kingdom, Canada, New Zealand, and Australia. The participants are listed in Appendix A. The agenda is in Appendix B.

TASK FORCE ON ACCELERATING INNOVATION

The TRB Task Force on Accelerating Innovation was established in 1999 to consider the development of a strategic forum to accelerate innovation in the highway community. The potential benefits of such a forum were the subject of *TRB Special Report 249: Building Momentum for Change* (1996).



FIGURE 1 International transportation asset management scan.

The task force is supported with financing provided under NCHRP 20-54 and composed of 18 high-level public and private highway industry leaders.

The task force has focused on two major barriers to innovation:

- Several members of the task force expressed the view that the “stovepipe” organizational culture in large organizations often can inhibit change that impacts multiple disciplines and multiple layers, but change still can be encouraged by a creative management staff.
- Many members of the task force noted that large organizations often fail to see that an emerging technology can advance only if it is understood and embraced by its executive staff.

The task force opted to examine these barriers through specific case studies. The following four topics allowed the task force to critically examine both the barriers and potential solutions:

- Accelerating construction technology transfer. An integrated approach to accelerating construction by examining options at the earliest stage of planning.
- Environmental stewardship for construction and maintenance. A collection of best practices that will be examined and promoted cooperatively by the highway community and environmental agencies in hopes of improving mutual trust.
- Construction estimating validation process. A risk-based analysis of highway projects that defines cost estimates in terms of ranges and risks, rather than single estimates, with the intention of improving the DOT’s credibility with the public.
- Performance-based maintenance contracting. An emerging approach to maintenance contracting that requires the contractor to meet overall performance standards but allows significant flexibility in determining the sequence of work, work details, and workforce, equipment, and supply allocation. The technique generally includes best-value contracting, performance-based specifications, and lump-sum bidding.

JOINT AASHTO–FHWA–NCHRP INTERNATIONAL TECHNOLOGY EXCHANGE PROGRAM

This program is undertaken jointly with AASHTO and its Special Committee on International Activity Coordination in cooperation with TRB’s NCHRP 20-36 on “Highway Research and Technology—International Information Sharing,” the private sector, and academia.

The International Technology Scanning Program has resulted in significant improvements and savings in road program technologies and practices throughout the United States. In some cases, scan studies have facilitated joint research and technology-sharing projects with international counterparts, further conserving resources and advancing the state of the art. Scan studies have also exposed transportation professionals to remarkable advancements and inspired implementation of hundreds of innovations. The result is large savings of research dollars and time, as well as significant improvements in the nation’s transportation system.

AASHTO SUBCOMMITTEE ON ASSET MANAGEMENT

Asset management is an important focus for both AASHTO and FHWA. In 1997, AASHTO created the Task Force on Asset Management to focus on growing interest in the concept. In 2003, AASHTO leadership sought to establish a more permanent standing for asset management in the AASHTO committee structure.

The task force was sunsetted and a Subcommittee on Asset Management was established with representation from the Standing Committees on Planning and Highways and other appropriate committees. In May 2004, the Standing Committee on Planning adopted a resolution supporting the continued development and implementation of sound asset management concepts as an AASHTO priority. The resolution was quickly ratified by the AASHTO Board of Directors at the 2004 midyear meeting.

A Strategic Plan for the AASHTO Subcommittee on Asset Management, 2004–2010, was adopted. The plan provides for a comprehensive, broad-based, and proactive approach to fully develop transportation asset management techniques and applications. The plan also provides a structured approach for advancing the state of the practice in AASHTO, FHWA, and state DOTs across the country.

The strategic plan recognizes that many states are now active in implementing asset management in their day-to-day activities. Goals focus on promoting further development of asset management tools, analysis methods, and research topics, including economic evaluation tools and trade-off analysis methods. The plan includes strategies that emphasize the importance of communicating and sharing information with policy and technical decision makers and elected officials on the benefits of applying asset management principles and techniques throughout the planning process—from goal setting and investment decisions to operations, preservation, and maintenance.

TRB'S TRANSPORTATION ASSET MANAGEMENT COMMITTEE

TRB's Transportation Asset Management Committee brings together practitioners and researchers to consider current asset management practices across all transportation modes, develops research needs, and encourages dialog and wide dissemination of information through meetings, workshops, conferences, and publications.

DEFINING ASSET MANAGEMENT

Most nations of the world have made significant investments in transportation infrastructure. In the United States alone, such investment is estimated at more than \$1.75 trillion (*1*). However, as this infrastructure is used and exposed to natural forces, its condition will deteriorate.

In the United States in particular, a significant challenge facing national, state, and local officials is preserving the functionality of the existing transportation asset base while at the same time funding expansions of the transportation network to handle increasing demands. Although transportation officials spend considerable time and energy on new roads, transit facilities, airports, and pedestrian and bicycle facilities, by some accounts the nation will spend more

money over the next several decades preserving and maintaining the existing transportation base than it will building new facilities.

Asset management is a strategic and systematic process of maintaining, upgrading, and operating physical assets effectively throughout their life cycle (2). It focuses on business and engineering practices for resource allocation and utilization, with the objective of better decision making based on quality information and well-defined objectives. It reflects a comprehensive view of system management and performance. The core principles of asset management are the following (2):

- **Policy driven.** Resource allocation decisions are based on a well-defined set of policy goals and objectives. These objectives reflect desired system condition, level of service, and safety provided to customers, and they typically are tied to economic, community, and environmental goals as well.
- **Performance based.** Policy objectives are translated into system performance measures that are used for both day-to-day and strategic management.
- **Analysis of options and trade-offs.** Decisions on how to allocate funds within and across different types of investments (e.g., preventive maintenance versus rehabilitation, pavements versus bridges, capacity expansion versus operations, different modal mixes, safety) are based on an analysis of how different allocations will impact achievement of relevant policy objectives. Alternative methods for achieving a desired set of objectives are examined and evaluated.
- **Decisions based on quality information.** The merits of different options with respect to an agency's policy goals are evaluated using credible and current data. Where appropriate, decision-support tools are used to provide easy access to needed information and to assist with performance tracking and predictions.
- **Monitoring to provide clear accountability and feedback.** Performance results are monitored and reported for both impacts and effectiveness. Feedback on actual performance may influence agency goals and objectives, as well as resource allocation and utilization decisions.

BENEFITS OF A TRANSPORTATION ASSET MANAGEMENT PROGRAM

How will an organization benefit from a healthy, well-managed asset management program? Many of the agencies that have applied robust programs attest to their ability to do the following:

- Better quantify the condition of key assets and eliminate the subjective.
- Collect the right data to drive the organization's decision making.
- Determine the best use of limited funds within the framework of the organization's mission.
- Improve system performance with constant or declining dollars.
- Apply advanced scenario and trade-off analyses to better understand investment strategies and future system conditions.
- Better communicate the organization's mission, goals, performance measures, and investment priorities.
- Articulate needs and gaps in funding based on facts and performance measures, not beliefs or wants.

- Improve dialogue with legislatures, governors, and citizens.
- Accelerate culture change—from expenditures to investments, from projects to customer satisfaction.
- Link asset management with the emerging public-private partnership movement.

ASSET MANAGEMENT INTERNATIONAL SCAN DETAILS

The purpose of the scan was to investigate best-case examples of transportation asset management techniques and processes in the world. FHWA, AASHTO, and NCHRP jointly sponsored this scan.

In addition to FHWA officials (at the headquarters and field levels), the panel included representatives from DOTs for Michigan, New Mexico, New York, and North Carolina; representatives of the American Public Works Association and the city of Portland, Oregon, Office of Transportation; and a university professor representing the TRB Committee on Asset Management.

These panel members represented a diverse set of interests and expertise in the areas of asset management, bridge and pavement management systems, transportation policy and planning, and transportation system operations.

The scan team met with the following types of representatives during its 17-day trip:

- National transportation agencies—England and New Zealand.
- National rail provider—England.
- Provincial or state DOTs—Alberta, Canada, and New South Wales, Queensland, and Victoria, Australia.
- City transportation and infrastructure officials—Brisbane, Queensland; Edmonton Alberta; United Kingdom, representing London and some other local governments; and New Zealand, representing urban and local communities.
- Transit provider—Brisbane, Queensland.
- Toll authorities—New South Wales and Victoria.
- Public-private partnership concessionaires—New South Wales and Victoria.

The scan team listed 31 observations (see Appendix C) of interest to transportation officials in the United States. These observations are organized in five major categories: asset management's role in decision making, leadership and organizational structure, asset management technical activities, program delivery, and human resources (3).

Workshop Presentations and Discussions

OPENING REMARKS

Kirk Steudle, chair of the AASHTO Asset Management Subcommittee, provided an overview of recent advances in the practice of asset management in the context of his experience as director of Michigan DOT and a member of both the international and domestic asset management scan teams. He noted that agencies are moving to managing their transportation assets more as a utility would. For example, improvement of assets is considered an investment rather than an expenditure.

The scan underscored the diversity of approaches to asset management. However, common drivers in the United States and abroad include the following:

- Limited resources,
- Increasing demands,
- Need for improved credibility with elected officials and the public, and
- More emphasis on strategic oversight.

Overarching themes include the following:

- Agencies are moving away from “worst first.”
- The focus is on preservation first.
- Agencies recognize data as an asset.
- Asset management supports enhanced communication.
- Asset management provides a strong justification for funding.
- Asset management is implemented through a variety of organizational structures.
- Agencies’ use of performance measures.

Don Lucas, chair of the TRB Task Force on Accelerating Innovation, reinforced these themes and recognized the importance of events such as this forum for sharing ideas and concepts.

It is clear that asset management as an organizational culture, as a business decision-making process, and as a policy direction is a critical foundation for transportation programs that are facing significant capital renewal and preservation needs. The United States is clearly facing such a challenge

—*Transportation Asset Management International Scan Report*

DOT ROUNDTABLE

Each participating state provided a brief overview of its asset management practices. Several states provided summaries, which are in Appendix D. Four states—Florida, Ohio, Michigan, and Utah—also developed long presentations, which are in Appendix F. The state presentations are summarized below.

Colorado

Asset management began in Colorado as a transportation investment strategy. How should resources be allocated to different parts of the system? Pavement and bridge management systems (BMS) provided a good foundation, but more work is needed to add culverts and intelligent transportation system (ITS) devices. Colorado DOT's problem is how to maintain operational capacity while maintaining the existing systems. The Statewide Transportation Improvement Program (STIP) and the long-range plan have been effective tools. However, the DOT has been less effective working with the legislature. Additionally, there has been some internal resistance to performance measures.

Connecticut

Connecticut DOT has a significant variety in the number and type of assets in its inventory, including roads, bridges, ports, airports, commuter rail, and ferry buses. One major issue is the need to prioritize investments in assets across modes. Connecticut DOT has had an Asset Management Division for just 5 months. At the beginning, it will focus on pavements and bridges. The process is supported by lots of data, but the DOT needs to get through institutional barriers to really start to manage the data. As an institution, the DOT is in the learning phase; it needs to learn from other states what worked and what did not. It is particularly interested in experiences of other New England states.

Florida

In Florida, asset management begins with a strong statutory policy framework documented in the Florida Transportation Plan. The Florida DOT has no asset management department, but its approach to decision making, investment analysis, and management of transportation assets spans the department, from planning and financial management to maintenance, bridge, and pavement offices. Florida recognizes that it is critical to maintain existing assets before investing in new system capacity. The mission, goals, and objectives were codified in 2000. These include the following:

- 80% of pavement meet standards based on annual condition survey (ride quality, crack severity, etc.) and recently changed criteria;
- 90% of bridges meet standards; and
- 100% of roads on state highways systems meet standards for maintenance.

A recently implemented performance measurement system focuses on safety, customers and market, highway condition, organizational performance, and production performance.

Next steps include the following:

- Develop communications plan for asset management.
- Assure it is extremely cost effective in both the short and long run.
- Address continued pressure to move funding to capacity from preservation programs.
- Emphasize cost of replacement if assets are not properly maintained or preserved.

This will be implemented through the following:

- Asset management maintenance model,
- Public–private partnership (PPP) model, and
- Transition from short-term view.

Georgia

Asset management systems have been worked on for several years, including pulling together an accurate inventory. Georgia DOT's goal is to forecast the cost of future needs. The pavement management system (PMS) is close to being able to determine optimal treatment strategies. The DOT just established an Asset Management Task Force to look at all aspects of the issue. The DOT wants to be able to forecast future needs and balance the needs with capital improvements.

Michigan

Michigan is defined by its government, geography, urban–rural mix, economics, auto dependency, and border position. Michigan DOT has jurisdiction over only 8% of the roads in the state. Therefore, the DOT needs to partner with many agencies. Challenges occur on issues such as the urban–rural balance and shifting funds.

Asset management in Michigan is structured around the basic framework presented in the *AASHTO Asset Management Guide (2)*. The DOT needs to focus on preservation. This requires balancing investments and goal setting as follows:

- Uses the statewide long-range planning process,
- Is based on needs assessment,
- Ensures measurable outcomes, and
- Considers political process.

The asset management program is also built on quality data and information. This is key because the data are an asset. The mantra is “collect once; store once; use over and over.” Ideally, information is automated and accessible using the geographic information system (GIS) framework. The data are also related through the six management systems. These six management systems are linked using a location referencing system (LRS), and projects are managed through a single database (emphasizes coordinated projects). The planning and programming process is another important element and is used to develop investment strategies (guides allocation of capital resources), projects, and programs. An annual call for projects is used. An investment template serves as a tool to help manage investment strategies.

Michigan DOT shared the following observations on what asset management has accomplished.

- It has helped track improvements in condition (ride) and average pavement life.
- It has helped communicate with elected officials (e.g., increase gas tax).
- It supports integration and proactive thinking.

Minnesota

Asset preservation is Minnesota's priority, but it is not glamorous. Preservation is based on a performance package—safety, mobility, and preservation. Resources are budgeted based on the related performance measures. The biggest issue is how to address unknowns and changing issues (e.g., asphalt has increased in price nearly 58% in the past year). However, putting together the budget is easier, since priorities are based on preservation and need.

Missouri

In the Missouri DOT, all the elements of asset management are in place. However, the process is not called asset management. The focus is on 18 results that reflect the customer's expectations. These results are measured quarterly, assessed, and discussed. Some large block goals are also used. The DOT is also working on division and district measures. Fortunately, the DOT has robust corporate data and has developed a spreadsheet-based trade-off tool. The tool allows the user to explore different funding allocations and understand if the different allocations meet the target conditions of the road system. The Missouri DOT would also like to learn from others.

New Mexico

The New Mexico DOT is really trying to start up an asset management program. New Mexico has a pavement preservation program and pavements are managed as an asset. New Mexico also has a significant amount of bridge data, but the data are not used to develop any real strategy. It has much less data on other types of assets.

New York

The New York State DOT (NYSDOT) has been working on asset management for a decade now. Over this timeframe there have been some institutional issues. Recent flooding pointed to some missing information in the systematic bridge inspection. Asset management is important because of the need to make comparisons systematically. NYSDOT's biggest challenge is to address the needs of rural New York versus New York City and its huge mass transit investment.

North Carolina

North Carolina DOT's emphasis has been on performance measures. It has good information on pavements and bridges. Since 1998, the maintenance quality assurance program also has provided good information on other types of assets. The legislature supported improvement of these assets. The DOT continuously needs good data, documentation, and demonstrated value

based on facts to put in front of legislators. The DOT also needs to look at the system and objectives for the state as a whole. It is very willing to borrow ideas and concepts from other states.

Ohio

The objective of Ohio DOT is to provide roads in high condition with low deficiencies. It uses charts to show high numbers of deficiencies before adopting asset management. The charts also demonstrate the disparate experiences by district and the significant improvements that have occurred since asset management was adopted.

Ohio DOT's strategy is simple, but it is effectively demonstrated by the following:

- Trade-offs are fewer.
- Deficiencies have been reduced 66% to 80%.
- Conditions are sustainable for a predictable level of effort.
- Long-term planning is simplified.

The process is based on a simple Deming system (4):

- Set multiyear system goals.
- Establish incremental 2-year strategic initiatives.
- Set annual action plans as milestones for 2-year initiatives.
- Review.
- Measure quarterly.
- Provide midyear action plan feedback.
- Measure system performance.
- Conduct annual job performance reviews and hold leaders accountable for conditions.

A funds management committee sets capital budgets and maintenance budgets for districts. Feedback on data and reallocation can occur. Budgeting is carried out from 2005 to 2015. Asset management provides an important linkage that ties together budgets, executive evaluations, division goals, institutional goals, and civil service documentation.

Important lessons learned include the following:

- Asset management is the basic tool.
- Conditions should drive budget.
- Evaluation is tied to condition.
- Enable savings and redirection of the budget as a complementary strategy.

Oregon

Philosophically, Oregon DOT is fairly advanced in asset management. It has a strong PMS and is improving its BMS. It is somewhat short on processing information; it needs to do better on trade-off analyses. Its recent crisis is that it has about 365 bridges that need work. With its system, it was able to communicate to the legislature the economic importance of these assets.

South Carolina

Asset management is the way of doing business in South Carolina. Asset management is used to prioritize the needs of the state, putting politics aside. Once that is done, however, the experts look at the inventory and the costs, and the political process has input into the program. In South Carolina, tourism is important. Tourism often drives construction, but it puts pressure on the state gas tax. Having both accelerated construction and a preservation program is challenging, and indeed the infrastructure is crumbling. The gas tax, which has not been increased since 1987, is the only source of highway revenue for the state.

Utah

Utah DOT focused on improving internal decision making and system performance. As in other states, the critical issue is the need to do more with less.

The process begins with strategic planning. Key goals include the following:

- Preservation,
- System performance improvement, and
- Safety.

The strategic plan, the long-rang plan, and the STIP work together. Action plans are also aligned with internal performance reviews. The basic philosophy is that good roads cost less. This is supported by the following:

- Project selection is consistent with policy documents that specify an open, fair, data-driven process. The focus is on (a) system preservation, (b) capacity enhancements, and (c) capacity increase if resources are left.
- Year flow of funds allows for flow over. Complications occur because of dedicated funds.
- Projects are prioritized first, then funded. This process is driven by performance measures.

Vermont

The Vermont Agency of Transportation (VTrans) is not unique, but asset management is written into the legislation. The legislation was negotiated about 5 years ago. VTrans has all the problems of a rural economy. One major issue is how to compare different assets, particularly ancillary assets. In addition, the political system is based on town meetings, which means that many projects are micromanaged. Asset management provides an opportunity to break away from this system. VTrans is also very dependent on the federal program. However, there is little congestion to worry about. VTrans' job is to manage and preserve without much building of a new system and without public-private partnerships.

INTERNATIONAL EXPERIENCES

Invited representatives from Alberta, Canada, New Zealand, and the United Kingdom provided an overview of asset management experiences in their countries. Each of the presenters had met with members of the asset management scan team in April 2005.

United Kingdom

Three documents set the stage for asset management in the United Kingdom. The Gershon Report, *Releasing Resources to the Front Line*, set the political agenda (5). Local Transport Plan 2 set policy for shared priorities (6). The Traffic Management Act aimed to tackle congestion and reduce disruption through a series of new duties and powers (7).

The history of asset management in the United Kingdom is as follows:

- 2001—Hertfordshire Highway Asset Management Plan;
- 2004—Framework for Highway Asset Management;
- 2005—Full Guidance on Local Transport Plans; and
- 2005—Guidance on Highway Infrastructure Asset Valuation.

The current status can be described in terms of awareness (high), understanding (good), asset management plan development (in progress), and asset management practice (emerging). The key issue is level of service, as this also serves as a stumbling block because of the need to balance cost, level of service, and risk. Investment decisions also present a challenge because of the use-it-or-lose-it culture, minimal application of economics, and whole-life costing.

Asset management is influencing decisions through the following:

- *Transport 2010*, which focuses on preservation and maintenance;
- Public financing initiatives (PFIs):
 - Numerous street lighting schemes,
 - Highway management public PFI in Portsmouth, and
 - Contract for M25, London's Orbital Motorway.

In summary, asset management is influential nationally, but locally asset management is beginning to influence decisions through integrated decision making and it will continue to evolve.

Alberta, Canada

Alberta Infrastructure and Transportation controls buildings and transportation. Therefore, there is a complex competition for funding. Alberta is actually the richest province in Canada because of oil revenue. However, politicians are interested in building new capacity as opposed to maintaining the existing infrastructure.

Asset management is based on performance measures. An annual business plan is published that uses performance measures, outcomes, and targets identified in the 3-year plan. The decision-making and monitoring processes are supported by data. Data quality is critical.

Alberta has developed several tools that use data and support the asset management process:

- The Network Performance Evaluation Decision Application (NPEDA) is being developed to support the asset management process. This tool has functionality similar to that of AssetManager NT and Asset Manager PT.
- The Transportation Infrastructure Management System (TIMS) has 20 applications that enable comprehensive information retrieval and analyses. Examples include the Highway Pavement Management Application (HPMA), Network Expansion Support System (NESS), Bridge Expert Analysis and Decision Support System (BEADS), NPEDA, and Rationalization and Optimization Decision Application (RODA). All of these tools are GIS based (see [Figure 2](#)).

In the near term, the objective is to do the following:

- Fine-tune data collection and performance measures.
- Identify additional performance measures needed to support the process.
- Continue development of TIMS.
- Provide input to the long-range plan.
- Improve on scenario planners (see [Figure 3](#)).

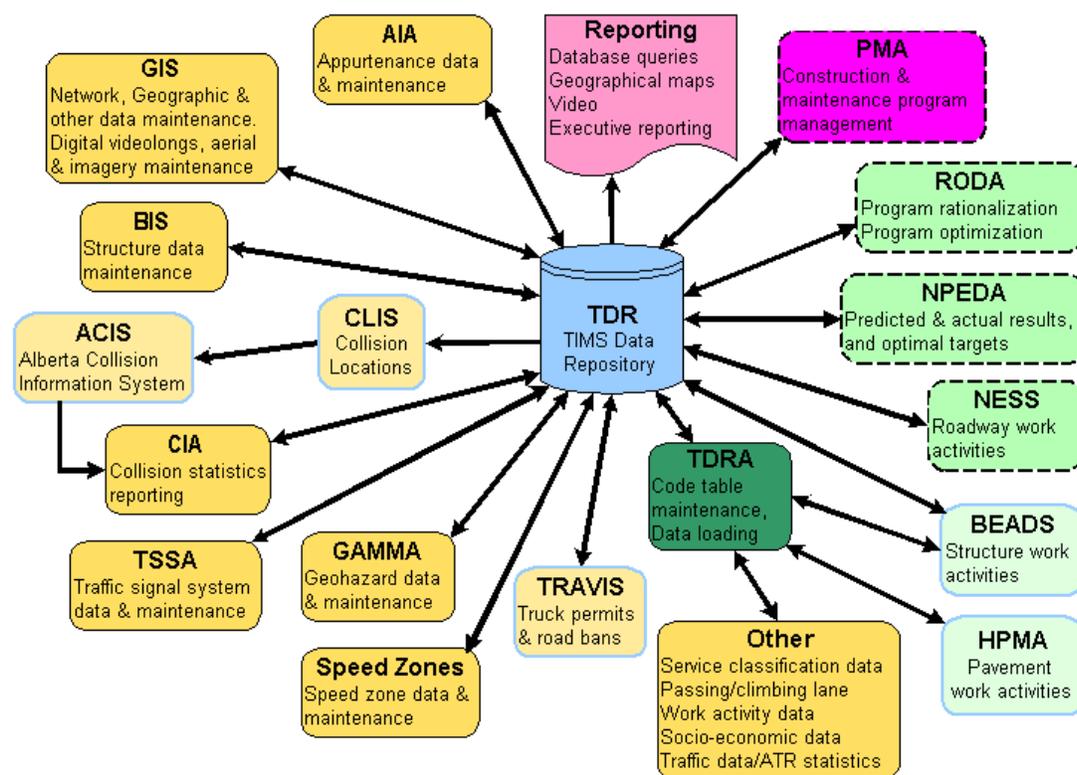


FIGURE 2 TIMS and key subelements.

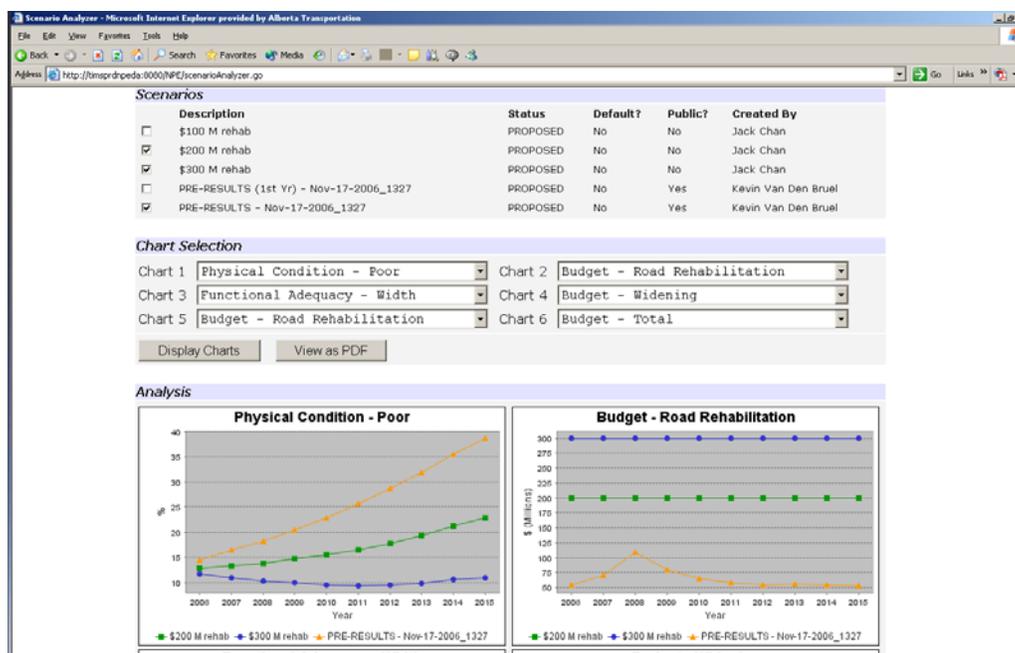


FIGURE 3 Alberta scenario planner.

New Zealand

Transit New Zealand's asset management approach has performance measures as the foundation. In New Zealand, funding depends on the asset management plan, levels of service, agreement on performance, and annual and 10-year forecasts. These are consistent requirements for Transit New Zealand and local government units that are driven by a strong federal government.

The plans are based on a hierarchy of performance measures ranging from vision to strategy to operational and tactical measures:

1. Agreement with Minister of Transport (quarterly reporting covering achievements, milestones, and financial data).
2. Statement of intent (3-year plan identifying objectives and direction).
3. Transmission of strategy into goals that include environment, social issues, and pavement (e.g., fatal accidents, skid resistance).
4. Agreement with Land Transport New Zealand (funding agency). This includes key performance indices and operational performance measures. The agreement simply describes and reports on the performance measures, but does not evaluate them.
5. Pavement condition report.
6. Divisional performance measures.

The following are important lessons learned:

- Ability to demonstrate that the infrastructure is being preserved and to demonstrate consequences.
- Need to cover the range of assets.

- Strong buy-in at the governance level.
- Fund accordingly.
- Data are critical.
- Sophisticated systems and software are not essential; processes are more important.

An important observation is the concern that many of the processes presented did not look very far into the future. In New Zealand, asset management should force organizations to look at life-cycle costs and the relationship to public finance initiatives and public–private partnerships. Long-term issues are not widely addressed, particularly by local authorities, because the very long term is very difficult. Most organizations are aware of the issues. Bridges lend themselves to long-term issues, but most other assets do not. There is the need to strategize how to integrate these concepts over the network.

PUBLIC–PRIVATE PARTNERSHIPS AND ASSET MANAGEMENT

One of the most important observations from the international scan was the importance of incorporating strong asset management principles in PPP agreements when such projects are considered. Glenn Sanders from TransUrban, operator of CityLink in Melbourne, Australia, provided an overview of CityLinks’ experience with asset management.

CityLink is a toll road that also includes communications assets. Although most of the assets are new, the facility does have some old structures. From the beginning, the focus has been on managing the whole package, including the initial asset, operation, and maintenance. This includes development, delivery, management, and operation, with the investor acting as an active participant in all stages.

Initially, many of the operations and maintenance activities were contracted out. However, a lot of those activities were brought back in-house to make sure that the ultimate customers (the road users) were satisfied. Key concepts include the following:

- Focus on strategic asset management. This controls tactical management and operations.
 - Understand the assets—civil, mechanical and electrical, ITS, traffic management, architectural and aesthetics.
 - Organize asset management around life-cycle groups:
 - Structural assets—30 years,
 - Mechanical and electrical assets—10 to 30 years, and
 - Electronic toll and traffic management assets—5 to 12 years.
 - Link corporate strategy to business functions. For example, outcomes from the management systems are linked to maintenance contractors through a code of maintenance standards.
 - Collect and use data:
 - Look for trends and changes in the data,
 - Transform data to information, and
 - Conduct consistent, objective assessments.
 - Define objectives:
 - Investment protection and

- Sustainability.
- Measure and benchmark using key performance indicators (KPIs) and standard costs.

Important observations from the CityLink experience include the following:

- Identify opportunities to include data collection in the original construction (e.g., weigh-in-motion sensors).
- Recognize that high expectations on level of service result in more data.
- Efforts are needed to strategically look at the asset.

AASHTO ACTIVITIES

Tony Kane, Director of Engineering and Technical Services for AASHTO, noted that several ongoing AASHTO efforts focus on asset management:

- Safety and traffic,
- Maintenance committee,
- AASHTOWare,
- Financial issues,
- Utility of asset management of information for securing new revenues,
- Quality—uniform measurement techniques,
- Modules for training of new CEOs (primer), and
- Input to the Commission on Performance Measures.

OPEN DISCUSSION

An open discussion followed the presentations. The following summary provides comments or questions in italics. Responses are attributed to representatives of particular states or agencies.

The presentations showed that using asset management produced an improvement in condition when additional resources were committed to that area. Was it really additional dollars or better use of existing dollars? Did asset management bring new money to transportation?

Ohio The information supported the need for change and additional resources. The result was (a) reallocation from one district to another (60%) and (b) net new revenue to go into rehabilitation (40%). Demonstrating that maintenance was covered and that net new revenues were required for capacity improvement received support in the legislature.

Florida At the same time the department's system preservation goals were codified in 2000, legislation was passed that brought revenues back to transportation that had been diverted. The Mobility 2000 legislation focused these additional revenues on highway capacity improvements. Asset management supported this change and additional revenues.

Missouri Choice of performance measures that are indicative of assets and attributes that are important to customers will help demonstrate improvement.

Vermont VTrans has had a problem finding matches for earmarks. It has been able to use asset management tools to explain to the legislature and demonstrate the need to not divert dollars from preservation to capacity expansion projects. Vermont has also used scores to evaluate capacity projects similar to the evaluation Utah and Ohio use.

North Carolina Using asset management tools, North Carolina has been able to move money around and generate new money.

Minnesota The statewide corridor fund is based on additional dollars obtained from federal sources. Districts can access this fund if they meet the standards for preservation. A new source of revenue is the dedicated sales tax on motor vehicles, which will be phased in.

How do agencies deal with variability in performance measures across different parts of the state? Specifically, is there a willingness to accept different levels of performance? There is also the fair share issue.

Minnesota Passing costs on to other generations is an important concern. There is a need to focus on life-cycle costs.

Michigan Fairness can be addressed by focusing on results, not on the amount of money. There is a need to recognize that transportation is a long-term investment.

Vermont Recognize that the transportation system is a mural or a quilt and the overall picture is important. Similarly, you cannot look at the system in terms of postcard views.

New York The 5-year plan is based on a signed memorandum of understanding (MOU) between the department and the governor based on five geographic regions. A funding formula determines the amount of money allocated to each region. Although the formula is clearly stated, allocations still become a problem.

Ohio This is a difficult issue. Ohio is a home-rule state. Therefore, the DOT needs to explain to mayors that they are better off than another city.

Utah Different performance measures are used for different functional classes of roads.

Ohio's performance management system: How does this fit with asset management? How does it relate to individual performance? Is it just field personal or linked to the designers, etc.?

Ohio The performance management system builds on the quality effort in the 1990s. Districts pay attention to the performance measures. While it is not described as asset management but just simply providing a good road, the performance management system embraces asset management system concepts. Performance measures become a good jumping-off point for improving the process and naturally relate to cost accounting. Asset management has evolved down to the front line through performance measures. Also, mid-level managers get merit

increases and have an opportunity to change their actions. Union and civil service employees get “written up.”

How are agencies using asset management to handle the construction industry?

Michigan The Michigan Transportation Team (MTT) (includes members of the Chamber of Commerce, construction industry, unions, etc.) uses the Michigan DOT director’s presentation to communicate with legislators. The MTT understands the issues.

Minnesota Minnesota had support from the Chamber of Commerce and construction industry for the constitutional amendment. This is seen as a partnership rather than a conflict.

