BEST PRACTICES FOR LINKING STRATEGIC GOALS TO RESOURCE ALLOCATION AND IMPLEMENTATION DECISIONS USING ELEMENTS OF A TRANSPORTATION ASSET MANAGEMENT PROGRAM

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16. Abstract

The research described in this report assembles a set of tools based on experiences and best practices in a diverse set of states for linking strategic goals to resource allocation and implementation decisions using aspects of asset management. A survey of practices in each of the state DOTs that explores documents and synthesizes both strategic planning processes and asset management was conducted. With input from an expert advisory panel, five states were for detailed analysis. These are Florida, Maryland, Michigan, Montana and Pennsylvania. Each of the states was visited by a project team that spent two days on site. Information on the strategic planning and asset management process was obtained through personal interviews with DOT officials and the acquisition of materials describing these processes. Based on detailed documentation of the practices in each of these states, a synthesis of best practice of strategic planning, asset management and the linkage between the two was developed. A model process for linking asset management to strategic planning is then developed. The model process that results does not represent any particular state, but incorporates elements from all five states. This model process can provide useful guidance to states interested in augmenting their existing processes.

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Executive Summary

The research described in this report not only builds on the past and ongoing work but also assembles a set of tools based on experiences and best practices in a diverse set of states. To do this, we draw on the literature and a survey of practices in each of the state DOTs that explores documents and synthesizes both strategic planning processes and asset management. With input from an expert advisory panel we selected states for detailed analysis. Based on detailed documentation of these states, we developed a synthesis of best practice.

The first step in the project was to explore the literature regarding asset management and strategic planning. Although there are a number of definitions of asset management, the most accepted and common definition has been given by the FHWA. Asset management can be defined as a "systematic process of maintaining, upgrading, and operating physical assets cost effectively. It includes preservation, upgrading and timely replacement of assets, through cost effective management, programming, and resource allocation decisions". It has provided a solid foundation from which to monitor the transportation system. The definition also states, "Asset Management combines engineering principles with sound business practices and economic theory, and provides tools to facilitate a more organized logical approach to decision making," (USDOT Asset Management Primer, 1999).

Asset Management is an efficient and cost effective way of strategically targeting resources. The guide on asset management prepared by Cambridge Systematics for the National Cooperative Highway Research Program (NCHRP) defines transportation asset management as a strategic approach to managing transportation infrastructure. The concept of asset management covers a very broad range of activities and functions. It includes investment decisions, prioritization, relationship with different stakeholders and partners, long range transportation planning, capital project development, etc.

Strategic planning is a systematic examination of an agency's internal and external operating environments, with development of a plan for the firm's future success. The strategic planning process basically helps the agency to plan for the future by answering three important questions: Where are we now? Where do we want to be? How do we get there?

In the transportation-planning sector, the strategic planning process assumes significance, as transportation is a publicly provided good, for which a strategic vision is required. A report prepared for the National Cooperative Highway Research Program (NCHRP), by

T.H. Poister and D.M. Van Slyke, presents findings of surface level explorations of strategic leadership and performance measurement in state DOTs (Poister et al, 2001).

All of the state DOTs contacted had strategic agendas in place, but the plans varied in terms of specificity and focus on strategic goals and objectives. One of the innovative approaches used by the state DOTs include the "Balanced Scorecard" (BSC) approach. This approach helps the planners to develop goals, objectives and performance measures in four different perspectives of organizational performance. These include the customer perspective, the financial perspective, the internal process perspective and learning and growth perspective.

A review of the literature found that asset management is very similar to strategic planning as some of the key elements that support asset management are strategic in nature. Michigan and Vermont are the two states that have legislation on asset management. Many other states are contemplating passing legislation supporting asset management.

The next step in the research process was to identify state departments of transportation that implemented strategic planning and/or asset management. All fifty states were analyzed. Obtaining strategic plans from the states was a two-stage process. Initially state websites were screened for documents containing the DOT's strategic plan. If such information was not on the website, direct contact was made with the DOT. Once the strategic plans were in hand, these were reviewed for content. Special emphasis was placed on goals, objectives and performance measures. Asset management and asset management-like practices were identified for each of the plans and compiled by state. The research determined that sixteen states either linked the use of asset management tools to their strategic plans, or are actively moving in the direction of asset management.

The results of this work were presented to our expert panel who then recommended a set of states for in-depth analysis. These are Florida, Maryland, Michigan, Montana and Pennsylvania. These states not only provide a variety of approaches to linking asset management to strategic planning, but also are geographically and physically diverse. A project team that spent two days on site visited each state. Information on the strategic planning and asset management process was obtained through personal interviews with DOT officials and the acquisition of materials describing these processes.

Florida

The state of Florida has a unique strategy of implementing a strategic planning process and developing an asset management program. Florida refers to their strategic planning process as policy planning, and although only briefly mentions the notion of asset management, they have been involved in such practices for several years.

There are several established principles that are considered when planning and developing the Florida transportation system. These include:

1) Preserving the existing transportation infrastructure

2) Enhancing Florida's economic competitiveness
3) Improving travel choices to ensure mobility

The legislature has charged the Florida Transportation Commission to develop and adopt measures for evaluating the performance and productivity of the Department of Transportation. FDOT is responsible for carrying out the planning and maintaining of Florida's infrastructure.

Policy Planning is the term used by Florida interchangeably with the term "strategic planning". Florida has an elaborate network of plans and programs, all of which feed each other. The initial document, from which all other documents are based, is the State Comprehensive Plan (SCP). This plan identifies 11 state goals and policies that are to be supported by the DOT and other state agencies.

The Florida Department of Transportation's Asset Management Process is a holistic approach using decision-making, investment analysis and management of transportation assets. It is possible to recognize links by identifying asset management practices and the use of supporting information. In order to determine this, we identified each goal, objective and performance measure that is considered to be asset management.

Goal 1 – System Preservation:
- Objective 1 – Ensure that 80% of pavement on the State Highway System meets standards
- Objective 2 – Achieve 100% of the acceptable maintenance standard on the State Highway System
- Objective 3 – Ensure that 90% of FDOT-maintained bridges meet Department standards while keeping all FDOT-maintained bridges open to the public safe.

Goal 2 – Mobility/Economic Competitiveness
- Objective 1 – Commit approximately 50% of the highway capacity improvement program for capacity improvements on the Florida Interstate Highway System (FIHS)

Goal 3 – Organizational Excellence/Customer Focus
- Objective 1 – Improve external customer satisfaction
- Objective 2 – Track and resolve external customer complaints
    a. Roadway Signs and Markings
        i. Visibility and Readability of Signs
        ii. Daytime Visibility of Markings
        iii. Nighttime Visibility of Markings
    b. System Issues
        i. Roadway Smoothness
        ii. Attractiveness of Highways
- Objective 3 – Implement a results based management system

Asset Management is incorporated into a continuous process that links policies with financial planning, programming and performance monitoring to determine if objectives

are met. The performance measurement then results in appropriate decisions regarding funding levels and adjustment of plans and policies to begin a new cycle.

The strongest link can be seen through FDOT's involvement with the state legislature. Their actions are highly driven by mandated statutes constructed through constant interaction between FDOT and the state legislature. These statutes address:

- Performance and productivity standards, development, measurement, and application. These assess:
    1. Production
    2. Finance and administration
    3. Preservation of the current state system
    4. Safety of the current state system
    5. Capacity Improvements: highways and all public transportation modes
    6. Disadvantaged business enterprise and minority business programs

- Establishes annual performance objectives and standards that can be used to evaluate performance and productivity

The Florida Department of Transportation's Asset Management Process is simply good quality management. While Florida does not have an asset management program per se, they have implemented a system of goals and performance measures, which ensure that their system is preserved to a legislated level of performance. This legislation plays a key role in the funding and the resulting prioritization of activities. Within this legislation, Florida has addressed four simple goals: safe transportation, system management, economic competitiveness and quality of life.

In addition, this system is mission driven and customer focused with a clear link between decisions, budgeting, and performance monitoring. Florida has developed a bottom-up process of incorporating input from many active MPO organizations for the purpose of decision-making in the areas of budgeting, performance monitoring and project priority selection.

Maryland

Maryland uses a centralized, top-down approach to developing and implementing its strategic plan. The high-level transportation policy goals are presented through the Maryland Transportation Plan (MTP) and reflect a blending of the following:

- Governor's Vision
- Secretary's and Modal Administrators' Priorities
- Statutory Requirements
- System Needs
- Public Desires

Each modal administration then creates its own strategic plan to support the high-level policies described in the MTP.

Maryland's State Highway Administration (SHA) is the only modal administration that has developed a comprehensive and formal asset management program. The Maryland State Highway Administration asset management program has five steps:

- Condition assessment
- Network level planning (optimization)
- Project selection
- Project advertisement
- Construction

The following system preservation objectives and performance measures relate directly to linking asset management to the strategic planning process:

Policy Objective: Preserve and maintain existing transportation infrastructure and services as needed to realize their useful life.

- Objective: (SHA) Increase the percentage of pavements with an acceptable ride quality on the State Highway system from 82% to 86% by January 2005.
    - Performance Measure: Percent of pavements rated fair to very good.
- Objective: (SHA) Ensure rate of structurally deficient bridges on the National Highway System continues to be below national averages each year. (5.9% for 2000 and 5.8% for 2001)
    - Performance Measure: Percent of Maryland SHA bridges on National Highway System that are structurally deficient.
- Objective: Maryland Port Authority (MPA) Maintain and improve terminal infrastructure (cranes, berths, cargo storage areas) to preserve and enhance capacity through the year 2010.
    - Performance Measure: Total number of work orders per year.
    - Performance Measure: Ratio of preventative maintenance vs. corrective maintenance work orders.
    - Performance Measure: Percent of covered storage area that meets industry standard.
    - Performance Measure: Percent of breakbulk vessel berths that meet industry standards.
- Objective: Maryland Transportation Authority (MdTA) Ensure no Authority bridges or overpasses are categorized as structurally deficient according to federal standards. Maintain the percentage of Authority bridges and overpasses out of compliance with federal functional standards at 5% or less in 2001 and thereafter.
    - Performance Measure: The percent (and number) of bridges and overpasses categorized as structurally deficient by federal standards.
    - Performance Measure: The percent (and number) of bridges and overpasses categorized as functionally obsolete by federal standards.
- Objective: (MdTA) Respond to all critical deficiencies identified in the annual inspection report within one year of identification.
    - Performance Measure: The percent of critical items that were corrected within 1 year of identification.

- Objective: (MdTA) Increase the percentage of high priority items that were corrected within three years to 80% in fiscal year 2004, and maintain at that level thereafter.
    - Performance Measure: The percentage of high priority items that were corrected within three years of identification.

When it comes to funding for particular paving projects, asset management plays a key role. Even though the districts have flexibility in which paving projects are submitted for approval for funding, these projects must support the overall network optimization plan or risk being rejected by the Chief Engineer. So at this lower level, the linkage between asset management and which projects are funded is very tight.

The efforts that the MDOT has made in the past several years in asset management, strategic planning, and the linkage between them has increased efficiency, particularly in the Pavement Division of the SHA. Their focus on long-term optimization serves the State's policy goals of system preservation and customer satisfaction well. There is a high level of cooperation between the centralized MDOT leadership and the local districts. This has been fostered by MDOT management and is enabled to a certain degree by Maryland's small size. One example of this is that MDOT holds yearly comprehensive and collaborative planning exercises between the central office and the districts.

Maryland has legislated public involvement in developing MDOT's high-level policy goals as well as MDOT's responsibility to provide an annual report back to the public on progress made. When this is coupled with MDOT's multi-modal structure and dedicated transportation fund, a great deal of flexibility to allocate resources between modes in order to satisfy these policy goals is possible. In order to meet these goals, the SHA has implemented an asset management program for pavements.

MDOT's Pavement Division has a more formalized asset management system than any other state in this study. The asset management process was developed to reach the challenging system preservation and customer satisfaction goals set forth by MDOT and are intimately linked to the strategic plan through formal performance measures.

Michigan

Michigan is an interesting case study in terms of asset management, in that it is one of the few states to have asset management mandated by state law. While Michigan may still have a way to go in terms of establishing a fully integrated state model of asset management and strategic planning, it is certainly on its way to achieving this integration. The Michigan Department of Transportation seems to have a lot of enthusiasm and hope for the changes and improvements that asset management will bring to its organization.

The most direct links between asset management and strategic planning are in the Act 499 legislation that enacted the Transportation Asset Management Council (TAMC), and in the strategic goal of Preservation. Act 499 explicitly terms asset management a

"strategic" process, in which goals and objectives are set, life-cycle costs are analyzed, and investment strategies are recommended. The TAMC is mandated to propose a strategy to the State Transportation Commission, which in turn produces the State Long Range Plan. However, it is anticipated that it will take at least three years for the Council to make such a strategic recommendation, as the models used for developing strategies need time to amass data to recognize trends.

There does appear to be some link between asset management and strategic planning in terms of budgeting. TAMC does produce an annual budget, and interviews suggest that asset management has changed the way that projects are planned in terms of funding. In the past, if the state had money, it would be awarded to teams based on their responsiveness, not the overall system needs or priorities. Asset management has given the state the tools needed to budget responsibly, and also to negotiate political funding.

The State Long Range Plan goal of Preservation provides a close linkage between asset management and strategic planning. MDOT has prepared specific strategies related to asset management and preservation:

- Strategy for Repairing and Rebuilding Roads: This relates to the statewide goal of having 95 percent of freeway pavements and 85 percent of non-freeway pavements in "good" condition by 2007. Road preservation programs will include long-term construction (20-30 years), rehabilitation (10-20 years), and capital preventive maintenance improvements (less than 10 years) based on analysis using the forecasting tools in the Pavement Management System (PMS).
- Trucks: New design standards – including pavement type and thickness, configuration of and distance between interchanges, and structural elements of bridges – will be used to address problems resulting from changing truck volumes, weights and sizes.
- Winter Maintenance Strategy: MDOT is exploring new technologies and techniques for dealing with winter weather, including alternative anti-icing materials.
- Bridge Preservation Strategy: This relates to the goals put forth in the Strategic Investment Plan for Trunkline Bridges – to have 95 percent of freeway structures and 85 percent of non-freeway structures in "good" condition by 2008, and to address 100 percent of structures deemed to be of highest priority based on condition by 2008.
- Bridge Widening or Lengthening Strategy: This strategy involves very long-term thinking about bridges, trying to anticipate where bridge widening or lengthening may be needed in the future and incorporating such upgrades, where feasible.

The other State Long Range Plan goals of Safety, Basic Mobility, Strengthening of the State's Economy, Transportation Service Coordination, Intermodalism, Environment & Aesthetics, and Land Use Coordination, can be indirectly tied to asset management, mainly through the performance measures of Bridge Condition, Pavement Condition, and the Customer Satisfaction Survey which are all utilized in analyzing MDOT's progress in achieving these goals.

There is also a link between asset management strategies and the state's Five Year Road & Bridge Program maintenance goal of having 95 percent of freeway pavements and

freeway bridges in "good" condition by 2007 and 2008, respectively, and 85% of non-freeway pavements and non-freeway bridges in "good" condition by 2007 and 2008, respectively.

The primary strategic planning performance measures of Bridge Condition, Customer Satisfaction Survey, and Pavement Condition are clear links with asset management. These performance measures are clearly outlined in the State Long Range Plan as indicators that affect the strategies, project selection, and level of investment that MDOT employs in meeting its state long range plan goals. The asset management Transportation Management System, specifically the Bridge Management System and Pavement Management System, are utilized in collecting data for these performance measures.

Michigan is actively pursuing asset management. This focus is mandated by state law and is transforming the way MDOT operates. It is decentralizing operations and pushing planners into regional offices with the engineers. It is causing officials to rethink the way the state's trunkline highways are maintained and improved. It has provided a common language that allows disagreements to be discussed rationally and resolved, not just within MDOT, but also between MDOT and city and county governments.

As Michigan continues down this path, more changes will occur. The state is only in the beginning phases of developing the data collection and management systems that will allow it to fully utilize the power of asset management. While asset management is referenced in the State Long Range Plan, specific linkages are hard to find within MDOT. Some of the people interviewed stated that more linkages will be developed but not until enough data has been collected and analyzed – a process expected to take a couple of years at least. There is also a lack of lower level performance measures within the strategic plan relating to asset management. The performance measures listed refer only to the percent of pavement and bridges rated as "good." Perhaps there are additional lower level performance measures, but these were not revealed during the interview process.

Michigan is definitely in the leading tier of states using asset management. A key factor enabling their progress is that it is founded in state law. This recently passed law has caused a sea change within MDOT. The culture is changing, and the old ways of "worst first" project prioritizations have been and are continuing to be replaced by thinking in terms of system optimization. As the data collection and management processes come on line and further linkages to the strategic plan are created, Michigan will realize additional benefits and will continue to be a model to other states looking to reap the substantial benefits of asset management.

Montana

Montana has well developed bridge, pavement, congestion and safety management systems. These systems include inventory, condition assessment, performance measures and evaluation. MDT has taken a leadership role in creating a web-accessible version of the bridge management system PONTIS.

Texas Research and Development Institute (TRDI) developed MDT's pavement management system. This network level system includes:

- Inventory
- History - construction, maintenance, condition
- Condition survey data
- Traffic data
- Database system
- Data analysis capability
- Report generation

The congestion management system and the safety management have been developed in-house. The safety management system is evolving to focus on localized spot improvements. There are also an intermodal management system and a public transportation management system.

Maintenance is integrated though out all the systems. For example, performance goals include reactive maintenance dollars. Decisions related to these goals are made on the basis of the pavement management system output. Similar efforts will be developed for signs, guardrails, and other hardware.

The "Performance Planning Process" is the system that integrates the various components of asset management. The performance planning process (P3) links ongoing annual and multi-year activities to plan program and deliver highway improvements. P3 is a project nomination process that is closely linked to the evaluation of performance measures. The inputs are:

- Statewide Long Range Transportation Plan. This is updated on a 5-year cycle and includes customer input, technical analysis and policy direction. This provides the vision.
- Funding Distribution plan. On a 1-year cycle this plan involves trade-off analysis and performance measures that are derived from the management systems. This provides the performance goals.
- Construction Program Delivery and System Monitoring. These are ongoing efforts that provide system performance measures through existing systems and public involvement.
- Statewide Transportation Improvement Program. The project nominations and customer input are updated annually. These are the investment decisions.

Montana has used the Balanced Scorecard to produce a strategic business plan. However, this business plan focuses on organizational performance rather than the delivery of transportation services. It is the way to make sure that the policy directions happen including tracking and implementing mechanisms.

"TranPlan 21" is Montana's statewide multimodal transportation plan. It was originally adopted in 1995 and was updated in 2002. TranPlan 21 fulfills the following functions:

1. Provides performance goals and gives relative weighting

2. Identifies performance objectives – tradeoff analysis with different goals recognizing fiscal constraints. Solicits weights from decision makers so that the political process is reflected in the weighting
3. Distributes resources (funding) to districts, systems, and types of work.

There are no formal legislative, budgetary or funding processes that link asset management and strategic planning in Montana.

However, strategic planning is very tightly tied to asset management in terms of goals and objectives, and the performance measures used to track progress. "TranPlan 21" sets the direction and vision for the P3 process by specifying direction but not which projects should be built to accomplish this goal.

A budget is given to the districts and the districts nominate the projects. A systems performance query tool facilitates assessment of the impacts of the projects. The GIS-based system brings up underlying management system data so that the user can assemble their program using various indicators of needs such as pavement ride, bridge conditions, and safety hot spots.

Each goal has specific actions identified. High priority items are ongoing or implemented before December of the current year, medium items are implemented within 2-5 years and low priority items are implemented when resources allow.

Most importantly the two processes are tied together in an annual "Program Delivery Status Report." This report addresses infrastructure investment, obligation of funds, and planned versus delivered program.

There are also fairly strong personnel linkages as leadership for both the strategic planning and the asset management processes come from the planning department. The goals identified in TranPlan 21 are translated into specific metrics in P3.

Pennsylvania

The Pennsylvania Department of Transportation has a strong strategic planning process as well as a well-defined asset management concept plan. The strategic planning process at PennDOT started in the 70's, however; the asset management concept plan came in March 2001.

PennDOT's strategic planning process has evolved over the years. The initial effort resulted in the formation of 24 major objectives. It led to the formation of a top-level strategic management committee (SMC). In 1987 and 1991, the strategic planning process was expanded to involve many more PennDOT managers. By 1991, around 500 managers were involved in the strategic planning process. In 1995, a wide variety of stakeholders were involved in the process for the first time (Poister, 2002).

In 1998, the Baldridge assessment process was initiated and the gaps in the department's strategic planning process came out in the open. It was found that, although the strategic planning process was in place, the resulting plans and decisions were not linked to the strategic planning process. Finally, the strategic planning process was revamped, and managers were specified for developing and updating the strategic plan and its implementation, and for monitoring and managing the strategic agenda. An advisory committee, consisting of some district engineers, bureau directors, and other leaders representative of the larger group of managers who would be involved in developing and evaluating strategic objectives, was formed to guide the strategic agenda.

PennDOT's approach to asset management has been influenced by a variety of policies, procedures and initiatives (PennDOT, 2001). These include:

- The Malcolm Baldridge National Quality Award criteria have been adopted illustrating PennDOT's focus on customers and performance
- PennDOT's strategic agenda identifies eight strategic focus areas that include performance based goals and objectives
- PennDOT has a base of asset inventory information and conducts regular surveys of asset condition of its most important assets
- PennDOT has bridge, roadway and maintenance management systems in place
- PennDOT conducts regular surveys of the public for perceptions on performance

There are two strategic focus areas with related higher-level goals, which have direct linkage with asset management or asset management-like activities. These include:

- **Maintenance First:** The maintenance first policy is reflected through prioritization of funding for all systems and services. Preventive maintenance is the primary element of any asset management process. Thus, asset management has been identified in one of the strategic objectives. The two higher-level goals of the Strategic Focus Areas (SFA) include smoother roads and cost-effective highway maintenance investment. Both of these higher-level goals can be considered an asset management element.
- **Customer Focus:** Customers are considered to be involved in tailoring the services and needs. Customers drive direction and measure department performance. This is an integral element of any asset management system. The two higher-level goals associated with this SFA include: improve customer satisfaction and improve customer access to information.

PennDOT has two sets of measures, Balanced Scorecard and Dashboard.

Balanced Scorecard*:* The following table gives a list of all the measures in the Balanced Scorecard, which are directly or indirectly linked to asset management.

Higher Level Goal	Performance Measure
Smoother Roads	International Roughness Index (IRI)
Cost-effective highway maintenance investment	Condition assessment for highways and bridges
Improve customer satisfaction	Baldridge organizational review package scores customer criteria
Improve customer access to information	Answer rate of calls to the customer call center

Dashboard: The following table gives a list of all the measures in the Dashboard, which are directly or indirectly linked to asset management.

Key Measure	Support Measure
Customer Satisfaction	Maintenance and Operations - CSI
International Roughness Index (IRI)	Interstate
	NHS Non-interstate
	Non-interstate routes and others
Bridges	Weak Link Bridges
Surface Improvement Maintenance	Betterment
	Surfacing
	Level and Seal
	Surface Repair
	Pavement Widening

There are 8 strategic focus areas as part of the strategic plan. Each department has a business plan, which is a tactical planning tool that fits into the strategic planning process. All the districts have a separate business plan. The main objective of the business plan is to determine how to bring costs down. The purpose of asset management is to implement the right strategy.

Every strategic objective has an owner or a leader who is responsible for that specific objective. In many of these objectives, the leaders are directly involved in implementing asset management in their division or are part of a specific management system. These direct personnel linkages are helpful in establishing the degree to which asset management is a part of the strategic planning process.

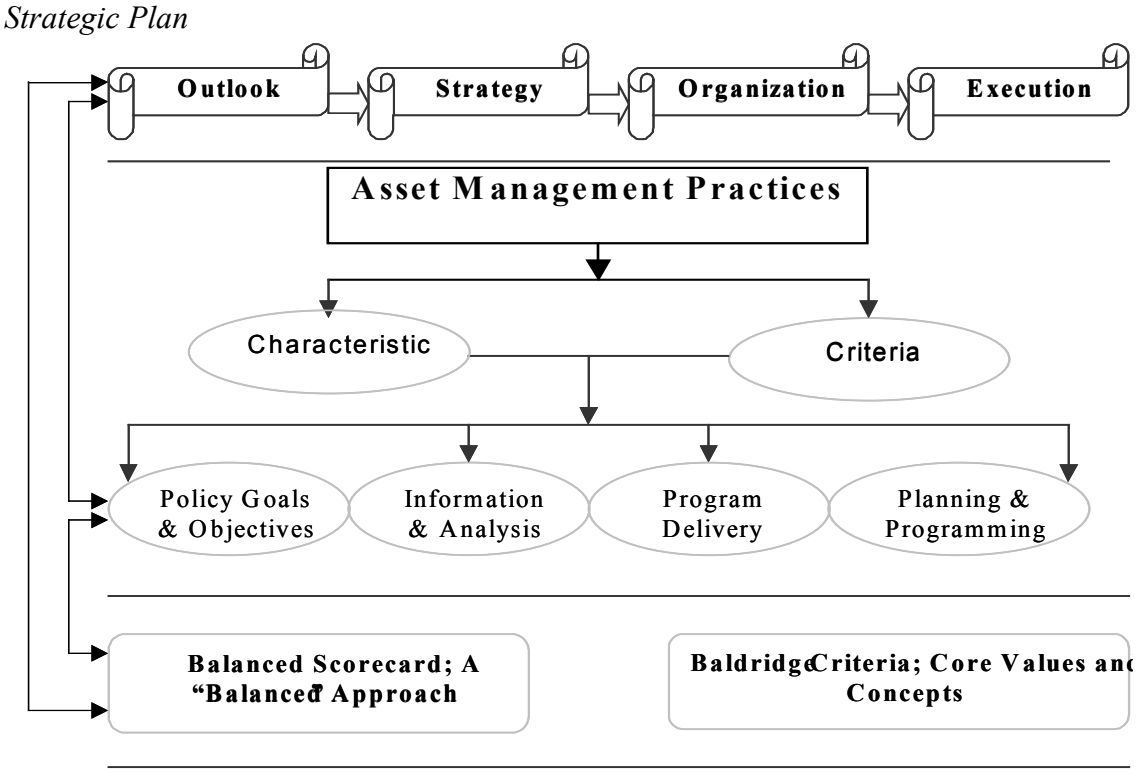
Today, asset management is in place for Highway, Bridges and ITS groups. Most of the dollars are in the highway and bridge program. PennDot is incrementally bringing asset management to roads and bridges. The system could be characterized as a strong management system in silo's, which is not integrated now. They are data rich today, but they need to take the system to the next level. Historically roadway, bridge and

maintenance were very silo oriented. Asset management has given the agency a good platform for trade off analysis. The strategic plan is integrated into an annual business plan at the high level areas. Asset management is one of the 23 objectives and thus it is not a strong system. Right now there is not much emphasis on asset management, as asset management is not defined at the strategic level. It is thus not a driver of the agenda, but a part of the plan.

A Model Process for Linking Asset Management to Strategic Planning

With the assistance of the expert panel, the best aspects of the process from each state was identified and synthesized into a model process. The model process that resulted does not represent any particular state, but incorporates elements from all five states. This model process can provide useful guidance to states interested in augmenting their existing processes. The model process is illustrated in the figure below.

The Model Process



Organizational Placement

Strategic planning for State DOT's should be a visible process where stakeholders, legislators, employees and agency leaders have input. A small group of high-level goals should be developed as a result of this process and handed down through the organization. The organization should then provide tactical action plans to achieve the high level objectives. This process also often leads to the development of specific

departmental tactics, which provide support for the strategic plan in daily activities. In support of the strategic plan, information and measures from balanced scorecards and dashboards maintained throughout the organization help guide strategic plan implementation.

Where should asset management reside within the organization in order to be most effective? Asset management needs to be integrated into all areas of the state DOT and also needs to be recognized as an organizational vision and a long-term planning tool and concept.

An Asset Management Advisory Committee consists of members appointed by the governor, who advise the DOT in the establishment of goals, benchmarks and performance indicators. Committee representatives should be drawn from transportation professionals from various levels of government. In addition, membership should be drawn from a variety of business, user, and municipal interests. The committee reports to the State Transportation Commission or its equivalent.

The Asset Management Committee should produce an annual budget. Allocations should be based on overall system needs or priorities. Asset management can give the state the tools needed to make short term versus long term trade off analyses, budget responsibly, and also negotiate funding which may span multiple administrations.

Legislation

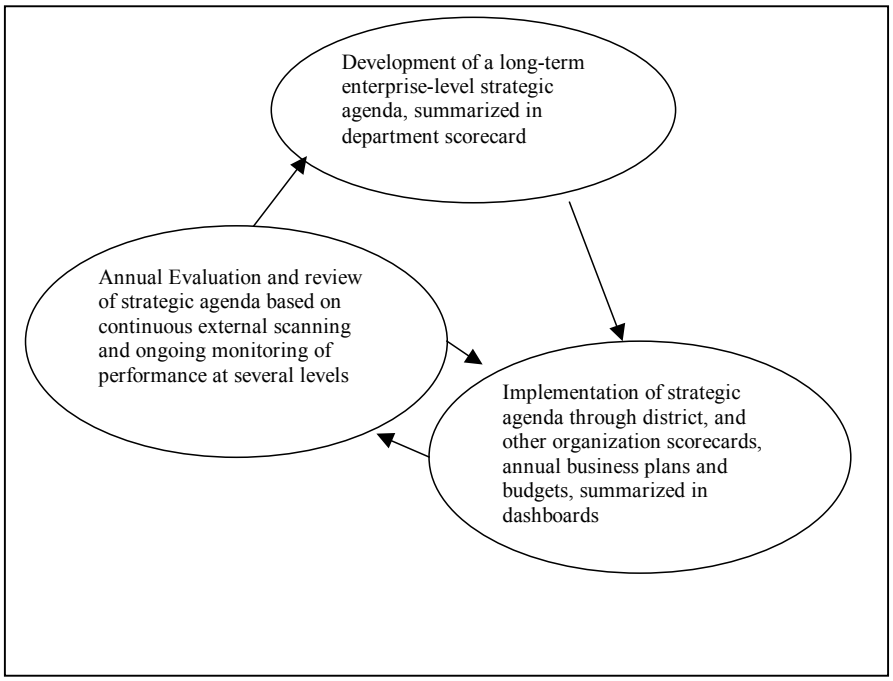
Several states legislated the implementation of asset management principles and linked funding to the asset management program. Legislation can be helpful in setting a clear statewide vision and preserving revenues for important asset preservation. Absent legislation, a mandate from the governor or secretary of transportation could be used instead.

Legislation should explicitly term asset management a “strategic” process, in which goals and objectives are set, life-cycle costs are analyzed, and investment strategies are recommended. The Asset Management Committee is mandated to propose a strategy to the State Transportation Commission, which in turn produces the State Long Range Plan. The legislation should establish annual performance objectives and standards that can be used to evaluate performance and productivity.

Overview of the Strategic Planning Process

The strategic planning process should be a two-step program. The first step develops a strategic agenda for the overall agency. This is a high-level direction setting activity, which results in the establishment of strategic focus areas used to guide the agency’s high-level plan. The second step is devoted to implementing the strategic agenda throughout the organization. This is done through implementation workshops or during department planning meetings and includes personnel goal setting activities.

Comprehensive Strategic Planning Process



The figure above represents the comprehensive strategic planning process. A cross-functional strategic planning team best accomplishes this process. The objective is to inform every employee and develop alignment and support of all functional areas to the strategic plan.

The circular process consists of three components: planning, implementation and evaluation. The planning component involves the development and updating of a department wide strategic agenda for a long-term period, usually four or five years. The strategic agenda is summarized in an enterprise level scorecard that contains the department's highest goals, strategic objectives and performance measures.

The implementation component uses the various state subgroups or regional entities in the development of organizational scorecards with their own strategic objectives and performance measures, which are linked directly to the enterprise level scorecard.

The evaluation component consists of the ongoing monitoring of performance measures at several levels. This process monitors the progress of implementing strategic initiatives and achieving strategic objectives and targets. The performance data provides feedback to organizational units responsible for implementation. On-going adjustment of strategies and tactics is encouraged to meet strategic plan objectives.

Policy goals are developed in the following top-down manner:

- High-level policy goals are developed by the Secretary's Office with both internal and external input.

- These goals are listed and described in the state transportation plan, which is the master policy document. The process should be updated at least every three years.
- Each modal administration develops a unique business plan with corresponding goals and objectives. These business plans support the policy goals outlined in the state transportation plan.
- Managers and employees within the modal administrations implement the items in their mode's business plan.

The Strategic Planning Agenda

The strategic planning agenda translates the high level goals into a specific operational plan for the Department. The strategic agenda is developed as a result of a five-step process. Given the framework of the strategic focus areas (SFA) of the department, and the high-level goals, technical teams develop strategic objectives. These objectives are then tested along the following development areas of the strategic agenda.

1. Leadership Direction: What is the expected impact of the proposed strategic objective on the high-level goal targets for this SFA?
2. Customer Expectations: will the proposed objective lead to customer satisfaction?
3. Customer Service Capabilities: Does the strategic objective consider the capacity and commitment of the State DOT and its partners?
4. Prioritization of Tasks and Strategies: What are the options, and how can the resources be redirected to pursue this proposal?
5. Plans and Performance Targets: Does the proposal contain actionable items with specific measures of success?

Implementation of the Strategic Agenda

The enterprise level strategic objectives and initiatives summarized by the strategic agenda are implemented through business plans, budgets, and expected work results developed at the district and regional unit level and in some cases by central office bureaus and county maintenance units. The implementation consists of the following four steps:

Organization of scorecards
Business planning
Resource allocation
Performance management

The Strategic Management Committee (SMC) reviews the progress of the departmental strategic objectives on a rotating basis, over a six-month period. This is a high level committee consisting of heads of the major agencies in the department and the modal administrations. The SMC scorecard tracks progress on each objective but not the general goals. The secretary holds area leaders accountable and SMC for achieving department wide results on their strategic objectives

The strategic management process is an ongoing planning process. The enterprise level strategic agenda, summarized by the department scorecard is implemented through scorecards and business plans developed by the districts. These organizations review their scorecards on a quarterly basis and manage their measurement. The district business plans containing both the organization scorecards and dashboards, are updated annually and are approved by SMC to ensure alignment with enterprise level strategic objectives.

The tasks of the implementation include:

- An overall rationale for a proposed objective
- Identification of the DOT organizations along with partners and suppliers who will be tasked with implementation
- Optimization analyses
- Opportunities for redirecting resources from existing programs
- A timetable for producing required outputs
- Appropriate measures.

This process involves the Asset Management Advisory Committee and requires support of all agency areas, which may take several months to accomplish.

Strategic Planning Elements

Eight strategic focus areas have been identified. The following table lists all the SFA's and their higher-level goals.

Strategic Focus Areas

Strategic Focus Area	High Level Goal	Strategic Objective
Maintenance First	Smoother roads	Improve ride quality by incorporating smooth road strategies into comprehensive pavement program
	Cost effective highway maintenance investment	Refine winter services best practices to achieve more timely and efficient response
		Use life cycle criteria as a tool for asset management and investment to reduce outstanding maintenance needs
Quality of Life	Balance social and environmental concerns	Improve customers' experiences of our facilities by enhancing beautification efforts and reducing roadside debris
		Develop timely transportation plans, programs & projects that balance social, economic and environmental concerns
	Demonstrate sound environmental practices	Implement strategic environmental management programs that adopt sound practices as our way of doing business
Mobility and Access	Delivery of Transportation products and services	Meet project schedules and complete work within budgeted costs
	Efficient movement of people and goods	Implement congestion management strategies that limit work zone restrictions, address incident management and reduce corridor delays
Customer Focus	Improve customer satisfaction	Implement a department-wide systematic process to continue improve customer satisfaction
	Improve customer access to information	Improve information access by providing quality customer contacts across organization with special attention to driver and vehicle enquiries.
Innovation and Technology	World class process and product performance	Map key processes and improve those with the most strategic impact on business results
		Deliver business results through planned enterprise-focused information technology
Safety	Safer Travel	Implement cost-effective highway safety improvements at targeted high crash locations
		Upgrade safe driving performance through education and enforcement initiatives
	Safer Working Conditions	Implement prevention strategies to reduce employee injury rate
		Implement prevention strategies to reduce vehicle accident rate
Leadership at all levels	Improve leadership capabilities and work environment	Provide employees with tools and expectations to communicate effectively in order to facilitate leadership at all levels
		Develop employee skills and capabilities through structured process of instruction, practice, leadership opportunities
Relationship building	Cultivate effective relationships	Implement a methodology to involve partners and stakeholders more meaningfully in DOT activities
		Strengthen the efficiency and effectiveness of transportation grant programs utilizing the methodology for partner and stakeholders

Source: Poister, 2002

An Asset Management Model

The Asset Management process should be holistic, using data driven decision-making processes, and investment analyses to manage transportation assets. Asset management should encompass the entire process, from programming and planning, to preservation. A solid policy framework, measurable objectives, and continuous performance monitoring characterize the process.

There should be no single office responsible for Asset Management; rather, it should be an integrated cross functional management practice used throughout the DOT, and considered a planning and evaluation process for reporting and interpreting results. A staff advisory position maybe a helpful guide to implementation and cross-functional integration.

Asset Management Goals

The following goals are representative of asset management programs. Specific goals may vary.

- Build, preserve and operate facilities in a cost-effective manner that delivers a level-of-service and overall system performance acceptable to the state.
- Deliver to customers the best value of each dollar spent
- Enhance the credibility and accountability of transportation investment decisions

When setting asset management goals, preservation of the system is prioritized above new capacity or system development. From an asset management perspective, this ensures that the value of the highways and bridges are not depreciated at the expense of new construction.

Asset Management Support Systems

Asset management support systems provide the ability to identify and inventory the condition, analyze usage patterns and determine deficiencies in various types and categories of infrastructure. The process of infusing asset management principles into the functional areas, results in a common asset management theme, uniformly present across the entire agency, providing consistent information, capable of integrating all functional areas with commonly held and defined systems. With these systems in place, based on a firm asset management foundation, Life Cycle Cost Analysis, a Prioritization Process, and Travel Demand Forecasting Models can be derived to improve the overall DOT performance levels.

Elements of Asset Management

Asset Management should be incorporated into a continuous process that links policies with financial planning, programming and performance monitoring. The performance measurements then provide uniform data measurements, which aid in project decisions regarding funding. This information also provides input for plans and policies in the next business cycle.

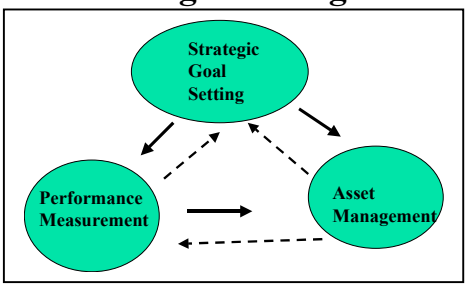
Major elements of an asset management system include:

Establishment of goals and objectives through development of a strategic plan
Identification of standards and benchmarks
Collection of data to develop performance standards and measure progress
Development of management systems to control processes and optimization
Implementation of a data driven program design and evaluation process
Program implementation
Documentation and monitoring of actions and results

Linkages

Strategic planning is enhanced by the implementation of an asset management program. As measurements and life cycle costs are better-understood and communicated, performance standards and financial cost implications are easier to analyze. Performance measurement, asset management and strategic planning functions have historically operated independently. The dynamic linkage process strengthens functionality and reinforces the business principles as shown in the figure below.

Strategic Linkages



It is important to develop linkages in these three areas. Some agencies enlist cross-functional teams in the goal setting process. Some agencies include asset management goals in the strategic plan. Asset management processes and principles drive some performance measures. The process is most efficient when performance measurement and asset management activities are directed by the strategic plan. Asset management activities and performance measurement processes should support the strategic plan with common language, goals and measurements.

There are several strategic focus areas (SFA) with related higher-level goals, which have direct linkage to asset management or asset management-like activities. These include:

- **Maintenance First:** The maintenance first policy is reflected through prioritization of funding for all systems and services. Preventive maintenance is the primary element of any asset management process. We can thus say that asset management has been identified in one of the strategic objectives. The two higher-level goals of the SFA include smoother roads and cost-effective highway maintenance investment. Both of these higher-level goals can be considered an asset management element.
- **Customer Focus:** Customers are generally involved in tailoring the services and needs within the plan. Customer focus areas drive direction and measurement within department performance. This is an integral element of any asset management system. The two higher-level goals associated with this SFA include: improve customer satisfaction and improve customer access to information.
- **Mobility/Economic Competitiveness:** This goal involves sustaining the long-term economic growth of the state and improving connections between modes to provide smooth transfers of people and goods.
- **Quality of Life:** Designing transportation systems to support communities' visions, sustaining the human and natural environments, including pedestrian, bicycle, and transit enhancing features, enhancing the availability of transportation services to the transportation disadvantaged and insuring that the decision making process is accessible and fair for all citizens of the state.

Funding and Budget Considerations

Linking asset management activities to the achievement of strategic planning goals in the budget is a critical feature of implementation. Successful processes should include asset management targets in the strategic plan. Linking asset management goals to the budget can preserve a long-term revenue stream for highway maintenance and preservation activities. Asset management targets and goals can also influence long-term financial plans and preserve financial allocations across political administrations. Asset management implementation often leads to a more visible funding and allocation process. Legislators often view an asset management program as a superior planning tool and process, where decisions are data driven and encompass the entire scope of the agency's resources.

In the model process, asset management is incorporated into a continuous process that links policies with financial planning, programming and performance monitoring to determine if objectives are met. The performance measurement then results in appropriate decisions regarding funding levels and adjustment of plans and policies to begin a new cycle.

Alignment of Performance Measures

Asset management activities typically enhance performance measurement activities. The discipline required for cataloging and recording asset value and condition helps agencies develop a standard baseline to evaluate many different types of assets. A common database for comparing project costs, life cycles, trade off analyses and system wide financial cost implications is often enhanced when implementing an asset management program. The more information commonly held and visible across departmental boundaries, the more collaborative the process can be. This collaboration often results in stronger linkages between asset management and performance measurement. If all stakeholders share the same data and measurement system, it is much easier to arrive at a consensus based allocation system. The better the data system, the easier it is to link departmental goals and objectives to the planning process.

Performance standards and measures used in the asset management process provide the foundation to gather and assess information. A culture of measurement and analysis usually begins with performance measurements, which are accessible to all, using common time horizons, valuation terms, and measures. In many cases, asset management implementation begins with the data and measures that are in place. Over time, performance measures and standards change to reflect the policy plans and objectives, which are defined in the strategic plan. Progressively, an integrated system emerges to allow cities, counties, highway and bridge departments to share and view each other's performance data at both the centralized level and decentralized field locations.

Scorecards and Dashboards

At the strategic level, a balanced scorecard may be developed. This scorecard should contain the main strategic focus areas and identify the high-level goals and strategic objectives. Each high-level goal and strategic objective should include one or more measures. If a scorecard is constructed properly it can target performance effectiveness for the next 3 to 5 years. Progress should be measured every six months and reviewed by the individual department accountable for the performance and by the agency leadership and the Asset Management Advisory Committee. Performance results need to be communicated agency wide at regular intervals with consistency.

To meet the tactical needs of the agency a dashboard may be created. A dashboard focuses on core business areas and typically targets effectiveness for a shorter period of time than a scorecard. The dashboards are generally reviewed on a monthly basis. Dashboard measures should be aligned to the strategic focus areas, yet are tactical in nature. Ideally the dashboard is linked to the scorecard. At the operational level these are statistical digests, organizational and work unit performance reports used to guide performance and activities. The Dashboard tracks a number of measures that pertain to the department's core functions and other important short-term activities. Dashboards are concerned more with current performance while scorecards are more long term oriented.

Personnel Linkages

Every strategic objective should have a manager who is responsible for that specific objective. These managers should be directly involved in implementing asset management in their division. These direct personnel linkages are helpful in integrating asset management into the strategic planning process.

Guidelines for Implementation

Linking strategic plans to asset management within a State Department of Transportation may raise a variety of implementation questions. These questions, which are helpful when DOT's are evaluating their own linkages between strategic plans and asset management programs, include:

Planning/Organizing

Organizational and structural questions:

1. **Is the Asset Management process managed in a single department or is it an integrated program?**

It is important to identify either the department or key players, which will contribute to the implementation and monitoring of the asset management program. This allows for the entire DOT to incorporate the importance of asset management into the structure wide strategic plan and individual department strategic plans.

2. **Does the organization have an Asset Management Champion who oversees the implementation of asset management under the guidelines of the strategic plan?**

The presence of an asset management guru could add to the acceptance of such a program. This person is the advocate and voice of asset management, which would give the program "legs". It may also ensure that the program permeates through the entire organization and becomes the culture of the DOT.

3. **Who is measured and evaluated on the success of asset management?**

This question begs the answer of who is ultimately responsible for the success of an asset management program. This could either be the top of the pyramid so to speak, for example, the Secretary of State or DOT. This could also rest on the shoulders of the asset management champion.

4. **Is the Strategic Plan internal or external?**

    a. How is the plan used in practice?

Is this plan used in theory and put on a shelf or is it a living document which is revisited and followed during the decision making process?

b. How does the plan shape internal relationships?

Is there a cohesive movement by all individuals and/or departments to follow the goals and objectives set forth by this document, or is it the responsibility of the individual to ensure the goals and objectives are met?

c. How does the plan shape external relationships?

5. Are goals and objectives aligned between the Strategic Plan and Asset Management documents?

a. Are goals aligned along cross-functional lines?

In other words, are goals and objectives the same for each department? The alignment of all strategic plans would ensure that all departments are working towards the same results.

b. Do goals and objectives have cross-functional targets and measurements?

In other words, are asset management and strategic planning performance measures aligned so that the same targets are being achieved?

<u>Funding Issues</u>

1. How are funds allocated and what linkage (relationship) exists between funding and asset management?

- Does Asset Management influence your financial allocation?
    - Is funding reserved for predetermined projects or do all projects compete for resources?
- How is your financial planning influenced by goals and your asset management strategies?
- Is your asset management program allowing for appropriate funding levels over time?

Performance Measures

1. **Are you using the same performance measures for both your asset management and strategic planning programs?**

Cross usage of similar performance measures enables the DOT to better track and accomplish the same goals and objectives. There can be a common evaluation and comparison of figures/results if the same requirements and measurements are used.

This following section addresses those DOTs that have no Asset Management program in place.

When you begin the implementation process, the following inquiries must be addressed:

1. *How does your strategic plan address your assets?*
2. *Do your performance measures link performance goals and objectives to your Strategic Plan?*
3. *Look at an established Asset Management guide*

Staffing

Both the Strategic Planning and Asset Management functions need to have sufficient staffing levels. It is helpful if a higher level of leadership can add focus on the integration of these two disciplines. An example would be the Secretary of State.

1. **To what extent do managers have cross-functional responsibilities?**

This question helps to identify whether management has a collaborative relationship and whether there is an open communication between departments. This would be necessary for the organizational wide adoption of an asset management program. The target to obtain the optimization of such a program would have to be universal among the individual departments and an objective of each manager.

In addition, asset management needs to have a centralized presence with tactical implementers. Field based personnel are usually most effective when they can use the same scorecard or measurements across agency objectives.

Controlling

1. **What oversight is in place?**
    - What role does legislation play?

- Absent legislation or mandates, what drives asset management and strategic plan linkages?
- To what degree is legislation present to support the planning and allocation process?

It is crucial to the successful implementation and performance of an asset management program to have a certain amount of mandatory legislation in place in order to maintain the importance of the asset management practices. The establishment of legislation may also provide for the creation of the asset management champion position. This person creates the urgency to move forward with the asset management practices and measures.

2. Does funding follow performance?

a. Implementation of an Asset Management framework is helpful for keeping track of an asset inventory.
b. Within this framework, the DOT would also have to justify the need for funding the particular project. For example, if you want a specific bridge repaired, how would it impact your performance measurements and does it follow your strategic planning goals and objectives?

Conclusions

A model process can be helpful in establishing a framework for developing a customized program which links asset management activities to the Agency's strategic planning process. Yet, each state is unique with a different mix of assets, goal setting processes and leadership structures. This model process was developed using elements of various excellent programs found in Florida, Maryland, Michigan, Montana and Pennsylvania. It is important to note that good results can be achieved regardless of structure. Leadership and education are key intangible elements, which often bridge the gap where structure and process fall short.

The benefit of a formalized asset management program that is closely linked to the strategic plan is improved program performance system wide. A by-product of such a linked program is improved interdepartmental communication and a broader holistic understanding of the agency goals and objectives by the employees and the public.

CHAPTER 1. INTRODUCTION

State DOT's have undergone unprecedented change over the last decade. Characterized by a disparate set of climate, terrain and population variables, each DOT has developed a unique and often innovative approach to asset management and strategic planning. In the past, strategic plans were commonly focused on process management, with each DOT prioritizing individual goals and objectives. Regional projects and common asset management issues were not measured or managed with common metrics leading to inconsistent implementation. There was little or no linkage between these two processes.

Today there are an increasingly large number of stakeholders involved in the process, communication is more complex and customer orientation is essential. In DOT strategic planning processes, it is not uncommon to find a wide variety of goals and objectives. It is also noted that there is no standard score card, or common definition of asset management variables or expense categories. In order to maximize performance and customer satisfaction a common measurement system is necessary.

Background

A workshop on managing changes in state DOTs was conducted in Minneapolis, Minnesota, in June 2000[1]. Many DOTs were comfortable with their organizations' strategic planning capabilities, but there was a consensus that the process often breaks down in the implementation stage. Overcoming this failure to implement major change effectively requires innovative approaches to developing strategic agendas. Ownership of strategies throughout the organization must be built, external support must be mobilized and strategy must effectively drive decisions down through the organization, targeting resources to achieve strategic objectives, and implementing appropriate performance measurement systems to evaluate success.

Most DOTs reported using a conventional approach to strategic planning, but a few have employed balanced scorecard models[2] to ensure a holistic view of strategy to create discipline in tying performance measures to objectives, and aligning operating level activities with departmental priorities. DOTs are involving larger numbers of managers, and employees in their strategic planning processes. Input is solicited from external stakeholders, and substantial effort is being made to meet customer needs and expectations. Few reported a linkage between strategic planning and asset management processes.

DOTs are working hard to use their strategic plans to drive decisions made throughout their departments, principally with the use of action plans and business planning processes. Whereas DOT information systems traditionally have focused on

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[1] See January-February issue of TR News, pages 20-22

[2] Kaplan, Robert S., and David P. Norton, *The Balanced Scorecard: Translating Strategy into Action,* Harvard Business School Press, Boston, 1996.

performance at the program and operating levels, the new generation of measurement systems is tied directly to overall strategy. In some departments, such measurement systems have become the primary driving force and central management tool for bringing about change and improving performance. While DOT measurement systems are more results oriented than ever before, challenges regarding the use of measures of real transportation outcomes as well as economic and environmental impact still remain.

Many DOTs work very deliberately to get managers and employees to identify and actively support their organizations' strategic plans. One way they build this kind of commitment is simply by assigning "ownership" of strategic goals or initiatives to particular individual managers. Others have systems for developing personal level goals and objectives for managers and employees that are closely aligned with departmental strategies. Some DOTs have also been revamping their budgeting and financial management systems in order to ensure that resource allocations are driven by overall departmental strategy, using such tools as activity based costing and various forms of results based budgeting or program budget systems.

It is clear that most state DOTs are taking innovative approaches to strengthen their capacity for strategic leadership and performance measurement. It is also clear that in this area, no standard solutions or measurements apply. Nevertheless, it is possible to develop some guiding principles from the DOT experience to date regarding the development and use of leading edge strategic management systems.

Overview of the Research

The research described in this report not only builds on the past and ongoing work but also assembles a set of tools based on experiences and best practices in a diverse set of states. To do this we draw on the literature and a survey of practices in each of the state DOTs that explores, documents and synthesizes both strategic planning processes and asset management. With input from an expert advisory panel we selected states for detailed analysis. Based on detailed documentation of these states we developed a synthesis of best practice of strategic planning, asset management and the linkage between the two.

Chapter 2 contains a discussion of the state of the art of asset management and strategic planning as applied to state DOT's. The chapter defines asset management and examines how strategic planning and performance measurement is described in the literature. It also describes how in the literature, linkages between asset management and strategic planning are established.

In Chapter 3, state DOT's that had implemented strategic planning and/or asset management were identified. All fifty states were analyzed. The chapter discusses the 16 states that seem to link asset management to the strategic planning process, or are actively moving in the direction of asset management. The results of this work were presented to our expert panel that then recommended a set of states for in-depth analysis. These are Florida, Maryland, Michigan, Montana and Pennsylvania. These states not

only provide a variety of approaches to linking asset management to strategic planning, but also are geographically and physically diverse.

The next five chapters describe the results of the in-depth studies of the five states. A project team that spent two days on site visited each of the states. Information on the strategic planning and asset management process was obtained through personal interviews with DOT officials and the acquisition of materials describing these processes. Each chapter begins with a profile of the DOT including an analysis of the type of leadership, organizational focus, and responsibilities of the department. If the state has any legislation pertaining to asset management or strategic planning, this was then discussed. The chapters then go on to describe the policy planning process, policy planning elements, asset management elements, and metrics/performance measures used by the state DOT. Each chapter then discusses the linkages between asset management and strategic planning in that state. The chapters conclude with a discussion of the advantages and weaknesses in each state model. The results of these state visits were then presented to the expert panel for their guidance in the development of a model process.

The focus of Chapter 9 is to develop this model process for linking asset management to strategic planning. The chapter summarizes the findings from the five best practices states. It then identifies the best aspects of the process from each state and synthesizes these into a model process. The model process that results does not represent any particular state, but incorporates elements from all five states. This model process can provide useful guidance to states interested in augmenting their existing processes.

The final chapter in the report provides additional guidance to states that would like to implement the findings of the study through a series of penetrating questions and factors to consider.

CHAPTER 2. LITERATURE REVIEW

2.1 Introduction

The emergence of asset management as an effective engineering and planning tool for maintenance and improvement of physical assets has opened new avenues to infrastructure management. New forms of integrated management systems are now emerging that goes beyond the individual management systems like pavement management systems (PMS) and bridge management systems (BMS). While not comprehensive, these integrated systems link information systems previously considered in isolation. The linkage of these integrated systems with supporting activities like data collection, performance measurement, decision making and prioritization is essential. All these elements are essential to a viable and rational strategic plan, thus establishing the framework for an asset management plan to be an integral part of any transportation strategic plan.

According to studies conducted by many private and public firms practicing asset management, the key to developing a sound strategic plan is to first know what the customers want (USDOT, 1999). A customer driven focus is an essential principle for any asset management system and hence its relation to the strategic plan becomes all the more significant. The Michigan Department of Transportation (MDOT) has been a leader in putting a customer focus into its strategic plan and explicitly discusses asset management. Likewise, other DOT's are in the process of linking asset management principles to strategic planning, although most of them do not explicitly mention asset management in their plans. This report documents the practice of asset management and strategic planning, as well as linkages between these programs, in state DOT's.

2.2 Asset Management

Although there are a number of definitions of asset management, the most accepted and common definition has been given by the FHWA. Asset management can be defined as a "systematic process of maintaining, upgrading, and operating physical assets cost effectively. It includes preservation, upgrading and timely replacement of assets, through cost effective management, programming, and resource allocation decisions. Asset management combines engineering principles with sound business practices and economic theory, and provides tools to facilitate a more organized, logical approach to decision making," (FHWA, 1999). In practice, asset management has provided a solid foundation from which to manage and monitor the transportation system.

