National Cooperative Highway Research Program

NCHRP Synthesis 238

Performance Measurement in State Departments of Transportation

A Synthesis of Highway Practice

Transportation Research Board
National Research Council

National Cooperative Highway Research Program

Synthesis of Highway Practice 238

Performance Measurement in State Departments of Transportation

THEODORE H. POISTER, Ph.D.
Georgia State University

Topic Panel

THOMAS BOEHM, *New York State Department of Transportation*
ALLEN W. BURDEN, *Federal Lands Highway Office*
BARBARA T. HARDER, *B.T. Harder, Inc.*
ROBERT C. JOHNS, *University of Minnesota*
JOSEPH ROBINSON, JR., *Pennsylvania Department of Transportation*
SUZANNE H. SALE, *Arizona Department of Transportation*
KATHLEEN STEIN-HUDSON, *Howard/Stein-Hudson Associates*
WILLIAM J. QUINN, *Consultant*
JON M. WILLIAMS, *Transportation Research Board*

Transportation Research Board
National Research Council

Research Sponsored by the American Association of State Highway and Transportation Officials in Cooperation with the Federal Highway Administration

NATIONAL ACADEMY PRESS
Washington, D.C. 1997

Subject Area
Planning and Administration

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

In recognition of these needs, the highway administrators of the American Association of State Highway and Transportation Officials initiated in 1962 an objective national highway research program employing modern scientific techniques. This program is supported on a continuing basis by funds from participating member states of the Association and it receives the full cooperation and support of the Federal Highway Administration, United States Department of Transportation.

The Transportation Research Board of the National Research Council was requested by the Association to administer the research program because of the Board's recognized objectivity and understanding of modern research practices. The Board is uniquely suited for this purpose as it maintains an extensive committee structure from which authorities on any highway transportation subject may be drawn; it possesses avenues of communication and cooperation with federal, state, and local governmental agencies, universities, and industry; its relationship to the National Research Council is an insurance of objectivity; it maintains a full-time research correlation staff of specialists in highway transportation matters to bring the findings of research directly to those who are in a position to use them.

The program is developed on the basis of research needs identified by chief administrators of the highway and transportation departments and by committees of AASHTO. Each year, specific areas of research needs to be included in the program are proposed to the National Research Council and the Board by the American Association of State Highway and Transportation Officials. Research projects to fulfill these needs are defined by the Board, and qualified research agencies are selected from those that have submitted proposals. Administration and surveillance of research contracts are the responsibilities of the National Research Council and the Transportation Research Board.

The needs for highway research are many, and the National Cooperative Highway Research Program can make significant contributions to the solution of highway transportation problems of mutual concern to many responsible groups. The program, however, is intended to complement rather than to substitute for or duplicate other highway research programs.

NOTE: The Transportation Research Board, the National Research Council, the Federal Highway Administration, the American Association of State Highway and Transportation Officials, and the individual states participating in the National Cooperative Highway Research Program do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of this report.

NCHRP SYNTHESIS 238

Project 20-5 FY 1992 (Topic 25-15)
ISSN 0547-5570
ISBN 0-309-6012-5
Library of Congress Catalog Card No. 97-066617

Price $20.00

NOTICE

The project that is the subject of this report was a part of the National Cooperative Highway Research Program conducted by the Transportation Research Board with the approval of the Governing Board of the National Research Council. Such approval reflects the Governing Board's judgment that the program concerned is of national importance and appropriate with respect to both the purposes and resources of the National Research Council.

The members of the technical committee selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and, while they have been accepted as appropriate by the technical committee, they are not necessarily those of the Transportation Research Board, the National Research Council, the American Association of State Highway and Transportation Officials, or the Federal Highway Administration of the U.S. Department of Transportation.

Each report is reviewed and accepted for publication by the technical committee according to procedures established and monitored by the Transportation Research Board Executive Committee and the Governing Board of the National Research Council.

The National Research Council was established by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and of advising the Federal Government. The Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in the conduct of their services to the government, the public, and the scientific and engineering communities. It is administered jointly by both Academies and the Institute of Medicine. The National Academy of Engineering and the Institute of Medicine were established in 1964 and 1970, respectively, under the charter of the National Academy of Sciences.

The Transportation Research Board evolved in 1974 from the Highway Research Board, which was established in 1920. The TRB incorporates all former HRB activities and also performs additional functions under a broader scope involving all modes of transportation and the interactions of transportation with society.

Published reports of the

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

are available from:

Transportation Research Board
National Research Council
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

Printed in the United States of America

PREFACE

A vast storehouse of information exists on nearly every subject of concern to highway administrators and engineers. Much of this information has resulted from both research and the successful application of solutions to the problems faced by practitioners in their daily work. Because previously there has been no systematic means for compiling such useful information and making it available to the entire community, the American Association of State Highway and Transportation Officials has, through the mechanism of the National Cooperative Highway Research Program, authorized the Transportation Research Board to undertake a continuing project to search out and synthesize useful knowledge from all available sources and to prepare documented reports on current practices in the subject areas of concern.

This synthesis series reports on various practices, making specific recommendations where appropriate but without the detailed directions usually found in handbooks or design manuals. Nonetheless, these documents can serve similar purposes, for each is a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems. The extent to which these reports are useful will be tempered by the user's knowledge and experience in the particular problem area.

FOREWORD

By Staff
Transportation
Research Board

This synthesis will be of interest to state transportation agency administrators, division and functional area managers, program managers, financial and human resources personnel, and others, including state legislators, who are concerned with implementing innovative programs in state departments of transportation (DOTs). It presents information on the degree to which state departments of transportation have developed and implemented performance measures in all transport modes for which they are responsible.

Administrators, engineers, and researchers are continually faced with highway problems on which much information exists, either in the form of reports or in terms of undocumented experience and practice. Unfortunately, this information often is scattered and unevaluated and, as a consequence, in seeking solutions, full information on what has been learned about a problem frequently is not assembled. Costly research findings may go unused, valuable experience may be overlooked, and full consideration may not be given to available practices for solving or alleviating the problem. In an effort to correct this situation, a continuing NCHRP project, carried out by the Transportation Research Board as the research agency, has the objective of reporting on common highway problems and synthesizing available information. The synthesis reports from this endeavor constitute an NCHRP publication series in which various forms of relevant information are assembled into single, concise documents pertaining to specific highway problems or sets of closely related problems.

With the advent of the Intermodal Surface Transportation Efficiency Act (ISTEA), as well as pressure from state governments for greater accountability of state funds, DOTs are increasingly endeavoring to develop performance measures, to improve their productivity, and to respond to outside demands from state government and the public. This

report of the Transportation Research Board describes how performance measures have evolved in state DOTs, the types of initiatives that have been developed, and the effectiveness of such measures in assessing performance and improving productivity, as perceived by the DOTs.

To develop this synthesis in a comprehensive manner and to ensure inclusion of significant knowledge, the Board analyzed available information assembled from numerous sources, including a large number of state highway and transportation departments. A topic panel of experts in the subject area was established to guide the research in organizing and evaluating the collected data, and to review the final synthesis report.

This synthesis is an immediately useful document that records the practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As the processes of advancement continue, new knowledge can be expected to be added to that now at hand.

CONTENTS

1 SUMMARY

4 CHAPTER ONE INTRODUCTION
The Importance of Performance Measurement, 4
Purpose and Approach, 7

8 CHAPTER TWO TRANSPORTATION PERFORMANCE MEASURES
Broader Paradigms, 8
Use of Measures in State DOTs, 10
The Changing Context, 11

13 CHAPTER THREE PERFORMANCE MEASUREMENTS IN STATE DOTS
Performance Measurement Patterns, 13
Highway Construction and Management, 14
Highway Maintenance, 17
Traffic Safety, 20
Public Transportation, 23
Water-Borne Transportation, 25
Aviation, 27
Rail Freight Transportation, 27
Driver and Motor Vehicle Services, 28
Multimodal and Intermodal Transportation Development, 28

34 CHAPTER FOUR INDIVIDUAL STATE PROGRAMS
Oregon DOT, 34
Pennsylvania DOT, 37
Minnesota DOT, 42
Florida DOT, 44

47 CHAPTER FIVE CONCLUSIONS

51 REFERENCES

54 GLOSSARY OF ACRONYMS

55 APPENDIX A STATE DOT PERFORMANCE MEASURES SURVEY

66 APPENDIX B REPORTED USE OF PERFORMANCE MEASURES BY INDIVIDUAL STATE DOTs

ACKNOWLEDGMENTS

Theodore H. Poister, Ph.D., School of Public Administration and Urban Studies, Georgia State University, was responsible for collection of the data and preparation of the report.

Valuable assistance in the preparation of this synthesis was provided by the Topic Panel, consisting of Thomas Boehm, Operations Management Division Director, New York State Department of Transportation; Allen W. Burden, Chief, Program and Administration Division, Federal Lands Highway Office; Barbara T. Harder, President, B.T. Harder, Inc.; Robert C. Johns, Associate Director, Center for Transportation Studies, University of Minnesota; Joseph Robinson, Jr., Manager, Productivity Center, Pennsylvania Department of Transportation; Suzanne H. Sale, Assistant Director, Arizona Department of Transportation; Kathleen Stein-Hudson, Principal, Howard/Stein-Hudson Associates; William J. Quinn, Consultant, Keizer, Oregon; Jon M. Williams, Transportation Economist, Transportation Research Board.

The Principal Investigators responsible for the conduct of this synthesis were Sally D. Liff and Stephen F. Maher, Senior Program Officers. This synthesis was edited by Linda S. Mason.

Crawford F. Jencks, Manager, National Cooperative Highway Research Program, assisted the NCHRP 20-05 staff and the Topic Panel.

Information on current practice was provided by many highway and transportation agencies. Their cooperation and assistance are appreciated.

PERFORMANCE MEASUREMENT IN STATE DEPARTMENTS OF TRANSPORTATION

SUMMARY

Measuring the performance of programs and services is increasingly recognized as a critical component of effective management strategy for state departments of transportation (DOTs). The renewed interest in performance measures has been triggered by several factors, including (1) the need to support strategic planning and strategic management processes with information on the performance of DOTs, (2) demands for increased accountability from the public, legislatures, and governors' offices, (3) governmentwide mandates in many states for agencies to develop strategic plans and supporting performance measures, (4) threats of privatization and the need to be competitive, and (5) growing commitments to identify and meet customers' needs. As the DOTs respond to these new challenges for effective leadership, charting new strategic directions and mounting efforts to strengthen their own management capacity, appropriate performance measures are essential for monitoring and improving performance over the long run. This synthesis reviews current use of performance measures by state DOTs and concludes with observations on their development and meaningful application as an effective management tool.

State DOTs traditionally have been data rich agencies, where substantial resources are used to maintain and update data files on transportation facilities, equipment, materials, program activity, operations, finances, travel patterns, accident statistics, and other areas, but this does not necessarily mean that DOTs use these data to measure the performance of their programs or transportation systems. However, over the past two decades the concept of performance measurement has been generating increased interest among state DOTs, as reflected in the kinds of highway maintenance management systems and pavement management systems adopted by many states and in the use of performance measures in allocating funds to local transit agencies by some state DOTs. Currently, many DOTs are developing new generations of performance measures, in part to facilitate implementation of the various management systems envisioned by the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991.

This synthesis identifies the kinds of performance measures presently used by state DOTs, across all transportation modes and program areas, focusing on what is being measured and how it is measured. To obtain this information, a detailed survey instrument was mailed to the 50 state DOTs, and the synthesis is based principally on the completed surveys received from 36 states and follow-up telephone interviews conducted with staff in numerous DOTs from November 1995 to July 1996, to clarify and expand the information they provided.

The most widely cited performance measures pertain to "traditional" program areas such as highway maintenance and traffic safety, where there is a long history of tracking work activity and needs. Substantial numbers of states also reported using performance measures in the areas of highway construction, public transportation, and aviation, while fewer states reported using measures in program areas where DOTs have less uniform involvement, such as rail transportation, ferry service, and ports and waterways. Relatively few DOTs reported the use of performance measures for driver licensing and vehicle registration, but in many states these functions are carried out by separate motor vehicles or public safety

departments. Only a few states indicated that they track measures of multimodal transportation development on a regular basis.

Areas in which performance measures are most likely to be tracked on a monthly basis include licensing and registration, and ferry service, followed by general administrative performance, highway maintenance, aviation, and ports and waterways. Measures of performance for multimodal transportation, traffic safety, rail transportation, and public transit tend to be tracked primarily on an annual basis. The most frequent management uses of these performance measures are program planning and evaluation, strategic planning, and external reporting. At the other end of the spectrum, relatively few of the DOTs indicated using these performance measures for evaluating managers' performance or operationalizing incentive systems. Moderate numbers of states reported using performance measures for setting performance targets and determining budget allocations.