How is risk addressed?

United Kingdom The framework document had a box for risk. It was included assuming that it would be addressed at some point in the future. However, risk became a hook for getting attention through the issue of corporate manslaughter—road fatalities, public liability (repudiation supported by data). The use of risk in decision making is weak.

New Zealand Everything the agency does involves risk. For example, what margin of error is acceptable in terms of how long things last? How well you manage risk determines how successful you are. For example, managing loose rock on a slope involves three steps: (a) Is there a risk? Identify risk. (b) What are you going to do about it? (c) Did you actually do what you said you were going to do?

Australia (CityLink) A private corporation cannot hide behind indemnity. Organizations need a formal risk management plan. An asset management plan is a subset of risk management that includes safety to the public, loss of revenue, impact on employees, and impact on the reputation of the company.

North Carolina Performance-based maintenance contracts are one way to address risk. These contracts include response times. Risk management suggests that response time will increase costs. Some elements of risk are covered by insurance.

How do you deal with the long-term issue of condition and performance at turnback?

Australia (CityLink) The life of an asset is a subjective guess. We need to measure and understand small increments in the life cycle. Anyone can inspect. We need to think about what needs to be done, get it done, and monitor. Think of it as mini-life cycles. The idea is that design and construction were appropriate for the long-term performance of the asset.

In each presentation a comparison between good and poor was used. Where did the number come from? How do we know that we are using the right number?

Missouri The benchmark “good” came from citizen participation. Nine hundred citizens were loaded into vans and asked for input on various roads—85% good, 15% fair.

Vermont The goal is set as “no more than $x\%$ will be poor” because of fiscal capacity. Thresholds are set by commodity managers.

Utah We looked at present condition by functional system and looked at resources required to keep the system in current condition. The second version of the *Good Roads Cost Less* study will allow Utah to set performance targets based on engineering estimates.

New Zealand A group of engineers set the level by Delphi. In the last 10 years these levels have not really changed. Generally there have not been complaints. Most complaints are about availability of the road (disruption because of patching.) The public is largely interested in safety and aesthetics. Thresholds have also been supported by customer surveys conducted every 2 years.

Colorado The public will not necessarily understand the value of preservation, therefore, engineering judgment is used.

Missouri Another input is the need to balance investment and customer expectations.

New York The DOT recognizes the need to talk the language of the customer, which is mobility. Mobility is measured as the percentage of time customers perceive that performance is satisfactory. Also using corridor management as the unit of operation is logical from the customers’ perspective. (Corridor management is also being used by the Ontario Ministry of Transportation.)

Oregon Using a corridor approach helped with the bridge issue. The real issue was getting freight to the port.

What are the right performance measures?

Missouri Performance measures cannot be developed in a vacuum. The measures must relate to vision and tangible results you expect to deliver to your customers. The game is a zero sum.

To what extent is marketability of your investment strategies important?

Missouri We have seen some success in targeting projects at the customer.

Vermont Missouri’s trade-off tool is a marketing piece. The tool demonstrates the trade-offs. Performance measures have worked in Vermont.

Oregon There is a need to make the connection with the customer. Transportation infrastructure has been taken for granted. We need to explain why transportation infrastructure is important for communities.

Australia (CityLink) Time saving and trip time reliability have been the key measures. Maintenance work does not interrupt rush hour and disruptions are communicated.

Is the data collection too much or too little? Does it need to be measured differently? Are there issues?

Alberta The initial investment is considerable. Maintenance of the data is outsourced and contractors have to update the data once a contract is complete. Therefore, data collection does not cost too much.

Missouri It depends on the maturity of the data collection process. Organizations need to generate acceptable measures. If data collection is a burden, then you are probably not collecting the right data.

Ohio Data should not be a barrier to entry. Data warehouses mean that you can leverage your legacy systems.

Utah Asset management as a strategic initiative from the central office means that you need to bring districts along. Success occurs because the field expertise of the districts is consistent with the asset management system recommendations.

Ultimately, a spike in construction leads to a spike in preservation needs. How do you deal with it?

Michigan We measure network health based on remaining service life. For example, poor health would be indicated by less than 2 years of remaining service life. In 1996 most pavements in Michigan were in poor condition. Obviously, there was a need for a more even distribution and Michigan DOT has worked to create a shift in the distribution.

Future Initiatives

FOLLOW-ON SERVICES

The FHWA Office of Asset Management, in cooperation with AASHTO, provides several resources as well as links to other sources. These are summarized below:

- Transportation Asset Management Today (TAMT) Community of Practice website (<http://assetmanagement.transportation.org>) serves as a repository of information, a clearinghouse for events and activities, and a source of information.
- Office of Asset Management—organized around three teams.
- Resource Center—provides technical support.
- Division office training program.
- Research and development:
 - Highway performance management system task force under way,
 - Life-cycle cost analysis,
 - Highway Economics Requirements System—State Version (HER-ST), and
 - Upgrade Pontis BMS.
- Training:
 - Workshops,
 - National Highway Institute (NHI) pavement preservation courses, and
 - NHI asset management course.
- Peer exchanges:
 - Metropolitan planning organization,
 - Safety, and
 - Budgeting.
- Publications—FHWA produces brochures, case studies and primers, many of which are available on the FHWA and TAMT websites, including a brochure on asset management and planning.
- Technical and professional organizations:
 - AASHTO Asset Management Subcommittee and
 - TRB Asset Management Committee.
- Other publications:
 - Domestic scan executive summary (8) and
 - Report from the international scan (3).
- Conference (New Orleans, November 2007).

WHERE TO NEXT?

Most states reported that the next step is continued implementation with a focus on external presentation of information. The forum provided many resources and ideas, and Florida, Michigan, Ohio, and Utah have indicated that they are willing to provide technical assistance, information, and contacts. Following the workshop, participants were also asked to identify

ideas, concepts, and tools that are relevant to their organization as well as provide suggestions for improving the workshops. Responses are in Appendix E.

While the major goal of the executive forum was to exchange information, several key topics for future program development surfaced from the discussion:

- Successful case studies to address external use of asset management information between DOTs and elected officials.
- Methods to show that preservation funding is as critical as or more critical than new construction to demonstrate its value to elected officials.
- Methods to show trade-offs between funding and system performance, again to demonstrate to elected officials the value of additional finances. Missouri DOT has a system that could be considered in other states.
- Better methods to show funding trade-offs between assets such as pavements and bridges.
- Continuing exchanges between DOT executives as much of the application of asset management in the near future is one of education and story telling.

Asset management, in many ways, represents a “revenge of the nerds.” . . . We are providing a rational basis for an investment process that can be inherently political.

—*Southeast Michigan Council of Governments official*

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APPENDIX A

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APPENDIX B

Strategic Workshop for Department of Transportation Executives *Agenda*

December 13, 2006
National Academy of Sciences
Washington, D.C.

Sponsored by
TRB Task Force on Accelerating Innovation
Joint AASHTO–FHWA–NCHRP International Technology Scanning Program

The TRB Task Force on Accelerating Innovation, partnered with the Joint AASHTO–FHWA–NCHRP International Technology Scanning Program, to conduct a 1-day, executive-level workshop on transportation asset management, December 13, 2006, in the National Academy of Sciences Lecture Room, 2100 C Street NW, Washington, D.C.

This forum was limited to 15 senior executives and their asset management program managers. The agenda was developed to maximize dialogue and discussion.

The program included the following highlights:

- International roundtable with speakers from Australia; Alberta, Canada; and the United Kingdom;
- U.S. roundtable and case studies with speakers from Florida, Michigan, Utah, and Ohio Departments of Transportation (DOTs);
- Focus on the role of asset management in the growing area of public–private partnerships (PPPs); and
- Extended dialogue time among senior executives.

The program offered opportunities to learn how other states and countries have benefited from asset management:

- Better quantifying the condition of key assets;
- Improving financial projections by professionally dealing with shortfall and expectations;
- Improving system performance even with constant or declining dollars;
- Improving analyses and strategic investment options;
- Improving internal decision making;
- Improving dialogue with legislatures, governors, and citizens;
- Advancing culture change from expenditures to investments; and
- Applying asset management to better analyze PPPs.

AGENDA

- 7:30 a.m. Continental breakfast
- 8:00 a.m. **Welcome and Introductions:** Don Lucas and Kirk Steudle, Cochairs
Review of the objectives of the forum and some administrative details.
The role of the TRB Task Force on Accelerating Innovation.
- 8:15 a.m. **Asset Management 101:** Kirk Steudle
A quick tutorial on asset management, with a focus on previous AASHTO efforts.
- 8:30 a.m. **DOT Roundtable**
DOT executives share thoughts about their own asset management programs and explain what they hope to gain from the forum.
- 9:00 a.m. **DOT Case Studies**
Representatives of four states—Florida, Michigan, Ohio, and Utah—present different aspects of their asset management programs, focusing on specific case studies. An open discussion follows.
- 10:15 a.m. Break
- 10:30 a.m. **International Roundtable**
Three international guests representing New Zealand; Alberta, Canada; and the United Kingdom present different aspects of their asset management programs, focusing on specific case studies.
- Paul Hardy, United Kingdom, summarizes the current state of development of highway–transport asset management practice in the United Kingdom.
 - Rob Perry, Alberta, Canada, discusses performance measurement at the business plan level and the processes involved, as well as its role in integrated infrastructure management.
 - Dave Bates, Transit New Zealand, discusses how the agency has integrated asset management into various levels of government and how it has permeated throughout the organization.
- 11:40 a.m. **Asset Management and Toll Facilities**
Glenn Sanders, TransUrban, discusses how asset management was integrated into the contract for the long-range building and operation of the CityLink Toll Facility.
- 12:15 p.m. Lunch

- 1:00 p.m. **Open Discussion**
An open discussion on the best ways to improve the state of the art.
- 2:30 p.m. **Follow-On Service:** Dave Geiger
Geiger talks about what services are available post-forum and how the group may help one another and advance their own programs.
- 2:45 p.m. **Closing Remarks:** Kirk Steudle and Don Lucas
- 3:00 p.m. Adjourn

APPENDIX C

Scan Findings

The following scan findings were taken from the International Scanning Study Team Report (3).

LEADERSHIP AND ORGANIZATION

1. Top-level agency commitment (at the very highest levels) in support of asset management was apparent in every case. Asset management was viewed by the CEO/COO of the agency as an important tool for managing the agency's portfolio and for maintaining credibility with the agency's constituencies. Part of obtaining this high-level commitment was showing how asset management could produce more cost-effective program results.

2. In almost all cases, changing the organizational culture to think of asset management as a key business area was pointed to as the key challenge. The evolution in the use of asset management was viewed as changing the culture of the organization.

3. Each agency had a management position or office responsible for asset management. This focal point for asset management provided guidance to other units in the organization and acted as a filter for asset information directed to different decision makers in the agency. In addition, this office usually acted as a major participant in national or state efforts to enhance asset management activities more broadly.

4. One of the most important aspects of the observed asset management programs was the bringing together of agency resources and capabilities for undertaking asset management and creating an asset management culture in the organization. Although many different units in an organization collected data and produced information on asset performance and condition, in several cases this information was synthesized at key decision points in the agency.

ASSET MANAGEMENT'S ROLE IN DECISION MAKING

5. Each site visited has made a commitment to, and allocated resources for, developing an asset management program, although the approaches varied in scope and content. Although the scan team found no common, integrated asset management model in the sites visited, the basic components of each asset management effort were the same. Importantly, asset management approaches were found in situations where maintenance outsourcing was a major part of program delivery, as well as where program delivery was done primarily with an agency's own staff.

6. In all of the sites visited, the agencies competed for resources across all government programs (such as education, public safety, community services, etc.). Few agencies had access to transportation-specific revenue sources, so they had to compete as "whole-of-government." Several examples in which good data on infrastructure needs provided justification for additional funds to be put into transportation infrastructure programs showed asset management's role in such a decision-making context.

7. Continuity in government has assured a stable environment for asset management to evolve. Top government transportation officials have held their positions for a long time (in U.S. terms). Once these individuals were convinced of the value of an asset management approach, they supported continuing asset management efforts.

8. Several major drivers were identified for adopting an asset management approach. Similar to the United States, increasing numbers of trucks using the road network, aging infrastructure, and congested road networks have created pressures on infrastructure owners. This has resulted in a need to better manage an important asset base with limited resources. It has also resulted in providing this management responsibility with a limited number of staff (in some cases, staff cutbacks) while at the same time maintaining staff capability. Finally, linking asset management to broader community and agency goals and conducting trade-offs among asset categories were mentioned as important characteristics of individual asset management efforts. In several cases, asset management was adopted during hard economic times, so it was viewed as a way to provide the most cost-efficient program delivery.

9. In some cases, national or state legislation has been an important catalyst to view asset management in a different way (e.g., New Zealand's sustainability law and Victoria's Road Management Act). In Australia, in particular, recent changes in liability laws have been important factors for developing (Victoria) or stimulating thinking about (Queensland and New South Wales) a more systematic approach to asset management. In England, national laws requiring the development of local transport plans and the legal mandate to maintain a community's asset base have led to better integration of asset management into local planning and decision making. In many cases, changing governmental accounting rules have also motivated a closer examination of how to assign value to assets.

10. A good asset management program conveyed to elected officials strong stewardship of transportation assets and has been an important consideration in increasing funding for transportation. In other words, agencies have been able to demonstrate the need for additional support, the link between investment and system performance, and the effect on the community of investing in infrastructure (Alberta, New Zealand, and VicRoads, in particular, illustrate this).

11. Statements of intent tie an agency's vision and key goals to LOS or performance measures, providing important vision and accountability points of departure for asset management. These performance measures, most of which do not deal with asset management, are used to assure that agency actions relate to government policies. In the case of asset management, performance measures on the condition, use, and functionality of the transportation asset have been used to monitor system performance trends and the overall effectiveness of investment programs. In England, for example, the asset management approach the national Department for Transport encourages for local governments is based on performance indicators and targets. At the strategic or upper-management level, only the most important information needed for establishing funding policies by agency heads or for monitoring agency progress toward policy achievement was provided. The operating core of the agency often received and produced information on many different performance and condition measures.

12. Asset management has been integrated into the many different corporate or agency planning and policy documents. For example, the scan team found asset management incorporated into strategic policy statements, agency visions, performance measures, asset-specific plans (e.g., state highway plans), tactical operations (e.g., contract specifications for maintenance outsourcing), and job descriptions. Asset management was incorporated into

multiyear planning efforts, often in 1-year, 5-year, 10-year, and 25-year plans. The total asset management approach suggests consistency in agency directions and activities.

13. Some advanced examples of asset management have also begun to integrate asset management principles and activities into a range of agency activities and products not specifically focused on asset management. This reflects the fact that many agencies faced transportation problems similar to those in the United States (e.g., congestion, safety, system operations, environmental quality) and that many nonmajor asset-based solutions (such as operations strategies) are being considered. For example, Transit New Zealand is attempting to link asset management efforts to its environmental policy and at the local level to community quality of life. In England, asset management is supposed to be incorporated into local transportation plans that focus on many different aspects of transportation system performance.

14. It was interesting to note the blurring of what is maintenance and how it relates to asset management for investment decisions. In some cases, periodic maintenance was portrayed as the asset management program, rather than as just one component of such a strategy. New South Wales has incorporated capital renewal projects (which in some cases meant total replacement of existing structures or portions of roads) into its network infrastructure program, a program that focuses on infrastructure maintenance and rehabilitation. The justification for this was that such projects are acceptable as long as road capacity is not increased. Projects that significantly increased capacity were considered part of the formal project development process, often requiring environmental assessment studies.

15. Consistency and cooperation were apparent in some cases among different levels of government in their approach to asset management. National or state agencies worked with local governments to provide guidance and/or participate in user groups. This was especially true in Alberta, England, and New Zealand, and in some cases in Australia.

TECHNICAL APPROACHES AND DATA USE IN ASSET MANAGEMENT

16. Life-cycle costing (also known as whole-of-life costing) has been adopted in each site as the basic approach to program and project costing. Importantly, data identification and collection were targeted to support this approach.

17. In only a few cases was any effort made to conduct technical trade-off assessments among asset categories, and these were heavily based on engineering judgment. Although the scan team looked for examples in which trade-off analysis occurred among different asset categories or among different programs areas (such as maintenance, capital expansion, and capital renewal), it found very few. It was clear that all of the agencies were working toward such a capability.

18. Many officials talked about “optimizing” decisions or “optimization approaches.” In U.S. terms, this means using quantitative analysis techniques to produce the most economically efficient outcome. The scan team believes the term, as used, really meant providing a balanced investment portfolio that reflected community goals and policy desires.

19. All of the agencies used risk assessment in their asset management program. For example, the likelihood of disruption or failure of certain types of infrastructure was made a conscious part of the asset management analysis in New Zealand (subject to high levels of natural disruptions). In Edmonton, a risk or vulnerability measure has been developed and incorporated into the formal project assessment process. In New South Wales, the assessment of

risk appeared to be a driving force in developing the network infrastructure program. In England, risk was used to help prioritize projects. Not surprisingly, the risk assessment associated with a concessionaire's participation in a PPP related to those factors that affected revenue generation, while that for public services tended to relate to safety, public support, and customer service factors. It appeared that the risk assessment approach was also used as a way to educate and obtain asset management buy-in from elected officials. The scan team's sense is that all of the sites visited have more formal risk applications and use them more in asset management applications than do agencies in the United States.

20. Government accounting procedures were viewed in several cases as inappropriate for assigning value to assets and driving asset management decisions. Based on experience in Queensland and England, asset management systems were viewed as much more appropriate to use for asset valuation than straight-line depreciation accounting rules.

21. Defining core purposes of the agency and investment program and determining the necessary technical support structure were considered important first steps in implementing asset management. Piecing together the supporting databases was described as critically important. In this construct, several agencies the team visited viewed data as an asset to be managed and replaced when it no longer served its function.

22. All of the agencies visited are adopting the approach of developing LRSs for database support for asset management. Instead of creating one comprehensive database for all assets under an agency's responsibility, agencies are relying on existing databases (even when they have been developed with different formats and levels of comprehensiveness) to support their asset management programs. In addition, several agencies adopted quality control procedures to make sure that the data collected were high quality. In one example, 30% of the lane kilometers were resampled every year to check the consistency, accuracy, and uniformity of the original data collection. In some cases, agencies are beginning to question the range of data collected and to assess the data's usefulness in supporting the decision-making process. An impressive aspect of the database systems was the wide extent to which the data were available within an agency. Many said that if you have a computer on your desk, you can access the asset management database.

23. Data-collection approaches and technologies are not that different from those used in the United States. The team saw on national networks pavement condition measuring vehicles, falling weight deflectometers, ITS collection of traffic data, use of GIS and Global Positioning System (GPS), use of the International Road Index, etc. Somewhat different from the United States, much more data are typically collected on a range of characteristics (e.g., skid resistance data). VicRoads is exploring the use of on-ground sensors, early warning systems, and nondestructive testing technologies as part of its data-collection efforts. At the other end of the technology spectrum, annual visual inspections of asset condition are conducted in London using clipboards.

24. The experience with deterioration modeling is not uniform across the agencies visited, and in many cases was quite limited. For example, no common definition exists for remaining service life for different assets, and in some cases agency officials questioned what this concept really meant. The experience with deterioration modeling ranges from commonly used software programs to reliance on experience and expertise in determining the most critical investments for preserving or enhancing future system performance.

PROGRAM DELIVERY

25. One of the most important observations from this scan is the importance of incorporating strong asset management principles in PPP agreements when such projects are considered. This was especially true in Victoria and New South Wales, where agency officials described the learning process they went through in subsequent PPP projects to have a better asset management provision incorporated into the concessionaire's agreement or deed. The model that appears to have been adopted in the sites visited was the use of input-output performance criteria as part of the concessionaire's deed that, in essence, guided the asset management strategy for the project. The concessionaire's response was to provide adequate funding in its business model to provide the desired asset management program. This institutional learning process is an important experience for U.S. asset owners considering entering into such arrangements.

26. In all of the sites visited, transportation agencies have used private contracts for delivering much, if not all, of their maintenance and minor capital construction programs. Preventive and renewal maintenance are important parts of a comprehensive asset management program, so the relationship between how and when assets are maintained and the contractors' program responsibilities becomes an important consideration in determining the overall effectiveness of asset management efforts. The key approach was to encourage contractor ownership of asset management in the delivered program. For example, in a performance-based contracting regime, an agency must make sure that the structural integrity of pavements is maintained or addressed when contractors are making maintenance investment decisions. In some cases in which contracts were let before a system of performance management was in place, questions of service quality, asset condition, and price occurred. Agencies in England, which has many years of experience with maintenance outsourcing, appear to be moving to a hybrid strategy of service provision by including owner agencies in service provision partnerships and, in some cases, providing services themselves again.

27. Agencies have made efforts to reach out to public officials and, in some cases, to the general public to convey the importance of an asset management policy. In Edmonton and New Zealand, for example, such outreach has been considered successful in developing support for agency funding. In all cases, the state ministers of transportation have bought into asset management as an important policy focus. In at least two cases (New Zealand and Victoria), focus groups were used to affirm the importance assigned to maintenance and capital renewal program investment. In other cases, focus groups were used to determine the attitudes and reactions of the general public toward the agency's priorities and resource allocation. In Edmonton, an infrastructure advisory committee consisting of important business and community leaders has been established.

28. Australia, New Zealand, and England, in particular, have very active asset management professional associations and user groups, spearheaded by local officials, that have developed materials aimed at both public officials and practicing transportation professionals. The scanning team found impressive asset management outreach material in England and New Zealand. In both cases, the initiatives were spearheaded by local government associations or national working groups (or alliances as they were called). Austroads, Australia's equivalent to AASHTO, is in the process of putting together asset management material, much of which is found in separate reports.

HUMAN RESOURCES

29. An effective asset management program has a strong human resource element. In some cases, an asset management program (and usually private outsourcing of maintenance) was implemented at the same time staff cutbacks occurred. Every agency visited, however, noted that a good asset management program requires capabilities in understanding the data-collection process and what the data mean. When private concessions were used for data collection and maintenance efforts, the owner agencies needed capable staff to manage the contracts. In almost every case, agencies have added staff since their low points in the 1980s and 1990s. Training (see below) thus has become an important human resource support activity.

30. Several agency personnel systems have created positions with asset management in the job responsibilities. As officials in England noted, local government positions for asset management professionals and civil engineers in general are being advertised with only limited success in attracting qualified applicants.

31. In many agencies the scan team visited, asset management training has been an important aspect of their asset management strategy, not only for staff but also for other jurisdictions using asset management approaches. In Alberta, England, New Zealand, and Queensland, in particular, manuals and best-practice procedures have been developed to promote consistency in asset management applications.

APPENDIX D

State Department of Transportation Asset Management Programs

The following descriptions of asset management programs in the various states participating in the forum were prepared before the workshop.

OREGON DEPARTMENT OF TRANSPORTATION

Introduction

The Oregon DOT is responsible for managing billions of dollars in nonlinear assets, such as facilities and fleet, and linear transportation assets, such as bridges, culverts, and roadways. To address the statewide problems of an aging infrastructure coupled with limited resources, Oregon DOT has recognized the need for a more strategic approach to managing its assets.

Oregon DOT has chosen asset management as its strategic approach, has adopted the goals and principles of AASHTO's *Transportation Asset Management Guide*, and is integrating asset management into its everyday business processes and decision making at all levels and across all functions of the organization.

Oregon DOT recognizes asset management as a systematic, strategic, and complete approach to maintain, upgrade, and operate physical assets such as facilities, roadways, traffic control structures, and bridges in a cost-effective way. Through extensive research and in conjunction with asset management implementation, Oregon DOT has learned that asset management is a tool that can be used to manage Oregon DOT assets so that they meet both business and customer needs at the lowest possible cost over the longest possible period. Oregon DOT sees asset management as a means to get the right information to the right people at the right time to obtain the right decision.

Oregon DOT Business Practices (Before Asset Management)

To effectively implement asset management, Oregon DOT performed an assessment of its business practices. Oregon DOT's goal is to move its core processes closer to nationally and internationally recognized asset management best practices. Currently, the following occurs in Oregon DOT:

- The data for many of Oregon DOT's assets are generally collected by program-specific staff residing in many Oregon DOT divisions. The data reside in 60 to 70 different databases. There are also about 92,000 databases in operation at Oregon DOT. Many of these are developed for a specific work requirement, are unsynchronized, and have limited capability for corporate use.
- Assets are referenced using two main reference techniques: by location (i.e., route or highway number, mile point, and offset) and by quantity of components in a specific mile point range (i.e., lineal feet of guardrail between two mile points).

- Many of the data definitions used in each asset data system are for the most part unique to the specific program, and the level of performance analysis varies, depending on program need.
- Predominantly, asset reporting is performed at a business program level for the benefit of the program that owns the data. Summary organizational-level reports are generated manually after contacts with individual program staff.

Identified Gaps (Before Asset Management)

Gaps have been identified that limit and to a large extent define Oregon DOT's current data management processes. These gaps include the following:

- Absence of recognized, widely used, or agreed-on organizational data standards and definitions for some categories of Oregon DOT assets;
- Absence of coordinated organizational data collection efforts;
- Absence of readily available linear asset information to be used in making scoping decisions for highway construction projects;
- Incomplete, not readily accessible, inadequate, or nonexistent location or condition data for all asset categories;
- Absence of analysis tools to manage all of Oregon DOT's assets results in inability to perform or difficulty with performing basic systemwide management functions, such as generating reports by asset or cross-asset category, condition, functional adequacy, cost, etc.;
- Inconsistent tracking of information about physical roadway components that leads to differing levels of management, maintenance, and understanding of current conditions; and
- Inconsistent corporate asset data in terms of collection interval, scale, or level of detail.

Foundation

Much foundational work has already been completed to build, maintain, and improve Oregon DOT's management system and data system structure. Oregon DOT's intent is to build on this existing foundation; use the goals, objectives, and strategies in its approved implementation plan; and move, over time, to a fully integrated asset management system.

Oregon DOT Asset Management Vision and Mission

Asset Management Vision

Asset management is fully institutionalized in Oregon DOT, therefore Oregon DOT's assets are managed strategically by using integrated and systematic data collection, storage, analysis, and reporting standards on a broad range of transportation system assets, optimizing funding and life-cycle decisions for operations, maintenance, and construction business functions.

Asset Management Mission

Recognizing that asset management is a process or methodology that Oregon DOT can use to cost effectively deliver an efficient, effective, reliable, and safe transportation service, the mission of Oregon DOT asset management is the following:

- To put in place the plans, people, processes, and products that enable Oregon DOT to implement accepted asset management practices in a timely and cost-effective manner and
- To continually monitor and improve asset management implementation over time.

We do this so that benefits to Oregon DOT in the areas of accountability, communication, risk management, and financial efficiency can be realized.

Implementation Activities

Oregon DOT has completed, or is in the process of completing, the following asset management implementation items:

- Executive committee structure,
- Tactical (working group) structure,
- Data governance structure,
- Research on asset management best practices,
- Research on data collection and maintenance best practices,
- In-depth assessments of current Oregon DOT management systems,
- Outreach materials such as web page, *INSIDE ODOT* articles, and brochure
- Pilot project in Oregon DOT's Region 2 that will provide a high-level gap analysis of asset feature data availability on selected roadway segments, as well as identify effort and resources required to address the gaps,
 - Communication plan,
 - Training plan,
 - Strategic plan,
 - Implementation plan,
 - Linkage with other Oregon DOT efforts and groups such as Sustainability, Mobility, Information Systems, OR-Trans Project, GIS, etc.,
 - Partnerships with other entities such as the City of Portland, Northwest Asset Management Users Group, Association of Oregon Counties, League of Oregon Cities, and the Oregon Chapter of the American Public Works Association.

Asset Management Implementation Goals

Oregon DOT's Asset Management Implementation Plan contains specific implementation goals, objectives, strategies, and action steps. The intent of these items is to build on the Oregon DOT management systems foundation already in place, to address identified gaps, and to provide direction for accomplishment of Oregon DOT's asset management vision.

Oregon DOT's asset management implementation goals cover three main areas:

- Goal 1 focuses primarily on improving Oregon DOT's corporate asset data, including location referencing, data storage systems, and data collection processes.
- Goal 2 relates to developing asset management data reporting processes.
- Goal 3 focuses on the flow and use of asset information throughout ODOT for optimal decision making.

Oregon DOT Asset Management Core Principles

Oregon DOT has identified a list of core principles that provide a focus for implementation activities. The following are the core principles:

1. Asset management will add value. Any asset management initiative must support Oregon DOT's Vision.

Vision for Oregon DOT was established in 1969 to provide a safe, efficient transportation system that supports economic opportunity and livable communities for Oregonians. Oregon DOT develops programs related to Oregon's system of highways, roads, and bridges; railways; public transportation services; transportation safety programs; driver and vehicle licensing; and motor carrier regulation.

2. Asset management will be done well. National and international best practices will be adopted for Oregon DOT's Asset Management Program. Processes and procedures will be developed and refined to take advantage of these proven methods and to create an asset management system that is responsive and adaptive and that meets changing business needs brought about by new technologies or by federal or legislative requirements.

3. Asset management will build on Oregon DOT's good management system work. Much work has already been done to build, maintain, and improve Oregon DOT's management system structure. This structure and the expertise it represents are vital to Oregon DOT's success. To implement asset management, we will build on Oregon DOT's existing management system foundation and move, over time, to a fully integrated asset management system.

4. Efforts under way to gather or improve Oregon DOT data will be supported. These efforts will be supported and encouraged to move forward. Information on new or developing corporate data policies that support asset management will be made available to current data collection efforts. Every effort will be made to ensure that data collection efforts conform to current data collection policies, processes, and procedures to the maximum extent feasible.

5. Asset management will be part of Oregon DOT's daily work function. The work to support Oregon DOT's Asset Management Program, including data collection, storage, and reporting, will be institutionalized and integrated into the everyday work of Oregon DOT staff. New, innovative, and automated tools will be used to accomplish this work.

6. Asset management will use trusted and reliable data. Oregon DOT's asset management system will contain corporate data for transportation features and their condition that are consistent, unduplicated, understandable, reliable, accurate, current, and owned by the responsible Oregon DOT business line.

7. Asset management processes will be regularly monitored. Performance measures will be used to monitor the effectiveness of cross-asset decision making, data monitoring, trade-off analysis reporting structure, and other key elements of asset management.

8. Asset management will support broad-based funding allocation decisions. Oregon DOT resource allocation decisions across regions, areas, and districts for modes or programs will

be made using the filter of performance-based, life-cycle cost, systemwide, cross-asset information.

9. Asset management processes will allow readily available asset reports. The asset management data reporting system will be fully automated, flexible, and complete. It will reliably perform cross-asset analysis and will monitor the inventory, condition, and performance of linear Oregon DOT assets. Getting accurate reports will be easy and intuitive.

10. Asset management will foster cross-asset communication. Oregon DOT's Asset Management Program will enhance current systems collaboration, coordination, and communication across asset categories. The right information will be available to the right people at the right time to make the right decision.

Oregon DOT Asset Management Next Steps

As stated previously, Oregon DOT has chosen asset management as its strategic approach to manage its wide variety of assets. The next steps to fully implement and use asset management in Oregon DOT include the following:

- Complete Region 2 pilot project and incorporate lessons learned into the Oregon DOT Asset Management Program.
- Continue needed training and outreach to stakeholders.
- Continue with implementation plan activities.
- Continue core principle focus.
- Continue connection and information sharing with key partners.
- Continue to research opportunities in which asset management processes can provide benefits to achievement of Oregon DOT's vision, mission, values, and goals.
- Continue to improve inventory, data management, and analytical tools to improve the quality and timeliness of Oregon DOT decisions.
- Continue to successfully meet Oregon DOT's Asset Management Program goals by gaining approval of a program option package for Oregon Transportation Commission and Legislative consideration that would provide permanent dedicated staffing for asset management initiatives in Oregon DOT starting July 1, 2007.

COLORADO DEPARTMENT OF TRANSPORTATION

Overview of the Investment Strategy Framework for the Colorado Department of Transportation

The Transportation Commission developed the Investment Strategy Framework to provide a better opportunity to use resources more effectively and efficiently. The framework has several key components that enable the alignment of the Colorado DOT's work activities to its organizational priorities as established by the Transportation Commission—in effect, to align the “top” with the “bottom” and the “bottom” with the “top.”

The purpose of the framework is to assist DOT in establishing priorities and assure that these priorities are being implemented, resulting in better service for the traveling public and improved accountability to the general public. A strategic framework (i.e., strategic plan) must

be flexible and practical, yet serve as a guide to implementing programs, evaluating how these programs are doing, and making adjustments when necessary. As such, goals, objectives, and system performance are part of the long-range planning process and the annual budget process.

A key to successful strategic planning is having performance measures that give accurate and timely information. The ultimate aim of implementing a measurement system is to improve the organizational performance of DOT, resulting in an improvement in system performance. DOT intends to use performance measures to continually evaluate progress toward accomplishing its goals and objectives, to determine where improvements can be made in its process, and to readjust work activities accordingly.