Asset management allows decision-makers to focus on key issues in a rational manner. An efficient asset management system will enable better access to both qualitative and quantitative data needed for the analysis. Evaluation of alternatives is enhanced by comprehensive, data driven analytical trade-off analysis, which is strengthened by asset management. It also aids the system users, stakeholders, state government officials, and managers concerned with day-to-day operations.

The practice of asset management helps in the following ways (FHWA, 2000):

- Better and more objective information is available to the decision making process
- It provides the ability to clearly demonstrate the implications of all investment opportunities
- Decision making is improved, which translates into savings of time and money
- It enables the agency to obtain maximum benefit from whatever level of funding the budget process provides

2.3 Strategic Planning and Performance Measurement in State DOTs

Strategic planning is a systematic examination of an agency's internal and external operating environments, and is the planning tool used to provide direction for the organization's future success. The strategic planning process basically helps the agency to plan for the future by answering three important questions: Where are we now? Where do we want to be? How do we get there?

In the transportation-planning sector, the strategic planning process assumes significance because transportation is a publicly provided good, for which a strategic vision is required. A report prepared for National Cooperative Highway Research Program (NCHRP), by T.H. Poister and D.M. Van Slyke, presents findings of surface level explorations of strategic leadership and performance measurement in state DOT's (Poister et al, 2001). The state DOT's included in the study were Virginia, Texas, Pennsylvania, Wisconsin, Maryland, New Mexico and Florida.

All of the state DOT's contacted had strategic agendas in place, but the plans varied in strategic goals and objectives. One of the innovative approaches used by the state DOT's was a "Balanced Scorecard" (BSC) approach. This approach helped the planners develop goals, objectives and performance measures based on four different organizational performance perspectives: the customer perspective, the financial perspective, the internal process perspective, and the learning and growth perspective.

The city of Charlotte, North Carolina is the frontrunner in adopting a balanced scorecard approach. These four perspectives incorporated several of the citywide objectives to ensure that departmental objectives were aligned with city council priorities. The basic advantage of the BSC approach is that it encourages a holistic view of the strategy and helps in better integrating the performance measures with the objectives. The Charlotte Department of Transportation (CDOT) incorporated both "high impact programs" and other "core functions" in its BSC planning process. All the operating divisions were given their own responsibilities and were required to have their own objectives and performance measures in support of the department's overall scorecard. The BSC approach has helped CDOT managers in developing an appropriate mix of strategic objectives and also in assuring that ongoing programs and activities are targeted towards achieving those objectives. Other DOT's that have used the BSC approach include Utah, Illinois and Texas.

Due to its nature of being a top management responsibility, the strategic planning core group always consists of the top officials. However, there are a lot of external stakeholders who are part of the process, all the way. For example, in Illinois, collaborative decision support computer software is being used to help groups resolve areas of disagreement and arrive at consensus-based decisions. In Maryland, customer representatives and other external stakeholders attend key performance area council meetings and provide input for the development of goals and objectives. In Pennsylvania, in-depth interviews have been conducted with key stakeholders and partners and this input is used in refining goals, focus areas and objectives.

In recent years, the strategic planning process in state DOT's has been explicitly focused on customer needs and expectations. For example, the Minnesota Department of Transportation has created its own internal professional market unit. It has identified seven customer segments (commuters, personal travelers, farmers, emergency vehicle operators, common carriers, shippers by truck only, and intermodal shippers) and has conducted telephone interviews to judge customer satisfaction. The Pennsylvania Department of Transportation (PennDOT), in its latest strategic planning process, conducted twenty-three focus group sessions with customers from across the state regarding expectations, satisfaction, preferences and concerns.

When incorporating a strategic planning framework into an agency's planning process, it is very important to tie the lower level planning activities to the overall strategic planning framework. Many state DOT's accomplish this objective by implementing annual plans, action plans and business plans that guide the agency in the delivery of the program. Annual plans help achieve yearly goals and objectives and accomplish portions of the strategic plan. Action plans focus on one specific area for a more detailed and comprehensive, action-oriented approach. Business plans have an obvious business perspective, with broad objectives and goals, like those of the strategic plan, that help identify key performance areas and goals. Annual plans, action plans, and business plans, as well as policy plans, can all be part of the strategic planning process. The surveys revealed that several DOT's have accomplished their strategic plans through these plans. For example, the Georgia Department of Transportation accomplished its strategic plan through annual plans. Other DOT's also used annual plans to keep their strategic agendas in place. Other states like Wisconsin, New York, Maryland and Pennsylvania use their business plan as part of their strategic plan.

The interviews also revealed that performance measures have been traditionally linked to program and operating units. However, a newer set of performance measures are now linked to the overall strategy of the agency. Description of performance measures of the state DOT's are listed in the following chapters.

2.4 Asset Management as a Strategic Planning Approach

Asset Management is an efficient and cost effective way of strategically targeting resources. The guide on asset management prepared by Cambridge Systematics for the National Cooperative Highway Research Program (NCHRP) defines transportation asset

management as a strategic approach to managing transportation infrastructure. The concept of asset management covers a very broad range of activities and functions. It includes investment decisions, prioritization, relationships with different stakeholders and partners, long range transportation planning, capital project development, and more. Key elements that support asset management as a strategic planning approach include:

- **Comprehensiveness –** A broad view of the agency, including a range of assets. All options and tradeoffs are done for investment decisions.
- **Applicable to all functional areas of an organization –** Asset management can be applied to all functions and levels in an infrastructure organization. It is adaptable to different needs of the organization and flexible in nature.
- **Long-term view –** Cost-Benefit analysis is accomplished throughout the life cycle of the asset.
- **Proactive –** Preventive maintenance strategies are a key to effective asset management.
- **A way of doing business –** Asset management can influence the business practices of any organization, in many functional applications. (www.michigan.gov/mdot, September 2002)

2.5 Setting the Limits to Asset Management

The FHWA definition of asset management states that asset management combines engineering principles with sound business practices and economic theory, and provides tools to facilitate a more organized, logical approach to decision making. But, it is very important to set boundaries on asset management to have an unequivocal idea of asset management as a strategic approach. Listed below are some of the important concepts and components of asset management that help in this regard.

2.5.1 Resource Allocation

Asset management is basically a process of resource allocation and a utilization evaluation tool. It is essential to define resources in the context of this process. Resources refer to all the assets at an agency's disposal that can be applied to managing the physical transportation infrastructure. Resources include revenues, human resources, equipment, materials, real estate, and corporate information (www.michigan.gov/mdot, September, 2002).

2.5.2 Assets

Although all resources can be viewed as assets, most of the guides and research on asset management has identified only physical transportation infrastructure as assets that need and can be managed under an asset management framework. Other than state owned physical assets, there can be other assets in which the state may have an interest. Data and human resources are examples of these other assets.

2.5.3 Actions

Agencies need to develop strategies to decide on the types of actions and investments needed. Asset management strategies can help agencies in this regard by providing trade-off analysis techniques to decide on a set of viable investments. Thus, asset management does not support the idea of a fixed set of strategies, and agencies needs to be flexible in their actions. Although actions can be tailored to particular situations, the following key elements should be included:

- Well defined measures of performance
- Effective distribution of roles and responsibilities
- Reliance on good information in all stages of infrastructure management
- Examining a range of options with effective trade-off analysis techniques
- A comprehensive decision making approach
- Management emphasis on customer service and accountability

2.5.4 Business Processes

Any business process can be applied as an asset management technique, but maximum benefits can only be achieved when it is applied consistently throughout the organization and integrated throughout all departments.

2.5.5 Data Collection

Data needs to be viewed as an asset and is essential to achieve the organization's strategic objectives. Business process requirements should be defined by data systems and this data should be available at all levels and functions of the division. The data collected should be focused, flexible, meaningful and comprehensive. Data integration is as important as data collection.

2.5.6 Performance Measurement

Performance measures should be observable, quantifiable measures that link outcomes with objectives. However, it should be kept in mind that the performance measures should have a narrow strategic focus and the business processes to be measured should be carefully identified and considered as a means of asset management and not the end product.

2.5.7 Management Systems

There are six types of management systems that can be integrated into an asset management system. These are bridge management systems, congestion management systems, intermodal management systems, pavement management systems, public transportation management systems, and safety management systems. The scope of asset management can span this entire management system network or focus on a part of it.

2.5.8 Technology

It has been determined that there is no limit to which technology can be incorporated into an asset management system. With improved information technology, new avenues have opened to infrastructure management. Technology like GIS, GPS and interactive maintenance tools can be made a part of an asset management system. Intelligent transportation systems provide a new dimension to managing assets and enhance the management of new kinds of ITS assets.

2.6 Legislation in Asset Management

Asset management is increasingly becoming an integral part of any state transportation plan. This is the reason institutionalization of asset management is seen as an obvious step towards making it a part of the planning process. This assumes more significance as many states are actually practicing asset management without calling it such. But before legislation is enforced, there are some elements that need to be considered. The transportation asset management guide, prepared by Cambridge Systematics for NCHRP, lists some of the important elements, which need to be kept in mind while institutionalizing asset management for transportation resource allocation decisions statewide:

- Creation of a technical advisory panel for overseeing asset management efforts
- Development of performance measures
- Establishing a GIS database
- Inclusion of life-cycle cost analysis as part of the asset management plan
- Maintaining a base level of funds for maintenance activities to sustain
- Maintain the statutory formulas for distribution of state and federal transportation funds

The following two states have institutionalized asset management in the transportation decision-making process.

2.6.1 Michigan

As part of the House Bill No. 5396, in order to provide a unified effort by various roadway agencies within the state, a transportation asset management council has been created within the state transportation commission. The council has the responsibility of developing a statewide asset management strategy. The council has to include ten voting members appointed by the state transportation commission. The procedures and requirements set by the council as part of the asset management strategy should include areas of training, data storage and collection, reporting, development of multiyear program, budgeting and finance and other issues related to asset management. A technical advisory panel must also to be created to support the council, but its recommendations will only be advisory. Necessary funding will be provided by annual appropriation from the Michigan transportation fund to the state transportation commission.

2.6.2 Vermont

The General Assembly of Vermont recently passed sections 24 and 25 of Act no. 64, which requires the Vermont Transportation Agency (VTrans) to submit information on its assets to the House and Senate committees on transportation. According to sections 24 and 25, the agency shall develop an asset management system, which is a systematic goal and performance driven management and decision making process of maintaining, upgrading and operating transportation assets cost-effectively. The system should list all assets and their condition related to pavements, structures, facilities, maintenance equipment, vehicles, materials, and data. It should also include deterioration rates for all infrastructure assets. The asset management plan should include the costs of implementing the plan, activities to be undertaken by the plan and comparative cost differentials between maintaining the infrastructure utilizing the maintenance program versus deferring the maintenance costs.

2.7 Previous Studies on Asset Management Practices in State DOTs

Information on state DOT asset management practices and related activities has been collected by visits and interviews conducted by Cambridge Systematics and surveys conducted by AASHTO in 1999. Although transportation asset management is still in the early stages of development, its recognition as a management tool by state DOT's is quite evident from the surveys and interviews.

As part of the NCHRP project ((20-21)(11)) asset management guide, Cambridge Systematics conducted interviews and surveys of eight state DOT's. It was found that the New York DOT and Michigan DOT have had active asset management programs or likewise activities, the Arizona DOT, Colorado DOT and PennDOT have started on their asset management plan and strategy, while the Washington DOT and California DOT did not have any asset management programs in place now nor plans for such in the future.

Classification of assets within a tiered structure helps to identify and categorize the transportation infrastructure assets according to function and responsibility. It also helps in effective performance programming. The interviews revealed that the Colorado DOT was investigating the feasibility of a tiered asset class structure of its highway assets, as part of its asset management strategy, while other DOT's do not have formal asset tier structures.

With regards to performance measurement and programming, most of the DOT's interviewed had implemented performance measurement systems, while the Washington DOT has integrated it with its long-range planning and capital programming process. The features of this process include vertical integration and consistency throughout the process, prioritization formulas and project selection based on benefit-cost criteria. Wisconsin is moving towards a project-oriented plan. Although the technical specifications of the performance measures differ among states, overall the specifications are similar in nature.

Surveys conducted by AASHTO in 1999 of state DOT's have provided a lot of information on the type of management systems used in state DOT's. The survey results have indicated that all states have multiple management systems in place, with an inventory and condition information system existing in almost every state DOT. Pavement and bridge management systems are the most common of all the individual management systems, with a 97% implementation rate (McNeil et al, 2000). The surveys also revealed that most of the management systems process technical information and are not used to develop broader policy goals and objectives, establish program-funding levels or prioritize projects.

2.8 Role of IT in Asset Management

The key to an effective asset management system is quality information. Information technology (IT) plays an important role in managing data systems for the collection and evaluation of information. IT is also important in establishing data collection procedures and in data integration and the development of supporting analytical tools (Derocher, 1998). However, it should be noted that it is not necessary to build new systems, but to build on what is already in place.

There are a number of information management systems, which are used in various agencies. The transportation asset management guide, prepared by Cambridge Systematics for NCHRP, has classified information systems according to the following four functional systems:

1. Infrastructure Management Systems
   - Pavements
   - Bridges
   - Maintenance Management Systems
   - Intermodal Management Systems
   - Other DOT-Maintained Facility and Features

2. Management Systems in Transportation, Operations, Safety and Customer Service
   - Highway Usage, Operations and Safety
   - Congestion, Safety, Public Transit and Intermodal Management Systems
   - Transportation Network Planning Models
   - Customer Information
   - Real-Time Weather Information

3. Systems to Manage Agency Resources
   - Accounting and Financial Management
   - Human Resource and Payroll Management
   - Maintenance Resources
   - Equipment and Materials Database
   - Real Estate and Property Data

4. Systems to Manage Programs and Projects
   - Planning and Programming Information
   - Project Pipeline and Construction Management
   - Bid Costs

Information plays a pivotal role in establishing an information management system to support asset management. The type of information may change in different agencies and systems, but there are certain common system requirements. They are:

1. Asset Inventories

The inventory should include extensive information on asset characteristics and classifications, including condition assessment, GASB financial reporting of infrastructure assets, needs analysis and ranking. There can be separate inventories for different classes of assets. The asset rank determines the coverage and detail of inventory data related to that asset.

2. Asset Condition and Performance

There must be condition and performance measures for each type of asset. In addition to technical measures, there should be measures to support policy making and to capture customer perspective. Condition measures should also be consistent with cost and deterioration models. The information systems objective should not be only to document current condition and performance data, but it should also be able to project asset condition and performance.

3. Cost Estimation and Reporting

Cost estimating models should be incorporated in order to manage key infrastructure activities. Time series of costs need to be developed, so compilation of construction and maintenance costs is necessary.

4. Needs Identification

Information should provide the capability to identify specific locations or individual facilities that do not meet one or more minimum standards. It should also provide the capability to estimate the costs of addressing the identified needs.

5. Program Delivery

Summarization of information on overall program delivery in terms of cost and time needs to be considered when establishing an information system.

The existing management systems can be applied to investigate the cost and implications of different asset management strategies. The infrastructure management systems can play a particularly important role in capital programming.

There are a number of IT strategies that can be applied based on agency needs, including overall IT plans and objectives for asset management. Several key considerations should be addressed when developing an IT strategy. These considerations are:

- Define the architecture for databases and systems that support asset management

- Develop an IT implementation plan addressing applications related to asset management. The plan should include GIS capabilities and requirements, data storage requirements and system integration priorities.

2.9 Summary

There are linkages between asset management and strategic planning in several DOTs. The focus of this literature review was to identify the existence of asset management without dwelling on the concepts of asset management. In the process, it was identified that asset management is similar to the strategic planning approach. Both share some key elements and complement each other. Michigan and Vermont are the two states that have passed legislation on asset management, although many other states have been contemplating legislation supporting asset management. Cambridge Systematics has done a substantive amount of research on the role of IT in asset management. This chapter has given a brief description of the state of practice of asset management in state DOT's and some of the research initiatives that are in place. The following chapters will document the practice of asset management and strategic planning in state DOT's in more detail.

CHAPTER 3. SURVEY OF FIFTY STATES

3.1 Introduction

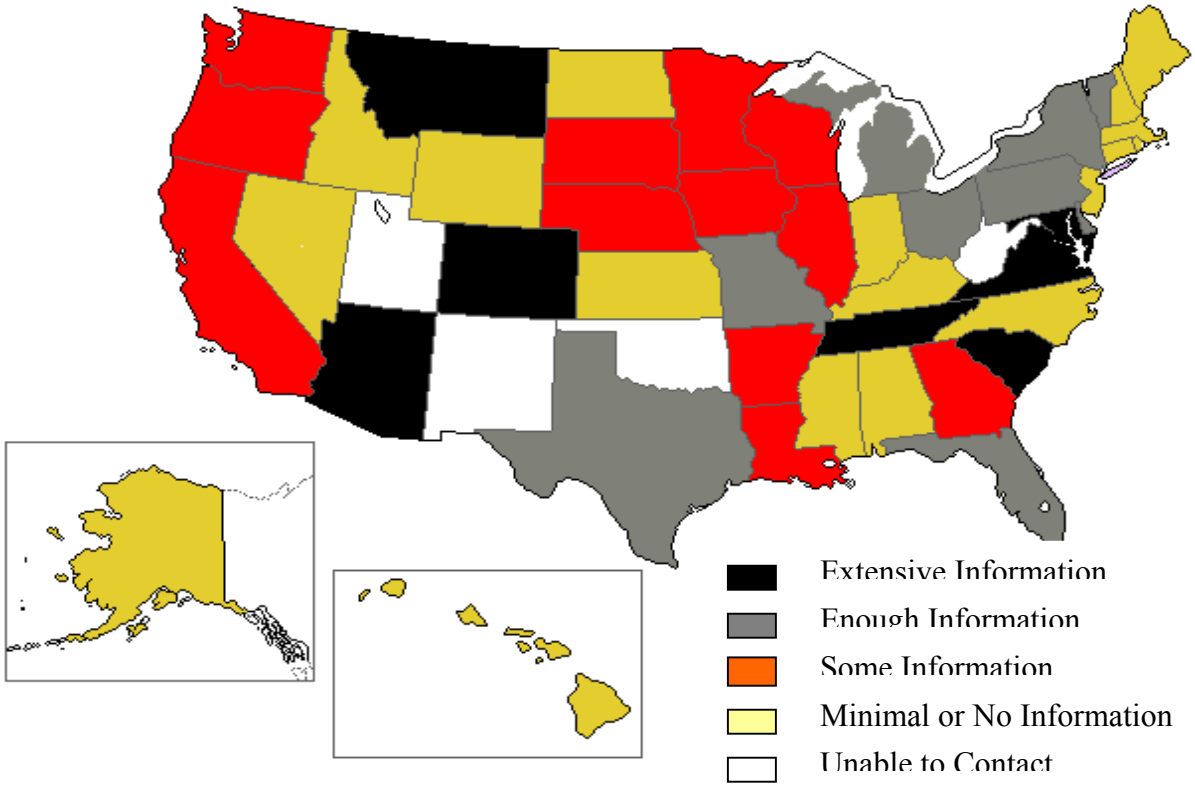
This step in the research process was to identify state departments of transportation that had implemented strategic planning and/or asset management.

All fifty states were analyzed. Extensive material was available for the states of Arizona, Colorado, Maryland, Montana, South Carolina, Tennessee, and Virginia (see states identified as "extensive" in Figure 4.1). These seven states are explicitly using asset management tools in conjunction with their strategic plans.

Twenty-one other states had at least some information available. Nine of these warranted further investigation due to the mention of asset management in their strategic plans or evidence that they were moving in the direction of asset management. These states are Delaware, Florida, Michigan, Missouri, New York, Ohio, Pennsylvania, Texas, and Vermont (see states identified as "enough" in Figure 4.1).

Eighteen states either had minimal or no information available, and we were unable to contact the remaining four (see Figure 4.1). These states were not investigated further.

Figure 4.1. States Identified by Survey



3.2 Methodology

Obtaining strategic plans from the states was a two-step process. Initially, state websites were screened for documents containing the DOT's strategic plan. If we couldn't find the information on the websites, we made direct contact with those state's DOT's. Someone within the DOT then either sent the information or directed the research team to the applicable website.

Once the strategic plans were in hand, they were reviewed for content. Special emphasis was placed on goals, objectives and performance measures. Asset management-like practices such as optimization of resource allocation, use of maintenance management systems, and emphasis on life cycle costs were identified for each of the plans and compiled by state.

3.2.1 Components Identified

Many of the following elements were identified among these strategic plans:

- System preservation
- Multi-modal tradeoffs
- Performance programming
- Maintenance/replacement tradeoffs
- Resource allocation
- Decision support using BMS/PMS
- Maintenance management systems
- Forecasting/tracking tools
- Life cycle costs
- Priority selection process
- Budgeting
- Stakeholder involvement
- Workplace improvement
- Construction

The research team also noted any specific mention of asset management or performance measures. Only six states specifically referred to asset management within their strategic plan, but many other states' plans included significant references to many of the asset management elements listed above.

3.3 States Researched

The sixteen states discussed in this section have either linked the use of asset management tools to their strategic plans, or are actively moving in the direction of asset management. These sixteen states (listed below) are covered in alphabetical order.

Arizona	New York
Colorado	Ohio

Delaware	Pennsylvania
Florida	South Carolina
Maryland	Tennessee
Michigan	Texas
Missouri	Vermont
Montana	Virginia

3.3.1 Arizona

An extensive quantity of material was available for Arizona. Their comprehensive strategic plan reviewed the state's short and long-term projections for the future. Goals, objectives, and performance measures span all departments within the DOT. Asset management was specifically included in the strategic plan, although there was no formal description of their asset management practices. Some asset management-like practices were referred to including: 1) increasing the quality, timeliness, and cost-efficiency of products and services, 2) optimizing the use of all resources, and 3) identifying the number of lanes open to traffic.

3.3.1.1 Goals

Arizona outlined five specific goals that are applied by all facets of the DOT. These goals are included in Table 3.1.

Table 3.1. Goals Outlined by Arizona DOT

Goal 1	Improve the movement of people and products throughout Arizona
Goal 2	Increase the quality, timeliness and cost-efficiency of products and services
Goal 3	Develop high performing and successful workforce
Goal 4	Optimizing the use of all resources
Goal 5	Improve public and political relationships to gain support that is necessary to meet Arizona's transportation needs

3.3.1.2 Objectives

Likewise, Arizona's objectives are as specific as its goals. The objectives support the goals previously outlined. A few of these are included in Table 3.2.

Table 3.2. Objectives Outlined by Arizona DOT

Objective1	Development process in which congestion management issues are incorporated into the highway development process
Objective 2	The maintaining of consulting costs
Objective 3	Response to inquiries within ten days
Objective 4	Maintaining total design work at 50% of total Construction Operating Budget
Objective 5	Produce no less than 70% of overall construction engineering in-house

These objectives, along with many others, are designed to ensure the attainment of the five goals outlined in the strategic plan.

3.3.1.3 Performance Measures

Specific performance measures were developed in order to achieve these goals and objectives. Some of Arizona's performance measures are listed in Table 3.3:

Table 3.3. Ratings Used by Arizona

PM 5	Average evaluation rating
PM 6	Injury incident rate
PM 7	Stakeholder satisfaction rating

* PM = Performance Measure

3.3.1.4 Inclusion of Asset Management Elements

While Arizona's strategic plan does not directly state that asset management is being practiced, we can infer that the Arizona DOT is using the following asset management elements:

- Performance programming
- Maintenance/replacement tradeoffs
- Forecasting/tracking tools
- Life cycle costs
- Priority selection processing
- Budgeting
- Workplace improvement
- Stakeholder involvement

Interestingly, it also mentions the creation of a future department responsible for collecting and analyzing asset management data through the Data Collection Bureau.

3.3.2 Colorado

Colorado's strategic plan is divided into the five sub-programs of Safety, Mobility, System Quality, Strategic Projects, and Program Delivery. These five sub-programs have their own goals, objectives, and performance measures, which are discussed in the following sections. Similarly to Arizona, Colorado also mentions asset management-like practices. These practices include: 1) system preservation, 2) life cycle costs and, 3) decision support using Surface Condition Rating, Bridge Sufficiency Rating, and Maintenance Condition Survey, among others.

3.3.2.1 Goals

Colorado has goals for each of its sub-programs. Specific objectives support each of the sub-program's goals.

Table 3.4. Colorado Goals by Sub-Program

Safety	1.) Reduce transportation-related crashes, injuries and fatalities and the associated loss to society
System Quality	1.) Preserve transportation systems 2.) Keep the system available and safe for travel
Mobility	1.) Improve mobility 2.) Increase travel reliability
Strategic Projects	1.) Accelerated completion of projects 2.) Increase investments in various other programs
Program Delivery	1.) Delivery of high quality products and services in a timely fashion 2.) Attract and retain effective and qualified people 3.) Foster an environment that respects workforce diversity

3.3.2.2 Objectives

Objectives are specific to their corresponding sub-program goal. The objectives for the Safety goal are designed to reduce the rate and severity of accidents while promoting education and awareness.

Ensuring maximum useful life and maintaining acceptable levels of service and condition are objectives that support System Quality goals. Another objective is geared towards developing a "travel-friendly" transportation system by ensuring investments for aesthetics and environmental concerns.

In order to accomplish the Mobility goals, Colorado must anticipate its future needs. In order to do this, the DOT seeks external customer feedback and preserves transportation choices for residents. The primary means of accomplishing this is to maximize the efficiency of existing infrastructure and to enhance quality of life by addressing environmental concerns and improving aesthetics.

As for their Strategic Project goals, the inclusion of performance measures, such as promoting a partnership with all governments in order to accelerate strategic project delivery, is important. This is accomplished through maintaining the eligibility of the Colorado DOT's bonding program.

The Program Delivery objectives emphasize fiscal integrity by preserving base funding while pursuing new funding sources. The Colorado DOT feels that by following a planning process, it can identify innovative human resource solutions and create public confidence. This will help to ensure the fulfillment of the goals and objectives expressed in its strategic plan.

Table 3.4. Objectives for Colorado by Sub-Program

Safety	1.) Reduce the rate and severity of incidents 2.) Promote education and awareness
System Quality	1.) Ensure maximum useful life 2.) Maintain acceptable levels of service and condition 3.) Ensuring investments for aesthetics and environmental concerns
Mobility	1.) Maximize efficiency of existing infrastructure and enhancing quality of life
Strategic Projects	1.) Promote partnership with all governments in order to accelerate strategic project delivery
Program Delivery	1.) Emphasize fiscal integrity through timely funding 2.) Preserve the base funding in correlation with pursuing new sources

3.3.2.3 Performance Measures

Many performance measures are used to assess progress towards these goals and objectives. The performance measures for the Safety sub-program include a statewide safety incident rate. Alcohol-related incidents are compared to the Statewide Incident Rate. Perception ratings and corridor safety assessment improvement sites are also included in this category.

Surface condition ratings and bridge sufficiency ratings are important measures for the System Quality sub-program. Maintenance condition surveys and quality of life evaluations are administered to track progress toward improving System Quality.

The Mobility sub-program uses the Travel Rate Index and Customer Perception Rating, in addition to a few other measurements, to keep track of the progress they are making in this area.

Strategic Projects are concerned with monitoring actual funds encumbered and actual funds expended, in addition to tracking the number of days it takes to complete payment processing and billing.

Table 3. 5. Performance Measures for Colorado by Sub-Program

Safety	1.) Safety Incident Rate 2.) Perception Ratings 3.) Corridor Safety Assessment
System Quality	1.) Surface Condition Rating 2.) Bridge Sufficiency Rating
Mobility	1.) Travel Rate Index 2.) Customer Perception Rating
Strategic Projects	1.) Actual funds encumbered vs. funds expended 2.) Number of days to complete payment processing and billing
Program Delivery	Established at a lower level – Not included in the strategic plan

3.3.2.4 Inclusion of Asset Management Elements

The strategic plan for Colorado did not make any specific mention of asset management. However, Colorado's plan did contain the following asset management-like elements:

- System preservation
- Resource allocation
- Maintenance management systems
- Life cycle costs
- Priority selection processes
- Budgeting

3.3.3 Delaware

The Delaware DOT has developed its Long Range Transportation Plan document as a strategic tool for long range planning that establishes forward-thinking goals and develops a strategy to achieve these goals.

3.3.3.1 Goals

The mission of the Delaware DOT is "to provide a safe, efficient, and environmentally-sensitive transportation network that offers convenient, cost-effective mobility opportunities for people and the movement of goods."

The goal of the long range planning process is to:

- Set a clearly defined direction that guides and supports the governance of the organization
- Serve as a way to develop and present a common vision and purpose that is shared among all its customers and stakeholders
- Establish an increased level of commitment for the organization to its policies and help to motivate and direct the achievement of its goals

- Provide a method for improving services to travelers as well as a means of measuring the quality of the service that is provided
- Enable the department to set priorities and to match its planned resources to particular project opportunities

There is a three-tiered framework used to identify the activities constituting the DOT's plan. These activities are necessary to realize the vision for transportation in Delaware. The three tiers are:

- Principles
- Policies
- Actions

The Long Range Transportation Plan consists of six core principles:

- Development: "Direct our programs, services, and facilities to support a livable Delaware"
- Travel opportunities and choices: "Maximize travel opportunity and choice for all Delawareans"
- Cost effectiveness: "Use cost-effectiveness as one of our fundamental principles"
- Quality of life: "Continue to emphasize quality of life as our foundation"
- Economic development and growth: "Provide transportation opportunities that support economic development and growth"
- Planning and coordination: "Maintain planning and coordination as an integral part of our activities"

3.3.3.2 Objectives

In accordance with its six core principles, the Delaware DOT has formulated corresponding objectives.

For its Development principle, the objectives are:

- Coordinate land use and transportation in a manner that promotes long-term transportation efficiency
- Direct or focus transportation investments in Delaware in a manner that promotes sustainable development within designated areas

For its Travel Opportunities and Choices principle, the objectives are:

- Promote an expanded variety of travel opportunities to workplaces, services, residences, and recreational and work destinations, and provide reasonable travel options for those who have limited mobility options;
- Encourage innovative transportation solutions.

For its Cost-effectiveness principle, the objectives are:

- Use cost effectiveness as a key indicator when prioritizing projects or choosing among alternatives – optimizing the investment of resources across all modes and balancing our fiduciary responsibilities with social equity mandates
- Maintain and use existing resources and equipment as a means towards cost effectiveness
- Take advantage of technology as a means of providing efficient services

For its Quality of Life principle, the objectives are:

- Provide environmentally sensitive transportation solutions that minimize negative environmental impacts and promote improved quality of the environment
- Enhance security and safety for all Delaware DOT services and facilities
- Make transit facilities convenient and attractive
- Promote safety and quality of life through contextual design of transportation improvements

For its Economic Development and Growth principle, the objectives are:

- Promote transportation's role in local and statewide economic development by improving the accessibility of freight transportation for industry and manufacturing, consumers to goods and services, and workers for jobs
- Support economic development and redevelopment of existing communities

For its Planning and Coordination principle, the objectives are:

- Coordinate activities and investments with other government agencies and offices in Delaware
- Implement ongoing monitoring activities and actions, measuring progress against long-range planning strategies
- Respond to public concerns and needs when creating policies and documents
- Promote planning as a key component of our long-term effectiveness, and implement actions to support effective planning and management

3.3.3.3 Performance Measures

The Delaware DOT has conducted a survey of its physical facilities, including:

- Roads
- Bridges
- Rail
- Park and ride/Park and pool
- Aviation
- Ports

The Delaware DOT measures its operations through Vehicles Miles Traveled (VMT) and Vehicle Hours Traveled (VHT).

3.3.3.4 Inclusion of Asset Management Elements

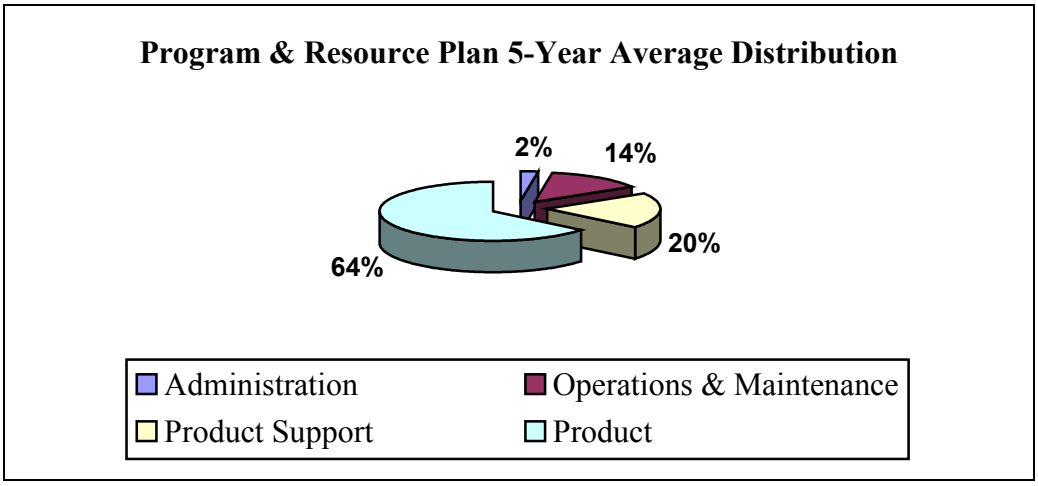
The Delaware DOT's Long Range Transportation Plan document contains the following asset management elements:

- System preservation
- Maintenance/replacement tradeoffs
- Forecasting/tracking tools
- Budgeting
- Workplace improvement
- Stakeholder involvement

3.3.4 Florida

There is no official strategic planning document provided by the Florida Department of Transportation, but it is indirectly accomplished through the published Florida Transportation Plan (FTP). The Transportation Plan and Resource Plan provide program levels that form the basis for the Department's Finance Plan, Tentative Five-Year Work Program, and Legislative Budget Request. Its plan reflects a program budget of $24.6 billion over a five-year period. The budget was divided into several categories: construction, right-of-way, public transportation projects, product support, operations and maintenance, and administration.

Figure 3.2. Florida's Resource Program & Resource Plan Distribution



The FTP has two components:

(1) "A long range component identifies the goals and objectives for the next 20 to 25 years that are necessary to address the needs of the entire state transportation system, to effectively and efficiently use all modes of transportation to meet such needs, and to provide for the interconnection of all modes in a comprehensive inter-modal transportation system", and

(2) "A short range component identifies the objectives and strategies for the next 1 to 10 years that are necessary to implement the goals and objectives identified in the long range component. The short range component defines the relationship between the long range goals and short range objectives, specifies those objectives against which the Department's achievement of such goals will be measured, and identifies transportation strategies necessary to efficiently achieve the goals and objectives."

3.3.4.1 Goals

The long-range goals include:

Table 3.6. Florida DOT Goals

1.) Safe transportation for residents, visitors and commerce
2.) Preservation and management of Florida's transportation system
3.) A transportation system that enhances Florida's economic competitiveness
4.) A transportation system that enhances quality of life in Florida

3.3.4.2 Objectives

Objectives are described within the short-range component of the 2020 Florida Transportation Plan. These objectives are organized around three strategic goals: 1) preserve and manage a safe, efficient transportation system, 2) enhance Florida's economic competitiveness, quality of life, and transportation safety, and 3) pursue organizational excellence. The objectives related to the first strategic goal are shown in Table 3.7.

Table 3.7. Florida DOT Objectives

1.) Adequately maintain all elements of Florida's transportation system
2.) Increase the efficiency of the transportation system using appropriate technologies
3.) Manage access on Florida's public roads to preserve capacity and enhance safety and mobility
4.) Improve incident management to minimize the impact on traffic flow
5.) Improve the safety of commercial vehicle operations
6.) Minimize response times of each entity responding to crashes and other incidents
7.) Implement hurricane response and evacuation plans in cooperation with emergency management agencies

3.3.4.3 Performance Measures

Performance measures are specified for each objective and compared to a baseline figure established in fiscal year 1995/96. There are several quantifiable performance measures for each objective. Table 3. 8 lists the performance measures for the first objective listed in Table 3.7.

Table 3. 8. Florida Performance Measures for System Maintenance Objective

1.) Percent of Turnpike pavement meeting Department standards
2.) Percent of Interstate pavement meeting Department standards
3.) Percent of arterials and other freeways meeting Department standards
4.) Number of commercial vehicles weighed
5.) Lane miles contracted for resurfacing
6.) Number of projects funded through the county transportation program
7.) Number of portable scale weighings performed
8.) Percent of commercial vehicles weighed that were overweight
9.) Number of bridges inspected
10.) Number of bridges let to contract for repair
11.) Number of bridges let to contract for replacement
12.) Lane miles maintained on the State Highway System

3.3.4.4 Inclusion of Asset Management Elements

Florida's 2020 Transportation Plan includes the following asset management elements.

- System preservation
- Multi-modal tradeoffs
- Maintenance/replacement tradeoffs
- Forecasting/tracking tools
- Construction
- Budgeting

3.3.5 Maryland

Maryland is unique among the states in that it has a truly multi-modal Department of Transportation. Separate divisions within the Department manage each of the transportation modes. These divisions and their responsibilities are described below.

- **Maryland Transportation Authority** – responsible for managing, operating, and improving the state's toll facilities
- **Maryland Transit Administration** – responsible for local transportation services such as light rail, buses, the metro subway, and MARC trains

- **Maryland Port Administration** – responsible for handling the more than 30 million annual tons of cargoes from around the world that pass through the Port of Baltimore
- **State Highway Administration** – responsible for the more than 16,000 lane miles of interstate, primary, and secondary roads and more than 2,500 bridges in Maryland
- **Motor Vehicle Administration** – responsible for vehicle registration, tags, and driver's licenses
- **Maryland Aviation Administration** – responsible for BWI airport and air travel services

3.3.5.1 Goals

The Maryland Department of Transportation (MDOT) has divided its strategic plan into two separate plans, the MDOT Strategic Plan and the Maryland Transportation Plan.

The MDOT Strategic Plan defines its goals as follows:

- System Preservation and Enhancement
- Stable Funding for Transportation
- Inter-modal Planning and Smart Growth
- Transportation System Safety
- Mobility and Commerce
- Excellence in Government
- Environmental Stewardship

The Maryland Transportation Plan defines its goals as follows:

- Smart Growth, Smart Transportation
- System Preservation
- Transportation Facility and System Performance
- Safety and Security
- Protecting Maryland's Environment
- Providing Mobility and Accessibility with Transportation Choice
- Supporting the State's Economy
- Moving Goods
- Funding our Transportation Future
- Serving our Customers

3.3.5.2 Objectives

The MDOT Strategic Plan presents its objectives in relation to each specified goal. The objectives are defined as follows:

For the System Preservation and Enhancement goal:

- Develop inter-modal teams to evaluate the condition of MDOT facilities and equipment, explore the benefits of consolidated procurement of major equipment, and propose a schedule for the rehabilitation and replacement of needed facilities to maximize their lifespan at the lowest cost
- As part of the Moving Maryland Initiative, apply Intelligent Transportation Systems (ITS) and information technologies to aid traveler mobility and demand management to reduce congestion throughout Maryland's multi-modal transportation system
- Begin dedicated funds and/or personnel necessary to have Computerized Maintenance Management System (CMMS) operational in critical areas for each Modal Administration
- Plan facilities to aid in the efficient movement of freight in ways that promote job creation, support the vitality of existing communities, and minimize the impact on the environment
- Apply state of the art information technology to the management of freight terminals and operations to provide more efficient service to commercial customers

For the Stable Funding for Transportation goal:

- Continue to apply creative financing for capital projects, and establish private sector partnerships that provide funds for transportation services and facilities beyond the resources of the Department
- Develop an incentive system for the operating agencies to increase productivity and performance through a sharing of savings or increase in revenues that will be reflected in subsequent budgets
- Support, through staff and other resources, State Government sponsored efforts to identify ways in which revenues that support the Trust Fund can be enhanced or extended
- Develop a mechanism for MDOT to share in tax revenues generated by transportation facilitated economic development projects

For the Inter-modal Planning and Smart Growth goal:

- Form a team of modal and TSO staff charged with the developing specific recommendations on how the Department can improve inter-modal planning
- Collaborate with other state and local agencies for all projects in the Neighborhood Conservation Program, Smart Growth Transit Program, Enhancements Program, and Retrofit Sidewalk Program. For each project,

document activity of other agencies and how it can affect project scope and timing
- Utilize the administrative and regulatory influence of the Governor's Port Land Use Task Force to direct development to Designated Revitalization areas and to the Port of Baltimore
- Commit 100% of the funds available for the Retrofit Sidewalk Program each fiscal year
- Emphasize the importance of noise abatement through the local subdivision process to local planning offices. Include a policy stating this requirement in update of Maryland Transportation Plan
- When Enhancements Program is reauthorized, revise program criteria to emphasize collaboration with neighborhood revitalization initiatives
- Beginning in FY 2000, budget capital funds where feasible to complete 5% of the bicycle/pedestrian access projects in Access 2000 inventory

For the Transportation System Safety goal:
- Increase safety for users of the transportation system through the implementation of safety improvement programs, safety and security oversight of transit facilities, and improved signing and delineation
- Develop a comprehensive, multi year Strategic Highway Safety Plan that will serve as a blueprint for enhancing highway safety Statewide
- Ensure that safety requirements are considered in the planning, design, construction, and operation of all transportation system facilities
- Develop and implement comprehensive safety awareness, education, and training programs to increase public awareness of transportation safety issues
- Continue to coordinate risk management programs throughout the Department with the goal of continuing to reduce the frequency and severity of occupational accidents

For the Mobility and Commerce goal:
- Work with other State Agencies, local governments, and the private sector to identify transportation infrastructure and operational improvements that will improve access to developing and existing job centers and freight locations, and commuter and freight corridors
- Identify specific economic development initiatives to include in the capital budget and Consolidated Transportation Program (CTP), and in setting operating priorities
- Develop and implement a program through the MDTA that actively markets MDOT facilities for public /private partnership - joint development projects. Expedite transfer or reuse of surplus MDOT properties that can be used for economic development
- Work with the Department of Business and Economic Development, the Governor's Port Land Use Task Force, and other State and local agencies to ensure coordination of economic development initiatives

- Develop and publish economic benefit statements for selected major projects included in the current CTP

For the Excellence in Government goal:

- All Administrations will design and implement a leadership and management program that incorporates the principles of Managing for Results (MFR) and Continuous Quality Improvement (CQI) to emphasize the provision of consistent quality customer service
- All MDOT employees will be provided with an opportunity to receive a minimum of 8 hours of CQI related training each per year
- Conduct a CQI oriented review of the Office Functions Manual in order to identify, and where possible eliminate duplicate functions that add no value to operations
- Apply appropriate funds in the Consolidated Transportation Information Technology Program towards the utilization of technology that promote more efficient transportation services
- Seek means to enhance employee enrichment initiatives

For the Environmental Stewardship goal:

- Mitigate the noise impact of transportation facilities through noise abatement programs to provide additional protection to affected homes and businesses that meet the mitigation criteria
- Maintain MDOT's commitment to bikeways/greenways by connecting and expanding the current 900 miles of greenway to include as much as possible of the areas that have been identified as potential additions
- Establish an inter-modal environmental task force to evaluate the ongoing review and streamlining of federal and State environment laws and regulations pertaining to transportation and transportation facility operations and planning
- Offer training sessions to inform appropriate staff of laws and regulations, their purpose, and how to comply, and to share experiences that may cross modal lines
- Identify forests and wetlands areas for potential preservation, and apply available funding to protect this acreage as available

The Maryland Transportation Plan also presents its objectives in relation to each specified goal. The objectives are defined as follows:

For the Smart Growth, Smart Transportation goal:

- Direct transportation funding to Priority Funding Areas and support of the Governor’s Smart Growth Executive Order

- Design and coordinate transportation projects, facilities, programs, and services to reinforce local land-use plans and economic-development initiatives that support Smart Growth principles
- Work with local communities to increase their understanding of Smart Growth principles and opportunities and to incorporate Smart Growth into plans and visions

For the System Preservation goal, MDOT's objective is to preserve and maintain existing transportation infrastructure and services as needed to realize their useful life.

For the Transportation Facility and System Performance Goal, MDOT's objective is to maximize the carrying capacity and operating performance of existing transportation facilities and services.

For the Safety and Security goal:

- Design, build, and operate facilities services, and programs that reduce the rate of injury and deaths to our customers
- Reduce crimes against property and persons using Maryland's transportation facilities, services, and operations

For the Protecting Maryland's Environment goal, MDOT's objective is to minimize impacts on, and strive to enhance, Maryland's resources.

For the Providing Mobility and Accessibility with Transportation Choice goal:

- Increase transportation choices available to access and circulate within and between activity centers
- Increase access to jobs, goods, and services

For the Supporting the State's Economy goal:

- Target transportation investments to serve existing and growing businesses, as well as housing and commercial markets, that support development and redevelopment opportunities consistent with Smart Growth
- Enhance transportation services and facilities used by business travelers, recreational travelers, and tourists

For the Moving Goods goal:

- Promote a diverse and interconnected system of freight transportation that leads to the efficient and reliable dispersal and transfer of cargo
- Increase the competitiveness of the Port of Baltimore and BWI Airport cargo facilities and services

For the Funding our Transportation Future Goal, MDOT's objective is that for every program period, the Department will strive to meet or exceed the capital investment recommendation of the Commission on Transportation Investment.

For the Serving our Customers goal:

- Involve customers in transportation decision making from the onset of systems planning through project development and design
- Improve internal accountability of all modes' performance through the managing for results initiative
- Improve customer access to transportation products, information, and services

3.3.5.3 Performance Measures

MDOT's performance measures for its strategic plan are located in the agency's Annual Attainment Report on Transportation System Performance, which is an attachment to the Maryland Transportation Plan. The performance measures are defined as follows:

For the Smart Growth, Smart Transportation goal:

- Number of projects programmed
- Spending levels

For the System Preservation goal:

- Transit vehicle age (to gauge the condition of the transit system) – average age of MTA and WMATA buses
- International Roughness Index (to measure pavement condition) - percent of SHA maintained roads rated fair to very good
- Federal standard for structural deficiency and functional obsolescence (to measure bridge condition) – percent of bridges and overpasses categorized as structural deficiency by federal standards

For the Transportation Facility and System Performance goal:

- Percentage of the State Highway system that is congested using VSF
- Congestion using Level of Service on Freeways and Arterials in Baltimore and Washington region
- Percentage of routes with "successful" or "acceptable" performance
- Average customer visit time
- BWI Terminal Gate Capacity
- Average Annual Peak Hour Throughput at the Fort McHenry and Baltimore Harbor Tunnels

For the Safety and Security goal:

- Injuries and fatalities on State and Toll Facilities
- Overall injury and fatalities-number and rate per 1 million population

- Bicyclist injury and fatalities – number and rate per 1 million population
- Number of fatal vehicle collisions at Authority facilities
- Number of vehicle collisions involving injuries at Authority facilities
- Annual fatality and injury collision rate (per 100 million vehicle miles) at Authority facilities
- Number of injuries and fatalities per year on MPA property
- Incidents at BWI
- Ratio of sworn police officers to riders on the transit system
- Dollar value of theft and damage at MPA facilities, BWI compliance with FAA security inspection

For the Protecting Maryland's Environment goal:

- Pollution standard that measures ground level ozone (to measure air quality)
- Percentage of required mitigation that has been completed (to measure the implementation of environmental mitigation and enhancements)

For the Providing Mobility and Accessibility with Transportation Choice goal:

- Vehicle Miles Traveled (VMT) per capita (state roads only)
- Total transit ridership (all systems)

For the Supporting the State's Economy goal:

- Number of direct, indirect, induced jobs affected by investments
- Number of direct, induced, indirect jobs, and jobs related to activities at the Port of Baltimore
- Number of jobs resulting from highway construction
- Total passengers through BWI
- Tons of MPA "general cargo"

For the Moving Goods goal:

- Total pounds of cargo moved at BWI
- Annual tons of foreign cargo (bulk and general) moved through the Port of Baltimore
- Tons of MPA "general cargo"
- Annual number of loaded freight cars on state-owned lines

For the Funding our Transportation Future goal:

- Innovative revenues
- Cumulative financing of cooperative capital investment with MDOT
- Difference between proposed CTI funding level and actual program

For the Serving our Customers goal:

- Percentage of branch office customers rating service as good or very good
- Percentage of riders rating overall MTA effectiveness as excellent, very good, or good

- Percent of satisfied customers
- Percent of external customers survey responses rating SHA performance at B or better

3.3.5.4 Inclusion of Asset Management Elements

MDOT's Strategic Plan and the Maryland Transportation Plan documents contain the following asset management elements:

- System preservation
- Resource allocation
- Decision support using BMS/PMS
- Maintenance management systems
- Forecasting/tracking tools
- Life cycle costs
- Construction
- Priority selection process
- Budgeting
- Workplace improvement
- Stakeholder involvement

3.3.6 Michigan

The Michigan Department of Transportation's strategic planning process incorporates three plans. These are the Michigan Transportation Policy Plan (MTPP), the MDOT Business Plan, and the State Long-Range Plan. The MTPP establishes the mission for Michigan's transportation system and also provides a framework for accomplishing it. The State Long-Range Plan is the guiding document for public sector transportation investment decisions. The MDOT Business Plan lays out specific objectives for achieving the mission of "providing the highest quality transportation services for economic benefit and improved quality of life." The following sections will discuss the goals and objectives of the business plan.

3.3.6.1 Goals

The primary goal of the Michigan Department of Transportation (MDOT) is to become a customer driven agency. The key to achieving this goal is knowing the customers and understanding their needs. MDOT has clearly outlined in their plan that high customer satisfaction is possible through mutual understanding of both customer needs and transportation system requirements. The plan also states that achieving this goal would help them to be better informed about costs and benefits of an integrated transportation system.

The agency's second goal is also customer focused and aims at delivering products and services to meet the customer's most important needs. The description of the goal

involves many important asset management concepts like implementation of integrated management systems and innovative technology for improved asset management. This goal also includes system preservation, which is perhaps the most important element of any asset management plan.
The other two goals of the plan deal with human resources and organizational attributes. Staff training, teamwork and improved decision-making are the basis around which these goals have been achieved.

The four goals are outlined below:

Goal 1: Customers

- Establishing partnerships
- External communication
- Transportation Service centers
- Policy Direction

Goal 2: Products/Services

- Improve Traffic Safety
- Innovative Technology
- System Preservation
- Rationalization of the system
- Support and strengthen economy
- Regulatory environments

Goal 3: Human Resources

- Prepare MDOT for challenges
- Recognize and reward employees
- Employee Training and Development
- Multi-Cultural Workplace
- Safe Work Environment

Goal 4: Organizational

- Become a process organization
- Become a learning organization
- Internal Communication
- Team-Oriented
- Improve decision making
- Improve Efficiency

3.3.6.2 Objectives

The detailed goals and their objectives of the plan are given in Table 3.9.

Table3.9. Michigan Goals and Objectives

Goals	***Objectives***	***Performance Measures***
Become Customer Driven	1. Develop improved accessibility to the customers and all the partners to ensure a clear understanding of their needs 2. Build consensus in support of transportation initiatives to promote public safety and preserve the existing system	Not Explicitly Stated
Deliver Products/Services to meet customers, most important needs	1. Maintain, preserve and enhance all components of Michigan's inter-modal transportation system to meet the highest needs of the customers 2. Implement integrated management systems and innovative technology for improved asset management 3. Continuously evaluate and refine product and service delivery using process improvement techniques	Not Explicitly Stated
Promote Employee Excellence	1. Prepare MDOT personnel to meet future challenges through leadership, team building and employee empowerment 2. Provide ongoing staff training and development opportunities 3. Communicate clearly and consistently to the staff	Not Explicitly Stated
Become Flexible and Responsive Organization	1. Utilize the philosophy and principles of total quality to become process oriented and customer focused 2. Continuously monitor and respond to the evolving needs of the customers and employees	Not Explicitly Stated

3.3.6.3 Performance Measures

MDOT has implementation strategies that define a performance management system focused on improving the performance of individuals and the department. The strategic leadership team formed the Performance Management Advisory Council (PMAC) to implement MDOT's Performance Management System. However, specific performance measures have not been identified in either the business plan or the asset management plan.

The Performance Management System is linked to the business plan with goals of promoting employee excellence and emphasizing employee training and development. This system will also help the department to become a flexible and responsive organization.

3.3.6.4 Inclusion of Asset Management Elements

MDOT has been a pioneer in linking asset management attributes to strategic planning. The MDOT business plan has strategic objectives, which are directly linked to asset management. Many asset management concepts are also included in the plan. The following are attributes of asset management that have been explicitly mentioned:

- Asset Management
- System Preservation
- Performance Programming
- Maintenance Management Systems
- Stakeholder Involvement

3.3.7 Missouri

The Missouri Department of Transportation (MoDOT) has undertaken a comprehensive statewide planning effort defined as the MoDOT Long-Range Transportation Direction that examines transportation needs and establishes the direction for the state's investment in all modes of transportation.

3.3.7.1 Goals

The following transportation goals were developed in cooperation with the Missouri DOT's transportation partners who represented rural and urban areas:

- Ensure safety and security of travel, decreasing the risk of injury or property damage on, in, and around transportation facilities
- Take care of the existing system of roads, bridges, public transportation, aviation, passenger rail, and ports
- Relieve congestion to ensure the smooth flow of people and goods throughout the entire system

- Broaden access to opportunities and essential services for those who cannot or choose not to drive
- Facilitate the efficient movement of goods using all modes of transportation
- Ensure Missouri's continued economic competitiveness by providing a safe, reliable, and efficient transportation system
- Protect Missouri's environment and natural resources by making investments that are not only sensitive to the environment, but that also provide and encourage environmentally beneficial transportation choices
- Enhance the quality of our communities through transportation

In addition, the Missouri DOT establishes priorities among each mode's needs, which focuses its efforts on meeting the most important needs first.

- Highway and bridge investments will concentrate on the National Highway system and remaining arterials and establish goals for the entire highway and bridge system
- The state's most important passenger rail needs can be met by implementing the Midwest Regional Rail Initiative on existing rail tracks with modifications between St. Louis and Kansas City
- Missourians consistently rated public transportation as a high-priority need. Trying to meet 90% of the established needs will bring about significant improvements in urban and rural areas

3.3.7.2 Objectives

Within its transportation plan, the Missouri DOT defines its objectives for each individual mode, including:

- Aviation
- Bicycle and pedestrian accommodations
- Freight rail
- Highway systems
- Bridge systems
- Passenger rail
- Public transportation
- Ports

The Missouri DOT works with its transportation partners to identify which major highway and bridge projects are the state's highest priorities. It uses measurable factors like safety, connectivity, and traffic growth to establish these priorities.

3.3.7.3 Performance Measures

The Missouri DOT went to great lengths to involve the public in the planning process and in the development of performance measures.

Road Rallies were held, where randomly selected citizens and civic leaders in different parts of the state were driven on a pre-selected course along state roads and over state bridges. During the journey, the passengers graded road conditions based on factors such as:

- Pavement smoothness
- Lane and shoulder width
- Striping
- Signage
- Others

The Missouri DOT had already traversed the same routes and used existing engineering standards to assess conditions. It then used the previously gathered public input to apply scores, based on the aforementioned engineering standards. These scores form the baseline against which the Missouri DOT will measure its success in meeting its objectives.