A variety of innovative practices were revealed by the survey, as illustrated by the following examples:

- The Wisconsin DOT monitors a set of "corporate" measures to track quality of highway design and construction activities as perceived by contractors and maintenance managers, in addition to on-time and on-budget performance, delivery costs, control of unprogrammed costs, and productivity in relation to staff costs.
- Reflecting the current customer service orientation of many DOTs, the Minnesota DOT surveys motorists in the state to assess the percentage who are satisfied with their travel times for work and other kinds of trips, and the Pennsylvania DOT uses surveys to gauge motorists' ratings of the roads maintained by the state.
- To measure traffic congestion on a statewide basis, the New Jersey DOT monitors the number of vehicle miles and the number of person miles traveled on segments of its highway system by different gradations of volume/capacity ratios.
- The Maryland DOT uses a peer review program in which the roads surveyed in a given county each year to measure highway condition are inspected by a team of resident engineers from other counties in the state.
- Several state DOTs, such as the Illinois DOT, measure the actual costs per accident (or fatality or injury) avoided by safety improvement projects 2 years or so after they are completed.
- The Washington DOT is in the process of developing a transit mobility index which is intended eventually to track the availability, connectivity, and affordability of both fixed-route public transit and paratransit service in Washington counties.
- The Minnesota DOT not only tracks the number of carloads shipped or received on project rail lines annually, but also estimates the additional revenue earned by farm producers when shipping grain and other commodities via these rail lines.
- The Pennsylvania DOT is planning to measure congestion at truck/rail intermodal facilities.
- Other DOTS, such as those in New Jersey and Minnesota, track the miles of roads in their highway systems that are compatible for bicycle usage.
- The New Jersey DOT also conducts large scale telephone surveys to measure modal choice and track the percentages of short-range commuting trips made by carpooling, vanpooling, public transit, bicycles, or walking as opposed to single-occupancy vehicles.
- The California DOT tracks estimates of the number of vehicles in use, vehicle miles traveled by mode, fuel consumption, and fuel economy on an annual basis.
- As gross indicators of the productivity of its own workforce, the Maryland DOT tracks such measures as the number of transit passenger trips per Maryland Transit Administration employee and the number of passengers enplaned per Maryland Aviation Administration employee.

In summary, many state DOTs are taking significant steps to measure the performance of their programs and services, moving beyond the traditional operating level systems oriented to monitoring inputs and immediate outputs. The new generation of performance measures tends to be focused more strategically, with greater emphasis on quality and impact from the customers' perspective. These measures are being used increasingly to report on DOTs' performance to external audiences—governors' offices, legislatures, the media, and the public—in addition to internal decisionmakers, in response to demands for increased accountability. However, these measurement systems seem to be perceived as more useful when they are created out of a genuine commitment to manage programs more effectively, rather than simply to comply with reporting requirements. The development of such performance measures tends to be an iterative process, and currently there is considerable experimentation with and refinement of content, methodology, reliability, cost, and usefulness.

CHAPTER ONE

INTRODUCTION

Measuring the performance of programs and activities is increasingly recognized as a critical component of effective management strategy for state departments of transportation (DOTs) as well as most other government organizations. The role and functions of state DOTs, and their socio-economic, political, and governmental environments are changing dramatically as they transition into the next century, creating new challenges for effective leadership that were unheard of 10 years ago. As DOTs respond to demands for increased accountability, chart new strategic directions, and mount efforts to strengthen their management capacity, appropriate performance measures are essential for monitoring effectiveness and efficiency and working to improve performance over the long run. This report examines state DOTs' need for performance measures and synthesizes current initiatives to develop effective performance measurement systems that are useful to state transportation officials.

THE IMPORTANCE OF PERFORMANCE MEASUREMENT

A variety of trends and forces in the field of public administration generally have resulted in renewed interest in performance measurement. Taxpayer revolts, pressure for privatization of public services, and the "conservative revolution" aimed at curtailing government spending in many program areas have generated increased demands to hold government agencies accountable to legislatures and the public in terms of what they spend and what they produce. The Reinventing Government movement initiated by Osborne and Gaebler (*1*) with its emphasis on outsourcing and introducing market principles in government operations, along with Vice President Al Gore's National Performance Review (*2*) signal a new way of thinking about how performance is defined and how it is measured. More generally, growing recognition of the linkages and interdependencies among what used to be thought of as separate, somewhat isolated, policy domains—such as crime, civil rights, transportation, economic development, energy, and the environment—has broadened the scope of issues, strategies, and impacts that agency heads must keep track of.

Internally, public managers have been experimenting with new approaches to strengthen the management capacity and overall organizational capacity of their departments, most notably through strategic planning and more encompassing strategic management systems as well as total quality management (TQM) processes aimed at improving service quality and customer satisfaction. Efforts to initiate strategic planning tend to have a greater likelihood of success in agencies with established performance measurement systems because they often provide critical information for assessing organizational strengths and weaknesses (*3*). Ongoing strategic management is impossible without the development and use of performance measures to track progress in achieving strategic goals and objectives (*4,5*). At the operating level, TQM programs require regular performance measurement in order to provide baseline data against which to evaluate the success of continuous process improvement activities (*6,7*).

Performance measures have long been used in government for program monitoring and evaluation purposes (*8,9,10*) and in conjunction with traditional performance management systems (*11,12,13*). In addition, they have been introduced into public budgeting systems to make them more efficiency oriented (*14,15*), although often at a micro-management rather than a policy level. Interest in performance measures waned somewhat in the late 1980s, however, in part because they were often not incorporated effectively in meaningful decision-making processes. By contrast, the current resurgence of commitment to performance measurement (*16,17,18*) takes a strategic perspective, attempts to be more outcome oriented, integrates performance measures meaningfully in other management processes, is mission driven and emphasizes the importance of service quality and responsiveness to customers, measures actual performance against predetermined targets or standards, and uses benchmarking for external comparisons where feasible.

The need for meaningful performance measurement in government has been underscored by resolutions taken by several public interest or professional organizations over the past several years. In 1989 the Governmental Accounting Standards Board (GASB) passed a resolution that "strongly encourages" state and local governments to develop indicators of "service efforts and accomplishments" (*19*). GASB calls for measures in four categories including (1) inputs, (2) outputs, (3) outcomes and service quality, and (4) efficiency, and it has conducted reviews of useful performance measures in several program areas to illustrate the kinds of indicators that are most appropriate. In 1991 the National Academy of Public Administration (NAPA) passed a resolution which "strongly recommends that units of government at all levels make a concerted effort to encourage agency heads and program managers to monitor program quality and outcomes as part of an overall system aimed at improving the performance and credibility of major public programs" (*20*). The NAPA resolution encourages policy makers and program managers to agree on appropriate measures of cost, quality, quantity, and outcomes, and to provide regular public reporting on agencies' performance.

In 1992 the American Society for Public Administration (ASPA) passed a very similar resolution calling on governments to measure and report program effectiveness and efficiency and "eventually to set performance targets and monitor

progress against targets" (*21*). NAPA and ASPA both noted that credible measures are feasible but that performance measurement was still the exception rather than the norm in American government. Consistent with these endorsements of performance measurement as an effective tool for strengthening management capacity in the public sector, in 1993 a task force of the National Governors' Association proposed a model for "performance-based governance" with the following four components: a shared vision, measurable goals, performance measures, and performance budgets (*22*).

Federal Government Initiatives

The U.S. Congress has passed two pieces of legislation over the past several years that are intended to build performance measurement into federal management processes. First, the Chief Financial Officer's (CFO) Act of 1990 requires 23 major federal agencies to have a chief financial officer who, among other duties, must provide for systematic performance measurement (Public Law 101-576). Second, and more far-reaching in effect, the Government Performance and Results Act of 1993 (GPRA) provides for strategic planning and performance measurement throughout the federal government (Public Law 103-62). Based on an assessment that "congressional policy making, spending decisions, and program oversight are seriously handicapped by insufficient attention to program performance and results," and that federal managers are "seriously disadvantaged" by unclear program goals and inadequate performance data, GPRA requires federal agencies to develop (1) strategic 5-year plans that identify missions, goals, and objectives and describe how they will be achieved, (2) annual performance plans, tied to proposed budgets, which also set forth indicators for measuring the outputs, service levels, and outcomes produced by each program, and (3) annual performance reports that compare actual program performance on the measures against previously set goals and objectives, all over a 7-year staged implementation schedule.

The Act also allows agencies to propose waivers from procedural requirements that impede goal achievement and calls for several pilot projects to demonstrate performance measurement for fiscal years 1994 through 1996. A review by NAPA of more than 40 of these pilot performance plans found substantial progress along with numerous issues requiring further clarification (*23*). Several of the recommendations presented in the NAPA report are relevant for state transportation officials who are interested or already engaged in implementing performance measurement systems. In abbreviated form, these recommendations include the following:

- Agency leadership should take an active role in strategic planning and performance measurement, including formulation and improvement of their agency's performance management system.
- Agencies should develop clear mission statements and strategic plans, and policy makers and staff should be educated to link them with performance measures.
- Performance indicators should attempt to cover the whole range of missions.
- Agency policy makers and staff should be encouraged to shift their focus from process/activity indicators to outcome indicators that focus on program results.
- Public officials need to provide considerably more emphasis on customer concerns, such as customer satisfaction, in their performance measurement efforts.
- Future performance plans should identify the basic data sources and data collection procedures that will be used and what process the agency will use for quality control of the data.
- Programs should provide information describing the basis for their performance targets for the forthcoming year (new procedures, budget reallocations, etc.).
- Performance targets should be realistic but, wherever feasible, should encourage progress beyond historical performance levels.
- Managers should be educated, encouraged, and rewarded for using performance data to improve programs at every point.
- Data should be disaggregated, such as by geographical area or customer groups, to identify where programs are achieving or not achieving desired outcomes.

In summarizing the findings from these pilot projects, the NAPA study concluded:

> Development of an effective performance management system requires systematic work in a number of essential areas: defining agency vision and strategic mission; establishing program missions and objectives; establishing long-term and annual program performance targets/goals; developing performance indicators and collecting performance data; using performance indicators in improving program performance; and communicating results so that they can be used by policy makers, managers, and the public. (23)

State Government Initiatives

Many state governments have implemented macro level processes for statewide strategic planning, budgeting, and performance measurement, and some are ahead of federal agencies in this area (*24*). The most highly visible of these efforts at this point is the *Oregon Benchmarks* program, which generated a strategic plan adopted by the state legislature in 1991 with provisions for monitoring progress toward achieving targets in a wide range of areas on an annual basis. The planning process involved businesses, nonprofit organizations, and other community groups as well as state and local government officials. It produced a strategic plan for the State of Oregon as a whole, rather than solely for state government itself, and the plan recognizes that achieving many of the targeted objectives will require collective action from all these sectors, and not just state agencies. As part of the continuing planning and evaluation process, the Oregon Progress Board tracks 259 "benchmark" indicators of performance in areas ranging from health care, academic achievement, adult education, and social harmony to crime, housing, community development, environmental quality, transportation, and economic development (*25*). The performance measures relating to

transportation that are tracked by *Oregon Benchmarks* are presented later in this report.

Other states have undertaken similar initiatives intended to make state government management and budgeting more results oriented. For example, the Florida Commission on Government Accountability to the People has created numerous "benchmark" indicators in wide ranging areas of performance, but it is still in the early stages of operationalizing these measures with actual data and enlisting the support of state agencies in linking their own objectives and measures to the *Florida Benchmarks (26)*. Similarly, *Minnesota Milestones* is a long-range plan developed by the executive branch of Minnesota state government, which has established 20 state goals and 79 performance indicators to be monitored annually (*27*). The *Milestones* are intended to play an important role in the state's budgeting process, but according to a review conducted by the Legislative Auditor, their impact to date apparently has been quite limited (*28*).

Many states, including those referenced above, have passed legislation in recent years requiring state agencies to establish their own performance measures and use them to report performance on a program level. For example, the Texas State Legislature established strategic planning and performance measurement requirements for all state agencies in 1991. The agencies developed their own mission statements, agency goals, objectives and outcome measures, strategies and output measures, and action plans within a framework of a statewide vision and functional goals, in a process illustrated in Figure 1.