The commission has identified the following four major business functions, called investment categories:

- Safety: services, programs, and projects that reduce fatalities, injuries, and property damage for all users and providers of the system.
- System quality: activities, programs, and projects that maintain the physical (integrity or condition) function and aesthetics of the existing transportation infrastructure.
- Mobility: programs, services, and projects that enhance the movement of people, goods, and information.
- Program delivery: functions that enable the successful delivery of DOT's programs, projects, and services.

Originally a fifth investment category was defined as Strategic Projects. Since all strategic projects impact system performance in the areas of safety, system quality, or mobility, the strategic projects category is now identified as a key program area that spans all investment categories.

Each investment category has specific performance objectives and associated measures that provide the foundation for discussion on how to best invest available funds. Performance measures provide tools to relate the expenditures and work results to the policies, priorities, and goals of the department as determined by the Transportation Commission. Performance measures are used on an annual basis as well as on a long-range plan basis to relate expenditures and work results to the desired performance objectives (i.e., the desired result) for the state highway system.

As part of the statewide transportation planning process, the Transportation Commission sets long-range policy direction and allocates resources by program area to one of four investment categories—safety, system quality, mobility, and program delivery—as well as to the Strategic Projects Program.

In support of these investment categories, the Colorado DOT Executive Management Team identified five core service business processes:

- Roadway management: all physical elements of roadway, tunnel, and bridge maintenance activities from curb line to curb line (i.e., roadway edge).
- Roadside management: all roadside [from curb line (roadway edge) to edge of right-of-way] maintenance activities, including rest areas and other off-road facilities.
- System operations: all traveler information and traffic-related activities, including tunnel operations and emergency/incident.

- Snow and ice management: all services and maintenance activities to keep the road open for the winter season, including post-event operations and the reopening of closed roads.
- Project delivery: all activities for the delivery of a transportation project from planning to construction management to final.

An action plan has been developed for each core service. The action plans identify strategies (i.e., what activities are needed to achieve the goals and objectives) and measures to help DOT regions, divisions, and offices align their activities to support the DOT goals established by the Transportation Commission. The investment objectives are influenced by the allocation (appropriation) of funding by program and investment category. The action plan teams will have an ongoing role in monitoring progress toward achieving these goals and objectives.

The next step is to develop work program plans that implement the action plans. These are organization-specific tasks that are identified to align day-to-day work to Colorado DOT’s priorities to accomplish DOT’s goals and objectives.

Figure 4 graphically depicts the process.

Roles and Responsibilities

The Transportation Commission does the following:

- Approves the vision statement, mission statement, and investment category goals and objectives, policies, and priorities.

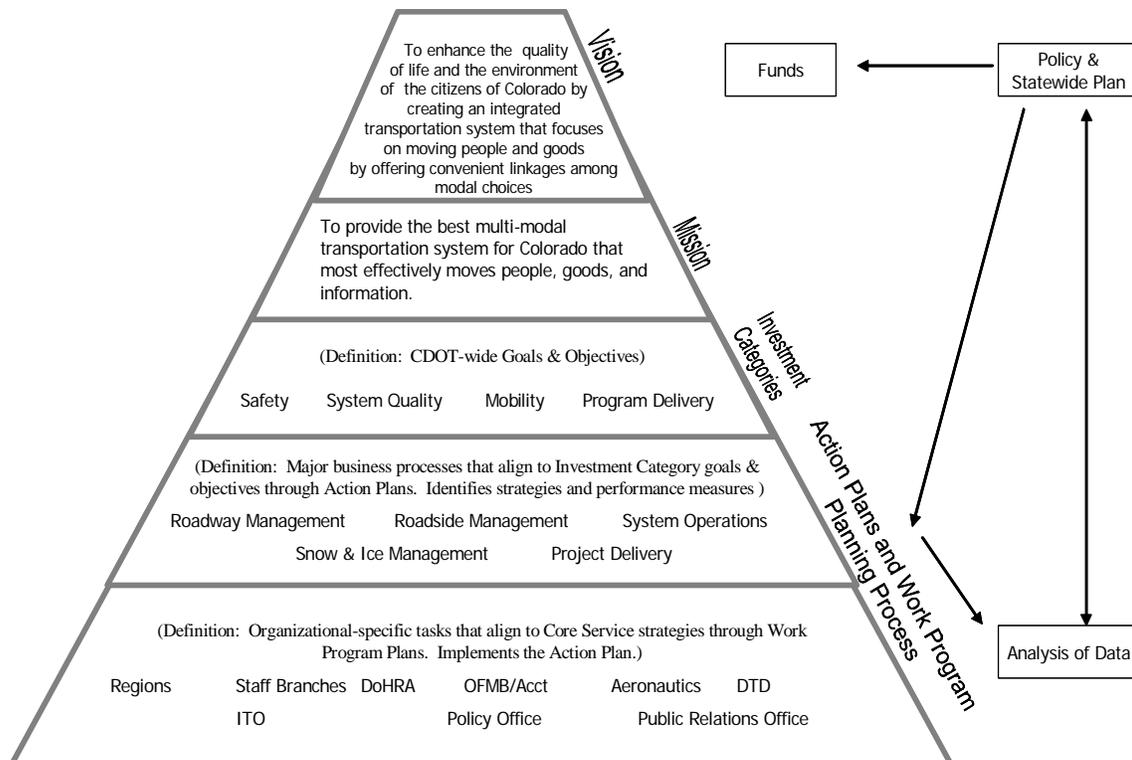


FIGURE 4 Colorado’s asset management process.

- Approves the Statewide Transportation Plan (20-plus-year, long-range plan).
- Approves the STIP (6-year capital investment program).
- Approves the annual budget.

The DOT Executive Management Team (EMT) does the following:

- Identifies core services that define DOT critical business processes
- Approves the action plans that identify strategies and performance measures that support accomplishment of identified investment goals and objectives

Action Plan Teams (consisting of a team of relevant DOT staff) do the following:

- Prepare, for EMT approval, action plans that identify strategies and performance measures to support accomplishment of the goals and objectives

The Division of Transportation Development (DTD) does the following:

- Coordinates development of regional and statewide transportation plans.
- Facilitates action plan teams and development of the action plans.
- Coordinates the collection of data for each performance measure identified in the action plans from the respective data providers.
 - Facilitates quarterly meetings with the action plan teams to analyze the performance measurement data and make necessary adjustments to the core service action plans.
 - Develops quarterly and annual reports to track progress of the core service performance measures, demonstrate accountability, and communicate performance results to all division programs.

Colorado DOT divisions and organizations do the following:

- Each organizational unit in DOT has responsibilities for collecting and reporting to DTD on performance measures.
 - Each organization develops its respective work program plan that aligns with the action plans.

Responses to Specific Questions

1. Do the goals and performance measures correspond to the program's directives provided in statute?

Yes, statute calls for the Transportation Commission and DOT to operate and manage the state highway system and create a statewide transportation plan. Performance of the system, resource allocation, and project prioritization are all supported by DOT's Transportation Investment Strategy.

2. Are the performance measures meaningful to stakeholders, policy makers, and managers?

Some of the performance measures are meaningful to all groups, such as the percent of good or fair pavement. Others are more technical in nature and can be hard to understand for the

layperson. CDOT continually works to review and, if necessary, modify performance measures to provide the most meaningful information to stakeholders, policymakers, and managers.

3. Does the department use a variety of performance measures?

Yes, see action plans.

4. Are the data collected for the performance measures valid, accurate, and reliable?

Yes, data are collected by the appropriate technical area and reported to a central location. The department continually reviews the validity, accuracy, and reliability of performance measures to ensure that we collect the best possible data, given resource constraints and the state of the art.

5. Are the performance measures linked to the proposed budget base?

Yes, performance measures are used to determine the amount budgeted to each investment category and program area. After resources are allocated in the budget, management systems are used to adjust performance targets to what is achievable within the budgeted amount.

6. Is there a change or consequence if the department's performance targets are not met?

When a performance measure is not met, the Core Service Action Teams analyze the problem; determine if a change is needed in process, procedure, or target; and make appropriate recommendations of action required to the Executive Management Team.

OHIO DEPARTMENT OF TRANSPORTATION

A visitor to the Ohio DOT will find no particular program, office, or person that is devoted to asset management. However, asset management at Ohio DOT is deeply ingrained and has been demonstrably effective:

- Bridge deficiencies as measured by general appraisal conditions have been reduced by more than 60%, and Ohio DOT's bridge inventory is in a steady state of 97% of bridges meeting goal.
- Pavement deficiencies on major routes have been reduced by nearly 70%, with 96% of the miles meeting DOT's pavement goals.
- Maintenance deficiencies have been reduced by 82% and are in a continuous state of high condition.

Ohio DOT does not have particularly complex or sophisticated technical systems for most of these assets. It does have excellent inventories of conditions and flexible data warehouse strategies to run ad hoc and standard reports on conditions, down to the county level.

What Ohio DOT does that may be unique is set detailed and explicit goals for system conditions and then budget, plan, and manage personnel so that the condition goals are met. Included in this process are the following:

- DOT allocates funds to each major asset program area in a detailed way, with explicit goals for bridge, pavement, and maintenance accomplishments.
- Deputy directors and other managers are held explicitly accountable during annual evaluations and in quarterly updates to meet their system condition goals.
- District goals are broken down by county, and each county has a widely understood series of maintenance performance measures to meet.

- The department widely publicizes the condition goals and regularly communicates to all levels its progress toward meeting the goals.

These strategies have resulted in a steady decline in system deficiencies and have led to stable and predictable conditions for a predictable level of effort. The key has been to make system condition goals the central focus of budgeting, planning, and human resource activities.

NEW MEXICO DEPARTMENT OF TRANSPORTATION

New Mexico has had an asset management program for many years. We have been measuring the pavement for friction, smoothness, and condition on an annual basis and reporting to the legislature. We have been surveying the pavement and putting together a list of construction projects based on the conditions in the field. The construction program generally has controlled the level of service of the roadway. This is an expensive way to go, so the New Mexico DOT started looking at alternatives.

New Mexico is now switching over to a life-cycle maintenance-based program. The maintenance section, in cooperation with the DOT District Offices, sat down and developed a 5-year cycle for maintaining our pavements. A plan has been developed that touches every piece of roadway within the 5-year cycle, with the greatest percentage of projects being of the preservation type. The projects in the program are based on the condition of the roadway, functional class, fundable category, and traffic loads. We do still have a construction program that is also figured into the plan so that maintenance money is not wasted on a road that is going to be replaced anyway.

The construction, maintenance, and design sections are working toward the same goal. Maintenance plans to start working with the designer of the road to include a sheet in the plans that outlines a projected maintenance schedule. The hope is that as the project is passed on to the maintenance section from the construction section, the maintenance engineer will prepare a maintenance schedule based on the elements designed into roadway. The microlevel projects should be pressed forward to an aggregate macro program on a yearly basis.

Pavement is the most expensive asset New Mexico has in its inventory, other than the real estate that all of our transportation facilities reside on. It is where we are starting and are putting most of the effort. We are also looking at tying other efforts into the 5-year cycle plan. One effort we are looking at is replacing all of the signs adjacent to a maintenance project in which the sheeting has passed its life span or warranty. Another item is to set up fencing and fence tightening adjacent to these projects. More of these corridor- and project-driven efforts will be looked at as we progress.

Bridges do not fall under the maintenance section in New Mexico, so we have not really discussed plans for them yet. It is expected that bridges will probably have a different level of service than a road. The products used in corrosion control, joints, etc., all have a far different life span than a concrete or asphalt pavement.

The data collection portion of our program in New Mexico is performed by contracting with our two larger universities. Each university hired 12 students to work in pairs under the direction of a graduate student to visually collect the distress data. One or two of the university's professors were in charge of the program. New Mexico State University collected all of the data from the southern part of the state and the University of New Mexico collected all of the data

from the northern part of the state. The number of miles was essentially equal. The students collected a representative sample at each posted mile marker for 1/10th of a mile. The information the students gathered is shown in **Table 1**. The students collected data over the whole system over the past summer. The department also fields several crews that collect roughness and skid data on an annual basis.

The majority of our road feature data is collected on a continual basis via the local patrol supervisors. The supervisors drive their inventory of roads daily and enter into our maintenance database all of the features that they or their crews touch.

The level of service is primarily set by the legislature. The department also sets its own standards, which reside in our maintenance management handbook.

We hope this short discussion will give you an idea of how New Mexico operates and where we are headed. If you would like to know more about any of our programs, please contact State Maintenance Engineer Tom Raught at 505-827-5176.

MISSOURI DEPARTMENT OF TRANSPORTATION

The Missouri DOT's mission is to provide a world-class transportation experience that delights our customers and promotes a prosperous Missouri. Seventeen value statements guide behavior and shape decision making at all levels. A quarterly publication, the *Tracker*, documents how Missouri DOT's performance-based system focuses on the customer. It measures Missouri DOT's performance in giving customers what they want for 18 tangible results. Those include uninterrupted traffic flow, smooth and unrestricted roads and bridges, and a safe transportation system. Progress is determined in terms of upward or downward desired trends. Information in its pages guides department operations and determines DOT's overall performance.

A relational database known as Transportation Management Systems holds the majority of the department's corporate-level data. The four key areas included are pavement management, bridge management, safety management, and traffic management.

In addition to the core data items listed above, many additional elements have been developed to enhance our ability to coordinate business areas, track performance, and estimate needs. Additional developments include applications for STIPs, real property, work zones, and billboards.

All data are tied by a common location reference system that combines both linear (log mile) and geospatial (GPS, arc reference) attributes. This allows any data created and maintained

TABLE 1 Data Collected in New Mexico

Asphalt Items	Concrete Items
Weathering and raveling	Corner breaks
Bleeding	Faulting of transverse joints and cracking
Rutting and shoving	Joint sealing
Longitudinal cracking	Lane/shoulder drop or heaving
Transverse cracking	Longitudinal cracking
Alligator cracking	Patching and maintenance
Edge cracking	Spalling and joints and cracks
Patching and maintenance	Transverse and diagonal cracks

in transportation management system (TMS) to be linked. In addition to the data, digital video is available on the entire highway system, linked to all data using the same reference system.

Details have been developed allow data to be stratified down to the level of maintenance areas or specific area engineers.

Many of the most commonly required queries have been provided in menu form. However, the maintenance of all data within TMS allows extremely complex queries of data to be performed by staff with limited computer knowledge.

The uses of the data vary widely. Crash data are located so that individual locations or intersections can be analyzed. Pavement data are stored at very close intervals (every 100 ft, 50 ft for video images) and can be easily added to crash data if desired.

Missouri DOT uses data from TMS to develop performance curves that can predict future needs in the area of pavement and bridges. Funding requirements at a state or district level can be developed and trade-off scenarios examined. The ability to analyze crash data in conjunction with physical features, such as the presence or absence of median guard cable, allows estimates to be made of the societal cost saving associated with decisions on spending between different safety appurtenances.

CONNECTICUT DEPARTMENT OF TRANSPORTATION

The Connecticut DOT is responsible for all modes of transportation in the state and is composed of five bureaus: Aviation and Ports, Finance and Administration, Policy and Planning, Engineering and Highway Operations, and Public Transportation. Aviation and Ports is responsible for one international airport, five general aviation airports, and one port. Engineering and Highway Operations oversees decentralized construction and maintenance operations, along with a centralized design office, Research and Materials Laboratory, rights of way, and oversize-overweight permits. Public Transportation oversees all rail operations along with transit and ridesharing. Finally, Policy and Planning oversees intermodal and environmental planning, along with administering the Metropolitan and Rural Regional Transportation Programs.

Division of Asset Management–Performance Measurement

The Division of Asset Management–Performance Measures was formed in July 2006. Organizationally, this division is located in the Bureau of Policy and Planning, but will interact with all bureaus.

Initially, this division will develop goals and policies for a department-wide strategy to optimize allocation of resources. The strategy will focus on a variety of topics relevant to asset management, including research and design, construction, materials, facility preservation, quality assurance of the infrastructure, performance measurement, multimodal analysis, and defining the most cost-effective methods and strategies for the department's assets.

As a northeastern state, Connecticut is faced with an aging Interstate system, which requires increasing maintenance dollars to keep it serviceable. For that reason, the initial focus of this division will be on roadways and bridges. A PMS and a BMS (Pontis) have existed for many years; however they have not been used to their full potential.

Methodology and Activities

1. The Division of Asset Management will be responsible for developing departmentwide policies, principles, and best practice methods for improving resource allocation and utilization decisions. The division will also provide a key linkage between bureaus to ensure that decisions are based on life-cycle cost analysis and data integration from several resources.

2. The division will compile an inventory from operating bureaus and analyze the condition of all department assets, including but not limited to roadways, structures, capital facilities rail, bridges, ports, rest areas, and commuter lots. This will include the following:

- a. Tracking performance and deterioration,
- b. Determining function and value,
- c. Researching strategic trade-offs among preservation, operations, and capacity expansion,
- d. Choosing materials, construction methods, and preservation and maintenance approaches, and
- e. Monitoring condition to determine if, when, and what type of improvement, repair, maintenance, or replacement activities are necessary to maintain the optimum life of the asset.

FLORIDA DEPARTMENT OF TRANSPORTATION

Mission

Provide a safe transportation system that ensures the mobility of people and goods, enhances economic prosperity, and preserves the quality of our environment and communities.

Plan: FTP

Sets statewide policy guidance for accomplishing the Florida DOT mission. Establishes prevailing principles that guide investment decisions.

Key Performance Measures

Serve as the dashboard to measure the overall performance of the agency in meeting the goals and objectives of the FTP (Figure 5).

Goals

1. Mobility,
2. Economic competitiveness,
3. Preservation:
 - a. Ensure 80% of pavement meets standards (pavement condition survey—ride, crack, rutting),
 - b. Ensure 90% of bridges meet standards (Pontis), and

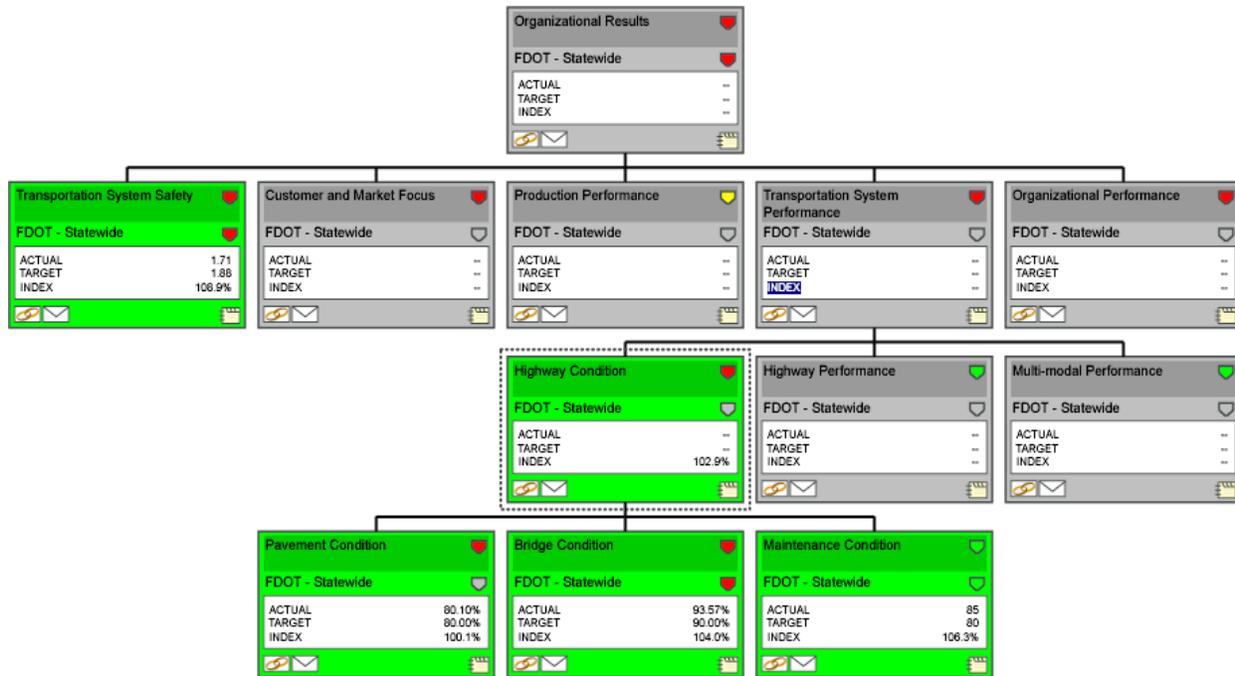


FIGURE 5 Florida Performance Measurement System.

- c. Ensure 100% of acceptable maintenance standard (Maintenance Rating Program MRP 80).

VERMONT AGENCY OF TRANSPORTATION

Introduction

Transportation departments nationwide are struggling to meet increasing demand in an era of declining resources. There are simply too many needs. Revenues into both the federal and state transportation funds are sluggish at best, and the future is uncertain. Departments must do more with less by carefully managing transportation assets to make every dollar count. This is why transportation departments have adopted an asset management approach.

What is transportation asset management? FHWA and the state transportation organization AASHTO define asset management as “a strategic and systematic process of operating, maintaining, upgrading, and expanding physical assets effectively throughout their life cycle. It focuses on business and engineering practices for resource allocation and utilization, with the objective of better decision making based on quality information and well-defined objectives.”

Simply put, asset management is putting limited transportation dollars to work where they do the most good. That means maintaining an aging transportation infrastructure before it becomes unusable. This is common sense, but it is easier said than done and it requires balancing

many competing interests. Departments must consider trade-offs among paving, bridges, new highways, rail, airports, park-and-ride lots, and more. This document will describe the background and status of transportation asset management in Vermont.

Vermont Environment

Vermont is a small state in both geography and population. VTrans consists of 1,300 employees and is centrally managed by a secretary, a deputy secretary, five directors, and a commissioner of motor vehicles. Top management, engineering, information technology, finance, contracting, and legal are all located in one building in Montpelier, Vermont. Because of the small size and central location, VTrans staff is accessible at all levels to employees, the public, and the Vermont Legislature.

Unlike larger states, VTrans does not have autonomous regions that develop their own programs. The state, however, is divided into nine maintenance districts responsible for normal maintenance activities such as snow removal, guardrail repairs, sign replacement, litter, potholes, etc.

Eleven regional planning commissions (RPCs) and one metropolitan planning organization (MPO) assist VTrans planning efforts. Although final project decisions are made by VTrans management, the RPCs' priorities are factored into the process.

The state has an aging infrastructure that must be preserved. VTrans views asset management, quantitative project prioritization criteria, and associated performance measures as a means to get the most out of limited transportation dollars.

The total transportation budget of only \$450 million including the Department of Motor Vehicles (DMV) is highly dependent on federal funding (about 55%). That budget supports the following transportation infrastructure:

- 3,200 two-lane miles of pavement on state roads,
- 2,675 bridges greater than 20 ft in length,
- 10 state-owned airports,



FIGURE 6 US-2 in Danville, Vermont.

- 305 mi of state-owned rail line with 265 bridges, and
- 122 heated and 289 unheated buildings.

Other assets include a fleet of vehicles, park-and-ride lots, rest areas, and ancillary highway assets.

Vermont does not have or need sophisticated ITS systems for managing urban rush hour traffic. The population of the largest city is only 40,000 people in a metropolitan area of about 150,000.

Background of Asset Management in Vermont

Strictly defined, transportation asset management is a tool for making transportation investments in a way that maximizes the value of existing transportation infrastructure, including the ability to predict asset conditions under different funding levels. Electronic databases and computer models are usual features of an asset management system. A broader definition includes all transportation investment and the ability to do comparative scenarios with different levels of funding for all aspects of the transportation system. VTrans has been working with the broader definition (as has FHWA).

Vermont is one of the few states that have asset management and performance measures written into statute. VTrans was involved on a cooperative basis with the General Assembly, the Joint Fiscal Office, and the Legislative Council in developing the wording of the legislation. Statute requires VTrans to do the following:

- Develop an asset management plan, which is a systematic goal- and performance-driven management and decision-making process of operating, maintaining, and upgrading transportation assets cost-effectively.
- Include deterioration rates for infrastructure assets.
- Determine, long-term, the annual funds necessary to fund infrastructure maintenance at the recommended performance level.

Assets mentioned in the legislation are pavements, structures, facilities, construction and maintenance equipment, vehicles, real estate, materials, corporate data and information, and ground and water transportation facilities and equipment. In 2005 and 2006, the Legislature required a quantifiable project prioritization method that assigns a numeric score to projects listed in the annual budget. Those scores must include the project priorities from the 11 RPCs and Vermont's one MPO.

Asset Management Systems

Like many other states, Vermont has “stovepipe” systems that analyze investments within a single type of asset. The status of Vermont's asset management systems are:

- Pavement—computer software for pavement management is widely available. Vermont's Paving Section does an excellent job running Deighton's dTIMS pavement management software.



FIGURE 7 Missisquoi Bridge over Lake Champlain.

- **Bridges**—Vermont uses AASHTO’s Pontis bridge management software. VTrans’ Structures Section measures structurally deficient bridges, but it is working to make more use of the Pontis deterioration models and a bridge health index to plan effective preventive maintenance.
- **Safety**—This is not an asset, but safety and crash statistics are important drivers in project prioritization and selection. In the last 2 years, Vermont has doubled the number of crash incidents collected with a new DMV crash form, education, and a web-based crash reporting form for law enforcement. As part of the Highway Safety Improvement Program, VTrans analyzes the crash statistics and identifies the top 50 high-crash locations in the state. VTrans calculates the benefit–cost ratios of possible fixes, makes appropriate repairs, and monitors the results. Even though Vermont’s highway fatality rate is well below the national average, VTrans continues to work with other agencies to keep that rate low in spite of rising traffic volume.
- **Maintenance management**—VTrans’ Operations Division uses MATS (Maintenance Activity Tracking System) to record most highway maintenance work by location. MATS is being expanded to track inventory and condition of ancillary assets.
- **Central garage fleet and equipment**—The Central Garage must have the right equipment available at the right time, especially for snow removal and emergencies. VTrans uses software from Maximus to track equipment usage and to optimize maintenance and replacement cycles at the least cost.
- **Buildings**—The Operations Division uses facility inventory and condition reporting software to calculate a building health index and to recommend repairs in a priority sequence.
- **Signs**—Traffic Operations maintains a database of 80,000 signs. More than 5,000 signs are replaced annually because of knockdowns, obsolescence, loss of reflectivity, changing federal standards, or as part of paving and construction projects.
- **Aviation**—The Aviation Section uses the Airport Information Management System to identify, prioritize, and track progress on aviation-related projects. Aviation safety is the primary project driver at both the federal and state levels. A consultant is helping VTrans develop an aviation policy plan that will address managing these assets, prioritizing projects, and measuring the results.
- **Roadway construction**—Construction projects that realign a highway, build a new highway, or add lanes are complex and expensive. These multiyear projects typically involve many hearings, right-of-way purchases, and state and federal permits. The Program Development

Division is developing an approach to prioritize roadway projects; however, VTrans has a years-long backlog of projects already under way or promised.

- Congestion management—Many states have highly sophisticated congestion systems to manage rush-hour urban traffic. As a rural state, VTrans does not need a congestion management system at this time. Although congestion is increasing, Vermont is the envy of our urbanized neighbors.

The following are individual asset areas where VTrans is improving its management approach:

- Large culverts greater than 6 ft in diameter/width—VTrans has prioritized several large culverts for emergency repairs. Failed culverts, especially if they are deeply buried, can be expensive, dangerous, and disruptive to repair. An asset management plan that addresses problems before failure can add decades to culvert life and save millions of dollars.

- Small culverts less than 6 ft in diameter—The state needs an accurate inventory and condition rating of the 40,000 culverts on state roads. Highway Operations districts are inspecting and collecting information on culverts and drainage components to better manage this critical asset.

- Rail—VTrans owns 305 mi of rail lines with 265 bridges that are leased to rail operators. The rail operators are responsible for the track and bed per terms of the lease. VTrans is responsible for rail bridges. Bridge inspections and condition ratings are under way so that VTrans can determine needs and prioritize activities on this valuable asset. Currently, VTrans has little information on the economic benefit of rail to Vermont, including the kind of freight, origin and destination, and equivalent numbers of trucks removed from highways. A consultant is working with VTrans to develop a rail policy plan that will address performance measures and asset management.

- VTrans is also improving the inventory, condition assessment, and management of other assets:

- Bike-friendly highways and bike paths,
- Sidewalks,



FIGURE 8 Clearing the rail to Rutland. (Photo by Shaun McGinnis.)

- Ledges and slopes,
- Retaining walls,
- Public transit buses, and
- Rest areas.

Asset Management and Performance Measures

VTrans has developed 33 strategic performance measures, 18 of which are related to the condition of the underlying asset.

Performance measures need targets that are achievable, affordable, and balanced with competing transportation demands. Achieving that balance is a challenge. It implies making value judgments on the relative importance of paving, bridge, bike paths, roadway capacity, public transit, and more.

It is relatively easy to compare similar assets and make rational decisions if the asset has a good inventory, condition rating, and deterioration model. Comparison between asset classes is far more difficult. To help with that comparison, VTrans asked program managers to describe the measure in terms of “good,” “fair,” and “poor” and to define what those terms mean. Those definitions help evaluate between asset classes. The primary determinants, however, are still federal funding restrictions, project momentum, and expert judgment on how to preserve the asset.

The [Table 2](#) is a sample of asset performance measures and targets.

It is easy to choose projects and measure asset performance with a sophisticated computer management system that models deterioration and predicts financial needs. That capability enables VTrans to say, “With X dollars, we will deliver Y asset condition in the long term.” VTrans, like other DOTs, does that well for pavement and bridges but not for the other asset classes. An example for paving for 2006 is in [Figure 9](#).

The above chart relates asset condition in terms of good, fair, or poor to different funding levels over a period of time. Funding levels have little impact in a single year, but have a huge impact in the long term. Note that the chart shows two \$55 million scenarios. One is labeled “Worst First.” Good asset management principles apply the right treatment at the right time to prevent deterioration. That often means paving a highway while it can still be salvaged, even though a nearby highway might be in rougher condition but beyond simple repairs. That is difficult to explain to the public, but it does provide the best value for limited dollars.

Project Prioritization

Before 2005, VTrans had difficulty explaining why one project was chosen over another. “Engineering judgment” is not an acceptable explanation. That situation encouraged “I want my share” thinking, which is not good asset management.

The Legislature in 2005 required VTrans to develop a quantifiable project prioritization method that assigns a numeric score to projects listed in the annual budget. Those scores must factor in project priorities from the 11 RPCs and Vermont’s one MPO. Assets included are pavement, bridge, roadway, traffic and safety, bike and pedestrian, park and ride, buildings, aviation, and rail.

The purpose of this process is to incorporate asset management principles into VTrans’ programs. VTrans strives to minimize long-term costs by using engineering analysis to determine the optimum treatment at the right time. That analysis is tempered by the wishes of the regions most affected by VTrans decisions.

TABLE 2 VTrans Strategic Performance Measures (partial list as example)

Asset–Investment Categories	Strategic Performance Measures	Target
Highways	Pavement condition index based on vehicle miles traveled Percent of miles of pavements rated in “very poor” condition	70 on a scale of 0–100 < 25%
	Number of structurally deficient (SD) bridges (bridges longer than 20 ft)	Fewer than: <ul style="list-style-type: none"> • 21 Interstate SD bridges • 122 state SD bridges • 255 town SD bridges
	Park-and-ride facility condition	Improve facility condition index each year
Rail	Increase in ton-miles of freight	3% increase per year
	Increase in Vermont origin or destination carloads	3% increase per year
Bike–Pedestrian	Mileage of bicycle and pedestrian facilities developed	Develop 4 mi per year
Maintenance	Percentage of state highway centerlines renewed annually	100%
	Complete spring litter cleanup on 100% of state roads by the end of May	100%
	Paint structural steel each calendar year to preserve bridges	780 tons of structural steel
Transportation Buildings	Improve average building condition as measured by the building condition index	TBD
Central Garage	Percentage of vehicles within their cost-effective service lives	85% or more

To get regional and local input, VTrans asked the 11 RPCs and the MPO to establish a priority for each of their projects in the VTrans Capital Program. The RPCs consulted with their associated citizen Transportation Advisory Committee to determine relative project importance from a local perspective.

In parallel, VTrans program managers developed priorities using their engineering systems, asset condition, traffic volume, and other factors appropriate for the asset. VTrans priorities are blended with the RPC priorities to develop a project score. (RPC priorities closely mesh with VTrans priorities. It is not surprising that two groups of intelligent people trying to do the right thing come up with similar results.)