In addition, the Missouri DOT conducted statewide public surveys of randomly selected citizens and civic leaders to help establish the top priorities for all modes of transportation. According to the survey, the top two priorities among those surveyed are:

- A safe transportation system
- Maintaining the existing system

By maintaining the existing system, the Missouri DOT is not implying that no improvements will be made to the existing system. Rather, its ultimate goal is to bring all aspects of the existing system up to an acceptable level and maintain them there.

3.3.7.4 Inclusion of Asset Management Elements

Missouri DOT's Long-Range Transportation Direction document contains the following asset management elements:

- Multi-modal tradeoffs
- Resource allocation
- Forecasting/tracking tools
- Life cycle costs
- Construction
- Budgeting
- Stakeholder involvement

3.3.8 Montana

3.3.8.1 Goals

The goals of the Montana DOT are defined in its Strategic Business Plan through critical success factors that utilize a balance of the following perspectives:

- Financial
- Customer satisfaction
- Business process improvement
- Stable and well-trained workforce

For each of these factors, the Montana DOT has developed a set of corresponding goals and objectives. These are detailed in an extensive set of tables located within its business plan document. Montana DOT has developed several corresponding actions towards the achievement of each of these goals, which are included in detail within the aforementioned tables.

For the financial perspective Montana DOT has defined the following goals:

- Maximize revenue streams and explore innovative financing options
- Deliver a cost-effective transportation program to the citizens of Montana
- Develop a consistent, statewide project programming methodology

For the customer satisfaction perspective Montana DOT has defined the following goals:

- Provide a safe and efficient inter-modal transportation system
- Maximize external customer satisfaction
- Enhance the social, economic, and environmental qualities of Montana

For the stable and well-trained workforce perspective Montana DOT has defined the following goals:

- Provide a safe and healthy workplace for employees
- Optimize the Montana DOT work environment to assure a qualified and stable workforce
- Use information technology to conduct business efficiently and effectively

3.3.8.2 Objectives

The Montana DOT has developed a set of objectives corresponding to each of these goals. There are too many of these objectives to include in this section, but a complete list of them is detailed in an extensive set of tables located within Montana DOT's Strategic Business Plan document.

3.3.8.3 Performance Measures

The Montana DOT developed a balanced scorecard approach to measure progress toward attaining the agency's business. The balanced scorecard provides a quantifiable method of evaluating the organization and examining its needs from an overall perspective.

The balanced scorecard identifies and then builds interrelationships between various parts of the organization by placing a focus on the following quadrants:

- Financial
- Customer
- Internal business
- Learning and growth

For its financial quadrant, Montana DOT has defined the following measures:

- Percent of revenue growth per year
- Various cost effectiveness indicators
- Percent variance from annual project mix

For its customer quadrant, Montana DOT has defined the following measures:

- Highway/Air fatalities and injuries
- Customer satisfaction index
- Ridership and wetland creation

For its internal business quadrant, Montana DOT has defined the following measures:

- Percent of project phases and/or projects delivered on time
- Overall ride index
- Employee satisfaction index

For its learning and growth quadrant, Montana DOT has defined the following measures:

- OSHA/WC rates
- Turnover/sick rates
- Percent trained and utilized

In addition, in its Performance Programming Process document, Montana DOT has established objectives, performance measures, and performance targets in the following four program areas:

- Pavement
- Bridge
- Safety
- Congestion

3.3.8.4 Inclusion of Asset Management Elements

Montana DOT's Strategic Business Plan document contains the following asset management elements:

- System preservation
- Multi-modal tradeoffs
- Performance programming
- Maintenance/replacement tradeoffs
- Resource allocation
- Decision support using BMS/PMS
- Maintenance management systems

- Forecasting/tracking tools
- Life cycle costs
- Construction
- Budgeting
- Workplace improvement
- Stakeholder involvement

3.3.9 New York

The New York State DOT has extended their Transportation Program from a five-year program to a twelve-year program in order to coincide with the Metropolitan Transportation Improvement Programs (TIP). The transportation program lists 21st century goals, which are strategic and long-term in nature. The objectives and performance measures have also been documented within the twenty-first century goals. These are discussed in detail in the following sections.

3.3.9.1 Goals

The goals have been divided into four groups. These are Bridges, Pavements, Mobility, and Safety. The mobility goal is emphasized the most, due to the focus of the New York State Department of Transportation on cost-effective mobility and congestion management projects.

3.3.9.2 Objectives

All the goals have specific objectives centered on three key areas: Safety, Preservation and Serviceability. Maintaining an acceptable level of bridge and pavement infrastructure condition is a primary objective of this program. It also identifies that maintenance of about 60% of the total lane mileage is essential for having the system in place.

The mobility goal has detailed objectives and performance measures, which are very objective specific. The objectives and performance measures for the mobility goal are described in terms of reducing the travel delays for both people and goods. Another important objective of the mobility goal is reducing congestion. Other objectives include increasing bicycle and pedestrian transportation facilities and integrating them with highway and transit projects.

3.3.9.3 Performance Measures

The performance measures are specific to the objectives. For bridges, the Bridge Condition Index (BCI) and the Maintenance Condition Index (MCI) are the two main measures that determine performance. For pavements, the surface ratings and the ratio of preventive maintenance actions to total actions determine performance. The performance

measures for mobility are in terms of Persons-Hours of Delay (PHD), Ton-Hours of Delay (THD), and travel time. Detailed objectives and performance measures are given in Table 3.10.

Table 3.10. Goals and Objectives Outlined by New York

Goals	*Objectives*	*Performance Measures*
Bridges – Assure a safe and serviceable bridge infrastructure for all public highway facilities in New York state at the lowest practical life cycle cost	1.Provide mitigation measures to assure that all bridges are safe 2. Assure an acceptable bridge infrastructure condition through all appropriate life cycle actions 3. Address bridge structural and geometrical features that compromise the efficient movement of goods and people	1. Bridge Condition Index 2. Maintenance Condition Index 3. No load or clearance postings on NHS and other specifically identify routes.
Pavement - Maintain a balanced program of preventive maintenance and rehabilitation projects which minimizes the user costs	1. Maintain the system such that at least 60% of total lane mileage is in good to excellent condition 2. Give priority to projects on the national highway system and other corridors with high commercial traffic volumes	1. Percentage of preventive maintenance actions to total actions 2. Percentage of overall lane miles with surface ratings 7 or greater
Mobility – To move people and goods safely and conveniently	1. Reduce the growth of daily recurring persons hours of delay (PHD) by ten percent by the end of first five years of the program period and by additional reductions within 20 years 2. Reduce the growth of daily recurring ton hours of delay (THD) by ten percent by the end of first five years of the program period and by additional reductions within 20 years 3.Promote the reduction in single occupant vehicle travel during peak hours 4. Promote the connectivity of designated National Highway System (NHS) routes to the non-highway transportation modes 5.Increase bicycle and pedestrian transportation by programming projects to implement approved bicycle/pedestrian plans 6. Reduce congestion, accidents, and long-term infrastructure costs on state arterials by aggressively pursuing arterial management techniques	1. Persons-hour of delay (PHD) and person-hour of delay per centerline mile on the CMS network 2. Ton-hours of delay and ton-hours of delay per centerline mile on the CMS network 3. PHD/$M 4. Percent increase in peak hours average vehicle occupancy 5. Number of spot locations eliminated 6. Number of dedicated network miles to be functional at the end of 5 years 7. Reduction in daily person and ton travel time 8. New miles of on-street bicycle facilities 9. Number of corridors where arterial management techniques are to be pursued
Safety – Ensure that highway safety is considered in development and implementation of all department programs and projects		1. Number of locations on Final Regional Work Program (FRWP) 2. Number of severe and total accidents projected to be reduced as a result of safety capital projects 3. Number of treated High Accident Locations (HAL) accidents occurring in capital projects 4. Number of severe and total accidents projected to be reduced as a result of HAL's treated

3.3.9.4 Inclusion of Asset Management Elements

The New York State Transportation Program document contains the following asset management elements:

- System preservation
- Performance measures
- Priority selection process
- Budgeting

3.3.10 Ohio

Ohio prepares its Business Plan every other year. The Business Plan states the department's mission, vision, values, and goals. By implementing this plan, the Ohio Department of Transportation (ODOT) expects to see teamwork, quality principles, work force development, and the most efficient processes.

3.3.10.1 Goals

At a high level, ODOT has defined six goals in its Business Plan. These goals define the key elements that the organization will focus on. The six goals are as follows:

- Understand thoroughly the diverse transportation needs of customers.
- Communicate effectively with internal and external customers.
- Refine a planning process that identifies strategies and projects to address evolving transportation needs.
- Deliver projects in a reliable, predictable and timely manner to ensure achievement of transportation goals.
- Excel at preventive maintenance practices to maximize public's investment.
- Be a quality culture that embraces continuous improvement.

3.3.10.2 Objectives

At a lower level, ODOT has defined initiatives to move the Department towards accomplishing its goals. They call for improvements in the freeway network, development of a system to measure and manage congestion, improvement in their mission-critical snow and ice control, and efforts to ingrain Quality Principles into the way they do business. Also, developing a modern customer-friendly project management system is a primary objective. This last objective is designed to facilitate better management of the fiscal forecasting and project tracking systems. ODOT's eleven initiatives are listed below:

- Update ACCESS Ohio
- Develop Strategies to Measure and Manage Congestion
- Develop a Modern Customer Friendly Project Management System
- Re-defining County Priorities

- Build bridges Faster, Smarter, Better
- Improve Quality of its Construction Plans
- Modernize Its Construction Administration Practices
- Change the Way ODOT Currently Test and Accepts Materials
- Develop Innovative Contracting Methods
- ODOT Will Expand Partnering
- Will Continue to Emphasize the Snow and Ice Initiative

In their business plan, ODOT establishes clear steps that need to be taken to implement these initiatives. Also, ODOT has assigned ownership responsibilities for each initiative and identified the affected ODOT Central Offices.

Table 3.11. Ohio Strategic Initiatives

Strategic Initiative	*Goals of the initiative*
Update ACCESS Ohio	Develop a plan update advisory team.
	Update ACCESS Ohio goals and guiding principles
	Incorporate ODOT's system analysis of bridge and pavement needs.
	Review and incorporate urban areas' long-range modal plans.
	Update database on new census results.
	Expand macro corridor concepts and strategy for completion.
Develop Strategies to Measure and Manage Congestion	Use the 2001's analysis as the basis for identifying highway and transit projects, which should be funded by the TRAC and to determine which areas of congestion require further study to determine if they can be improved.
	Predict the amount by which the congestion will grow in 20 years.
	Completion of a statewide congestion analysis report to be included in ODOT's State of the Transportation System report.
	Develop a formal "operational strategy" leading the department into new active ways of thinking to maximize the use of existing capacity. These practices will include: - Continuing expansion of "freeway service patrols" to help move stalled cars from freeways to prevent backups - Complete the policy on ITS use to help identify accidents and notify emergency personnel of the need to respond quickly to crash sites - Continue encouraging law enforcement and locals cities to adopt best practices to clear accidents quickly - Continue to emphasize ODOT's maintenance of traffic efforts to keep construction zones moving - Continue emphasis on snow and ice excellence to minimize urban delay. - Emphasizing with local governments the need to manage access – such as curb cuts – effectively so that roadways' existing capacity can be preserved.
Develop a Modern Customer Friendly Project Management System	To develop and implement a project management system that will be linking ODOT's new approaches to project delivery, planning, system forecasting and financial management.
Re-defining County Priorities	Get the conditions of each district to statewide averages or above for all eight-roadway items within three years. The steps involved to achieve the goal will be: - Each county will review its deficiencies in the basic roadway item. - It will determine which areas need the greatest focus based on its deficiencies relative to all other counties and relative to statewide conditions goals. - County will determine how much time should be devoted to snow and ice, construction inspection, training and other functions. - Based on the remaining work force hours, county will prioritize its efforts and forecast how much progress its

	forces can achieve through force account work. - In case of failure (conditions not improved within three years) the county forces ought to forecast how much progress can be added by help from district-wide crews such as: guardrail or ditching crews. - If goal still not achieved, then county should consider letting contracts bring condition levels up to standards. - Once on standard, county needs to set up an on-going plan and production plan to ensuring the conditions persist.
Build bridges Faster, Smarter, Better	Conduct a literature search and surveys of manufacturers, contractors, and state DOT's to determine which rapid repair/construction methods are available, along with which methods have been successful.
	Collect cost and feasibility information for each method.
	Initiate sample projects with the most promising expeditious construction techniques and processes.
	Develop best practices guidance for the most expeditious/cost effective bridge construction techniques.
	Complete the initiative by June 2002.
Improve Quality of its Construction Plans	Develop the composition and responsibilities of the constructibility review team, the frequency and locations of reviews.
	Develop a constructibility review checklist to be used uniformly by all districts.
	Develop a measuring system to determine the effectiveness of constructibility reviews.
	Provide high quality and cost effective plans that can be constructed using standard construction methods, materials, and techniques.
	Move value engineering and preliminary engineering earlier into the development process.
	Complete a new process by June 2002.
Modernize Its Construction Administration Practices	Develop a qualified and capable group of construction technicians to be utilized as a statewide core of specialists, to allow for better manpower utilization at district level and to assist in achieving consistency and uniformity in construction administration.
	Develop a formal training curriculum for inspectors and technicians.
	Provide a uniform advancement ladder that would be based on field experience, formal training, and proficiency testing.
	Update the way ODOT currently conducts construction inspection taking into account prioritization, while maintaining a critical inspection task list.
	Develop a construction project inspection and material control procedure that properly prioritizes resources based on the critical inspection task/items. This will include automating the inspection and documentation process to reduce errors, and capture critical information in a timely manner.
	Develop a manual for critical item inspection that reduces that reduces the need for full time inspection of some work items, and a Quality Control / Quality Assurance (QC/QA) approach for ensuring quality material. QC/QA specification procedures will place more documentation requirements on contractors, ands quality assurance on ODOT.
	Continue utilizing highway workers to supplement inspection as needed.
	Achieve prompt finalization of construction projects.

	Optimize construction engineering and inspection (CE) costs.
	Increase the number of projects completed on time.
Change the Way ODOT Currently Test and Accepts Materials	Partner with FHWA and the industry to develop a QC/QA approach to utilize contractor developed mix designs and in-process quality control programs to ensure material quality.
	Partner with FHWA and the industry to establish certification programs with currently tested materials. Modify the existing CMS computer system and its testing component TAS to allow the use pf certified materials.
	Forma a team of ODOT contractors, materials and construction [personnel to evaluate all materials processes for need, documentation requirements and computerization modifications with a goal of lowering the current testing documentation by at least 50 percent.
Develop Innovative Contracting Methods	Incorporate innovative contracting methods to reduce traffic congestion and contract time, and to enhance project quality.
	Create a multi-disciplinary team to develop and implement a Value Engineering (VE) feedback loop to incorporate acceptable VE proposals in ODOT's standard drawing and plans prior to bidding.
	Create a multi-disciplinary team to study the following innovative contracting methods and develop new ones: - Setting of project completion dates. - No excuse bonus lump sum contracts. - A+B contracting, or the bidding both of cost (A) and the time to complete the project (B) considered. - A+B-C bidding, or the bidding both of cost (A), plus warranty (B) for the lowest cost (-C). - Liquidate savings, which is a bonus provision equivalent to the liquidated damages. - Lane and ramp rental, which gives the contractor only limited days to close ramps or lanes without a penalty, which amounts to the "rental" of the lane or ramp. - Incentive/Disincentive, which rewards early completion and penalizes late completion.
ODOT Will Expand Partnering	Complete project on or before the contact completion dates.
	Increase Value Engineering savings.
	Reduce the number of change orders and construction claims.
	Identify district projects this year (2002) with intent to partner all jobs in the future.
	Establish training for al levels of projects administration staff to educate personnel on the initiative.
	Create measurements to track success.
	By the end of FY 2002 the Central Office partnering coordinator will develop a report outlining recommendations.
Will Continue to Emphasize the Snow and Ice Initiative	Implementation of material evaluation and treatment guidelines.
	Implementations of complete pavement/weather evaluation and recommend deployment strategy.
	Implementation of computer routing software evaluation and implement resource analysis.
	Implementation of evaluation of equipment for road condition reporting and operational management.

3.3.10.3 Performance Measures

ODOT has not defined performance measurements, as such. Rather, they are defined in the goals related to the strategic initiatives.

3.3.10.4 Inclusion of Asset Management Elements

Just as with performance measurements, ODOT has not specifically mentioned asset management in its business plan. However, many of the goals related to strategic initiatives include elements of asset management, including:

- Performance Programming
- Forecasting/Tracking Tools
- Construction
- Priority Selection Process

3.3.11 Pennsylvania

3.3.11.1 Goals

The Pennsylvania DOT (PennDOT) has divided its planning documents into the following separate plans:

- 2002-2003 Business Plan
- 2003-2004 Business Plan
- Highway Administration Business Plan
- Moving Pennsylvania Forward

However, all four plans share the same following overall goals:

- Smoother Roads
- Cost Effective Highway Maintenance Investment
- Balance Social, Economic, and Environmental Concerns
- Demonstrate Sound Environmental Practices
- Delivery of Transportation Products and Services
- Efficient Movement of People and Goods
- Improve Customer Satisfaction
- Improve Customer Access to Information
- World-class Process and Product Performance
- Safer Travel
- Safer Working Conditions
- Improve Transportation Security
- Improve Leadership Capabilities and Work Environment
- Cultivate Effective Relationships

3.3.11.2 Objectives

The Pennsylvania DOT presents its objectives in relation to each specified goal. The objectives are defined as follows:

For the Smoother Roads goal:

- Improve ride quality by incorporating smooth road strategies into a comprehensive pavement program

For the Cost Effective Highway Maintenance Investment goal:

- Refine winter services practices to achieve more timely and efficient responses
- Use life cycle criteria as a tool for asset management and investment to reduce outstanding maintenance needs

For the Balance Social, Economic, and Environmental Concerns goal:

- Improve customers' experiences of our facilities by enhancing beautification efforts and reducing roadside debris
- Develop timely transportation plans, programs, and projects that balance social, economic, and environmental concerns

For the Demonstrate Sound Environmental Practices goal:

- Implement a strategic environmental management program that adopts best practices as our way of doing business

For the Delivery of Transportation Products and Services goal:

- Meet project schedules and complete work within budgeted costs

For the Efficient Movement of People and Goods goal:

- Implement congestion management strategies that limit work zone restrictions, address incident management, and reduce corridor traffic delays
- Implement keystone corridor rail passenger improvements as a pilot multimodal initiative

For the Improve Customer Satisfaction goal:

- Implement a systematic process that further involves customers in identifying requirements for more responsive products and services

For the Improve Customer Access to Information goal:

- Improve information access by providing quality customer contacts across the organization with special attention to driver and vehicle inquiries

For the World Class Process and Product Performance goal:

- Map key processes and improve those with the most strategic impact on business results
- Deliver business results through planned, enterprise-focused information technology

For the Safer Travel goal:

- Implement cost-effective highway safety improvements at targeted high crash/fatality locations
- Upgrade safe driving performance through education and enforcement initiatives

For the Safer Working Conditions goal:

- Implement prevention strategies to reduce the employee injury rate
- Implement prevention strategies to reduce the vehicle accident rate

For the Improve Transportation Security goal:

- Develop a transportation security plan
- Implement security-related action items

For the Improve Leadership Capabilities and Work Environment goal:

- Provide employees with the tools and expectations to communicate effectively in order to facilitate leadership at all levels
- Develop employees' skills and capabilities through a structured process of instruction, practice, and leadership opportunities

For the Cultivate Effective Relationships goal:

- Implement a strategy to involve partners and stakeholders more meaningfully in PennDOT activities
- Strengthen the efficiency and effectiveness of transportation grant programs utilizing the methodology for partners and stakeholders

3.3.11.3 Performance Measures

The Pennsylvania DOT presents its performance measures in relation to each goal. For a detailed listing of PennDOT's goals, strategies and performance measures, see Table 3.19 at the end of the chapter. The performance measures are defined as follows:

For the Smoother Roads goal:

- International Roughness Index (IRI) on major (NHS) roads

For the Cost Effective Highway Maintenance Investment goal:

- Condition assessment for highways and bridges

For the Balance Social, Economic, and Environmental Concerns goal:

- Highway project environmental approvals meeting target dates

For the Demonstrate Sound Environmental Practices goal:

- ISO 14001 environmental criteria

For the Delivery of Transportation Products and Services goal:

- Dollar value of 12-year program construction contracts initiated (calendar year)

For the Efficient Movement of People and Goods goal:

- 2002 peak period work zone lane restrictions
- 2005 travel delays on selected corridors

For the Improve Customer Satisfaction goal:

- Baldridge Organizational Review Package Scores-Customer Criteria

For the Improve Customer Access to Information goal:

- Answer rate of calls to the Customer Call Center

For the World Class Process and Product Performance goal:

- Baldridge Organizational Review Package Scores-All Criteria

For the Safer Travel goal:

- Number of fatalities per year

For the Safer Working Conditions goal:

- Injury rate per 100 employees working 1 year

For the Improve Transportation Security goal:

- Statewide security plan and action items

For the Improve Leadership Capabilities and Work Environment goal:

- Organizational Climate Survey (OCS) – Selected items
- Organizational Commitment, Quality of Communication, Quality of Supervision and Job Satisfaction

For the Cultivate Effective Relationships goal:

- PennDOT/Partner business effectiveness survey scores

3.3.11.4 Inclusion of Asset Management Elements

The Pennsylvania DOT planning documents contain the following asset management elements:

- Asset management

- System preservation
- Multimodal tradeoffs
- Maintenance/Replacement tradeoffs
- Resource allocation
- Decision support using BMS/PMS
- Maintenance management systems
- Forecasting/tracking tools
- Life cycle costs
- Construction
- Priority selection process
- Budgeting
- Workplace improvement
- Stakeholder involvement

3.3.12 South Carolina

The South Carolina Department of Transportation (SCDOT) developed and deployed its first strategic plan in 1998. Following that initiative, the new position of Deputy Director of Strategic Planning, Finance, and Administration was created. This person is responsible for developing the performance measurements for each of the business processes in the Department.

This strategic plan allowed SCDOT to identify its mission, vision, goals, and values. In early 2000 SCDOT reviewed the original 1998 Strategic Plan to make sure that the goals and objectives were still properly aligned. Table 4.12 presents the goals, objectives, and associated performance measures within SCDOT's strategic plan. Since there are many objectives for each of the goals, we will review only the main objective for each goal.

3.3.12.1 Goals

SCDOT has seven goals, as follows:

- Increase Safety on S.C. Roads and Within SCDOT
- Improve the Quality, Efficiency and Appearance of Highways
- Improve and Expand Multi- Modal Transportation System
- Implement Integrated Financial and Project Management System
- Improve Employee Skills, Work Environment and Opportunities
- Improve Management of Equipment and Technology
- Provide Highest Level of Customer Service

Goal 1. Increase Safety on S.C. Roads and Within SCDOT
The eleven objectives for this goal address the different ways of reducing the number of crashes, injuries and fatalities on South Carolina's transportation network. Much attention was given to reducing the number of highway crashes and lost workdays due to occupational accidents by 5%. More importance was given to reducing work-zone

related accidents by 10% by implementing comprehensive work zone safety programs. Median barriers are being erected along 284 miles of interstate in an effort to reduce crash frequency.

Goal 2. Improve the Quality, Efficiency and Appearance of Highways
SCDOT has defined 23 objectives to target the improvement of the quality, efficiency, and appearance of highways. Special attention was given to expand the Pavement Management System (PMS) to include all paved roads in the state's system. The Maintenance Management System (MMS) is also being implemented to allow SCDOT personnel to develop a systematic program to plan, schedule, and record maintenance activities on the state's road network. Monitoring and analysis of bridge conditions are possible through the use of SCDOT's Bridge Management System (BMS). The creation of the Quality Management Team ensures that infrastructure elements are in conformity with plans and specifications. Many other objectives are defined to ensure that SCDOT will achieve this goal.

Goal 3. Improve and Expand Multi- Modal Transportation System
This goal was established in an attempt to diversify the modes of transportation and to expand public transportation coverage in un-served counties by 10%. Also, SCDOT is planning to increase the maintenance savings of public transportation providers by 5% and to improve transit technology statewide. Finally, the most important initiative is to develop a long-range inter-modal plan for the state.

Goal 4. Implement Integrated Financial and Project Management System
Integrating financial and project management systems is an important part of asset management. SCDOT initiated several steps to streamline its financial and project management systems. The General Ledger Accounting System was modified to facilitate reconciliation to the Comptroller General System. The use of electronic fund transfers for contract payments is being implemented. Also, a tracking tool will be developed to allow SCDOT to track schedules and financial requirements for contracts. This system provides valuable feedback that will eventually facilitate integrated decision-making. Other initiatives to improve financial and project management processes were also defined (see Table 3.12).

Goal 5. Improve Employee Skills, Work Environment and Opportunities
SCDOT has defined standards for the quality of employees, work environment, and opportunities. Clear initiatives were taken to ensure these three standards would be met. SCDOT will recruit and attract quality employees and ensure a diverse workforce, provide human resource training programs, and provide leadership skill training for managers and supervisors.

Goal 6. Improve Management of Equipment and Technology
SCDOT has many other types of assets besides highways and bridges. In order to better manage these assets, SCDOT is developing a comprehensive Total Asset Management Program to be fully compliant with the General Accounting Standard Board (GASB) 34.

Other initiatives were also started, such as the development and implementation of an electronic document management system.

Goal 7. Provide Highest Level of Customer Service
Some of the more important initiatives related to this goal are to survey the public every three years to determine their perception of SCDOT's strengths and weaknesses, to complete 95% of all requests within 60 calendar days, and to reduce delays due to incidents on urban freeways through expansion of Intelligent Transportation Systems (ITS).

3.3.12.2 Objectives

There are many objectives and strategies defined by South Carolina. For each goal SCDOT has defined initiatives, which are listed in Table 3.12.

3.3.12.3 Performance Measures

As with the objectives and strategies, SCDOT has a plethora of performance measures, which are also listed in

Table 3.12.

Table 3.12. South Carolina Goals, Initiatives and Performance Measures

Goal	*Initiative*	*Performance Measure*
Increase Safety on S.C. Roads and Within SCDOT	Reduce number of highway crashes, injuries, and fatalities in South Carolina by 5% by 2003 through the development and implementation of a variety of statewide safety initiatives	• Annual number of crashes, injuries and fatalities
	Reduce the number of lost workdays involving SCDOT employees due to occupational accidents by 5% by 2003 through the continued implementation and expansion of various employee safety programs and the establishment of a SCDOT Safety Committee	• Annual number of lost workdays
	Reduce work zone- related crashes, injuries, and fatalities by 10% by 2003 through the development and implementation of a comprehensive work zone safety program	• Annual number of work- zone crashes, injuries and fatalities
	Reduce speed- related crashes, injuries and fatalities by 5% by 2003 through the continued implementation and expansion of a comprehensive speed management program	• Annual number of speed- related crashes, injuries and fatalities
	Reduce red light running crushes, injuries, and fatalities by 5% by 2003 through the development and implementation of a comprehensive red light running program in several South Carolina cities	• Annual number red light running crashes, injuries and fatalities in targeted cities
	Begin implementation of the Corridor Safety initiative in at least two districts	• Number of Corridor Safety initiatives underway
	Reduce losses to agency through the implementation of a Risk Management System to identify losses and target countermeasures at specified locations	• Number of sites identified and/or corrected • Dollar amount of claim payouts
	Develop a program to reduce traffic crushes where hydroplaning is a significant factor	• Number of hydroplaning crashes
	Complete the installation of interstate median barriers on approximately 284 miles of highway	• Number of hits • Number of miles of barriers installed and accepted by SCDOT
	Reduce the number of run- of –the- road crashes, injuries, and fatalities by 5% by 2003 in the five counties with the highest frequency of such crashes	• Annual number of run- of- the- road crashes, injuries and fatalities

	Reduce the number of pedestrian and bicycle crashes, injuries and fatalities by 5% by 2003 in the three counties with the highest frequency of such incidents through the implementation of pedestrian assessments and supporting programs	• Annual number of pedestrian and bicycle crashes, injuries and fatalities
Improve the Quality, Efficiency and Appearance of Highways	Complete the construction of all bonded and non- bonded Interstate interchange improvement projects	• Percent of bonded Interchange Projects completed • Percent of non- bonded Interchange Projects completed
	Expand the Pavement Management system to cover all paved roads in the State System	• Percent of state roads added to the pavement management system
	Implement the Maintenance management System statewide	• Percent complete based on milestones
	Maintain paint system on statewide bridge system	• Reduce percentage of tones of steel needing painting • Tons of steel painted
	Develop and implement a plan to decrease the number of deficient bridges in the state	• Reduce percentage of square footage of bridge decks that are deficient
	Carolina Bays Parkway design- build project to be completed	• Project accepted by SCDOT
	SC 170 design- build project to be completed	• Project accepted by SCDOT
	Begin construction for the Design/ Build project on the Cooper River Bridges in Charleston	• Design/ Build contract signed by SCDOT
	Implement the SIB projects according to the schedules and budgets in the intergovernmental agreements and STIP	• Percent of projects on or ahead of schedule
	Implement the MPO projects according to the schedules and budgets in each of the bonding agreements and STIP	• Percent of projects on or ahead of schedule • Percent of projects on or below budgets
	Implement the COG projects according to the schedules and budgets in each of the bonding agreements and STIP	• Percent of projects on or ahead of schedule • Percent of projects on or below budgets
	Implement System and Inter-modal Connectivity projects according to the schedules and budgets in STIP	• Percent of projects on or ahead of schedule • Percent of projects on or below budgets
	Implement enhancement projects to improve the appearance of SC highways and other transportation facilities	• Number of enhancement projects completed and expenditures
	Develop a Long- Range Plan for the Intelligent Transportation System	• Plan approved by SCDOT
	Develop and implement a Quality Management Team to review construction project sites and project records to ensure conformity with plans and specifications	• Number of team reviews complete

	Develop and implement the first year of a six- (6) year program to maintain all rural roads with less than 500 ADT with chip seal treatment	• Percent of miles resurfaced with chip seal as compared with miles yet to seal
	Develop and implement the first year of a five- (5) year program to inspect all the shoulders and ditches for deficiencies that require maintenance	• Number of miles of ditches inspected
	Develop and implement a comprehensive wildflower/roadside beautification program	• Program implementation complete
	Develop and implement a traffic signal maintenance program, which includes annual inspection and the replacement and upgrade of equipment on a 12- year cycle	• Annual inspections • Number of traffic signal upgraded as compared to the numbers to be upgraded
	Ensure all MPO's, designated as non- attainment areas, develop transportation plans and programs to conform to Clean Air Act requirements	• Approved Air Quality Plans
	Ensure that all MPO's have a current certified Long Range Transportation Plan	• Plans accepted by FHWA
	Reduce the time required to receive individual environmental permits by 30%	• Average time to obtain 404/401/OCRM permits
	Improve the adequacy of erosion and sediment control measures in construction projects	• Training for all inspectors to insure appropriate measure is installed to control sediment from leaving the construction site
Improve and Expand Multi-Modal Transportation System	Develop a comprehensive coordination plan with input from other state agencies involved in delivery of public transportation services	• Plan approved by SCDOT and state agencies
	Increase public transportation coverage in un- served counties by 10%	• Percentage of un- served counties providing public transportation
	Increase maintenance savings of public transit providers by 5%	• Dollar savings due to maintenance costs
	Increase transit technology statewide	• Number of new applications available for use by transit agencies
	Increase the number of DBE's certified in highways and mass transit by 10%	• Number of certified DBE's
	Meet or exceed the goals set for the DBE Program in pre-construction and construction	• Dollars committed to pre-construction • Dollars committed to construction
	Develop a long- range, inter-modal plan for South Carolina	• Plan approved by SCDOT Commission
Implement Integrated Financial and	Implement modified General Ledger Accounting System	• System fully operational • Monthly reconciliation of General Ledger System to the Comptroller General System

Financial and Project Management System	Implement an updated accounts receivable system, which includes participation agreements and notes receivable	• System fully operational • Monthly reports prepared • Percentages of Invoices collected within 30/60/90 days
	Define plan for continued enhancement of the Accounting System	• Plan submitted to senior management
	Use Electronic Fund Transfer for contract payments	• Electronic funds transfer used for 50% of contracts • Electronic funds transfer used for 100% of remainder
	Pay 90% of construction estimates within 90 days of final acceptance	• Percent of invoices paid in 90 days
	Close 95% of projects within 90 days of payments of final construction estimates	• Percent of invoices paid in 90 days
	1. Implement at least semi- monthly federal aid billing to increase cash reserves	• At least semi- monthly bills submitted to FHWA
	Develop a comprehensive SCDOT Construction Resource Manager Planning and Reporting System to track schedules and financial requirements	• System fully operational
	Implement AASHTO software programs, including Letting and Award System (LAS) and Proposal and Estimate System (PES), to assist with project management	• Program implementation complete
Improve Employee Skills, Work Environment and Opportunities	Increase donations to the Employee Leave Pool by 20%	• Number of increases in donations
	Recruit and attract quality employees and ensure a diverse workforce	• Percent of minorities and women in work force
	Provide Human Resource Training programs to include EEO and Diversity training	• Reduce EEO and Sexual Harassment cases
	Provide leadership skill training for managers and supervisors	• Number of managers and supervisors trained
	Increase usage of the SCDOT library by promoting available materials and services	• Increase in usage
	Provide employee special needs assistance through the Chaplaincy Assistance Program	• Number of employees assisted
Improve Management of Equipment and Technology	Upgrade PC's and install Windows 2000	• Percent of computers with new system • Replace 1/3 of computers yearly
	Develop and Adopt a Phase I and Phase II comprehensive Total Asset Management Program	• Plan accepted by Comptroller General and SCDOT
	Update Capital Improvement Plan to include year 2007	• Plan approved by SCDOT Executive Committee

	Complete Phase I of shared resource fiber optic network on the Interstate System	• Phase I (construction & routes) complete
	Develop and Implement Phase I of an Electronic Document Management System	• EDMS system in place
	Develop Phase I GIS to provide graphical reference to data and documents	• Implementation of system • Percent of miles complete
	Review all facilities including rest areas annually to determine the needs of the facility to be both physically and environmentally clean. Provide an assessment report and implement improvements as budget restraints allow	• Assessment report completion date: 11-15-2001 • Implement improvements by: 06-30-2002
	95% of all maintenance equipment listed on the present utilization chart will meet minimum usage standards	• Percentage of equipment meeting minimum usage standards
Provide Highest Level of Customer Service	Survey the public every three years to determine their perception of SCDOT strengths and weaknesses. Determine how the public measures DOT and what the public expects	• Final report received • Number of initiatives resulting from report
	Measure customer input in project and program activities and in business plans	• Customer satisfaction measurements included in annual business plan
	Improve customer service & responsiveness of oversize/ overweight permit process	• New system operational
	Report to public on success of the 27-in-7 program and the impact on SC	• Begin semi- annual reports in the July & December issues of the "Connector" and updates on the SCDOT web site
	95% of all requests and complaints received by the maintenance units will be completed within sixty (60) calendar days	• Percent of requests/ complaints completed
	Reduce delays due to incidents on urban freeways through the expansion of SHEP, and ITS, and increased interagency coordination on Incident Management	• Number of hours of SHEP operation, miles covered and responses • Number of miles under video surveillance • Number of Incident Management Teams Established
	Reduce condemnation rate by 1% annually	• Annual condemnation rate
	Expand customer/ public opportunities to participate in identification of project and program activities	• Update SCDOT Public Participation Program

3.3.12.4 Inclusion of Asset Management Elements

SCDOT is a pioneer in asset management. Their strategic plan contains many asset management elements, including:

- Multi-modal Tradeoffs
- Performance Programming
- Maintenance/Replacements Tradeoffs
- Decision Support Using BMS/PMS
- Maintenance Management Systems
- Budgeting
- Workplace Improvement
- Stakeholder Involvement

3.3.13 Tennessee

3.3.13.1 Goals

The Tennessee Department of Transportation (TDOT) has taken a proactive approach towards designing its strategic plan. Its approach relies on requiring that the managers and staff who actually implement the plan are also involved in its development. All efforts to articulate and carry out a strategic plan are coordinated by the Office of Strategic Planning. Within this office are four "Goal Teams," representing a cross-section of organizational units within TDOT, to ensure that ideas are drawn from across all functional units.

In their *2002-2003 Strategic Plan,* TDOT has articulated four goals (TDOT website):

1. Create a departmental culture that emphasizes opportunity, learning, recognition, and accountability for the benefit and development of TDOT employees.
2. Preserve the transportation infrastructure and enhance system capacity with full consideration of social and environmental issues.
3. Create a more effective and efficient process-based organization.
4. Maximize safety of the state's transportation system.

The implementation of each goal is monitored and the entire strategic plan is reviewed and updated on a yearly basis. According to TDOT's *Progress During 2001-2002* (TDOT website), the April 2002 revision of the *2001-2002 Strategic Plan* resulted in the elimination of the need for a 5th Goal (Develop a Needs-Based Planned Approach to Transportation Systems Development), which is seen as a major accomplishment. Also, some of the remaining goals' descriptions were altered. Due to constant monitoring and review, TDOT goals and objectives are frequently updated to reflect the current level of implementation.

3.3.13.2 Objectives

TDOT has clearly articulated 19 objectives for all four goals and 64 associated strategies that must be achieved to successfully carry out the goal. Table 3.13 lists these objectives grouped by their goal. Please see Table 3.20 at the end of the chapter for a list of the strategies associated with each goal.

Table 3.13. Tennessee DOT Objectives

Goals	*Objectives*
Goal 1	Implement at least two new educational or leadership development opportunities for TDOT Employees by June 2003.
	Implement an active employee recognition program throughout TDOT by June 2003
	Reach and maintain parity and increase utilization for underutilized groups within all TDOT Divisions/Regions by January 2005.
	Implement a fair, streamlined and practical performance evaluation system for TDOT by January 2005.
Goal 2	Improve traffic flow by identifying and modifying congested locations.
	Improve traffic flow and safety by constructing and operating an Intelligent Transportation System (ITS).
	Maximize the capacity of the existing highway system through effective incident and work zone management.
	Promote increased vehicle occupancy by providing high occupancy vehicle (HOV) lanes on interstate highways.
	Develop and implement a strategy to upgrade intermodal freight connector routes.
	Connect county seats and major rural cities to the interstate system with highways meeting current design standards to promote safety, access, mobility and economic development.
	Develop and implement cost-effective maintenance strategies for the existing transportation infrastructure.
Goal 3	Provide a method to measure and improve departmental processes.
	Increase our internal and external customer satisfaction.
	Improve internal and external data sharing and communication using electronic technologies.
	Increase upward and downward communication within the Department among all levels.
Goal 4	Reduce both fatalities and serious injuries resulting from crashes on Tennessee's highway system by 2% annually.
	Provide direction and support for transportation system safety initiatives in TDOT.
	Integrate (improve) public awareness and education programs for safe driving behavior throughout TDOT and state government.
	Establish a framework for implementing a "target zero" highway safety concept in Tennessee.

(Source: http://www.tdot.state.tn.us/)

3.3.13.3 Performance Measures

TDOT has defined seven performance measures in its strategic plan. As with the objectives, these are highly related to individual goals. Table 3.14 presents the performance measurements associated with each goal.

Table 3.14. Tennessee DOT Performance Measures

Goals	*Performance measurement*
Goal 1	Periodic changes in the Organizational Assessment Survey (data currently available: 1997 and 2000)
	Number of executives, managers, and supervisors who have completed mandatory training by category
Goal 2	Miles of congested Interstate – 1999 measurement will be used as the base year index.
Goal 3	Percentage of projects let to contract on schedule, based on the "Top Management Report"
Goal 4	Number of fatalities on Tennessee's highway system
	Seatbelt use in Tennessee
	Number of crashes and injuries on Tennessee highway system

(Source: http://www.tdot.state.tn.us/)

3.3.13.4 Inclusion of Asset Management Elements

TDOT's strategic plan does not specifically talk about asset management, but the key elements of system preservation and the use of forecasting/tracking tools are referred to.

3.3.14 Texas

The Texas Department of Transportation (TxDOT) has put together its Strategic Plan 2003-2007, which defines its major initiatives, recent and current challenges, possible solutions, funding options, and conclusions. More importantly, Texas has undergone a process to identify the transportation challenges and develop solutions for creating a new vision for Texas's transportations needs with clear goals and supporting actions.

3.3.14.1 Goals

The above-mentioned process resulted in the definition of five major objectives, which will enable TxDOT to work towards its priority goal, which is defined by the Governor: "To provide for all of Texas' transportation needs of the new century." The five objectives are:

- Reliable Mobility
- Improved Safety

- Responsible System Preservation
- Streamlined Project Delivery
- Economic Vitality

The "Texas Transportation Partnership" is a blueprint for addressing the transportation challenges facing Texas and defines the vision of Texas' transportation future. The goals critical to attaining this vision and the recommended actions for meeting the goals are included in this blueprint. For each of the long-range objectives, a specific goal was defined, listed below:

- Enhance Texas and urban metropolitan area mobility and ensure that congestion is less than in comparable peer US cities.
- Reduce the fatality rate on Texas roadways by five percent within ten years.
- Ensure that 90% of Texas' roads and 80% of bridges will be in good or better condition within 10 years.
- Improve project delivery from project conception to ribbon cutting, on average, by 15% within 5 years.
- Attract and retain businesses and industry with adequate transportation systems and services.

3.3.14.2 Objectives

For achieving these goals, TxDOT has defined strategies required to fulfill them. These strategies are accompanied by actions to be taken, recommended partnerships actions to support the goal, as well as which personnel are responsible for fulfilling them. Table 3.15 lists the strategies.

3.3.14.3 Performance Measures

Performance measurements were created to align TxDOT's business practices with the five main objectives defined in its strategic plan. TxDOT's current planning framework makes use of 121 performance measurements, of which 28 are considered key. The new format suggests five budget strategies with streamlined sets of performance as shown in Table 3.16.

For each of the five goals defined in the strategic plan, TxDOT has defined one item to measure the success of the goal. These are listed in Table 3.15.

Table 3.15. Texas Goals, Strategies and Performance Measurements

Goal	*Strategies*	*Performance Measure*
Enhance Texas and urban metropolitan area mobility and ensure that congestion is less than in comparable peer US cities	Consider the range of transportation alternatives as a part of all capacity improvement studies	Compare mobility statistics for Texas cities to their peers nationwide
	Increase transit availability in rural, urban and metropolitan areas	
	Increase the number of transit trips in rural, urban and metropolitan areas	
Reduce the fatality rate on Texas roadways by five percent within ten years	Increase the number of safety improvements completed.	Decrease in recorded fatalities per 100 million miles traveled
	Decrease the time required to install traffic signals	
	Increase the number of highway/ railroad crossings that are improved	
Ensure that 90% of Texas' roads and 80% of bridges will be in good or better condition within 10 years	Explore transportation modes and material alternatives that will reduce total life cycle preservations costs	Improvements in pavement condition and bridge inspection scores
	Preserve and upgrade general aviation facilities	
	Resurface and rehabilitate roadways to preserve investment	
	Replace or improve bridges in a timely fashion	
	Replace aged transit vehicles to minimize maintenance and operation costs	
Improve project delivery from project conception to ribbon cutting, on average, by 15% within 5 years	Reduce the total time from project identification to ribbon cutting	Reductions in the overall project planning, design and construction time frames
	Increase the percentage of project deadlines met	
	Expand hours of construction where appropriate to night- time and off- peak periods (within two years)	
Attract and retain businesses and industry with adequate transportation systems and services	Eliminate gaps or bottlenecks in the Texas transportation systems	Growth in the Gross State Product
	Decrease border -crossing time	
	Encourage the use of rail and barge as alternatives to highways for surface freight shipment	
	Improve the average travel speed on congested trade corridors	

Table 3.16. Texas Budget Strategies with related Performance Measures

Budget Strategy	*Output*	*Efficiency Measure*
Plan It	# Of plans delivered on time	% Of plans delivered on time
	# Of parcels delivered on time	% Of parcels delivered on time
	# Of projects reviewed for environmental impact	% Of projects mitigated
	# Of innovations resulting from research	
	# Of rail projects developed	
Build It	# Of projects build to increase capacity	
	# Of bridges replaced or rehabilitated	
	# Of airports receiving assistance	% Of general aviation airport needs funded
	# Of high crash locations improved	
Maintain It	# Of lane miles receiving surface improvements	% Of state highway system receiving surface improvements
	# Of signs/junkyards/auto graveyards brought in compliance	
Maximize It	# Of transit providers receiving assistance	
	# Of permits issued	
	# Of vehicles registered	
	# Of entries receiving auto theft prevention grants	
	# Of motor vehicle consumer complaints resolved	
	# Of highway safety grants awarded	
	# Of travelers served	
Manage It		

3.3.14.4 Inclusion of Asset Management Elements

As many other states, Texas has not specifically mentioned asset management in its Strategic Plan and Transportation Partnership. However, some of the asset management-like activities that emerged from the two documents are shown below:

- System Preservation
- Multi-modal Tradeoffs
- Priority Selection Process
- Budgeting

3.3.15 Vermont

The aim of the Vermont Agency of Transportation (Vtrans) is to preserve, develop, and enhance an integrated transportation system. In 2001, Vtrans conducted an update of its 1995 Long Range Transportation Plan. The update reviews the findings of the previous plan and lays out a new set of recommendations and strategies to guide Vtrans in the next

five-year period. The three goals of the previous plan were refined and another goal was added to the plan, which are discussed in the following sections.

3.3.15.1 Goals

At the conclusion of the 1995 Vermont Long-Range Transportation Plan, Vtrans developed a strategic plan with 29 strategies to support the long-range plan goals. Reorganization of many of the divisions took place as one of the outcomes of the strategic plan. In 1999, as part of their strategic planning process, the Vtrans Executive staff focused on improving Vtrans through four principle goals.

One of the most important goals of the long-range transportation plan is maintaining the existing transportation facilities. This concept is of primary importance to transportation asset management. These facilities include roadways, railroads, ferry terminals, bridges, public transit systems and vehicles and bicycle and pedestrian facilities.

The second goal is improving all modes of transportation to provide Vermonters with choices. In the past most of the funding went to highway and automobile oriented plans, but now there is an increasing need for development of other transportation alternatives to provide greater travel choices. The state thus has to have a balanced funding structure so that objectives of inter-modal services can be achieved.

The third goal of the plan is to strengthen the economy and improve quality of life. This goal is significant due to the direct and indirect impacts of transportation investments. Any new facility or expansion of an existing facility must be carefully considered, so that they do not negatively impact quality of life.

The final goal, added during the update, focuses on improving the performance of the Vermont Agency of Transportation.

3.3.15.2 Objectives

The implementation strategy addresses the concerns facing Vtrans and Vermont over the next five years. This strategy supports the four basic goals of the long-range plan. Many of the strategies deal with programs already in place; others include new issues that require coordinated effort for successful implementation. The list of Vermont's goals and objectives is given in the

Table 3.17.

Table 3.17. Goals and Objectives of Vermont Agency of Transportation

Goals	*Objectives*
Manage the state's existing transportation system facilities to provide capacity, safety and flexibility in the most effective and efficient manner	• Develop new safety and security systems in response to terrorist attacks of September 11 • Continue to develop and use tools such as safety management systems • Continue to use the pavement, bridge and maintenance management systems to maintain all facilities • Develop serviceability criteria as part of their overall asset management program • Develop access management guidelines to enable compatible land development while preserving traffic flow. • Examine the role of ITS in managing transportation issues
Improve all modes of Vermont's transportation system to provide commuters with choices	• Continue to advantageously use flexible federal funds and explore innovative financing mechanisms • Identify and enhance states key inter-modal connections • Investigate the use of ITS tools to reinforce inter-modal connections • Complete a roadway system modal plan • Continue to use public involvement efforts to gather input for Vtrans planning and project development activities • Implement traffic calming measures when and where appropriate • Explore the use of shared facilities to expand primary park and ride lot system
Strengthen the economy, protect and enhance the quality of the natural environment, and improve the quality of life	• Play an active role to support other state agencies' efforts to improve Vermont's air quality. • Adopt a policy regarding expanding the use of alternative fuel vehicles as fleet vehicles wherever appropriate • Work with Vermont agency of natural resources to improve storm water management at transportation facilities and projects • Develop transportation projects that adhere to the states emerging smart growth policy
Improve Vtrans' performance	• Develop and refine performance measurement system to better manage resources • Continue to implement the strategic planning process and incorporate recommendations outlined in the plan • Develop a coordinated schedule for update of the Long-range Plan, regional Transportation Plan, and modal policy and

	capital investment plans • Continue to work with regional planning commissions and metropolitan planning organizations and assist them in developing regional transportation plan updates.

3.3.15.3 Performance Measures

As part of the strategic planning process, Vtrans focused on developing both output and outcome performance measures. Outputs are the measurable amounts of products and services, while outcomes reflect the actual results achieved. This process was initiated in 2001, and is ongoing. However, the long-range transportation plan does not specifically identify the performance measures.

3.3.15.4 Inclusion of Asset Management Elements

The Long-Range Plan explicitly refers to asset management within some of its primary goals, i.e. maintaining existing infrastructure. Thus system preservation, which is one of the primary concerns of asset management, is the main objective of the plan. The elements of asset management within the plan include:

- System preservation
- Maintenance Management Systems
- Performance Measurement system
- Decision support using PMS, BMS etc.

3.3.16 Virginia

The Virginia Department of Transportation (VDOT) has developed its strategic plan 2000-2002 and 2002-2004 biennia, which is a continuation of its 1998-2000 plan. The plan provides more focus on customer driven activities. This plan emphasizes full implementation of strategic priorities covering the whole organizational hierarchy. The following subsections discuss the goals, objectives and performance measures in detail.

3.3.16.1 Goals

The Virginia DOT has established seven major goals. As part of its commitment to becoming a customer driven organization, one of the primary goals is to significantly increase the involvement, support and satisfaction of stakeholders and customers. Building new partnerships and relationships is seen as a way to achieve this goal. The other goals include:

- Recruit/Develop/Retain a great workforce
- Improve safety, operations, & maintenance
- Deliver a six-year highway construction program

- Improve use of technologies
- Ensure core functions and initiatives are resourced, investigated and initiate innovative approaches to funding
- Ensure environmental stewardship & transportation planning

There are two critical, common issues, which the department has addressed through these goals. These are: to retain a critically skilled and knowledgeable workforce and to meet the increasing demands for technology to address transportation needs.

The overall commitment of the agency is to make VDOT a great place to work. The goals also reflect the agency's aim of moving people and goods efficiently using all surface transportation modes – rail, highways and mass transit. VDOT aims to refine its budgeting process in order to fulfill this commitment to its customers and stakeholders and to deliver a quality construction program.

The strategic goal of ensuring that core functions and initiatives are resourced properly with innovative approaches to funding supports the other goals by ensuring that proper resources, finances, manpower, equipment, and facilities are available to facilitate the success of each goal.

3.3.16.2 Objectives

In order to achieve improved customer satisfaction and stakeholder involvement, surveys will be conducted involving motorists, policy makers and other agencies, and the customer satisfaction SOA (Strategic Outcome Area) Committee will formulate strategies based on the results of these surveys.

In order to retain a reliable and knowledgeable workforce, the Human Resources Division will develop and evaluate programs designed to increase opportunities for training and educational courses for the staff. A biennial employee satisfaction survey will also be part of the process.

To maintain safe operations, the strategic plan outlined that the maintenance division will implement integrated maintenance management programs, which include pavement management system, bridge management system, and condition assessment systems. The plan also provides strategies to improve construction project delivery through cost-effective techniques and scheduling.

The plan also outlines increased use and application of Intelligent Transportation Systems to ensure that the goal of advanced use of technology is met. The responsibility to oversee these operations belongs to the Technology and Information Management Steering committee (TIMSC).

3.3.16.3 Performance Measures

Table 3.18 categorizes VDOT's performance measures according to its goals.

Table 3.18. Virginia Goals and Objectives

Goals	*Performance Measures*	*Objectives/Strategies*
Significantly increase the involvement, support and satisfaction of stakeholders and customers	1. Statistically significant improvement in Customer Satisfaction Survey 2. State and local elected and appointed official's satisfaction 3. Other agencies' satisfaction support and involvement 4. Customers' reported satisfaction w/ VDOT interactions (captured through Highway Helpline)	♠ Administer customized surveys to determine stakeholder needs and expectations ♠ Inform and educate stakeholders on transportation issues
Recruit/Develop/Retain great workforce	1.Statistically significant improvement in turnover rates 2. Improvement in biennial results of employment satisfaction survey 3. Increase in number of professional certifications 4. Reduction in vacancy rates	♠ Encourage continuous learning programs ♠ Deploy automated systems to improve data collection and quality of information
Improve safety, operations & maintenance	1.Statistically significant improvement in Pavement Condition Index 2. Improvement in bridge conditions 3. Reduction in number of fatalities/accidents 4. Improvement in level of service ratings	♠ Implement integrated maintenance management program ♠ Examine hazardous locations and construction techniques to increase road safety and reduce congestion in work zones ♠ Expand the implementation of Intelligent Transportation systems
Deliver a six-year highway	1. Percentage of project	♠ Implement ITS and TMS technologies

Goals	*Performance Measures*	*Objectives/Strategies*
construction program	completed on time, completed within budget 2. Improvement of Quality indices 3. Percentage of project advertised on time 4. Percentage of projects that close without deficit	♠ Implement project management training ♠ Integrate environmental programs for construction and maintenance programs
Improve use of technologies	1. Reduction in variance in ROI 2. Increase level of customer satisfaction with technology 3. Number of ideas/tech. formally improved 4. Complete all projects within resource commitments and schedules	♠ Implement strategy technology plan ♠ Conduct cost-benefit analysis ♠ Implement project management training
Ensure core functions and initiatives are resourced, investigated and initiate innovative approaches to funding	1. Variance in funds budgeted vs. expended 2. Achieving/Sustaining avg. daily cash balance that meets established targets	♠ Examine innovative means of funding and financing ♠ Examine different ways of organizing to administer related transportation activities
Ensure environmental stewardship & transportation planning	1. Implement environmental program for construction and maintenance projects 2. Integrate federal and state transportation planning process	

3.3.16.4 Inclusion of Asset Management Elements

The VDOT strategic plan for 2000-2002 and 2002-2004 does not explicitly mention asset management, but it contains many elements that are integral parts of an asset management plan. These elements include:

- System preservation
- Resource allocation
- Maintenance / replacement tradeoffs
- Decision support using BMS/PMS
- Maintenance management systems
- Budgeting
- Stakeholder involvement

3.4 Commonalities Among States

Among these sixteen highly motivated states, we can identify several common threads used to create a unified and efficient organization. In keeping with the format of the previous text, these threads are dividing into four categories: goals, objectives, performance measures, and asset management practices.

Not surprisingly, the goals for all of the states are quite similar. Asset management is very much a term used by businesses in the private sector. Therefore, by adopting this new tool, DOT's move in the direction of acting like businesses. In order to become and remain successful, there are specific areas of concern for all businesses that must be maintained and continuously improved. These areas include workforce improvement, stakeholder involvement, safety, product performance, and customer satisfaction. These are all seen in the individual state strategic plans.

States have developed an enormous number of objectives in order to achieve the goals they have outlined. They may be worded differently, but all of them share common elements. In order to reach the goal of creating a better work environment, states have recognized the need for employee training and improved communication between staff and management. Product performance and customer satisfaction are addressed in similar ways. Roads, bridges and all other means of travel should be maintained in a cost-effective manner and required to meet all safety regulations. All construction repairs should be done in a timely manner. In doing so, congestion is reduced and the delivery of well-maintained travel infrastructure is accomplished.