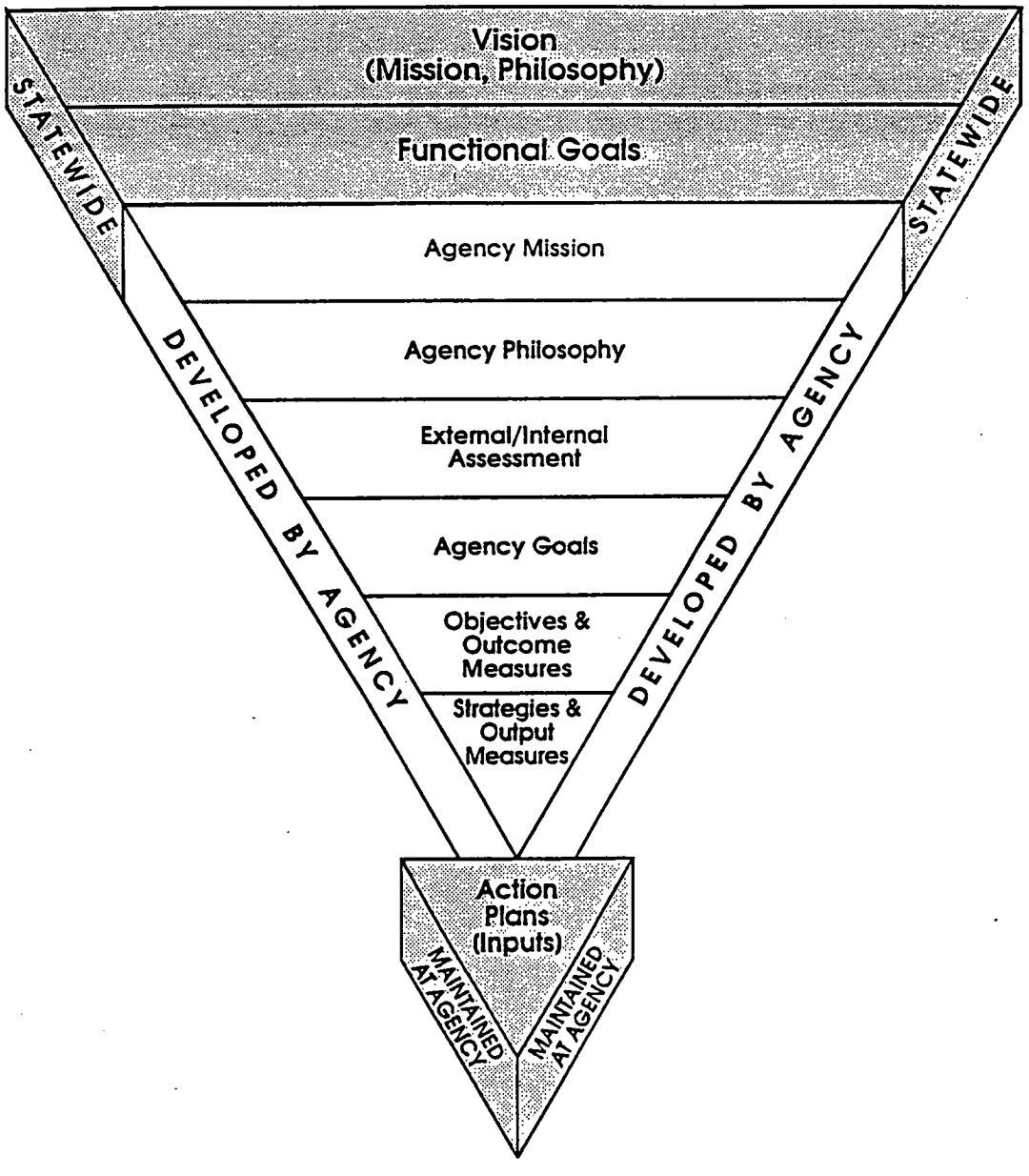


FIGURE 1 Texas Tomorrow strategic planning process. Source: *Texas Tomorrow: Strategic Planning and Performance Budgeting*, Texas Legislative Budget Board (August 1994).

The culmination of this activity was the adoption of *Texas Tomorrow*, a statewide vision and statement of missions and functional goals, by the Governor and the Legislative Budget Board in 1992. *Texas Tomorrow* sets targets and monitors performance on a total of 1,365 outcome measures, 1,348 output measures, 516 efficiency measures, and 69 explanatory/input measures as part of the state's budgeting process (*29*). While the outcome measures are tracked annually, the more operations oriented output and efficiency measures are monitored quarterly.

PURPOSE AND APPROACH

The purpose of this project is to survey current performance measurement practices in state transportation departments. It is primarily intended to identify the kinds of performance measures presently used by state DOTs, regarding all transportation modes and various program areas, in terms of what is being measured and *how* it is measured. Secondly, the project is intended to learn more about the *process* of performance measurement, how measurement activities are initiated and implemented in state DOTs and how measures are used as management tools.

Based on a review of available literature and prior experience, a detailed survey instrument was designed and mailed out to the 50 state DOTs. The survey, shown in Appendix A, included separate sections for individual transportation modes and program areas. In many cases, it was disassembled by the TRB state representative in a given DOT and distributed to various personnel who completed the individual portions pertaining to their particular programs. Completed surveys were received from 36 state DOTs. The completed surveys were reviewed carefully, and numerous follow-up telephone conversations were conducted with DOT staff over the period from November 1995 to July 1996 to clarify and expand on the information they provided.

Chapter 2 of this report provides an overview of the kinds of performance measures that traditionally have been used in the field of transportation generally and reviews the limited existing literature on the use of performance measurement systems by state DOTs specifically. Chapter 3 presents the information generated by the mail-out survey and follow-up telephone interviews, focusing primarily on the kinds of performance measures used for the various model or programmatic areas managed by state DOTs. Chapter 4 then profiles performance measurement initiatives in five different state DOTs, providing a sampling of these activities in the field. Finally, chapter 5 concludes with a summary of these findings and a brief review of issues concerning the development and utilization of performance measures in state DOTs.

CHAPTER TWO

TRANSPORTATION PERFORMANCE MEASURES

A variety of performance measures are used in the field of transportation, although they are rarely used consistently across transportation modes and they are often employed at the operating level as opposed to a systems or program level. Highway officials have traditionally used performance measures to assist in decision making regarding capacity enhancements and, more recently, maintenance activities. Sufficiency ratings measure the overall condition, safety, and service level of highway segments by comparing their physical and operating characteristics against a set of minimum design standards. Historically, present serviceability ratings (PSR), obtained from panels of individuals traveling down a road segment and rating the ride experience on a 1 to 5 scale, were used to measure rideability (*30*). A second measure, present serviceability index (PSI), obtained by mechanical equipment towed by a vehicle, was also used and correlated with PSR. However, PSR and PSI have largely been replaced by the International Roughness Index (IRI), a more objective measure of pavement roughness obtained from vehicles equipped with sensors that measure the longitudinal surface profile of a road. The resulting data are converted into a scale that represents road roughness.

Traditionally, roughness data, along with various other measures of pavement condition as well as the condition of shoulders, drainage structures, and roadside features are also commonly used as outcome measures of highway maintenance programs. These programs also measure labor productivity and unit costs, and sometimes quality of the work performed, in addition to the outcome measures to track their overall performance (*31*). Levels of service (LOS) ratings have long been used in highway systems planning and traffic operations. LOS measures roadway performance on an A to F scale for different classes of highway, with LOS A generally representing "free flow" conditions and LOS F representing gridlock (*32*).

Performance measures have also been used routinely by public transit agencies for some time both to manage their own systems and to report on their performance to state DOTs and the Federal Transit Administration. Commonly used measures pertain to operating costs, labor and vehicle productivity, safety, service quality and reliability, ridership, utilization ratios, cost-effectiveness, and financial performance. An analysis of data from several transit operations in California used factor analysis to reduce a myriad of performance indicators to the following seven "marker variables" which provide an overall assessment of local transit system performance: (1) Cost Efficiency: Revenue vehicle hours or revenue vehicle miles/operating expense, (2) Service Utilization: Total passenger trips or unlinked passenger trips/revenue vehicle hours, (3) Revenue Generation: Operating revenue/operating expense, (4) Labor Efficiency: Total vehicle hours/total employees, (5) Vehicle Efficiency: Total vehicle miles/peak period vehicles, (6) Maintenance Efficiency: Total vehicle miles/maintenance employees, and (7) Safety: Total vehicle miles/collision accidents (*33*).

BROADER PARADIGMS

While most of the traditional performance measures used in the field are operationally oriented, broader models have been suggested to facilitate tracking the performance of transportation systems in their larger societal context. Whereas LOS considerations figure prominently in planning highway construction and traffic engineering projects, for instance, they may be limited when interpreted as comprehensive performance measures. Claiming that LOS measures are simply proxies for vehicle operating speed, one thoughtful observer calls for a paradigm shift in which four other kinds of measures would be used to guide transportation decision making in an era of growth management, as follows:

- Mobility, measuring the ease with which individuals can move about on highways or other transportation modes,
- Accessibility, measuring the ease with which desired activities can be reached from any particular location,
- Livability, representing general attractiveness and quality of life in the immediate areas served by transportation facilities, and
- Sustainability, representing the ability of transportation facilities and services to meet travel needs of the present without compromising future generations in terms of impacts on natural resources and the environment (*34*).

While these conceptualized measures have not been operationalized in any standardized definitions or practices, they have begun to appear as criteria in project level evaluations, particularly with respect to multimodal corridor projects (*35*).

Similarly, the Board on Infrastructure and the Constructed Environment (BICE), which was convened by the National Research Council to examine the need for useful measures to help improve the performance of the nation's infrastructure, pointed out the need to view performance from the perspectives taken by a variety of stakeholders and to encompass secondary and tertiary impacts in comprehensive measurement systems. Thus, with respect to transportation infrastructure—including highways, airports, mass transit, and ports and waterways—the BICE report identified the need for measures reflecting economic impact, transport industry sales, public health and safety, social well-being, environmental impacts, national security, and social equity as well as the more directly transportation oriented measures of output, technical productivity, utilization, access and coverage, consumer safety, consumer

satisfaction, availability on demand, access to international routes, and fuel efficiency standards *(36)*.

On an international level, a working group consisting of highway and other transportation administrators convened by the European based Organization for Economic Cooperation and Development (OECD) has developed a "Family of Measures" designed to represent the performance of transportation systems from three different perspectives including government, road administrators, and road users. A report on the design of this system should be forthcoming in early 1997, but OECD further intends to operationalize the measures in several participating countries (the Minnesota Department of Transportation is involved in this project) to test whether the data might be useful for benchmarking purposes.

Operating statistics and performance measures are often collected by federal agencies from state DOTs and other transportation agencies, and these data can be distilled to provide a composite view of the nation's transportation system. The most frequently used of these reporting systems include the Highway Performance Monitoring System (HPMS) and the National Bridge Inventory System maintained by the Federal Highway Administration, the Fatal Accident Reporting System (FARS) maintained by the National Highway Traffic Safety Administration, and the National Transit Data Base (NTDB) maintained by the Federal Transit Administration.

Alone among federal agencies, the U.S. Department of Transportation (DOT) has a history of regular performance reporting to Congress. Formerly separate annual reports on individual transportation modes have more recently been consolidated into a single report on the condition and performance of the nation's highways, mass transit systems, and maritime facilities. DOT's report on the *1995 Status of the Nation's Surface Transportation System* describes the physical extent of the nation's transportation systems, their conditions and current usage, projected future usage, transportation financing, economic and environmental consequences, and alternative investment scenarios for maintaining and enhancing current service levels *(37)*.

Other federal compilations of transportation data present measures of performance on individual modes and, in some cases, comparative performance measures across modes. For example, the *Transportation Statistics: Annual Report 1994* compares circuity, a measure of direct accessibility computed as the ratio of actual distance traveled to the great circle distance, for highways, rail freight service, passenger rail service, and waterway transportation. It also compares trends over time in speed, length of trip, and travel time for railroads, aviation, transit buses, rail transit, commuter rail, and highways *(38)*.

However, much of the transportation related data currently maintained by government agencies are descriptive in nature and may not be useful in assessing the performance of systems, especially on a cross-modal basis. In a review of the information requirements to support national transportation policy making, a committee convened by TRB recommended creation of a national transportation performance monitoring system (NTPMS) to track key indicators concerning the nation's transportation system and its environment over time *(39)*. Noting that many existing federal data bases measure the safety, access, and to a lesser degree, service provided by individual transportation modes, the study concluded that development of an NTPMS would require linking these data to provide a more consistent basis for assessing overall system performance.

Rather than focusing primarily on individual modes, the NTPMS would be organized according to transportation *markets*—urban, rural, intercity passenger, intercity freight, and international—to facilitate monitoring performance from the perspective of the customers of transportation services, i.e. passengers and shippers. The general categories of indicators to be incorporated in the recommended system are shown in Figure 2. In addition to indicators of the supply and demand for transportation services, they include measures of performance in terms of safety and personal security, access and mobility, service delivery, and cost as well as transportation impacts on economic growth, national security, environmental quality and land use, and energy consumption.