2006 is the second year of the prioritization process. One start-up issue is that some projects are so far along that they must be completed regardless of other factors. This concept is

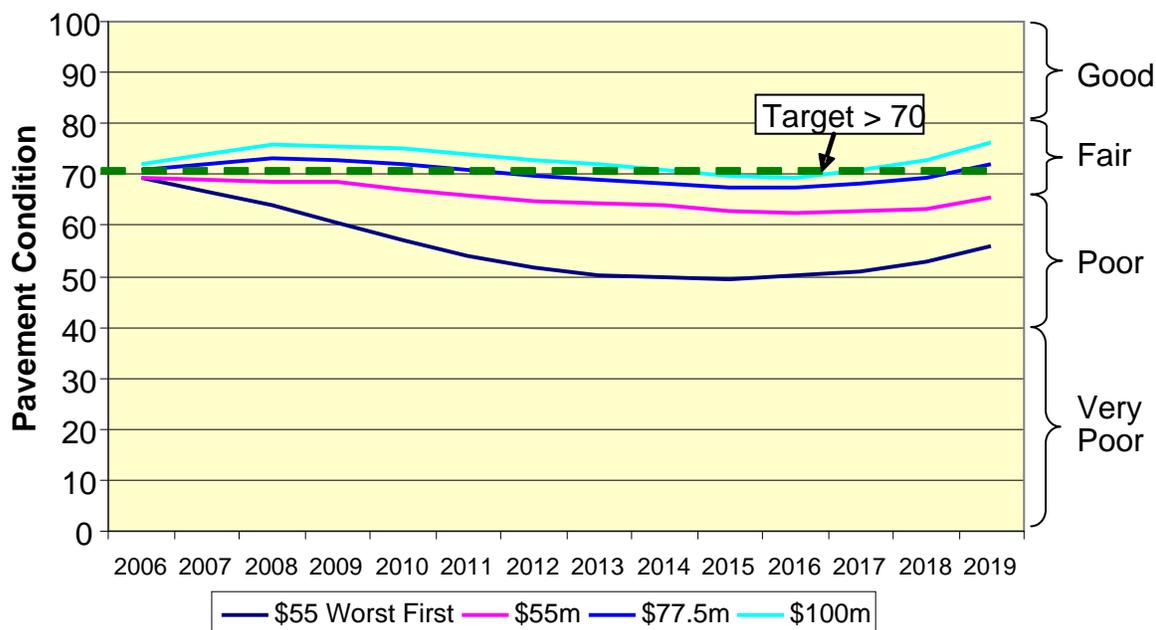


FIGURE 9 Pavement condition at different funding levels.
(Source: VTrans Pavement Management Section.)

referred to as “project momentum.” As old projects are completed, project momentum will be less important when assigning project priorities.

VTrans views prioritization as a crucial step in asset management. Assets such as paving and bridges use sophisticated systems to determine the most cost-effective treatment. Other assets such as VTrans’ 29 park-and-ride lots depend mostly on judgment. The key is to use a method appropriate for the size and complexity of the underlying asset.

Budget Development and Balancing Competing Interests

The budget focuses on maintaining the overall transportation system. This emerges from an asset management and performance management frame of mind that takes a systemwide view of transportation problems and needs. The rationale is to ensure the maximum benefit per dollar of investment, while at the same time achieving systemwide performance goals. There is an explicit link to the annual budget development process as a means to accomplish these goals.

Figure 10 illustrates the main steps in the budget development process. The most difficult step is No. 5—balancing costs with other VTrans needs. Ideally, this would be based on a quantitative scoring mechanism that could compare across asset classes and modes. In reality, decisions are heavily influenced by federal funding modal stovepipes, earmarks, must-do emergency projects, prior commitments, and legislative feedback. Little discretionary money is left.

Another challenge is related to target performance levels in boxes Nos. 1 and 2. Targets must be achievable, affordable, and balanced across asset classes. That balance is difficult to achieve between competing interests.

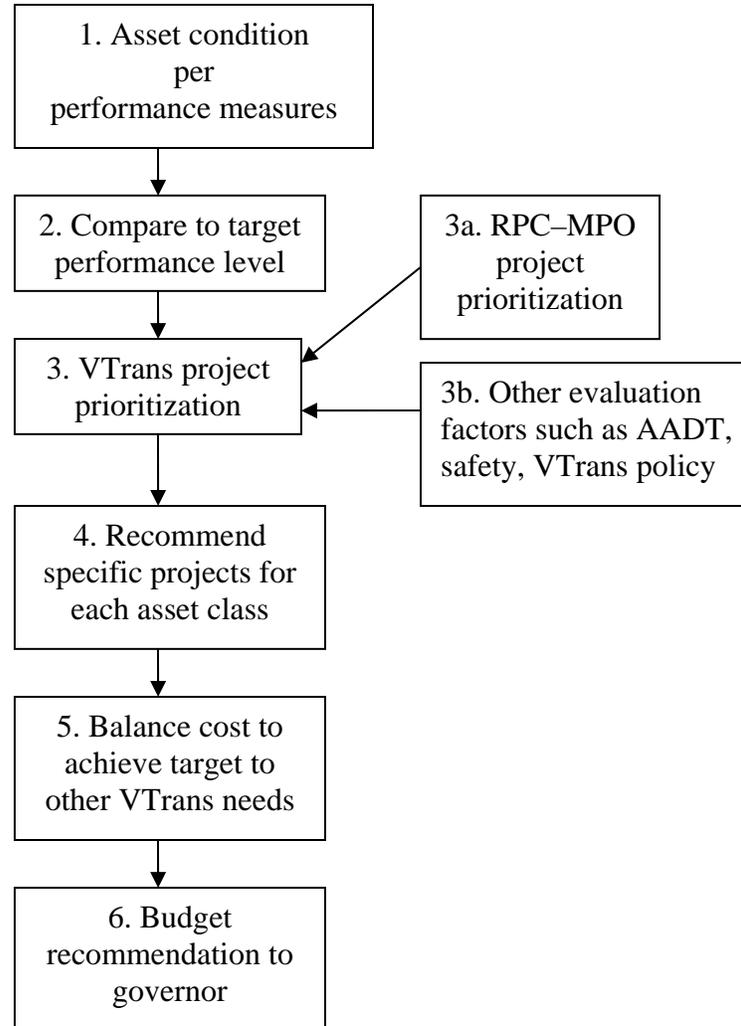


FIGURE 10 VTrans budget development steps.
(Note: AADT = annual average daily traffic.)

The budget document submitted to the Legislature contains a list of projects by program. VTrans believes that stakeholders, including the Legislature, will buy into the process of prioritization, performance measures, and targets. That, in turn, should minimize the number of Legislature-mandated projects.

A Budget Committee of eight managers representing VTrans divisions meets frequently about 6 months before the start of the January legislative session. The secretary's office and the VTrans Budget Section obtain preliminary budget figures from the State Agency of Administration. Program managers, in turn, develop a program that reflects their project priority scoring. The program managers meet with the Budget Committee to explain their program and how it affects the underlying asset and whether it will help achieve the target performance level (if a target has been established). Budget adjustments are made until December, at which time the governor's office gives final budget figures to state agencies and departments. (These figures

use the latest revenue projections from the Transportation Fund and General Fund.) Of course, more adjustments are made during the legislative session starting in January.

One important step is determining the relative size of each transportation program across modes. For example, for Fiscal Year 2008, money is shifting to Interstate bridges from several other programs. These decisions are based on the overall asset condition, performance measure, and institutional knowledge. As a small, centralized DOT, VTrans is in a reasonable position to make qualitative judgments. However, a more scientific, engineering approach would make decisions easier to explain. The overall approach is still under development and will certainly improve over the next few years.

Next Steps

- Review or establish target performance levels for each asset class. Targets must be achievable, affordable, and balanced across asset class. These are high-level decisions that must reflect VTrans and state policies and preferences. For example, what is the relative importance of paving, rail, bridges, Interstate bridges, etc.?
- Analytical tools need a common repository that can link assets by location, condition, value, and usage. The VTrans Information Technology Section is working on an integrated data warehouse that will improve on those linkages. This will also drive on-time and on-budget performance reporting for projects. Nationwide, DOTs are developing dashboards to report their performance by state, county, town, and project. A comprehensive database that is frequently updated is crucial to accurate reporting.
- Performance measures need to be brought down to operational levels. These measures must support VTrans' mission, vision, and objectives. The agency's mission, vision, and objective statements are being rewritten and are scheduled to be published in early 2007.
- VTrans is developing policy plans for rail, aviation, and public transit. These plans will address the project selection process and performance measures. Rail is of particular importance because of the asset value and financial commitment to operate 305 mi of rail line with 265 bridges.

In conclusion, transportation asset management is part of the VTrans culture. VTrans has made excellent progress in the last 5 years, but asset management and performance measures are an ongoing effort. VTrans and other DOTs are faced with deteriorating infrastructure that must be maintained with fewer dollars. Good stewardship requires that VTrans maximize the use of limited funds through a transportation asset management approach.

APPENDIX E

Follow-Up Questionnaire and Responses *Transportation Asset Management Executive Workshop*

We do appreciate your coming to the Transportation Asset Management Executive Forum and participating actively. As we said, we would like you to answer a couple of questions:

1. What new idea, concept, or approach did you learn that you will try in your organization?

Abigail McKenzie, Minnesota DOT: I heard a more detailed discussion of Ohio's approach to tying performance appraisals to infrastructure management, including more concern about culverts and edge drains than I've previously heard.

Tim Lattner, Florida DOT: I recognized the importance of communication between the different sections within the organization or "silos," as they were called. Each section or silo needs to be aware of what the others are doing to ensure that all are working toward improving and preserving the system for the long term. A short-term gain for one section (construction) may be a long-term loss for another (maintenance). Having an asset management program will ensure that the communication is occurring and will show how decisions by one section affect the other sections and in the end will allow for the best overall decision for the department in the long term.

Christie Holland, Florida DOT: I liked Ohio's pay-for-performance concept.

Denise Jackson, Michigan DOT: We are very much interested in improving Michigan DOT's capability to conduct asset management trade-off analysis; therefore, we will be following up with Missouri to explore the tool that was demonstrated at the executive forum. I appreciated the opportunity provided to Missouri to showcase one of their recent developments that might help others, especially those states that have been involved in asset management for awhile. Within Michigan, there are opportunities throughout the year to communicate our progress toward system condition goals and how asset management has benefited us in improving system health. In an era where there is not enough money to address all deficiencies, the Missouri tool may be an effective communication tool that we could use to help engage the state Legislature, State Transportation Commission, and department leadership in investment trade-offs and their impacts.

Don Hillis, Missouri DOT: I liked the remaining life analysis by Michigan. As you recall, they had maps showing the remaining life of their pavements over time and the impact of increased investment. That would be a good tool to explore for use in Missouri. Currently, we look at condition of roads and present that visually on a map.

Kim Schvaneveldt, Utah DOT: Ohio talked about holding district leaders accountable for the performance results of their respective systems. While this idea is not new to us, we will put more effort into district accountability and cascading responsibility downward in individual

performance plans. Another thing we've talked about but not started yet is the need for a political and public outreach program to educate in the philosophy we follow. Better understanding by all stakeholders will lead to better credibility and support.

Tim Raught, New Mexico DOT: I was extremely interested to know that some states are getting a return out of the asset management programs in as little as 4 years. When we started down this road, we came up with a preliminary guess of about 10 years. I also plan to steal Pete Rahn's (Missouri's) spreadsheet idea for use by our management while telling our asset management story to the public, legislature, etc.

George Gerstle, Colorado DOT: The spreadsheet approach used to conduct trade-off analysis presented by Missouri may have some applicability in Colorado. In addition, incorporating long-term maintenance, operations, and reconstruction costs into the decision to expand the system is something Colorado needs to make some progress on.

Bart Selle, Vermont Agency of Transportation: Marketing asset management to the financial decision makers is extremely important. Most legislators understand the need to maintain assets and the "pay me now or pay me a lot more later" effect; however, sometimes that falls by the wayside when they see a list of projects by location. Although meaningful performance measures are important, those alone aren't enough. Presentation of trade-offs in an understandable format is equally important. It seems to work for Missouri. We will look into their approach. Like other DOTs, we want to improve how we use asset management, performance measures, and targets to drive budget choices. We want stakeholders to focus on the transportation network instead of individual projects. Marketing is an important part of that.

Len Evans, Ohio DOT: I have recognized the importance of senior leadership support for transportation asset management and the need for the continual education of these and other key decision makers. Our agency is anticipating changes in government leadership and must make the case to keep asset management a priority. This may be difficult due to the lack of excitement associated with preserving facilities that are already in place and expected to function in perpetuity. The lack of accomplishment associated with preserving these assets may shift the attention of new leaders to other prominent interests. It will be our obligation to educate these new leaders about the successes that have already been realized in regards to this form of management and the benefits derived from the successful application of the core asset management principles.

Tim Gilchrist, New York State DOT: We should resolve to get the process of implementing back on track and ensure a coordinated, simple approach. We should worry less about goals than trends.

Lou Adams, New York State DOT: Our modernized maintenance asset management application is now a few months into production usage. Ohio's work in cost and productivity accounting is of interest in this context. To date, our lack of work history records has hindered our analysis of asset deterioration and especially the impact of maintenance actions on assuring that the service lives of assets are achieved.

Lacy Love, North Carolina DOT: Many good themes came out of the strategic workshop. First of all, we in North Carolina have done a good job of identifying what our current conditions are, but we've not used our management tools to project what the future condition of our system will be in based on an investment strategy (i.e., what will our transportation system look like in 5 or 10 years based on various funding scenarios?). That leads to a tool like Missouri DOT's, Michigan DOT's, or Ohio DOT's on future condition based on funding strategies. Additionally, I was interested in Utah DOT's *Good Roads Cost Less* report. We need to do a better job of documenting what we've done and what we're going to do in a more formalized manner. Several states have done a good job of this and will provide a good source of reference. Also, we have asked Gordon Proctor from Ohio DOT to attend our Maintenance Conference in March and April of this year to talk about the Ohio DOT experience.

2. What idea, concept, or approach helped you reinforce the current approach to asset management in your organization?

Abigail McKenzie, Minnesota DOT: In the overview session, the emphasis on setting performance goals and integrating your asset management approach into your performance-based planning approach is consistent with Minnesota DOT's approach.

Tim Lattner, Florida DOT: The use of performance measures as a core concept in implementing asset management. Their use to measure how well the department is performing and to help communicate this to all the sections within the organization as well as to others outside the agency who are interested adds a great value. Put simply, what gets measured gets done.

Christie Holland, Florida DOT: While some states are leaders, there were a number of common themes and observations and struggles expressed by all. Decisions should be based on accurate data, sound engineering and economic analysis, and improved decision making supported by performance-based goals. Performance measures, appropriate levels of service, trade-off analysis, and life-cycle performance should be used to support decision making. We need to avoid "worst first" prioritization and do the right thing at the right time. We need to address political pressure to do capacity instead of preservation.

Denise Jackson, Michigan DOT: Although there may be some individual differences in the way asset management is specifically applied in each of the states attending, it was encouraging to see that strategically the asset management concepts are very similar. It was evident that leadership—a champion—is important to successfully move from an organization focusing on "worst first" to one that embraces the asset management approach. The idea of starting simple, but getting started, was a key message that could benefit those states that might view asset management performance measures as a daunting task. Goals and performance measurement establish the foundation for success.

Don Hillis, Missouri DOT: I appreciated the discussions about the importance of the trade-off analysis and performance measures. The interest we have received in our trade-off analysis tool

has reinforced the value in being able to visually display the trade-off when choices are made. We have room to improve, but I feel pretty good about where we stand with asset management.

Kim Schvaneveldt, Utah DOT: There was a lot of interest in the idea that good asset management leads to more credibility, which in turn leads to more funding. We have been having success in this area; this seems to be a universal principle understood by those in attendance. Even though it wasn't discussed at the forum, there was a lot of interest in the beginning about how to do cross-asset analysis. We have that capability and have successfully performed cross-asset analysis between bridges and pavements. The same principles apply to any asset.

Tim Raught, New Mexico DOT: Recently the New Mexico DOT moved the pavement condition measurement folks under me. This generated a bunch of consternation from the unit they came from. It was reassuring to me that the measurement and the practitioners are side by side in several of the other agencies. I strongly believe that if you don't have a cause-and-effect analysis going on, you will get nowhere with your program!

George Gerstle, Colorado DOT: The need to link performance measurement and asset management decisions to employee and performance management is critical to incorporate into ongoing decision making. In addition, the organization needs to clearly define why it is doing asset management. Is it to increase credibility with the public and legislature or to optimize management of the system? The terminology, structure, and orientation of the program will be different, depending on the objective.

Bart Selle, Vermont Agency of Transportation: The approach must be appropriate for the DOT. Small, highly centralized, rural DOTs have different problems than large DOTs. Vermont is on the right track with a quantifiable project prioritization system that will help explain our recommendations. The VTrans budget submitted to the legislature contains a detailed list of specific projects, but now each project has a priority score. We hope our project recommendations will be accepted with minimal changes.

Len Evans, Ohio DOT: The forum reinforced the importance and universality of the asset management concepts. Although applied in many different ways, the core concepts were fundamental to the way transportation agencies should be run. Communication through simple but effective performance measures is one way to succeed in effecting significant change in a relatively short period of time. Although the application of performance measures is an iterative exercise, there have been few examples in which this effort did not make a difference when outcomes were evaluated. An emphasis on effective performance measurement must continue, as well as increased benchmarking both internally and externally to identify and deploy effective transportation practices.

Tim Gilchrist, New York State DOT: Continue using the biennial program update process as a framework for asset management implementation. Even consider doing it more often than biennially, especially for the maintenance program.

Lou Adams, New York State DOT: Our work on multi-operator mode, neutral customer-focused performance outcomes will continue in the context of transportation dashboard reporting, both to agencies that provide transportation facilities and services and on the Internet for anyone to use. In the context of our biennial transportation program update process, our regions continue to clamor for trade-off analysis technical tools. We will continue to focus on a common measure of economic efficiency as the means by which trade-off analysis can be implemented.

Lacy Love, North Carolina DOT: I think the theme that continues to come out loud and clear is having a way to quantify the condition of the North Carolina transportation system and a way to communicate it effectively with our stakeholders. Then a conscious and intelligent decision can be made based on all the information. We are in the process of developing performance measures for system operations, maintenance, and preservation. We will continue to work on these and refine them as we learn and gain more experience. Also, to evolve to an asset management organization requires support at the top, a strategic plan, a communication and educational plan, and a team approach. It cannot be a centralized effort, but has to be a broad-based initiative based on inclusion of management, staff, and employees.

3. This is the fourth in a series of strategic forums to accelerate innovation and exchange ideas. Share with us your thoughts on the concept and any suggestions on how we might improve the technique.

Abigail McKenzie, Minnesota DOT: You began to ask about the next steps each state would take, but it might have been stronger if there had been a more formal process for discussing this (i.e., brainstorming, organizing, prioritizing actions).

Tim Lattner, Florida DOT: As this was my first strategic forum on asset management, I believe the format of allowing open discussion and exchange of ideas is the best format, as you get a chance to better understand the challenges and experiences faced and how to best implement the program.

Christie Holland, Florida DOT: This was my first opportunity to participate in a strategic forum. I thought it was an informative workshop.

Denise Jackson, Michigan DOT: There was value in having leaders from all disciplines, including engineering, planning, maintenance, and finance, share ideas and engage in open discussion. This forum provided an opportunity to not only hear about what peer states are doing and to assess our experiences against theirs, but also to hear what is happening at the international level. The international experiences are important to continue to share with others. I would encourage you to try to engage the other states that were not in attendance by continuing to have forums, TRB sessions, peer state visits, newsletters, and web communications. For asset management to become an integral part of a transportation department's processes, it must be championed by the leadership but also be part of the day-to-day operations. Therefore, I would suggest that all disciplines and levels be exposed to asset management concepts.

Don Hillis, Missouri DOT: I like these forums. They are much more conducive to discussion because only a few people are there. I think we need to leave the forums with a clear action plan to further spread the word within our own organizations and within our industry.

Kim Schvaneveldt, Utah DOT: It was a good idea to have the top transportation leaders from each agency in attendance for their education, understanding, and support. Probably that is why the forum was only scheduled for 1 day. The 1-day time allowed did not allow for deeper understanding of where each state was and what detailed best practices we could learn from each other.

Tim Raught, New Mexico DOT: I like your approach to spreading the news on a given subject. The one change I would make would be to hold this meeting in one of four states you had doing a presentation and have a follow-up to the meeting where the attendees do a field trip to see firsthand the innovation discussed. Thanks for inviting me. Though it is often not quantifiable, it is nice to get a feel for the status of similar programs in other states. That way you know whom to call.

George Gerstle, Colorado DOT: In addition to these executive management-oriented sessions, which are useful, more in-depth, program management-level sharing and discussion sessions would be useful.

Bart Selle, Vermont Agency of Transportation: The concept of accelerated innovation and the forum are excellent. You carefully chose speakers who shared different, but relevant, experiences. One suggestion is to allow more time for networking with other attendees. That's one of the most valuable parts of the forum. The reception the night before was excellent, but some attendees didn't know about it until after they made their plane reservations. It was very gracious of Shirley Ybarra to open her home to us, but you might not have a generous invitation like that at every forum. If not, have a reception at the hotel the evening before. It's good to meet a few people before the forum starts. The discussions at the end of the day were excellent, but we could have gone on for another hour. Expand the message beyond the 15 states represented at the forum. Focused webinars are worth trying, even though questions and conversations are awkward over the web. Maybe a follow-on at the asset management conference in New Orleans would work, too.

Len Evans, Ohio DOT: I felt that the strategic forum provided an opportunity for some open discussion on the topic area. Committed leadership is important for effective changes to occur and this forum provided the opportunity for leaders to evaluate their experiences and the experiences of others. Accelerating innovation needs momentum as well. Future events and exchanges should be advertised to past attendees to continue progress. I would encourage the use of focused webinars assisted by process or committee owners in FHWA or TRB to sustain and build additional momentum for this and future strategic forum topic areas. Thanks to the forum hosts and attendees for making this happen.

Tim Gilchrist, New York State DOT: Just keep talking at national forums. Gradually you will be able to change the culture of the states that were not selected to participate this time. Explain asset management like Ohio did, as an extension of the quality effort.

Lou Adams, New York State DOT: I appreciated the pairing of an executive with a technical manager for the forum. The common experience provides an incentive for more dialogue between those with the strategic and the directing levels of responsibility in NYSDOT. As AASHTO reaches out to the 35 states that were not present, I would encourage simultaneous communication at the technical and executive levels as a means of accelerating adoption of asset management principles and practices.

Lacy Love, North Carolina DOT: The executive workshop is an effective tool to bring a group of people together for an intense focus on asset management. However, a topic this important should not be confined to the 15 state agencies that were able to attend. Some thought should be given to doing this on a regional basis. There are other states that would benefit from hearing the same information shared in this one, but didn't have the opportunity to attend. Other states are probably struggling with the same issues and problems and are searching for a better way of doing business, but don't have the knowledge or experience that the 15 states that attended the workshop do. And while the workshop was a good start, the bigger challenge is: Now what? How do we keep the momentum going?

APPENDIX F

Presentations

This appendix contains the PowerPoint presentations from the workshop:

- Highway Performance Measurement and Integrated Asset Management in Alberta, Canada;
- Transportation Asset Management Planning in the United Kingdom;
- Integrated Asset Management: Some Thoughts from New Zealand;
- Melbourne CityLink, Australia, Asset Management;
- Asset Management: What Is It and Why Should You Care?
- Asset Management: Current Status, Next Steps;
- Asset Management: From Strategy to Reality;
- Improving Internal Decision Making and System Performance; and
- Michigan's Perspective.



Highway Performance Measurement and Integrated Asset Management in Alberta

Presentation to Strategic Workshop for DOT Executives
Transportation Asset Management

Rob Penny, P.Eng.
Assistant Deputy Minister
Alberta Infrastructure & Transportation
Alberta, Canada

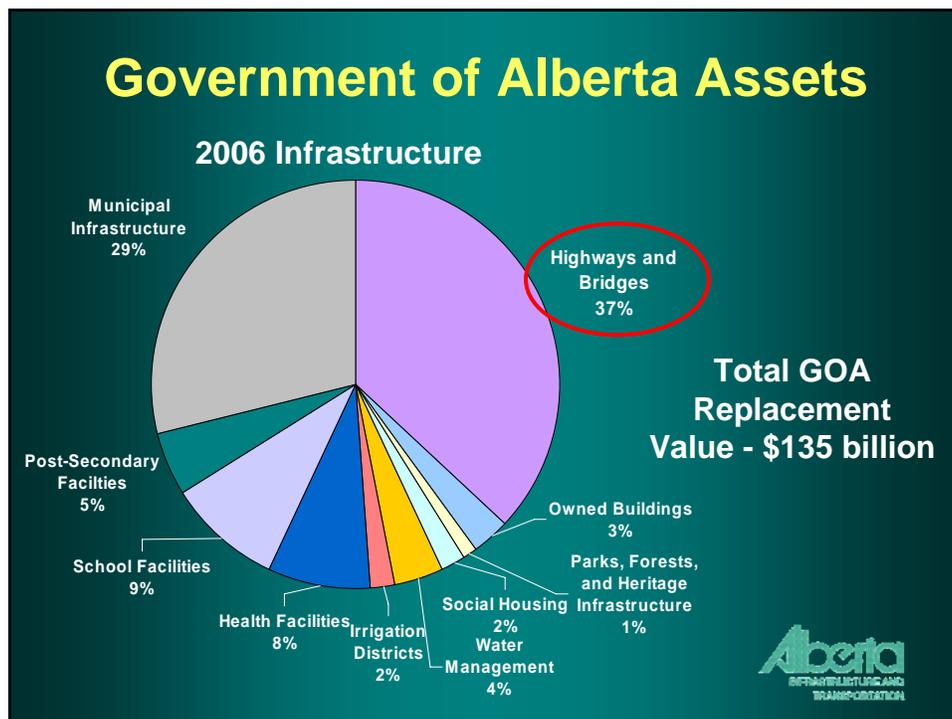
Dec 13, 2006
www.infra.gov.ab.ca



Alberta

- Area: 661,190 sq km (approximately the same size as Texas)
- Population: 2,974,807 (2001)
- Department is responsible for both buildings and highway infrastructure





Highway & Bridge Assets



- Estimated 2006 Replacement Value: \$ 50.7 billion
- 26,520 km of paved highway (16,480 mi)
- 4,340 km of gravel highway (2,700 mi)
- Outsourcing (mid 90's)
 - Primary role of the department is to manage the highway network
 - Design, construction supervision and maintenance are outsourced to consultants and contractors

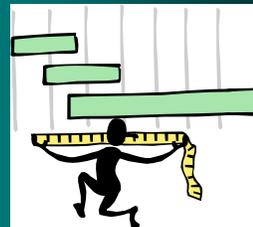
Capital Planning Initiative

- To ensure effective and innovative capital planning and funding of government-owned and -supported infrastructure.
- Funding for highway infrastructure must compete against funding for other infrastructure types.
- Three key performance measurements across infrastructure types:
 - Condition,
 - Functional adequacy, and
 - Utilization.



Performance Measures for Highways

- Condition
 - % good, fair, or poor based on roughness
- Functional Adequacy
 - % functionally adequate that meets geometric standards (width, horizontal alignment), appropriate surface type, and no weight restrictions
- Utilization
 - % of network properly utilized



Annual Business Planning

- Performance measures are linked to business goals.
- Predictions are identified in the 3-year business plan:
 - Anticipated outcomes: based on approved budget;
 - Optimal targets: ideal targets based on unconstrained budget.
- Actual performance measure results are published in the annual report and are compared against targets set in business plan.



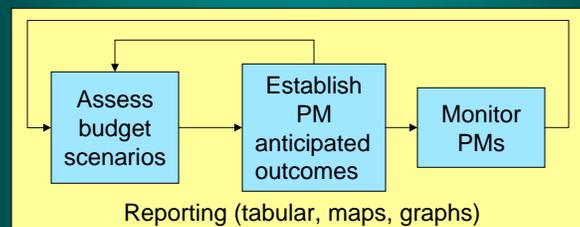
Monitoring Actual Performance

- Data are collected and updated annually:
 - Accuracy and consistency of the data collection is critical to properly analyze trends over multiple years.
- Quality control is critical.

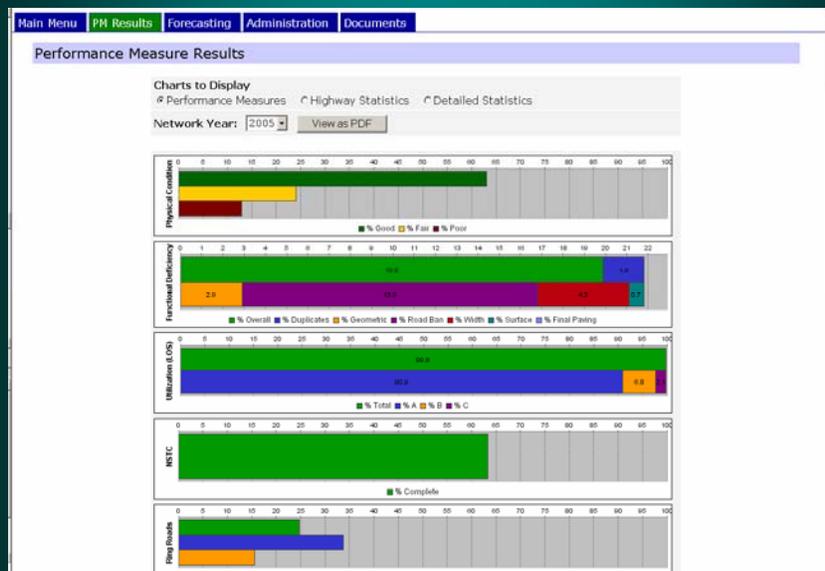


Network Performance Evaluation Decision Application (NPEDA)

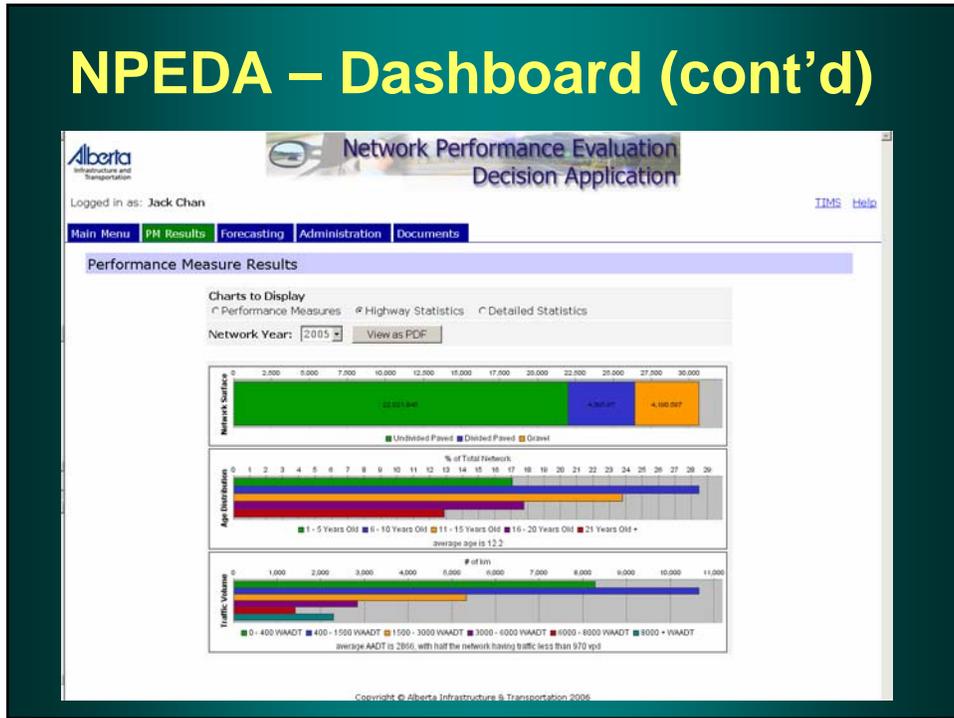
- Custom application which does performance measure calculations and analyses.
- Evaluates and develops tentative budget scenarios based on performance measures.
- Calculates and reports results and anticipated outcomes.
- Monitors the performance of the entire network and individual highways throughout their life cycle.