Performance measures are handled in two ways by the DOT's: either they are mentioned, or they are not. If these measures are mentioned, they are quite similar in nature due to their technical relevance. For example, in order to reduce the number of accidents on the roadways, states use the Injury Incident Rating to compare their numbers to nationwide figures. Another common measurement is the Average Evaluation Rating. This is used for determining the how well the transportation infrastructure is holding up. Again, this is compared to nationwide ratings. These ratings are used to determine where and when

infrastructure repairs need to be implemented. Many of the states also engage in perception ratings and corridor safety assessments to determine whether their goals are being met.

The inclusion of asset management is not always clear. Since this term is relatively new in the public sector, it is often faced with internal criticism. However, asset management-like practices are being implemented, which suggests that the asset management concept is being accepted. All of the states are using some sort of BMS (Bridge Maintenance System) and PMS (Pavement Management System). This is recognized by the goals and objectives that are outlined and by the performance measures that are in place. Very few states mention the development of an asset management department or movement into the field, but through various other actions, it is clear that asset management features are a driving force behind the analysis and maintenance of public infrastructure.

Table 3.19. Pennsylvania Goals, Strategies and Performance Measures

Goals	*Strategies*	*Approaches*	*Performance Measures*
Maintenance First			
Smoother Roads	Improve ride quality by incorporating smooth road strategies into a comprehensive pavement program	Provide proper staffing and training to sustain an excellent bridge safety inspection program	International Roughness Index (IRI) on major NHS
		Implement AASHTO 2002 Design Standards (Align the Departmen design procedures with nationally accepted standards	
		Implement and support a Bridge maintenance and preservation program	
Cost Effective Highway Maintenance Investment	Refine winter services practices to achieve more timely and efficient responses	Driver simulator (develop software to train snowplow operators)	Condition Assessment for highways and bridges
	Use life cycle criteria as a tool for asset management and investment to reduce outstanding maintenance needs	Implement an asset management strategic plan	
		Implement and support a bridge maintenance and preservation program	
		Complete the S.A.G.A. journey with Round#2, in order to develop a “world class” transportation organization	
		Implement a traffic line paint machine replacement program	
		Implement the Commonwealth’s 800 MHz radio system standard	
		Facility repairs to roadside rest areas	
		Roadside Rest Comprehensive Strategy (long range plan to upgrade and manage roadside rest facilities to meet changing customer needs)	
		RWIS Maintenance contract (Insure delivery of highway weather information to enhance emergency preparedness)	
		Support the SISSI Project (Validate Superpave design procedures, and prepare for implementing the new 2002 Pavement Design Standards)	
		Allegheny County State of the Art Tunnel Washing equipment (Reduce county operational cost and provide customers with improved tunnel service)	
Quality of Life			

Balance Social, Economic and Environmental Concerns	Improve customer's experiences of facilities by enhancing beautification efforts and reducing roadside debris	Benchmarking deer/ tire/ debris on DOT highways against other state DOT's and DOT county Organizations	Highway project environmental approvals meeting target dates
	Develop timely transportation plans, programs and projects that balance social, economic and environmental concerns	Develop Erosion and Sediment Control strategy	
		Implement 21st Century Commission Report (review the Department's policies, procedures and impacts on environment, and develop and implement policies to create sustainable pattern of development)	
		Implement actions to streamline and improve mitigation value	
		Cultural resources implementation	
		Develop and implement Water Resource Strategy (Define water resource start for use in DOT operations, and develop policy and guidelines for implementation)	
Demonstrate Sound Environmental Practices	Implement a strategic environmental management program that adopts best practices as a way of doing business	Develop Strategic Environmental Management Program (Green Plan/ Facilities Management program)	ISO 141001 environmental criteria
		Systematic identification, programming, planning and evaluation of environmental impacts from UST removals	
Mobility and Access			
Delivery of Transportation Products and Services	Meet project schedules and complete work within budgeted costs	Complete ISO 9000/Guide 25 certification for Materials Testing Lab	Dollar Value of 12- Year program construction contracts initiated
		Analysis of specified overhead and profit markups associated with extra work performed on a force account basis	
		Construction and design of Project Office Manual	
		Incorporate context- sensitive design into the project development process	
		Complete implementation of dual units- both metric and US customary units	
		Development of Pennsylvania's "See Through" Barrier (Compliance with environmental mitigation measures to existing standard bridge barriers)	

		Update sign structure standard drawings	
		Development of a web browser / database for fish resources	
		Native freshwater mussel survey in the Allegheny river	
		Complete Species of Special Concern Handbook and Training	
		Agency funded positions to support project delivery	
		Pavement Policy manual rewrite	
		Statistical evaluation of various materials testing areas	
		Continue to implement ECMS Business Process Reengineering recommendations to develop cost effective methods for improving construction community practices	
		Reengineering the Project Documentation Process	
Efficient Movement of People and Goods	Implement congestion management strategies that limit work zone restrictions, address incident management, and reduce corridor travel delays	Implement congestion management strategies identified in the "Highway Congestion Management Strategic Plan" including those that limit work zone restrictions, address incident management, and reduce corridor delays	2002 Peak Period work zone lane restrictions 2005 Travel Delays on selected corridors
		Implement congestion management strategies identified in the "Mobility and Access SFA- Efficient Movement of People and Goods" including those that limit work zone restrictions, address incident management, and reduce corridor delays	
	Implement a highway operations management program that supports and expands ITS which includes Traffic Management Centers, improves the efficiency of traffic signals, improves traffic signs and	Improve safety, efficiency and reliability of the Commonwealth's transportation system using ITS strategies	
		Establish a broad- based multidisciplinary organizational structure to facilitate the planning, design, deployment, operations and maintenance of ITS services	
		Foster and encourage public, private, and academic partnership to implement and operate ITS	
		Improve the efficiency of traffic signals	
		Improve traffic signs and markings	
		Complete Durable Pavement Marking Program	

	markings, and completes the durable pavement marking program	Completion and/ or implementation of Statewide Operations Center (SOC) Enhancements	
Improve Customer Satisfaction	Further involve customers in identifying requirements for more responsive products and services	Develop and integrate Customer Service Index for the Chief Engineer's Office and Highway Administration Bureau's	Baldridge Organizational Review Package Scores- Customer criteria
		Provide automated customer feedback mechanisms on all activity websites	
		Implementation of two more customer segmentation projects within Highway Administration Bureaus	
		Develop a statewide model for automated complaint analysis and customer feedback in Maintenance using district best practices	
Improve Customer Access to Information	Improve information access by providing quality customer contacts across the organization with special attention to driver and vehicles inquiries		Answer rate of calls to the Customer Call Center
Innovation and Technology			
World Class Process and Product Performance	Map key processes and identify and improve those with the most strategic impact on business results	Consultant for evaluation and implementation of new Products (More timely evaluation and implementation of innovative technology, and better turnaround time on new product evaluations)	Baldridge Organizational Review Package Scores- all criteria
		Euro- Penn Concrete Research	
		New Product Evaluations	
	Deliver business results through planned, enterprise-focused information technology	Update QARTS/ SMART system	
		Use ECMS to improve project delivery	
		Use Expert Systems to expedite project delivery	
		Improve paper and electronic work flow through EDMS	
		Implement State- of Art Bridge Management System	

		Participate in PNDI Partnership (Develop interagency GIS database to provide technically accurate and up to date information)	
		Implement State- of Art Maintenance and Roadway management System	
		Expedite data exchange capabilities through Commercial Vehicle Information Systems and network (CVISN)	
		Expedite issuance of Highway occupancy permits	
		SIMOS Maintenance	
	Conduct electronic business activities and enhance communications with electronics business tools	Purchase additional GPS units for the Districts and upgrade annually	
		OCE' Equipment Upgrade/ Plans Reproduction (Increase accuracy and efficiency in plans reproduction)	
Safer travel	Implement cost-effective highway safety improvements at targeted high crash/ fatality locations	Develop policies and procedures to provide districts with guidance on improving high crash/ fatality locations and evaluate their effectiveness. Districts will do the actual project implementation	Number of fatalities per year
	Upgrade safe driving performance through education and enforcement initiatives	Quality assurance and technical assistance for the Ignition Interlock	
		Development of PI&E materials and campaigns. Implementation of paid advertising that address the 5 priority areas. Development and implementation of targeted enforcement for the 5 priority areas	
Safer Working Conditions	Improve safety of maintenance work zones	Implement prevention strategies to reduce the employee injury rate and the vehicle accident rate	Injury rate per 100 employees working 1 year
Leadership at All Levels			
Improve Leadership Capabilities and Work	Provide employees with the tools and expectations to communicate	Develop and communicate to all employees the department and organizational goals, objectives, key facts and issues	Organizational Climate Survey- selected items
		All EPR's have a negotiated training plan and are tracked for timely completion	

Work Environment	effectively in order to facilitate leadership at all levels	Continued implementation of Communications Plan	Organizational Commitment, Quality of Communication, Quality of Supervision and Job Satisfaction
	Develop and implement a comprehensive workforce development strategy.	Develop, implement, and support TU colleges within Highway Administration	
		School of construction training implementation	
		School of design implementation	
		Implementation of highway maintenance training and education initiative for technical knowledge and skills	
		Implementation of traffic engineering education initiatives for technical knowledge and skills	
		Develop and implement a systematic recruiting and hiring process with continual monitoring of its effectiveness	
		Develop and implement HA Central Office employee program to improve employee moral, satisfaction, and wellness	
Relationship Building			
Cultivate Effective Relationships	Partner with industry to build relationships	Provide financial and human resources to support AASHTO Convention activities in Pennsylvania	PennDOT/Partner business effectiveness survey scores
		Establish/Continue joint workshops with industry to help them move towards a better quality industry	
	Develop tools to build relationships	Highway administration “Center of Excellence” complex	
		Promote participation in organization that assists employees in professional development	
		Work with internal and external partner to ensure favorable legislation for PENNDOT and the Commonwealth	
		Develop and outreach program for external customers and stakeholders on key Department issues, including multimedia communication tools	
		Develop a toolbox of public relation materials	
		Develop and implement programs to enhance teamwork and morale	

Table 3.20. Tennessee Goals, Objectives and Strategies

Goal	*Objectives*	*Strategies*
Demonstrate that TDOT's employees are our most important resource and critical to our success	Implement at least two new educational or leadership development opportunities for TDOT Employees by June 2003.	Implement the TDOT Masters Degree Distance Learning Program for Civil Engineers.
		Investigate similar distance learning opportunities for other disciplines.
		Continue the development of curricula for the TDOT Leadership Development series.
	Implement an active employee recognition program throughout TDOT by June 2003.	Identify Best Practices of Employee Recognition within TDOT.
		Prepare and distribute a Guide for Employee Recognition.
		Create a forum for Employee Recognition. (i.e., Newsletter, website, meetings, recognition boards).
	Reach and maintain parity and increase utilization for underutilized groups within all TDOT Divisions/Regions by January 2005.	Determine best practices for reaching parity, i.e., minority and female representation and utilization. Represents: Parity = 17% Utilization: Varies based upon U. S. Department of Labor availability in local metropolitan statistical areas.
		Provide annual parity (representation) and utilization awareness training for all executives, directors, managers, and supervisors beginning with Headquarters; and to provide quarterly progress updates.
		Establish individual director, manager and supervisor goals for parity and institute incentives for reaching goals. Include on the Commissioner's annual fall quarterly staff meeting agenda, a report on each staff member's quest toward parity/utilization and a department ADA update. Establish a reporting system mechanism for accountability and annual reporting purposes.
		Provide awareness training on ADA and implementation of accommodations for the disabled.
	Implement a fair, streamlined and practical performance evaluation system for TDOT by January 2005.	Evaluate the current Performance Evaluation system looking for strong and weak points.
		Investigate alternative Performance Evaluation systems (Best Practices).

		Identify needs of the system such as computer ready forms, including customer service perspective, tracking system for accountability, a departmental focus on Performance Evaluation, and a presentation to managers and supervisors.
		Implement and evaluate a pilot, and implement the new process
Increase capacity and efficiency of current transportation infrastructure with full consideration of social and environmental issues	Improve traffic flow by identifying and modifying congested locations.	Biennially inventory all choke points on interstates and major urban routes and propose solutions with cost estimates.
		Incorporate these proposed solutions (2.1.1) in the department's long-range plan and Five-Year Program process.
		Develop criteria to measure delay and increase capacity to calculate improvement.
	Improve traffic flow and safety by constructing and operating an Intelligent Transportation System (ITS).	Implement a pilot project using ITS in a major travel corridor by Spring 2003. Evaluate the project by Spring 2005. Continue to advance the ITS Program working with the ITS Committee. (Ongoing)
		Investigate other useful purposes of collected ITS traffic data (e.g. planning activities) and distribute to the public by 2002.
		Expand truck weigh-in-motion systems to interstate weigh stations in Coffee and Robertson Counties by Summer 2004 and in Giles and Montgomery Counties by 2006.
	Maximize the capacity of the existing highway system through effective incident and work zone management.	Explore the expansion of the HELP Program.
		Establish and implement policies for night construction by Spring 2003. Consult with contractors and other stakeholders to identify: (1) The types of projects that can be conducted at night without compromising safety or quality. (2) The public benefits of night construction compared to construction during times with higher traffic volumes. The additional costs for night construction including the state's cost for construction management.
	Promote increased vehicle occupancy by providing high occupancy vehicle (HOV) lanes on interstate highways.	Encourage the consideration of HOV lanes in MPO long-range plans
		Create a process to evaluate the effectiveness of existing HOV lanes.
	Develop and implement a strategy to upgrade intermodal freight connector routes.	Prioritize needs and estimate costs for intermodal linkages statewide.

	Connect county seats and major rural cities to the interstate system with highways meeting current design standards to promote safety, access, mobility and economic development.	Ensure the incorporation of these needs in the long-range transportation planning process.
	Develop and implement cost-effective maintenance strategies for the existing transportation infrastructure.	Develop asset management systems: (1) Pavement Management System (PMS) (2) Bridge Management System (BMS) and (3) Maintenance Management System (MMS).
		Develop strategies to mitigate traffic disruption from routine maintenance activities.
		Develop more efficient strategies and procedures for performing transportation systems maintenance activities.
		Encourage the use of long-life and user friendly materials for maintenance and rehabilitation activities. (Life cycle costing)
		Ensure that adequate funding is designated for resurfacing of interstates and the state highway system.
Create a more effective and efficient process-based organization	Provide a method to measure and improve departmental processes.	Educate, encourage and empower staff to continuously improve areas under their control.
		Provide outreach to raise awareness at all levels of management of the need and responsibility to continuously monitor, evaluate and improve processes under their supervision.
		Recommend management / supervisor training which covers the basics in process improvement, process management and performance management and the tools to support each.
		Establish internal process evaluation team(s) or identify a "pool" of potential resources with process improvement experience to work with staff to develop a work plan and identify resources to address a major assessment and/or change effort.
		Work with the Office of Strategic Planning to implement performance measures throughout the Goal Teams.
		Continuously upgrade and integrate information systems and infrastructure to support process improvements, provide improved access to information, and to enhance decision-making.
		Review, evaluate, and make recommendations to modify the IT Strategic Plan to support and complement the overall Department Strategic Plan.

		Support the implementation of a user-based information technology-training plan.
		Support the development and implementation of a strategy for IT support positions within functional areas to serve as liaisons between user groups and the IT Division and to provide support within the functional areas.
	Increase our internal and external customer satisfaction.	Determine our internal customer satisfaction baseline.
		Determine our external customer satisfaction baseline.
		Implement the Customer Service Plan.
		Hire a full time customer service coordinator for TDOT.
	Improve internal and external data sharing and communication using electronic technologies.	Increase directors, managers, and all employees e-awareness/e-literacy.
		Support implementation of the E-Strategy Plan.
		Increase the percentage of employees having access to the Intranet.
	Increase upward and downward communication within the Department among all levels.	Make department policies available on the Intranet.
		Determine baseline scores for communication from the organizational assessment survey.
		Develop ways to measure increases in communication
Maximize safety of the State's Transportation System	Reduce both fatalities and serious injuries resulting from crashes on Tennessee's highway system by 2% annually.	Reduce work zone crashes by: (a) Utilizing work zone assessment baseline data to set improvement targets. (b) Analyzing process review information to identify key work zone safety issues
		Identify initiatives to address specific safety concerns on the highway systems: Rumble strips, Raised markers, Truck parking, Utility poles, Mailboxes, National Cooperative Research Program (NCHRP) #350, Seatbelts, Alcohol (DUI), Speeding
	Provide direction and support for transportation system safety initiatives in TDOT.	Improve the delivery time and use of traffic record data.
		Assist in coordination of efforts with the TRRAC (Tennessee Traffic Records Advisory Committee.)
		Analyze current crash data in conjunction with the Governor's Highway Safety Office annual plan.
		Partner with the railroad industry and other agencies to improve the safety of highway railroad grade crossings.
		Analyze funding available for safety related activities in engineering, construction, education, and public awareness on an annual basis.

		Review Goal Team 4 Report of departmental funding sources for safety initiatives.
		Review current safety programs annual reports and plans and determine process or methods used to measure efficiency and effectiveness of programs.
	Integrate (improve) public awareness and education programs for safe driving behavior throughout TDOT and state government.	Review Governor's Highway Safety Office Annual Plan to identify current safety issues to target.
		Increase seat belt usage by TDOT personnel.
		Identify actions to begin agency education awareness on seat belt usage.
	Establish a framework for implementing a "target zero" highway safety concept in Tennessee.	Explore use of consultants to assist with defining and implementing "target zero" concept.
		Contact State of Washington to learn more about how they defined and implemented their program.

CHAPTER 4. FLORIDA CASE STUDY

4.1 Introduction

The state of Florida provides a unique strategy of implementing a strategic planning process and developing an asset management program. Florida refers to its strategic planning process as policy planning, and although only briefly mentioning the notion of asset management, it has been involved in such practices for several years. The following section will summarize the practices in policy planning and asset management that Florida currently follows. The following sections also provide a demonstrated attempt at linking Florida's policy planning and asset management practices.

4.2 Florida Department of Transportation

Type of Leadership

- A Secretary who reports directly to the governor leads the Florida Department of Transportation

Structure

- There are nine commissioners
- The agency is decentralized with a central office and eight districts

Responsibilities

- The Department is responsible for 12,000 of the 116,000-centerline miles of public roads in the state, and maintains 6,200 of the 11,000 bridges statewide.

4.2.1 Planning Documents

- State Comprehensive Plan (SCP)
- Florida Transportation Plan (FTP)
- Short Range Component
- Program and Resource Plan
- Long-Range Program Plan
- Legislative Budget Request (LBR)
- Performance Report

4.2.2 Strategic Goal Setting Process

Florida takes a simplistic approach to achieving success in its planning process and maintaining its assets. There are four goals, which are outlined in the Short Range Component, used throughout the entire Department. These goals include:

- Preservation (System Management)
- Economic Competitiveness

- Mobility (Safe Transportation)
- Quality of Life

Strategies have been developed to help achieve these goals. They include:

- Ensure all partners have a clear vision of what they want in the long-term
- Determine what types and quantity of infrastructure will be consistent with those visions within existing and projected fiscal resources
- All partners must identify what it will take to ensure that public investment in supporting the vision is efficient, effective, and can be preserved at reasonable level with a minimal burden to future taxpayers

4.2.3 Asset Management Process

Florida does not have a department dedicated to asset management, but there are several programs and objectives contained in its numerous documents that indicate that there are practices of asset management in place.

Asset management is the entire process from programming and planning to preservation of its system. Preservation is integrated through the Pavement Management System, Bridge Management System, and Maintenance Rating Program.

4.2.4 Linkages between Asset Management and the Strategic Planning Process

The linkages occur through the strategic goals, performance measures for pavements and bridges, and funding allocations.

The legislature also mandates that FDOT, in cooperation with Metropolitan Planning Organizations (MPO's) and other affected entities, develop and implement a separate and distinct system for managing each of the following programs:

- Highway pavement
- Bridges
- Highway Safety
- Traffic Congestion
- Public transportation facilities and equipment
- Intermodal transportation facilities and equipment

4.2.5 Demonstrated Benefits

The use of policy planning and the incorporation of asset management have provided Florida with 1) an efficient system, and 2) a reliable system. In addition, efficiency and reliability allow Florida to easily set a budget.

4.2.6 Barriers and Challenges

The following are barriers, which have been identified by both FDOT and the research team.

- Too highly focused on preservation
- Limited resources
- Inflexible
- Provide smooth and efficient transfers between modes
- Integration of modes
- Applying innovative policies
- Clarifying roles and responsibilities
- Reaching a consensus – e.g. funding, system criteria, policies and guidelines

4.3 DOT Profile

Table 4.1 and Table 4.2 provide a quick overview of the following information.

4.3.1 Type of Leadership

A Secretary who reports directly to the Governor leads the Florida Department of Transportation (FDOT). A Transportation Commission composed of nine commissioners is responsible for policy oversight of the Department.

4.3.2 Organizational Focus

The agency is decentralized and operated through a central office and eight districts located throughout the state.

4.3.3 Number of Employees

There are a total of 10,600 employees. Before the Career Service reform, there were 330 employees who were exempt from Career Service. This number is now significantly larger.

4.3.4 Responsibilities

The agency is responsible for roadways, bridges, and for motor carrier compliance in the state. The Department's role with respect to public transportation is to provide funding and technical support to local agencies and private-sector entities who own and operate 14 seaports, 22 commercial airports, 3,000 miles of main route rail, 18 local and regional transit systems, 6,200 bridges, and 48 specialized systems serving the transportation disadvantaged.

Miles of Road

The Department is responsible for 12,000 of the 116,000-centerline miles of public roads in the state.

Number of Bridges

The Department maintains 6,200 of the 11,000 bridges statewide.

Preservation Budget

For fiscal year 2000/2001, the Department's annual budget is $3.7 billion of which approximately $1.2 billion is set aside for preservation needs (pavement, bridge and routine maintenance).

Construction Budget

$700 million is programmed for highway capacity improvements. By statute, 50 percent of this must be dedicated to the Florida Intrastate Highway System (FIHS), which is a 3,750-mile component of the state highway system serving regional commerce, high speed, and long distance travel. It includes interstates, turnpike and other major expressways and arterials. This system is essential to economic development in the state since it represents only 31 percent of the centerline miles on the State Highway System but carries 50 percent of the state's traffic and 70 percent of its truck traffic.

4.3.5 Section Responsible for Asset Management

None.

Table 4.1. Fast Facts about FDOT

Decentralized	Tallahassee Central Office
Eight Districts	10,600 employees statewide
Oversight provided by the Florida Transportation Commission	Trust funded by user fees (Ex. Tolls, gas tax, vehicles registration, etc.)
$4.6 billion in fiscal year 2000/2001 budget	$25.4 billion in the five-year work program
$1.2 billion average contract lettings for the past five years	

Table 4.2. Fast Facts about Florida's Transportation System

$1.00 invested in transportation = $2.86 in user benefits	State Highway System has 39,703 lane miles and 6,253 bridges
828 aviation facilities (131 are public of which 20 have scheduled service)	23 Fixed-route Transit Systems
14 seaports	2,888 railway miles

The Public Transportation division manages department involvement in multi-modal transportation including air, waterway, rail, transit, bicycle and pedestrian travel.

4.4 Legislation

The Florida Department of Transportation (FDOT) and the Florida legislature have a close statutory and working relationship. The statutes are analyzed by both entities and this process allows for the reliable selection of specific projects, which fit both budget constraints and needs. The transportation administration has developed a Transportation Code. The purpose of the Florida Transportation Code is, “to establish the responsibilities of the state, the counties, and the municipalities in the planning and development of the transportation systems serving the people of the state and to assure the development of an integrated, balanced statewide transportation system.” The purpose of this code is mainly the protection of public safety and the general welfare of Florida state residents. It is also established for the preservation of all transportation facilities in the state.

There are several established principles that must be considered when planning and developing the Florida transportation system. These include:

- Preserving the existing transportation infrastructure
- Enhancing Florida's economic competitiveness
- Improving travel choices to ensure mobility

The legislature has charged the Florida Transportation Commission to develop and adopt measures for evaluating the performance and productivity of the Department of Transportation. FDOT is responsible for carrying out the planning and maintaining Florida's infrastructure.

The legislature also mandates that FDOT, in cooperation with Metropolitan Planning Organizations (MPO's) and other affected entities, develop and implement a separate and distinct system for managing each of the following programs:

- Highway pavement
- Bridges
- Highway safety
- Traffic congestion
- Public transportation facilities and equipment
- Intermodal transportation facilities and equipment

The established management system should be developed and implemented so that it provides adequate information for FDOT to make informed decisions regarding the proper allocation of transportation resources.

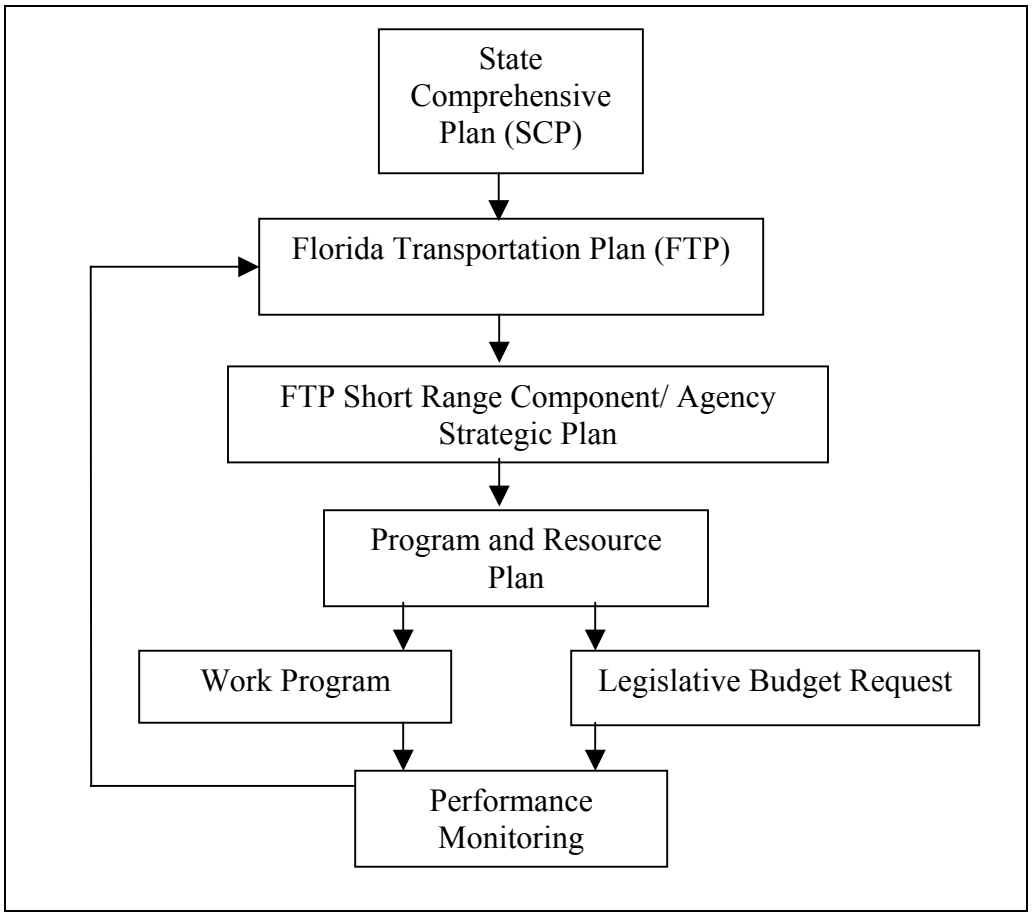
4.5 Policy Planning Process

Policy Planning is the term used by Florida interchangeably with the term "strategic planning." Florida has an elaborate network of plans and programs, all of which feed into each other. This is illustrated in Figure . The initial document, from which all other documents are based, is the State Comprehensive Plan (SCP). This plan identifies 11 state goals and policies that are to be supported by the DOT and other state agencies. Following that is the Florida Transportation Plan (FTP), which contains trends and conditions and long-range goals and objectives. This document contains a 20-year time horizon and is updated on a five-year cycle. The Short Range Component, the agency's strategic plan, contains short-range objectives and strategies. It has a five to ten year time horizon and is updated annually. After consulting these three documents, the Program and Resource Plan is developed. This is how programs are identified and funding and priority decisions are determined. Funding is determined by consulting the Finance Plan, revenue forecasts and cash analysis. This is FDOT's maintenance program and contains most of the agency's asset management practices. The financially balanced Program and Resource Plan serves as the basis for the Five Year Work Program and Legislative Budget Request (LBR). The Five Year Work Program shows specific project phases responsive to local priorities. The LBR is the vehicle for appropriations action by the

Legislature. Feedback allows for adjustments to be made in the next planning and programming cycle.

A Performance Monitoring system is used to determine outcome and output measures used to monitor progress. It specifies program targets and performance standards also used to monitor progress. This system also provides guidance for next year's program fund allocation.

Figure 4.1. Florida's Planning and Program Development Process



4.6 Policy Planning Elements

4.6.1 Goals

The following bulleted points are the four department-wide goals, with corresponding objectives, outlined in FDOT's FTP. In bold are asset management-related goals and objectives.

- **Preservation (System Management)**

    - **Objective 1 – Ensure 80% of the pavement on the state highway system meets department standards**
    - **Objective 2 – Ensure 90% of department-maintained bridges meet department standards**
    - **Objective 3 – Ensure that the department achieves 100 percent of the acceptable maintenance standard on the state highway system**
- Economic Competitiveness
    - Objective 1 – Analyze the state's and district's economic performance relative to the competition
    - Objective 2 – Sustain long – term growth
    - Objective 3 – View from the perspective of companies evaluating the state as a place in which to do business
- Mobility (Safe Transportation)
    - Objective 1 - Improve connections between modes to provide smooth transfers of people and goods.
- Quality of Life
    - Objective 1 – Design the transportation system to support communities' visions, compatible with corridors of regional and statewide significance.
    - Objective 2 – Design the transportation system in a way that sustains human and natural environments and conserves non-renewable resources.
    - Objective 3 – Design the transportation system to include human scale, pedestrian, bicycle, transit-oriented and other community-enhancing features, where appropriate.
    - Objective 4 – Increase access to and use of alternatives to the single-occupant vehicle.
    - Objective 5 – Enhance the availability of transportation services to persons who are transportation disadvantaged, and ensure the efficiency, effectiveness and quality of those services.
    - Objective 6 – Ensure that the transportation decision-making process is accessible and fair for all communities and citizens of Florida

4.7 Asset Management Elements

The Florida Department of Transportation's asset management process is a holistic approach using decision-making, investment analysis and management of transportation assets. Although it prefers not to explicitly refer to its practices as "asset management," the agency has been conducting such practices for several years.

Asset management is the entire process from programming and planning to system preservation. A solid policy framework, measurable objectives, and continuous performance monitoring characterize it. The asset management concepts that are relied on for decision making are: management systems, strong relationships between condition and performance, and an emphasis on tradeoff and investment analysis. These concepts

are all integral components of daily business and support the Department's mission to provide safety, mobility, economic prosperity and the preservation of the quality of its environment and communities. The concepts are part of the culture and are strongly supported by upper management. They transcend planning and financial management to maintenance, bridge, and pavement offices. There is no single office responsible for asset management; rather, it permeates throughout the Department with planning responsible for evaluating and reporting the results.
Unique to Florida is the investment decision that preservation of the system is "taken off the top." It is critical that the state maintains its existing assets before spending more funds for new capacity on the system. From an asset management perspective, this ensures that the state does not depreciate the value of its highways and bridges. This allows for confidence that infrastructure will be maintained at current value. The idea of preservation is divided into three categories: pavement, bridge and routine maintenance. Each of these categories has an extensive, inventory driven, performance based management system that allows decision-making to be based on needs and priorities.

Each aspect of preservation is identified in more detail:

Pavement Management System – An annual pavement condition survey is conducted to evaluate ride quality, crack severity and average depth of wheel-path ruts. A rating of six or less on a 10-point scale in any of these areas causes a pavement segment to be declared eligible for treatment. The pavement condition objective is that at least 80 percent of the State Highway System lane miles are of sufficient quality to meet Department standards. Currently 78 percent of the lane miles meet the standards.

Bridge Management System – Each of the 6,200 state-owned bridges, as well as an additional 4,000 bridges, is inspected every two years to identify whether it needs preventative maintenance, minor or major repair work, or replacement. A bridge that meets Department standards is defined as not showing evidence of structural deterioration, not being limited by weight restrictions, nor needing preventative maintenance. 90 percent of Department maintained bridges must be kept at a level that meets these standards and currently 93 percent of bridges meet the standards.

Maintenance Rating Program – State highway maintenance condition is based on a sampling process that rates five primary categories of highway environment three times a year. The items rated are roadway (potholes etc.), roadside (shoulders), vegetation and aesthetics (mowing, litter removal), traffic services (signs, lighting), and drainage (ditches). Each category is rated and the overall maintenance condition is calculated. A maintenance rating of 80 is considered acceptable. The Department's objective is to ensure that 100 percent of the State Highway System meets the maintenance standard and currently, this standard is being met.

Only after all preservation and public transportation dollars have been allocated are capacity dollars distributed. Another "off the top" allocation is that 50 percent of all

highway capacity dollars go to the Florida Intrastate Highway System. This statutory requirement ensures that the goals of mobility and economic prosperity are supported. A decision support system is used as a tool to support investment decisions and the relative need for improvements are based on five variables: pavement condition, congestion, safety, intermodal connectivity and economic development. Mobility performance measures of quantity and quality of service, accessibility, and utilization of the system are also used. These include level of service, vehicle miles traveled, percent of system heavily congested, and connectivity to intermodal facilities.

The characteristics that ensure the success of the Department's asset management process are the statutory authority, management commitment, quality data, and the fact that it is needs based.

4.8 Metrics in Place

Refer to the following section.

4.9 Linkages between Asset Management and the Strategic Planning Process

Since there is little mention of asset management within FDOT, there are no specific links between asset management and policy planning mentioned in the various documents. However, we were able to make indirect links by following and understanding the planning and program development process. For example, it is documented that there is a link between FDOT's involvement in an asset/maintenance management program, which it refers to as the Program and Resource Plan (PRP), and the Florida Transportation Plan. The FTP provides a framework for the PRP, which guides the development of the five-year work program. Policy planning provides a long-term outline for asset management, which is then worked back into the short-term policy plan for carrying out the work program. Figure , which can be found at the end of this section, helps to illustrate the link(s) between FDOT's policy planning and its involvement in asset management.

4.9.1 Goals, Objectives and Performance Measures

It is also possible to recognize links by identifying asset management practices and the use of supporting information that is given. In order to determine this, we identified each goal, objective and performance measure that is considered to be asset management-related.

Goals and Objectives:

- System Preservation:
    - Objective 1 – Ensure that 80% of pavement on the State Highway System meets standards

    - Objective 2 – Achieve 100% of the acceptable maintenance standard on the State Highway System
    - Objective 3 – Ensure that 90% of FDOT-maintained bridges meet Department standards while keeping all FDOT-maintained bridges open to the public safe.
- Mobility/Economic Competitiveness
    - Objective 1 – Commit approximately 50% of the highway capacity improvement program for capacity improvements on the FIHS
- Organizational Excellence/Customer Focus
    - Objective 1 – Improve external customer satisfaction
    - Objective 2 – Track and resolve external customer complaints
        - Roadway Signs and Markings
            - Visibility and Readability of Signs
            - Daytime Visibility of Markings
            - Nighttime Visibility of Markings
        - System Issues
            - Roadway Smoothness
            - Attractiveness of Highways
    - Objective 3 – Implement a results based management system

Measures of Effectiveness/Performance Measures:

- Pavement Management:
    - Percent of Turnpike pavement meeting Department standards
    - Percent of Interstate pavement meeting Department standards
    - Percent of arterials and other freeways meeting Department standards
    - Lane miles contracted for resurfacing – this indicates a testing of road quality
    - Bridges:
    - Florida ensures that 90% of Department maintained bridges must be kept at a level that meets these standards and currently 93 percent of their bridges meet the standards
    - Number of bridges inspected
    - Number of bridges let to contract for repair
    - Number of bridges let to contract for replacement

There is one supporting link that can be identified in the short-range component plan. The focus area is concerned with organizational performance. The supporting measure of effectiveness is concerned with the percent of key performance measures monitored by automated information systems.

4.9.2 Funding Allocations

Asset management is incorporated into a continuous process that links policies with financial planning, programming and performance monitoring to determine if objectives are met. The performance measurement then results in appropriate decisions regarding funding levels and adjustment of plans and policies to begin a new cycle.

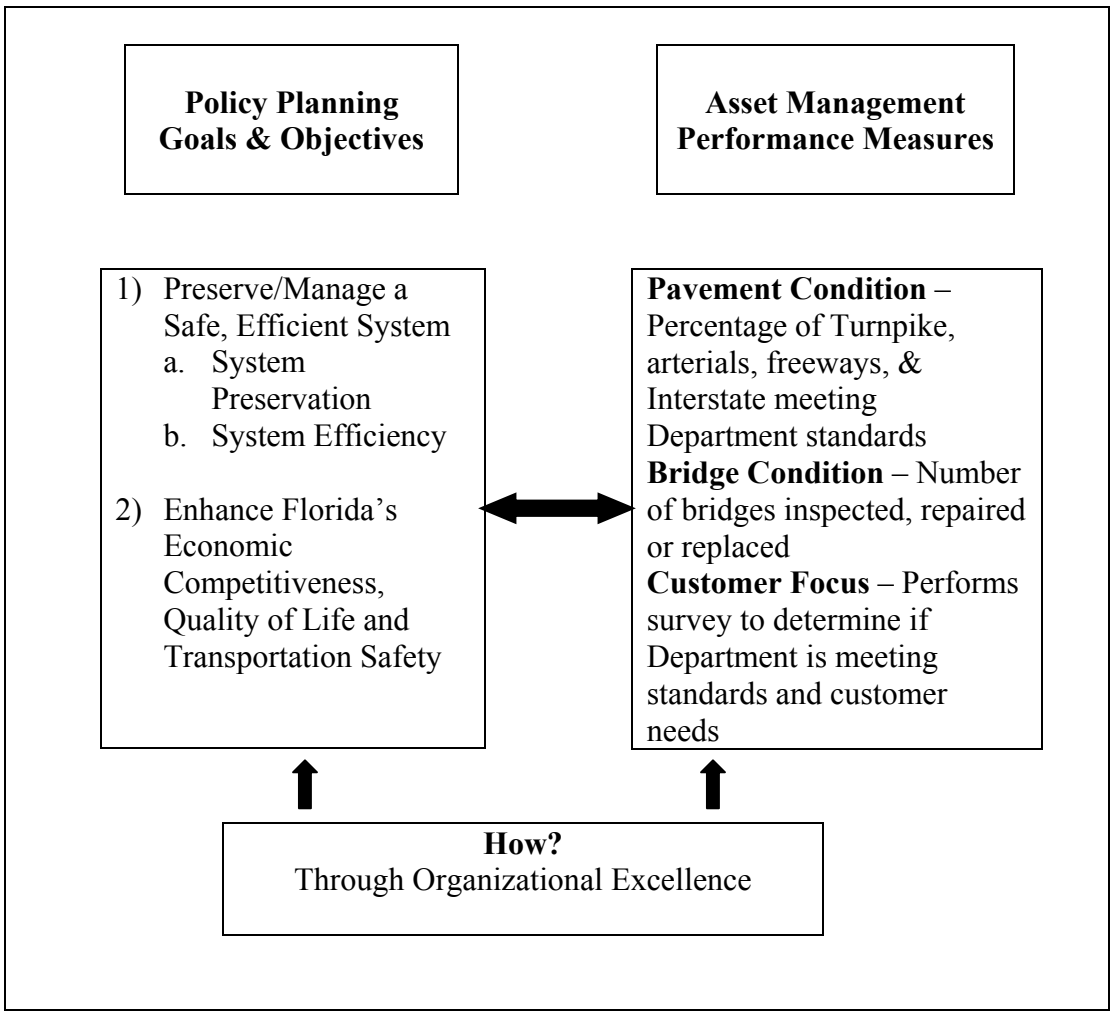
4.9.3 Legislation

The strongest link can be seen through FDOT's involvement with the state legislature. The agency's actions are highly driven by mandated statutes constructed through constant interaction between FDOT and the state legislature. These statutes address:

- Performance and productivity of standards, development, measurement, and application. These must assess:
  - Production
  - Finance and administration
  - Preservation of the current state system
  - Safety of the current state system
  - Capacity Improvements: highways and all public transportation modes
  - Disadvantaged business enterprise and minority business programs
- Establishes annual performance objectives and standards that can be used evaluate performance and productivity

The structured statutes enable FDOT to construct the Department's goals and objectives. All goals and objectives are based upon: planning and developing an integrated and balanced statewide system, preserving existing infrastructure, enhancing economic competitiveness, and ensuring mobility. Preserving existing infrastructure is a specific function of asset management, and can be demonstrated evidence of FDOT's practice of asset management.

Figure 4.2. Links between Policy Planning and Asset Management in Florida



4.10 Advantages and Weaknesses in State Model

Due to the highly mandated developing and implementing process that the DOT must follow, the system had evolved into an extremely reliable source tool. The nature of the highly structured system lends itself to creating an atmosphere of reliability. Every year, the DOT knows how much money it will have in its budget and what projects are on the "to-do" list. Budgets are easily created and allocated. Projects are easily chosen and implemented. Each year, depending on budget and cost of each venture, the projects at the top of the list are taken care of first. If there is additional money left over, it goes to the next job on the list.

However, there is one disadvantage to having such a highly structured selection process. There is no room for flexibility. Budgets are not revisited and new projects cannot take precedent over those already on the "to-do" list. For example, since there is such a direct focus on preservation, a request for increasing capacity on a specific highway cannot be considered.
Florida has recognized this disadvantaged and it is taking measures to fix the problem. As mentioned previously, it is recognizing that capacity and quality of life are an increasing concern and is working towards considering more projects that deal with these issues.

4.11 Demonstrated Benefits

The use of policy planning and the incorporation of asset management have provided Florida with an efficient and reliable system. In addition, efficiency and reliability allow Florida to easily set a budget. This is easily done because of the prior knowledge of which projects are to be done and how much they will cost. It simply means following a list of projects and setting aside money for each.

4.12 Barriers and Challenges

Florida is in the process of developing measures to overcome flaws in the system. It is currently looking at expanding focus on delay in traffic mobility.

The 2003 Florida Legislature has passed legislation that puts into statute the creation of the Florida Strategic Intermodal System. The legislation directs the Florida Department of Transportation to develop a Strategic Intermodal Plan, and creates a Statewide Intermodal Transportation Advisory Council. The recently updated 2020 Florida Transportation Plan identified significant changes that will occur over the next 20 years. These changes will have a dramatic effect on Florida's transportation system. Florida's future economic health will depend on a system that can successfully move growing numbers of residents, tourists and goods within Florida and to and from the United States and international markets. By 2020, Florida will add about 5 million new residents, imports and exports are expected to double, and the number of tourists is expected to reach nearly 85 million. Meeting the needs generated by such dynamic growth will require investment of statewide funds in a well-planned transportation system that efficiently connects the various forms of travel. Our limited resources must be focused on statewide and regional priorities that are essential to Florida's economy and quality of life.

A transportation system that:

- Is made up of statewide and regionally significant facilities and services
- Contains all forms of transportation for moving both people and goods, including linkages that provide for smooth and efficient transfers between modes and major facilities

- Integrates individual facilities, services, forms of transportation (modes) and linkages into a single, integrated transportation network
- Targeting expenditures to help the state's economic competitiveness, including increased corridor emphasis in planning and funding projects
- Applying innovative policies and technologies, including Intelligent Transportation Systems
- Clarifying the state's roles and responsibilities on and off this system
- Providing input to the next update of the Florida Transportation Plan (2025)
- Reaching agreement on policies to guide decisions related to the Strategic Intermodal System
- Reaching consensus on system criteria and the facilities to be included on the map
- Reaching agreement on funding and priorities to implement the system

4.13 Conclusion

In summary, the Florida Department of Transportation's asset management process is simply good quality management. While Florida does not have an asset management program per se, it has implemented a system of goals and performance measures, which ensure that the system is preserved to a legislated level or performance. This legislation plays a key role in the funding and the resulting prioritization of activities. Within this legislation, Florida has addressed four simple goals: safe transportation, system management, economic competitiveness and quality of life.

In addition, this system is mission driven and customer focused with a clear link between decisions, budgeting, and performance monitoring. Florida has developed a bottom-up process of incorporating input from many active MPO’s for the purpose of decision-making in the areas of budgeting, performance monitoring and project priority selection.

CHAPTER 5. MARYLAND CASE STUDY

5.1 Introduction

This chapter describes how the State of Maryland links asset management to their strategic plan. It is organized into ten sections as outlined below:

5.2 Maryland Department of Transportation

The Maryland Department of Transportation (MDOT) has a unique multi-modal focus and is responsible for planning and development, operation, and maintenance of the state's transportation system. MDOT has a Secretary of Transportation who is appointed by the governor. The Secretary's Office provides the policy direction and management for MDOT.

5.2.1 MDOT Modal Administrations

There are five Modal Administrations:

- State Highway Administration (SHA)
  - Maintains 16,600 lane miles of highway and 2,520 bridges
- Maryland Transit Administration (MTA)
- Maryland Aviation Administration (MAA)
- Maryland Port Administration (MPA)
- Motor Vehicle Administration (MVA)

Also closely affiliated, but not actually part of MDOT, is the Maryland Transportation Authority (MdTA), responsible for Maryland's seven toll facilities.

5.2.2 Transportation Funding

Funding for MDOT occurs through the Transportation Trust Fund, which collects revenue from taxes, revenue generated by the modes, and revenue generated through

bond sales. The Transportation Trust Fund allows considerable flexibility in distributing funding between modes.

5.2.3 Legislation

Senate Bill 731, passed in October 2000, established the following requirements for the State Report on Transportation:

- Maryland Transportation Plan (MTP): Must be revised every three years through a public participation process, must be expressed in terms of goals and objectives and use a multi-modal approach where feasible.
- Consolidated Transportation Program (CTP): Must be revised annually, based on the Maryland Transportation Plan.
- Annual Attainment Report on Transportation System Performance: Documents the progress made in achieving the goals of the MTP and CTP, using performance indicators to quantify this progress.
- Advisory Committee: Advises on MDOT's goals, benchmarks and indicators. It is mandated to include representatives from a wide variety of groups, appointed by the governor.

5.2.4 Strategic Planning Process

MDOT's Strategic Planning Process is:

- Centralized, with a top-down approach
- Goals are developed through a series of internal and external iterative processes
    - Internal Processes
        - Direction from Secretary and Modal Administrators
        - Modal Planning Directors – work on policy issues and form goals, objectives and performance indicators
        - Modal Working Group – representatives from each mode and the MdTA work on lower level issues
    - External Processes
        - Input from the Governor's Office and an Advisory Committee
        - Input from focus groups (public and private sector stakeholders)
        - Telephone survey of 1,000 randomly selected state residents
        - Leadership interviews of members of the business community, elected officials, government agencies and transportation civic groups
        - Meetings with local governments
        - Public feedback on the internet
        - Public outreach meetings held throughout the state

The result of this Strategic Planning Process is the Maryland Transportation Plan (MTP). Furthermore, individual Modal Administrations create Strategic Plans to support the MTP, and the Annual Attainment Report tracks yearly progress.

5.2.5 Strategic Planning Elements

There are 10 high-level policy goals outlined in the Maryland Transportation Plan:

- Smart Growth, Smart Transportation
- System Preservation
- Transportation Facility and System Performance
- Safety and Security
- Protecting Maryland's Environment
- Provide Mobility and Accessibility with Transportation Choice
- Supporting the State's Economy
- Moving Goods
- Funding Our Transportation Future
- Serving Our Customers

5.2.6 System Preservation

System Preservation is the policy goal that is most strongly linked to asset management. Its main policy objective is to preserve and maintain existing transportation infrastructure and services as needed to realize their useful life. The State Highway Administration, the Maryland Port Administration, and the Maryland Transportation Authority have detailed system preservation objectives related to asset management.

5.2.7 Asset Management Elements

The State Highway Administration (SHA) is currently the only modal administration with a comprehensive and formal program, and only within its Pavement Division. Here is a summary of its asset management process:

- 5-Step Asset Management Program
    - Condition Assessment
    - Network Level Planning (Optimization)
    - Project Selection
    - Project Advertisement
    - Construction

The first three steps are discussed below.

Condition Assessment

Condition Assessment is performed yearly on the entire SHA network. The assessment is based on ride quality and is categorized as very good, good, fair, mediocre or poor.

Network Level Planning (Optimization)

This is the heart of the asset management system. A linear programming model is used to develop investment strategies that meet specific objectives. In order to carry out the network level planning, seven parameters for each pavement segment must be determined. These parameters are listed in Table5.1:

Table 5.1. Maryland Optimization Parameters

Parameter	***Categories***
Pavement Type	Flexible, Rigid, Composite
Traffic Level	Low, Medium, High
Road Type	Interstate, Non-Interstate
Road Class	Urban, Rural
District	D1, D2, D3, D4, D5, D6, D7
Last Major Treatment Level	15 Years, 12 Years, 8 Years, 5 Years
Condition State	Very Good, Good, Fair, Mediocre, Poor

Parameters results are used to group together similar pavements. Treatment levels are also grouped according to the life expectancy of a pavement after a given treatment has been applied. The seven treatment levels are:

- 15 years, 12 years, 8 years, 5 years (major treatments)
- +4 years, +2 years (maintenance treatments)
- Do nothing

These pavement and treatment groupings are used to develop performance models, cost models and benefit models. The output of this step is a list of the percentage of lane miles in each pavement group that should be treated, and at which level of treatment.

Project Selection

- The Project Selection process is run using internally developed software called the Project Selection Tool (PST).
- While the Optimization step is performed by the Pavement Division, all the districts participate in the Project Selection step.
- The PST shows each district its roadway inventory along with pavement condition and traffic information; lists the goals for the district including lane miles to treat and benefit to accomplish within a budget constraint; and provides a list of candidate projects for the district to select from.
- Each district selects projects it wishes to have funded. The restriction is that the projects must have results that conform to the investment strategy developed in the Optimization step.
- The Pavement Division then attempts to create a design that meets the life requirement while remaining within the defined costs.

5.2.8 Linkages between Asset Management and the Strategic Planning Process

Linkages between asset management and the strategic planning process were looked for in three areas:

- Funding
    - Tactical but not strategic link
- Personnel
    - Modal Planning Directors and Modal Working Group both have some involvement in the asset management and strategic planning processes
- Goals and Objectives – the strongest linkage
    - Alignment of performance measures

5.2.9 Goals and Objectives

Each modal administration develops its own strategic plan based on the Maryland Transportation Plan (MTP). The goals in each modal strategic plan must be linked to the goals of the MTP, and these goals must be supported by one or more specific objective. These objectives must have corresponding performance measures.

As previously mentioned, the strategic goal of the MTP that most clearly links to asset management is that of Preservation. This linkage is made through corresponding performance measures that are asset management related.

5.2.10 Strengths and Weaknesses of MDOT's Model

Strengths include:

- Its centralized, top-down structure, with performance measures to ensure compliance
- The Optimization process for asset management
- Unique organizational structure incorporating different modes
- Focus on long-term optimization
- Legislated public involvement and Annual Attainment Report
- High level of flexibility in allocating resources among modes to meet policy goals
- Pavement Division asset management system is good first step

Weakness include:

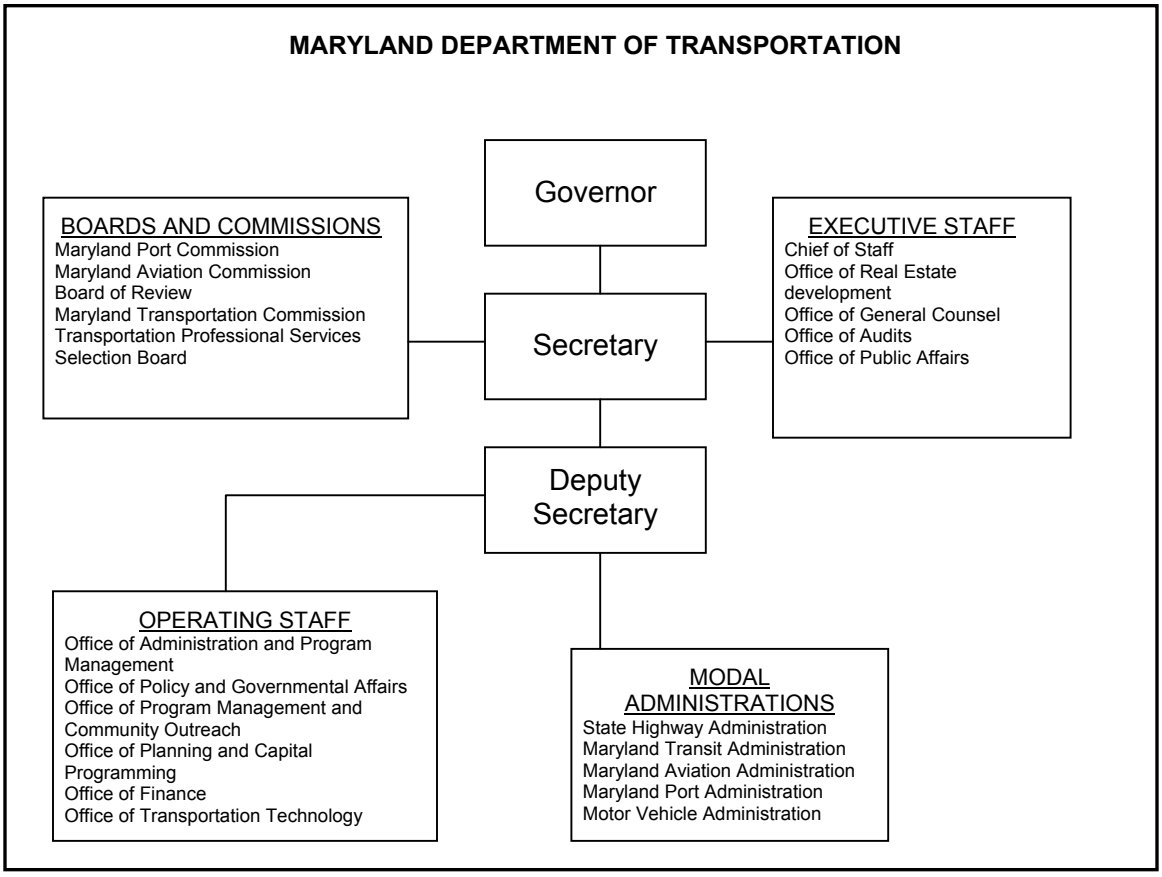
- Not all assets are managed with the same focus
    - Pavement Division is the only group to use formalized asset management
    - Could expand to bridges, commuter rail, and toll highways

5.3 DOT Profile

5.3.1 Organization

The Maryland Department of Transportation (MDOT) is unique among the states in its multi-modal focus. It is responsible for planning and development, operation, and maintenance of the State's transportation system. MDOT establishes and maintains the high-level policy goals for the organization and is responsible for implementing them through its modal administrations. MDOT is organized as shown in Figure 5.1 (Fiscal 2004 Budget Overview).