Supply
System
- General characteristics,
- Coverage,
- Physical condition,
- Fare or fee structure, and
- Elasticity of supply.

Providers
- General characteristics and
- Financial condition.

Demand
- User characteristics,
- Activity levels,
- Flows, and
- Elasticity of demand.

Performance
- Safety and personal security;
- Access and mobility;
- Service delivery:
  - Level,
  - Efficiency, and
  - Quality; and
- Cost.

Impacts
- Economic growth,
- National security,
- Environmental quality and land use, and
- Energy use.

FIGURE 2 NTPMS data attributes and descriptors. Source: *Data for Decisions*, Transportation Research Board, 1992 *(39)*.

While the NTPMS has not been implemented at this point, its emphasis on a customer perspective, multimodal focus, and outcomes orientation represent an emerging consensus regarding performance measurement in transportation. DOT's

Bureau of Transportation Statistics (BTS), which was created in 1993 to provide leadership in this area, is presently concluding the process of developing an all-modes transportation performance measurement system based loosely on the NTPMS model. The focus of this new BTS effort is to track reliable data that will be useful in making comparisons across regions and across different modes of transportation, with an emphasis on measures that are relevant to decision making and acceptable to decision makers.

USE OF MEASURES IN STATE DOTs

State transportation departments have traditionally been data rich agencies, with huge data files updating inventories of facilities, equipment, and materials, and other data bases recording work accomplished in far-flung highway maintenance programs and large volumes of transactions in other programs. In addition, other files contain data on existing travel patterns, volumes of usage, and accident statistics as well as information on projects pending and completed. But, all this does not necessarily mean that DOTs were using data to measure the performance of their programs and actual transportation systems, beyond project level evaluations.

However, as evident in the professional literature over the past two decades, the concept of performance measurement has been generating increased interest and credibility among state DOTs. Since highway construction, and increasingly highway maintenance, programs had historically consumed the bulk of their attention and resources, the development of performance measures focused on these areas, at least initially. With the advent of comprehensive maintenance management systems (*40,41*), departments began monitoring labor productivity and operating efficiency measures for these programs. In addition, some DOTs began implementing programs to measure the quality of their maintenance programs in terms of the level of service afforded by their highway systems (*42*). To complement these maintenance management systems, state DOTs also began developing pavement management systems to extend the performance criteria to focus on level of service and cost-effectiveness over the long run (*43,44*). These systems entail substantial investments in condition surveys, roughness measures, and the like to assess pavement performance. In addition, some state DOT's have used various performance measures in determining allocations of operating assistance funds to local transit agencies (*45,46*).

A study conducted by the Urban Institute for the U.S. DOT almost 20 years ago discussed the importance of going beyond tracking activity levels and efficiency measures, and it proposed numerous measures for tracking the effectiveness of state transportation services (*47*). This report suggested several uses of such outcome oriented data:

- reviewing progress and trends in the provision of transportation services,
- providing guidance for resource-allocation decisions,
- informing budget formulation and justification,
- supporting in-depth program evaluation and program analysis,
- encouraging employee motivation,
- assessing the performance of contractors,
- providing quality-control checks on efficiency measurements, and
- improving communication between citizens and government officials (*47*).

In the early 1980s the Pennsylvania Department of Transportation implemented numerous performance monitoring systems as part of an overall strategy to strengthen management capacity and revitalize a lethargic and largely dysfunctional agency (*48*). Used to support a management by objectives (MBO) approach to performance management, PennDOT developed a monthly Management Objectives Report that tracked accomplishments in key result areas throughout the Department and compared them against standards and targets. Within this framework, similar reports tracked the performance of highway construction activities at the district level and monitored output, labor productivity, and unit costs of highway maintenance activities at the county level. In addition, during this period PennDOT also developed an initial trained observer survey to measure highway, shoulder, drainage, and roadside condition over time. Furthermore, a mail-out survey of nearly 4,000 motorists designed to gauge user impacts of its highway maintenance program was piloted as part of these overall performance measurement efforts (*49*).

Undoubtedly, other state DOTs have developed similar measurement systems, but not many are reported in the literature. However, two papers presented to the 1995 annual meeting of the Transportation Research Board illustrate DOTs concerns with, and approaches to, performance measurement. Beginning in 1985, the New York State DOT developed its Management Performance Indicators (MPI) report to provide upper level management with information on the Department's performance (*50*). This effort was part of an overall strategy for moving NYSDOT's management culture toward increased operational planning and goal-oriented management. Intended to provide a synthesized focus on the most critical areas of departmental performance, the MPI was designed to meet the following three primary objectives identified by the executive team:

- to provide a continuous view of how NYSDOT is performing,
- to help managers identify potential problem areas earlier, and
- to strengthen communication among departmental managers.

Keyed to the needs of top management, the MPI consisted of 15 performance measures selected by the Commissioner and executive team, five to be reported quarterly and 10 to be reported on a monthly basis. It is interesting to note the staff time required to develop this report:

> This required two staff members to work half-time for nine months to identify potential indicators and to work with executive managers to select the specific measure to be included in

> the report. It then required one person full time and another person quarter-time over a three month period to work with program area staff translating the indicator ideas into actual performance measures. Currently, the MPI requires one person half-time to maintain and enhance the report, plus one person quarter-time to produce the report. (*50, p. 45*)

Several of the indicators pertain to the management of NYSDOT's capital program regarding contract lettings, project development, and the construction program, while others are administrative, financial, and safety related indicators. The indicators are presented in tabular and graphical formats showing historical trends, comparisons among regions, and comparisons against goals or standards. Developing and using the MPI has been a highly interactive process involving the executive team, the staff unit that maintains the system, and managers of the operating units whose functions are being measured. Lessons learned from this experience include the following:

- Close involvement of program staff in the data development, modification, and interpretation of performance measures is essential.
- Performance measurement should be used as a tool to identify opportunities to improve performance, rather than to lay blame for apparent poor performance.
- Managers should resist the temptation to enlarge the report: 15–20 measures is an optimal number.
- The organizations within a transportation agency (e.g. offices, divisions, districts, regions) should have their own performance indicators.
- The process is dynamic. Virtually every indicator has been modified to reflect improved understanding of issues and associated problems.
- Some measures don't live up to their expectations. These performance indicators should be dropped as quickly as possible.
- Staff tend to focus on particular areas to the detriment of others, so performance measures must be selected carefully to ensure that all critical program areas get attention.

The Wisconsin DOT began to engage in performance measurement in the early 1990s as a result of a strategic planning process and subsequent commitment to a total quality improvement program (*51*). After an initial period of generating "warm fuzzy" solutions that "made the office a more comfortable place to work, but . . . didn't necessarily improve products and services to end users or reduce the cost of delivering these products and services," the quality program began to focus more squarely on improving competitive performance, and it was recognized that "if performance is not measured, it is hard to tell success from failure."

While performance measures were a "foreign language" in the Department at the outset, their application apparently did not threaten managers and employees, many of whom "actually wanted measures to document their performance and to establish improvements they were making." Thus, consistent with the strategic plan, it was determined to focus in each functional area on measures of performance in terms of four general attributes including on-time, on-budget, at reasonable comparable cost, and of high quality. These measures will continue to be refined in terms of both what is measured and how it will be measured.

THE CHANGING CONTEXT

State transportation agencies often develop and use performance measures in the course of implementing new management systems, sometimes in response to federal legislation. The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 is a landmark piece of legislation that makes wholesale revisions in the intergovernmental arrangements for making transportation policy. The Act created a new integrated Surface Transportation Program, established a 155,000-mile national highway system, provides state and local government officials with greater flexibility to transfer funds from one transportation program to another, significantly alters the relationships between metropolitan planning organizations (MPOs) and state DOTs in transportation planning and project selection, revises federal cost-sharing rates to create a "level playing field" for all modes of transportation, and requires new styles of planning for such issues as congestion management and pavement maintenance (*52*).

ISTEA is having a major impact on the role of state DOTs and the way they conduct their business, forcing many to rethink their missions and their partnerships with local government jurisdictions and transportation providers. In addition, the original Act required state DOTs to develop the following kinds of formal systems for more effective planning and management, where such systems were not already in place:

- Pavement management systems,
- Bridge management systems,
- Safety management systems,
- Congestion management systems,
- Public transportation management systems, and
- Intermodal management systems.

While the specific requirements and timetables for implementing some of these management systems were relaxed somewhat with passage of the National Highway System Designation Act of 1995, state DOTs are moving ahead in developing these systems, and in the process they are developing and experimenting with a wide range of performance measures.

Beyond the impact of ISTEA, and the Clean Air Act Amendments of 1990, state transportation departments are generally operating in a period of unparalleled change driven by a diverse array of factors, and the successful implementation of strategies to deal with these changes over the long run is likely to require additional emphasis on performance measurement. A study conducted for TRB by NAPA in conjunction with researchers from the University of North Carolina (*53*) succinctly summarizes the changing context within which state DOTs must function as follows:

> Perhaps what differentiates the current circumstances from those of the 1960s and 1970s is the broad scope of the changes now affecting the state DOTs, the accelerating rate at which changes are confronting them from inside and outside the organization, and the dramatic changes in society, technology, politics, and the economy that create the overall context for DOTs. Public concerns about the environment continue and intensify. In addition, transportation is affected by the increasing global implications of economic development, as well as changes in demographics, shifts in patterns of travel demand, and budget pressures at all levels in business and government. Many DOTs are faced with seemingly boundless demand for more transportation capacity to handle enormously increased traffic flows, particularly from trucks and single-occupant autos. Financial pressures are particularly serious for DOTs when public expectations for more and better services are juxtaposed against an eroding tax base, increasing the need for rehabilitation and maintenance . . . . (53, pp. 6–7)

In its recommended self-assessment toolkit designed to help new DOT chief administrative officials (CAOs) develop strategies to deal effectively with the changing, and sometimes competing, demands placed on their organizations, the NAPA report emphasized the importance of having good information on, among other things, the condition and performance of a state's transportation infrastructure as well as the efficiency and effectiveness of a DOT's major programs and operating processes. Clearly, state DOTs have an even greater need for good performance measures now than in the past. The recommended model for new CAOs also calls for indicators or benchmarks of success for each major program or functional area and measures that are monitored and applied to drive the deployment of people, funds, and technology.

However, it is by no means clear that most state DOTs have such measurement systems in place. A recent report prepared for TRB by the Highway Users Alliance (HUA) notes a "general lack of state transportation program goals that are suitable for measuring and reporting progress toward achievement" (54). According to this report, while many states have in fact made significant progress in terms of adding capacity to their highway systems and improving the physical condition of their highways, only a few states have a *long-standing* program for measuring and reporting pavement conditions and that fewer still have established measurable goals for improving pavement condition. Noting that one bright spot in this area is the federal/state program for monitoring the condition of the nation's bridges on a 2-year cycle, the HUA report goes on to say:

> However, in many cases, state transportation departments have stopped the record-keeping systems that were prevalent in earlier years. Highways are no longer being rated periodically and systematically in terms of sufficiency. Although there is renewed interest in pavement rating, most states have no historical record-keeping system to determine whether or not progress is being made in pavement structural condition or rideability. (54, p. 2)

After reviewing the most common information needs of new state DOT top executives, the HUA study presents a list of 38 performance measures that are essential for monitoring the overall effectiveness and efficiency of state transportation programs. These include measures of administrative performance, highway program performance, public transportation program performance, motor vehicle program performance, and the performance of other state transportation programs. The HUA report concludes that in addition to being critical for DOT officials' use in managing their departments, these program performance measures will become "increasingly important tools for legislators and citizens in judging the performance of public programs and in holding officials accountable for the efficiency and effectiveness of their programs." While much of the data needed to implement such performance measurement systems are readily available, the report also concludes that DOTs will need to commit increased resources to performance measurement and to establish program goals as benchmarks for assessing program performance in order to use these systems effectively.

Current indications are that the DOTs have a growing commitment in this area. In 1992, the National Quality Initiative (NQI) was launched by the American Association of State Highway and Transportation Officials (AASHTO), the Federal Highway Administration, and the American Road and Transportation Builders Association, along with other industry associations, for the purpose of assuring that the nation's highway systems provide the highest quality facilities and services. The NQI, which is intended to bring TQM approaches to highway partnerships at the highest levels, recognizes the need to establish performance measures as benchmarks in evaluating the quality of state highway programs. Furthermore, recent research suggests that most DOTs are actively engaged in developing quality improvement processes at this point, with many incorporating customer feedback into these processes, and that these initiatives further encourage the development and use of performance measurements (55). Along with strong commitments to strategic management and quality services, there is growing recognition among state DOTs that effective performance measures are essential for results-oriented management.