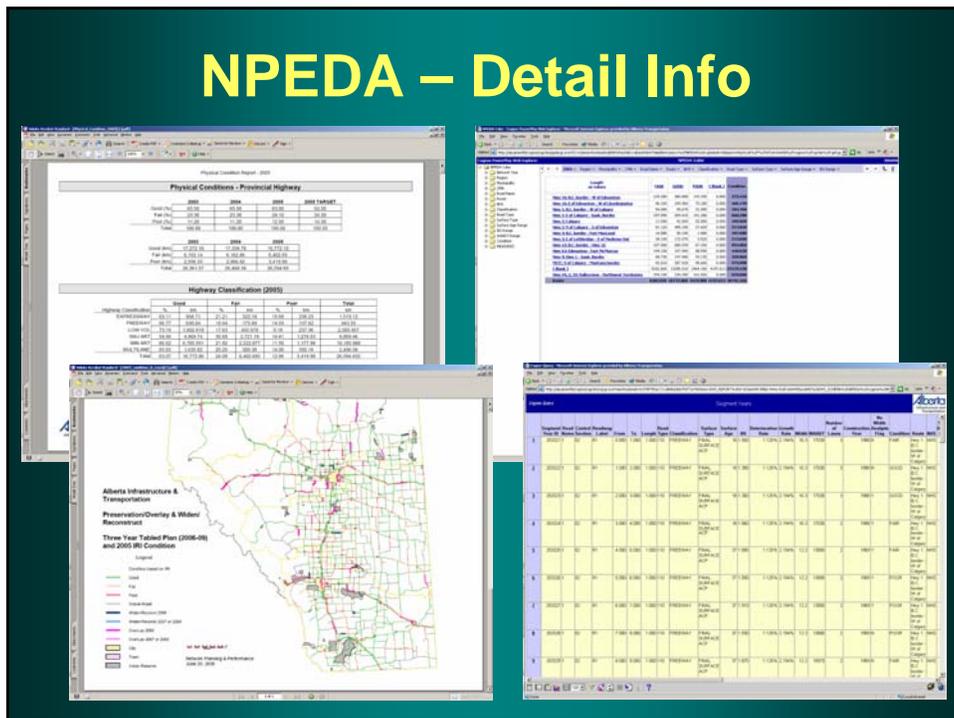
NPEDA – Dashboard



NPEDA – Dashboard (cont'd)



NPEDA – Detail Info

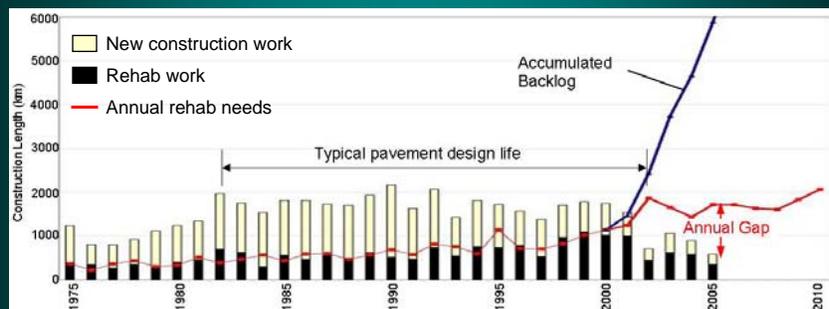
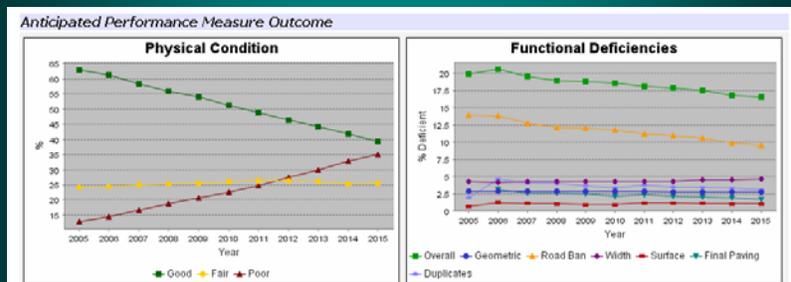


Evaluating Current Budget

- Anticipated outcomes are calculated during business planning phase:
 - Based on the approved budget and projects that are being scheduled over for the next few years.
- This allows the application to analyze each individual project impact on the overall highway system.



Anticipated Outcomes

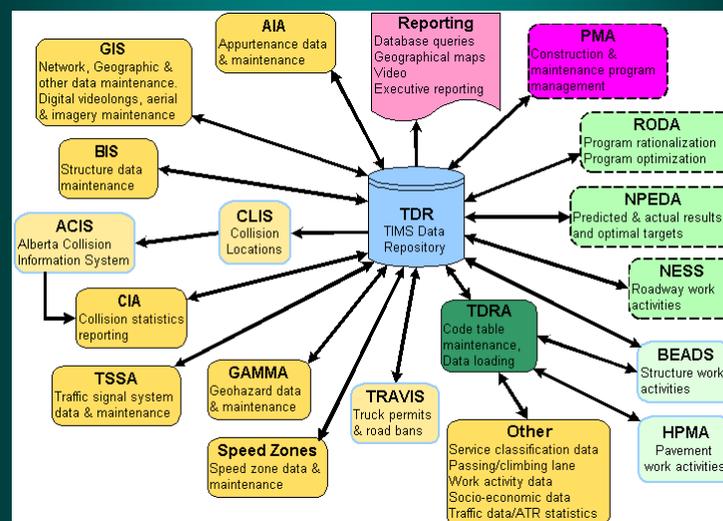


Transportation Infrastructure Management System (TIMS)

- 20 applications (inventory and expert systems) that enable comprehensive information retrieval and analyses.
- Uses a common database to share data across different work units.
- Expert systems:
 - HPM: Highway Pavement Management Application
 - NESS: Network Expansion Support System
 - BEADS: Bridge Expert Analysis and Decision Support System
 - NPEDA: Network Performance Evaluation Decision Application
 - RODA: Rationalization and Optimization Decision Application



“Harnessing knowledge for excellence in transportation asset performance”



Future Direction

- Fine tune data collection processes and standardization aspects.
- Fine tune existing performance measures.
- Develop additional performance measures where required (e.g., bridge, congestion).
- Continue with implementation of applications in TIMS.
- Provide input from TIMS to the department's long-range plan.



7th International Conference
on Managing Pavement Assets

ICMPA
CALGARY, CANADA 2008

**“Preserving what we have...
Investing in the future ...
Finding the balance”**








<http://www.icmpa2008.com>

June 24 – 28th 2008

TRANSPORT ASSET MANAGEMENT PLANNING IN THE U.K.

Presentation to
Strategic Workshop for DOT Executives
Transportation Asset Management

by
Paul Hardy, exp consulting
December 13, 2006

National Academy of Sciences Lecture Room,
2100 C St. N.W. Washington, DC., USA

exp | consulting

Overview

- Context
- History
- Status
- Future

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Overview

•Context

- History
- Status
- Future

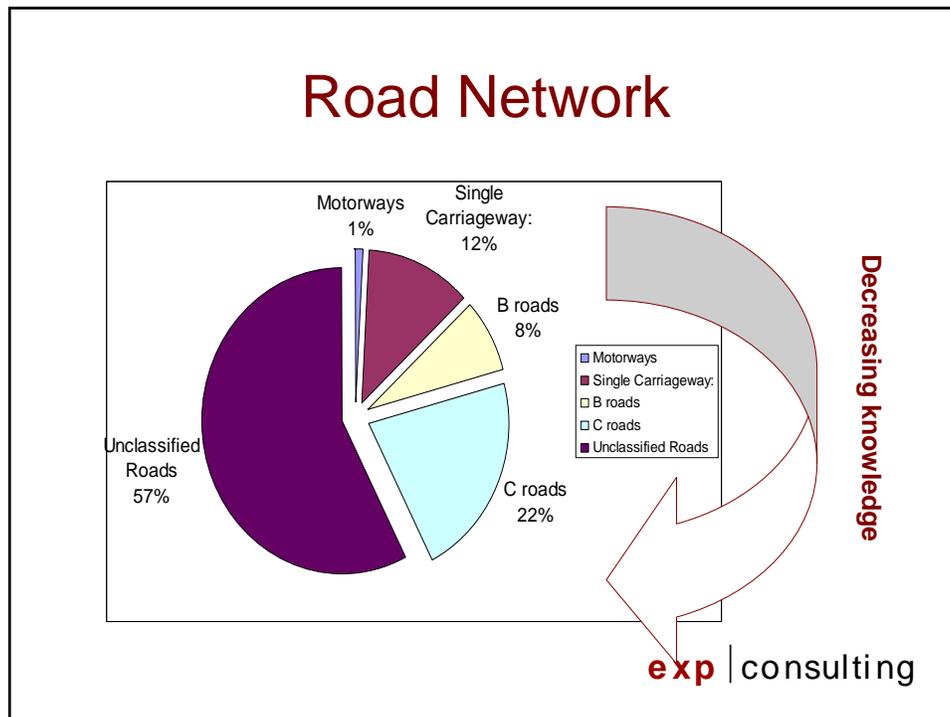
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UK

	USA	Canada	Australia	NZ	UK
Population (million)	285	31	20	4	60
Area ('000 sq km)	9,809	9,970	7,688	286	230
People per sq km	29	3	3	14	261
Road Length ('000 km)	6,378	1,409	810	92	372
Persons per km of road	45	22	24	43	160
Vehicles per km of road	0.65	0.14	0.11	0.32	1.62

Source: Austroads Road Facts 2005

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UK: Road Administration

England:

- Strategic Road Network:
 - The Highways Agency
- Local Road Network: Councils
 - 34 county councils
 - 35 metropolitan authorities
 - 48 unitary authorities

London:

- TfL and 33 London boroughs

Scotland:

- Trunk road agencies
- 32 unitary authorities

Wales:

- Trunk road agencies
- 22 unitary authorities

Northern Ireland:

- Northern Ireland road service

Variety of service delivery arrangements from

- In-house resources to
- Full outsourced service delivery

Increasing use of single “brand” partnered service delivery for local authorities

Asset management is a retained highway authority function



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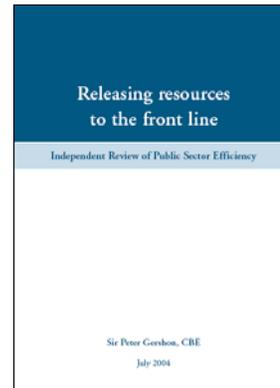
Political Agendas: Gershon

“...to consider the scope for efficiency savings across all public expenditure...”

Agreed public sector efficiency saving targets for 2007–2008

Transport	£785m
Local Government	£6,450m*

(*35% derived through procurement in other services (for example ... **highways maintenance** and waste).

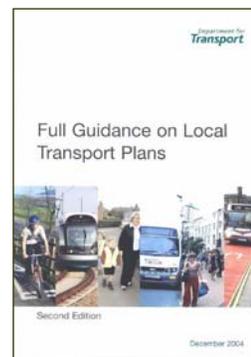


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Policy: Local Transport Plan 2

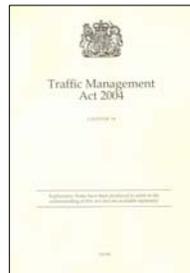
Shared priorities:

- Congestion
- Accessibility
- Safer roads
- Air quality
- Other quality-of-life issues



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Traffic Management Act



Aim: to tackle congestion and reduce disruption... through a series of new duties and powers.

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- Context

•History

- Status
- Future

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History

- Codes of Practice for Highway Management
- National Road Condition Monitoring Survey
- United Kingdom Pavement Management System
- Various software systems

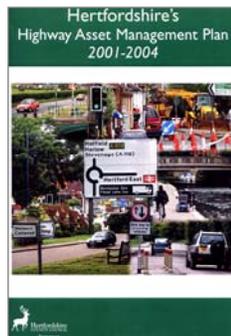
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History

2001:

Hertfordshire
County Council
publishes the U.K.'s
first HAMP

Contributes to
Hertfordshire's
excellent CPA
rating



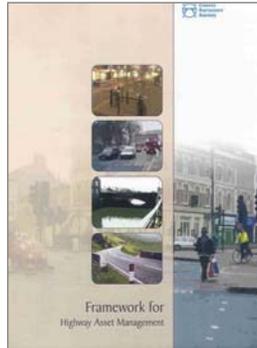
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History

2004:

CSS Produces the Framework for Highway Asset Management

Followed up by workshops and knowledge network

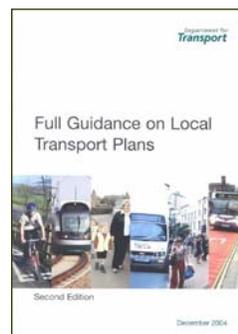


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History

2005:

Department for Transport requires report from each authority with LTP2 submission on progress in developing a TAMP

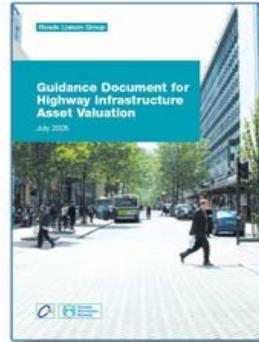


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History

2005:

CSS publishes
Guidance on
Highway
Infrastructure Asset
Valuation



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- Context
- History
- **Status**
- Future

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Status: Overview

- **Awareness**
 - All highway authorities are aware of asset management
- **Understanding**
 - The majority have a basic understanding of how the concept might apply to them
- **Asset Management Plan Development**
 - Progress with the development of TAMPs is mixed
 - A handful published, numerous in stages of development
- **Asset Management Practice**
 - A handful of authorities progressing implementation
 - Others practicing elements as they always did

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Status: Practice

	Basic				Leading Edge				
Goals and Objectives									
Inventory									
Condition									
Demands Aspirations									
Performance Gaps									
Lifecycle Planning									
Budget Optimisation									
Risk Assessment									
Forward Works Programme									
Physical Works and Service Delivery									
Performance Measurement									
Improvement Actions									

Average
 Leading

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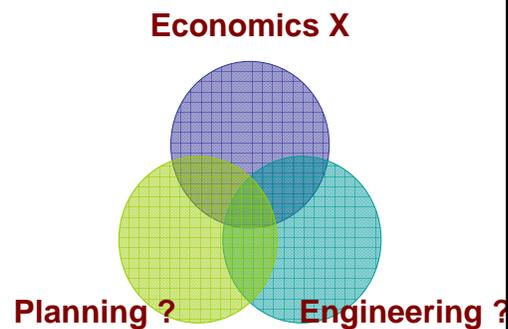
Status: Key Issues

- Defining levels of service
- A key stumbling block of early TAMPs
 - Customer perceptions vs technical “needs”
 - Backlog
 - Sustainability
 - Cost – LOS – Risk relationship

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Status: Key Issues: Investment Decision Practice

- Arbitrary decision making in significant areas
- Limited option appraisal
- “Use it or lose it” culture...
- Minimal application of economics and whole-life costing



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Investment Improvement Opportunity

- Arbitrary decision making in significant areas
- Limited option appraisal
- “Use it or lose it” culture
- Minimal application of economics and whole-life costing

These practices almost certainly lead to sub-optimal choices. Better value can be achieved from improving them.

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Status: Key Issues: Conflicting Drivers

- Short-term program horizons encourages a “best use” of available funds approach
- Options known to not be the best long-term option are often implemented

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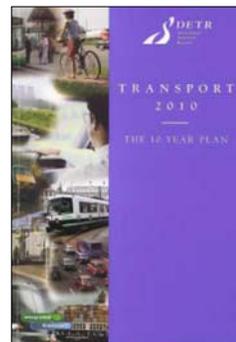
Is asset management influencing decisions?

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Transport 2010

“Tackling the maintenance backlog:
as a result of past under-investment
local roads are in their worst
condition for 30 years, with
consequences for traffic flow and
safety.”

“...provide sufficient resources to local
authorities to halt the deterioration
in the condition of local roads by
2004 and to eliminate the backlog
by the end of the Plan period” (i.e.
2010)



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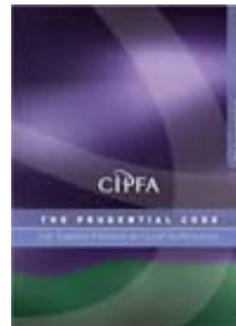
PFI

- Numerous street-lighting schemes
- 1 highway management PFI in operation in Portsmouth
- Birmingham likely to be next
- A small number (6) hoping to follow
- Giant contract being tendered currently for the M25 London's Orbital Motorway

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Prudential Code

- Came into effect in April 2004.
- Allows local authorities to make capital spending decisions funded from borrowing.
- A number of councils are accessing prudential borrowing to invest in highway asset renewals



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Is asset management REALLY influencing decisions?



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Road Funding

- Many local highway authority budgets are still set independently of much of their asset management information.
- Many internal budget distribution models have significant elements that are based on road length or local political boundaries.

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Is asset management REALLY influencing decisions?

Nationally: yes

Locally: less so



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Overview

- Context
- History
- Status

• **Future**

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Is asset management REALLY
influencing **BETTER**
decisions?



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*Asset Management
that
demonstrates
prudent stewardship*

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Asset Investment Strategies

- Long-term investment strategies
- Option appraisal methodologies
- Business case

- Strategies designed to deliver demonstrably improving stewardship

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“Proper” Transport Asset Management

- Highway Asset Management Plan
 - Asset management applied to highway assets
- Transport Asset Management Plan#1
 - A HAMP with peripheral transport assets added in bus stops and the like
- Transport Asset Management Plan #2
 - Asset management principles applied across all activities, i.e., includes network management, improvements

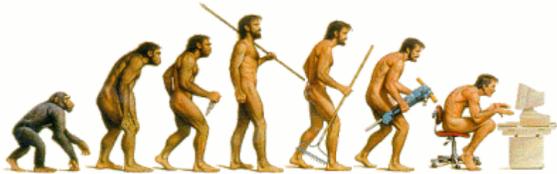
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Integrated Transport Asset Management

Safety
Traffic Management
Demand Management
Transport Planning
Maintenance

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Transport Asset Management



Practice is evolving, i.e.,

- Taking time,
- Progressing,
- Still a bit hairy ..., and
- If we are not careful it may become a purely “intellectual exercise.”

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UK Local Road Transport Asset Management: School Report 2006

*Shows willing and tries
hard, room for improvement
but with more focused
application has impressive
prospects for the future.*

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**Thank you for listening.
Any questions?**

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Integrated Asset Management

Some Thoughts from New Zealand

Dave Bates
Transit New Zealand
December 2006



Setting the Scene

- 10,900 km of strategic road network managed by Transit New Zealand (a government entity).
- 82,300 km of local roads managed by 73 local government units.
- 19.4M vehicle-kilometers traveled in 2005–2006 on strategic road network.
- NZ\$340 M (US\$232 M) maintenance and operations program in 2006–2007.
- NZ\$770 M (US\$525 M) capital program in 2006–2007.





Key Statistics for Transit New Zealand

- Asset value NZ\$18 B (US\$12 B).
- Staff employed by Transit 410.
- 11% of network surfaced in 2005–2006.
- 2.3% of network renewed or rehabilitated in 2005–2006.
- <0.1% of structures renewed in 2005–2006!
- Low rate of renewal means infrastructure is ageing and intervention for maintenance is high.



TRANSIT
NEW ZEALAND



Integration of Asset Management

- Funding for operations and maintenance is dependant upon:
 - Asset management plan in place;
 - Levels of service being defined;
 - Agreement on performance to be achieved, both operationally and financially; and
 - Robust annual plan and indicative 10-year forecast.
- Requirements are common to both Transit New Zealand and local government units.



TRANSIT
NEW ZEALAND





2. Statement of Intent

- Strategic plan sets out the vision.
- Statement of intent converts the vision to performance measures.
- Basis of higher-level agreement with Minister of Transport
- Includes both organizational performance measures and forecast service performance.
- Objectives, performance measures, and targets for the next 3 years.
- Document is accepted by the government, and reported against in the annual plan.



Fatal accidents on state highways (Outcome 2)

The number of fatal accidents on state highways will reflect the safety mitigation activities undertaken by Transit, as well as the actions of other agencies and road users. By working in collaboration with other transport agencies in the wider sector, Transit will positively influence the road toll.

By applying the principles of the “3Es” (engineering, enforcement and education) — particularly engineering and education — to road planning and management, Transit will contribute to reducing the number of deaths by accident on state highways to <200 per annum by the end of 2007/08.

Outcome 2

Delivery of Transit’s annual state highway maintenance and improvement programme (Outcome 4)

The change in the tracking of the state highway maintenance and improvement programme as a direct result of using cash flow variance to compare the forecast to actual dollars spent.

To contain expenditure within ± 5% of target from the start of the year.

Outcome 4

Proportion of network maintained to level-of-service for road condition (Outcomes 2,4,5)

Maintaining the integrity and safety of the national state highway network, to an acceptability level of >97%, by the end of the reporting period as a direct result of regular monitoring and quality control.

Maintaining the condition of the national state highway network to an acceptability level of >97% by the end of the reporting period, measured by regular SCRIM (Sideways force Coefficient Routine Investigation Machine) assessment of the network (to check skid resistance of the road surface).

Outcomes 2, 4, 5



3. Agreement with Land Transport New Zealand

- Key performance agreement with Land Transport New Zealand (the funding agency).
- Contains some of the KPMs, some of the operational performance measures and reporting levels of service achieved.




Typical Performance Measures

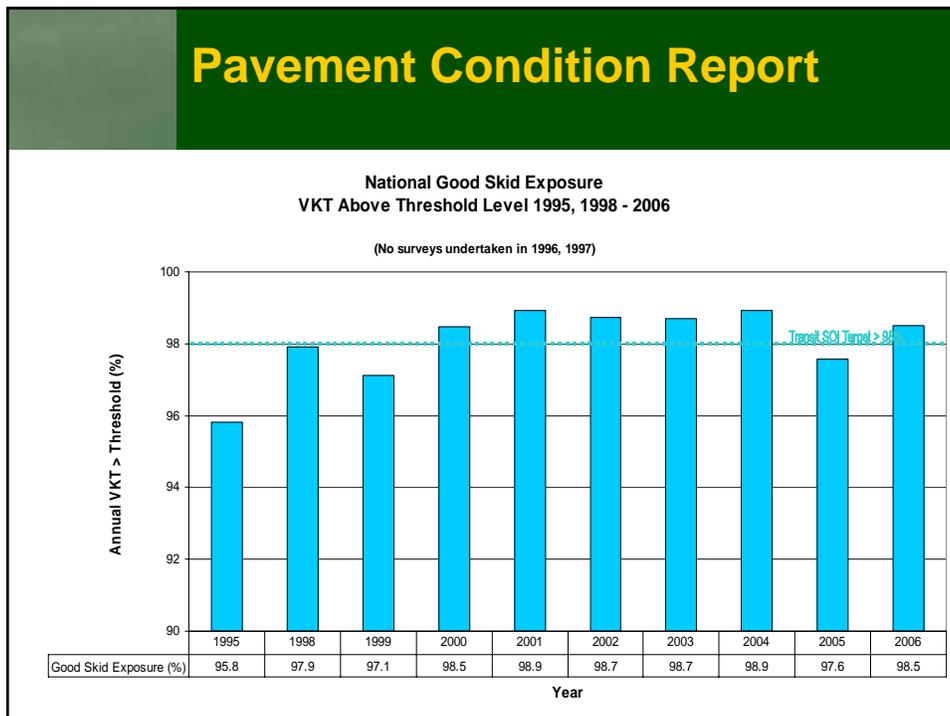
Maintenance of State Highways	
All performance measures listed in chapter 5 of the Authority's Programme and Funding Manual plus the following:	
Road quality	Report
Age index AI = $\text{sum}(\text{length} \cdot \text{AI}) / \text{sum}(\text{length})$	Report only
Road condition index RCI = $\text{sum}(\text{length} \cdot \text{RCI}) / \text{sum}(\text{length})$	Report only
Surface condition index SCI = AI + RCI	Report only
Pavement integrity index PII = $\text{sum}(\text{length} \cdot \text{PII}) / \text{sum}(\text{length})$	Report only
Smooth travel exposure STE = % of network classified as smooth	Report only
% network with good skid exposure above threshold level	Report only
Environmental effects	Report
Dealing with noise = % urban state highways with a speed environment greater than 70 km/h in noise-sensitive areas where traffic noise is treated by designed solutions	Report only
Dealing with road runoff = % of the network within sensitive receiving environments where stormwater run-off is treated by designed solutions	Report only
Road maintenance cost	Report
Cost of routine maintenance per lane-km	Report only
Cost of periodic maintenance per lane-km	Report only
Road maintenance cost	Target
% variation between planned and actual year's total expenditure on routine and periodic maintenance. (Where "planned" is the approved allocation resulting from the February review of the NLTP)	±2%

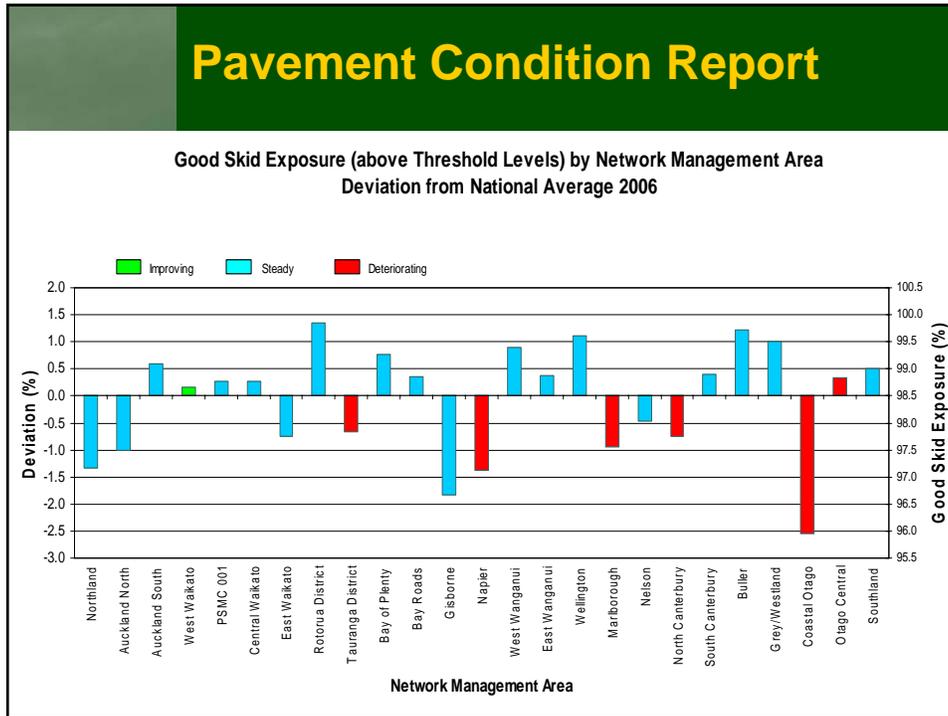




4. Asset Management Plan/Pavement Condition Report/Contract Documents

- These documents predominantly document the service level indicators and key performance indicators
- External contracts required to report on these measures.
- Results are aggregated and reported nationally against service level indicators.
- Pavement condition report covers those relating to the performance of the network pavements.





5. Divisional Performance Measures

- Set to cover both operational and administrative targets that arise from strategic plan, statement of intent, Land Transport NZ Agreement, or annual business plan.
- Disaggregated to specific measures for lower levels of management.
- Are reported on monthly to internal management (traffic light reports).

TRANSIT
THE TRAVELER'S CHOICE

Typical Divisional Performance Measures

Stream 2: Sustainable Asset		Accountable Manager: Dave Bates, National Operations Manager				Hide Mthly Targets	Hide Resources
0000/09 Goal 0006/07 Target 0006/07 Risk		The level of road user and community satisfaction is maintained or improved TBO TBO					
Return to 12-3 annual view	Edit Mode	Peerf.	Objective	Measure	Target	Quarter 2 Progress	Explanation
Show resources	Return to Map				(Q2 Oct-Dec)	(Q2 Oct)	(Observation, threat or opportunity)
What is required? A Transit's standards for route security, network availability, road condition, safety and environmental impact are met		A Transit's standards for route security, network availability, road condition and environmental impact are met	Transit's standards for route security, network availability, road condition and environmental impact are met	Percent network availability, with closures greater than 12 hours, or two hours for high density roads at peak times, reported	95.0%	Some issues but under control	New measure of percentage availability being developed.
What do we deliver? 1 We deliver to the Board a maintenance programme that strikes an optimal balance between objectives, risks and costs				Trends for environmental impact	Achieved/ On track	First group of projects underway in regions.	
How do we manage? Maintain and Operate the Network Plan 3 Know the asset → Extract best value → 4 Execute & monitor programme				Trends for road condition	Achieved/ On track	2005/06 performance to November Board.	
What do we need? 6. Review POCMAU progress reporting to better identify the risk of not completing plan and reduce ad hoc reporting 7. Develop an approach for measuring network availability				% compliance with legislation, legislative instruments and external policy requirements	Achieved/ On track	No known issues.	
1 Apply standards		B We deliver to the Board a maintenance programme that strikes an optimal balance between objectives, risks and costs	Road user satisfaction	CGI no worse than corresponding six month period of the previous year	Some issues but under control	Still to resolve the transfer of survey data to programme priority.	
2 Review POCMAU progress reporting to better identify the risk of not completing plan and reduce ad hoc reporting 7. Develop an approach for measuring network availability			Congestion through travel time delays	Achieved/ On track	Board approves draft annual plan with minimal network.		
3 Review POCMAU progress reporting to better identify the risk of not completing plan and reduce ad hoc reporting 7. Develop an approach for measuring network availability			Board satisfaction with stewardship of value in operations plan proposal and rationale	Achieved/ On track	Draft Annual Plan being put together for Board scrutiny.		
4 Review POCMAU progress reporting to better identify the risk of not completing plan and reduce ad hoc reporting 7. Develop an approach for measuring network availability		C A realistic asset management plan	Positive peer review of linkages between network perf issues, activities and funding requests	Asset management plan signed off by the Board	Issues in need of management attention	Initial scoping underway, but focus on preparation on 2007/8 Plan and staff shortages mean completion unlikely till third quarter.	
4 Review POCMAU progress reporting to better identify the risk of not completing plan and reduce ad hoc reporting 7. Develop an approach for measuring network availability			Performance benchmark against similar organisations	Issues in need of management attention	Await significant progress on Asset Management Plan.		

Overall Thoughts on Asset Performance Issues

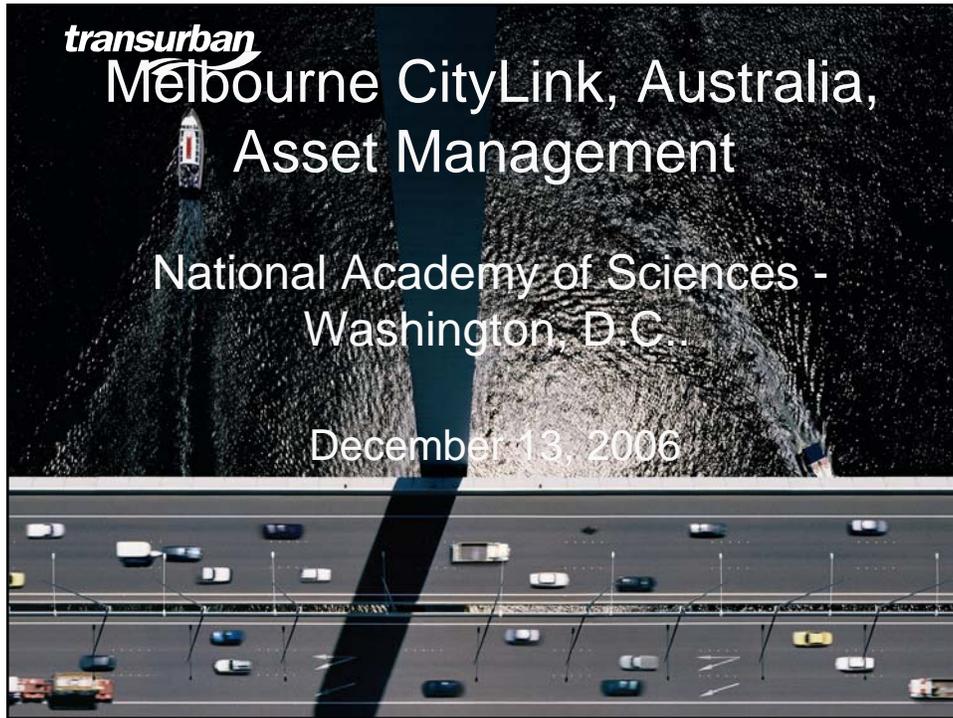


- The ability to demonstrate that the infrastructure is being preserved, and to demonstrate the consequences of not investing in asset management is critical in today's environment.
- It is also critical that a suite of performance measures covering the whole range of infrastructure/asset performance is developed.
- There must be strong buy-in at the governance levels that the performance levels set truly reflect the desired outcome
- Performance measurement then becomes a strong framework on which to argue funding requirements and demonstrate consequences.

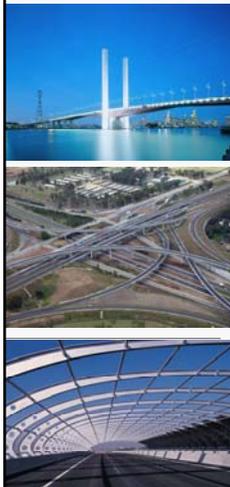
Overall Thoughts on Asset Performance Issues (cont'd)

- Start off with basic performance measures and get them engrained before looking to refine and expand them.
- Data collection is critical to successful asset management but too much inaccurate, unfriendly data are worse than none at all.
- The ability to have data and manipulate it at an area network level does change behaviors and outcomes.
- Choosing performance measures that are both meaningful and relevant without inducing perverse behaviors is an art.