Figure 5.1. Maryland Department of Transportation



5.3.2 The Secretary of Transportation

The Governor appoints the Secretary of Transportation. "The Secretary's Office provides overall policy direction and management to the Maryland Department of Transportation. Units within the office provide support in the areas of finance, procurement, engineering, audits, administrative services, planning and capital programming, human resources, Minority Business Enterprise certification, and equal opportunity. The Office of Transportation Technology Services provides centralized computing, network infrastructure, and general information technology services for MDOT. Executive staff

support is provided for management services, public affairs, general counsel, and policy and government relations. The Secretary's Office also makes grants to various entities for transportation related purposes." (Program Description – The Secretary's Office).

5.3.3 Modal Administrations

The major responsibilities for the modal administrations are listed below.

5.3.3.1 State Highway Administration

- Plan, design, and construct highways and bridges on state system.
- Maintain 16,601 lane miles of highways and 2,520 bridges including pavement and bridge repair, snow removal, mowing, litter pick up, and maintenance of signs and traffic control devices.
- Operate an aggressive traffic management program using state-of-the-art technology, in cooperation with the Maryland State Police, local jurisdictions and nearby states.
- Deliver a safety-operating program that funds the enforcement of motor vehicle size, weight and safety laws, and highway safety grants to local jurisdictions.

(Maryland Department of Transportation 49).

5.3.3.2 Maryland Transit Administration

- Operate the Baltimore-region MTA bus, light rail and Metro systems.
- Operate the MARC train system and commuter bus program statewide.
- Provide funding in support of locally operated transit systems in each county.
- Provide liaison with WMATA system in Maryland suburbs of Washington, D.C.

(Maryland Department of Transportation 31).

5.3.3.3 Maryland Aviation Administration

- Own and operate BWI and Martin State airports.
- Foster and develop general aviation in Maryland.
- License and certify general aviation airports.
- Administer statewide programs for general aviation.

(Maryland Department of Transportation 15).

5.3.3.4 Maryland Port Administration

- Develop, maintain and, in some cases operate, state-of-the-art marine facilities.
- Promote the Port of Baltimore and provide excellent customer service at a competitive value.
- Ensure that the State's navigable waters are safe for efficient commercial navigation.
- Serve as stewards of the Chesapeake Bay and Maryland's natural environment. (Maryland Department of Transportation 23).

5.3.3.5 Motor Vehicle Administration

- License drivers, register and title vehicles and administer motorcycle safety, automobile insurance and driver safety programs.
- Regulate vehicle sales through a dealer, salesman and manufacturer-licensing program.
- Manage the vehicle emission program and school bus inspection program. (Maryland Department of Transportation 39).

5.3.3.6 Maryland Transportation Authority

Note: While the Maryland Transportation Authority is not a part of MDOT, it is closely affiliated with it.

- Responsible for all financing, construction, operation, maintenance and policing of Maryland's seven toll facilities.
- The Authority may finance and construct revenue-producing projects on behalf of MDOT.
  (Maryland Department of Transportation 59).

5.3.4 MDOT Assets

Table 5.2 lists a few of the assets managed by MDOT.

Table 5.2. Maryland DOT Assets

Airports	2
Ports	1
Highway Lane Miles	16,601
Bridges	2,520
Miles of Sound Walls	70
Signalized Intersections	2,341
Busses	900
Locomotives	30
Rail cars and coaches	260

5.3.5 Revenues and Expenditures

Maryland's source of revenues and their expenditure by function for the year 2002 are shown in Figure 5.2 and Figure 5.3 below. (Comprehensive Annual Financial Report 22)

Figure 5.2. Maryland Expenditures by Function

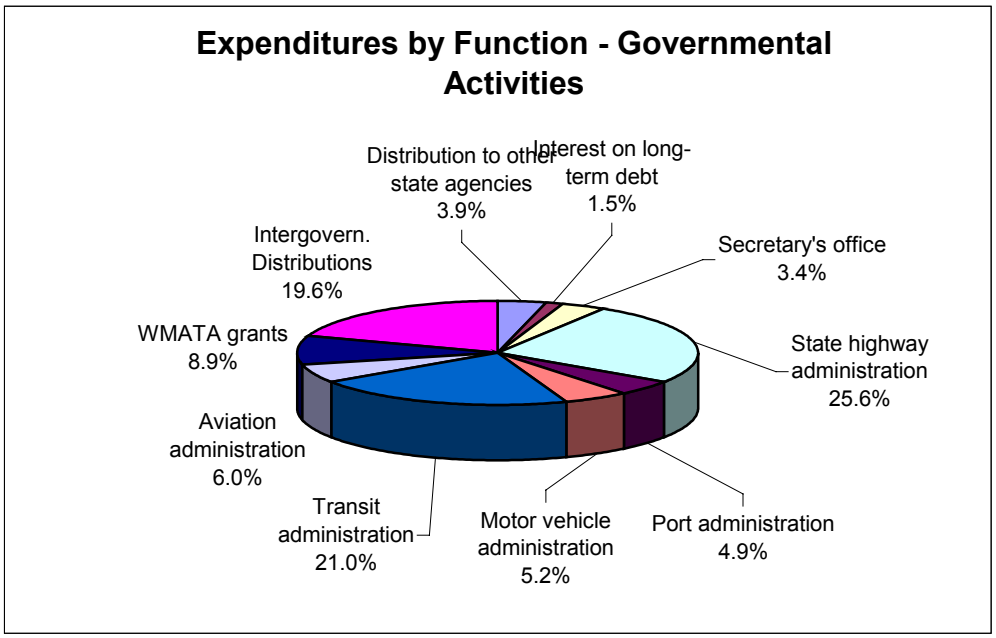
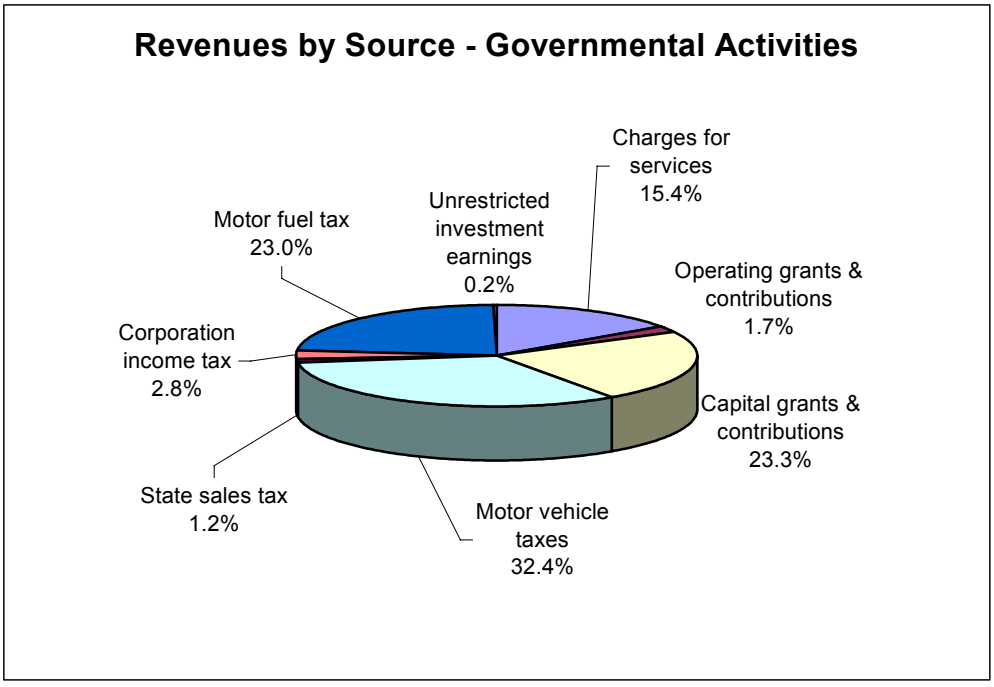


Figure 5.3. Maryland Revenues by Source



These charts show that, at least in fiscal year 2002, minor redistribution is occurring within the Maryland Department of Transportation (MDOT). The combination of motor fuel taxes and motor vehicle taxes accounts for just over 55% of total revenue to the transportation trust fund. Expenditures for the State Highway Administration (SHA) and the Motor Vehicle Administration (MVA), local government road maintenance aid (Intergovernmental Distribution) and debt service used mainly to fund highway projects account for about 52% of total expenditures.

5.3.6 Transportation Trust Fund

Funding for MDOT occurs through the transportation trust fund. This special fund collects revenue through motor vehicle fuel taxes, vehicle titling taxes, vehicle registration fees, a portion of the corporate income tax, revenues generated by the modes, and proceeds from bond sales. There is considerable flexibility to shift money between modes within this structure. Unlike some states, which dedicate at least some portion of the vehicle titling tax to the General fund and then provide grants for public transit, Maryland dedicates all of the vehicle titling tax to the Transportation Fund and funds public transit through the Transportation Fund.

5.3.7 Capital Assets

Table 5.3 (below) shows the value of MDOT's capital assets as of June 2002.

Table 5.3. Maryland DOT Capital Assets

MARYLAND DEPARTMENT OF TRANSPORTATION Capital Assets Used in the Operation of Government Funds Schedule By Function and Activity 30-Jun-02 (amounts expressed in thousands of dollars)						
Function and Activity	Land	Buildings	Equipment	Infrastructure	Construction in Progress	Total
The Secretary's Office	92	7,714	21,839		8,191	37,836
State Highway Administration	1,229,567	199,380	175,234	9,196,854	1,079,436	11,880,471
Maryland Port Administration	163,173	187,772	106,289	235,820	154,643	847,697
Motor Vehicle Administration	12,176	114,453	17,028		46,391	190,048
Mass Transit Administration	138,141	227,009	821,159	1,464,989	365,525	3,016,823
Maryland Aviation Administration	123,732	474,311	32,507	257,142	287,632	1,175,324
Total Capital Assets	1,666,881	1,210,639	1,174,056	11,154,805	1,941,818	17,148,199

Highway infrastructure accounts for over 53% of all MDOT assets. Other items of note are that transit infrastructure accounts for about 8.5% and SHA land accounts for 7.2% of total MDOT assets. Assuming that much of the construction in progress for the SHA is infrastructure, that 53% figure is probably on the rise.

As will be shown later, Maryland has focused their asset management efforts on pavements. This seems prudent in that so much value is tied up in highway infrastructure.

As will be shown, the Pavement Division developed their asset management program in order to help them meet specific goals related to ride quality. These specific goals were created to fulfill two strategic policy goals: system preservation and customer service. It is this linkage between asset management and strategic planning that is of primary interest in this research.

5.4 Legislation

5.4.1 Senate Bill 731

In October 2000, Senate Bill 731 was passed by the Maryland legislature. This bill established requirements for the State Report on Transportation, which consists of the Maryland Transportation Plan (MTP), the Consolidated Transportation Program (CTP) and the Annual Attainment Report on Transportation System Performance. The MTP is the strategic plan for MDOT and guides the development of the CTP, which is a six-year program of capital projects.

5.4.2 Maryland Transportation Plan

The requirements for the MTP are as follows:

- Must be revised every three years through an inclusive public participation process
- Must include a 20-year forecast of State transportation needs based on anticipated financial resources
- Must be expressed in terms of goals and objectives
- Must indicate the types of projects and programs proposed to accomplish the goals and objectives
- Must use a multi-modal approach when feasible
- Must be reviewed by the Maryland Office of Planning to ensure consistency between transportation investments and the State's economic growth, resource protection, and planning policy objectives.

5.4.3 Consolidated Transportation Program

The requirements for the CTP are as follows:

- Must be revised annually
- Must include (not a complete list)…
    - A list of program priorities
    - A statement of MDOT's projected annual operating costs
    - Descriptions of major capital projects
    - A list of major capital projects for the current year and successive five planning years
    - A list of major bridge work projects
    - A summary of the capital and operating programs for the Maryland Transportation Authority (MTA)

- An indication of anticipated revenue sources for each listed major capital project
- A summary of current efforts and future plans to develop and promote bicycle transportation and to accommodate a safe walking and bicycling environment within a reasonable distance to rail stops, light rail stops, and subway stations.

5.4.4 Advisory Committee

This legislation also created an advisory committee consisting of members appointed by the governor to advise MDOT in the establishment of goals, benchmarks and indicators. This committee must include (at a minimum) the following:

- A representative of the Maryland Business Community
- A representative of the disabled citizens community
- A representative of rural interests
- A representative of an auto users group
- A representative of a transit users group
- A representative of the goods movement industry
- A nationally recognized expert on transportation demand management (TDM)
- A nationally recognized expert on pedestrian and bicycle transportation
- A nationally recognized expert on transportation performance measurement
- A representative of an environmental advocacy organization
- A representative from the Maryland Office of Planning
- A representative of the Maryland Association of Counties
- A representative of the Maryland Municipal League
- A chairman appointed by the governor

5.4.5 Annual Attainment Report on Transportation System Performance

Finally, this bill required MDOT to publish an Annual Attainment Report on Transportation System Performance. This document reports on the progress made in achieving the goals of the MTP and the CTP and must be presented to the governor and the general assembly *before* they consider the proposed MTP and CTP. The Annual Attainment Report must use performance indicators to quantify progress made on the goals and objectives in the MTP. Additionally, the Annual Attainment Report must include intermediate benchmarks toward the attainment of long-term goals for the following transportation indicators:

- An increase in the share of total person trips for each of the following modes of travel: transit, high occupancy auto, pedestrian, and bicycle,
- A decrease in indicators of traffic congestion as determined by MDOT.
- Any other performance goals established by MDOT for reducing automobile traffic and increasing non-automobile traffic.

5.5 Strategic Planning Process

5.5.1 Overview

Maryland uses a centralized, top-down approach to developing and implementing its strategic plan. The high-level transportation policy goals are presented through the MTP and reflect a blending of the following:

- Governor's Vision
- Secretary's and Modal Administrators Priorities
- Statutory Requirements
- System Needs
- Public Desires

Each modal administration then creates their own strategic plan to support the high-level policies described in the MTP.

5.5.2 Responsibility For Strategic Plan

It is the Office of Planning and Capital Programming within the Secretary's Office that is responsible for developing the MTP. Each mode provides representatives that assist during the development of the plan, but it is the Secretary's Office that is ultimately responsible.

5.5.3 How Policy Goals Are Developed

Policy goals are developed through a comprehensive series of iterative internal and external processes.

Internal processes include:

- Direction provided by the Secretary and Modal Administrators as to the priorities and future course for Maryland's transportation system.
- Modal Planning Directors working on policy issues, formation of goals, objectives, and performance indicators, and to secure support of modal administrations in the overall process.
- Modal Working Group composed of representatives from each transportation mode and the Transportation Authority working on issues of data capability, tools, statutory requirements and considerations bearing on formation of goals, objectives, and performance measures.

External processes include a State legislated "inclusive public participation process" and have involved:

- Consultation with the Governor's office
- Gubernatorially appointed Advisory Committee composed of persons representing a diverse range of interests throughout the State provides advice toward establishment of goals, benchmarks and indicators.

- Focus groups created around specific aspects of transportation and composed of stakeholders from the private and public sectors
- A 1,000-person telephone survey of randomly selected residents from around the State
- Leadership interviews of Maryland business groups, transportation civic groups, elected officials, and State government agencies
- Meetings with local governments during annual consultation tour meetings
- Posting draft goals on the internet
- Regional public outreach meetings held throughout the state
- Additional outreach efforts to traditionally hard to reach communities (non-English speakers and minorities)

5.5.4. How Policy Goals Are Communicated

The MTP, the CTP, and the Annual Attainment Report are available to every employee in MDOT. These documents are also available on MDOT's website for employees as well as the general public. There are also yearly conferences where departmental goals and policies are communicated to the employees.

More directly, since each modal administration creates their own strategic plans, goals, and objectives in support of the MTP, and the MTP is a reflection of the high-level policy goals of the Department, the employees in each office are aware of and working towards the fulfillment of high-level policy goals.

5.5.5 How Policy Goals Are Implemented and Evaluated

5.5.5.1 Implementation of Policy Goals

Policy goals are implemented in the following top-down manner:

- High-level policy goals are developed by the Secretary's Office with both internal and external input.
- These goals are listed and described in the MTP, which is the master policy document. This must be updated at least every three years by law.
- Each modal administration develops a unique business plan with corresponding goals and objectives. These business plans support the policy goals outlined in the MTP.
- Managers and employees within the modal administrations work to implement the items in their mode's business plan.

5.5.5.2 Evaluation of Policy Goals

Progress toward achieving policy goals is measured and evaluated as follows.

- The Annual Attainment Report shows what progress has been made on longer term policy goals. This is mandated by State law and must be updated every year.

- The Managing for Results (MFR) document contains measures that describe operational facets of each of the modal administrations. This document is also updated annually and submitted to policymakers.
- The Governor's Budget Office and the General Assembly evaluate these performance measures and provide feedback in the form of budget recommendations or requirements.
- The Secretary of Transportation in the evaluations of agency heads uses these performance measures informally.

5.6 Strategic Planning Elements

The master document describing Maryland's transportation policy goals is the Maryland Transportation Plan (MTP). It consists of ten high-level goals supported by eighteen policy objectives. Each of the high-level goals is listed below along with their corresponding policy objectives. Goals that are asset management related are shown in bold italics and include a description of the corresponding detailed performance measures from the MFR document.

Table 5.4. MTP Goals (2002 Maryland Transportation Plan) (Managing for Results FY 2004)

Goal 1: Smart Growth, Smart Transportation		
Policy Objectives	Detailed Objectives	Performance Measures
Direct Transportation Funding to Priority Funding Areas and support the Governor's Smart Growth Executive Order		
Design and coordinate transportation projects, facilities, programs and services to reinforce local land-use plans and economic-development initiatives that support Smart Growth principles.		
Work with local communities to increase their understanding of Smart Growth principles and opportunities and to incorporate Smart Growth into local plans and visions.		
Goal 2: System Preservation		
Policy Objectives	Detailed Objectives	Performance Measures
Preserve and maintain existing transportation infrastructure and services as needed to realize their useful life.	***(SHA) Increase the percentage of pavements with an acceptable ride quality on the State Highway system from 82% to 86% by January 2005.*** ***(SHA) Ensure rate of structurally deficient bridges on the National Highway System continues to be below national averages each year. (5.9% for 2000, 5.8% for 2001 and 5.7% for 2002)*** ***(MPA) Maintain and improve terminal infrastructure (cranes, berths, cargo storage areas) to preserve and enhance***	***Percent of pavements rated fair to very good.*** ***Percent of Maryland SHA bridges on National Highway System that are structurally deficient.*** ***Total number of work orders per year.***

	capacity through the year 2010.	***Ratio of preventative maintenance vs. corrective maintenance work orders.*** ***Percent of covered storage area that meets industry standard.*** ***Percent of breakbulk vessel berths that meet industry standards.***
	(MdTA) Ensure no Authority bridges or overpasses are categorized as structurally deficient according to federal standards. Maintain the percentage of Authority bridges and overpasses out of compliance with federal functional standards at 5% or less in 2001 and thereafter. ***Respond to all critical deficiencies identified in the annual inspection report within one year of identification.*** ***Increase the percentage of high priority items that were corrected within three years to 80% in fiscal year 2004, and maintain at that level thereafter.***	***The percent (and number) of bridges and overpasses categorized as structurally deficient by federal standards.*** ***The percent (and number) of bridges and overpasses categorized as functionally obsolete by federal standards.*** ***The percent of critical items that were corrected within 1 year of identification.*** ***The percentage of high priority items that were corrected within three years of identification.***
Goal 3: Transportation Facility and System Performance		
Policy Objectives	Detailed Objectives	Performance Measures
Maximize the carrying capacity and operating performance of existing transportation facilities and services.		

Goal 4: Safety and Security		
Policy Objectives	Detailed Objectives	Performance Measures
Design, build and operate facilities, services and programs that reduce the rate of injury and deaths to our customers.		
Reduce crimes against property and persons using Maryland's transportation facilities, services and operations.		
Goal 5: Protecting Maryland's Environment		
Policy Objectives	Detailed Objectives	Performance Measures
Minimize impacts on, and strive to enhance Maryland's resources.		
Goal 6: Providing Mobility and Accessibility with Transportation Choice		
Policy Objectives	Detailed Objectives	Performance Measures
Increase transportation choices available to access and circulate within and between activity centers.		
Increase access to jobs, goods and services.		
Goal 7: Supporting the State's Economy		
Policy Objectives	Detailed Objectives	Performance Measures
Target transportation investments to serve existing and growing businesses, as well as housing and commercial markets, that support development and redevelopment opportunities consistent with Smart Growth.		
Enhance transportation services and facilities used by business travelers, recreational travelers, and tourists.		

Goal 8: Moving Goods		
Policy Objectives	Detailed Objectives	Performance Measures
Promote a diverse and interconnected system of freight transportation that leads to the efficient and reliable dispersion and transfer of cargo.		
Increase the competitiveness of the Port of Baltimore and BWI Airport cargo facilities and services.		
Goal 9: Funding Our Transportation Future		
Policy Objectives	Detailed Objectives	Performance Measures
For every program period, the Department will strive to meet or exceed the capital investment recommendation of the Commission on Transportation Investment.		
Goal 10: Serving Our Customers		
Policy Objectives	Detailed Objectives	Performance Measures
Involve customers in transportation decision making from the onset of systems planning through project development and design.		
Improve internal accountability of all modes performance through the managing for results initiative.		
Improve customer access to transportation products, information and services.		

5.7 Asset Management Elements

Maryland's State Highway Administration (SHA) is the only modal administration that has developed a comprehensive and formal asset management program. This program is currently in place only within the Pavement Division of the SHA. Peter Stephanos and Paul Dorsey of the Maryland SHA and Adel Hedfi of Axiom Decision Systems, Inc., have written a comprehensive overview of the asset management process, which is only briefly summarized here.

The Maryland State Highway Administration asset management program has five steps.

- Condition assessment
- Network level planning (optimization)
- Project selection
- Project advertisement
- Construction

5.7.1 Condition Assessment

MDOT performs a condition assessment of its roughly 16,000-lane mile highway network every year. This assessment is based on ride quality where each segment is categorized as either very good, good, fair, mediocre, or poor. Consistency is maintained through the use of a piece of equipment known as ARAN.

5.7.2 Network Level Planning (Optimization)

This is the heart of the asset management system and is controlled by the Pavement Division with the SHA. A linear programming model is used to develop investment strategies that meet specific objectives. A typical objective would be to maximize pavement condition given a specific budget constraint. The output of this step is not treatment plans for specific highway segments, but rather a listing of how many lane miles of pavement in each condition should be treated and what type of treatment should be used. For example, one item of the output may be to resurface 120 lane-miles of pavement in Fair condition.

In order to perform this task, seven parameters for each pavement segment must be determined and tracked in a database. These parameters are:

- Pavement Type – 3 categories (Flexible, Rigid and Composite)
- Traffic Level – 3 categories (Low, Medium and High)
- Road Type – 2 categories (Interstate and Non-Interstate)
- Road Class – 2 categories (Urban and Rural)
- District – 7 categories (D1, D2, D3, D4, D5, D6 and D7)
- Last Major Treatment Level – 4 categories (15 yrs, 12 yrs, 8 yrs and 5 yrs)
- Condition State – 5 categories (Very Good, Good, Fair, Mediocre and Poor)

This allows pavements to be "grouped" according to various combinations of these parameters.

Treatment levels are also grouped according to the life expectancy of a pavement after a given treatment has been applied. There are seven treatment levels: 15 yrs, 12 yrs, 8 yrs, 5 yrs, +4 yrs, +2 yrs and do nothing. The first four are major treatments and the last two are maintenance treatments.

These groupings are used to develop performance models, define costs and benefits, and to run the optimization process. As an example consider pavement performance. Future pavement performance depends on the pavement type, the traffic level, and the treatment level applied. Since there are three categories of pavement types, three categories of traffic level, and four major treatment types there are 36 different models (3x3x4=36) to predict future pavement performance. Similar models exist for unit costs and benefits. The output of this step is the percentage of each group that should receive each level of treatment. Once the Chief Engineer approves this "investment strategy", the process moves to the next step.

5.7.3 Project Selection

While the system optimization process is run on one computer within the Pavement Division, the project selection process has participation from each of the local districts as well as the Office of the Chief Engineer.

This participation occurs through the use of software developed within the SHA called the Project Selection Tool (PST). This tool shows each district an inventory of all the roadway sections within it along with their condition and traffic information. It also lists the goals to be accomplished for the district including lane miles to treat and benefit to accomplish within a budget constraint. Finally it provides a list of candidate projects that the district can select from. This list of potential projects is developed prior to the project selection step through interaction between the districts and the Pavement Division. The districts then develop cost estimates for each project.

The districts then use the PST to select projects for funding. The PST allows the user to see how effective any given project is at meeting the district goals. After the districts select the projects, the Office of the Chief Engineer reviews each project and determines if it will receive funding. The Pavement Division then attempts to design an alternative that meets the design life specified while remaining within the defined costs.

5.7.4 Project Advertisement

The projects are then advertised. After the bids are received the costs in the PST are adjusted to reflect actual costs. This may require changes to project selections if actual costs exceed the estimates.

5.7.5 Construction

The projects are then executed.

No other modal administration in Maryland has developed such a formal asset management program. The Bridge Division, a part of the SHA, uses a systematic process to identify and repair or replace problem bridges, but it doesn't have the focus on overall system health that the Pavements approach does. For example, the process for identifying and repairing bridges begins with inspections. The engineers prioritize bridge repairs based on findings from the biennial inspections and subsequent follow up inspections by the engineers. The priority levels are E (emergency) and P (preferences), and further graded A, B, C, or D. P's (preferences) are those repairs that are based on criterion other than structural (e.g. improve the ride of a bridge deck due to complaints, cosmetic concrete repairs, etc.). "A" graded repairs are the highest priority, followed by B's, C's, and D's. The A's are then worked on a first-in, first-out basis. There has generally been enough funding in the budget every year to address each "A" priority bridge (Miller interview).

Another area within the SHA that is beginning to adopt an asset management approach is the Highway Hydraulics Division. Maryland has one of the largest storm water management systems in the United States. Much of the infrastructure related to storm water management (pipes, culverts, retention areas, etc.) was built prior to the 1960's. These facilities were constructed out of corrugated metal and concrete, which have lifespans of 50 years and 75 years respectively. The problem is that many of these facility locations were not documented and other location and specification information was not catalogued. The Highway Hydraulics division has been undertaking an inventory of these "lost" assets and is now in the process of performing preventative maintenance in an effort to extend their life. This is important due to the potential high cost of traffic disruption if a hydraulic system should fail (Veeramachaneni et al., interview).

The Office of Traffic and Safety and the Office of CHART and ITS Development are beginning on the path of using asset management. (CHART – Coordinated Highways Advisory Response Team, ITS – Intelligent Transportation System) These two divisions are beginning to inventory their assets by location with the long-term goal of performing repairs to traffic signals, cameras, etc. first repair visit because the service person will know the precise hardware configuration at each location (Hicks et al., interview).

The goals of using asset management within the Pavements Division of the SHA are to be able to determine a funding strategy and to select specific projects to maximize highway network health given a set of budgetary constraints. Asset management also allows managers within the SHA to predict future network health under a variety of funding levels. This in turn allows them to provide policymakers with accurate information on the effects of different policy actions and infrastructure funding levels on the transportation network.

MDOT uses several asset management metrics within their Managing For Results (MFR) initiative. These metrics apply to certain areas within the SHA, MPA, and MdTA.

5.7.6 Within the SHA

Objective: Increase the percentage of pavements with an acceptable ride quality on the State Highway system from 82% to 86% by January 2005.

Performance measure: Percent of pavements rated fair to very good.

Objective: Ensure rate of structurally deficient bridges on the National Highway System continues to be below national averages each year. (The national rate was 5.9% for calendar year 2000, 5.8% for calendar year 2001, and 5.7% for calendar year 2002.)

Performance measure: Percent of Maryland SHA bridges on National Highway System that are structurally deficient.

5.7.7 Within the MPA

Objective: Maintain and improve terminal infrastructure (cranes, berths, cargo storage areas) to preserve and enhance capacity through the year 2010.

Performance measure: Total number of work orders per year.
Performance measure: Ratio of preventative maintenance vs. corrective maintenance work orders.
Performance measure: Percent of covered storage area that meets industry standards.
Performance measure: Percent of breakbulk vessel berths that meet industry standards.

5.7.8 Within the MdTA

Objective: Ensure no Authority bridges or overpasses are categorized as structurally deficient, according to federal standards. Maintain the percentage of Authority bridges and overpasses out of compliance with federal functional standards at 5% or less in 2001 and thereafter.

Performance measure: The percent (and number) of bridges and overpasses categorized as structurally deficient by federal standards.
Performance measure: The percent (and number) of bridges and overpasses categorized as functionally obsolete by federal standards.

Objective: Respond to all critical deficiencies identified in the annual inspection report within one year of identification. (Critical deficiencies include both emergency and non-emergency items. Emergency items are addressed immediately. An appropriate response

to a critical deficiency is to achieve a resolution, or to begin necessary repairs, within one year of identification.)

Performance measure: The percent of critical items that were corrected within 1 year of identification.

Objective: Increase the percentage of high priority items (as identified by the annual inspection report) that were corrected within three years to 80% in fiscal year 2004, and maintain at that level thereafter. (Note: High priority items are deficiencies that have the potential of becoming more serious if not corrected within the next several years.)

Performance measure: The percentage of high priority items that were corrected within three years of identification (Managing for Results FY 2004).

5.8 Linkages between Asset Management and the Strategic Planning Process

Linkages between asset management and strategic planning were looked for in three areas – through goals and objectives, through funding, and through personnel. The primary area of linkage for Maryland is through goals and objectives.

In Maryland strategic policies are developed through iterative internal and external processes combining the Governor's vision, the Secretary's priorities, the modal administration's priorities, statutory requirements, system needs, and public desires. These strategic policies are documented in the Maryland Transportation Plan (MTP). The MTP must be updated every three years per State law.

Each modal administration then develops its own strategic plan. The goals of these various strategic plans must be linked to the goals within the MTP. Each modal administration's goals must be supported by one or more specific objectives. These objectives have to be measurable and therefore must have a corresponding performance measure. This requirement to set goals, objectives, and performance measures is formalized in a process called Managing for Results (MFR).

Each modal administration must update its MFR document annually. This structure links asset management to the strategic plan. The following system preservation objectives and performance measures relate directly to linking asset management to the strategic planning process.

5.8.1 Asset Management Related Objectives and Performance Measures

Policy Objective: Preserve and maintain existing transportation infrastructure and services as needed to realize their useful life.

- Objective: (SHA) Increase the percentage of pavements with an acceptable ride quality on the State Highway system from 82% to 86% by January 2005.
    - Performance Measure: Percent of pavements rated fair to very good.

- Objective: (SHA) Ensure rate of structurally deficient bridges on the National Highway System continues to be below national averages each year. (5.9% for 2000 and 5.8% for 2001)
    - Performance Measure: Percent of Maryland SHA bridges on National Highway System that are structurally deficient.
- Objective: (MPA) Maintain and improve terminal infrastructure (cranes, berths, cargo storage areas) to preserve and enhance capacity through the year 2010.
    - Performance Measure: Total number of work orders per year.
    - Performance Measure: Ratio of preventative maintenance vs. corrective maintenance work orders.
    - Performance Measure: Percent of covered storage area that meets industry standard.
    - Performance Measure: Percent of breakbulk vessel berths that meet industry standards.
- Objective: (MdTA) Ensure no Authority bridges or overpasses are categorized as structurally deficient according to federal standards. Maintain the percentage of Authority bridges and overpasses out of compliance with federal functional standards at 5% or less in 2001 and thereafter.
    - Performance Measure: The percent (and number) of bridges and overpasses categorized as structurally deficient by federal standards.
    - Performance Measure: The percent (and number) of bridges and overpasses categorized as functionally obsolete by federal standards.
- Objective: (MdTA) Respond to all critical deficiencies identified in the annual inspection report within one year of identification.
    - Performance Measure: The percent of critical items that were corrected within 1 year of identification.
- Objective: (MdTA) Increase the percentage of high priority items that were corrected within three years to 80% in fiscal year 2004, and maintain at that level thereafter.
    - Performance Measure: The percentage of high priority items that were corrected within three years of identification.

Figure 5.4 illustrates the linkage inherent to these objectives and performance measures.

The only high-level goal in the MTP that directly links to* asset management *objectives is system preservation. As shown in

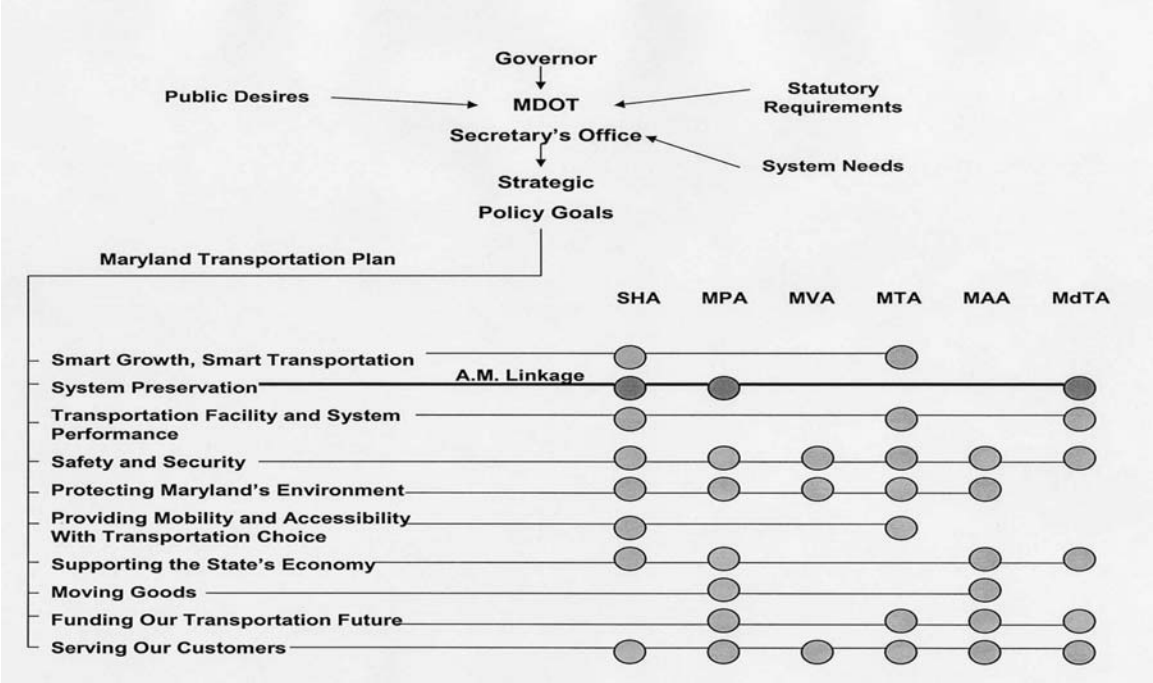
Figure 5.4, only three of the modal administrations have asset management related objectives. They are the State Highway Administration, the Maryland Port Administration, and the Maryland Transportation Authority. However, only the Pavement Division within the SHA had a formal asset management program in place. In fact this program was developed in order to better meet the system preservation (and customer satisfaction) goals in the MTP.

MDOT doesn't specifically mandate the use of formal asset management techniques for any of their modes or for any of their assets. Rather, the SHA recognized the value of asset management in allowing them to meet the system preservation and ride quality goals for Maryland's highway network.

Asset management does not link to the overall allocation of funding among the modes of MDOT. Funding at the strategic level is determined through political processes with input from the various modal administrations. However, when it comes to funding for particular paving projects, asset management plays a key role. Even though the districts have flexibility in which paving projects are submitted for approval for funding, these projects must support the overall network optimization plan or risk being rejected by the Chief Engineer. So at this lower level, the linkage between asset management and which projects are funded is very tight.

Another area where linkage may occur is in personnel, i.e. are the people involved in asset management the same as those creating the strategic plan? This is not the case in Maryland or any other state for that matter. Even though the personnel involved in asset management do have a voice in the creation of the strategic plan, they are but one of many voices from the public, elected officials, modal managers, etc. that have voices in shaping the direction of transportation policy in Maryland.

Figure 5.4. Maryland Asset Management Linkages



5.9 Advantages and Weaknesses of Maryland's Model

The strength of Maryland's process is its centralized, top-down method of creating policy and of encouraging compliance throughout the organization. Having specific objectives

and performance measures at the working level and reviewing them annually allows policymakers to regularly monitor progress and make changes where needed. Law does not mandate the use of asset management, so it will only be implemented where it makes sense and where local management is progressive enough to change their practices.

Maryland has chosen to formalize asset management only in the Pavement Division. This is a good first step in that that is where the vast majority of infrastructure assets are. The rail lines of the MTA and the tollways, bridges and tunnels of the MdTA stand out as the logical next steps in formalizing asset management. In fact, the objectives are already in place at the MdTA. Interestingly, track quality and maintenance were not included in MTA's MFR objectives.

Another strength to Maryland's approach is that even though it is a small state, it has widely varying terrain and a mix of both urban and rural areas. This may make it a good model for other larger states.

One weakness is that not all assets are managed with the same focus. For example, bridges are managed differently than pavements.

5.10 Conclusion

The efforts that the MDOT has made in the past several years in asset management, strategic planning, and the linkage between them has increased efficiency, particularly in the Pavement Division of the SHA. Their focus on long-term optimization serves the State's policy goals of system preservation and customer satisfaction well. There is a high level of cooperation between the centralized MDOT leadership and the local districts. This has been fostered by MDOT management and enabled to a certain degree by Maryland's small size. One example of this is that MDOT holds yearly comprehensive and collaborative planning exercises between the central office and the districts.

Maryland has legislated public involvement in developing MDOT's high-level policy goals as well as MDOT's responsibility to provide an annual report back to the public on progress made. When this is coupled with MDOT's multi-modal structure and dedicated transportation fund, a great deal of flexibility to allocate resources between modes in order to satisfy these policy goals is possible. In order to meet these goals, the SHA has implemented an asset management program for pavements.

MDOT's Pavement Division has a more formalized asset management system than any other state in this study. The asset management process was developed to reach the challenging system preservation and customer satisfaction goals set forth by MDOT and are intimately linked to the strategic plan through formal performance measures.

CHAPTER 6. MICHIGAN CASE STUDY

6.1 Introduction

Michigan is an interesting case study in terms of asset management, in that it is one of the few states to have asset management mandated by state law. While Michigan may still have a ways to go in terms of establishing a fully-integrated state model in terms of asset management and strategic planning, it is certainly on its way to achieving this integration, and the Michigan Department of Transportation seems to have a lot of enthusiasm and hope for the changes and improvements that asset management will bring to its organization.

6.2 Michigan Department of Transportation

The highest authority in the Michigan Department of Transportation (MDOT) is the Governor of Michigan. Appointed by the Governor, the State Transportation Commission is the main policy-making body of MDOT, consisting of 6 members each appointed for a 3-year term.

6.2.1 Michigan Department of Transportation Assets

The major assets of MDOT include (as reported in 1999):

- 9,700 miles of state highway
- 5,670 bridges and culverts

The Valuation of DOT assets, including roads, bridges, ramps, land, buildings, and railroad, totaled $14,593,900,006 in 2001.

6.2.2 Planning Documents

The Michigan DOT does not explicitly label any of its planning as "strategic," but it does produce a number of planning documents, some of which are related to what can be termed "strategic" goals and objectives. These documents are:

- State Long Range Plan – the current plan is "2000-2025 – Mobility is Security." It is within this document that MDOT formulates its "strategic" goals.
- Five Year Road & Bridge Program – the current program is "Volume IV – 2002 to 2006." This document serves as the guide for implementing and updating the strategies of the State Long Range Plan.
- Business Plan
- State Transportation Improvement Program/STIP
- Michigan Transportation Policy Plan

6.2.3 Strategic Goal Setting Process

The State Transportation Commission is primarily responsible for setting the goals and objectives of the State Long Range Plan, but public involvement is also stressed. Input is received from the Customers and Providers Committee, which includes representatives from various community organizations, special-interest groups and MPO's. The general public is then tapped; for the 2000-2025 plan, 23 meetings were held throughout the state.

6.2.4 State Long Range Plan – Strategic Goals & Strategies

Eight goals are laid out in the State Long Range Plan 2000-2025:

- Preservation
- Safety
- Basic Mobility
- Strengthening of the State's Economy
- Transportation Services Coordination
- Intermodalism
- Environment & Aesthetics
- Land Use Coordination

There are also three strategies named within the State Long Range Plan, which are to be used in achieving the eight goals:

- Asset Management
- Corridors of Highest Significance
- Congestion Management

6.2.5 Asset Management – State Legislation

Act 499, written into law in 2002, mandated the practice of asset management and established the 11-member Transportation Asset Management Council (TAMC), which reports directly to the State Transportation Commission. The TAMC, comprised of transportation professionals from various levels of government, is responsible for the administration of the asset management process, including areas of training, data storage and collection, reporting, developing a multi-year program, budgeting and funding.

6.2.6 Asset Management Process

MDOT lists the following as its key elements in asset management:

- Establishing goals and objectives in a strategic plan
- Data collection and storage
- Transportation Management Systems
- Setting performance measures and standards

- Alternatives analysis (e.g. life cycle cost analysis and a prioritization process)
- Decision-making and program development
- Plan implementation
- Monitoring and reporting

MDOT still has a way to go in fully realizing the asset management process it has set forth. Currently, it is in the process of formulating and developing most of the above named systems. It has established various programs in its Transportation Management Systems, as listed below:

- Bridge Management System
    - PONTIS and Michigan-specific interface
- Congestion Management System
- Intermodal Management System
- Pavement Management System
    - PASER rating system
        - New to MDOT, to establish consistent data for entire state
        - Train 45-50 people per year
    - Annual "Windshield Survey"
        - Sufficiency rating system
        - Subjective measurement of ride smoothness, cracking, rutting
- Public Transportation Management System
- Safety Management System

MDOT has also put in place a Road Quality Forecasting System, in which future pavement condition is estimated using the measure Remaining Service Life (RSL). The appropriate level of pavement maintenance is determined by this system.

6.2.7 Metrics in Place

In the State Long Range Plan, 2000-2025, it is stated that over 100 performance measures are used by MDOT and have been incorporated into the Transportation Management Systems database. The following performance measures relate to asset management:

- Bridge Condition
    - Each bridge is evaluated every two years to determine maintenance, rehabilitation, or replacement requirements
- Customer Satisfaction Survey
    - Provides feedback on how MDOT is meeting customer demands and measures customer perceptions about system condition and service
- Pavement Condition
    - Evaluation based on ride quality, crack severity and average depth of wheel path ruts

6.2.8 Linkages between Asset Management and the Strategic Planning Process

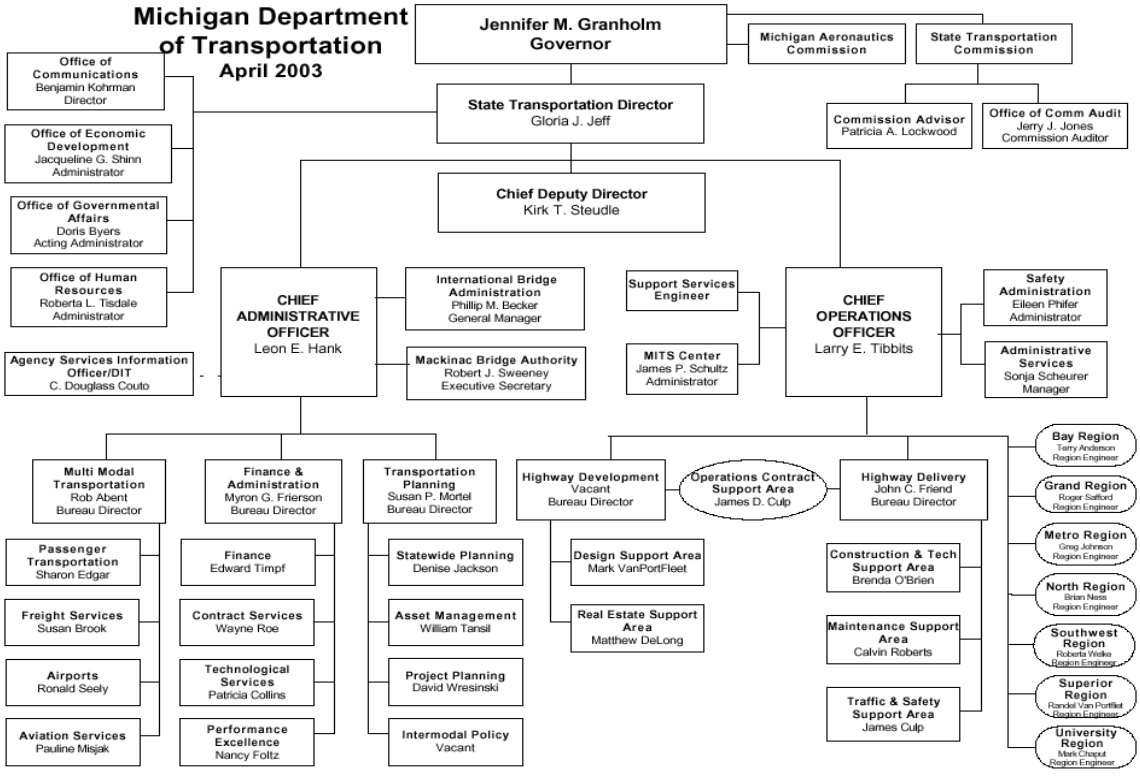
- The main linkage between asset management and strategic goals in Michigan is in its **legislation**:
    - Act 499 requires that MDOT practice asset management as part of its planning efforts. It asserts that asset management is a strategic process in which goals and objectives are set, life-cycle costs analyzed, and investment strategies recommended. Act 499 also created TAMC, which is mandated to propose strategy to the State Transportation Commission and prepare an annual budget.
- There is a moderate linkage related to **funding**:
    - While the funding process is not clearly stated, asset management has affected how MDOT prioritizes projects and has also steadied its funding from year to year. Michigan is moving away from a "worst first" prioritization, looking at its system as a whole and being more forward thinking about projects and their long-term effects.
- There is a prospective linkage in terms of **personnel**:
    - The State Transportation Commission is the main body responsible for setting the strategic goals of the State Long Range Plan, but in the future, TAMC will also contribute to this process.
- Linkages between asset management and strategic goal setting can also be seen in the **goals and objectives** themselves:
    - It is said in the State Long Range Plan that "the concept of asset management applies to all of the state long range plan goals." This assertion is backed by the claim that asset management related performance measures are used in evaluating each goal. These linkages are not expressed in great detail, and for certain goals it seems that this linkage is somewhat indirect, at best. However, one goal in particular is clearly linked to asset management:
        - Preservation: MDOT has formulated five strategies specifically related to preservation and asset management:
            - Strategy for Repairing and Rebuilding Roads
            - Trucks
            - Winter Maintenance Strategy
            - Bridge Preservation Strategy
            - Bridge Widening or Lengthening Strategy
- Linkages between asset management and strategic goals are seen in one other way: **metrics/performance measures**:
    - As already discussed, the performance measures of Bridge Condition, Pavement Condition and Customer Satisfaction Survey are related to asset management.

6.2.9 Linkages: Advantages & Disadvantages

- Advantages:
  - Asset management is embedded in Michigan's state law, which provides a strong foundation for building a successful asset management program
  - Michigan has a top-down approach, which puts everyone on the "same page" and provides a "common language," promoting better communication and understanding within the agency
  - Asset management has helped to stabilize the DOT's funding and has led to better project prioritization and planning with the entire system in mind
- Disadvantages
  - Asset management is still a relatively new concept for MDOT, only instituted in law last year, and so it has yet to be fully integrated into the planning process
  - The top-down approach seems to have neglected lower-level performance measures, which may be useful in carrying out the asset management process and successfully linking asset management principles to strategic goals
  - Multimodal tradeoffs may never be completely possible due to protected funding for transit

6.3 DOT Profile

Figure 6.1. Michigan Department of Transportation Organizational Chart



6.3.1 Budget

Average annual budget for Road & Bridge Investment, 2002-2006: $1,200,000,000
Average annual budget for Routine Maintenance, 2002-2006: $225,000,000
5-year Trunkline Program Budget, 2002-2006: $6,297,000,000

6.3.2 Inventory

As written in Michigan's State Long Range Plan 2000-2025, Michigan's system of state highways, county roads and municipal streets totals 119,929 miles. As of 2000, the Michigan Department of Transportation had jurisdiction over 9,704 miles on the state highway, or trunkline, system, including all of the "I", "U.S" and "M" numbered highways. State trunklines account for over 90 percent of the 4,760 miles of National Highway System (NHS) in Michigan.

6.3.3 MDOT Transportation Assets (1999)

- 9,700 Miles of state highway
- 5,670 Bridges and culverts
- More than 700 miles of railroad
- 215 Carpool lots
- 2,400 Trucks, vans and cars
- 450,000 Signs; 4,025 traffic & 12,328 freeway lights
- 8 Million feet of guardrail and 4,500 miles of fence
- 105 Garage, sign, maintenance/service & storage buildings
- One Central Office, 7 regional offices, 25 transportation service centers
- 83 Safety rest areas and 13 Welcome Centers
- 85 Roadside Parks, 27 scenic turnouts, 41 picnic sites
- 163 Pumphouses, 188 water wells
- 54 Sewage disposal facilities & 64,000 catch basins
- 40,500 Acres that must be maintained

6.3.4 Valuation of Assets

In 2001, MDOT placed a total value on their assets of $14,593,900,006. This was broken down into four categories as shown in

Table 6.1 below.

Table 6.1. Michigan DOT Asset Management Valuations

Asset Category	Value (2001)
Roads, Bridges, Ramps	$11,752,016,492
Land	$2,811,645,819
Buildings	$16,404,572
Railroads	$13,834,124
Total	**$14,593,900,006**

6.3.5 MDOT Regions and Transportation Service Centers

MDOT divides Michigan into 7 regions: Superior, North, Grand, Bay, Southwest, University and Metro. Each region has a regional office, located in Escanaba, Gaylord, Grand Rapids, Saginaw, Kalamazoo, Jackson, and Southfield, respectively, and each has multiple Transportation Service Centers (TSC):

6.3.6 State Transportation Commission

The Michigan State Transportation Commission is the policy-making body for all state transportation programs. It is comprised of six members, serving three-year terms and appointed by the Governor, with the advice and consent of the State Senate. No more than three Commissioners can be members of the same political party.

The Commission establishes policy for the Michigan Department of Transportation in relation to transportation programs and facilities and transportation development, as provided by law. Responsibilities of the Commission include the development and implementation of comprehensive transportation plans for the entire state, including aeronautics, bus and rail transit, providing professional and technical assistance, and overseeing the administration of state and federal funds allocated for these programs.

6.4 Legislation

The use of asset management in Michigan is a product of law. Act 308 of the Public Acts of 1998 created the Act 51 Transportation Funding Study Committee, which recommended the asset management approach. The Committee's report was fundamental in the drafting of legislation that resulted in the enactment of Act 499 of the Public Acts of 2002. Below is an excerpt from Section (5) of Act 499:

> The council shall develop and present to the state transportation commission for approval within 90 days after the date of the first meeting such procedures and requirements as are necessary for the administration of the asset management

> process. This shall, at a minimum, include the areas of training, data storage and collection, reporting, development of a multi-year program, budgeting and funding, and other issues related to asset management that may arise from time to time. All quality control standards and protocols shall, at a minimum, be consistent with any existing federal requirements and regulations and existing government accounting standards.

This legislative mandate put the implementation of asset management on the fast track in the State of Michigan. Act 499 also created an 11 member Transportation Asset Management Council (TAMC), consisting of public transportation professionals from various levels of government. The TAMC reports directly to the State Transportation Commission.

Michigan's plan is to first implement asset management for the federal-aid eligible highway system and then to continue on with county and municipal systems.

6.5 Strategic Planning Process

While MDOT does not term any of its planning as "strategic," it does produce a number of documents that are related to strategic planning:

- State Long Range Plan
  - Most recent: 2000-2025 – Mobility is Security
  - Contains "strategic" goals and objectives of the department
- Five Year Road & Bridge Program
  - Most recent: Volume IV – 2002 to 2006
- Business Plan
  - Most recent: 1997
- State Transportation Improvement Program /STIP
  - Most recent: 2002-2004
- Michigan Transportation Policy Plan

The Five Year Road & Bridge Programs, revised annually, serve as guides for implementing, and also updating, the strategies of the Long Range Plan.

The State Transportation Commission is responsible for setting the goals and objectives in the State Long Range Plan. However, MDOT also facilitates public involvement. There is a Customers and Providers Committee that provides input into the Long Range Plan. Committee members are representatives from a broad range of groups impacted by transportation, including the Michigan Commission for the Blind, the Inter Tribal Council, Detroiters Working for Environmental Justice, the League of Michigan Bicyclists, and the Rural Development Council.

For the 2000-2025 Long Range Plan, MDOT held nine Customer and Provider meetings over nine months, in which the goals and objectives of the updated plan were significantly shaped. After incorporating the committee's input into the plan, MDOT held 23 meetings throughout Michigan to obtain public input. An average of three

meetings were held in each MDOT Region and attendance averaged 21 persons. Two of the themes evidenced in feedback from these meetings emphasized asset management. These were 1) adequately maintain the existing system and avoid building more than can be maintained, and 2) apply the corridor approach in the preservation and development process.

MDOT also reviews the Long Range Plan with the state's Metropolitan Planning Organizations (MPO's), to ensure coordination between the Plan and the MPO long-range plans. This review includes a high-level look at state highway activities within MPO areas. There is also MPO representation on the Customers and Providers Committee. MDOT will be working further with MPO's in the development of companion long-range plans for each of the MDOT regions.

6.6 Strategic Planning Elements

MDOT's State Long Range Plan, 2000-2025 – Mobility is Security, outlines eight goals and corresponding objectives. Listed below are these goals and a summary of their objectives. In bold are the goals and objectives related to asset management.

- **Preservation** – Within the constraints of state and federal law, direct investment in existing transportation systems to effectively provide safety, mobility, access, intermodal connectivity, or support economic activity and the viability of older communities, and ensure that the facilities and services continue to fulfill their intended functions.
    - **Develop service standards and evaluation criteria that establish the intended functions for each system/mode receiving state support**.
    - **According to the service standards, maintain and, where appropriate, improve or expand state highways, county roads, city streets, bridges, public transportation services and equipment, aviation facilities, and non-motorized facilities under jurisdiction**.
    - Preserve rail corridors presently serving traffic and support public policy that encourages reinvestment to ensure their continued economic viability and safety. Preserve abandoned railroad corridors for possible future transportation service.
    - Encourage federal authorities to continue to maintain and, where necessary, improve Great Lakes navigational channels and related facilities.

- Safety – Promote the safety and security of the transportation system for users and passengers, pedestrians and motorized and non-motorized vehicles.
    - Reduce the rate and severity of motor-vehicle crashes through research, innovation, and application.
    - Participate in safety educational campaigns, aimed at road users, passengers and pedestrians.
    - Recognize the differing demands of the many modes using the same road network.

  - Implement infrastructure improvements and security procedures and ensure that the planning process considers the safety of community residents.
  - Coordinate with appropriate agencies to improve safety and traffic flow at transportation intersection points, and improve safety of transit, intercity buses and trains, bus stops, carpool parking lots, stations and rest areas.
  - Adhere to sound engineering practices and uniform, high standards in traffic signs, signals, and pavement markings.
  - Promote high qualification and training standards for those professionals responsible for traffic engineering, crash prevention, and enforcement.
  - Identify and address the needs of aging drivers/pedestrians, the visually and physically impaired, and other groups with distinct safety needs.