CHAPTER THREE

PERFORMANCE MEASUREMENT IN STATE DOTs

This chapter discusses the kinds of measures identified in survey responses for each of the transportation modes after summarizing their overall usage patterns in terms of frequency, geographic basis, and management functions. Survey forms were returned by 36 of the 50 state DOTs, an impressive response rate for such a demanding questionnaire. However, not all of the returns constituted "complete" surveys, because in some cases they reported on the use of measures for some but not all of the transportation modes included in the survey. Additional materials such as management reports or special studies relevant to the subject were received along with the surveys, and in many cases follow-up telephone conversations with personnel identified in the returned surveys generated further information on the use of performance measures.

PERFORMANCE MEASUREMENT PATTERNS

A wide variety of performance measures was identified through this process, and as expected, the reported use of such measures varies from mode to mode. The most frequently cited measures were in more "traditional" areas, such as highway maintenance (with measures reported by 32 states) and traffic safety (30 states), where there is a long history of tracking work activity or needs. (It should be reiterated that in some cases departments responding to the survey had completed only selected portions of the questionnaire so that the number of states using performance measures in a particular area is likely to be undercounted, i.e. a non-response does not necessarily mean that a department does not use any performance indicators in a particular program area).

Substantial numbers of states also reported using performance measures in the areas of highway construction (22 states), public transportation (23 of the more urbanized states), and aviation (21 states). Also as expected, performance measures were identified less frequently for program areas that are less uniformly emphasized by state DOTs, such as rail transportation (16 states), ferry service (13 states), and ports and waterways (12 states). Only 10 states reported using performance measures regarding driver licensing and vehicle registration, but in many states these functions are carried out by separate departments of motor vehicles or public safety departments. Only 13 DOTs reported using measures of general administrative performance, while only 10 states indicated that they track measures of multimodal transportation development on a regular basis. Complete listings of the DOTs reporting the use of performance measures in these various areas are included in Appendix B.

Performance measures in the program areas differ substantially in reporting frequencies, as shown in Table 1. Areas most likely to be tracked on a monthly basis include licensing and registration and ferry service, followed by administrative performance, highway maintenance, aviation, and ports and waterways. Measures of performance for multimodal transportation development, traffic safety, rail transportation, and public transit tend to be tracked primarily on an annual basis.

As shown in Table 2, performance measures in most of the program areas tend to be reported most frequently on a statewide basis, with the exception of ferry service which is site-specific. Highway maintenance performance measures are also frequently reported on a regional or district basis. As shown in Table 3, the most frequent administrative or management uses of performance measures reported by state DOTs are program planning and evaluation (81 percent of all measures reported), strategic planning (73 percent), and external reporting (73 percent). At the other end of the spectrum, only 29 percent of all

TABLE 1

FREQUENCY OF REPORTING PERFORMANCE MEASURES

Program Areas	Monthly (%)	Quarterly (%)	Annually (%)	Other (%)
Multimodal Transportation	17	–	92	8
Highway Construction	28	8	28	38
Highway Maintenance	47	13	60	35
Traffic Safety	10	7	83	22
Public Transportation	17	22	61	7
Ferry Service	62	23	46	15
Aviation	42	19	32	19
Railroads	22	–	72	6
Ports and Waterways	42	17	42	17
Licensing and Registration	67	22	33	33
Administrative Performance	46	18	46	9

Totals may exceed 100% due to multiple reporting frequencies.

TABLE 2

GEOGRAPHIC BASIS FOR REPORTING PERFORMANCE MEASURES

Program Areas	Statewide (%)	Region/District (%)	County (%)	Urban/Local (%)
Multimodal Transportation	58	25	25	25
Highway Construction	72	28	6	6
Highway Maintenance	69	52	28	3
Traffic Safety	81	20	22	17
Public Transportation	48	11	24	28
Ferry Service	15	31	8	15
Aviation	77	7	–	13
Railroads	78	–	–	6
Ports and Waterways	50	25	–	8
Licensing and Registration	89	22	22	22
Administrative Performance	73	36	–	

Totals may exceed 100% due to multiple bases of reporting or may be less than 100% due to site-specific reporting.

TABLE 3

REPORTED MODERATE OR SUBSTANTIAL USE OF PERFORMANCE MEASURES FOR VARIOUS MANAGEMENT FUNCTIONS

Program Areas	Tracking Performance (%)	Performance Targets (%)	Strategic Planning (%)	Operationalizing Incentive Systems (%)	Determining Budget Allocations (%)	Evaluating Managers' Performance (%)	Program Planning and Evaluation (%)	External Reporting (%)
Multimodal Transportation	75	67	100	25	83	33	92	84
Highway Construction	58	44	38	14	40	16	66	54
Highway Maintenance	68	68	88	11	83	37	89	80
Traffic Safety	63	66	81	17	46	24	83	83
Public Transportation	74	43	65	24	57	26	85	78
Ferry Service	77	38	92	23	62	15	77	85
Aviation	58	65	84	23	45	36	87	90
Railroads	44	33	78	6	28	17	95	50
Ports & Waterways	50	42	67	8	42	8	83	50
Licensing & Registration	78	89	78	22	44	67	67	67
Organizational Performance	64	64	55	18	36	64	73	55
All Measures	56	56	73	17	56	29	81	73

measures identified in the survey are used to evaluate managers' performance, and only 17 percent are used to operationalize incentive systems. In the mid-range, 56 percent are reportedly used for tracking overall organizational performance, and identical percentages are reportedly used for setting performance targets and determining budget allocations.

HIGHWAY CONSTRUCTION AND MANAGEMENT

Not surprisingly, many states responding to the survey reported using performance measures to track the performance of their highway construction programs, including numerous "process" indicators as well as measures of the adequacy of their overall highway systems. For example, the Arizona Department of Transportation tracks bid prices versus engineering estimates to assess the degree to which these estimates are accurate and realistic, and it monitors the number of change orders per construction project to gauge the thoroughness and overall performance of the design and engineering process. ADOT also tracks actual construction costs versus bid prices and the percentage of projects that are completed on time as measures of contractors' performance in building roads. ADOT assesses the quality of contractors' work in its certification acceptance field review of each project. Regarding overall system adequacy, Arizona monitors the number of bridges with weight restrictions. The department is planning to measure congestion on a systematic basis by tracking traffic volume to highway capacity ratios at the approximately 750 federal Highway Performance Monitoring System (HPMS) sites on its state highways.

Many other state DOTs measure the performance of their highway design and engineering units. Representative indicators include the number and amounts of project cost increases or decreases (Florida), actual versus planned project letting schedules (North Carolina), the percent of engineering work that has to be reworked (Oregon), the ratio of engineering

costs to total project costs (Oregon), and the ratio of design engineering cost to state road construction dollars let and the ratio of construction engineering cost to state road construction dollars let (Minnesota). The Oregon DOT also monitors the "percent preliminary engineering redo," the preliminary engineering cost incurred doing rework as a percent of total preliminary engineering costs on a monthly basis. The Connecticut DOT tracks highway construction administrative costs on a project by project basis.

Similarly, measures of contractor performance were reported in terms of time, cost, and quality. For example several states, such as Florida, North Carolina, and Oregon, track the number of construction projects completed on time. The Florida DOT also tracks the number of delinquent projects, the number of time extensions granted, and the number of additional days required to complete projects, computed both with and without the number of bad weather days. Perhaps uniquely, with respect to highway construction projects, the North Carolina DOT monitors the number of accidents occurring in construction zones.

A number of states also track actual project costs as compared with award costs (North Carolina) or the percentage change from the bid amounts awarded (New York). Most, if not all, state DOTs conduct highway construction quality assurance programs, such as those cited by the Georgia, Michigan, and Maryland DOTs among others, in which they test materials, inspect the quality of work of ongoing projects, and measure the smoothness of completed highway construction projects. However, these data tend to be retained at the project level rather than being aggregated on a statewide basis over some period of time. While highway construction costs are monitored closely on a project basis, they may also be averaged across the state as a gross indicator of program efficiency. For example, the Arkansas DOT monitors the average cost per mile of highway constructed, while the Georgia DOT monitors the cost per lane mile constructed separately for urban and rural highways.

DOTs also monitor the quality of their highway construction projects. For example, the Oregon DOT tracks an index of construction quality on a quarterly basis. This index incorporates (1) a technical rating of workmanship made by the final inspection rating team, (2) a materials compliance rating, (3) a measure of pavement smoothness taken within 6 months of project completion, and (4) evaluations of the construction process taken by a survey of contractors.

Design and Engineering: Wisconsin's Corporate Measures

As part of its ongoing quality planning process, the Wisconsin DOT's Division of Highways has established outcome oriented performance measures of its design and engineering activities at both the "corporate" and "functional" levels. The four measures for the design function, the four measures for the construction function, and the six corporate measures are identified in Table 4. Four of the corporate measures incorporate various functional level measures.

TABLE 4

CORPORATE AND FUNCTIONAL MEASURES WISDOT DIVISION OF HIGHWAYS

Corporate Measures	Targets (%)
Unprogrammed Costs	14
Production Index	3.4
Engineering Delivery Cost	30
Designs on Time	80
Design on Budget	80
Product Quality Index	80
Functional Measures	
Design	
On-Time	80
On-Budget	80
Delivery Cost	16
Quality	80
Construction	
On-Time	85
On-Budget	90
Delivery Cost	13
Quality	80

Source: Wisconsin DOT internal memoranda.

These indicators are measured annually and compared against targets set a few years in advance (*57*). The first of these corporate measures computes the dollar value and percentage of unprogrammed costs arising from changes in field conditions or materials quantities that differ significantly from design concepts or plan estimates. For fiscal 1995, the Division's unprogrammed costs across all districts and central office bureaus totaled $45 million or 11.1 percent of let contracts, which was better than the target of 13.8 percent.

The production index is intended to compare outputs to inputs as a measure of productivity. It is computed as the ratio of all contract lettings, public utilities costs, real estate acquisition, construction costs, construction change orders, and cost overruns divided by staff costs, consultant contracts, and design construction change orders. For fiscal 1995 the Division hit its target of a production index of 3.4 to 1; its goal is to attain a production ratio of 4.0 to 1 by fiscal 2000.

While these first two corporate measures are uniquely divisionwide measures, the other four are "roll-ups" of the design and construction functional measures. For example, the engineering delivery cost provides a measure of design and construction engineering costs, including both in-house and outside consulting costs, as a percent of the total cost of highway projects for the year. The design engineering cost as a percent of award cost measures the efficiency of the design effort in moving a project through the design process from inception to letting, while the construction engineering cost as a percent of total construction cost measures the efficiency of construction contract administration between letting and contract completion. For fiscal 1995 this measure stood at 32.3 percent, but it is targeted to decrease to 29.4 percent by fiscal 1998.

The design-on-time measure is the percent of plans that are ready for letting in the fiscal year for which they are scheduled. It represents the Division's ability to deliver projects for

bid letting when they have been promised to the department's customers. For fiscal 1995, this measure was targeted at 80 percent, but actual performance fell short of this goal with 77.9 percent of all projects scheduled for 1995 actually proceeding to letting during that year. The design-on-budget measure represents the Division's ability to estimate project award costs accurately and to deliver designs that are let at those estimates. It is computed as the percent of all completed projects whose actual costs were "at or near" the estimated costs and therefore within the program budget. This measure was also targeted at 80 percent, but actual performance in fiscal 1995 fell somewhat short of this goal, coming in at 79 percent.

Finally, the product quality index combines two functional level measures, the design quality index and the construction quality index, which are oriented to an internal customer perspective. The design quality index measures the quality of project plans from the point of view of contractor and project manager. It is based on the percent of projects requiring few or no significant changes because of plan errors. The construction quality index measures the quality of completed construction projects from the point of view of a maintenance manager or supervisor, defined as the percent of projects with few or no special maintenance concerns. This is determined by the maintenance supervisors themselves, who use a rating form to inspect each completed construction project several months after it is put into service for conditions such as unstable slopes or poorly drained ditches that might create premature maintenance problems. For fiscal 1996 the Division hit 76 percent on the design quality index and 92 percent on the construction quality index, as compared against the standard of 80 percent for each.

At the functional level, then, the Wisconsin DOT annually tracks on-time performance, on-budget performance, delivery cost, and product quality separately for both highway design and highway construction. For example, the construction on-time measure is the percent of construction projects completed on time as weighted by award cost, targeted at 85 percent, whereas the construction on-budget measure is the award costs of all completed projects as a percent of actual construction costs, which is targeted at 90 percent. Currently, work is under way in the Division of Highways to develop and test comparable performance measures for other functional areas such as traffic, highway maintenance, real estate, technical services, planning and programming, administration, and environment. These measures and their target values were to be established for use in fiscal 1996.