Topics



Transurban Overview

Melbourne CityLink fast facts and history

- Contract structure (O&M provider)

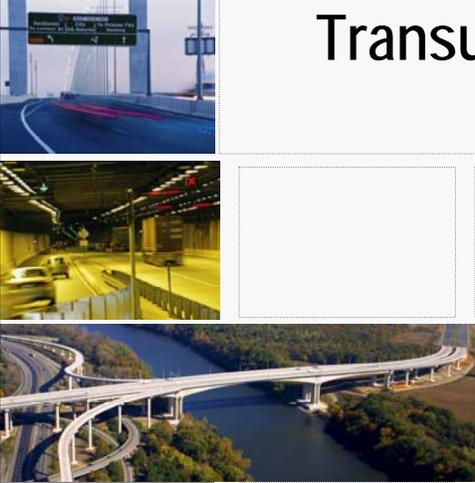
Understanding the assets

Investment protection

- Asset management
- Contract management

Measuring and benchmarking

Transurban Overview

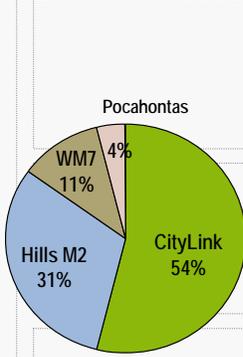




Who is Transurban

CityLink
100% Ownership and Operations
Hills M2
100% Ownership and Operations
Westlink M7
47.5% Ownership 100% Tolling
Pocahontas USA
100% Managed Investment and Operations

- Investor, owner, and manager of Australia's best toll road assets
- Innovator in sophisticated electronic toll roads
- Pioneer of full electronic tolling
- Develop, deliver, manage, and operate
- Investor operator
 - Long-term management of strategic assets
 - Long-term relationship with governments



Asset	Percentage
CityLink	54%
Hills M2	31%
WM7	11%
Pocahontas	4%



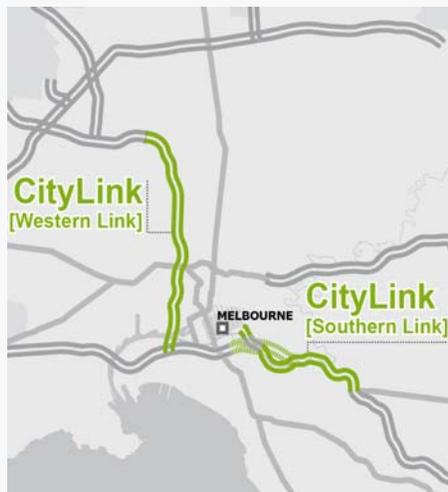
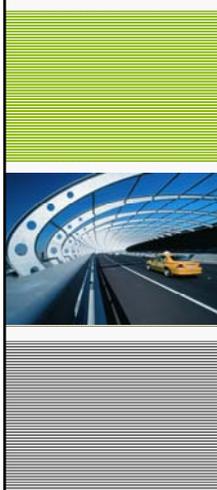
Our First 10 Years



- Top 10 road investor globally
- Market capitalization US\$4.8 billion
- Ownership and management of Australian and U.S. toll roads
 - CityLink (Vic), Westlink M7 (NSW), Hills M2 (NSW), Pocahontas (USA)
- Innovation
 - Tolling solutions, customer service, financial structures
- Delivery
 - Complex projects, robust contracts, accurate traffic forecasts, growing patronage, and shareholder value
- Relationships
 - Positive relationships with state governments, communities, and stakeholders



Melbourne CityLink – Case Study



- Privately funded (PPP)
- US\$2b construction cost, 1996-2000
- 14-mi motorway
- 3.3 mi of tunnels, 5 mi of elevated road
- 34-year concession
- 100% electronically tolled
- Over 200 million transactions per year
- US\$200m revenue pa



Melbourne CityLink



For the record.....

- CityLink 1 million + e-TAGs
- >700,000 daily transactions
- 750,000 + customers
- 800,000 + accounts
- 1.4 million vehicles registered
- Open Road volumes: > 230,000 vehicles per day (>15% heavy commercial)
- Tunnel Traffic : > 90,000 vehicles per day



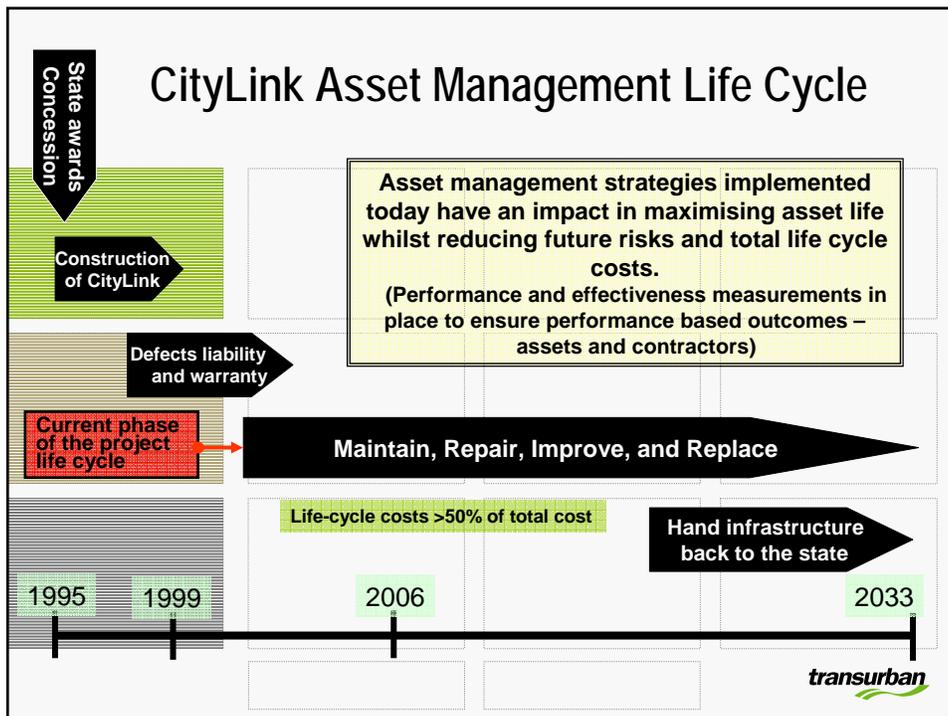
transurban

Melbourne CityLink - Tunnels

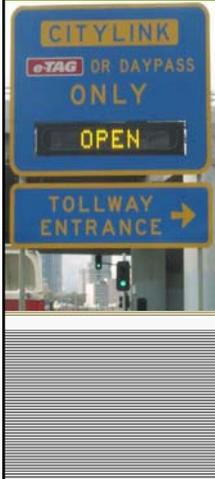


	Burnley Tunnel	Domain Tunnel
Total Length	2.3 mi	1 mi
Maximum Depth	200 ft	80 ft
Traffic Envelope	3 Lanes (14 ft wide) + 18-in. shoulders	3 Lanes (14 ft wide) + 18-in. shoulders
Emergency Egress		
• Cross Passage	√	√
• Escape Stairs	√	√
• Refuge Rooms	√	
• Pedestrian Egress Tunnel	√	

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City Link O&M Structure – Started As

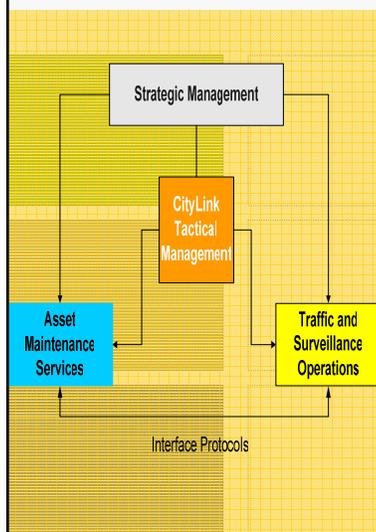


Outsourced Operations and Maintenance (O&M):

- Road operations –control room
- Incident response
- Maintenance
- Roadside Tolling System Engineering and Maintenance (H/W and S/W)
- ITS/control system engineering and maintenance (H/W and S/W)
- Environmental management (noise, air, water, hydrogeology)
- Transponder logistics

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CityLink O&M Structure - Today



CityLink undertakes:

- **Strategic asset management**
 - Design and engineering control
 - Major repairs and replacement
 - Improvement and expansion
 - Defect rectification – design out
- **Tactical management of maintenance and operation outcomes**
- **Roadside tolling system engineering and maintenance**
- **ITS/control system engineering and maintenance**
- **Environmental management (noise, air, water, hydrogeology)**
- **Transponder logistics and engineering**

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Understanding the Assets



- Civil
 - Roads, bridges, tunnels, and drainage systems
- Mechanical and electrical
 - Tunnel systems (air management, water management, emergency systems, signage, lighting)
 - Street lighting, plant equipment
- ITS, electronic tolling, traffic management and plant management systems
- Architectural and aesthetics
 - Feature lighting and landscaping

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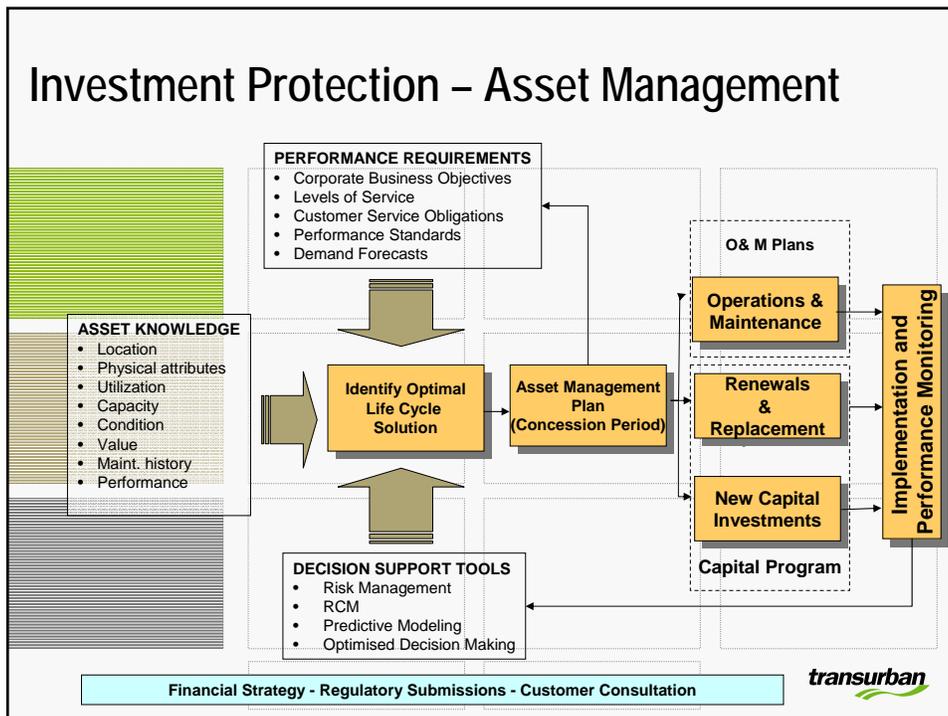
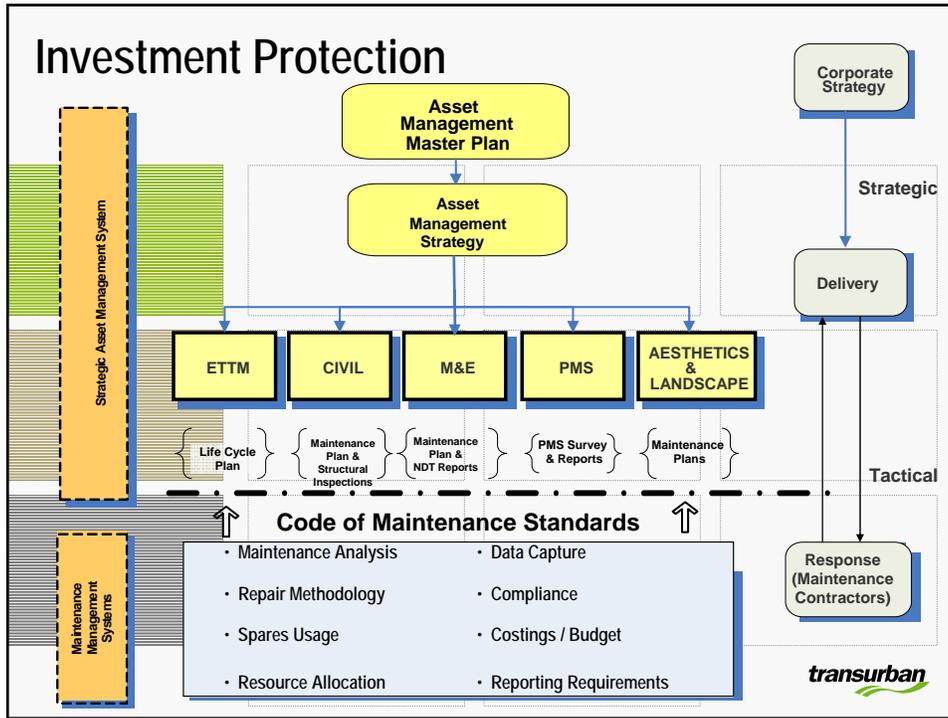
Understanding the Assets



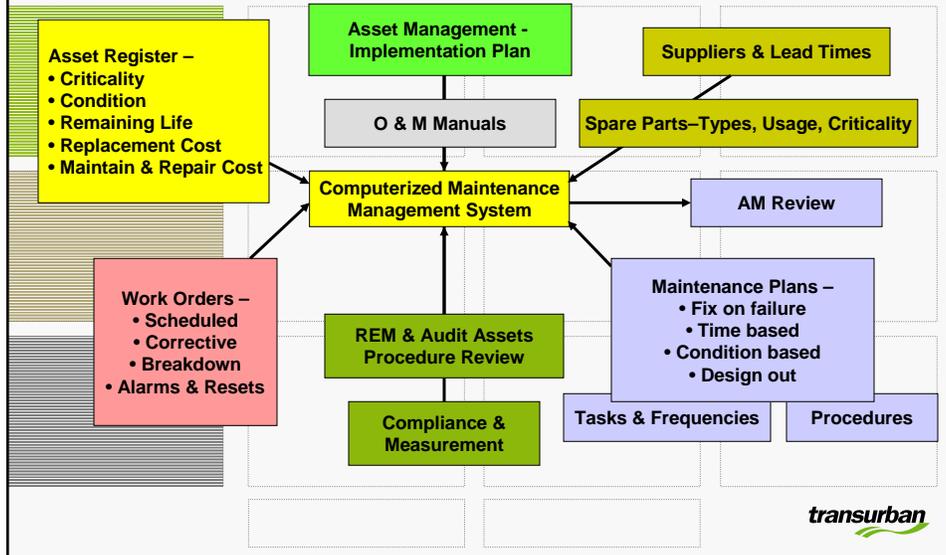
- Life cycle –groups:
 - Structural assets:
 - Long life cycles - 30 years
 - M&E Assets:
 - Medium life cycles – 10 to 30 years
 - ETTM Assets:
 - Short life cycles – 5 to 12 years

CityLink has a mixture of all these life cycle categories, therefore maximizing the life cycle and managing obsolescence has very different asset management and spare part strategies in each case.

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Investment Protection - Contract Management



Investment Protection - Forward Looking

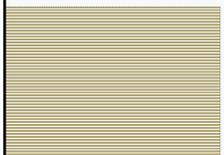


- Design out defects and inherent faults
- Replace worn or troublesome assets that continually fail or cause problems
- Replace assets that will reduce risk and improve infrastructure investment
- Replace assets which are energy inefficient or environmentally unfriendly
- Capital replacement programs should create a evergreen site and ensure compliance with the concession deed including specified "Hand Back" requirements

(Proactive Planning and Continuous Improvement)

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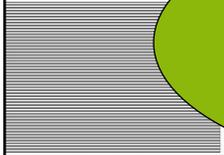
Measuring and Benchmarking



- Measure asset group costs and performance levels.
 - Key performance measures.
- Benchmark asset group costs and performance levels.
 - Ability to continually apply “industry best practices” based on actual learnings.



Sustainability

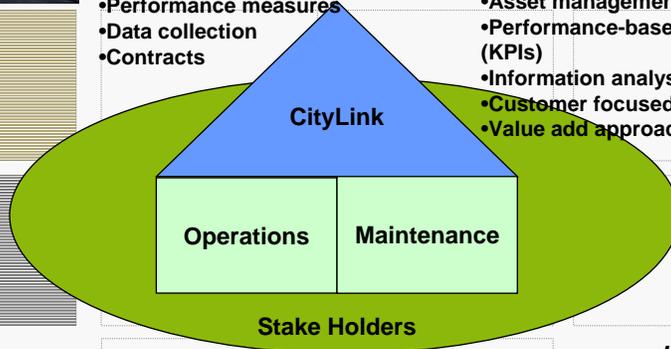


Primary Requirements

- Concession
- Compliance
- Reporting
- Operate
- Maintenance
- Performance measures
- Data collection
- Contracts

Secondary Requirements

- Relationships
- Communications
- Interface agreements
- Agreements – aligned
- Optimisation of assets
- Asset management
- Performance-based outcomes (KPIs)
- Information analysis
- Customer focused
- Value add approach





ASSET MANAGEMENT

What Is It and Why Should You Care?

Transportation Asset Management Executive Forum
December 13, 2006



Kirk T. Steudle, P.E.
Director
Michigan Department of Transportation





Challenges

Congestion



Preserving Investments



Aging Infrastructure

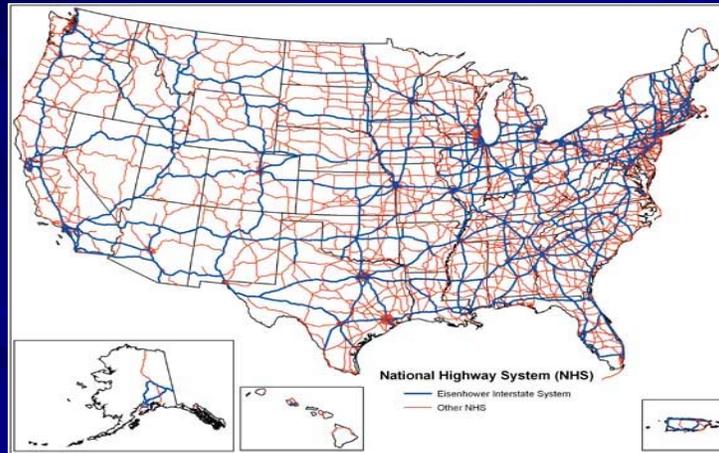


Economic Growth



National Statistics

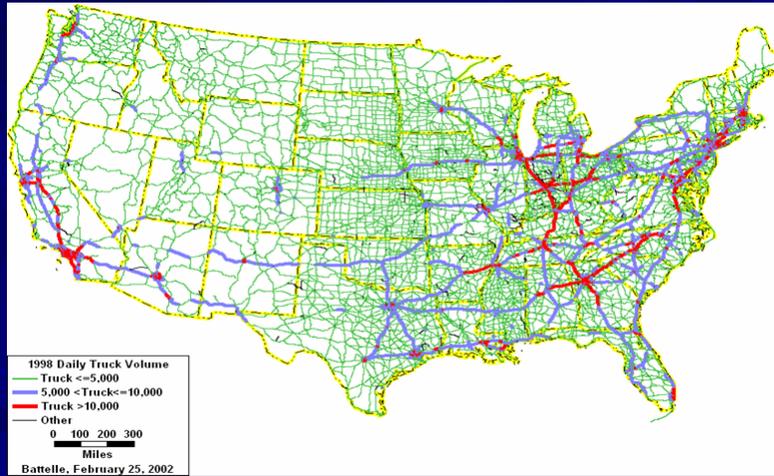
3,963,262 mi of roads
590,685 bridges



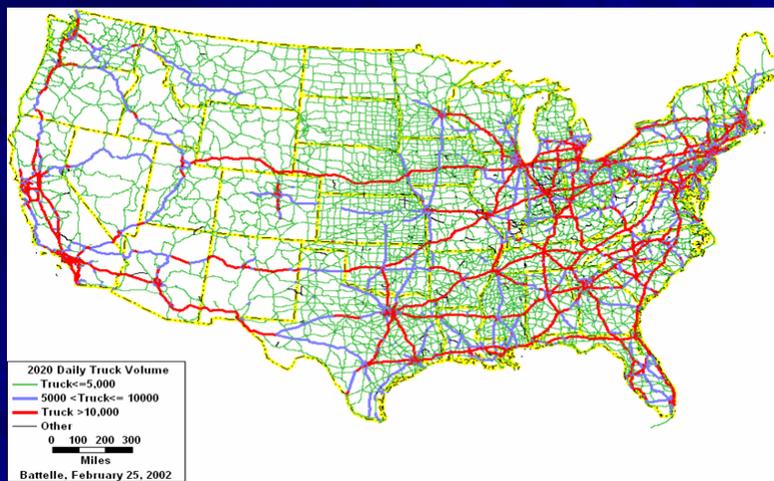
Economic Growth

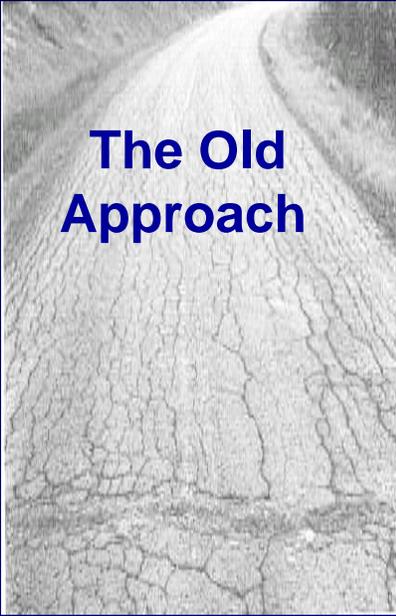


Truck Volumes - NHS - 2000



Truck Volumes in 20 Years





The Old Approach

- Limited preservation
- Underestimated traffic, loads, costs
- Use locally available materials
- Repaired worst first
- Design for lowest initial cost
- Limited design life
- Limited economic analysis
- Insufficient funds

Asset Management The New Approach

- Transportation networks viewed as utilities
- Investments in assets rather than the traditional public idea of mere expenditures of funds

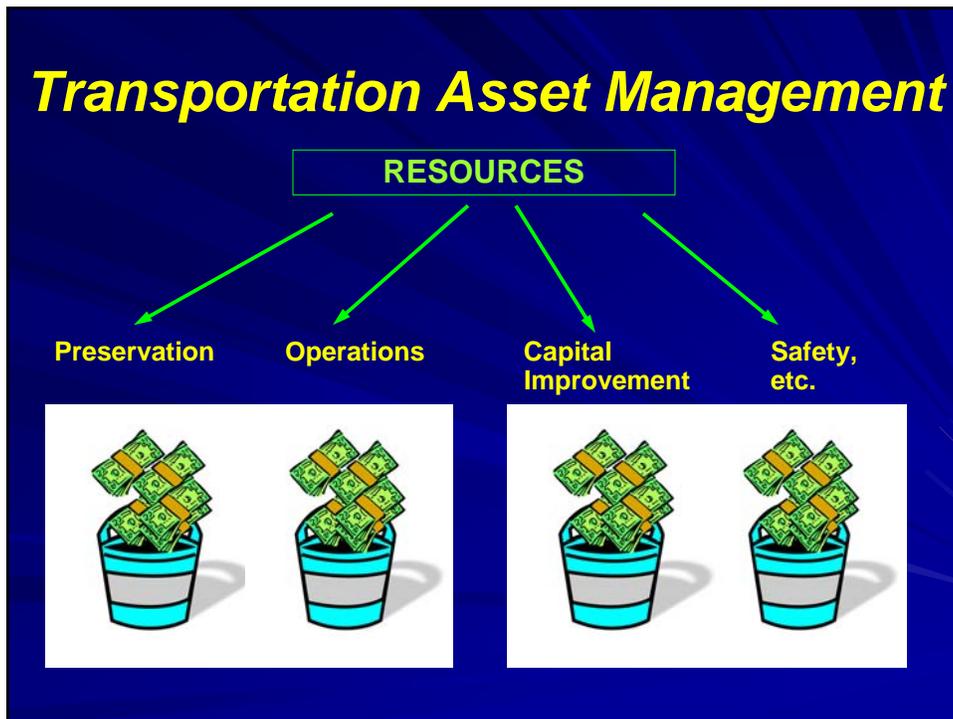


How Does Transportation Asset Management Work?

- Decisions are based on accurate data, sound engineering, and economic analysis
- Improved decision making supported by policies, performance-based goals, performance measures, and appropriate service levels
- Long-term view of assets
- More robust management and monitoring systems

What Makes TAM Strategic?

- Focus on the strategic goals of the agency, performance measures, and system performance
- All assets considered comprehensively
- Trade-off analysis and life-cycle performance used to support decision making
- Apply economics, business, and engineering principles, needs assessment—public involvement, and risk assessment to manage assets and evaluate trade-offs



National Activities

- AASHTO established AM Task Force 1997 and full subcommittee in 2004
 - Equal representation from SCOP and SCOH
- AASHTO adoption of Strategic Plan 1999–2000 revised in 2004
- FHWA established an Office of Asset Management
- TRB Task Force in 2000 and Committee in 2004
- NCHRP Project to Develop first-generation Asset Management Guide
- Joint website established and five national workshops since
- NCHRP Project to develop a trade-off analysis tool currently AASHTOWare starting Phase 1 development

AASHTO Subcommittee on Asset Management

Mission: Advance the state-of-the-practice of asset management in state DOTs to optimize resources utilizing performance-based goals and measures regarding operation, preservation, and improvement of transportation systems for member agencies.

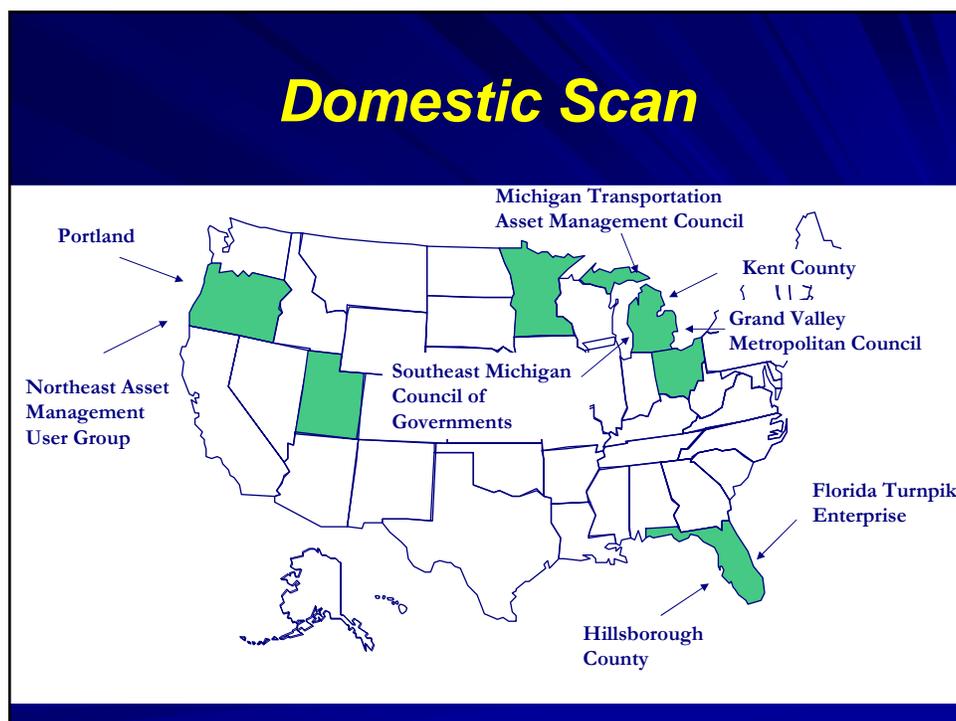
AASHTO Subcommittee on Asset Management

- Focus on implementation
- Develop, improve, promote, and support the use of management systems, economic evaluation tools, and trade-off analysis methods
- Share information application of performance measurement and decision-making tools
- Education and training

International and Domestic Scanning Review

International Scan





International and Domestic Scanning Review

- Drivers
 - Limited resources
 - Increasing demands
 - Credibility with elected officials and the public, that is, linking funding to system performance
 - Strategic oversight where private provision of services was used
- Overarching Themes
 - Move away from “worst first”
 - Preservation first
 - Data is an asset
 - Enhanced communication
 - Strong justification for funding
 - Organization structure
 - Performance measures – behavior modifier

In sum....

It is clear that asset management as an organizational culture, a “business decision-making process,” and as a policy direction is a critical foundation for transportation programs that are facing significant capital renewal and preservation needs. The United States is clearly facing such a challenge.

Asset management, in many ways, represents a “revenge of the nerds,” . . .

We are providing a rational basis for an investment process that can be inherently political.

*--SEMCOG Official
Michigan*



FLORIDA DEPARTMENT OF TRANSPORTATION

***Asset Management:
Current Status,
Next Steps***



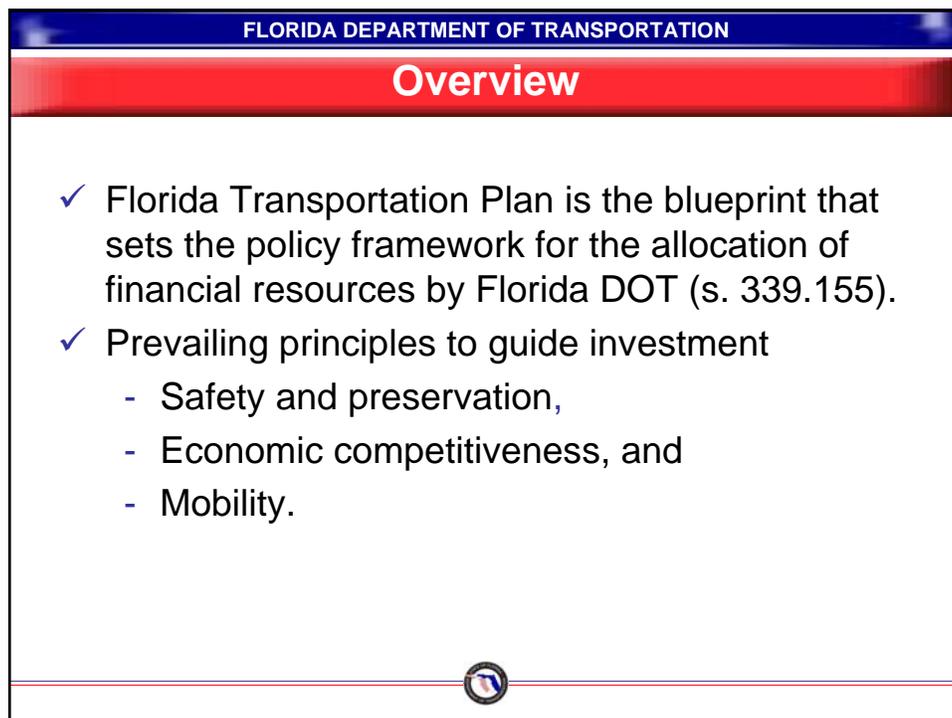
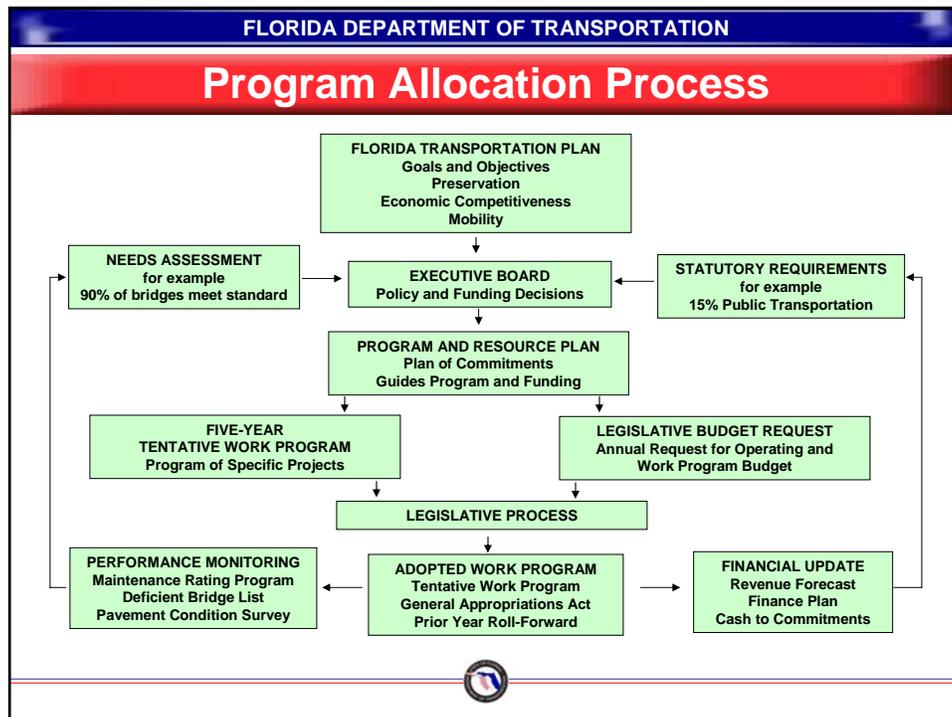
December 13, 2006

FLORIDA DEPARTMENT OF TRANSPORTATION

Current Status

- ✓ Policies preserve roads and bridges.
- ✓ Buy-in from governor, Legislature, local officials.
- ✓ Condition of the system has been fully evaluated since 1987.
- ✓ Funds are first allocated to meet goals and objectives.