- Basic Mobility -- Work with the general public, public agencies and private sector organizations to ensure basic mobility for all Michigan citizens by (at a minimum) providing safe, effective, efficient and economical access to employment, educational opportunities and essential services.
  - Seek transportation solutions that respond to customer needs using the most beneficial and cost-effective mix of transportation modes.
  - Increase efficiency of the transportation corridor in a manner consistent with their statewide importance by modernizing their design, applying congestion management techniques, and improving service in alternate modes, reserving the addition of lanes for the highest priority road segments.
  - Preserve freedom of choice regarding all modes of transportation.
  - Enhance the responsiveness and efficiency of transit and ridesharing services, keeping routes effective and reducing costs.
  - Encourage bicycling and walking by maintaining non-motorized facilities.
  - Develop a plan to facilitate a base level of public transportation services statewide, giving special consideration to the elderly, people with disabilities, and the transit-dependent.
  - Provide electronic and other types of information on modes and systems so travelers can make informed choices about transportation alternatives.
  - Actively encourage public participation throughout the transportation decision-making process.

- Strengthening the State's Economy – Provide transportation infrastructure and services that strengthen the economy and competitive position of Michigan and its regions for the 21st Century.
  - Create more efficient connections and access to border crossings, intermodal facilities and improved linkages between modes.
  - Focus any transportation investment for economic development on those projects that improve Michigan's competitiveness or retain/increase state employment opportunities. Support opportunities for job creation/

retention through transportation investments that serve employer and employee needs.
    - Provide reliable all-season transportation network.
    - Support tourism by providing transportation system that facilitates travel, enhance recreation opportunities and protects natural amenities.
    - Improve rail infrastructure to accommodate safer, higher speed and more efficient rail service.
    - Coordinate with the maritime community to improve the marine navigation system and to more efficiently utilize the Great Lakes fleet.
    - Promote development and application of new technologies, as appropriate and cost-effective to address transportation issues.

- Transportation Services Coordination – Create incentives for coordination between public officials, private interests and transportation agencies to improve safety, enhance or consolidate services, strengthen intermodal connectivity, and maximize the effectiveness of investment for all modes by encouraging regional solutions to regional transportation problems.
    - Promote and support regional coordination to achieve greater economies of scale and improve connectivity.
    - Enhance coordination among state, regional, city, county, township, tribal officials and other parties to facilitate efforts to anticipate, accommodate or manage growth.
    - Coordinate public transportation service among transit agencies, human service agencies, school systems and local governments to minimize duplication of service.
    - Assist coordination between transportation agencies and private sector freight interests to ensure the transportation system serves the needs of commerce effectively and safety.
    - Promote coordination among airport officials and transportation agencies and land use planners to coordinate improvements to infrastructure and services that support aviation facilities.

- Intermodalism – Improve intermodal connections to provide “seamless” transportation for both people and products to and throughout Michigan.
    - Employ complementary intermodal strategies to address transportation congestion where adding capacity may not be practical.
    - Resolve transportation problems by encouraging the use of the most beneficial and cost-effective mix of transportation modes available.
    - Improve the efficiency of intermodal freight facilities and linkages among modes to improve freight service in Michigan.
    - Encourage transportation trip continuity and improve the efficiency, safety and convenience of passenger, freight and commercial transportation.

- Environment & Aesthetics – Provide transportation systems that are environmentally responsible and aesthetically pleasing.

  - Protect, preserve, maintain and enhance the aesthetic and visual qualities of state highways, bridges, and other transportation facilities, as design, construction, maintenance, improvement or repair is undertaken.
  - Plan and design transportation improvements that respect sensitive or unique natural, scenic and cultural environments, and in compliance with all environmental regulations.
  - Protect and enhance the transportation environment and mitigate environmental impacts related to transportation development.
  - Incorporate creative design in transportation infrastructure to reflect Michigan's cultural, natural and artistic heritage.
  - Challenge federal rules and guidelines when the outcomes of enforcing them will not achieve their intended objectives.
  - Encourage local participation in aesthetic work and encourage state and local partnerships for aesthetic work along transportation corridors.

- Land Use Coordination – Coordinate local land use planning, transportation planning and development to maximize the use of the existing infrastructure, increase the effectiveness of investment, and retain or enhance the vitality of the local community.
  - Create incentives to coordinate local land use planning with planning for transportation and other infrastructure improvements on a multi-jurisdictional basis.
  - Preserve right-of-way corridors for anticipated transportation improvements and work with local governments to address access control problems along existing corridors.
  - Develop and implement a mechanism to coordinate airport and land use planning and encourage appropriate land use controls around airports.
  - Encourage participation by land developers in transportation finance, through voluntary contributions or other mechanisms, so that transportation agencies share in the returns from new investment and road users are not burdened by unnecessary congestion.
  - Implement transportation solutions that respect the integrity and cohesiveness of communities by seeking input as early as possible in the project development process from local officials and area residents.
  - Coordinate transportation improvements in economically depressed areas with efforts to revitalize those communities.

The State Long Range Plan 2000-2025 also identifies three major strategies for attaining the above-mentioned goals:

- **Asset Management**
- Corridors of Highest Significance
- Congestion Management

The Plan states that the concept of asset management applies to all of the state long range plan goals, but that the process is most directly related to the plan goal of Preservation.

MDOT has formulated specific strategies in the area of asset management and Preservation, including:

- **Strategy for Repairing and Rebuilding Roads**
- **Trucks**
- **Winter Maintenance Strategy**
- **Bridge Preservation Strategy**
- **Bridge Widening and Lengthening Strategy**

MDOT's Five Year Road & Bridge Program, 2002 to 2006, discusses the ten-year goal for road and bridge conditions, announced in 1997. These condition goals, set by the State Transportation Commission, are as follows:

- **Condition rating of "good" for 95% of freeway pavements by 2007**
- **Condition rating of "good" for 85% of non-freeway pavements by 2007**
- **Condition rating of "good" for 95% of freeway bridges by 2008**
- **Condition rating of "good" for 85% of non-freeway bridges by 2008**

Table 6.2 shows the progress made from 1996 to 2000.

Table 6.2. Michigan DOT Progress Towards Strategic Goals

Asset Type	% Good – 1996 / Goal	% Good – 2000 / Goal
Freeway Pavement	79 / 95	82 / 95
Non-Freeway Pavement	56 / 85	67 / 85
Freeway Bridges	?? / 95	78 / 95
Non-Freeway Bridges	?? / 85	82 / 85

The Five Year Road & Bridge Program, 2002 to 2006, also stipulates MDOT's goal of continuing to use the corridor approach in maintaining its assets.

6.7 Asset Management Elements

MDOT's asset management literature outlines what they see as the major elements of an asset management system:

- Establishing goals and objectives through development of a strategic plan
- Collecting data to measure progress toward achieving the established goals and objectives
- Using management systems to control the various processes
- Developing appropriate performance measures
- Identifying standards and benchmarks
- Developing alternative analyses procedures
- Making decisions based on these results and developing an appropriate program
- Implementing the program
- Monitoring and reporting results of actions taken

Even though Michigan has asset management mandated by legislation, full implementation has not yet been achieved. The state is now in the process of collecting asset data in a comprehensive, systematic way, and it could take several years to complete this data collection.

MDOT has developed a Transportation Management System (TMS), which provides MDOT the ability to identify the condition, analyze usage patterns and determine deficiencies of its infrastructure. MDOT sees TMS as an integrated system, providing consistent information across all areas of MDOT and, as needed, capable of expanding into other asset management areas. Currently, TMS includes:

- Bridge Management System: MDOT uses the PONTIS system of the American Association of State Highway & Transportation Officials, along with a Michigan-specific interface. Within the TMS computer application, bridge inventory and analyses are organized into three packages: Inventory, Inspection, and Work.
- Congestion Management System: CMS uses historic, current and forecasted attributes to identify current and future congested roadways. Users can see accessibility and mobility conditions in one of four ways: Area/Route Level Analysis, Socioeconomic/demographic Summaries, Performance Measure Tracking, and Trend Analysis.
- Intermodal Management System: IMS integrates Michigan's air, rail, marine, and non-motorized transportation assets into the asset management process and is responsible for data management, analysis and deficiency identification for the state's non-highway assets. IMS is organized as a computer application within TMS, in which intermodal assets are divided into three groups: Facilities, Segments, and Services.
- Pavement Management System: MDOT is currently switching to the PASER rating system (1-10 scale) and also employs a sufficiency rating system – an annual, subjective "windshield survey" of the entire state system. The primary motivation for switching to PASER is to have consistent data across the entire federal-aid highway network (first phase) and across the entire network, including city and county roads (second phase). MDOT is training 45 to 50 people each year in PASER.
- Public Transportation Management System: Transit agencies use their own Internet connections and some locally installed software to access PTMS and enter their information. PTMS contains contact information for the Michigan transit agencies, a statewide vehicle inventory used for forecasting needs, and a financial database used for both budgeting and obtaining state funds.
- Safety Management System: SMS analyzes vehicular crashes and the roads on which they occur. Obtaining data from the Michigan State Police, MDOT's Traffic & Safety Division inputs the data into the TMS computer application, where it is organized into three packages: Road Segment, Intersection, and Interchange.

MDOT also employs a Road Quality Forecasting System, in which the pavement distress data collected in the Pavement Management System is used to estimate the future condition of a pavement network. To do this, MDOT uses the pavement condition

measure Remaining Service Life (RSL). RSL is determined by analyzing distress point values for pavement over time, and MDOT uses its own performance modeling software to do this. Based on the pavement's RSL category, three types of fixes can be made: Reconstruction & Rehabilitation (R&R), Capital Preventive Maintenance (CPM), and Reactive Maintenance (RM).
Other asset management elements that MDOT is in the process of developing are: Life Cycle Cost Analysis, a Prioritization Process, and Travel Demand Forecasting Model.

6.8 Metrics in Place

As specified in the State Long Range Plan, over 100 performance measures have been incorporated into the Transportation Management System (TMS) database. MDOT organizes these performance measures into three categories:

- System Condition performance relates to the physical condition of the asset, and is most pertinent to the goal of Preservation.
- Accessibility, Mobility, and Safety performance refers to how frequently the transportation service is offered, how efficiently it operates, and how many accidents are occurring, relating directly to the goals of Basic Mobility, Intermodalism, Safety, and indirectly to the goal of Strengthening the State's Economy.
- Operational and Service performance relates to how well the system is meeting the needs of the public, and relates most closely to the goal of Transportation Services Coordination.

A sample of the performance indicators MDOT uses to monitor progress in attaining its goals are listed below. Those related to asset management are in bold.

- Adequate Primary Runway System: Data on primary runway length, width, surface, and lighting.
- Airports with All Weather Access: Indicates airport progress toward all-weather accessibility.
- **Bridge Condition: Each bridge is evaluated every two years through the bridge inspection process and the National Bridge Inventory.**
- Bus Fleet Condition: Data on mileage and age of fleet.
- Bus Replacement: Data on physical and functional bus condition, comfort, convenience, and reliability.
- Crash Rates and Trends: Crash rate data, monitors system safety.
- **Customer Satisfaction Survey: Provides feedback from customers on how well MDOT is addressing their expectations.**
- Intermodal Facilities with NHS Connections: Measures the number of key intermodal facilities with direct connections to the NHS.
- Level of Service: Measures how easily a trip is made based on speed, travel time, and delay.
- Passenger Terminals served by two or more modes: Measures level of highway and intermodal access for air, bus, and rail facilities.

- **Pavement Condition: Evaluates road condition based on ride smoothness, cracking, and rutting.**
- Percent of Population Served by Transit: Measures transit use per capita.
- Runway Pavement Condition: Field inspections at airports using methods developed by U.S. Air Force.
- Seasonal Load Restrictions: Measures system's ability to carry commercial traffic.

6.9 Linkage between Asset Management and Strategic Planning

In the opening message of the 5 Year Road & Bridge Program, Volume IV – 2002 to 2006, written by Gregory J. Rosine, the then-Director of the Michigan Department of Transportation, asset management is specifically mentioned: "All MDOT road improvement projects continue to be prioritized based on long-term asset management strategies."

Further in, it is stated "MDOT continues to base its Five Year Road & Bridge Program on thoughtful investment strategies based on sound asset management principles and extensive customer feedback."

And, within the State Long Range Plan, 2000-2025, it is asserted, "the concept of asset management applies to all of the state long range plan goals." While this may all be true, it is difficult to find explicit examples of asset management linking to the strategic planning process of MDOT. This is no doubt due to the relative newness of asset management to the MDOT organization, and to the fact that Michigan has only just set up systems to collect and manage data under the process of asset management.

Certainly, the most direct links between asset management and strategic planning are in the Act 499 legislation that enacted the Transportation Asset Management Council (TAMC), and in the strategic goal of Preservation.

6.9.1 Legislation

Act 499 explicitly terms asset management a "strategic" process, in which goals and objectives are set, life-cycle costs are analyzed, and investment strategies are recommended. The TAMC is mandated to propose a strategy to the State Transportation Commission, which in turn produces the State Long Range Plan. However, it is anticipated that it will take at least three years for the Council to make such strategic recommendation, as the models used for developing strategies need time to amass data to recognize trends from this data.

6.9.2 Funding

There does appear to be some link between asset management and strategic planning in terms of funding, or budgeting. TAMC does produce an annual budget, and interviews suggest that asset management has changed the way that projects are planned in terms of funding. In the past, if the state had money, it would be awarded to teams based on their responsiveness, not on the overall system needs or priorities. Asset management has given the state the tools needed to budget responsibly, and also to negotiate political funding.

6.9.3 Goals and Objectives

The State Long Range Plan goal of Preservation provides a close linkage between asset management and strategic planning. MDOT has prepared specific strategies related to asset management and preservation:

- Strategy for Repairing and Rebuilding Roads: This relates to the statewide goal of having 95 percent of freeway pavements and 85 percent of non-freeway pavements in "good" condition by 2007. Road preservation programs will include long-term construction (20-30 years), rehabilitation (10-20 years), and capital preventive maintenance improvements (less than 10 years) based on analysis using the forecasting tools in the Pavement Management System (PMS).
- Trucks: New design standards – including pavement type and thickness, configuration of and distance between interchanges, and structural elements of bridges – will be used to address problems resulting from changing truck volumes, weights and sizes.
- Winter Maintenance Strategy: MDOT is exploring new technologies and techniques for dealing with winter weather, including alternative anti-icing materials.
- Bridge Preservation Strategy: This relates to the goals put forth in the Strategic Investment Plan for Trunkline Bridges – to have 95 percent of freeway structures and 85 percent of non-freeway structures in "good" condition by 2008, and to address 100 percent of structures deemed to be of highest priority based on condition by 2008.
- Bridge Widening or Lengthening Strategy: This strategy involves very long-term thinking about bridges, trying to anticipate where bridge widening or lengthening may be needed in the future and incorporating such upgrades, where feasible.

The other State Long Range Plan goals of Safety, Basic Mobility, Strengthening of the State's Economy, Transportation Service Coordination, Intermodalism, Environment & Aesthetics, and Land Use Coordination, can be indirectly, and rather loosely, tied to asset management, mainly through the fact that the performance measures of Bridge Condition, Pavement Condition, and the Customer Satisfaction Survey are all utilized in analyzing MDOT's progress in achieving these goals.

There is also a link between asset management strategies and the state's Five Year Road & Bridge Program maintenance goal of having 95 percent of freeway pavements and freeway bridges in "good" condition by 2007 and 2008, respectively, and 85% of non-freeway pavements and non-freeway bridges in "good" condition by 2007 and 2008, respectively.

6.9.4 Performance Measures

The primary strategic planning performance measures of Bridge Condition, Customer Satisfaction Survey, and Pavement Condition are clear links with asset management. These performance measures are clearly outlined in the State Long Range Plan, 2000-2025 Mobility is Security, as indicators that affect the strategies, project selection, and level of investment that MDOT employs in meeting its state long range plan goals. The asset management Transportation Management System, specifically the Bridge Management System and Pavement Management System, are utilized in collecting data for these performance measures.

6.9.5 Personnel

A personnel linkage does not currently seem to exist between asset management and strategic planning in Michigan, but it looks like it will in the future. The Transportation Asset Management Council has not provided input into the Long Range Plan yet, as it is just getting started, but it will in the near future. And, considering that the Asset Management Council deals directly with the State Transportation Commission, the body that is responsible for much of MDOT's strategic planning, it appears that there will at least be a closeness, if not direct overlapping, of personnel between asset management and strategic planning.

6.10 Advantages and Weaknesses in the State Model

An advantage of Michigan's model is that asset management is embedded in state law. Having a clear mandate provides direction for the state to implement a successful asset management process. A current weakness of the model is that asset management and strategic planning are not completely integrated. Asset management is sort of like a blanket over all of the goals of the Michigan Department of Transportation, and is a "strategy" the department follows, but is not specifically linked in many ways to the strategic planning process of MDOT.

Michigan's state model is a top down system, in which the goals and objectives are set from as high up as the Governor, and the State Transportation Commission. While this does provide a clear directive for the entire state, and puts everyone on the same page, it might not involve lower-levels of management enough. Perhaps lower-tier performance measures and controls need to be further developed in the state model.

6.11 Demonstrated Benefits

The most frequently mentioned benefit realized within MDOT due to the implementation of asset management is that of improved communication and teamwork. Different parts of the organization now have a common language with which to discuss and resolve differences. This also allows a more rational debate between cities, counties, and the state. The comment that everyone is now "on the same page" was made repeatedly. Asset management also requires more teamwork between planners and engineers,

something that was lacking prior to this effort. The following comment from an engineer is illustrative:

> "In the past maintenance guys wouldn't listen to planners and the operations and planner interface was not very positive. With asset management concepts in place, there is more reason to work as a team. The systems guy looks at the percent of the system that could be reconstructed, etc. He looks at how to get the maximum life out of the system."

Another stated benefit resulting from asset management is an increased ability to plan for future years. One respondent mentioned that, prior to asset management, year-to-year planning was not possible because you never knew what would happen to the funding. Much time was spent preparing projects and putting them on the shelf. Then if funding would become available, it would be assigned to whoever responded most quickly with a ready-made project – not to the projects that would necessarily have the most positive impact on the overall system.

Asset management has also provided MDOT with an effective kit of tools with which to negotiate political funding. By being able to show the benefits of making specific infrastructure improvements (e.g., extending the life of a highway segment with a short term fix – delaying major reconstruction until funding is easier to obtain), MDOT can more easily obtain dollars during tight fiscal years.

6.12 Barriers and Challenges

The following list of barriers and challenges are taken directly from responses to on-site interviews.

- Difficulty in changing from an engineering culture to a strategic planning culture
- Coming to consensus on data measurement and collection processes
- Difficulty in developing standards
- Providing training for everyone to help them understand the asset management and strategic planning processes
- Developing a forecasting tool to estimate roadway deterioration rates
- Inability to do multimodal tradeoffs due to Federal legislation
- Lag time between repair and system updates

6.13 Conclusion

Michigan is actively pursuing asset management. This focus is mandated by state law and is transforming the way MDOT operates. It is decentralizing operations and pushing planners into regional offices with the engineers. It is causing officials to rethink the way the state's trunkline highways are maintained and improved. It has provided a common language that allows disagreements to be discussed rationally and resolved, not just within MDOT, but also between MDOT and city and county governments.

As Michigan continues down this path more changes will occur. The state is only in the beginning phases of developing the data collection and management systems that will

allow it to fully utilize the power of asset management. While asset management is referenced in the State Long Range Plan, specific linkages are hard to find within MDOT. Some of the people interviewed stated that more linkages will be developed but not until after enough data has been collected and analyzed – a process expected to take a couple of years at least. There is also a lack of lower level performance measures within the strategic plan relating to asset management. The performance measures listed refer only to the percent of pavement and bridges rated as "good." Perhaps there are additional lower level performance measures, but they were not revealed during the interview process.

Michigan is definitely in the leading tier of states using asset management. A key factor enabling their progress is that it is founded in state law. This recently passed law has caused a sea change within MDOT. The culture is changing, and the old ways of "worst first" project prioritizations have been and are continuing to be replaced by thinking in terms of system optimization. As the data collection and management processes come on line and further linkages to the strategic plan are created, Michigan will realize additional benefits and will continue to be a model to other states looking to reap the substantial benefits of asset management.

CHAPTER 7. MONTANA CASE STUDY

7.1 Introduction

Neither the term "asset management" nor "strategic planning" is terminology used in Montana. The strategic direction for the Montana Department of Transportation (MDT) is set in "TranPlan 21" (Montana Department of Transportation, 2002). Asset management is defined within the context of MDT's performance based resource allocation and budgeting process, referred to as the Performance Programming Process (P3) (Montana Department of Transportation, 2003).

7.2 Montana Department of Transportation (MDT)

Type of Leadership

- Established in 1913, the MDT Transportation Commission is a quasi-judicial board consisting of five members, appointed by the Governor for four-year terms.

Structure

- The state is divided into five commission districts.

Responsibilities

- The agency is responsible for roadways and bridges and some small general aviation airports.

Transportation Budget: FY 2001 Revenues - $464 million

- 54.56% federal funds
- 37.47% state fuel tax
- 6.7% motor carrier services
- 1.27% accounts receivable

Major Assets

- 1,200 miles of Interstate roads
- 2,700 miles of non-Interstate roads
- 500 bridges
- Total value of all road and bridge assets is $5,215 billion deflated, based on a replacement cost of $11.5 billion

7.2.1 Strategic Planning Elements

Montana does not use the term "strategic planning," but its strategic direction is set in "TranPlan 21," Montana's statewide multimodal transportation plan. TranPlan 21 was originally drafted in 1995 and updated in 2002. Functions of TranPlan 21 include:

- Providing performance goals and relative weighting
- Identifying performance objectives
- Distributing resources by district, system, and types of work.

Montana also produces a strategic business plan using the Balanced Scorecard. However, this strategic business plan focuses on organizational performance rather than program delivery.

7.2.2 Strategic Planning Process

MDT's strategic planning process includes significant stakeholder involvement, achieved through open houses, speakers' bureau, an information/comment line, press releases, focus groups, surveys and newsletters. Also involved are the three MPO's – Billings, Great Falls, and Missoula – in Montana.

7.2.3 Strategic Goals

From the strategic planning process, specific goals were identified:

- Roadway System Performance
- Economic Development
- Traveler Safety
- Access Management
- Land Use Planning
- Bicycle and Pedestrian Transportation
- Public Transportation

Each goal has corresponding actions or objectives. Looking more closely at Roadway System Performance, its associated actions are to:

- Establish explicit priorities of roadway improvements
    - Preservation
    - Capacity expansion
    - Other
- Preserve mobility for people and industry
- Improve productivity of the roadway system

7.2.4 Asset Management Elements

Montana does not use the term "asset management," but asset management does occur through its Performance Planning Process (P3) system. And, MDT has well developed pavement, bridge, congestion and safety management systems in place. For example, MDT uses PONTIS as its bridge management system and a pavement management system developed by Texas Research and Development Institute (TRDI).

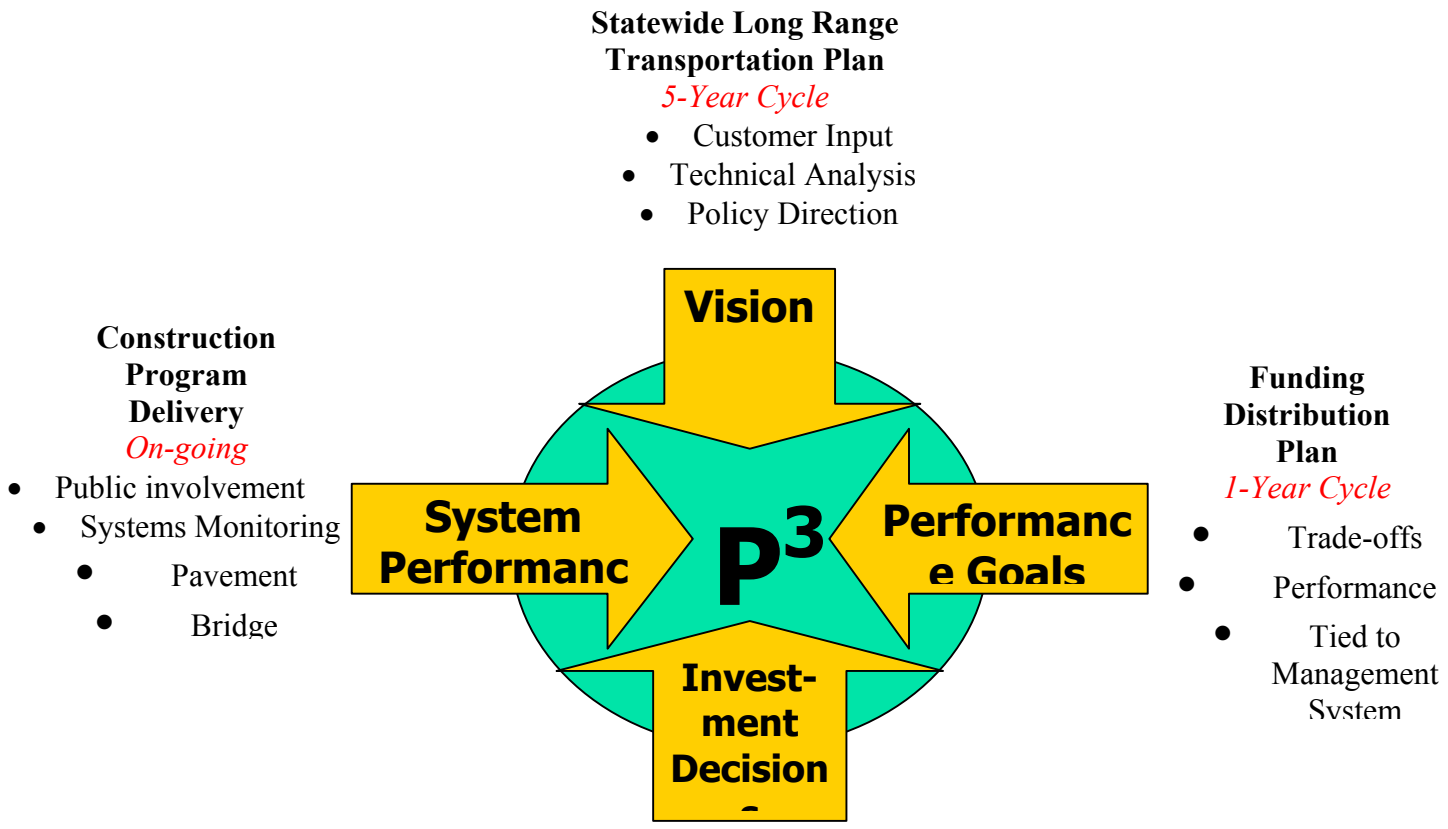
The Performance Planning Process (P3) integrates the component systems of asset management in the following manner:

- P3 links ongoing, annual and multiyear activities
- P3 serves as a project nomination process
- P3 ensures consistent goals and goal measurement

7.2.5 MDT's Performance Programming Process (P3)

The inputs into the P3 system are the Statewide Long Range Transportation Plan, the Funding Distribution Plan, the Construction Program Delivery and System Monitoring, and the Statewide Transportation Improvement Program. The dynamics of this system are demonstrated in the following Figure .

Figure 7.1. Montana P3 System



Statewide Transportation Improvement Program

1-Year Cycle

- Project Nominations
  - Customer Input
- Tied to Funding Plan

7.2.5.1 Benefits of the P3 process

- Customer driven
- Incremental development
- High level of accountability
- Supports sound investments
- Cross cutting

7.2.5.2 Barriers and Challenges

- Institutional change is difficult
- Process only covers 70% of the project – some statutory programs are not included
- Process is resource intensive
- Models are needed to support the process
- Data and information needed

7.2.6 Linkages between Asset Management and the Strategic Planning Process

While there are no formal legislative, budgetary or funding linkages between asset management and strategic planning in Montana, strategic planning is tightly linked to asset management in terms of goals, objectives, and performance measures. TranPlan 21 sets the direction and vision for the P3 process, which then nominates projects to support the vision. The asset management and strategic planning processes are then tied together in an annual Program Delivery Status Report.

Linkages between asset management and strategic planning can also be found in terms of personnel, in that leadership for both processes come from the planning department.

7.3 DOT Profile

The Montana Department of Transportation (MDT) is responsible for the state designated highways and infrastructure, pass through transit programs for the elderly and disabled and rural transit, and for 14 small general aviation airports.

Montana DOT is organized as a commission as shown in

Figure 7.2. The state is divided into 5 commission districts with headquarters in

- Missoula
- Butte
- Great Falls
- Glendive, and
- Billings

State and Federal funds expended by MDT amount to over $300 million.

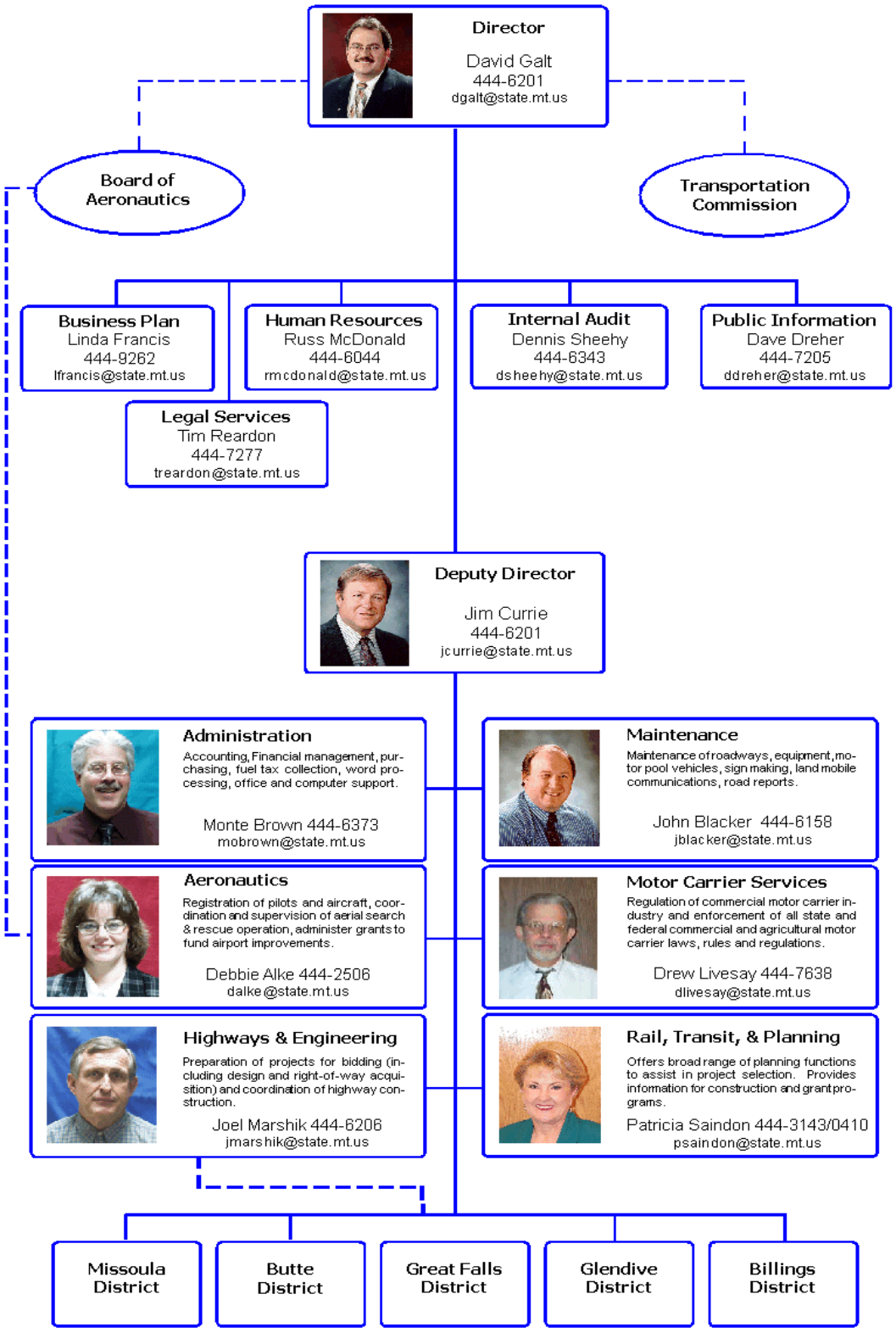
MDT is responsible for the following highway assets:

- 1,200 miles of Interstate (all state maintained)
- 2,700 miles of non-Interstate (all state maintained)

- 2,800 miles of state Primary system (all state maintained)
- 4,700 miles of state Secondary system (2,500 miles state maintained)
- 365 miles of state Urban (70 miles state maintained)
- 500 bridges

These roadways and bridges are valued at $5,215 billion deflated. This value is based on a replacement cost of $11.5 billion that is then deflated using the Consumers Price Index (CPI) and then depreciated based on a twenty-eight year life span.

Figure 7.2. Montana Department of Transportation Organizational Chart



7.4 Legislation

P3 satisfies the requirements imposed on state DOT's for long range planning by TEA-21. Specifically:

- Broad-based customer oriented planning process that ensures existing assets are preserved, and
- A direct link between the goals of the long-range plan and the actual investments.

At the state level, P3 supports Montana's statutory requirement for the distribution of Primary Highway Funds (MCA 60-3-205) and the allocation of funds to the Interstate and National Highway Systems. P3 leaves intact existing programs including:

- Urban and Secondary systems (MCA 60-30206 and 2111)
- Community Transportation Enhancement program.

7.5 Strategic Planning Process

The strategic planning process includes significant stakeholder input. The 3 MPO's – Billings, Great Falls, and Missoula are all involved. Project specific plans (DOT provides list of projects) and metropolitan plans are referenced in the STIP rather than TranPlan.

Public involvement is challenging. The physical size of the state and the low population mean that it is difficult to gather stakeholders together. Several strategies are applied on an ongoing basis:

- Open houses were held at 12-15 locations during three different time periods. The locations included 7 landed tribal governments, and 1 landless tribal government. METNET tele-video was used to enhance participation.
- Speakers bureau
- Toll free information and comment line
- Press releases and advertisements
- Focus group meetings
- Surveys using telephone and mail outs.
- Newsletter

Following a review of transportation trends and issues, specific goals and actions were identified. The goals are as follows:

- Roadway System Performance
    - Establish explicit priorities for roadway improvements. These priorities are preservation, capacity expansion and other improvements.
    - Preserve mobility for people and industry in Montana
    - Improve the productivity of the roadway system
- Economic Development
    - Preserve the efficient functioning of the transportation system used by Montana's export-oriented ('basic") industries to access regional, national and international markets.

    - Monitor and address capacity needs arising from Montana's economic growth trends
    - Support stat and local economic development initiatives to maximize new economic opportunities.
    - Support the tourism industry through promoting access to recreational, historical, cultural and scenic destinations.
    - Support MDT's organizational capacity to support economic development.
- Traveler Safety
    - Reduce the number and severity of traffic crashes on Montana's roadways
    - Provide leadership and coordinate with other Montana agencies to improve travel safety.
- Access Management
    - Improve corridor level access management to preserve the highway system.
- Land Use Planning
    - Provide technical support and leadership to encourage local jurisdictions to support transportation corridor preservation and management through their land use planning and development permitting authority.
    - Consistently apply MDT's Systems Impact Action Process to ensure developers equitably mitigate their impacts to the highway system.
- Bicycle and Pedestrian Transportation
    - Institutionalize bicycle and pedestrian modes
    - Target bicycle and pedestrian improvements to account for urban, rural, and regional differences in current and future use.
- Public transportation
    - Promote and support increased use of public transportation systems.
    - Preserve intercity public transportation service and encourage/ facilitate the development of new services.
    - Work to improve service to social service passengers and the transportation disadvantaged – the elderly, children at risk, low income and persons with disabilities – through interagency coordination.
    - Identify and implement transportation demand management actions that will work in Montana.

7.6 Strategic Planning Elements

Montana has used the Balanced Scorecard to produce a strategic business plan. (http://www.mdt.state.mt.us/dir/matrix/businessplan.html). However, this business plan

focuses on organizational performance rather than the delivery of transportation services. It is the way to make sure that the policy directions happen, including tracking and implementing mechanisms.

"TranPlan 21" is Montana's statewide multimodal transportation plan. It was originally adopted in 1995 and was updated in 2002. TranPlan 21 fulfills the following functions:

- Provides performance goals and gives relative weighting
- Identifies performance objectives – tradeoff analysis with different goals recognizing fiscal constraints. $\Leftrightarrow$ Performance measures
- Solicits weighted from decision makers so that the political process is reflected in the weighting
- Distributes resources (funding) to districts, systems, and types of work

Strategic direction for the state may also be set by the legislature or the governor's office.

Based on the original 1994/1995 report, annual reports describe system characteristics, and present policy goals and the status of actions. Biennially, a technical and public perception analysis is conducted and a public involvement process collects data.

Fundamentally, this strategic document sets the philosophy for the department including the director/ deputy director/ and commissioners. They understand the performance programming process.

7.7 Asset Management Elements In Place

Montana has well developed bridge, pavement, congestion and safety management systems. These systems include inventory, condition assessment, performance measures and evaluation.

MDT uses PONTIS as its bridge management system. MDT has taken a leadership role in creating a web-accessible version of PONTIS. The general public can access data and use basic queries through the web (http://webdb2.mdt.state.mt.us/pls/bms_pub/pontis40_site.htm). The web-based system also provided access to route clearance and posting information.

MDT's pavement management system was developed by Texas Research and Development Institute (TRDI) (http://www.trdi.com/content/montana.htm). This network level system includes:

- Inventory
- History - construction, maintenance, condition
- Condition survey data
- Traffic data
- Database system
- Data analysis capability
- Report generation

The congestion management system and the safety management system have been developed in-house. The safety management system is evolving to focus on localized spot improvements. There are also an intermodal management system and a public transportation management system.

Maintenance is integrated though out all the systems. For example, performance goals include reactive maintenance dollar. Decisions related to these goals are made on the basis of the pavement management system output. Similar efforts will be developed for signs, guardrails, and other hardware.

The "Performance Programming Process" is the system that integrates the various components of asset management. The performance planning process (P3) links ongoing annual and multi-year activities to plan, program and deliver highway improvements. P3 is a project nomination process that is closely tied to the evaluation of performance measures. The inputs are:

- Statewide Long Range Transportation Plan. This is updated on a 5-year cycle and includes customer input, technical analysis and policy direction. This provides the **vision**.
- Funding Distribution plan. On a 1-year cycle this plan involves trade-off analysis and performance measures that are derived from the management systems. This provides the **performance goals**.
- Construction Program Delivery and System Monitoring. These are ongoing efforts that provide system **performance measures** through existing systems and public involvement.
- Statewide Transportation Improvement Program. The project nominations and customer input are updated annually. These are the **investment decisions**.

P3 focuses the investment decision-making on the customer. P3 ensures consistent goals and how movement towards these goals will be measured. The current set of objective, measures, and performance targets are summarized in Table .

MDT is currently updating the Statewide Transportation Planning Process including citizen's input. The first round was in 1994. Specific goals included improved pavement condition on NHS and state roads to ensure ride quality. In the updated version, the overall economic benefit of the program will also be included, which includes economic development. Ultimately, the process will include the REMI model to quantify the impacts.

Other modules include:

- Tracking Program Delivery
- Tracking Economic Development Impacts

7.8 Asset Management Elements In Process

Specific asset management elements under development or under consideration include:

- Relational Databases to Integrate Individual Management Systems

- Resource Allocation
- Life Cycle Costs
- Asset Management for Maintenance and Operations – AMMO

7.9 Asset Management Elements Not In Place

Elements to consider not in place include consideration of multimodal tradeoffs. This is because the agency has only had a multi-modal component since the early 1990's. While there are 90 providers of transit related to the agency, they go through a different process and therefore, tradeoff analysis at this stage is inappropriate.

7.10 Metrics in Place

The goals identified in TranPlan 21 are translated into specific metrics in P3 as shown in Table .

7.11 Linkages Between Asset Management and the Strategic Planning Process

There are no formal legislative, budgetary or funding processes that link asset management and strategic planning in Montana.

However, strategic planning is very tightly tied to asset management in terms of goals and objectives, and the performance measures used to track progress. "TranPlan 21" sets the direction and vision for the P3 process by specifying direction but not which projects should be built to accomplish this goal.

A budget is given to the districts and the districts nominate the projects. A systems performance query tool facilitates assessment of the impacts of the projects. The GIS-based system brings up underlying management system data so that the user can assemble his program using various indicators of needs such as pavement ride, bridge conditions, and safety hot spots.

Each goal has specific actions identified. In the annual report, a "responsible office(s)," priority (high, medium or low) and the status are also identified. High priority items are ongoing or implemented before December of the current year, medium items are implemented within 2-5 years and low priority items are implemented when resources allow.

Most importantly, the two processes are tied together in an annual "Program Delivery Status Report." This report addresses infrastructure investment, obligation of funds, and planned versus delivered program.

There are also fairly strong personal linkages as leadership for both the strategic planning and the asset management processes come from the planning department.

7.12 Demonstrated Benefits

MDT lists the benefits of the P3 process as follows (Montana Department of Transportation, 2003):

- Customer driven
    - Public and stakeholders set the vision in TranPlan 21.
    - Opportunities for annual comments and updating
    - District offices nominate the projects
- Incremental development
    - Existing projects are not disrupted, new projects are added
    - Feedback leads to incremental improvement of the management systems.
- High level of accountability
    - Commits to project mix tied to system performance.
    - Tracks actual performance over time.
- Supports sound investments
    - Demonstrates tradeoffs
    - Demonstrates decline in performance to due to reduced funding
- Cross-cutting
    - Links policy goals to project investments
    - Moves MDT to common goal
    - Provides feedback for monitoring predicted versus actual performance.

7.13 Barriers and Challenges

Changing of business processes is challenging. Institutional change needs to recognize the culture of the organization. For example, input from the field is critical and must be trusted. Similarly, there is a tendency to look in the rearview mirror rather than looking forward.

This process only covers about 70% of the program. There are statutory programs that are not included. These include collectors on the state urban system, CMAQ funds and enhancement funds. These are all handled in a different way.

The process itself consumes resources. There are much higher expectations on the part of all the stakeholders. Due diligence is required to prevent new legislation via regulation. For example, most processes do not recognize the cost of public involvement.

Other issues include:

- Lack of models to support the process
- Access to information and data

7.14 Conclusion

MDT is very pleased with the result of their process. They credit the success of the process to the fact that "nothing was done in a black box -- everything was done in a glass box."

Table 7.1. MDT Objectives and System Performance Measures used in P3

Area	**Objective**	**Performance Measures**	**Performance Targets**		
			Interstate	NHS	Primary System
Pavement	Preserve highway pavement condition at existing or higher levels on Interstate, NHS and Primary systems	Ride Index – a measure of the quality (smoothness) of the ride as perceived by the highway user	Average ride desirable or superior, less than 10% of miles below desirable	Average ride desirable or superior, less than 20% of miles below desirable	Average ride desirable or superior, less than 20% of miles below desirable
Bridge	Improve the condition of the bridges on the state highway system	Number of functionally obsolete, structurally deficient and substandard bridges as measured by the National Bridge Inventory Condition Assessment	Reduce number of functionally obsolete, structurally deficient and substandard bridge on the state highway systems.		
Safety	Improve the safety of the state highway system	Number of correctable crash sites funded for improvement	Reduce the number of sites with correctable crash features		
Congestion	Maintain and improve the congestion levels on the rural portion of the highway system and improve major interchanges and system operation within urban areas	Congestion Index on the highway system – a measure of travel delay. The higher the congestion index, the less congestion and the more mobility experienced by travelers	Congestion index $\geq$ 70 (Level of service B)	Congestion index $\geq$ 55 (Level of service C)	Congestion index $\geq$ 55 (Level of service C)

CHAPTER 8. PENNSYLVANIA CASE STUDY

8.1 Introduction

The state of Pennsylvania provides us with a unique opportunity of exploring the relationships between asset management and the strategic planning process in the state department of transportation. The Pennsylvania Department of Transportation has a strong strategic planning process as well as a well-defined asset management concept plan. The strategic planning process at PennDOT started in the 70's, however; the asset management concept plan came in March 2001. This chapter on Pennsylvania focuses on the strategic planning process at PennDOT, the asset management framework as well as the linkages between them. The following few sections provide a brief overview of the state of Pennsylvania and the state department of transportation.

8.2 Pennsylvania Department of Transportation

Type of Leadership

- A Secretary who reports directly to the governor leads the Pennsylvania Department of Transportation (PennDOT).

Responsibilities

- The agency is responsible for 44,000 miles of state highways and 16,000 NBIS highway bridges and 8,000 state highway bridges.

8.2.1 Strategic Planning Process

- PennDOT develops an enterprise-level strategic agenda every four years, which it also summarizes in a scorecard, used for evaluation
- An advisory committee, comprised of district engineers, bureau directors, and other representatives, guides the strategic agenda
- Managers are specified to develop and update the strategic plan
- The most recent strategic plan includes 8 Strategic Focus Areas (SFA's), 13 corresponding high-level goals, and 21 corresponding strategic objectives
- The strategic objectives were developed by technical teams and were tested along the following developmental guidelines
    - Establishing the Leadership Direction
    - Identifying Customer Expectations
    - Assessing Departments' Customer Service Capabilities
    - Developing Priority Tasks And Strategies
    - Finalizing Plans and Performance Targets
- PennDOT also uses the Baldridge assessment process to critique its strategic planning

8.2.2 Strategic Planning Implementation

There are six deputantes and 11 districts that develop organizational scorecards with their own strategic objectives and performance measures, which are linked directly to the enterprise-level scorecard. Implementation consists of the following four steps: organization of scorecards, business planning, resource allocation, and performance management. The Strategic Management Committee (SMC) reviews the progress of the departmental strategic objectives on a rotating basis, over a six-month period.

8.2.3 Strategic Planning Elements

The eight Strategic Focus Areas (SFA's) named in the strategic plan are:

- Maintenance First
- Quality of Life
- Mobility and Access
- Customer Focus
- Innovation and Technology
- Safety
- Leadership at all Levels
- Relationship Building

The two SFA's that are most related to asset management are Maintenance First and Customer Focus.

8.2.4 Asset Management Elements

In March 2001, Cambridge Systematics prepared an asset management concept plan for PennDOT, establishing an integrated approach to transportation asset management within the organization. This plan identified three goals:

- Build, preserve and operate facilities in a cost-effective manner that delivers a level of service and overall system performance acceptable to the Commonwealth
- Deliver to customers the best value of each dollar spent
- Enhance the credibility and accountability of transportation investment decisions

To meet these goals, PennDOT has established an asset management framework, incorporating four elements:

- Establish policy goals and objectives that provide incentives for good asset management
- Collect information and perform analyses to effectively support asset management policy and decisions
- Conduct planning and programming to make resource allocation decisions that reflect good practice in asset management
- Use appropriate oversight techniques and follow-through in Program Delivery

8.2.5 Asset Management Scope

PennDOT's asset management program is primarily concerned with the assets that PennDOT owns: roadways (interstate and state), bridges, operations hardware, equipment, and rail facilities. However, PennDOT is also interested in managing other assets in which it has interest, such as local roads, streets, bridges, and culverts, traffic signals, railways, transit assets, bicycle/pedestrian assets, and intermodal facilities.

8.2.6 Metrics

Baldridge Assessments

- In November 1997, PennDOT implemented a very aggressive and strategic quality initiative using Baldridge assessment criteria developed by the National Institute of Standards. Utilizing these assessments, every organization within PennDOT is responsible for identifying its own shortcomings, or "gaps."

PennDOT Scorecard (Biannual Reporting)

- Operates at the strategic level
- Contains the 8 Strategic Focus Areas, 14 high-level goals and 23 strategic objectives with corresponding measures
- Targets performance effectiveness for the next 3 to 5 years
- Progress is measured every six months

SMC Dashboard (Monthly Reporting)

- Operates at the tactical level
- Uses 14 measures with 84 support measures.
- Serves as a monthly performance report to help the committee in decision-making
- Measures focus on core business areas and targets effectiveness for the next 1 to 3 years

8.2.7 Linkages between Asset Management and the Strategic Planning Process

Asset management and the strategic goals of PennDOT are linked in three main ways: Through the strategic goals and objectives, the alignment of performance measure/metrics, and personnel.

8.2.8 Goals and Objectives

- Maintenance First: This SFA is reflected through prioritization of funding for all systems and services. Two high-level goals of this SFA are smoother roads and cost-effective highway maintenance investment, which are asset management elements.
- Customer Focus: Customers are involved in tailoring services and needs and help in measuring department performance. Two asset management-related high-level

goals associated with this SFA are improving customer satisfaction and improving customer access to information.

8.2.9 Alignment of Performance Measures/Metrics

Both the scorecard and the dashboard have linkages to asset management. For example, the scorecard metric International Roughness Index (IRI) is used to measure ride condition and links to the asset management-related high-level goal of Smoother Roads, part of the Maintenance First SFA. Similar linkages exist with the dashboard.

8.2.10 Personnel

Every strategic objective has an owner or a leader who is responsible for that specific objective. For many of these objectives, the leaders are directly involved in implementing asset management in their division or are part of a specific management system.

8.2.11 Linkages: Advantages & Disadvantages

- Advantages
  - Discipline and standardization give this state an excellent data baseline from which to build future programs
  - "Maintenance First," one of the strategic planning goals and also a direct concept of asset management, is a good beginning in linking asset management and strategic planning.
  - The asset management system has helped PennDOT and its partners make trade-off decisions regarding infrastructure investments
  - The performance measurement system follows the Baldridge process, an extremely useful tool for measuring performance
  - There are some performance measures, both in the scorecard and the dashboard, which are directly linked to asset management.

- Disadvantages
  - There may be too many goals and objectives to be relevant
  - Asset management has low visibility in the strategic plan
  - Asset management is still at the infancy level and is at a "concept" program level
  - The department is still struggling to provide information on performance measures as an input to the strategic plan
  - The dashboard items are technical, but do not impact the system nor budget allocation

8.2 DOT Profile

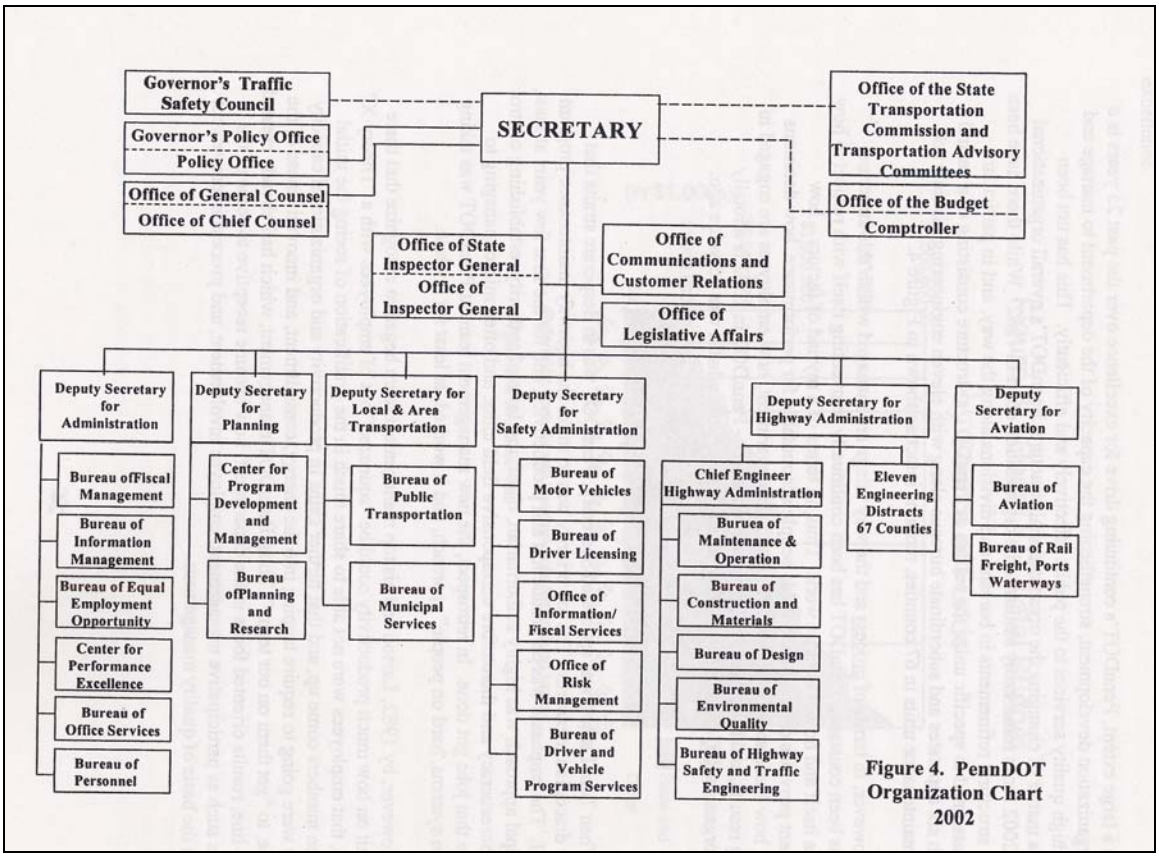
PennDOT is one of United States leading pubic works organization. It owns and operates more than 40,000 linear miles of highways. It has the nation's fifth largest state owned highway system. PennDOT also administers one of the nation's largest grant programs

for mass transit, rail freight and aviation. PennDOT employs about 12,000 people with an annual budget exceeding $4 billion (USDOT, 2002).

8.2.1 Type of Leadership

A Secretary who reports directly to the Governor leads the Pennsylvania Department of Transportation. The following chart shows the organizational structure of the department.

Figure 8.1. PennDOT Organizational Chart



Source: Poister T.H, "Transforming PennDOT: A case study in the continuing drive for excellence," 2002.

8.2.2 Number of Employees

There are a total of 11,956 employees.

8.2.3 Responsibilities

The agency is responsible for roadways and bridges.

8.2.4 Miles of Road

The Department is responsible for 44,000 miles of state highways.