Highway System Adequacy

Going beyond their own design, engineering, and highway construction activities, state DOTs also monitor the adequacy and overall performance of their highway systems. For example, based on data generated in highway condition surveys and information developed as part of multi-year transportation planning and programming processes, most DOTs track the miles of existing highway that need to be reconstructed and the number of bridges on the state system that need to be rebuilt. Monitoring these measures over time provides one indication of the overall serviceability of the existing highway system as well as the department's performance in reducing the backlog of needed reconstruction projects.

Similarly, many states monitor sufficiency ratings of their highways and bridges. For instance, the Minnesota DOT annually tracks the percent of state trunk highway miles with good or excellent sufficiency ratings, which combine pavement quality, safety, and preservation characteristics. Mn/DOT also tracks the percent of trunk highway bridges that are sufficient in terms of load capacity, vertical and horizontal clearance, bridges with sufficiency ratings of 80 or greater. The department also measures the percent of the state's population residing within 10 minutes or 5 miles of state aided public roads as an indicator of access to roads that are in good condition and have high safety standards. In addition, Mn/DOT assesses the percent of drivers who are satisfied with their travel times for work and other kinds of trips by contracting periodically for specific questions in general purpose market research telephone interviews with approximately 800 randomly sampled Minnesota citizens. Looking at the need to support economic development through high-quality transportation, the department also tracks the percent of wholesale and retail sales in Minnesota that take place in the 65 significant economic centers that are served by the department's year-round unrestricted (10 ton) market artery routes, which constitute 40 percent of the state's total highway system (*58*).

Similarly, the Oregon Department of Transportation tracks both the percent of the state's residents living within 10 miles of Oregon Access Highways and the percent of the road miles in that system that have been built in accordance with the target design and operational standards to "handle traffic at a steady 55 mile-per-hour rate" (*25*). In addition, the ODOT measures the percent of miles of limited-access highways in Oregon metropolitan areas that are not heavily congested during peak hours. This is measured by the percent of urban interstate highways and other freeways having a volume service flow ratio of less than 17. ODOT also monitors the percent improvement in conformity ratings, measured by the increase in the percent of total lane miles rated fair or better in terms of compliance with AASHTO standards for design speed, lane width, shoulder width, bridge width, horizontal alignments, vertical alignments, grades, stopping sight distances, and pavement cross slope and superelevation.

Measures of Congestion

State DOTs have traditionally measured traffic congestion on a site-specific basis for project planning purposes and sometimes on a more systematic basis on a sample of road segments around the state, for example HPMS sites, regularly over time. However, given the recent ISTEA emphasis on the development of congestion management systems, at least for their Transportation Management Areas (over 200,000 population), many DOTs are implementing congestion measurements on a more comprehensive basis. Very different approaches have emerged in this process. As mentioned earlier,

for example, the Arizona DOT will operationalize volume to capacity ratios at its approximately 750 HPMS sites to track congestion levels over time.

The Pennsylvania Department of Transportation is taking a decentralized approach by using the 14 Metropolitan Planning Organizations (MPOs) and seven rural Local Development Districts (LDDs) in the state to develop congestion management system plans. This strategy recognizes the fact that perceptions as well as actual traffic conditions vary widely around the state and that congestion is a relative concept wherein conditions that are seen as heavily congested in smaller, rural areas are not likely to be perceived as problematic in larger, more urbanized areas. Thus, PennDOT has identified a number of performance measures relating to congestion—such as vehicle miles traveled by functional class of highway, vehicle miles or person miles traveled by speed range, average speed versus peak hour speed, travel times, hours of delay, volume/capacity ratios, high accident locations, and qualitative perceptions of congestion—and is providing training and support to MPO and LDD staff to help them identify and resolve congestion problems in their areas (*59*). Apparently, the majority of these local planning organizations are using speed and delay surveys or travel time delay runs to measure congestion on the National Highway System or other major roads in their areas.

In contrast, the New Jersey Department of Transportation is taking a much more centralized approach in developing its congestion management system. The two performance measures used to identify congestion problems are the percent of vehicle miles traveled in different ranges of volume/capacity ratio and the percent of person miles traveled broken down by volume/capacity ratio. For each road segment in New Jersey's highway system, data on traffic volume during peak periods are collected annually, and since the carrying capacity of each segment is maintained in the road inventory, it is easy to determine the ratio of volume to capacity for each segment. Then, the number of vehicle miles traveled is computed as volume multiplied by the length of the link in miles. Given both the ratio of volume to capacity and the vehicle miles traveled on each segment, the vehicle miles can be summed over the segments falling into each of the following ranges on the volume/capacity ratio: 0 to 0.5, 0.5 to 0.75, 0.75 to 0.90, 0.90 to 1.00, 1 to 1.3, and 1.3 and over. If more vehicle miles are concentrated in the lower ranges of the volume to capacity measure over time, it would signify that New Jersey's highway system is becoming less congested.

The distribution of person miles traveled across these ranges of the volume/capacity ratio is determined by factoring in vehicle occupancy figures. Automobile and truck occupancy estimates are obtained from accident records, although at least one other state agency, the Maryland Highway Administration, has found that this method tends to overstate automobile occupancy, probably because accidents involving multi-occupant vehicles are more likely to result in personal injuries and are therefore more likely to be reported to the police. Occupancy rates in transit vehicles are available from New Jersey Transit, which operates several transit systems in the state. These data are applied to the vehicle miles already computed for each segment in order to determine the number of passenger miles traveled. Thus, the New Jersey DOT is able to monitor various levels of traffic congestion on state highways in terms of its impact on both vehicle miles and person miles traveled.

HIGHWAY MAINTENANCE

As highway maintenance programs are typically a state DOT's largest operating programs, and because most of this work tends to be performed by the department's own workforces, many agencies have well-established maintenance management systems that use a variety of performance measures. These systems usually combine financial information with operating data and incorporate measures of resources utilized, costs, and work completed in terms of specific maintenance activities. They often compare actual performance against targeted value as well as provide for historical comparisons or trends. Because these maintenance management systems serve a variety of uses, the measures tend to "roll up" through the organization, providing detailed information perhaps daily or weekly at the operating level but also providing more aggregated, less frequent reports to higher management levels.

For example, the Washington State Department of Transportation tracks actual versus planned maintenance expenditures on a monthly basis. More specifically, the department also tracks the percent of total maintenance funds expended on each set of maintenance functions, as well as the percent of labor hours and the percent of materials and equipment hours spent on each activity group. WSDOT also monitors units of work accomplished by each maintenance activity and relates them to the resources going into the operation. Actual expenditures and accomplishments are compared against preset standards as well as historical data. All of these measures are monitored for each of the department's districts and for the state as a whole and are tracked on an annual as well as a monthly basis.

Similarly, the North Carolina DOT monitors the work accomplished in each of 200 maintenance functions on a monthly, quarterly, and annual basis. The department measures operating efficiency as the dollar cost per unit accomplished and measures productivity by the labor cost per unit accomplished and the equipment cost per unit accomplished. The North Carolina DOT measures overall efficiency as the total maintenance cost per lane mile, and per road mile maintained, as does the Minnesota DOT. All of these measures are tracked by county, division, and state.

These kinds of measurements are quite typical among state DOTs. The Arizona DOT, for example, tracks the cost efficiency and labor productivity of its maintenance operations on 128 separate activities. Statewide data for fiscal 1991 for a particular surface maintenance activity, hand patching with premixed material, are shown in Table 5. The data show that more time and more funds were expended on this activity than originally planned, and that more work was accomplished in this maintenance function than planned. The number of cubic yards of premix accomplished per labor hour exceeded the

TABLE 5

HAND PATCHING WITH PREMIXED MATERIAL ARIZONA DEPARTMENT OF TRANSPORTATION—1991

	Planned	Actual
Crew Days	1,411	1,585
Labor Days	4,205	4,737
Cubic Yards	3,305	3,643
Total Cost	$703,213	$858,423
Cubic Yards per Hour	0.09	0.10
Costs per Cubic Yard	$212.77	$235.67

standard of 0.09, but the unit cost of $235.67 per cubic yard also exceeded the target of $212.77. ADOT monitors these measures separately for each of its four districts, areas within those districts, and individual organizational units (counties) within those areas. The data are reviewed on a daily basis at the operating level, as well as on a monthly, quarterly, and annual basis at higher management levels. Most, if not all, state DOTs use the efficiency and productivity measures cited above for Washington, North Carolina, and Arizona in managing their highway maintenance programs. The differences among them are primarily in terms of functional specifics and how they are used to manage operations.

Highway Condition and Serviceability Measures

Going beyond measures of inputs and immediate outputs, state DOTs have also monitored their effectiveness in terms of the outcomes impacted by maintenance programs, namely the condition and serviceability of the highway systems being maintained. These measures relate to the physical condition of various attributes of highway systems, pavement smoothness or roughness, skid resistance, overall pavement quality, and overall serviceability. Various DOTs have had different pieces of the highway condition "puzzle" in place for several years, but with ISTEA's encouragement for full-fledged pavement management systems, many states are now developing more comprehensive information systems for managing their existing highway systems. Some state DOTs are integrating these pavement management systems, or more encompassing roadway management systems, with their traditional maintenance management systems.

Most state DOTs employ a combination of techniques to measure the condition of their highways. The Rhode Island Department of Transportation, for example, conducts pavement distress surveys and measures IRI on its roads every 2 years, while the Connecticut DOT has pioneered in the use of a photologging technique to assess pavement roughness and distress. The North Carolina Department of Transportation conducts visual condition surveys as well as nighttime visibility surveys to assess the condition of its highways. The Oregon DOT conducts serviceability ratings and tracks the percent of its lane miles that are rated in fair or better condition on an annual pavement condition survey. ODOT also monitors the cost-effectiveness of its maintenance operation, measured by the cost per percent increase in the percentage of lane miles rated fair or better on pavement condition.

The Minnesota Department of Transportation combines pavement distress data with IRI measurements to develop an overall Pavement Quality Index (PQI), an indicator of the overall quality of a highway's driving surface, which ranges from 0 (worst) to 4.5 (the best possible). Each road segment in the state's 12,100-mile trunk highway system is rated on the PQI every 2 years. Table 6 shows these ratings for fiscal 1994 for the three classes of roads in the system, along with the distribution of vehicle miles traveled on these roads.

TABLE 6

VEHICLE MILES TRAVELED AND PAVEMENT QUALITY INDEX MINNESOTA DEPARTMENT OF TRANSPORTATION—FY 1994

Highway System	Percent VMT	1994 PQI
Principal Arterials	78	3.3
Minor Arterials	20	3.1
Collectors and Local Roads	2	3.0

Source: Mn/DOT Annual Performance Report, 1994.

Mn/DOT also combines the PQI values with data collected in field surveys of actual road conditions to compute sufficiency ratings. In fiscal 1994, 72 percent of its highways were accorded good or excellent sufficiency ratings, 80 or above, which exceeded the target of 69 percent. To complement these objective measurements of highway condition and tap into customer's ratings of particular aspects of highway services, Mn/DOT participates in an omnibus telephone survey of 800 Minnesota residents conducted by the University of Minnesota. Two measures that are tracked annually are the percent of respondents who report they are satisfied with snow and ice removal along major routes (91 percent in 1994) and the percent who are satisfied with the appearance of roadsides along major routes (87 percent).

As is the case with most agencies responsible for highway maintenance, the Virginia Department of Transportation uses a variety of measures including IRI roughness data, skid resistance numbers, pavement distress data observed in windshield surveys, and overall sufficiency ratings. VDOT develops maintenance level of service measures for each component of the highway system (i.e. roadway, shoulders, drainage, etc.) and in the aggregate for each engineering district. These level of service ratings are actually percentages of sampled highway segments that conform to maintenance goals regarding the elimination of specified distress conditions such as cracking, raveling, rutting, and potholes, as well as ride quality. The overall target for these LOS measures is 80 percent. The Department is also videologging pavement conditions as part of its new pavement management system.

Currently, VDOT is in the early stages of developing a new Integrated Maintenance Management System (IMMS), which eventually will integrate condition and maintenance outcome measures with the more traditional maintenance financial and operating data. The first component of this new system will be

a computerized inventory of all maintainable assets on the highway system, which consists of approximately 11,000 miles of interstate highways and other expressways and roughly 45,000 miles of secondary roads. The inventory, which will utilize Geographic Information System (GIS) technology, will include not only centerline miles and associated roadway features, but also all other assets that require maintainance, such as paved and unpaved shoulders, drainage pipes and ditches, roadside fences and grassy areas, traffic barriers, signals and signs, guardrails, and impact attenuators. All of these assets will be identified as separate items in the inventory. Data on the highway functional class and traffic volume such as vehicle miles traveled will also be included.