FLORIDA DEPARTMENT OF TRANSPORTATION

Overview

- ✓ Mission, goals, and objectives (s. 334.046):
 - Ensuring that 80% of the pavement on the State Highway System meets department standards.
 - Ensuring that 90% of the department-maintained bridges meet department standards.
 - Ensuring that the department achieves 100% of the acceptable maintenance standard on the State Highway System.



FLORIDA DEPARTMENT OF TRANSPORTATION

Resurfacing Program

- ✓ Annual condition survey
 - Ride quality,
 - Crack severity, and
 - Rutting.
- ✓ Objective: 80% of pavement on the State Highway System meets department standards.
- ✓ Operating policy: Resurface 5.9% of the State Highway System.



FLORIDA DEPARTMENT OF TRANSPORTATION

Resurfacing Policy Change

- ✓ Expansion of ride rating deficiency criterion to below 5.5 for pavements with a speed limit of 45 mph or less reduced pavement deficiencies by an accumulated 405 lane miles.
- ✓ This policy change is estimated to have an annual reduction of approximately 120 lane miles and frees up approximately \$25 million per year.
- ✓ Revised operating policy: resurface 5.6% of the State Highway System to ensure 80% of pavement meets department standards.



FLORIDA DEPARTMENT OF TRANSPORTATION

Bridge Program

- ✓ Inspections conducted on all bridges every 2 years; helps determine need for:
 - Preventive maintenance,
 - Major or minor repair work, and
 - Replacement.
- ✓ Objective: 90% of state-maintained bridges meet department standards.
- ✓ Operating policy: program replacement of bridges within 6 years of deficiency identification (9 years for economy replacement).



FLORIDA DEPARTMENT OF TRANSPORTATION

Routine Maintenance Program

- ✓ Maintenance Rating Program (MRP) evaluates and rates actual field conditions:
 - Roadway, roadside, traffic services, drainage, and vegetation aesthetics.
- ✓ Objective: 100% of roads on the State Highway System achieve the maintenance standard.
- ✓ Operating policy: provide full funding required to achieve a MRP of 80 or above which is equivalent to attaining 100% of the department's objectives.



FLORIDA DEPARTMENT OF TRANSPORTATION

Performance Measurement System

Category	Actual	Target	Index
Organizational Results	--	--	--
Transportation Systems Safety	1.71	1.08	108.0%
Customer and Market Focus	--	--	--
Production Performance	--	--	--
Transportation System Performance	--	--	--
Organizational Performance	--	--	--
Highway Condition	102.9%	100%	102.9%
SIS Highway Performance	100.0%	100.0%	100.0%
Multi-modal Performance	100.0%	100.0%	100.0%
Pavement Condition	100.1%	100.0%	100.1%
Bridge Condition	104.0%	100.0%	104.0%
Maintenance Condition	106.3%	100.0%	106.3%



FLORIDA DEPARTMENT OF TRANSPORTATION

Next Steps

- ✓ Develop communications plan for asset management.
- ✓ Extremely cost effective in both short and long run.
- ✓ Continued pressure to move funding to capacity from preservation programs.
- ✓ Emphasize cost of replacement if assets are not properly maintained—preserved.



FLORIDA DEPARTMENT OF TRANSPORTATION

Asset Maintenance Model

- ✓ Covers routine maintenance.
- ✓ Uses both by roadway system and geographic area.
- ✓ Generally 5- to 7 -year contracts, bid via RFP.
- ✓ Used performance standards (MRP).
- ✓ Contractor bids lump sum price—paid in installments over the life of contract:
 - Assumes price risk and
 - Assumes system impact risk within limits.



FLORIDA DEPARTMENT OF TRANSPORTATION

Public Private Partnership Model

- ✓ Routine maintenance and roadway surface
 - Generally 12 to 20 years.
- ✓ Above plus roadway performance (capacity)
 - Generally 30 to 50 years.
- ✓ Characteristics of both
 - Generally significant roadway segments or system and
 - Performance standards—preservation and capacity.



FLORIDA DEPARTMENT OF TRANSPORTATION

Scale of Asset Management

Routine Maintenance	Preservation	Life-Cycle Capacity
		
5–7 Years	12–20 Years	30–50 Years



Asset Management: From Strategy to Reality

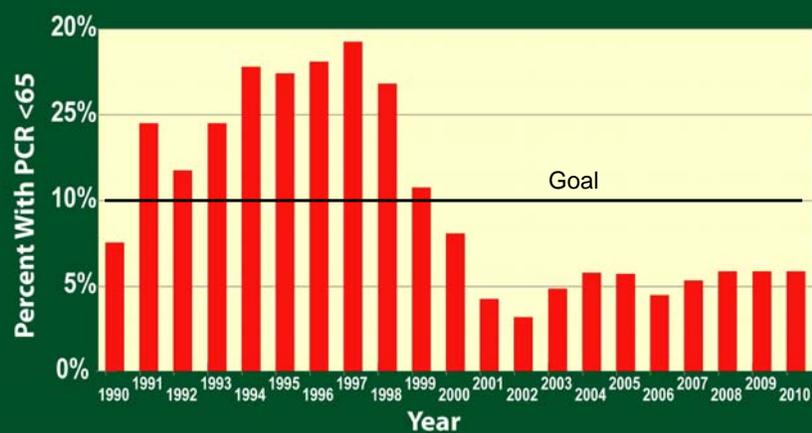


The Experience of
The Ohio Department of Transportation

Ohio Department of Transportation

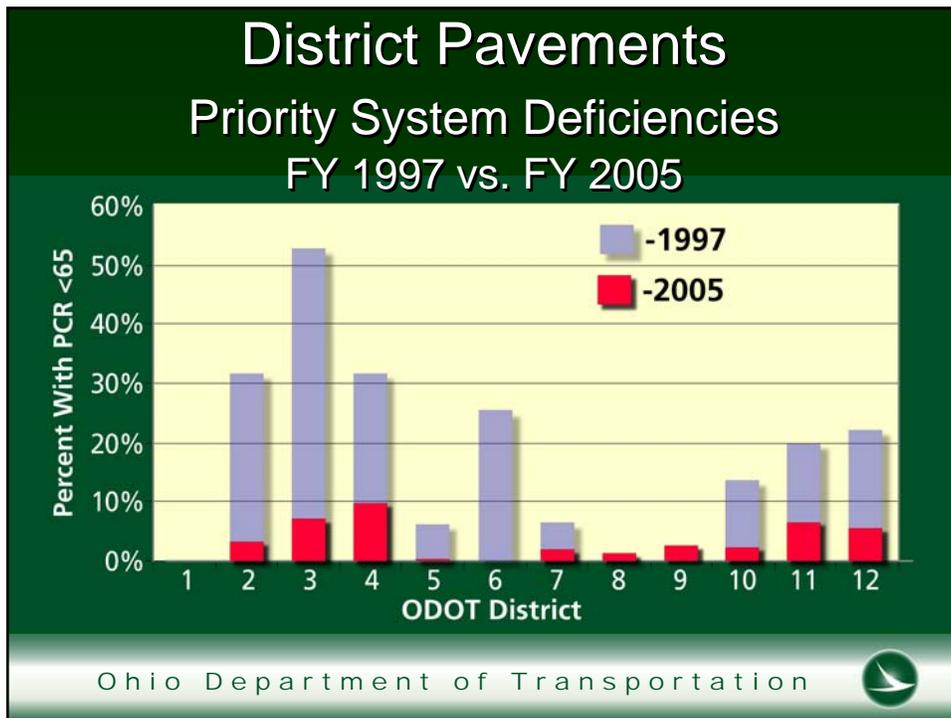
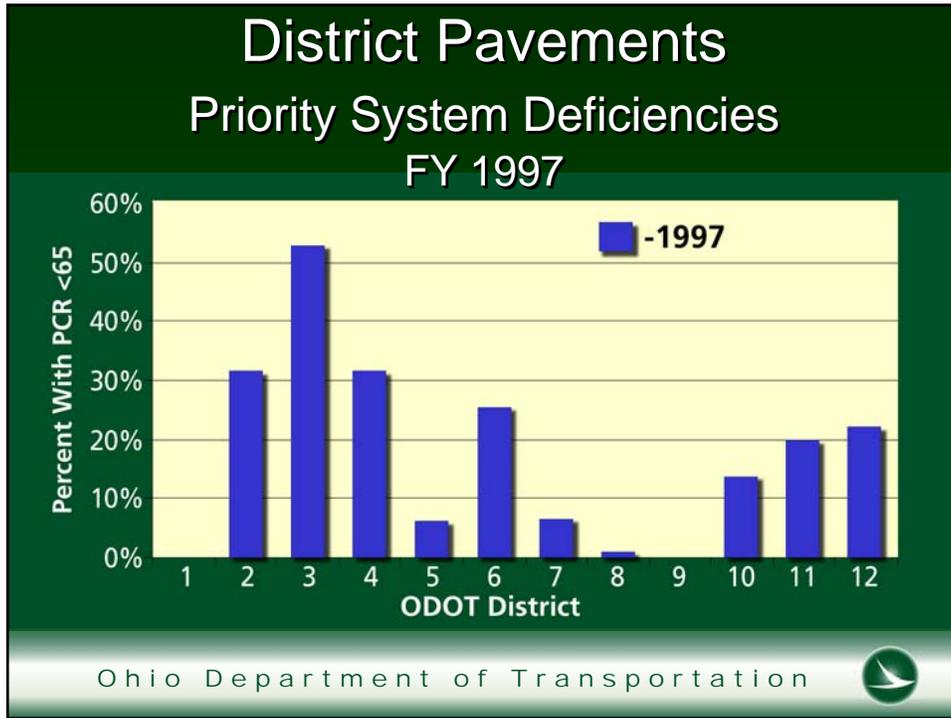


Deficient Pavements Priority System 1990 – 2010



Ohio Department of Transportation

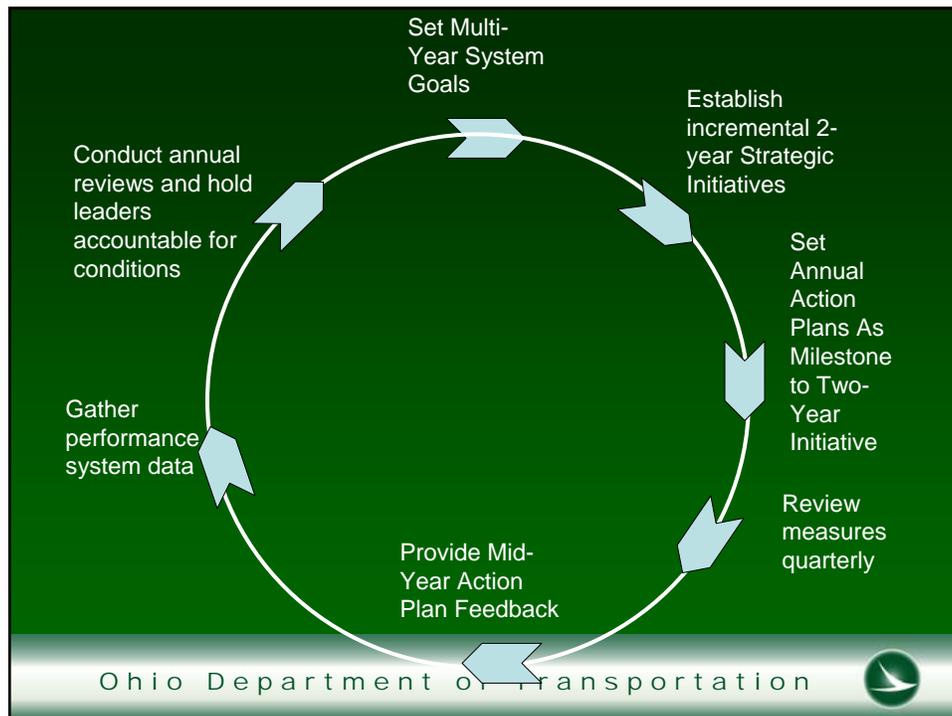


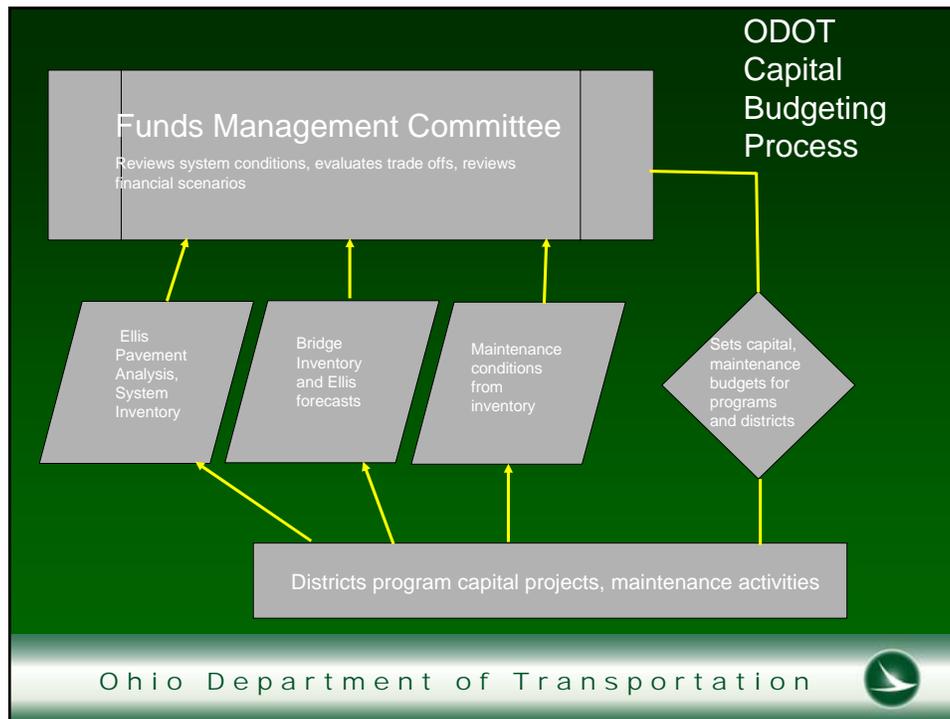


ODOT: Simple But Effective

- System condition deficiencies reduced between 66 and 80 percent
- Conditions are sustainable for predictable level of effort
- Long-term planning is simplified
- Provides all disciplines management systems to guide activities

Ohio Department of Transportation





ODOT Capital Budgeting

ODOT Budget	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
General System Two-Lane Pavements	\$93	\$93	\$108	\$113	\$179	\$186	\$240	\$249	\$259	\$270	\$280
<i>Percent of System at acceptable level</i>				98%		97%		97%			97%
Major 2 lane repair		\$5	\$15	\$15	\$15	\$15					
Priority System Freeway Routine Maintenance	\$179	\$179	\$217	\$228	\$192	\$199	\$189	\$196	\$204	\$212	\$221
<i>Percent of System at acceptable level</i>				96%		97%		97%			97%
Priority System Freeway Pavement Rehab and Replacement	\$150	\$192	\$150	\$150	\$150	\$150	\$172	\$173	\$175	\$176	\$178
Urban Pavements (State Routes in Cities)	\$35	\$35	\$35	\$35	\$35	\$35	\$35	\$35	\$35	\$35	\$35
<i>Percent of System at acceptable level</i>				96%		95%		90%			90%
Total Pavement Programs	\$457	\$504	\$525	\$541	\$570	\$585	\$636	\$654	\$674	\$693	\$714
District Bridge Repair, Replacement and Maintenance	\$141	\$141	\$170	\$179	\$187	\$197	\$193	\$199	\$206	\$184	\$191
<i>Percent of Bridges at acceptable level of General Appraisal</i>				98%		98%		97%			97%
Major, High-Cost Bridge Replacement and Maintenance	\$80	\$117	\$60	\$60	\$61	\$61	\$62	\$62	\$63	\$64	\$64
Total Bridge Programs	\$221	\$258	\$230	\$239	\$248	\$258	\$255	\$261	\$269	\$248	\$255

Ohio Department of Transportation

Linkage

ODOT asset management tied to:

- **Budgets**
- **Executive Evaluations**
- **Division goals**
- **Institutional goals**
- **Civil service documentation**

Ohio Department of Transportation



Lessons

- **Asset management should just be considered basic management**
- **Conditions should drive budgeting**
- **Evaluations should be tied to system condition achievements**
- **A complementary strategy is to enable savings and redirection**

Ohio Department of Transportation



Conclusion

Asset management must be part of a larger strategic management process

Ohio Department of Transportation



Improving Internal Decision Making & System Performance

Kim Schvaneveldt

LTPO
Connecting Communities
ASSET MANAGEMENT

TAM Executive Forum, Washington DC
December 13, 2006

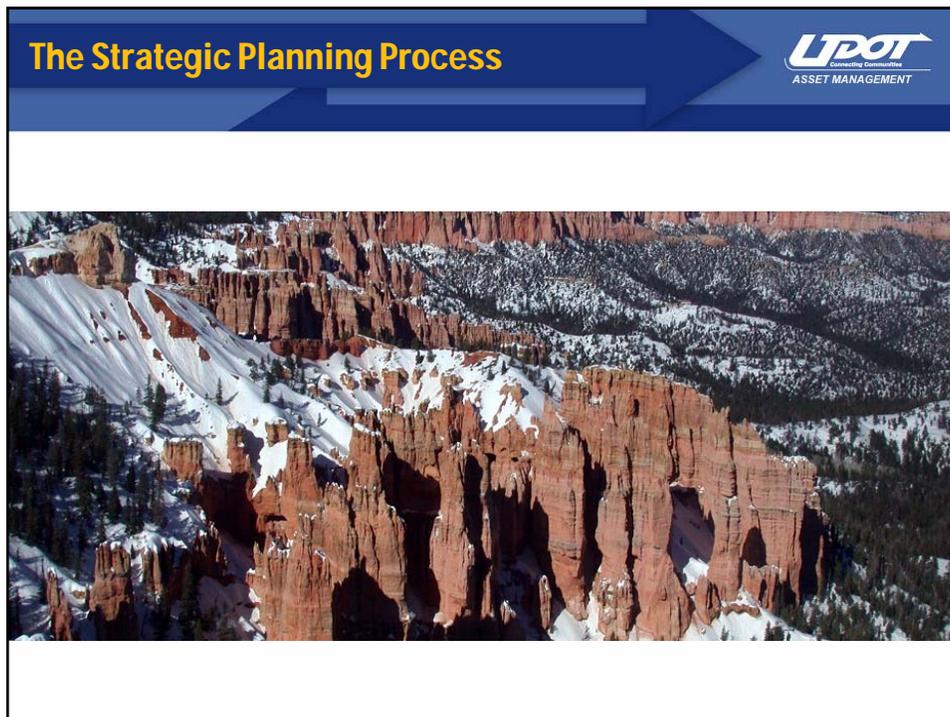
Critical Transportation Issues

LTPO
Connecting Communities
ASSET MANAGEMENT

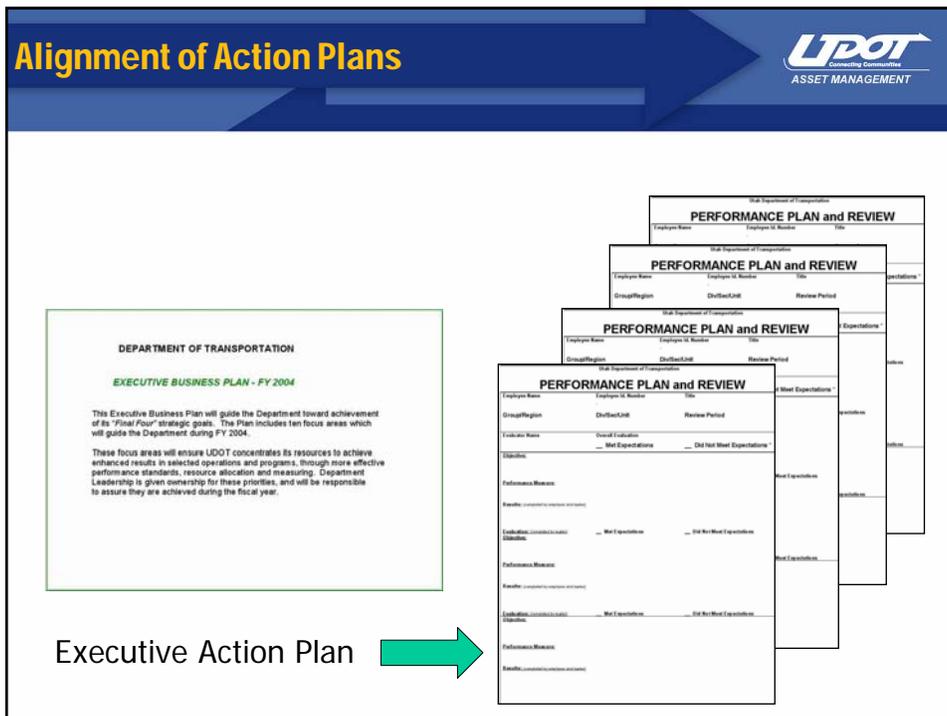
Year	Travel (%)	Population (%)	Highway Mileage (%)
1990	0	0	0
1992	~10	~5	~1
1994	~20	~10	~1
1996	~30	~15	~1
1998	~40	~20	~1
2000	~50	~25	~1
2002	~60	~30	~1
2004	~68	~35	~1
2006	~75	~40	~1
2008	~80	~42	~1
2010	88	43	4

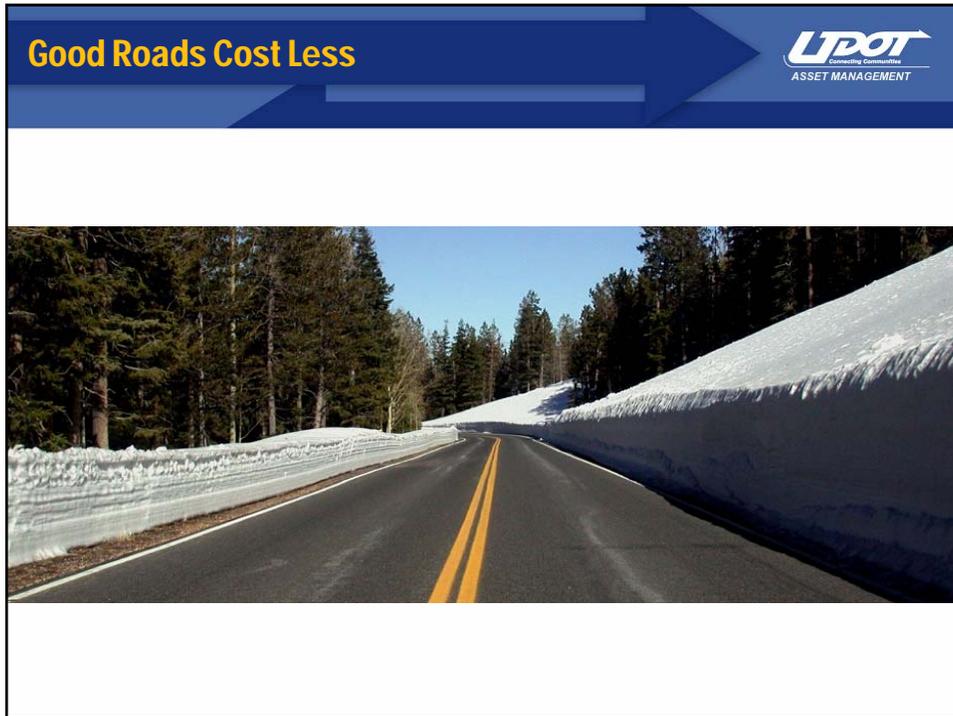
Critical Issues

- Limited Funding
- Preserve the Existing System
- Fund Congestion Relief Projects



-
- UDOT "Final Four" Strategic Goals
- UDOT
Connecting Communities
ASSET MANAGEMENT
1. Take Care of What We Have
 2. Make the System Work Better
 3. Improve Safety
 4. Increase Capacity





Good Roads Cost Less - 1977

UTDOT
Connecting Communities
ASSET MANAGEMENT

GOOD ROADS COST LESS
(Pavement Rehabilitation Needs, Benefits
and Costs in Utah)

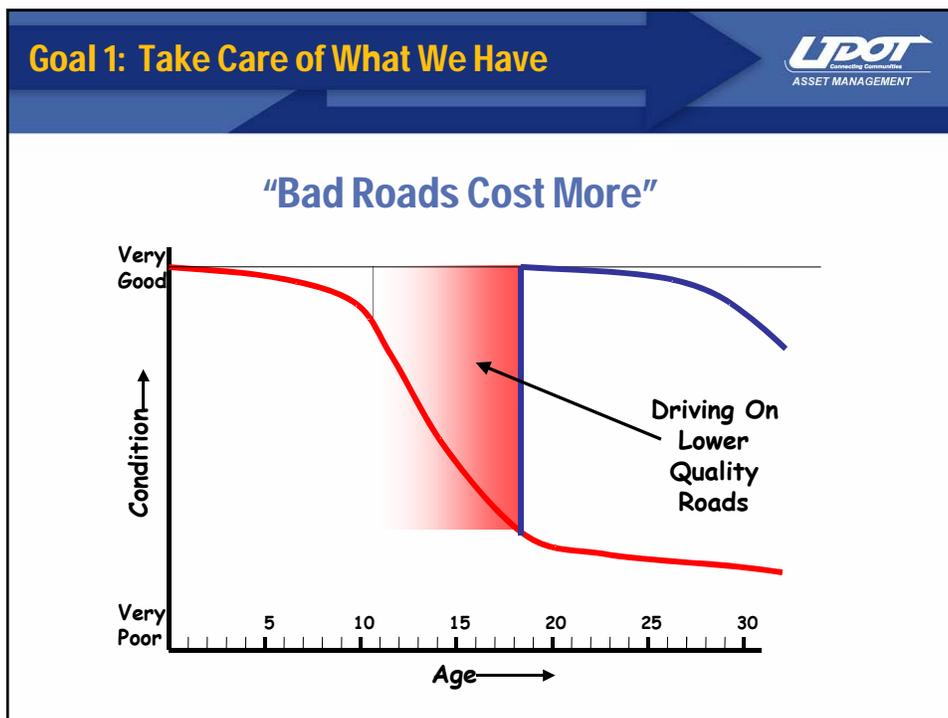
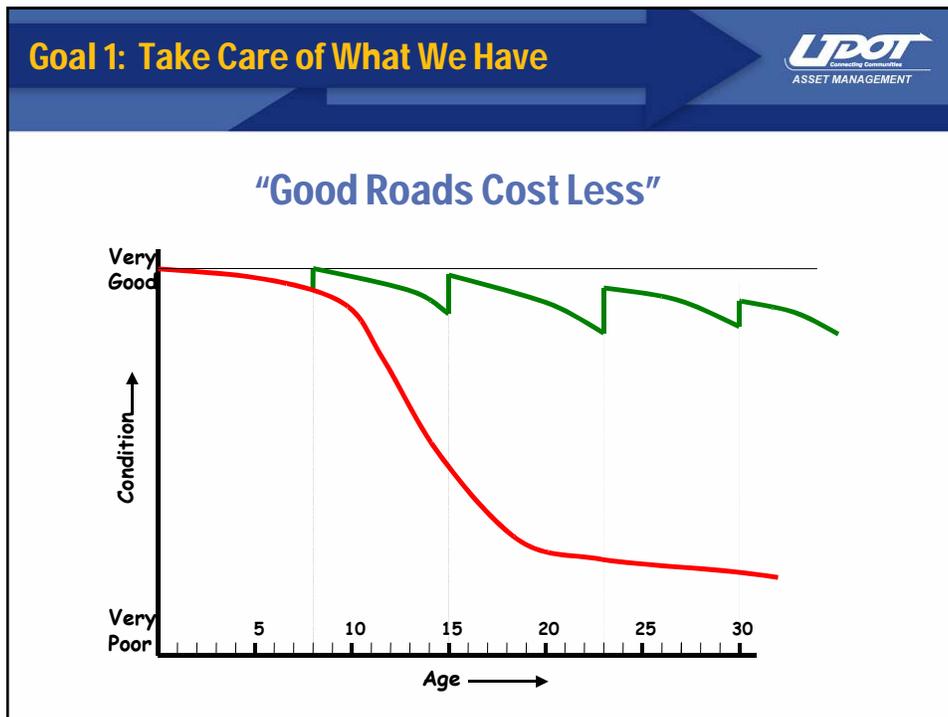
UDOT-MR-77-8

October 1977

Prepared By:
Dale E. Peterson, P.E.
Research and Development Engineer

RESEARCH AND DEVELOPMENT UNIT
UTAH DEPARTMENT OF TRANSPORTATION

- ✓ Good Roads Cost You Less Than Bad Roads
- ✓ The Cost to rehabilitate, maintain and drive on good roads is considerably less than for bad roads



Good Roads Cost Less - 1977

Recommendations

- Maintain pavements in good condition in order to minimize maintenance and rehabilitation costs to UDOT and user costs to the traveling public.
- Maintain highway network pavements in a better overall condition than they were currently being maintained.
- This increase in overall condition would require additional funding to upgrade UDOT's poor pavements to good condition so that future maintenance, rehabilitation and user costs could be reduced.
- The increased funding could be recovered in as little as four years through improved benefits.

Good Roads Cost Less - 2006 Study Update

Report No. UT-06.15.

GOOD ROADS COST LESS
2006 Study Update

Prepared For:
Utah Department of Transportation Research and Development Division

Submitted By:
Deighton Associates Limited
112 King Street East
Bowmanville, Ontario, Canada
L1C 1N5

Authored By:
Jeffrey L. Zavitski, Kim Schvaneveldt, Austin Baysinger,
Abdul Wakil, Bill Lawrence, Dave Blake, Doug Anderson,
Gary Kuhl, Glen Ames, Lloyd Neeley

November 2006

Almost thirty years after publishing the Good Roads Cost Less study in 1977, UDOT continues to face challenges maintaining pavements in good condition within the context of a constrained budget environment.

This report presents an **update** to the original Good Roads Cost Less study and **takes into account additional factors and data that were unavailable when the first study was undertaken.**

The report reaffirms that Good Roads Cost Less.

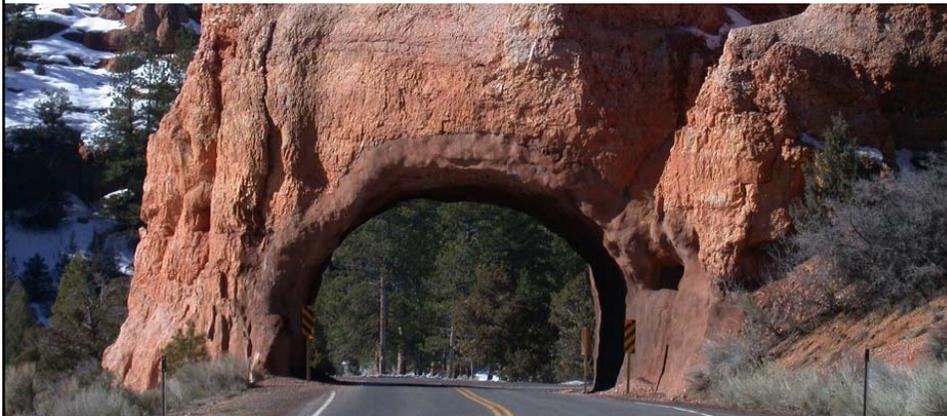
Good Roads Cost Less - 2006



Recommendations

- Continue or increase funding for preservation & rehabilitation
- DO NOT divert preservation & rehabilitation funds to other programs
- Use all funding flexibility when determining preservation & rehabilitation treatments
- Change Performance Measures

Selecting & Programming Highway Projects



Policy 07-10

Selecting & Programming Highway Projects

Effective: _____ Revised: **UDOT 07-10**

Purpose
The purpose of this policy is to establish the authority for the development of the Statewide Transportation Improvement Program (STIP), and to outline the policies and procedures involved in this process.

Policy
The Utah Transportation Commission (UTC) is the approving authority for all construction programs and projects. The Utah Department of Transportation (UDOT) will prepare and annually update the program for construction projects to be considered and approved by the UTC. The program will reflect a six-year list of projects and will follow the statements below and the development process for the STIP as outlined in the procedures of this document. The first four years are financially constrained in accordance with funds available for that fiscal year. The last two years are projects in concept development.

Selecting Projects
The following statements apply when selecting projects:

1 - Long Range, Statewide Planning with Local Input
The UTC's project selection criteria reflect the goals of the Statewide Long Range Transportation Plan (SLRP) and take into consideration regional and local priorities. The strategic goals for Utah's transportation system as developed in the long range plan include:

1. **Take Care Of What We Have**
2. **Make The System Work Better**
3. **Improve Safety**
4. **Increase Capacity**

2 - Open, Fair, Criteria-driven Process
It is UTC policy to have a fair, open and equitable selection process based on criteria that determine which projects contribute most to state, regional and local transportation and economic development goals. Further, the UTC process intends to use decision support systems based on criteria (data) to help maximize and prioritize resources using quantifiable measures.