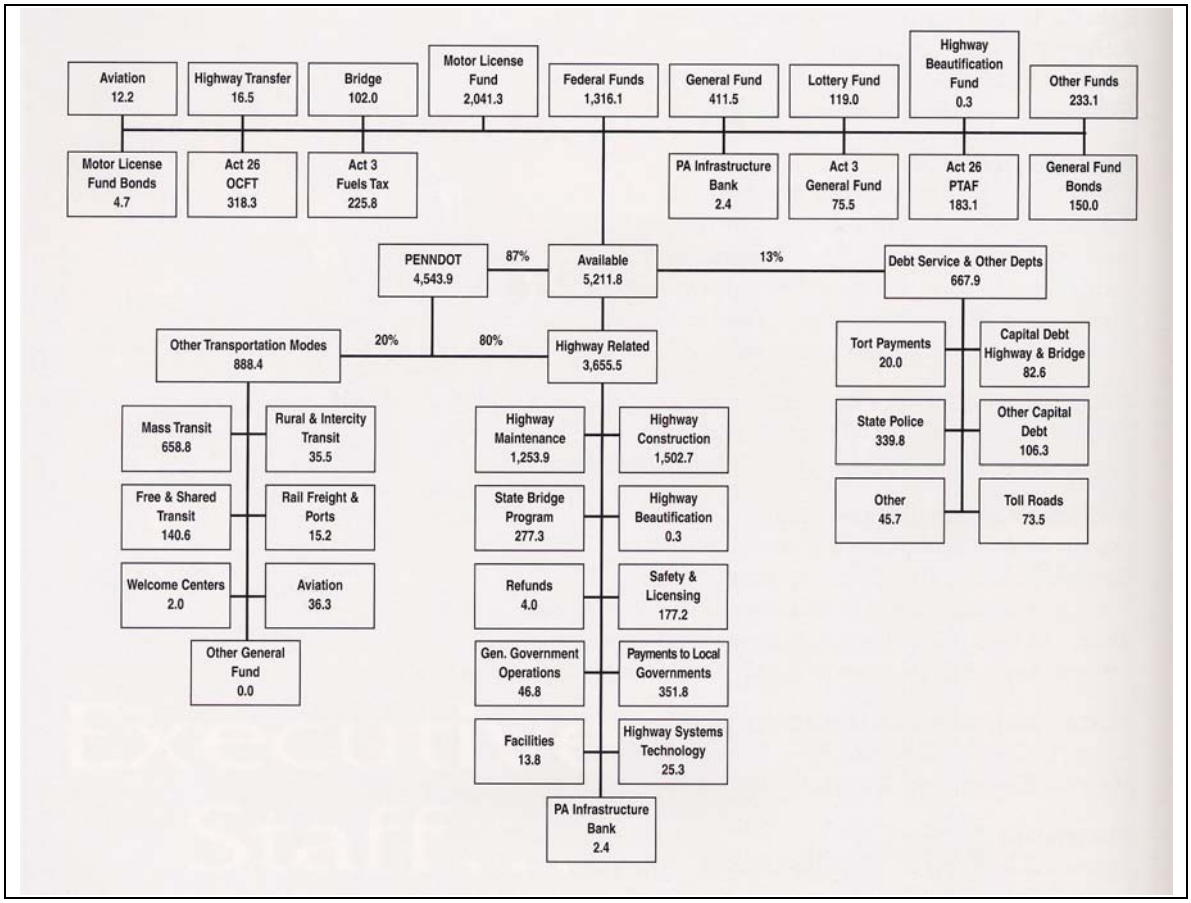
8.2.5 Number of Bridges

The Department maintains 16,000 NBIS highway bridges and 8,000 state highway bridges greater than 8 feet in length.

8.2.6 Transportation Budget

Figure 8.2 shows the different sources of funding and its allocation to different modes and activities. The major sources of funding are basically of two types: motor licensing and federal funding. Out of the total available funds of 5,211 million dollars, 87% went to PennDOT and the rest towards debt service and other departments. Nearly 80% of the PennDOT funds was allocated to highway related works and only 20% to other transportation modes.

Figure 8.2. PennDOT Transportation Budget



8.2.7 Description of Workforce

The majority of the workforce in PennDOT is involved in the Highway sector. The highways account for 85.6% of the workforce, followed by the safety administration accounting for 10.1 %. General administration is around 3.2% and all the other modes

have only 1.1% of the workforce.

Table 8.1 gives a detailed breakdown of the workforce.

Table 8.1. PennDOT Description of Workforce

HIGHWAY		**SAFETY ADMINISTRATION**		**GENERAL ADMINISTRATION**		**OTHER MODES**	
Total	**10,571**	**Total**	**1,254**	**Total**	**400**	**Total**	**131**
Maintenance	8552	Support	169	Executive	120	Aviation	44
Construction	2,019	Motor vehicles	602	Administration	280	Transit	34
		Driver Licensing	483			Rail	10
						Welcome centers	43

Source: PennDOT, " Annual report 2002," 2002.

8.3 Strategic Planning Process

8.3.1 Background of Strategic Planning Process at PennDOT

PennDOT's strategic planning process has evolved over the years. The initial effort resulted in the formation of 24 major objectives and the formation of top-level Strategic Management Committee (SMC). In 1987 and 1991, the strategic planning process was expanded to involve many more PennDOT managers. By 1991, around 500 managers were involved in the strategic planning process. In 1995, a wide variety of stakeholders were involved in the process for the first time (Poister, 2002).

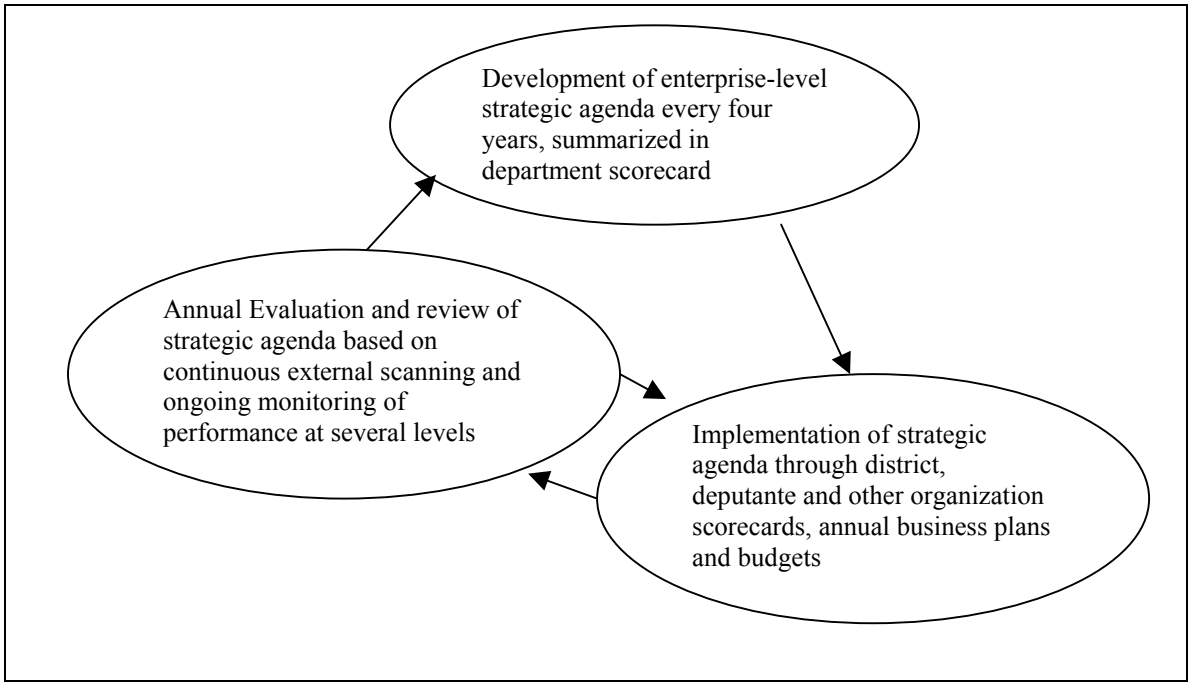
In 1998, the Baldridge assessment process was initiated and the gaps in the department's strategic planning process came out in the open. It was found that, although the strategic planning process was in place, the resulting plans and decisions were not linked to the strategic planning process. Finally, the strategic planning process was revamped and managers were specified for developing and updating the strategic plan and for implementing, monitoring and managing the strategic agenda. An advisory committee, consisting of district engineers, bureau directors, and other leaders representative of the larger group of managers who would be involved in developing and evaluating strategic objectives, was formed to guide the strategic agenda.

8.3.2 Overview of the Strategic Planning Process

The most recent strategic planning process was a two-year planning process. More than one year was spent on developing a strategic agenda for the overall department and the rest of the time was devoted to spreading the strategic planning agenda throughout the organization in implementation workshops. The comprehensive strategic planning process is given in

Figure 8.5.

Figure 8.5. Strategic Planning Process at PennDOT



Source: Poister, 2002.

The strategic planning team develops the strategic planning agenda (Poister, 2002) according to the Baldridge assessment criteria and must:

- Be grounded in data, particularly with respect to customers expectations
- Provide for effective implementation as part of the planning process
- Identify costs and commit specific funding sources to strategic initiatives
- Utilize appropriate performance measures to manage the strategic agenda

The circular process consists of three components: planning, implementation and evaluation. The planning component involves developing and updating a department-wide strategic agenda for four years. The strategic agenda is summarized in an enterprise level scorecard that contains the department's highest goals, strategic objectives, performance measures, etc. (Poister, 2002).

The implementation component consists of 6 deputantes and 11 districts developing organizational scorecards with their own strategic objectives and performance measures that are linked directly to the enterprise level scorecard (Poister, 2002). The evaluation component consists of the ongoing monitoring of performance measures at several levels to track progress in implementing strategic initiatives and achieving strategic objectives and targets. The performance data provide feedback to the organizational units responsible for implementation, allowing for the readjustment of strategies.

8.4 The Strategic Agenda

8.4.1 Developing the Strategic Agenda

Given the framework of the Strategic Focus Areas (SFA's) and high-level goals, technical teams developed strategic objectives or strategies. Eight technical teams came up with 43 proposed strategic objectives. These objectives were tested along the five developmental guidelines for the strategic agenda (Poister, 2002):

- Establishing the Leadership Direction: What is the expected impact of the proposed strategic objective on the high-level goal targets for this SFA?
- Identifying Customer Expectations: Will the proposed objective lead to customer satisfaction?
- Assessing Departments' Customer Service Capabilities: Does the strategic objective consider the capacity and commitment of PennDOT and its partners?
- Developing Priority Tasks And Strategies: What are the options, and how can the resources be redirected to pursue this proposal?
- Finalizing Plans and Performance Targets: Does the proposal contain actionable items with specific measures of success?

The tasks of the technical team also included:

- Providing an overall rationale for proposed objective
- Identifying the PennDOT organizations along with partners and suppliers who would be implementing it
- Identifying alternative approaches and their resource requirements
- Identifying opportunities for redirecting resources from existing programs
- Providing timetables for producing required outputs
- Identifying appropriate measures

Finally, after many deliberations and meetings, 8 Strategic Focus Areas were identified with 13 high-level goals and 21 strategic objectives.

8.4.2 Implementation of Strategic Agenda

The enterprise-level strategic objectives and initiatives summarized by the departmental scorecard are implemented through business plans, budgets, and expected work results developed at the district and deputante level and in some cases by central office bureaus and county maintenance units, as well. The implementation consisted of the following four steps:

- Organization of scorecards
- Business planning
- Resource allocation
- Performance management

The Strategic Management Committee (SMC) reviews the progress of the departmental strategic objectives on a rotating basis, over a six-month period. The SMC scorecard tracks progress on each objective and not the general goals. Every high-level goal has a designated leader, and these leaders are held accountable by the secretary and SMC for achieving department-wide results on their strategic objectives (Poister, 2002). Each December, the SMC conducts a systematic review of the entire enterprise-level scorecard to determine what needs to be updated. The SMC may consider changing the measure or the targets for particular strategic objectives.

The strategic management process is an ongoing process at PennDOT, incorporating the principle of planning by process. The enterprise-level strategic agenda, summarized by the department scorecard, is implemented through scorecards and business plans developed by the districts and the deputantes. These organizations review their scorecards on a quarterly basis in order to manage their measures. The district and deputante business plans, containing both the organization scorecards and dashboards, must be updated annually and approved by SMC to ensure alignment with enterprise-level strategic objectives.

8.4.3 Integration of Strategic Planning and the Baldridge Process

Although strategic planning is an important element of the Baldridge process, they do not coincide structurally and hence there is a disconnection between the two. The districts and deputantes are required to prepare business plans and update them annually; the bureaus are required to prepare organizational review packages (ORPs) every two years to be reviewed by Baldridge examiners.

The mismatch occurs because some county maintenance units and bureaus may be penalized in Baldridge reviews, even though they are not directed to develop business plans. Ted Poister's report has given recommendations to remove this confusion and establish a better linkage between the strategic planning process and the Baldridge Assessments. These are:

- Maintain current arrangements but clarify the procedural integration of the two processes
- Require only districts and deputantes to undergo Baldridge reviews as well as develop business plans
- Align the two processes by requiring districts and county units, as well as deputantes and bureaus, to engage in business planning and undergo Baldridge reviews

8.5 Strategic Planning Elements

Pennsylvania Department of Transportation has identified eight Strategic Focus Areas (SFAs). The following table lists these SFAs, their high-level goals, and some corresponding strategic objectives.

Table 8.2. PennDOT Strategic Focus Areas

Strategic Focus Area	High Level Goal	Strategic Objective
Maintenance First	Smoother roads	Improve ride quality by incorporating smooth road strategies into comprehensive pavement program
	Cost effective highway maintenance investment	Refine winter services best practices to achieve more timely and efficient response
		Use life cycle criteria as a tool for asset management and investment to reduce outstanding maintenance needs
Quality of Life	Balance social and environmental concerns	Improve customers' experiences of our facilities by enhancing beautification efforts and reducing roadside debris
		Develop timely transportation plans, programs & projects that balance social, economic and environmental concerns
	Demonstrate sound environmental practices	Implement strategic environmental management programs that adopt sound practices as our way of doing business
Mobility and Access	Delivery of Transportation products and services	Meet project schedules and complete work within budgeted costs
	Efficient movement of people and goods	Implement congestion management strategies that limit work zone restrictions, address incident management and reduce corridor delays
		Implement keystone corridor rail improvements as pilot Multimodal initiative
Customer Focus	Improve customer satisfaction	Implement a department-wide systematic process to continue improve customer satisfaction
	Improve customer access to information	Improve information access by providing quality customer contacts across organization with special attention to driver and vehicle enquiries
Innovation and Technology	World class process and product performance	Map key processes and improve those with the most strategic impact on business results
		Deliver business results through planned enterprise-focused information technology
Safety	Safer Travel	Implement cost-effective highway safety improvements at targeted high crash locations
		Upgrade safe driving performance through education and enforcement initiatives
	Safer Working Conditions	Implement prevention strategies to reduce employee injury rate
		Implement prevention strategies to reduce vehicle accident rate
Leadership at all levels	Improve leadership capabilities and work environment	Provide employees with tools and expectations to communicate effectively in order to facilitate leadership at all levels
		Develop employee skills and capabilities through structured process of instruction, practice, leadership opportunities
Relationship building	Cultivate effective relationships	Implement a methodology to involve partners and stakeholders more meaningfully in PennDOT activities
		Strengthen the efficiency and effectiveness of transportation grant programs utilizing the methodology for partner and stakeholders

Source: Poister, 2002.

8.6 Asset Management Elements

8.6.1 Asset Management at PennDOT

The Pennsylvania Department of Transportation has realized the importance of maintaining the existing transportation systems for the economic well being of the state. A sound approach to maintaining assets is necessary to effectively meet the strategic objectives. In March 2001, Cambridge Systematics prepared an asset management concept plan for PennDOT, establishing an integrated approach to transportation asset management.

It was identified that asset management is a strategic approach to managing infrastructure (PennDOT, 2001). Its goals are to:

- Build, preserve and operate facilities in a cost-effective manner that delivers a level of service and overall system performance acceptable to the Commonwealth
- Deliver to customers the best value of each dollar spent
- Enhance the credibility and accountability of transportation investment decisions

8.6.2 Scope of Asset Management

The primary scope of asset management at PennDOT is within the assets directly owned and maintained by PennDOT. However, PennDOT is also interested in managing some assets that are not owned by PennDOT (Penn DOT, 2001). The PennDOT owned assets include:

- Roadways (Interstate and state)
- Bridges and Other Structures
- Operations Hardware
- Equipment
- Rail facilities
- Facilities

Other assets, which PennDOT has interest in are:

- Local Roads and Streets
- Local Bridges and Culverts
- Traffic Signals
- Railways
- Transit
- Bicycle/Pedestrian
- Intermodal facilities

8.6.3 PennDOT's Approach to Asset Management

PennDOT's approach to asset management has been influenced by a lot of policies, procedures and initiatives (PennDOT, 2001). These include:

- The adoption of The Malcolm Baldridge National Quality Award criteria, illustrating PennDOT's focus on customers and performance
- PennDOT's identification of eight Strategic Focus Areas, which include performance based goals and objectives
- PennDOT's base of asset inventory information, established through regular surveys of the condition of its most important assets
- PennDOT's bridge, roadway and maintenance management systems, in place
- PennDOT's regular surveying of the public and its partners for perceptions on performance

8.6.4 PennDOT's Asset Management Framework

PennDOT has divided its asset management framework into four aspects of resource allocation program delivery (Penn DOT, 2001). These four aspects are:

- Policy Goals and Objectives: Policy guidance encourages and provides incentives for good asset management
- Information and Analysis: Information resources effectively support asset management policy and decisions
- Planning and Programming: Resource allocation decisions reflect good practice in asset management
- Program Delivery: Appropriate oversight techniques and follow-through reflect industry good practice in asset management.

8.6.5 Asset Management Elements in Place

The following table gives an overview of the different kinds of asset management elements that are in place at PennDOT.

Table 8.3. PennDOT Asset Management Elements in Place

Element	Yes/No	Planning Process	Management Concept	Part of Computer Based Program
a) System Preservation	Yes	Yes	Yes	Yes
b) Multimodal Tradeoffs	No	Yes	No	No
c) Performance Programming	Yes	Yes	Yes	No
d) Maintenance/replacement tradeoffs	Yes	No	Yes	No
e) Resource allocation	Yes	Yes	No	No
f) Decision support using PMS/BMS	Yes	Yes	Infancy	Yes
g) Maintenance management systems	Yes	In Progress		In Progress
h) Forecasting/tracking tools	Yes	Yes	Yes	
i) Life cycle cost analysis	Yes	No	No	No
j) Construction	Yes			
k) Priority Selection Process	Yes	Yes	Yes	
l) Budgeting	Yes	Yes		
m) Workplace Improvement	Yes			No
n) Stakeholder Involvement	Yes	Yes	Yes	No

It can be seen from the above table that system preservation exists as part of a computer-based program. These computer-based programs include a roadway management system and a bridge management system. System preservation is one of the primary elements in any asset management system. Other than system preservation, only a handful of elements are present at a management concept level within PennDOT. However, most of the asset management elements are part of PennDOT in some form.

8.7 Metrics in Place

The highest decision-making body within PennDOT is the Strategic Management Committee (SMC). The SMC provides leadership, addresses enterprise-wide issues, and sets strategic direction for PennDOT. The purpose of PennDOT's performance measurement is to improve business results.

8.7.1 The Baldridge Assessments

In November 1997, PennDOT implemented a very aggressive and strategic quality initiative, incorporating performance excellence criteria based on Baldridge criteria developed by the National Institute of Standards (Poister, 2002). Utilizing these assessments, every organization within PennDOT is responsible for identifying its own shortcomings. These are referred to as "gaps." The Baldridge process involves:

- Rigorous assessments of current performance based on a comprehensive set of specific criteria
- Identification of existing performance gaps
- Systematic effort to close these gaps through follow-up action and monitoring

There are seven categories of performance criteria in the national Baldridge process: leadership, strategic planning and management, information and analysis, customer and market focus, human resource development, process management, and business results.

The Baldridge process has helped PennDOT transform into a high performance organization.

8.7.2 Scorecard vs. Dashboard

8.7.2.1 PennDOT Scorecard (Biannual reporting)

At the strategic level, there is the scorecard. The scorecard contains the eight Strategic Focus Areas with 14 high-level goals and 23 strategic objectives. Each high-level goal and strategic objective includes one or more measures. The scorecard targets performance effectiveness for the next 3 to 5 years. Progress is measured every six months (USDOT, 2002).

8.7.2.2 SMC Dashboard (Monthly Reporting)

The SMC dashboard is at the tactical level. The dashboard has 14 measures with 84 support measures. It is a monthly performance report to help the committee in decision-making. The measures focus on core business areas and targets effectiveness for the next 1 to 3 years (USDOT, 2002). Some measures are also aligned to the eight Strategic Focus Areas.

At the operational level, there are statistical digests and organizational and work unit performance reports.

The Strategic Management Committee has realized that depending solely on the scorecard is not an effective process of performance measurement. This is because there may be many goals and policies which are important to the department, but do not figure in the scorecard. In contrast, the dashboard tracks a number of measures that pertain to the department's core functions and important activities. The dashboard is concerned more with current performance while the scorecard is oriented more towards the future. The dashboard is more focused on ongoing operations rather than strategic initiatives.

The dashboard is reviewed on a monthly basis using a management-by-exception approach. Both dashboards and scorecards are required in business plans. The scorecard has a broader framework, focusing on department wide strategic agenda, while the dashboard is concerned more with daily work-oriented objectives.

8.7.3 PennDOT Scorecard of Measures

The following table shows the metrics or the performance measures related to each high-level goal. It shows the scorecard measures.

Table 8.4. PennDOT Scorecard Measures

Strategic Focus Area	**High Level Goal**	**How success will be Measured**	**Metric**
Maintenance First	Smoother roads	Better ride conditions on major (NHS) highways	International Roughness index (IRI)
	Cost effective highway maintenance investment	Reduction in outstanding maintenance needs	Condition Assessment for highways and Bridges
Quality of Life	Balance social and environmental concerns	Timely decisions based on public and technical input on project managers	Highway project environmental approvals meeting target dates
	Demonstrate sound environmental practices	Attaining world class environmental status	ISO 14001environmental criteria
Mobility and Access	Delivery of Transportation products and services	Honoring commitments on scheduled transportation projects	Dollar value of 12-year program construction contacts initiated
	Efficient movement of people and goods	Reduced Travel Delays	2002-peak period work zone lane restrictions 2005-travel delays on selected corridors
Customer Focus	Improve customer satisfaction	Competitiveness on Malcolm Baldridge criteria for excellence	Baldridge organizational review package scores- customer criteria
	Improve customer access to information	Prompt answers to telephone inquiries	Answer rate of calls to the customer call center
Innovation and Technology	World class process and product performance	Competitiveness on Malcolm Baldridge Criteria for Excellence	Baldridge organizational review package scores-all criteria
Safety	Safer Travel	Fewer fatalities from highway crashes	Number of fatalities per year
	Safer Working Conditions	Fewer work related injuries	Injury rate per 100 employees working in a year
Leadership at all levels	Improve leadership capabilities and work environment	Positive trends in employee feedback on job related factors	Organizational climate survey (OCS)-selected items
Relationship building	Cultivate effective relationships	Effectiveness of partnerships to achieve business results	PennDOT/Partner business effectiveness survey scores

The dashboard has a set of 14 key measures and 84 support measures. These key measures are:

- Agility
- Permit Cycle Time
- Customer Satisfaction
- International Roughness Index
- Program Delivery
- Bridges
- Fatalities
- Surface Improvement Maintenance
- Workforce
- Baldridge (Organizational Review Package - ORP)
- Baldridge (Link to Scorecard)
- Gap closure
- Driver Licensing
- Vehicle Registration

8.8 Linkages between Asset Management and the Strategic Planning Process

8.8.1 Goals and Policies

There are two Strategic Focus Areas with related high-level goals that have direct linkage with asset management or asset management-like activities. These are:

- Maintenance First: The maintenance first policy is reflected through prioritization of funding for all systems and services. Preventive maintenance is the primary element of any asset management process. We can thus say that asset management has been identified in one of the strategic objectives. The two high-level goals of the SFA are: smoother roads and cost-effective highway maintenance investment. Both of these high-level goals can be considered asset management elements.
- Customer Focus: Customers are considered to be involved in tailoring services and needs. Customers drive direction and measure department performance. This is an integral element of any asset management system. The two high-level goals associated with this SFA are: improve customer satisfaction and improve customer access to information.

8.8.2 Alignment of Performance Measures

PennDOT has primarily two sets of measures, the scorecard and the dashboard. The following section gives a list of all the measures that are asset management elements or asset management-like elements.

Scorecard

The following table gives a list of all the measures in the scorecard that are directly or indirectly linked to asset management.

Table 8.5 PennDOT Scorecard Measures linked to Asset Management

High-Level Goal	**Performance Measure**
Smoother Roads	International Roughness Index (IRI)
Cost-effective highway maintenance investment	Condition assessment for highways and bridges
Improve customer satisfaction	Baldridge organizational review package scores customer criteria
Improve customer access to information	Answer rate of calls to the customer call center

Dashboard

The following table gives a list of all the measures in the dashboard that are directly or indirectly linked to asset management.

Table 8.6. PennDOT Dashboard Measures linked to Asset Management

Key Measure	**Support Measure**
Customer Satisfaction	Maintenance and Operations – CSI
International Roughness Index (IRI)	Interstate
	NHS Non-interstate
	Non-interstate routes and others
Bridges	Weak Link Bridges
Surface Improvement Maintenance	Betterment
	Surfacing
	Level and Seal
	Surface Repair
	Pavement Widening

8.9.2 Other Linkages

- There are 8 Strategic Focus Areas as part of the strategic plan. Each department has a business plan, which is a tactical planning tool that fits into the strategic planning process. All the districts have a separate business plan. The main

objective of the business plan is to figure out how to bring costs down. The purpose of asset management is to implement the right strategy.

- **Personnel Linkages**: Every strategic objective has an owner or a leader who is responsible for that specific objective. In many of these objectives, the leaders are directly involved in implementing asset management in their division or are part of a specific management system. These direct personnel linkages are helpful in establishing the degree to which asset management is a part of the strategic planning process.

8.10 Advantages and Weaknesses of the State Model

There are a lot of merits in the present model at PennDOT. At the same time, it has been seen that the department has certain concerns in their model that need to be addressed. These merits and demerits are both in the strategic planning process and the asset management process, as well as the linkages between them. These are discussed below:

8.10.1 Advantages

- There are a lot of linkages occurring, and discipline and standardization are giving Pennsylvania an excellent data baseline from which to build future programs.
- "Maintenance First," which is a direct concept of asset management, finds its place as one of the strategic planning goals. This is a good beginning of direct linkages between asset management and strategic planning.
- The asset management system has helped the department and its partners to make trade-off decisions regarding infrastructure investments based upon analyses of various funding and treatment scenarios.
- The information on asset management acts as an input for the dashboard, prepared for the department. (Bureau of Design)
- The performance measurement system follows the Baldridge process. This is an extremely useful tool for measuring performance and PennDOT trains people in the Baldridge process.
- There are some performance measures, both in the scorecard and the dashboard, which are directly linked to asset management

8.10.2 Disadvantages

- This process has shifted the focus from asset preservation to mobility
- Linkages are weak between the local business units and strategic plan
- There may be too many goals and objectives to be relevant
- Asset management has low visibility in the strategic plan
- Asset management is still at the infancy level and is at a "concept" program level
- The department is still struggling to provide information on performance measures as an input for the strategic plan

- Asset management has a strong management concept in silo's, which is not integrated now
- The dashboard items are not as technical as required to impact the system and budget allocation

8.11 Conclusion

Today asset management is in place for Highway, Bridges and ITS groups. Most of the dollars are in the highway and bridge program. They are incrementally bringing asset management to roads and bridges. The system could be characterized as a strong management system in silo's, which is not integrated now. They are data rich today, but they need to take the system to the next level. Historically, roadway, bridge and maintenance were very silo oriented. Asset management has given the agency a good platform for trade-off analysis. The strategic plan is integrated into an annual business plan at the high-level areas. Asset management is one of the 23 objectives and thus it is not a strong system. Right now there is not much emphasis on asset management, as asset management is not defined at the strategic level. It is thus not a driver of the agenda, but just a small part of the plan.

CHAPTER 9. DEVELOPING A MODEL FOR LINKING ASSET MANAGEMENT TO STRATEGIC PLANNING

9.1 Methodology

After investigating the processes for strategic planning and asset management, documented by each of the 50 states, five agencies were selected, because they seemed to embody best practices. Elements from programs in Florida, Maryland, Michigan, Montana and Pennsylvania were used in the development of the model. Agency visits and extensive cross-functional interviews were conducted to explore the planning and implementation of asset management and strategic planning. The linkages between these planning disciplines were investigated. The management systems and the relationships between the stakeholders and the agencies were analyzed in the areas of performance measurement, asset management and strategic planning. Legislation, organizational structure and corporate culture were identified. Processes and procedures and management systems were explored.

After completing our evaluation of best practices linking to asset management and performance measures in the strategic plan, a model process was developed. The process is used as a guide, which incorporates the best elements of each program we identified in our review of best practices. The model provides a high level conceptual roadmap of the key planning features and elements.

The model process consists of procedural elements and substantive decision support tools. The process is representative of the results found in each of the individual states. It represents a composite of the best practices found in the five states as a whole. The following sections describe each of these components.

9.2 Findings from the Five Best Practices States

9.2.1 Strategic Planning

Strategic Planning is a leadership function that set the course for agencies. The process of strategic planning in private industry has been implemented in a variety of ways. No company plans to fail but those who fail to plan will not achieve the long-term results. For public or private organizations, which build and manage infrastructure, this process is an important activity. Yet, blending and melding the goals and objectives of an agency with many functions and assets can be daunting. The process is made more complex by the political party influence and the longevity of the political party in office.

Key Findings:

- Policy development is based on objective information and data

- A broad range of alternatives are considered to achieve objectives

- Decisions are made based on an understanding of comparative costs and outcomes
- Policy and goal setting are important processes, which are implemented differently in each of the agencies interviewed.
- No one plan fits all. There are many plans, which roll up to the strategic plan.
- Outside stakeholders are included in program inputs in a variety of ways. Input from MPO's and appointed officials are included in the process of setting the goals and direction of the agency.
- The number of goals and policy objectives varies by state.
- A combination of top down and bottom up goal setting seems to be most effective.
- The planning function is not the organizational focal point. "Delivering the plan" seems to be rallying principal.
- Funding is not usually linked to performance.
- Trade offs and optimizations improve with good strategic planning.
- Communicating the plan is an institutional challenge given the different federal mandates and programs.

9.2.2 Performance Measurement

The maxim, you can't manage what you don't measure is the starting point in this process. Each State DOT is unique in their budget process and organizational structure. By their very nature DOT's manage many assets and functions. A common foundation or "language" is necessary to eventually make trade offs and optimizations, which will provide the best yield of performance and profitability. The challenge in this process is to establish a culture of measurement and then to build consensus in the identification of a common measuring stick where all assets can be measured and valued using a common set of values and statistics. Ideally the outcome of this process will allow leadership to make informed decisions about the financial trade offs between transit and bridges and highway investments.

Key Findings:

- Performance measures are reviewed on a regular basis (cost, schedule, satisfaction)
- Program outputs and outcomes are monitored, reported and communicated
- Performance measures, linked to the strategic plan are the most successful.

- A Top down- bottom up model seemed to best capture the diversity and the disparate nature of the DOT processes.

- While the number of key focus areas varied from state to state, a regimented process of defining key goals and objectives is a necessary first step.

- A culture of performance measurement and discipline is necessary. Several states have used the Malcolm Baldridge process to facilitate institutional learning.

- Few agencies link performance measures to pay.

- Project funding was not linked to performance.

- The Pennsylvania process was the best model for the establishment and inculcation of performance measurement.

- Performance measures are becoming more sophisticated as data collection improves.

- There seems to be a need to have both agency and departmental performance measures.

9.2.3 Asset Management

Asset management is a strategic business management approach to maintain transportation infrastructure, allocate system and financial resources and improve performance and utilization of state owned assets. The objective of establishing a strong asset management system is to facilitate the processes of building, preserving and operating facilities while delivering the best value for each dollar spent. The practice of asset management enhances the credibility of an agency's analytical process. It also enhances the accountability to the public, and to both internal and external stakeholders. Each individual agency's needs, resources, goals, leadership and stakeholder expectations shape the asset management process. There seems to be no single correct approach to asset management, yet there are various concepts, which generally emerge as a result of an asset management program. Agencies involved in an asset management program generally have a more strategic view of their transportation system, integrate more performance based measures and analytical tools in the evaluation of projects and have a more integrated information management system to evaluate trade offs between investment and maintenance activities. Finally and possibly most importantly, a strong asset management program becomes a permeating culture or business process, which can be applied to all areas of the agency. Asset management can provide a common valuation method to evaluate competitive projects and assist in the capital budget process. To be effective, asset management theory and practice is present in some form in the following areas:

- Policy Goals and Objectives
- Planning

- Performance Measurement of Program Delivery
- Information tools

Implementation of asset management has traditionally been piloted in the highway area. Over time, the process has been implemented in other areas and the program scope and implementation has grown within the DOT's. In some states, key performance measures and outcomes have been legislated.

Key Findings:

- Asset management is an individualized management process not a universally held or generic program.

- Asset management provides a common language for departments and divisions to agree on funding allocations. Policy development is influenced by more objective information available to all.

- Customer focus becomes a higher priority and participation results in a more proactive policy formulation process.

- Management processes, decision criteria and performance measures are more cooperative and collaborative and consistent with overall agency policy.

- Traditional funding allocations have moved from a "black box" to a "glass box".

- Trade-off analysis and optimizations have improved.

- A common information system is a necessary first step and foundation discussion.

- Legislation can be a powerful tool in mandating process implementation.

- Asset management improves accountability and performance

9.2.4 Legislation

Due to the political nature of the agency, change is constant. New leadership brings new focus areas. State DOT's are large agencies with many employees and numerous programs to deliver safely and within budget. Recognizing the differences in planning horizons and political processes, several states have adopted legislation to preserve funding categories and establish input links and program deliverables.

Key Findings:

- Due to the long term nature of the asset and the life cycle costs associated with key assets a reliable funding stream is necessary.

- Informing the public about trade-offs is complex.

– Agencies with legislated performance standards tend to focus on preservation.

– Performance measurements and data systems are more sophisticated where legislation is present.

– States with legislated funding tend to have fewer goals.

– Public agencies have accountability for program delivery whether or not the funding is legislated.

– The asset management process has become more developed and disciplined where legislation is involved as exemplified in the MI DOT model.

9.2.5 Linkages

Asset Management and Strategic Planning are linked in a variety of ways. These include legislation, funding, goals and objectives, performance measures and personnel.

Key Findings:

- Legislation explicitly refers to asset management a "strategic process" in which goals and objectives are set, life cycle costs are analyzed and investment strategies are recommended

- Legislation established annual performance objectives and standards that can be used to evaluate performance and productivity

- Asset management has changed the way that projects are planned in terms of funding

- State long range planning goals related to preservation and maintenance of existing infrastructure provide close linkages between asset management and strategic planning

- Goals related to organizational excellence/customer focus provide a linkage between asset management and strategic planning

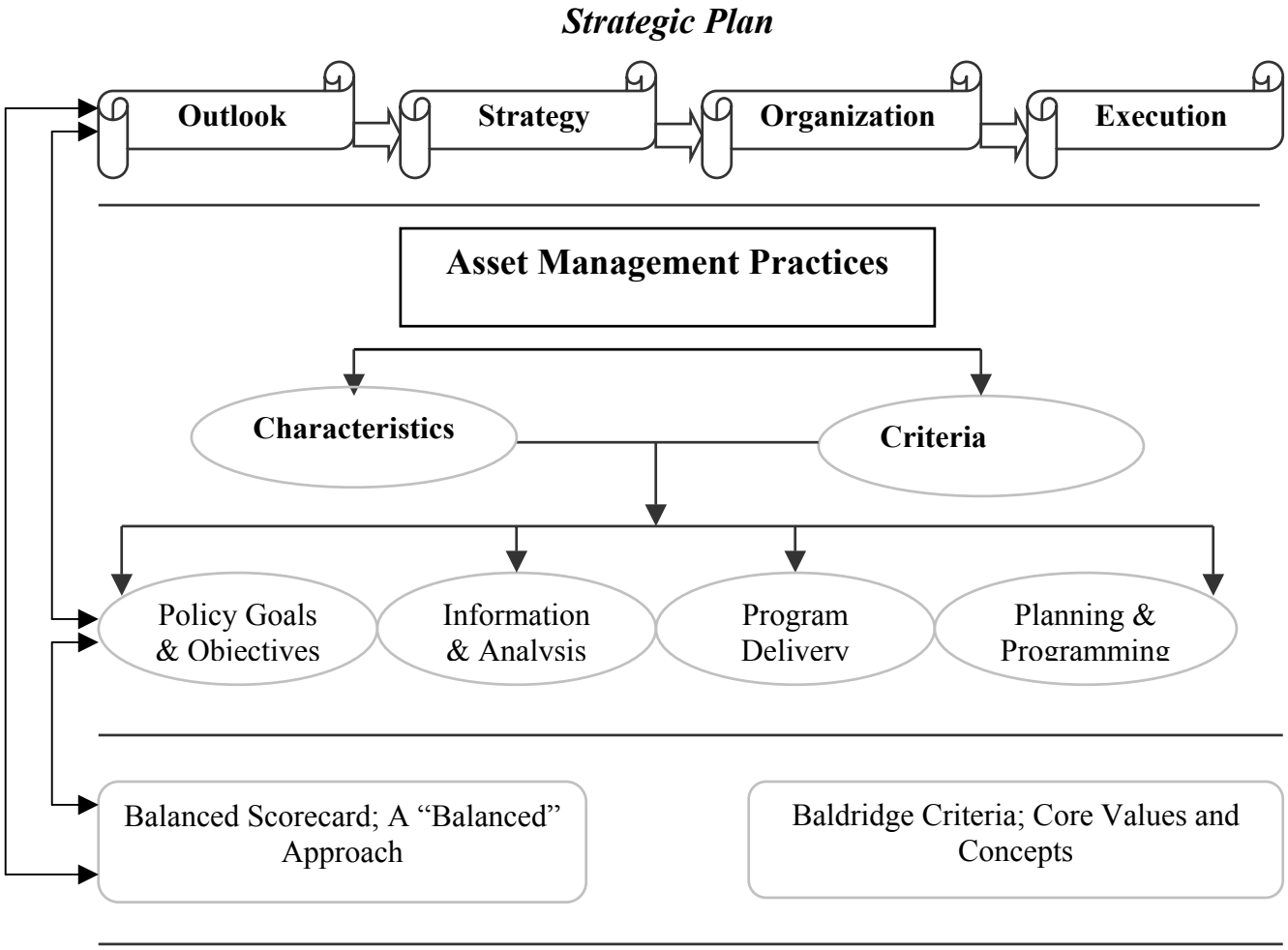
- Primary strategic planning performance measures of bridge condition, customer satisfaction survey, and, pavement conditions are clear links with asset management

- Personnel linkages include leaders who are responsible for a specific objective being directly involved in implementing asset management

9.3 Procedural Elements of the Model Process

In this section of the chapter, the results from the five best practices states are integrated to provide a model process. The model process is a synthesis of the best practices from each of the five states in the sample. While the model process does not represent a particular state, elements of each state process are incorporated into the model process. The model process is illustrated in Figure 9.1.

Figure 9.1. The Model Process



9.3.1 Organizational Placement

Strategic planning for State DOT's should be a visible process where stakeholders, legislators, employees and agency leaders have input. A small group of high-level goals should be developed as a result of this process and handed down through the organization. The organization should then provide tactical action plans to achieve the high level objectives. Some states have developed programs of integrating top down, bottom up developmental goal setting procedures. This process has good results in

aligning strategic goals and plans throughout the agency. This process also often leads to the development of specific departmental tactics, which provide support of the strategic plan in daily activities. In support of the strategic plan, information and measures from balanced scorecards and dashboards maintained throughout the organization help guide strategic plan implementation.

Where should asset management reside within the organization in order to be most effective? Asset management needs to be integrated into all areas of the state DOT and also needs to be recognized as an organizational vision and a long-term planning tool and concept. To achieve this objective, asset management must be visible at the executive level and recognized by the state leadership in all planning documents and programs. To be most effective in the priority setting process for project evaluation, it must also be an element, which is integrated into each modal administration. The concept of asset management needs to be integrated into the agency's culture.

Typically the asset management process is not a stand-alone function within a State DOT. Instead, it is most often simply a management process where specific accountabilities are assigned by asset area. Historically, highway departments have pioneered the development and implementation of asset management programs within their agency. As other groups within the DOT interface with the highway division, implementation of asset management programs in other areas are often adopted. With each successive business cycle, asset management gains momentum and velocity within the organization. Asset management typically resides initially in a centralized function but as the agency gains familiarity with the processes and procedures, more implementation decisions and allocations can be made in field offices.

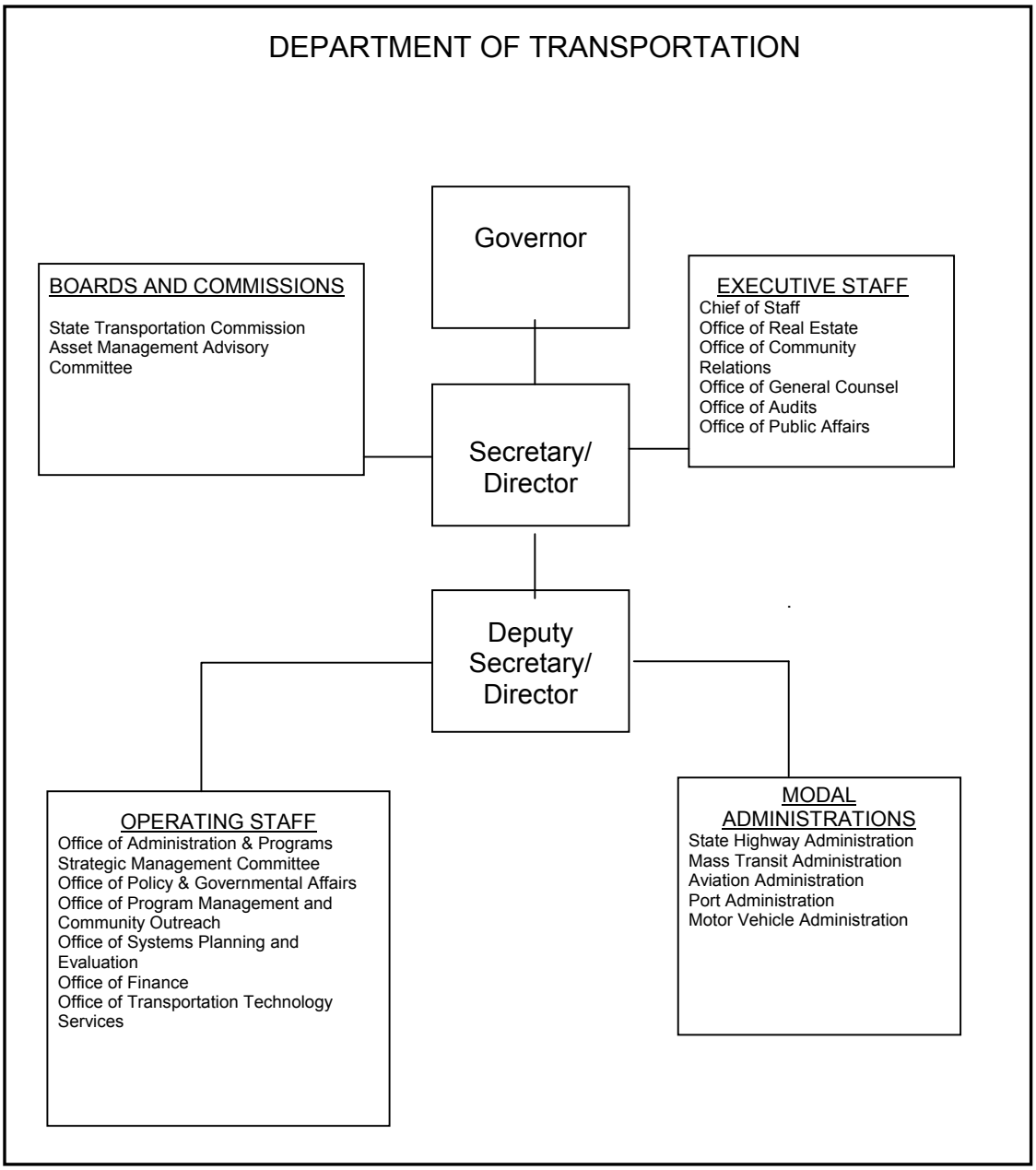
Figure 9.2 represents an organization chart for this conceptual model. The Governor appoints the Secretary or Director of Transportation. The Director or Secretary's office provides overall policy direction and management oversight to the Department of Transportation. Units within the operations area provide support in the areas of finance, procurement, engineering, audits, administrative services, planning and capital programming, human resources, minority business enterprise certification, strategic management and equal opportunity. The operations area also provides centralized computing, computer network infrastructure, and general information technology services for the agency.

Executive staff support is provided for management services, public affairs, general counsel, and policy and government relations; and acts as an oversight arm to ensure that asset management is a visible process and is integrated into all aspects of the organization. Modal administrations help focus each unit on program delivery.

The State Transportation Commission is the policy-making body for all state transportation programs. It is comprised of members appointed by the governor, with advice and consent of the state senate. The Commission is responsible for development and implementation of comprehensive transportation plans for the entire state.

The Asset Management Advisory Committee consists of members appointed by the governor, who advise the DOT in the establishment of goals, benchmarks and performance indicators. Committee representatives should be drawn from transportation professionals from various levels of government. In addition, membership should be drawn from a variety of business, users, and municipal interests. The committee reports to the State Transportation Commission

Figure 9.2. Conceptual Organization Chart



9.3.2 Legislation

Several states have legislated the implementation of asset management principles and linked funding to the asset management program. In some cases, legislation has been implemented to link performance standards to consequences. In other cases, legislation was adopted to ensure specific planning activities were comprehensive and complete. Legislation can be helpful in setting a clear statewide vision and preserving revenues for important asset preservation. Absent legislation, a mandate from the governor or secretary of transportation could be used instead.

The Asset Management Advisory Committee is required by the legislation or mandate to develop procedures and requirements necessary for the administration of the asset management process. The Committee is responsible for reviewing and incorporating asset management into the following areas:

- Program priorities
- Major capital projects
- Major bridge and capital projects for the current year and successive five planning years

The DOT is also required to publish an annual attainment report. The annual attainment report is required by the legislation to use performance indicators to quantify the progress made on the department's goals and objectives. Additionally, the attainment report must include intermediate benchmarks toward the attainment of the agency's long- range goals.

9.4 Strategic Goal Setting

9.4.1 Overview of the Strategic Planning Process

The strategic planning process should be a two-step program. The first step develops a strategic agenda for the overall agency. This is a high-level direction setting activity, which results in the establishment of strategic focus areas used to guide the agency's high-level plan. The second step is devoted to implementing the strategic agenda throughout the organization. This is done through implementation workshops or during department planning meetings and includes personal goal setting activities.

Figure 9.3. Comprehensive Strategic Planning Process

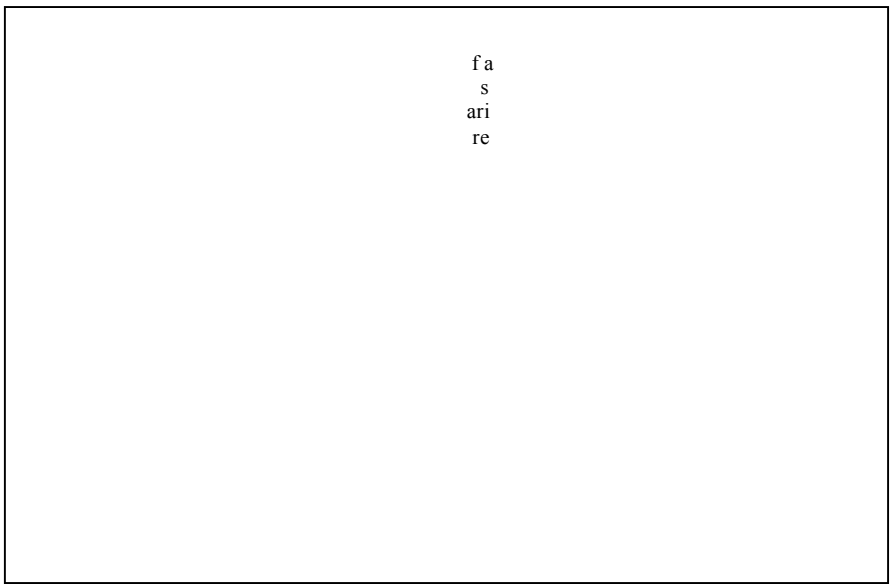


Figure 9. 3 represents the comprehensive strategic planning process. This process is best accomplished by a cross functional strategic planning team. The objective is to inform every employee and develop alignment and support of all functional areas to the strategic plan.

The circular process consists of three components, planning, implementation and evaluation. The planning component involves the development and updating of a department wide strategic agenda for a long-term period, usually four or five years. The strategic agenda is summarized in an enterprise level scorecard that contains the department's highest goals, strategic objectives and performance measures.

The implementation component uses the various state subgroups or regional entities in the development of organizational scorecards with their own strategic objectives and performance measures, which are linked directly to the enterprise level scorecard.

The evaluation component consists of the ongoing monitoring of performance measures at several levels. This process monitors the progress of implementing strategic initiatives and achieving strategic objectives and targets. The performance data provides feedback to organizational units responsible for implementation. On-going adjustment of strategies and tactics is encouraged to meet strategic plan objectives.

9.5 Strategic Policy Goals

A centralized, top-down approach to developing and implementing the strategic plan helps guide the agency direction. The high-level transportation policy goals are presented through the transportation plan and reflect a blending of these perspectives:

- Governor's Vision
- Secretary's and Modal Administrators Priorities
- Statutory Requirements
- System Needs
- Public Desires

Policy goals are developed in the following top-down manner:

- High-level policy goals are developed by the Secretary's Office with both internal and external input.
- These goals are listed and described in the state transportation plan, which is the master policy document. This must be updated at least every three years by law.
- Each modal administration develops a unique business plan with corresponding goals and objectives. These business plans support the policy goals outlined in the state transportation plan.
- Managers and employees within the modal administrations implement the items in their mode's business plan.

Policy goals are developed through a comprehensive series of iterative internal and external processes. Internal processes include:

Direction provided by the Secretary and Modal Administrators for priorities and the future course of the system.

- Modal Planning Directors work on policy issues, formation of goals, objectives, and performance indicators, and secure support of modal administrations.
- The Modal Working Group composed of representatives from each transportation mode work on issues of data capability, tools, statutory requirements and considerations, which impact formation of goals, objectives, and performance measures.
-

External processes include a State legislated "inclusive public participation process" and involve:

- Consultation with the Governor's office
- Gubernatorial appointed Advisory Committee composed of representatives with diverse interests throughout the State; provide advice in the establishment of goals, benchmarks and indicators.

- Focus groups created around specific aspects of transportation and composed of stakeholders from the private and public sectors
- A 1,000-person telephone survey of randomly selected state residents
- Leadership interviews of the state's business groups, transportation civic groups, elected officials, and State agencies
- Meetings with local governments during annual consultation tour meetings
- Posting draft goals on the internet
- Regional public outreach meetings held throughout the state
- Additional outreach efforts to hard to reach communities (non-English speakers and minorities)

9.6 The Strategic Planning Agenda

The strategic planning agenda translates the high level goals into a specific operational plan for the Department. The strategic planning team develops the strategic planning agenda, which is consistent with the following criteria:

1. Grounded in data, particularly with respect to customer expectations
2. Provides for effective implementation as part of the planning process
3. Identifies costs and commits specific funding sources to strategic initiatives
4. Utilizes appropriate performance measures to manage the strategic agenda

The strategic agenda is developed as a result of a five-step process. Given the framework of the strategic focus areas (SFA) of the department, and the high-level goals, technical teams develop strategic objectives. These objectives are then tested along the following development areas of the strategic agenda.

- Leadership Direction: What is the expected impact of the proposed strategic objective on the high-level goal targets for this SFA?
- Customer Expectations: will the proposed objective lead to customer satisfaction?
- Customer Service Capabilities: Does the strategic objective consider the capacity and commitment of the State DOT and its partners?
- Prioritization of Tasks and Strategies: What are the options, and how can the resources be redirected to pursue this proposal?
- Plans and Performance Targets: Does the proposal contain actionable items with specific measures of success?

9.7 Implementation of the Strategic Agenda

The enterprise level strategic objectives and initiatives summarized by the strategic agenda are implemented through business plans, budgets, and expected work results developed at the district and regional unit level and in some cases by central office bureaus and county maintenance units. The implementation consists of the following four steps:

- Organization of scorecards
- Business planning
- Resource allocation
- Performance management

The Strategic Management Committee (SMC) reviews the progress of the departmental strategic objectives on a rotating basis, over a six-month period. This is a high level committee consisting of heads of the major agencies in the department and the modal administrations. The SMC scorecard tracks progress on each objective but not the general goals. The secretary holds area leaders accountable and SMC for achieving department wide results on their strategic objectives (3). Each year, the SMC should conduct a systematic review of the entire enterprise level scorecard to assess needs. The SMC may consider changing the target measures for particular strategic objectives.

The strategic management process is an ongoing planning process. The enterprise level strategic agenda, summarized by the department scorecard is implemented through scorecards and business plans developed by the districts. These organizations review their scorecards on a quarterly basis and manage their measurement. The district business plans containing both the organization scorecards and dashboards, are updated annually and are approved by SMC to ensure alignment with enterprise level strategic objectives.

The tasks of the implementation include:

- An overall rationale for a proposed objective
- Identification of the DOT organizations along with partners and suppliers who will be tasked with implementation
- Optimization analyses
- Opportunities for redirecting resources from existing programs
- A timetable for producing required outputs
- Appropriate measures.

This process involves the Asset Management Advisory Committee and requires support of all agency areas, which may take several months to accomplish.

More directly, since each modal administration creates their own strategic plan, goals and objectives, in support of the state transportation plan, the state plan becomes a reflection of the high-level policy goals of the Department. As a result, the employees in each office are aware of and support the fulfillment of high-level policy goals.

Progress toward achieving policy goals is measured and evaluated as follows.

- The Annual Attainment Report shows progress made on longer-term policy goals. This is updated every year and is fed by scorecards and dashboards.
- The Managing for Results (MFR) document contains measures that describe operational facets of each of the modal administrations. This document is also updated annually and submitted to policymakers.

- The Governor's Budget Office and the General Assembly evaluate these performance measures and provide feedback in the form of budget recommendations or requirements.
- The Secretary of Transportation, in the evaluations of agency heads uses these performance measures.

9.8 Strategic Planning Elements

Eight strategic focus areas have been identified. Table 9.1 lists all the SFA's and their higher-level goals.

Table 9.1. Strategic Focus Areas

Strategic Focus Area	High Level Goal	Strategic Objective
Maintenance First	Smoother roads	Improve ride quality by incorporating smooth road strategies into comprehensive pavement program
	Cost effective highway maintenance investment	Refine winter services best practices to achieve more timely and efficient response
		Use life cycle criteria as a tool for asset management and investment to reduce outstanding maintenance needs
Quality of Life	Balance social and environmental concerns	Improve customers' experiences of our facilities by enhancing beautification efforts and reducing roadside debris
		Develop timely transportation plans, programs & projects that balance social, economic and environmental concerns
	Demonstrate sound environmental practices	Implement strategic environmental management programs that adopt sound practices as our way of doing business
Mobility and Access	Delivery of Transportation products and services	Meet project schedules and complete work within budgeted costs
	Efficient movement of people and goods	Implement congestion management strategies that limit work zone restrictions, address incident management and reduce corridor delays
Customer Focus	Improve customer satisfaction	Implement a department-wide systematic process to continue improve customer satisfaction
	Improve customer access to information	Improve information access by providing quality customer contacts across organization with special attention to driver and vehicle enquiries.
Innovation and Technology	World class process and product performance	Map key processes and improve those with the most strategic impact on business results
		Deliver business results through planned enterprise-focused information technology
Safety	Safer Travel	Implement cost-effective highway safety improvements at targeted high crash loations
		Upgrade safe driving performance through education and enforcement initiatives
	Safer Working Conditions	Implement prevention strategies to reduce employee injury rate
		Implement prevention strategies to reduce vehicle accident rate
Leadership at all levels	Improve leadership capabilities and work environment	Provide employees with tools and expectations to communicate effectively in order to facilitate leadership at all levels
		Develop employee skills and capabilities through structured process of instruction, practice, leadership opportunities
Relationship building	Cultivate effective relationships	Implement a methodology to involve partners and stakeholders more meaningfully in PennDOT activities
		Strengthen the efficiency and effectiveness of transportation grant programs utilizing the methodology for partner and stakeholders

Source: Poister, 2002

9.9 An Asset Management Model

The Asset Management process should be holistic using data-driven decision-making processes, and investment analyses to manage transportation assets. Asset management should encompass the entire process, from programming and planning, to preservation. A solid policy framework, measurable objectives, and continuous performance monitoring characterize the process. The Asset Management concepts that are relied on for decision making, management systems, linkages between condition and performance, and an emphasis on tradeoff and investment analysis are all integral components of daily business. These asset management concepts support the agency's mission to provide safety, mobility, economic prosperity and the preservation of the quality of the environment and communities.