Secondly, condition measures for all these assets, as generated by roughness testing, videologging, and more intensive condition surveys, will be incorporated in this same data base. This will allow the IMMS to assess maintenance needs, identify priorities, program maintenance work, and track performance more effectively on a site-specific basis. This system will facilitate tracking changes in the condition of assets, individually and in the aggregate, and in measuring the average maintenance expenditure per unit of change or improvement in asset condition.

Ohio's Maintenance Management and Maintenance Quality Systems

The Ohio DOT has a fairly typical maintenance management system that tracks hours, costs, and accomplishments of 70 maintenance program activities. This system measures labor cost, equipment cost, and materials cost per unit of work accomplished, for example, the labor cost per "swath mile" of roadside mowing completed. All maintenance work is tracked by location, according to route number and the nearest tenth of a mile, so these productivity measures can be analyzed at a very fine level of detail as well as on a highly aggregated basis.

Ohio DOT also has a well-established roadway condition survey, initiated in the early 1970s, in which two-member crews make detailed physical inspections of road sections on a sample basis. The department has two of these crews, who go into each of Ohio's 88 counties once every 3 months. In each county the crew observes 20 to 25 2-mile sections of roadway. They drive the road segment on the shoulder and count deficiencies in 13 categories, such as excessive shoulder dropoff, potholes and other pavement distress, pavement obstructions, and nonfunctional drainage ditches. One measure that is tracked over time in individual counties is a composite of four of these items, pavement potholes, shoulder dropoff, mowing and roadside appearance, and litter. This measure is recorded as the number of deficiencies per lane mile, as one indicator of the quality of the road from the motorists' perspective. At present, Ohio DOT is engaged in a re-engineering of maintenance management processes, and as part of that effort is considering modifying this maintenance quality system to integrate it more fully with pavement evaluation and maintenance management.

Maryland's Peer Review Program

The Maryland Department of Transportation conducts a similar kind of highway condition survey, but with a personnel twist: The roads surveyed in a particular county are inspected by a team of resident maintenance engineers from other counties, rather than by central office personnel. The department's 27 resident maintenance engineers rotate into 5-person teams that visit each county once each year, sometime between April and October. The teams inspect a random sample of approximately 100 half-mile road segments, driving on the shoulder and observing conditions on 39 specific measures pertaining to the roadway, shoulders, drainage, traffic control and safety, and roadside features. Composite scores which can range from 0 to 100 are computed on the results, with most county ratings falling between 70 and 100 with a mean average of approximately 80.

The principal advantage of Maryland's Peer Review Program is that the ratings tend to carry greater credibility and more influence as a motivational force by virtue of the surveys being carried out by resident managers' own peers. While these resident maintenance managers obviously lose time from their responsibilities in their home counties, they also benefit from contact with their peers in varying settings and the opportunity to see firsthand how well maintenance operations are performed in other counties.

Florida's Maintenance Rating Program

The Florida Department of Transportation also relies on regular sample surveys of road condition to assess the effectiveness of its highway maintenance program. In each of the state's eight districts, two-person teams visit each maintenance area within their jurisdiction and walk the 500-foot-long road segments to observe specific conditions in five maintenance categories: (1) roadways, (2) roadsides and shoulders, (3) vegetation and aesthetics, (4) traffic services, and (5) drainage. Approximately 120 road segments are sampled during each iteration of the survey, as follows:

- 30 or more urban, limited-access highways
- 30 rural, limited-access highways
- 30 urban arterial highways
- 30 rural arterial highways.

The teams also survey these same sample segments at night to inspect the visibility of traffic signs and pavement markings. The results of these surveys are combined into a composite measure of highway condition ranging from 0 to 100 (the top score). The Florida DOT has set a goal of achieving an overall maintenance rating of 80 on this scale. Florida's maintenance rating survey is conducted three times per year, or every 4 months running from July through October, November through February, and March through June, in all 32 maintenance areas. The results are analyzed separately and combined into annual scores, as well as aggregated across maintenance areas and districts. The department's conventional

maintenance management system generates information on work completed, costs, and productivity on a daily basis, every 2 weeks, and for the same 4-month periods in which the road condition surveys are conducted. This facilitates the monitoring of work accomplished versus work planned and analysis of the correspondence between specific maintenance activities and the condition ratings of particular roadway elements.

PennDOT's Maintenance Measurement Systems

The Pennsylvania Department of Transportation has used a monthly reporting system since 1980 to track the efficiency and labor productivity of its county maintenance units. As illustrated in Figure 3, this "Red book" shows the counties' planned versus actual production of specific maintenance functions, tons of mechanized patching on paved roads for instance, for the most recent month and for the fiscal year to date. In addition, the report also shows unit costs and labor hours per unit accomplished by each county, as compared against targeted values and statewide averages.

Complementing this maintenance management system, PennDOT also conducts a quality assurance program in which inspectors from the central office conduct independent reviews to evaluate the quality of work completed at three randomly selected job sites in each county during the course of a year. These field audits, which are conducted on an unannounced schedule in order to sample "typical" jobs involving pavement, shoulder, or drainage maintenance functions, focus on both adherence to prescribed operating procedures and the quality of the work completed. The results of these quality audits are summarized annually for each county maintenance unit with average scores on a six-point scale running from "unsatisfactory" to "excellent."

In addition, PennDOT measures its effectiveness in maintaining the roads in good condition through its STAMPP program (for Systematic Technique to Analyze and Manage Pavements in Pennsylvania). STAMPP generates condition data from surveys conducted by two-person teams who drive on the shoulder at 5 miles per hour and record any observed pavement distress or shoulder problems. The 11 district teams that conduct these surveys consist of part-time employees, mostly college engineering students, who are hired for the summer for this specific purpose. PennDOT provides detailed training on how to conduct the survey and operates two quality assurance processes to ensure accuracy in the ratings and uniformity in the process across the districts. Separate surveys on the condition of drainage structures, many of which cannot be observed from a vehicle on the shoulder, are carried out by district personnel.

The STAMPP condition surveys are conducted on 100 percent of all interstate highways and on 50 percent of all other highways each year. (All highways in the National Highway System will be surveyed annually in the future.) In addition, PennDOT also collects IRI data on the same cycle, using vans equipped with accelerometers and ultrasonic sensors (soon to transition to laser sensors) which transmit data to on-board computers to compute IRI values. Data from the STAMPP survey are combined with the IRI data to compute an Overall Pavement Index (OPI), running from 0 to 100 (perfect), which is the best summary measure for making comparisons across counties or districts and for tracking the condition of the state's highways over time. In addition, the survey data are used by the STAMPP process to update models of pavement performance and to identify recommended maintenance treatments for individual road segments. One measure generated by this process is the estimated cost of bringing the roads up to standard. As illustrated in Figure 4, maintenance needs are estimated separately for pavements, shoulders, guardrails, and drainage for four different systems in PennDOT's highway inventory. Standardized as a measure of unmet maintenance needs per mile, these data can also be used to assess the department's effectiveness in maintaining highways over the long run.

TRAFFIC SAFETY

Maintaining safety on state highways has been a serious concern of DOTs for a long time, although at best it is an issue over which they have only partial control, and performance measures have become quite standardized in this area, particularly in terms of outcomes. On the input side, state transportation departments track the number of safety improvement projects completed on their highway systems and the funds invested in them. They also record the numbers of safety inspections conducted on passenger cars and light trucks as well as the motor carrier safety inspections and hazardous materials inspections conducted, along with warnings issued and trucks placed out of service.

Looking at intermediate results in terms of motorists' behavior that impacts on safety, DOTs track statistics on the percent of vehicles exceeding posted speed limits, often using data collected at HPMS sites. The DOTs in many states develop estimates of motorists driving under the influence of alcohol or illegal drugs, usually inferred from data recorded in arrest and accident reports. In addition, many DOTs also commission annual or periodic surveys to track trends in the use of seat belts, child restraints, and motorcycle helmets in compliance with state laws.

Outcomes of traffic safety efforts are monitored by accident statistics over time. State DOTs track numbers of accidents occurring on their highways on monthly and annual bases. These are broken down by accidents involving property damage only, those resulting in personal injury, and those resulting in death. Usually, the estimated dollar value of property damage and the number of injuries, severe injuries, and fatalities are also reported. DOTs also keep track of the number of accidents involving pedestrians and the number of pedestrians killed on state highways. The states are required to report accident statistics, in substantial detail, to the Federal Highway Administration and the National Transportation Safety Administration so that highway safety can be monitored on a national level. These data characterize highway accidents by type (e.g., car crashes), the kinds of vehicles involved (e.g.,large

REPORT NUMBER: R780
PROGRAM NUMBER: P4602780

MORIS HIGHWAY COUNTY MANAGEMENT SUMMARY
ACTIVITY/PRODUCTION COST REPORT
REDBOOK
FOR THE MONTH OF JUNE 1995
DISTRICT 01-0

DATE: 07/08/95 TIME: 02:08:27
PAGE NO: 1

ACT/UNTS	DESCRIPTION	COUNTY NAME	DEPARTMENT ANNUAL PLAN	DEPARTMENT ANNUAL %COMP	DEPARTMENT YEAR TO DATE PLAN	DEPARTMENT YEAR TO DATE ACTUAL	DEPARTMENT YEAR TO DATE %COMP	CONTRACT YEAR TO DATE PLAN	CONTRACT YEAR TO DATE ACTUAL	CONTRACT YEAR TO DATE %COMP	YTD UNIT COST	HIST UNIT COST	AVERAGE MAN-HOUR PER UNIT
711 7121	ROADS-PAVED	CRAWFORD	851	111%	851	949	111%	0	0	0%	$205.19	$228.35	7.84
TONS	PATCHING	ERIE	3030	92%	3030	2814	92%	0	0	0%	$300.42	$325.58	9.85
	MANUAL	FOREST	535	101%	535	543	101%	0	0	0%	$189.44	$192.68	6.48
		MERCER	218	135%	218	294	135%	0	0	0%	$172.60	$237.88	6.11
		VENANGO	636	56%	636	358	56%	0	0	0%	$256.22	$236.95	9.51
		WARREN	1420	98%	1420	1404	98%	0	0	0%	$150.52	$192.90	4.86
		-TOTAL-	6690	95%	6690	6364	95%	0	0	0%	$235.24	$265.41	7.97
	ST-HIST UNIT COST: $211.46;		ST-AVG UNIT COST: $198.05;				ST-AVG MHRS/UNITS:		6.66;		STD.MHRS/UNIT =		7.50
711 7122	ROADS-PAVED	CRAWFORD	5133	106%	2633	2503	95%	2500	2945	117%	$69.65	$64.37	1.06
TONS	PATCHING-MEC	ERIE	2600	98%	2600	2565	98%	0	0	0%	$75.67	$78.87	1.21
		FOREST	2320	95%	2320	2207	95%	0	0	0%	$50.69	$64.38	.56
		MERCER	2780	107%	2780	2993	107%	0	0	0%	$82.24	$90.12	1.71
		VENANGO	170	100%	0	0	0%	170	170	100%	$.00	$.00	.00
		-TOTAL-	13003	102%	10333	10269	99%	2670	3115	116%	$70.77	$74.65	1.16
	ST-HIST UNIT COST: $51.86;		ST-AVG UNIT COST: $54.16;				ST-AVG MHRS/UNITS:		.88;		STD.MHRS/UNIT =		1.10
711 7124	ROADS-PAVED	CRAWFORD	449695	98%	449695	443828	98%	0	0	0%	$1.42	$1.26	.01
GALS	SURF TREAT	ERIE	300500	99%	300500	300447	99%	0	0	0%	$1.51	$1.55	.01
	LIQ BIT	FOREST	12672	104%	12672	13286	104%	0	0	0%	$1.29	$1.59	.01
		MERCER	351000	100%	351000	352377	100%	0	0	0%	$1.34	$1.26	.01
		VENANGO	300285	100%	300285	300410	100%	0	0	0%	$1.12	$1.09	.01
		WARREN	174748	92%	174748	161351	92%	0	0	0%	$1.26	$1.66	.01
		-TOTAL-	1588900	98%	1588900	1571699	98%	0	0	0%	$1.34	$1.28	.01
	ST-HIST UNIT COST: $1.25;		ST-AVG UNIT COST: $1.30;				ST-AVG MHRS/UNITS:		.01;		STD.MHRS/UNIT =		.01
711 7125	SURFACE	FOREST	600	99%	600	595	99%	0	0	0%	$41.33	$54.09	.67
TONS	TREATMENT 1"	MERCER	4200	107%	4200	4513	107%	0	0	0%	$45.23	$96.35	.55
	PLANT MIX	VENANGO	8675	100%	0	0	0%	8675	8675	100%	$.00	$.00	.00
		WARREN	715	99%	715	714	99%	0	0	0%	$121.31	$47.75	.32
		-TOTAL-	14190	102%	5515	5823	105%	8675	8675	100%	$54.37	$65.15	.53
	ST-HIST UNIT COST: $34.70;		ST-AVG UNIT COST: $36.04;				ST-AVG MHRS/UNITS:		.30;		STD.MHRS/UNIT =		.01

FIGURE 3 Source: *County Management Summary*, Pennsylvania Department of Transportation (June 1995).