Selecting & Programming Highway Projects

Selecting Projects

The following statements apply when selecting projects:

1. Long Range, Statewide Planning w/ Local Input
2. Open, Fair, Criteria-driven process
3. Safety Criterion (Goal 3)
4. Transportation Criteria - data
5. System Preservation First (Goal 1)
6. Capacity Enhancements before Capacity Increases (Goal 2)
7. Increase Capacity (Goal 4)
8. Non-UDOT Participation
9. Interchange Participation
10. The UTC will determine all STIP projects

Selecting & Programming Highway Projects



5 - System Preservation First – “Take Care of What We Have”

Well planned and executed maintenance and preservation activities will extend the highway system's life by many years, at a far lower cost than replacing it. Preservation, maintenance and operations shall have the greatest weight in allocating funds among UDOT's programs. **Preservation and management of the existing system should be accomplished by funding system preservation needs first and providing funds for new construction only after the preservation needs have been met.** The basic transportation system needs are the amount of funding, determined by the Asset Management System, to meet the condition targets or goals established by the department.

Selecting & Programming Highway Projects



6 - System Efficiency Projects – “Make The System Work Better”

UDOT will preserve and optimize the capacity of the existing highway infrastructure before increasing capacity by adding new lanes. Therefore, the first reaction to present and future capacity issues are alternatives to increasing capacity by adding new lanes.

“Making the System Work Better” is addressed primarily through three strategies:

1. Intelligent Transportation System (ITS)
2. Access Management
3. Transportation Demand Management (TDM)

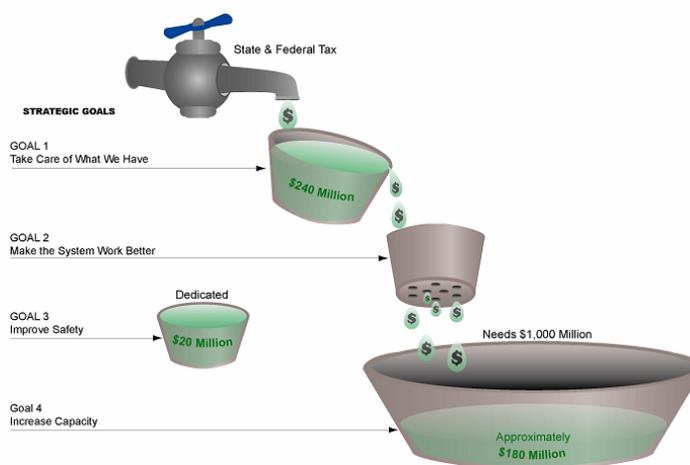
Selecting & Programming Highway Projects

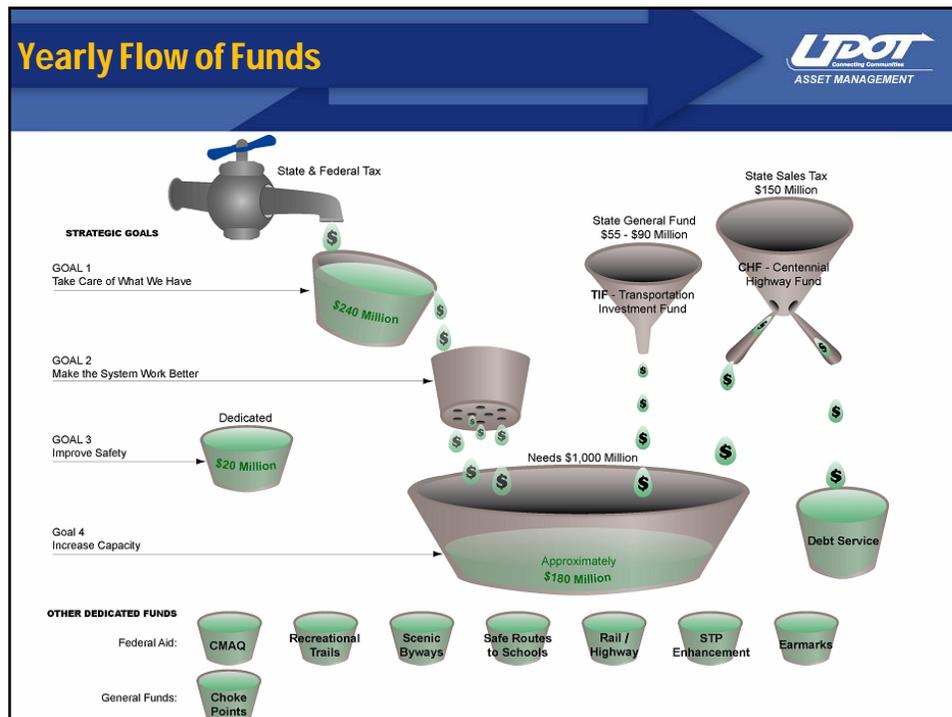


7 - Capacity Projects – “Increase Capacity”

With the rate of population growth projected to continue, it is clear that UDOT needs to continue to add new routes, widen existing corridors, construct new interchanges, and perform other work to increase capacity. Because projected revenues are not expected to meet all the identified capacity needs, UDOT will continue to identify funding to address this growing need.

Yearly Flow of Funds





Selecting & Programming Highway Projects

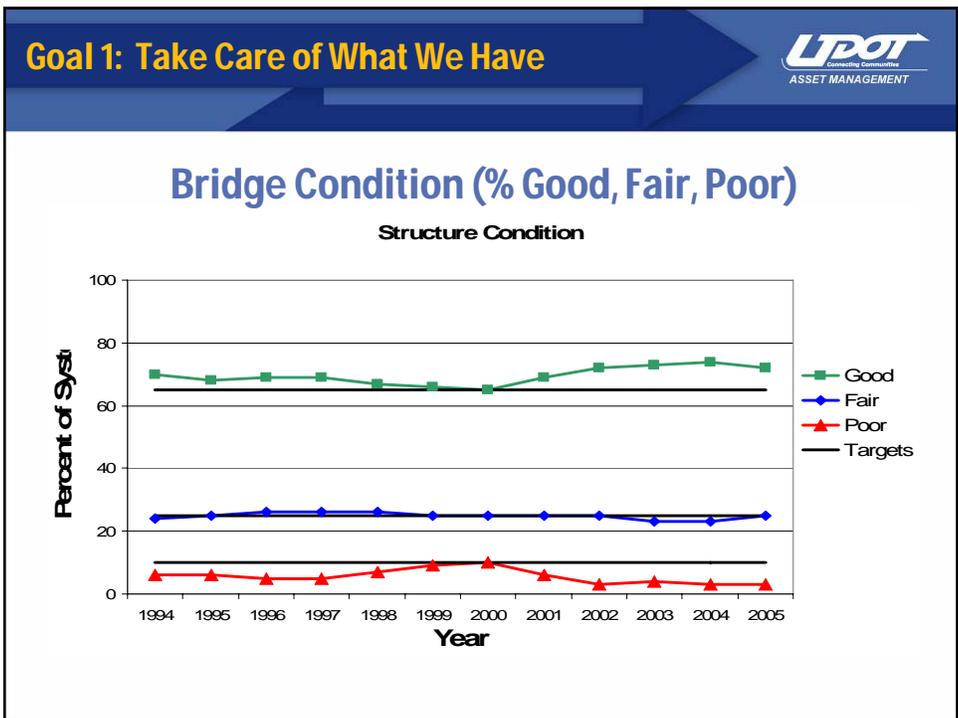
UTDOT
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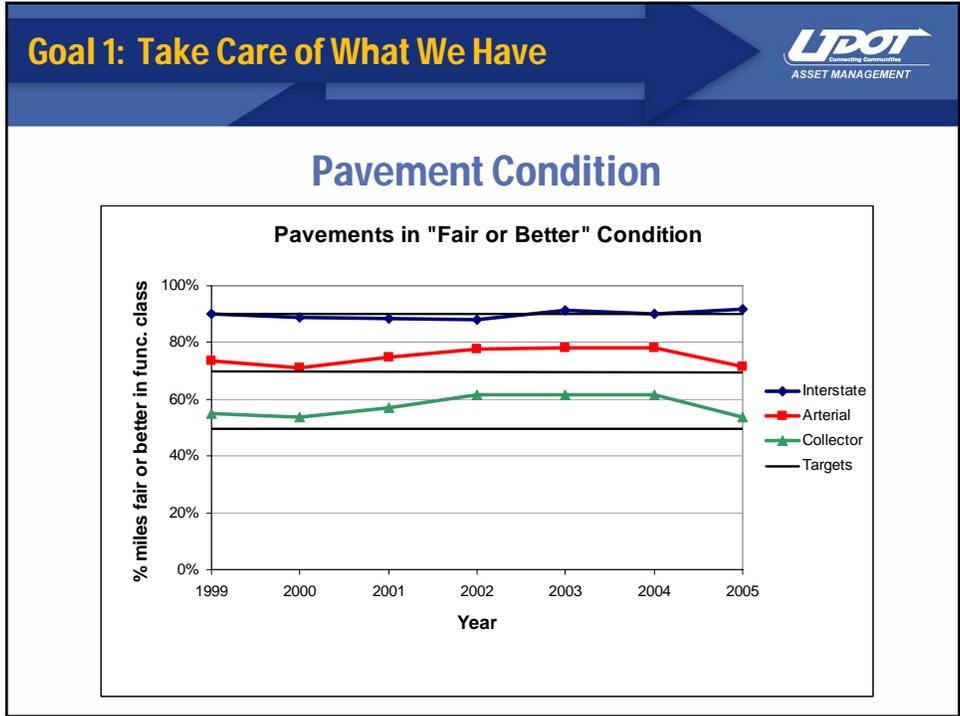
Funding Projects

The following statements apply when funding projects:

1. Prioritize First then Fund

All projects will be ranked or prioritized using quantifiable measures first; then funding will be applied, using any flexibility allowed, to fund the projects in priority order.





Why Asset Management ?



- A systematic way for defining needs
 - + A convincing basis for requesting resources
 - + A rational way to allocate resources
 - + A consistent way to measure performance
-
- = A business-like management approach and a way to improve credibility

Why Asset Management ?



Example Questions

- How much should be invested to keep roads, bridges, and other assets at acceptable service levels?
- If the budget is allocated this way how will the system perform?
- What would an optimal program of projects include?
- What would be the effect on asset condition of a 15% increase or decrease in funding?
- What would be the effect on asset condition of trading off maintenance and preservation dollars with congestion mitigation dollars?
- What are the best performance measures for UDOT?

UDOT TAM Vision



UDOT
Connecting Communities
ASSET MANAGEMENT

Vision

In three to five year's time UDOT's Asset Management System will be:

- **Integrated:** where funding allocation decisions are broad based across various asset categories;
- **Automated:** so that funding allocation decisions are generated in a more systematic, repeatable and objective manner;
- **Expanded:** to include other network assets other than just pavements and bridges;
- **Accessible:** to all UDOT stakeholders through the internet or other communication media

UDOT TAM Mission

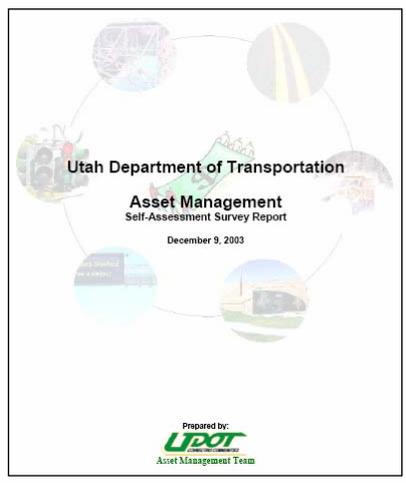


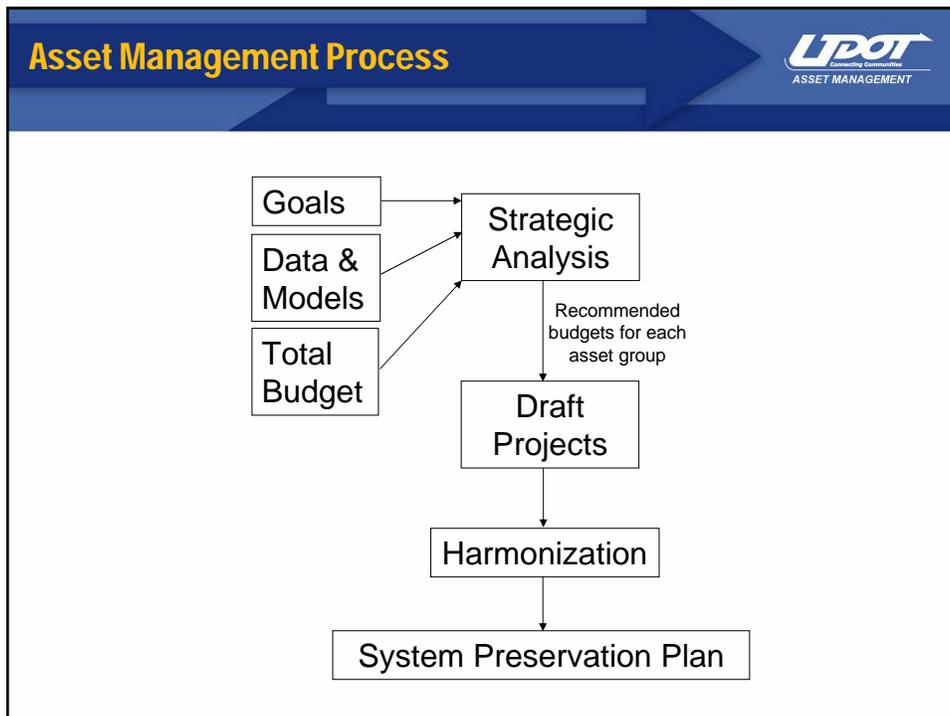
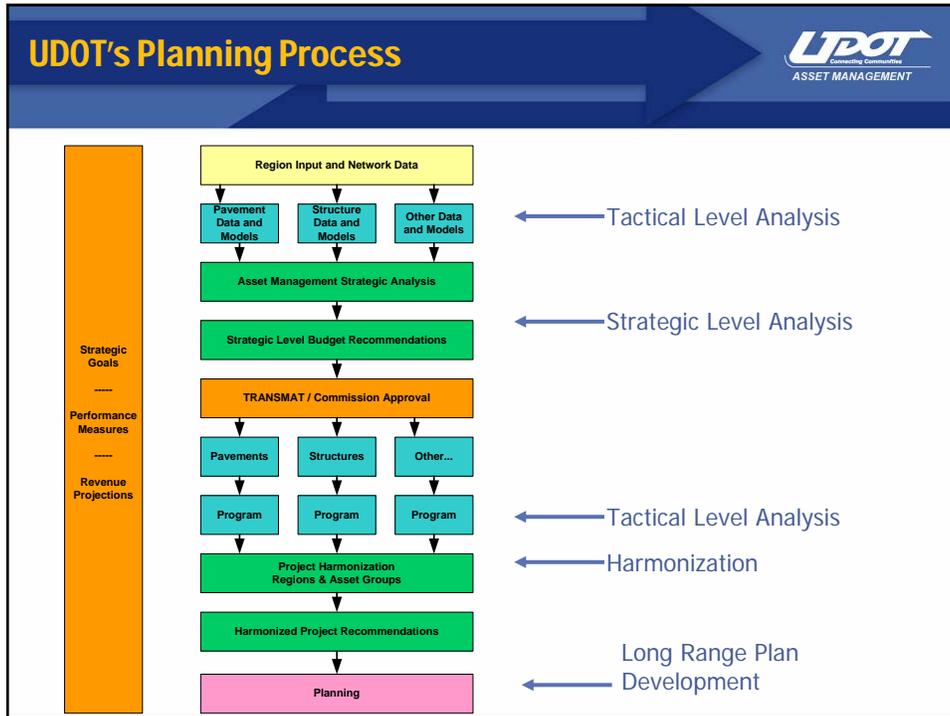
UDOT
Connecting Communities
ASSET MANAGEMENT

Mission

- To put in place the plans, people, processes and products which enable UDOT to implement accepted asset management practices in a timely and cost effective manner; and
- To continually monitor and improve the asset management implementation over time; so that
- Benefits to UDOT in the areas of Accountability, Communication, Risk Management and Financial Efficiency can be realized.

<p>Self-Assessment Survey</p> 	
<p>Asset Management Guide</p> <p>Transportation Asset Management Guide</p> <hr/> <p>November 2002</p> <hr/> <p>prepared for National Cooperative Highway Research Program (NCHRP) Project 20-24(11)</p>	<p><input checked="" type="checkbox"/></p> <p>Self-Assessment Survey</p> <ul style="list-style-type: none"> • Refer to the AM Guide

<p>Self-Assessment Survey</p> 	
<p>Publish Survey Report</p> 	<p><input checked="" type="checkbox"/></p> <p>Self-Assessment Survey</p> <ul style="list-style-type: none"> • Refer to the AM Guide • Review the survey • Add questions if needed • Select participants • Perform survey • Analyze survey – gap analysis • Publish survey report



Harmonization Process

Before

Road	From	To	Asset	ElementID	Year	Treatment
0006P	173.424	178.705	P	006P-16056	2012	FUNCTIONAL_REPAIR
			P	006P-16056	2020	MINOR_REHAB_ASPHALT
			B	0F 263	2013	PREVENTIVE_DECK
			B	0D 833	2015	PREVENTIVE_DECK
			B	0D 833	2018	PREVENTIVE_SUBSTRUCTURE
			B	0D 833	2016	REPAIR_DECK
			S	0006P-173.42	2011	SAFETY_IMPROVEMENT

After

Road	From	To	Asset	ElementID	Year	Treatment
0006P	173.424	178.705	P	006P-16056	2012	FUNCTIONAL_REPAIR
			P	006P-16056	2020	MINOR_REHAB_ASPHALT
			B	0F 263	2012	PREVENTIVE_DECK
			B	0D 833	2012	PREVENTIVE_DECK
			B	0D 833	2020	PREVENTIVE_SUBSTRUCTURE
			B	0D 833	2016	REPAIR_DECK
			S	0006P-173.42	2012	SAFETY_IMPROVEMENT

Goal 1: Take Care of What We Have

System Preservation Plan (SPP)

- Published yearly
- Optimized 10-yr preservation program based on data and expected funding levels
- Regions and asset groups work together to plan
- Regions implement the plan

UDOT's Planning Process

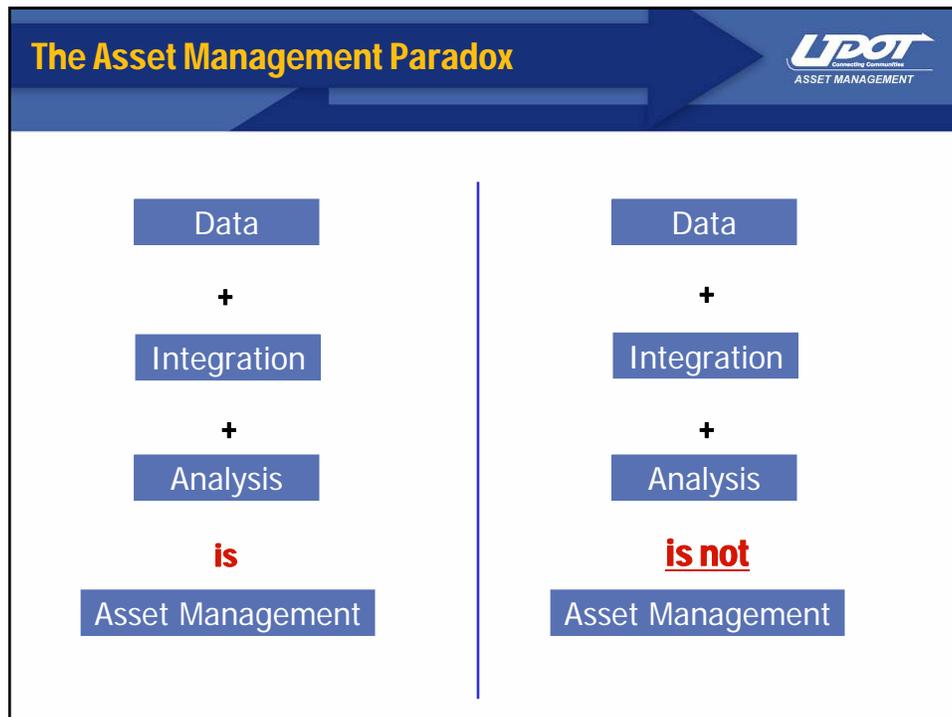


UDOT Planning & Programming Schedule

Planning & Programming Component	2007	2008	2009	2010	2011
Long Range Plan (LRTP) - 25 to 30 Years	←				←
Short Range Plan (SPP) - 10 Years	←		←		←
Statewide Transportation Improvement Plan (STIP) - 6 Years	←	←	←	←	←

The Asset Management Paradox

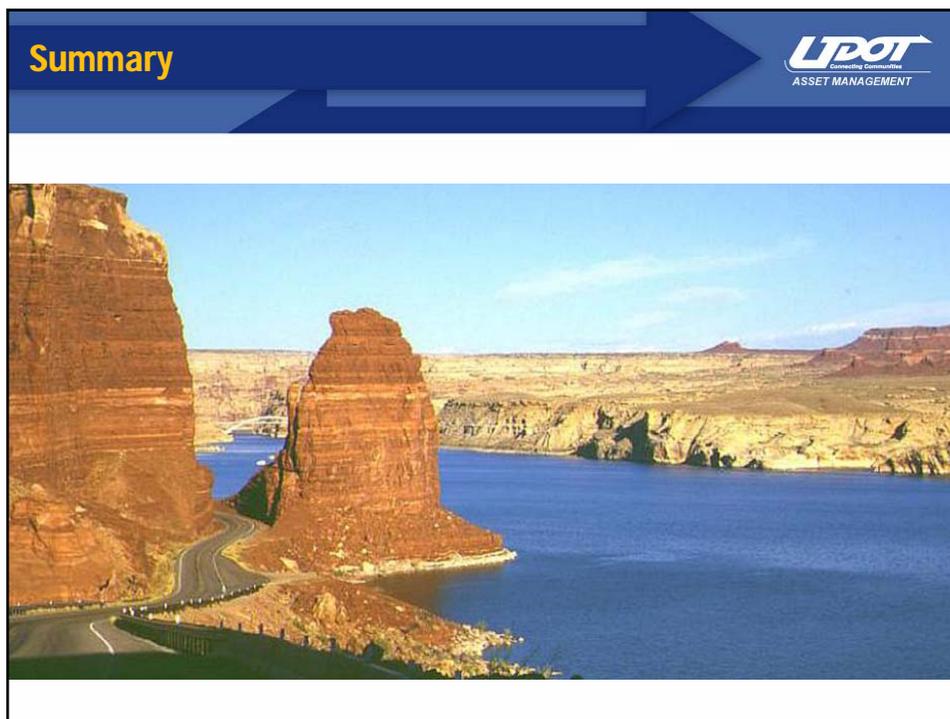


The Asset Management Paradox 

"An asset management system can not be implemented in any agency unless that agency first adopts best practice asset management."

"An asset management system is not necessarily in itself good asset management"



A slide titled "Summary" with the UDOT logo and "ASSET MANAGEMENT" text. The main content is a list of bullet points under the heading "Improving Internal Decision Making".

Improving Internal Decision Making

- Strategic Planning – Define Goals, Objectives, Strategies & Tasks
- Align all Plans & Work to Strategic Goals
- Adopt a Philosophy or Strategy i.e. "Good Roads Cost Less" for each Strategic Goal
- Policy & Procedure – define flow of funds
- Define Planning Process

Summary



Improving System Performance

(Even with constant or declining dollars)

- Adopt "Good Roads Cost Less" strategy - DO NOT use "Worst First" strategy
- Improve system condition over time
- Maintain assets in as good a condition as possible
- Be good stewards – take care of what you have before adding new mileage
- Set "Stretch" Goals
- Optimize & Prioritize projects using data & decision support systems
- Harmonize

Questions ?



Michigan's Perspective

December 13, 2006

Michigan is Defined by:

- Geography
- Government
- Urban/Rural
- Economics
- Auto-dependent
- Border position





Challenges for Transportation Investment

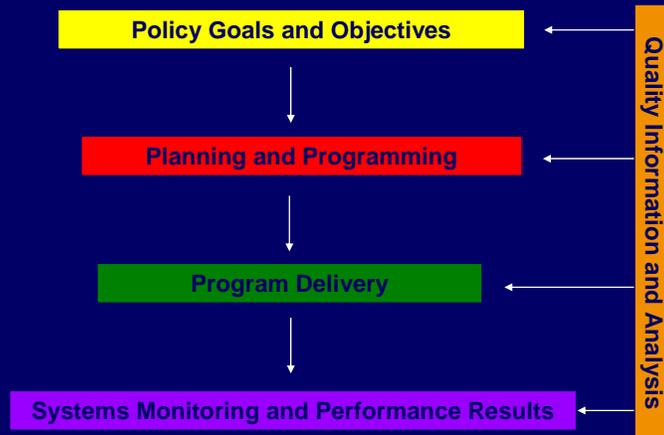
- Rural & urban geographic balance
- Financial realities
- Shifting the discussion
 - From - Where are funds spent?
 - To - Are we getting the results we need?



Asset Management



Michigan Department of Transportation's Asset Management Process



Balancing Investments Goal Setting

- Goals established through SLRP Process
- Based on needs assessment
- Ensures measurable outcomes
- Considers political realities



Quality Information & Data

- Maintain high-quality information that supports asset management and business process
- Collect and update data cost-effectively
- Data viewed as "corporate asset"
- Collect it once; store it once; use it over and over
- Information automated and accessible to all parties
 - GIS Framework Project
 - Global Positioning System (GPS)

Quality Information & Data

- Not what you collect but how you store it and make it available
- Six management systems
- Adopted a single linear referencing system
- Projects are managed through a single database, our MAP database

Planning and Programming

- Develop Investment Strategies
- Integrated Call for Projects
- Five-Year Program Development

Planning and Programming Developing Investment Strategies

- Investment strategies guide the allocation of capital resources
- Investment focused where they will most benefit the public
- Strategies ensure funding is distributed according to strategic direction, need, geographic balance and financial constraint



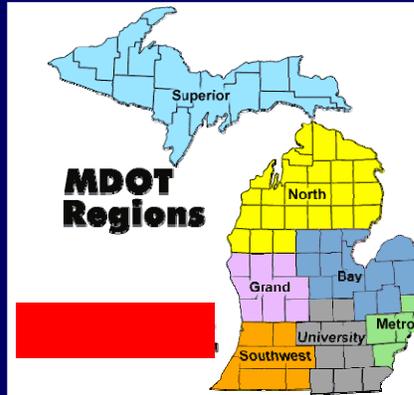
Developing Investment Strategies Investment Template



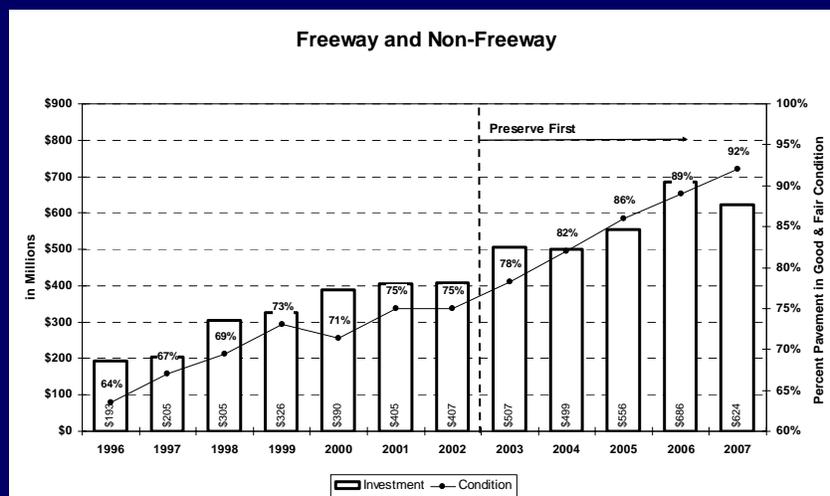
- Tool for managing financial resources to ensure funding is targeted towards goals
- The statewide template is our investment strategy
- Establishes funding to program categories
- Provides mechanism to constrain the capital program needs to available revenues

Program Development

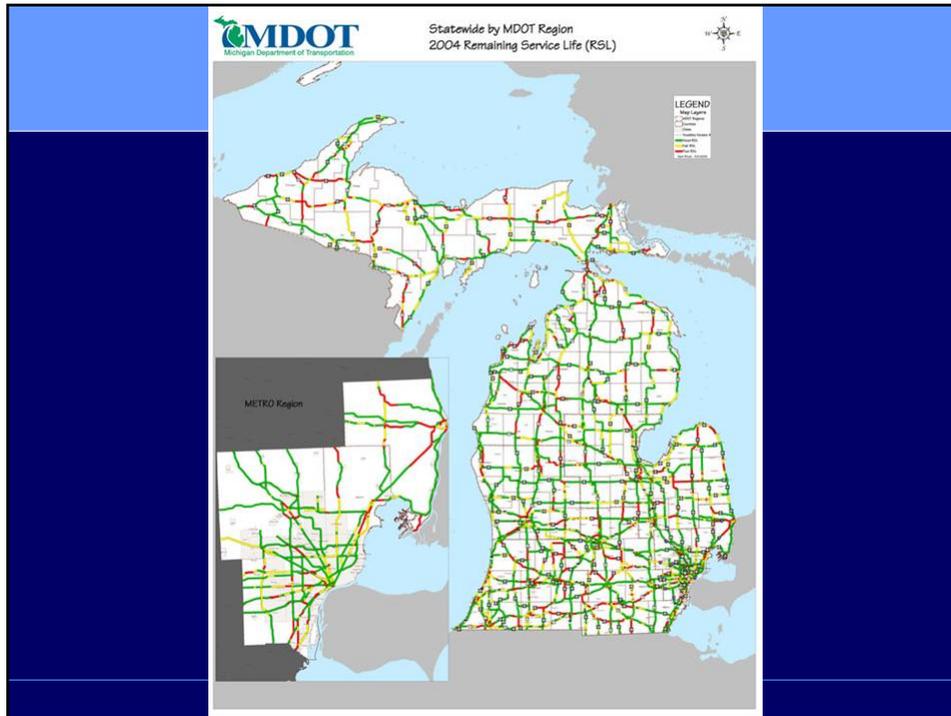
- Annual Call for Projects (CFP) Process – Adds year five (5) to the Five-Year Transportation Program.
- The CFP guides the program development process and links Commission policies with project selection.
- MDOT regions are responsible for submitting projects for the upcoming years based on template distributions (investment strategies).



Road Preservation Investment Level and Pavement Condition







Results: Average Pavement Life

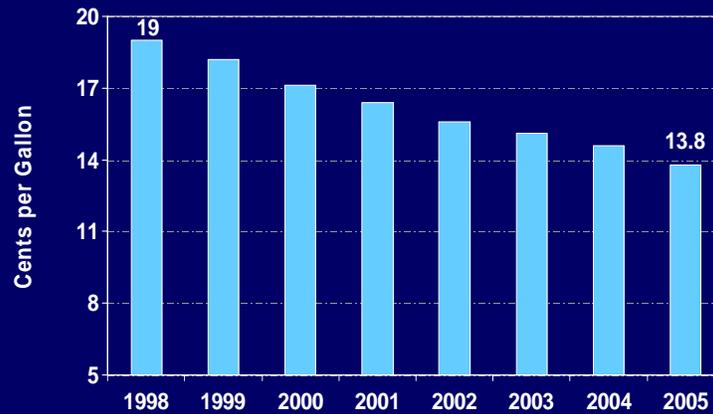
1996: 6.8 years

2005: 8.95 years

Average pavement life
has increased nearly
32 percent



Decline in Purchasing Power



The Purchasing Power of the State Gasoline tax has Declined by 27.4% Since 1998

Communicating with Elected Officials

- Build Michigan II – Raised gas tax by 4 cents
- Preserve First – Greater emphasis on preserving roads and bridges
- Legislative Hearings – Five-Year Transportation Program
 - Used asset management data to justify program
 - Supported by public

Benefits of the Asset Management Approach

- Integrated
- Strategic
- Proactive
- Advanced Systems
- Forward Thinking



Questions?

THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

The **National Academy of Sciences** is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. On the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Ralph J. Cicerone is president of the National Academy of Sciences.

The **National Academy of Engineering** was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers. Dr. Charles M. Vest is president of the National Academy of Engineering.

The **Institute of Medicine** was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences by its congressional charter to be an adviser to the federal government and, on its own initiative, to identify issues of medical care, research, and education. Dr. Harvey V. Fineberg is president of the Institute of Medicine.

The **National Research Council** was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both the Academies and the Institute of Medicine. Dr. Ralph J. Cicerone and Dr. Charles M. Vest are chair and vice chair, respectively, of the National Research Council.

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