Asset Management concepts should be part of the culture and need to be strongly supported by upper management. Asset Management should transcend planning, financial management and maintenance activities. There should be no single office responsible for Asset Management; rather, it should be an integrated management practice used throughout the DOT, and considered a planning and evaluation process for reporting and interpreting results. A staff advisory position may be a helpful guide to implementation and cross-functional integration.

9.10 Asset Management Goals

The following goals are representative of asset management programs. Specific goals may vary.

- Build, preserve and operate facilities in a cost-effective manner that delivers a level-of-service and overall system performance acceptable to the State.
- Deliver to customers the best value of each dollar spent
- Enhance the credibility and accountability of transportation investment decisions

9.11 Scope of Asset Management

The primary scope of asset management:

- Roadways (Interstate and state)
- Bridges and Other Structures
- Operations Hardware
- Equipment
- Rail facilities

Other assets, sometimes included:

- Local Roads and Streets
- Local Bridges and Culverts

- Traffic Signals
- Railways
- Transit
- Bicycle/Pedestrian
- Intermodal facilities

When setting asset management goals, preservation of the system is prioritized above new capacity or system development. From an asset management perspective, this ensures that the value of the highways and bridges are not depreciated at the expense of new construction. This ensures that the current infrastructure is maintained at current value. The governor usually makes this decision priority.

9.12 Asset Management Support Systems

Asset management support systems provide the ability to identify the condition, analyze usage patterns and determine deficiencies in various types and categories of infrastructure. The process of infusing asset management principles into the functional areas results in a common asset management theme across the entire agency, providing consistent information across all areas, capable of integrating all functional areas with a commonly held and defined system. These asset management support systems are:

Bridge Management System: The PONTIS system of the American Association of State Highway & Transportation Officials, along with specific interface criteria should be organized into three areas: Inventory, Inspection, and Work.

Congestion Management System: This system uses historic, current and forecasted attributes and identifies current and future roadway congestion. The Asset Management Advisory Committee could assess accessibility and mobility conditions in one of four ways: Area/Route Level Analysis, Socioeconomic/Demographic Summaries, Performance Measure Tracking, and Trend Analysis.

Intermodal Management System: This system integrates air, rail, marine and non-motorized transportation assets into the asset management process and is responsible for data management, analysis and deficiency identification for the state's non-highway assets. This system organizes intermodal assets into three groups: Facilities, Corridors, and Services.

Pavement Management System: A system such as PASER should be implemented across the entire system of federal, city and county roadway systems in order to develop a sufficiency rating system of the entire roadway network. A system such as PASER provides consistent data across the entire federal-aid highway network (first phase) and across the entire network, including city and county roads (second phase).

Public Transportation Management System(PTMS): Transit agencies may use their own information systems to access this system. PTMS contains contact information for

the agency, a statewide vehicle inventory, for forecasting needs, and a financial database used for budgeting.

Safety Management System: This system analyzes vehicular crashes and the roads on which they occur. Three areas can be analyzed and can feed asset management information: Road Segment, Intersection, and Interchange.

Road Quality Forecasting System: This system complements the Pavement Management System in which the pavement distress data collected is used to estimate the future condition of a pavement network. The pavement condition measure of Remaining Service Life can be determined by analyzing distress point values for pavement over time, and can be compared against the state's own performance history in this area. Based on the pavement's remaining service life category, three types of fixes can be made: Reconstruction & Rehabilitation, Capital Preventive Maintenance, and Reactive Maintenance.

With these systems in place, based on a firm asset management foundation, Life Cycle Cost Analysis, a Prioritization Process, and Travel Demand Forecasting Models can be derived to improve the overall DOT performance levels.

9.13 Elements of Asset Management

Asset Management should be incorporated into a continuous process that links policies with financial planning, programming and performance monitoring to determine if objectives are met. The performance measurements then result in appropriate decisions regarding funding levels and adjustment of plans and policies to begin a new cycle.

Major elements of an asset management system include:

- Establishment of goals and objectives through development of a strategic plan
- Identification of standards and benchmarks
- Collection of data to develop performance standards and measure progress
- Development of management systems to control processes and optimization
- Implementation of a data driven program design and evaluation process
- Program implementation
- Documentation and monitoring of actions and results

9.14 Asset Management Related Objectives and Performance Measures

The following asset management related policy goals, objectives and performance measures should be adopted:

Policy Goal: Preserve and maintain existing transportation infrastructure and services to realize the asset's useful life.

1. Objective: Increase the percentage of pavements with an acceptable ride quality on the State Highway system by a specific percentage improvement by a given time.

Performance Measure: Percent of pavements rated fair to very good.

2. Objective: Ensure rate of structurally deficient bridges on the National Highway System continues to be below national averages each year.

Performance Measure: Percent of state bridges on National Highway System that are structurally deficient.

3. Objective*:* Ensure no bridges or overpasses are categorized as structurally deficient according to federal standards. Maintain the percentage of bridges and overpasses out of compliance with federal functional standards at 5% or less.

Performance Measure: The percent (and number) of bridges and overpasses categorized as functionally obsolete or structurally deficient by federal standards.

4. Objective: Respond to all critical highway deficiencies identified in the annual inspection report within one year of identification.

Performance Measure: The percent of critical items that were corrected within 1 year of identification.

5. Objective: Increase the percentage of high priority items that were corrected within three years to x% in fiscal year xxxx, and maintain at that level thereafter.

Performance Measure: The percentage of high priority items that were corrected within three years of identification.

6. Objective: Maintain and improve terminal infrastructure (cranes, berths, cargo storage areas) to preserve and enhance capacity through the year xxxx.

Performance Measure: Total number of work orders per year.

Performance Measure: Ratio of preventative maintenance vs. corrective maintenance work orders.

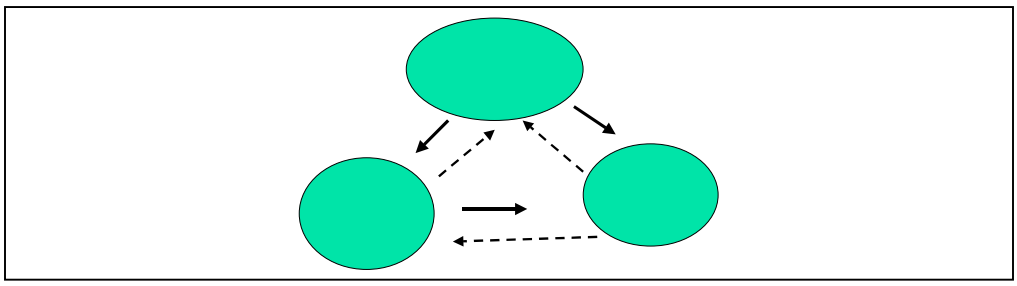
Performance Measure: Percent of covered storage area and break bulk vessel berths that meets industry standards.

9.15 Linkages

In the development of a model for linking asset management to strategic planning, key elements were defined as inputs. It is important to recognize that this process simply identifies best practices by functional area and that there may be institutional barriers in this mix and match approach. Although both asset management and strategic planning have been extensively studied, there has been little analysis of how states have linked the two. Linkage of asset management theories and practices to the strategic planning process and performance measurement area is essential to realize the best possible outcome of a fully implemented asset management program.

Strategic planning is enhanced by the implementation of an asset management program. As measurements and life cycle costs are better-understood and communicated, performance standards and financial cost implications are easier to analyze. Performance measurement, asset management and strategic planning functions have historically operated independently. The dynamic linkage process strengthens functionality and reinforces the business principles as shown in Figure9. 4.

Figure 9.4. Strategic Linkages



It is important to develop linkages in these three areas. Some agencies enlist cross-functional teams in the goal setting process. Some agencies include asset management goals in the strategic plan. Asset management processes and principles drive some performance measures. In the model, each area has impact on the other areas. The process is most efficient when performance measurement and asset management activities are directed by the strategic plan. Asset management activities and performance measurement processes should support the strategic plan with common language, goals and measurements. This is shown more explicitly in Figure 5.

9.15.1 Goals and Policies

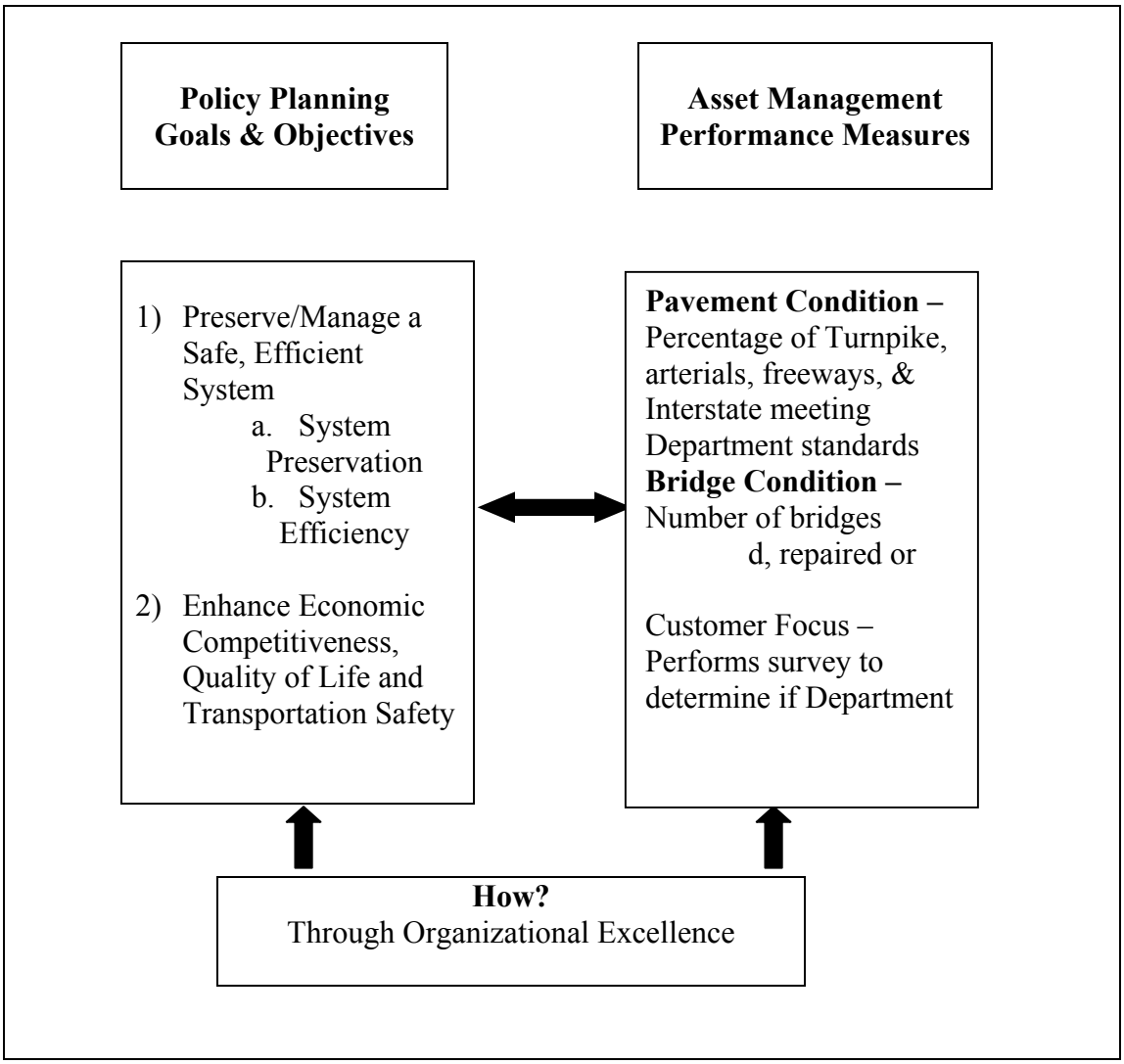
There are several strategic focus areas with related higher-level goals, which have direct linkage with asset management or asset management-like activities. These include:

- **Maintenance First:** The maintenance first policy is reflected through prioritization of funding for all systems and services. Preventive maintenance is the primary element of any asset management process. We can thus say

that asset management has been identified in one of the strategic objectives. The two higher-level goals of the SFA include smoother roads and cost-effective highway maintenance investment. Both of these higher-level goals can be considered an asset management element.

- **Customer Focus:** Customers are considered to be involved in tailoring the services and needs. Customers drive direction and measure department performance. This is an integral element of any asset management system. The two higher-level goals associated with this SFA include: improve customer satisfaction and improve customer access to information

Figure 9.5. Links Between Policy Planning and Asset Management



- **Mobility/Economic Competitiveness:** This goal involves sustaining the long-term growth of the state and improving connections between modes to provide smooth transfers of people and goods.

- **Quality of Life:** Designing transportation systems to support communities' visions, sustaining the human and natural environments, including pedestrian, bicycle, and transit enhancing features, enhancing the availability of transportation services to the transportation disadvantaged and insuring that the decision making process is accessible and fair for all citizens of the state.

9.15.2 Funding and Budget Considerations

Linking asset management activities to the achievement of strategic planning goals in the budget is a critical feature of implementation. Successful processes should include asset management targets in the strategic plan. Linking asset management goals to the budget can preserve a long-term revenue stream for highway maintenance and preservation activities. Asset management targets and goals can also influence long-term financial plans and preserve financial allocations across political administrations. Asset management implementation often leads to a more visible funding and allocation process. Legislators often view an asset management program as a superior planning tool and process, where decisions are data driven and encompass the entire agency's resources.

In the model process, asset management is incorporated into a continuous process that links policies with financial planning, programming and performance monitoring to determine if objectives are met. The performance measurement then results in appropriate decisions regarding funding levels and adjustment of plans and policies to begin a new cycle. The Asset Management Committee should produce an annual budget. Allocations should be based on overall system needs or priorities. Asset management can give the state the tools needed to budget responsibly, and also to negotiate political funding.

9.15.3 Legislation

Legislation should explicitly term asset management a "strategic" process, in which goals and objectives are set, life-cycle costs are analyzed, and investment strategies are recommended. The Asset Management Committee is mandated to propose a strategy to the State Transportation Commission, which in turn produces the State Long Range Plan. The legislation should establish annual performance objectives and standards that can be used evaluate performance and productivity

9.15.4 Alignment of Performance Measures

Asset management activities typically enhance performance measurement activities. The discipline required for cataloging and recording asset value and condition helps agencies develop a standard baseline to evaluate many different types of assets, which have always been managed for results, but often across management systems, which did not interact with one another. A common database for comparing project costs, life cycles, trade off analyses and system wide financial cost implications is often enhanced when implementing an asset management program. The more information commonly held and visible across departmental boundaries, the more collaborative the process can be. This

collaboration often results in stronger linkages between asset management and performance measurement. If all stakeholders share the same data and measurement system, it is much easier to arrive at a consensus based allocation system. The better the data system, the easier it is to link departmental goals and objectives to the planning process.

Performance standards and measures used in the asset management process provide the foundation to gather and assess information. A culture of measurement and analysis usually begins with performance measurements, which are accessible to all, using common valuation terms, and measures, which allow interdepartmental agencies to access and evaluate performance. In many cases asset management implementation begins with the data and measures, which are in place. Over time, performance measures and standards change to reflect the policy plans and objectives, which are defined in the strategic plan. A common database is often the necessary starting point. Progressively, an integrated system emerges to allow cities, counties, highway and bridge departments to share and view each other's performance data.

Performance measurement is an important element in the establishment of an asset management program. State agencies have long collected data to help manage assets and processes. Many have adopted unique ways of collecting and managing data specific to programs and projects, which have been designed around oversight goals, or funding categories. When developing measurements, which specifically feed an asset management program, more strategic measurements are often needed. The establishment of a standard data protocol is often a key element in ensuring enterprise wide data visibility, which will enhance planning, and the decision processes.

9.15.5 Scorecards and Dashboards

At the strategic level, a balanced scorecard may be developed. This scorecard should contain the main strategic focus areas and identify the high-level goals and strategic objectives. Each high-level goal and strategic objective should include one or more measures. If a scorecard is constructed properly it can target performance effectiveness for the next 3 to 5 years. Progress should be measured every six months and reviewed by the individual department accountable for the performance and by the agency leadership and the Asset Management Advisory Committee. Performance results need to be communicated agency wide at regular intervals with consistency.

For many DOT's, the scorecard is an effective tool for managing agency performance yet at the departmental level, the scorecard may not be specific enough to comprehensively manage all program delivery aspects. To meet the tactical needs of the agency a dashboard may be created. A dashboard focuses on core business areas and typically targets effectiveness for a shorter period of time than a scorecard. Some dashboards focus on the next one to three years. Dashboard measures are often aligned to the strategic focus areas, yet are tactical in nature. Ideally the dashboard is linked to the scorecard. Dashboards are often produced on a monthly basis as a performance report to help the

committee in decision-making. At the operational level they are statistical digests, organizational and work unit performance reports.

The dashboards are generally reviewed on a monthly basis. Both dashboards and scorecards should be required in agency business plans. The scorecard has a broader framework generally focusing on department wide strategic agenda, while the dashboard is concerned more with daily-work oriented objectives.

Depending solely on a scorecard is not an effective process of performance measurement. There may be many goals and policies which are important to the department's program delivery, but do not impact the departments performance scorecard. In contrast, the Dashboard tracks a number of measures that pertain to the department's core functions and other important short-term activities. Dashboards are concerned more with current performance while scorecards are more long term oriented.

9.15.6 Sample Scorecard Measures

Table 9.2 shows the metrics or the performance measures related to each higher-level goal. It shows the balanced scorecard measures.

Table 9.2. Scorecard of Measures

Strategic Focus Area	High Level Goal	How success will be Measured	Metric
Maintenance First	Smoother roads	Better ride conditions on major (NHS) highways	International Roughness index (IRI)
	Cost effective highway maintenance investment	Reduction in outstanding maintenance needs	Condition Assessment for highways and Bridges
Quality of Life	Balance social and environmental concerns	Timely decisions based on public and technical input on project managers	Highway project environmental approvals meeting target dates
	Demonstrate sound environmental practices	Attaining world class environmental status	ISO 14001environmental criteria
Mobility and Access	Delivery of Transportation products and services	Honoring commitments on scheduled transportation projects	Dollar value of 12-year program construction contacts initiated
	Efficient movement of people and goods	Reduced Travel Delays	2002-peak period work zone lane restrictions 2005-travel delays on selected corridors
Customer Focus	Improve customer satisfaction	Competitiveness on Malcolm Baldridge criteria for excellence	Baldridge organizational review package scores-customer criteria
	Improve customer access to information	Prompt answers to telephone inquiries	Answer rate of calls to the customer call center
Innovation and Technology	World class process and product performance	Competitiveness on Malcolm Baldridge Criteria for Excellence	Baldridge organizational review package scores-all criteria
Safety	Safer Travel	Fewer fatalities from highway crashes	Number of fatalities per year
	Safer Working Conditions	Fewer work related injuries	Injury rate per 100 employees working in a year
Leadership at all levels	Improve leadership capabilities and work environment	Positive trends in employee feedback on job related factors	Organizational climate survey (OCS)-selected items
Relationship building	Cultivate effective relationships	Effectiveness of partnerships to achieve business results	DOT/Partner business effectiveness survey scores

9.15.6 Sample Dashboard Measures:

- Fatalities
- Permit Cycle time
- Driver Licensing
- Vehicle Registration
- Customer satisfaction
- Bridges
- Program Delivery Goals
- International Roughness Index
- Surface Improvement Maintenance
- Workforce development
- Organizational Performance Reviews
- Link to Scorecard
- Gap closure

9.15.7 Personnel Linkages

Every strategic objective should have an owner or a leader who is responsible for that specific objective. In many of these objectives, the leaders are directly involved in implementing asset management in their division or are part of any specific management system. These direct personnel linkages are helpful in establishing the degree to which asset management is a part of the strategic planning process

9.16 Conclusions

A model process can be helpful in establishing a framework for developing a customized program. Yet each state is unique with a different mix of assets, goal setting processes and leadership structures. This model process was developed using elements of various excellent programs found in Florida, Maryland, Michigan, Montana and Pennsylvania. It is important to note that good results can be achieved regardless of structure. Leadership is a key intangible element, which often bridges the gap where structure and process fall short. To the extent that a process can be developed to illustrate key concepts, measurements and linkages, it may be possible to accelerate program implementation.

The benefits of a formalize asset management program which is closely linked to the strategic plan is improved program performance system wide. A by-product of a good asset management program is improved interdepartmental communication and a broader holistic understanding of the agency goals and objectives by the employees and the public.

CHAPTER 10. GUIDELINES FOR IMPLEMENTATION

10.1 Introduction

Linking strategic plans to asset management within a State Department of Transportation may raise a variety of implementation questions. This chapter is a guideline or a checklist to evaluate the implementation and linkage process. During the data collection stage, and analysis process of this project, several answer responses were common. Agencies report that the benefit of linking asset management to strategic planning include:

1. The elimination of subjective decisions
2. Efficient allocation of resources
3. Spending money wisely, (better budget allocation)
4. Optimization of resources
5. The development of a cohesive organization
6. A uniform strategic focus agreed upon by all

A number of questions should be asked prior to the implementation of an asset management program that is linked to strategic goal setting. These questions, which are helpful when DOT's are evaluating their own linkages between strategic plans and asset management programs, include:

10.2 Planning/Organizing

Organizational and structural questions:

1. Is the Asset Management process managed in a single department or is it an integrated program?

It is important to identify either the department or key players, which will contribute to the implementation and monitoring of the asset management program. This allows for the entire DOT to incorporate the importance of asset management into the structure wide strategic plan and individual department strategic plans.

2. Does the organization have an Asset Management Champion who oversees the implementation of asset management under the guidelines of the strategic plan?

The presence of an asset management guru could add to the acceptance of such a program. This person is the advocate and voice of asset management, which would give the program "legs". It may also ensure that the program permeates through the entire organization and becomes the culture of the DOT.

3. Who is measured and evaluated on the success of asset management?

This question begs the answer of who is ultimately responsible for the success of an asset management program. This could either be the top of the pyramid so to speak, for example, the Secretary of State or DOT. This could also rest on the shoulders of the asset management champion.

4. Is the Strategic Plan internal or external?

a. How is the plan used in practice?

Is this plan used in theory and put on a shelf or is it a living document which is revisited and followed during the decision making process?

b. How does the plan shape internal relationships?

Is there a cohesive movement by all individuals and/or departments to follow the goals and objectives set forth by this document, or is it the responsibility of the individual to ensure the goals and objectives are met?

c. How does the plan shape external relationships?

5. Are goals and objectives aligned between the Strategic Plan and Asset Management documents?

a. Are goals aligned along cross-functional lines?

In other words, are goals and objectives the same for each department? The alignment of all strategic plans would ensure that all departments are working towards the same results.

b. Do goals and objectives have cross-functional targets and measurements?

In other words, are asset management and strategic planning performance measures aligned so that the same targets are being achieved?

10.3 Funding Issues

1. How are funds allocated and what linkage (relationship) exists between funding and asset management?

- Does Asset Management influence your financial allocation?
- Is funding reserved for predetermined projects or do all projects compete for resources?
- How is your financial planning influenced by goals and your asset management strategies?
- Is your asset management program allowing for appropriate funding levels over time?

10.4 Performance Measures

1. Are you using the same performance measures for both your asset management and strategic planning programs?

Cross usage of similar performance measures enables the DOT to better track and accomplish the same goals and objectives. There can be a common evaluation and comparison of figures/results if the same requirements and measurements are used.

This section addresses those DOTs that have no Asset Management program in place.

When you begin the implementation process, the following inquiries must be addressed:

- *How does your strategic plan address your assets?*
- *Do your performance measures link performance goals and objectives to your Strategic Plan?*
- *Look at an established Asset Management guide*

10.5 Staffing

Both the Strategic Planning and Asset Management functions need to have sufficient staffing levels. It is helpful if a higher level of leadership can add focus on the integration of these two disciplines. An example would be the Secretary of State.

1. To what extent do managers have cross-functional responsibilities?

This question helps to identify whether management has a collaborative relationship and whether there is an open communication between departments. This would be necessary for the organizational wide adoption of an asset management program. The target to

obtain the optimization of such a program would have to be universal among the individual departments and an objective of each manager.

In addition, asset management needs to have a centralized presence with tactical implementers. Field based personnel are usually most effective when they can use the same scorecard or measurements across agency objectives.

10.6 Controlling:

1. What oversight is in place?

- What role does legislation play?
- Absent legislation or mandates, what drives asset management and strategic plan linkages?
- To what degree is legislation present to support the planning and allocation process?

It is crucial to the successful implementation and performance of an asset management program to have a certain amount of mandatory legislation in place in order to maintain the importance of the asset management practices. The establishment of legislation may also provide for the creation of the asset management champion position. This person creates the urgency to move forward with the asset management practices and measures.

7. Does funding follow performance?

- Implementation of an Asset Management framework is helpful for keeping track of an asset inventory.
- Within this framework, the DOT would also have to justify the need for funding the particular project. For example, if you want a specific bridge repaired, how would it impact your performance measurements and does it follow your strategic planning goals and objectives?

10.7 Conclusions

Implementing asset management so that it is linked to strategic goal setting requires a multifaceted, coordinated effort. This effort should focus on planning, organizing, funding, performance measures and staffing. Only through such a structured approach will a strong linkage between asset management and strategic goal setting be achieved.

References

1. AASHTO, FHWA, *21st Century Asset Management*, 1999.
2. AASHTO, FHWA, *Advancing the State of the Art into the 21st Century through Public-Private Dialogue*, 1997.
3. AASHTO, FHWA, *Asset Management Peer Exchange – Using Past Experiences to Shape Future Practice*, 2000.
4. Cambridge Systematics, *Transportation Asset Management Guide, Task I – Synthesis of Asset Management Practice,* March 2002.
5. Derocher, Robert J, *Information Technology Comes of Age – Finally*, Progressive Railroads, May 1998.
6. Maryland Department of Transportation, *2002 Maryland Transportation Plan*, 2002.
7. Maryland Department of Transportation, *Comprehensive Annual Financial Report For the Fiscal Year Ended June 30, 2002*, Prepared by The Secretary's Office – Office of Finance.
8. Maryland Department of Transportation, "Description of Modes," internal document, copied March 20, 2003.
9. Maryland Department of Transportation, "Fiscal 2004 Budget Overview," internal document, copied February 4, 2003.
10. Maryland Department of Transportation, *Managing for Results FY2004 Final Submission*, internal document, 2003.
11. Maryland Department of Transportation, "Program Description – The Secretary's Office," internal document, copied February 4, 2003.
12. McNeil, S., Tischer, M. L., DeBlasio, A. J., *Asset Management: What is the Fuss?* Transportation Research Record 1729, TRB, 2000.
13. Michigan Department of Transportation, "5 Year Road & Bridge Program, Vol. IV - 2002 to 2006," May 2002.
14. Michigan Department of Transportation, "Asset Management...where MDOT and technology merge."
15. Michigan Department of Transportation, "State Long Range Plan 2000-2025 - Mobility is Security," August 2002.
16. Montana Department of Transportation, *TRANPLAN 21*, 2002.
17. Pagano, Anthony, Interview with Bruce Gartner, Ed Strocko, and John Contestibile, March 21, 2003.
18. Pagano, Anthony, Interview with Joseph Miller, March 21, 2003.
19. Pagano, Anthony, Interview with Peter Stephanos, Carl Vogel, Russel Yurek, and Raja Veeramachaneni, March 20, 2003.
20. Pagano, Anthony, Interview with Thomas Hicks and Mike Zezeski, March 21, 2003.
21. Pennsylvania Department of Transportation, "Annual Report, 2002," Harrisburg, PA, 2002.
22. Pennsylvania Department of Transportation, "Asset Management Concept Plan," Harrisburg, PA, Cambridge Systematics, March 2001.

23. Poister, T.H, "PennDOT's Strategic Management Process: A Review and Critique," University Park, PA, Pennsylvania State University, Pennsylvania Transportation Institute, Dec 2002.
24. Poister, T.H. "Transforming PennDOT: A case study in the continuing drive for excellence," Alpharetta, GA, Theodore Poister Associates, July 2002.
25. Poister T.H., Van Slyke D.M., *Managing Change in State Departments of Transportation,* NCHRP Web Document 39, 2001.
26. Stephanos, Peter, Paul Dorsey, and Adel Hedfi, *Maryland SHA's Project Selection Process*, internal document, 2003.
27. Transportation Asset Management Council, Michigan Department of Transportation, "Asset Management - Work Program (draft)," December 2002.
28. USDOT, FHWA, Asset Management Primer, 1999.
29. USDOT, "Performance Management in the USA: Pennsylvania Department of Transportation (PennDOT): A case study," Pennsylvania Department of Transportation, 2002.
30. ftp://ftp.mdt.state.mt.us/planning/tranplanp3.pdf, Montana Department of Transportation, Performance Planning Process, A Tool for Making Transportation Investment Decisions (2000), Accessed May 20, 2003.
31. http://ceic.commerce.state.mt.us/StateQuickFacts.html, Montana Department of Commerce Census & Economic Information Center, Accessed April 23, 2003.
32. http://factfinder.census.gov/servlet/BasicFactsServlet?_lang=en, American FactFinder – U.S. Census Bureau, Census 2000, Accessed May 22, 2003.
33. http://www.mgs.md.gov/esic/brochures/mdgeology.html, Maryland Geological Survey, "A Brief Description of the Geology of Maryland," (January 2002), Accessed May 24, 2003.
34. http://www.michigan.gov/mdot, Michigan Department of Transportation, Accessed May 29, 2003.
35. http://mlis.state.md.us/#stat, Maryland General Assembly, Senate Bill 731, Accessed May 24, 2003.
36. http://www.myflorida.com, The State of Florida, Accessed May 15, 2003.
37. http://www.princegeorges.com/maryland_map.htm, Prince Georges County Maryland, Maryland Map (1994), Accessed May 24, 2003.

Appendix A. Sample Questionnaires

A.1. Asset Management Questionnaire

Name / Title: _____

Organization: _____

Date & Time: _____

I. Asset Overview

1. What are the functions your department is responsible for?

2. Which of the following assets does your organization maintain? Please describe the magnitude of the assets in terms of number, length and coverage.

a) Highways, Streets and Bridges
b) Water Distribution Systems
c) Shipping containers
d) Railroad right-of-way
e) Railcars and other related assets
f) Airports
g) Gas generation and distribution
h) Electrical generation and distribution
i) Telephone services
j) Other (specify)
k) Traffic monitoring system

3. What is the total value of the assets/ category wise? How do you value your assets?

II. Asset Management

4. Please describe your asset management process?

5. Which of the following asset management elements is part of your planning/operations process?

Element	Yes/No	Planning Process	Management Concept	Part of Computer Based Program
o)System Preservation				
p)Multimodal Tradeoffs				
q)Performance Programming				
r)Maintenance/replacement tradeoffs				
s)Resource allocation				
t)Decision support using PMS/BMS				
u)Maintenance management systems				
v)Forecasting/tracking tools				
w)Life cycle cost analysis				
x)Construction				
y)Priority Selection Process				
z)Budgeting				
aa)Workplace Improvement				
bb)Stakeholder Involvement				

6. What has been the goal of implementing an asset management system in your agency?

7. How do you set asset management goals?

8. Please describe the process of implementing an asset management plan in your agency?

9. Which of the following types of management systems is used by your agency?
   a. Pavement Management System
   b. Bridge Management System
   c. Safety Management System
   d. Congestion Management System
   e. Intermodal Management System
   f. Public Transportation Management System

10. How are conflicting priorities or trade offs in asset management resolved?

III. Performance Measurement

11. What performance data do you collect?

12. How do you set performance measurement goals and priorities?

13. How is performance measurement linked to the asset management process?

14. How is performance measurement linked to the strategic plan?

15. What is the type of performance data you collect? What metrics do you use for measuring performance of the following?
    a) Highways, Streets and Bridges
    b) Water Distribution Systems
    c) Shipping containers
    d) Railroad right-of-way
    e) Railcars and other related assets
    f) Airports
    g) Gas generation and distribution
    h) Electrical generation and distribution
    i) Telephone services
    j) Other (specify)

IV. Asset Management and Strategic Planning

16. What are the links between asset management your strategic planning process?

17. What partnerships have been planned or developed to link goals to the strategic plan?
    a. Internal
    b. External

18. How long has asset management plan been part of the strategic plan?

19. Are any of the strategic planning goals directly linked to asset management?

A.2. High Level Questionnaire

Name / Title: _____

Organization: _____

Date & Time: _____

1. What are the primary responsibilities of your agency?

2. Which of the following assets does your organization maintain? Please describe the magnitude of the assets in terms of number, length and coverage.

    a. Highways, Streets and Bridges
    b. Water Distribution Systems
    c. Shipping containers
    d. Railroad right-of-way
    e. Railcars and other related assets
    f. Airports
    g. Gas generation and distribution
    h. Electrical generation and distribution
    i. Telephone services
    j. Other (specify)

3. How are policy goals developed within your organization?

4. How are objectives developed within your organization?

5. How are policies and goals measured or evaluated?

6. How are goals communicated within the organization?

7. How are conflicting priorities resolved?

8. How are asset management principles and programs addressed in your policy goals and objectives?

9. What are the links?

10. Is there a link between your strategic planning and asset management?

11. What do you feel has been the most positive outcome/benefit from linking asset management to strategic planning?

12. What is the biggest barrier in linking asset management to strategic planning?

13. How did you overcome those barriers?

14. How effective is the current process and where are the areas for greatest improvement?

15. What partnerships have been formed as a result of linking AM and PM to the Strategic Plan?

    a. Internal:

    b. External:

16. How have the organizations formal training processes and goal setting practices changed as a result of this integration?

17. Do you involve vendors in your asset management process?

18. Do vendors have a role in data collection and distribution?

19. Do vendors have a role in strategic planning process?

20. How are performance measures integrated into your planning process?

21. Was legislation used to gain support or push forward the integration of asset management and strategic planning? If so, can you provide details?

22. What has your agency learned in the process?

23. How has the strategic planning process changed?

A.3. Implementation Questionnaire

1. Please describe your role within the agency.

2. Which of the following assets does your organization maintain? Please describe the magnitude of the assets in terms of number, length and coverage.

    a) Highways, Streets and Bridges
    b) Water Distribution Systems
    c) Shipping containers
    d) Railroad right-of-way
    e) Railcars and other related assets
    f) Airports
    g) Gas generation and distribution
    h) Electrical generation and distribution
    i) Telephone services
    j) Other (specify)

3. How is what you do linked to the strategic plan?

4. What input do you have the strategic planning process?

5. How does the strategic plan impact your day-to-day activities?

6. How do you manage conflicting priorities?

7. What are the biggest barriers to linking the strategic plan to daily activities?

8. Has the asset management concept changed the way you do your job?

9. What are the inputs to performance measurement?

10. Do you collect, calculate or derive performance related data? If yes, what are you using it for?

11. What are your performance measurement goals?

12. Where does the data come from and how do you collect it?

13. How is performance measurement driven by the strategic plan?

14. How does performance measurement support the strategic plan?

15. What are three biggest barriers to linking performance measurement to the strategic plan?

    i. Technological
    ii. Organizational
    iii. Operational
    iv. Political

16. What metrics do you use and what do you use them for?

A.4. Strategic Planning Questionnaire

Name / Title: _____

Organization: _____

Date & Time: _____

1. Please describe your strategic planning process
    a. What are the inputs to the plan?
    b. Who owns the development of the plan?
    c. What are the goals in your strategic plan?
    d. Who owns the implementation of the plan?
    e. How is the plan evaluated?
    f. How do you incorporate Asset Management in the plan?
    g. How is performance measurement integrated into the plan?
    h. What are the three biggest barriers to the planning process?

2. How do you incorporate the various agency plans into the strategic plan?

3. What partnerships have been planned or developed to link goals to the strategic plan?

    1) Internal:

    2) External:

4. How have traditional asset management programs (below) been modified or changed to feed the strategic planning process?
    a. Transportation Management System (TMS)
    b. Bridge Management System
    c. Congestion Management System
    d. Intermodal Management System
    e. Pavement Management System
    f. Public Transportation Management System
    g. Safety Management System

5. How are tradeoffs between priorities reconciled?

6. We currently have the (year) version of your (what kind) plan(s). Is there a more recent version? Are there any other plans that we do not have in our possession? If so, can we obtain a copy of it/them?

7. Are there currently any strategic planning processes that you are implementing that are not included in any of the aforementioned plans? If so, what are they?

8. How does the Strategic Plan influence asset management?

9. How does the Strategic Plan drive performance measurement?

10. How is performance program delivery linked to the strategic plan?

11. How has this process changed over time? How often?

12. What are the biggest barriers to linking performance measurements to the strategic plan?

13. Has there been a change in the strategic planning management process? What, if anything, precipitated a change in strategic plan development?

14. How is the field organization involved in the planning and implementation of the strategic plan?

15. Have we missed any important aspect of asset management, which we need to be included?

Appendix B. Florida State Profile

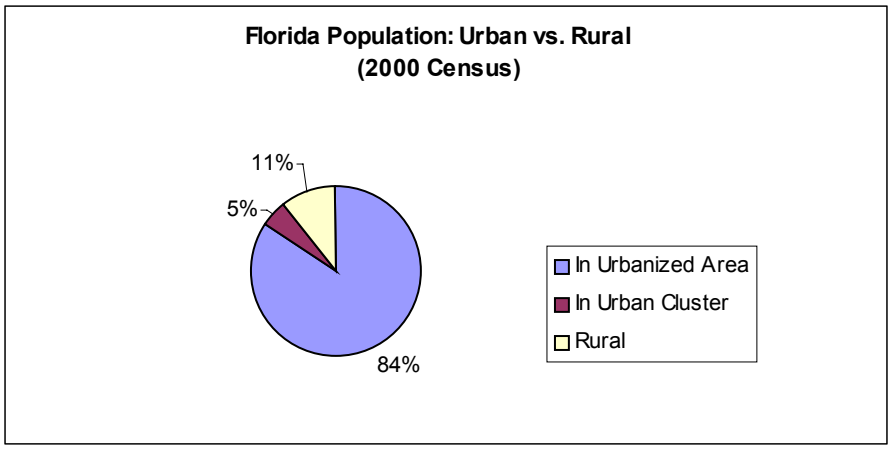
State Profile

Population Demographics

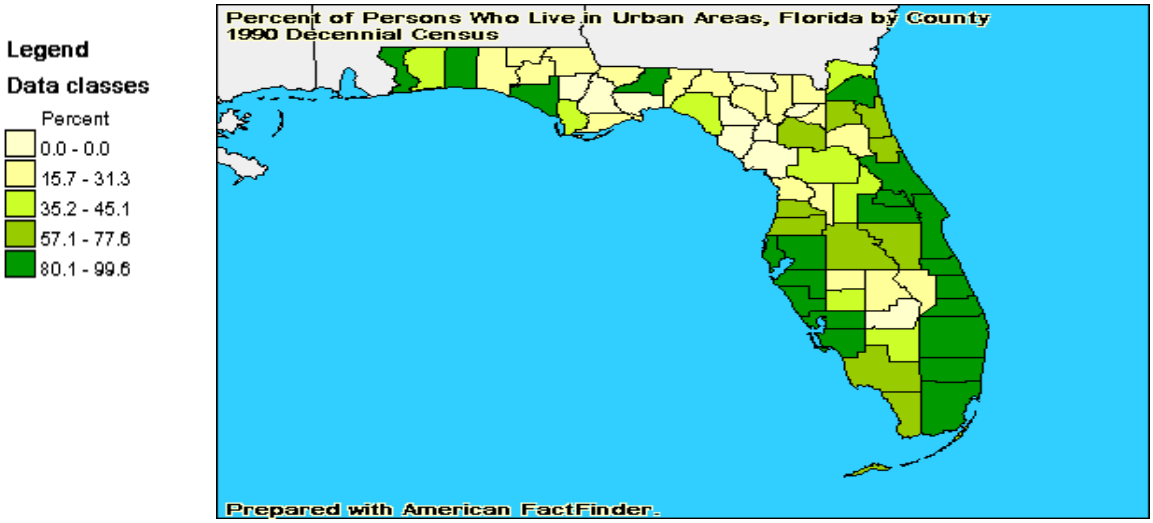
Structure of government: Governor and independent cabinet consisting of secretary of state, attorney general, comptroller, treasurer, commissioner of agriculture, and commissioner of education

Florida has a total population of 15,982,378, which ranks as the fourth largest population in the United States. We find that 84% of the population is primarily found in urban areas. This is illustrated in Figure B1. This population can be found mainly along the southern coastline stretching from Lake Okeechobee to the southern tip of Florida, and within a 50-mile radius of. Accordingly, these areas are considered two of the 19 Metropolitan Statistical Areas (MSA) that Florida embodies.

FigureB1. Florida Urban Population vs. Rural Population



FigureB2. Percent of Persons who live in Urban Areas, Florida



Interestingly, data is provided on the transportation habits of Florida's residents. This is illustrated in Table B3.

Table B3. Florida's Population's Transportation Habits

State	**Percent using Car-pools**	**Percent using Public transportation**	**Mean travel time to work (Minutes)**	**Percent worked outside county of residence**
Florida	12.9	1.9	26.2	18.1

*Workers 16 years and over

Geographic Characteristics

Below are some general facts about Florida's geography.

- Total area: 58,560 square miles
- Total land area: 54,252 square miles
- Total water area: 4,308 square miles
- Rank among states in total area: 22nd
- Length north and south: 447 miles (St. Mary's River to Key West)
- Width east and west: 361 miles (at its widest point)
- Highest natural point: 345 feet near Lakewood in northeast Walton County
- Coastline: 1,197 statute miles
- Largest lake: Lake Okeechobee, 700 square miles
- Largest county: Palm Beach, 2,578 square miles
- Smallest county: Union, 245 square miles
- Number of lakes (greater than 10 acres): about 7,700
- Number of islands (greater than 10 acres): about 4,500

Florida is generally a flat state with many bodies of water. The state's length is twice that of its width, which means that most of its highway miles run north and south. The state has an equal amount of urban and rural areas, however most of the urban areas lie on the coastline of the state. There are a few exceptions around the state capital and in the center of the state.

Appendix C. Maryland State Profile

State Profile

General Facts

Located south of Pennsylvania, west of Delaware, north of Virginia, and east of West Virginia, Maryland is a relatively small eastern seaboard state. Some basic facts are listed below:

- Land area 9,774 sq mi
- Total Area 12,407 sq mi Rank: 42
- Total Population (2000) 5,296,486 Rank: 19
- Urban Population (2000) 4,558,668 86%
- Rural Population (2000) 737,818 14%
- Largest City Baltimore
- Primary Metropolitan Statistical Areas
    - Baltimore, MD
    - Hagerstown, MD
    - Washington, DC
    - Wilmington, Newark
- Capital Annapolis
- Highest Point Backbone Mt. Elevation: 3,360 ft.
- Lowest Point Sea Level Elevation: 0 ft
- Nickname Old Line State
- Median Household Income $51,695 Rank: 1 (2000)

Economy

With the highest average household income of any state, Maryland has a strong economy. A quick list of Maryland's primary non-governmental economic sectors is included below.

Primary agricultural products from Maryland include:

- Seafood
    - Oysters
    - Crabs
    - Clams
    - Fin fish
- Greenhouse and nursery products
- Chickens
- Dairy Products
- Soybeans

Primary mineral products from Maryland include:

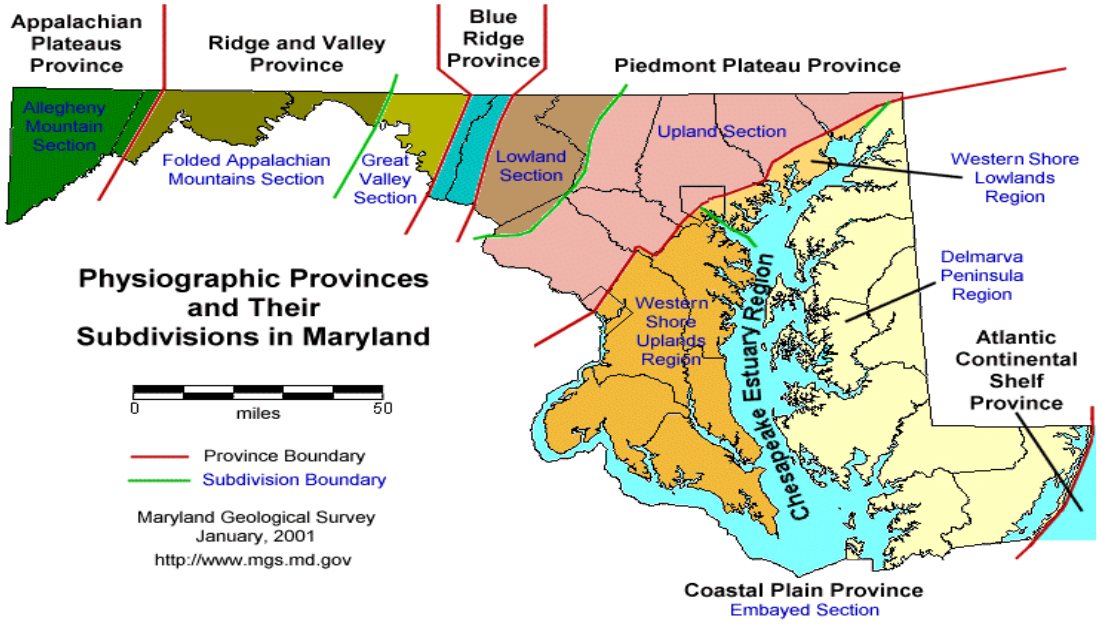
- Stone

- Coal
- Sand
- Gravel
- Cement

Geography

"Maryland is part of six distinct physiographic provinces: (1) the Atlantic Continental Shelf Province, (2) the Coastal Plain Province, (3) the Piedmont Plateau Province, (4) the Blue Ridge Province, (5) the Ridge and Valley Province, and (6) the Appalachian Plateaus Provinces. These extend in belts of varying width along the eastern edge of the North American continent from Newfoundland to the Gulf of Mexico." (Maryland Geological Survey). See Figure C1 below.

Figure C1. Maryland Geography (Maryland Geological Survey)



So for being such a small state, Maryland has a variety of landscape features that impact its transportation system. People within MDOT often refer to Maryland as a microcosm of the United States because of this diversity of environments as well as the existence of significant urban as well as rural areas.

- Clay

Maryland's primary manufacturing industries are:

- Food products
- Chemicals
- Computer and electronic products
- Transportation equipment
- Primary metals

Appendix D. Michigan State Profile

State Profile

Michigan is located in the northern Midwest of the United States, bordering Ohio, Indiana, Illinois, Minnesota and Canada. Michigan has four international border crossings: the Detroit-Windsor Tunnel, the Ambassador Bridge, the Blue Water Bridge, and the International Bridge. Michigan is surrounded by four of the five Great Lakes: Lake Michigan, Lake Superior, Lake Huron and Lake Erie. The state capital is Lansing.

Michigan totals 96,716 square miles, consisting of 56,804 square miles of land area and 39,912 square miles of water area. Michigan is divided into 83 counties and split into two landmasses: the Lower Peninsula and the Upper Peninsula.

Michigan has a relatively flat terrain, its highest point being an elevation of 1,979 feet at Mount Arvon, Baraga County. The state's lowest point is 571 feet at Lake Erie, Monroe County.

Michigan's total population (as measured in Census 2000) is just under 10,000,000, making it the eighth most populous state in the country. Of this population, almost 75 percent is urban, with approximately 6.6 million people living in Urbanized Areas and 840,000 living in Urban Clusters. Approximately 2.5 million of Michigan's population is considered rural. Michigan averages 175 persons per square mile, with population being most highly concentrated in the southeastern portion of the Lower Peninsula.

Michigan has six Metropolitan Statistical Areas (MSA's):

- Benton Harbor
- Grand Rapids – Muskegon – Holland
- Jackson
- Kalamazoo – Battle Creek
- Lansing – East Lansing
- Saginaw – Bay City – Midland

Michigan has one Consolidated Metropolitan Statistical Area (CMSA), consisting of three Primary Metropolitan Statistical Areas (PMSA's):

- Detroit – Ann Arbor – Flint

Michigan has 20 Urbanized Areas and 102 Urban Clusters. The state is most rural in the northern half of the Lower Peninsula and in the Upper Peninsula.

Of the working population 16 years and over in Michigan, 9.7 percent carpool and 1.3 percent use public transportation. The mean travel time to work is approximately 24 minutes and almost 30 percent of workers are employed outside their county of residence. (Census 2000)

In 2000, roadway usage in Michigan totaled 97.8 billion annual vehicle miles traveled (AVMT), a 17 percent increase from 1990.

Appendix E. Montana State Profile

State Profile

Montana is a very rural state. Montana has a population of slightly over 900,000 with around 54% living in urbanized areas and urban clusters. With a land area of 145,552 square miles, the density is 6.2 persons per square mile. Less than 1% use public transportation to travel to work and the mean travel time to work is 17.7 minutes (US Census, 2000). There are three urbanized areas – Billings, Great Falls and Missoula and another 28 urban clusters.

There are 56 counties in Montana. The state capital is Helena. Montana is bordered by Canada, Idaho, Wyoming, North Dakota and South Dakota.

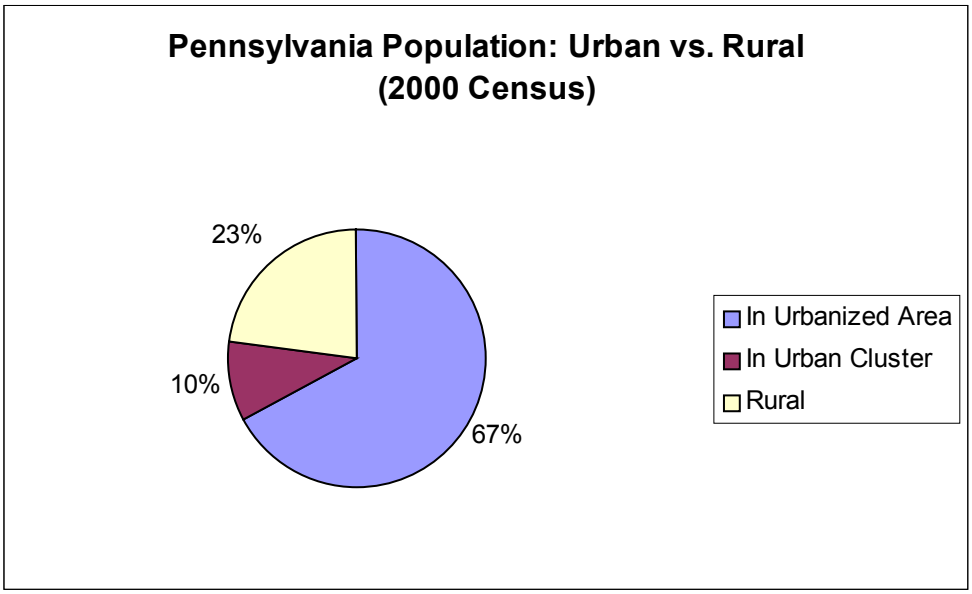
Appendix F. Pennsylvania State Profile

State Profile

Population Characteristics

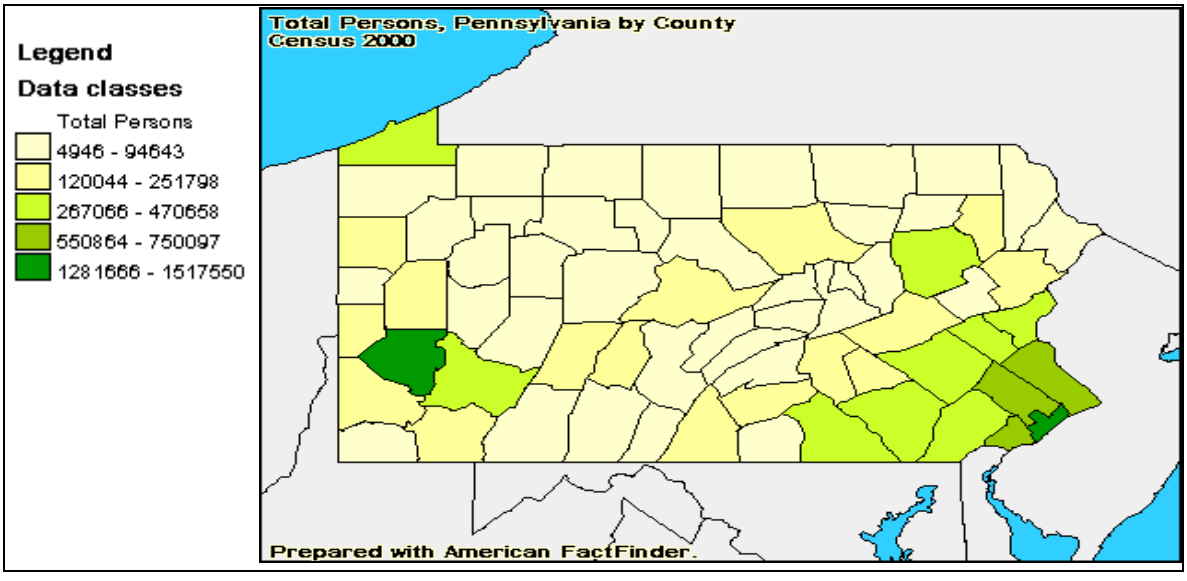
Pennsylvania is the sixth highest populated state with a total population of 12,281,284. Population density, in terms of persons per square mile, is approximately 275. People in Pennsylvania primarily live in an urban area, as seen from

Figure F1. Population: Urban vs. Rural



The following map shows the distribution of population in the state, by county.

Figure F2. Total Persons, Pennsylvania by County



Data on the population's transportation habits can be found in F1.

Table F1. Pennsylvania's Population's Transportation Habits

State	Percent using Carpools	Percent using Public transportation	Mean travel time to work (Min)	Percent worked outside county of residence
Pennsylvania	10.4	5.2	25.2	27.6

Geographic/General Characteristics

The following table gives a list of the number of counties, urban clusters, urbanized areas and Metropolitan Statistical Areas (MSA's) in the state of Pennsylvania.

Table F2. Geographic Characteristics

STATE	Number of MSA's	Number of UA's	Number of UC's	Number of Counties
Pennsylvania	13	22	120	67

Listed below are some other facts on the state of Pennsylvania:

- Land Area: 44,817 square miles
- Water Area: 1,239 square miles
- Lowest geographic point: Sea level (Delaware River)
- Highest geographic point: 3,213 feet (Somerset County)
- State Highways (2001): 43,696 miles
- Railways: 5100 miles
- Registered vehicles: 10,085,392
- 136 public-use airports
- 6 international airports
- Port of Pittsburgh is the largest inland port in the U.S.
  Pennsylvania turnpike was the first high speed, multi-line highway in the nation