PROGRAM ID: S4559740
REPORT ID: RMSRR974

PENNSYLVANIA DEPARTMENT OF TRANSPORTATION
ROADWAY MANAGEMENT INFORMATION SYSTEM
ACT 68 OF 1980
ROADWAY NEEDS REPORT

DATE: 05/08/95 15:31:22
PAGE: 1

COUNTY NO: 01
ADAMS

NNNNNNNNNN
NN 1994 NN
NNNNNNNNNN

TREATMENT	INTERSTATE		PRIORITY COMMERCIAL		AGRA/INDUSTRIAL ACCESS		NON-NETWORK		TOTAL	
	MILES	DOLLARS	MILES	DOLLARS	MILES	DOLLARS	MILES	DOLLARS	MILES	DOLLARS
BIT ROUTINE MAINT.	0.00	$ 0	80.93	$ 78,425	89.35	$ 170,889	136.80	$ 436,446	307.08	$ 685,760
BIT EDGE DET. WIDN	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0
BIT UNDERSIZE WIDN	0.00	$ 0	9.26	$ 268,609	56.88	$ 1,358,746	103.86	$ 2,375,338	170.00	$ 4,002,693
BIT SEAL COAT	0.00	$ 0	15.76	$ 291,359	57.29	$ 587,475	107.59	$ 1,279,149	180.64	$ 2,157,983
BIT MAJOR REHAB.	0.00	$ 0	8.98	$ 604,167	6.97	$ 426,988	1.37	$ 74,470	17.32	$ 1,105,625
CON ROUTINE MAINT.	0.00	$ 0	39.37	$ 434,981	0.00	$ 0	0.00	$ 0	39.37	$ 434,981
CON PRESERVATION	0.00	$ 0	4.92	$ 137,545	0.00	$ 0	0.00	$ 0	4.92	$ 137,545
CON PAVE. RESTOR.	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0
CON DEF. RESTOR.	0.00	$ 0	20.12	$ 1,924,993	0.00	$ 0	0.00	$ 0	20.12	$ 1,924,993
CON MAJOR 4-R	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0
CRC ROUTINE MAINT.	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0
CRC PATCHING	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0
CRC MAJOR REHAB	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0
UNP ROUTINE MAINT.	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0
UNP SHAPING	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0
UNP RESTABILIZE	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0
INT. NOT SURVEYED	0.00	-	2.04	-	0.02	-	1.51	-	3.57	-
PAVEMENT TOTAL	0.00	$ 0	172.12	$ 3,740,079	153.63	$ 2,544,098	247.28	$ 4,165,403	573.02	$ 10,449,580
P-SHD ROUTINE MAINT	0.00	$ 0	118.20	$ 5,542	95.64	$ 2,321	138.00	$ 4,942	351.84	$ 12,805
P-SHD CUTTING	0.00	$ 0	16.13	$ 4,665	10.94	$ 2,693	9.09	$ 1,938	36.16	$ 9,296
P-SHD SURF. IMPRV.	0.00	$ 0	24.16	$ 61,537	5.11	$ 15,461	2.53	$ 3,921	31.82	$ 80,919
P-SHD RECONSTRUCT	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0
U-SHD ROUTINE MAINT	0.00	$ 0	51.64	$ 0	99.47	$ 0	189.91	$ 0	341.02	$ 0
U-SHD CUTTING	0.00	$ 0	13.75	$ 2,629	25.49	$ 4,967	23.54	$ 5,858	62.78	$ 13,454
U-SHD RESTABILIZE	0.00	$ 0	1.07	$ 121	0.49	$ 150	2.21	$ 291	3.77	$ 562
NONE JOINT SEAL	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0
SHOULDER TOTAL	0.00	$ 0	224.98	$ 74,494	237.14	$ 25,592	365.28	$ 16,950	827.39	$ 117,036
GRAIL ROUTINE MAINT	0.00	$ 0	30.35	$ 20,302	9.57	$ 25,964	8.82	$ 22,467	48.74	$ 68,733
GRAIL REPAIR	0.00	$ 0	1.21	$ 26,323	0.81	$ 18,965	0.76	$ 12,821	2.78	$ 58,109
GRAIL REPLACE	0.00	$ 0	4.18	$ 175,001	2.75	$ 106,726	3.69	$ 151,143	10.62	$ 432,870
GRAIL END TREATMT.	-	$ 0	-	$ 142,763	-	$ 72,591	-	$ 106,775	-	$ 322,129
GUIDERAIL TOTAL	0.00	$ 0	35.73	$ 364,389	13.13	$ 224,246	13.27	$ 293,206	62.14	$ 881,841
DRAIN ROUTINE MAINT	0.00	$ 0	11.63	$ 2,100	3.27	$ 3,300	4.30	$ 11,400	19.20	$ 16,800
DRAIN FLUSH/CLEAN	0.00	$ 0	14.14	$ 138,197	5.59	$ 61,649	0.03	$ 235	19.76	$ 200,081
DRAIN REPAIR	0.00	$ 0	5.43	$ 397,776	0.14	$ 16,870	0.03	$ 3,542	5.60	$ 418,188
DRAIN REPLACE	0.00	$ 0	0.28	$ 49,718	0.29	$ 48,556	0.27	$ 37,638	0.84	$ 135,912
DRAIN INLET/OUTLET	-	$ 0	-	$ 14,794	-	$ 11,056	-	$ 710	-	$ 26,560
DRAINAGE TOTAL	0.00	$ 0	31.47	$ 602,585	9.30	$ 141,431	4.63	$ 53,525	45.40	$ 797,541
ADAMS COUNTY TOTAL		$ 0		$ 4,781,547		$ 2,935,367		$ 4,529,084	GRAND TOTAL =	$ 12,245,998

FIGURE 4 Source: Pennsylvania Department of Transportation. Bureau of Maintenance and Operations.

trucks), and contributing factors such as speeding, drinking drivers, or mechanical failures, as opposed to road conditions or design features.

To facilitate comparisons across geographic areas or over time, accident measures are typically standardized by traffic volume, for example the number of fatal accidents per 100 million vehicle miles traveled. To view traffic accidents from a perspective of community safety, the Kansas DOT tracks the total number of accidents, the number of fatal accidents, and accidents involving injuries per 1,000 residents of each county. It also tracks the same accidents per 100 vehicle miles traveled in the 38 municipalities with over 5,000 population.

State DOTs analyze accident data to identify high accident locations (HAL), and some track changes in the number of HAL miles in their highway systems over time. These data, along with indications of design related contributing factors, are typically used to develop and prioritize safety improvement projects. Projected benefit/cost ratios are usually computed as part of project planning and used as a selection criterion. More interesting as a performance measure, however, is the reduction in crashes, injuries, and fatalities at locations where safety improvement projects have been completed. The Illinois DOT, for example, examines the accidents reported at a given location for 2 years preceding the project and for 2 years after the project was completed. Counting only those kinds of accidents that would reasonably have been affected by the particular project, then, the DOT computes the number of accidents avoided by virtue of the project.

Projecting this rate of accident avoidance over the expected rate of return life of the project, 20 years for a turning lane at an intersection for example, the estimated total accidents avoided is related to the capital cost of the project to determine the cost per accident (or injury, or fatality) avoided by the project. Applying nationally normed costs of injuries and fatalities allows the estimation of an actual benefit/cost ratio after the project has been built. Other agencies, such as the Virginia DOT and the California DOT, report using similar methodologies to measure the effectiveness of their safety improvement programs. The Oregon DOT tracks similar data, expressed as a percentage of accident reduction, for all completed highway construction or reconstruction projects, not just safety improvement projects.

PUBLIC TRANSPORTATION

Although some state transportation departments, such as those in Maryland and New Jersey, directly operate public transit systems, public transportation in most states is primarily a local government function while the state role focuses on policy and financial assistance. Many state DOTs are concerned with assuring the availability of public transit in their local communities and accessibility to transit for residents who either have to depend on it or who prefer to use it. The DOTs in both Washington and Virginia, for example, track the percentage of the state's population residing in areas served by local transit systems. The North Carolina DOT tracks the number of smaller urban and rural areas as well as metropolitan areas with public transportation service, as does the Texas DOT. The New York Department of Transportation also tracks the number of rural communities served by intercity bus service. The Oregon DOT annually tracks the percent of Oregon communities achieving 100 percent of the applicable minimum service standards described in the Oregon Public Transportation Plan. The department also tracks the percent change in local financial investment in transit systems, including both capital and operating expenditures, as an indicator of community support for public transportation. As a measure of its own cost-effectiveness, ODOT also monitors its public transportation grant dollars per passenger trip on an annual basis.

Given a legislative mandate to provide transit services throughout the state to meet the needs of transit users, the Minnesota DOT has set ambitious objectives for increasing the availability of public transportation and tracks three indicators annually to measure performance in this area. First, it monitors the percentage of the population of greater Minnesota with access to transit services, including fixed-route, demand responsive paratransit service, and ridesharing. This accessibility percentage was computed to be 60.1 percent in 1992, increasing to 64.5 percent in 1994, and targeted for 100 percent by 1997. Second, Mn/DOT simply tracks the number of transit systems operating in the state, counted as 61 in 1992, increasing to 65 by 1994, and targeted at 93 for 1997. These numbers represent all transit operations in Minnesota, including multi-county systems, county systems, and municipal systems. The third measure is the number of counties in Greater Minnesota with countywide systems, defined as public transportation facilities and/or vehicles being accessible throughout a county regardless of what entities provide the service. While 39 counties qualified as having countywide systems in 1994, up from 37 in 1992, Mn/DOT has set an objective for all 80 of the state's counties to have countywide systems by 1997. At present, 22 of the counties have only municipal based transit systems, and 19 counties have no public transit service (*58*).

A Transit Mobility Index

Like many other departments concerned with measuring the availability of public transportation, the Washington DOT currently is limited to tracking the number of people and the percent of the state's total population residing within transit system service areas, whether or not these service areas are coterminous with county boundaries. However, WSDOT is attempting to develop a mobility index that would measure the degree of personal mobility afforded to residents by the public transit systems operating in the state. Working with researchers from the University of Washington, the department has developed a conceptual framework of "layering in" four criteria of the mobility provided by fixed-route and paratransit systems (*60*).

As overviewed in Figure 5, the four criteria include (1) spatial access to a fixed route and/or eligibility for paratransit service, (2) level of service as defined by days and hours or service availability, frequency of trips, and restrictions on trip

Criteria	Access Issue Addressed	Minimum Access Standards		Preferred Access Standards	
		Fixed-Route	Paratransit	Fixed-Route	Paratransit
Choice	Do citizens have a choice for access if a private vehicle is not available? Are there eligibility restrictions that limit citizen access?	Citizen within *3/4* mile of a route.	Citizen with unrestricted dial-a-ride alternative.	Citizen within *1/4* mile of a route.	Citizen with unrestricted dial-a-ride alternative.
	Are the access choices available weekdays only or everyday?	5 days per week	5 days per week	7 days per week	7 days per week
Availability	What hours of the day are the services available?	8 a.m.–6:00 p.m.	8 a.m.–6:00 p.m.	7 a.m.–11:00 p.m.	7 a.m.–11:00 p.m.
	How often are services potentially available? Are there trip purpose, reservation, or departure time restrictions that limit access?	Minimum of *two* bi-directional trips available per day.	Minimum of *one* round trip available per day. Maximum *24* hour advance reservation for travel within *4* hours of desired departure time.	*Hourly* bi-directional travel available.	Minimum of *two* or more round trips available per day. Maximum *12* hour advance reservation for travel within *2* hours of desired departure time.
Inter-City Connections	Do citizens have access option to other communities?	Connections with intercity services.	Connections with intercity services.	Connections with intercity services.	Connections with intercity services.
Affordability	Can citizens take advantage of services at a reasonable cost?	Fares less than or equal to 150% of statewide average fare.	Fares less than or equal to 150% of statewide average fare.	Fares less than or equal to 150% of statewide average fare.	Fares less than or equal to 150% of statewide average fare.
		Volunteer services or transportation vouchers available.	Volunteer services or transportation vouchers available	Volunteer services or transportation vouchers available	Volunteer services or transportation vouchers available

FIGURE 5 Public transit mobility measures. Source: D.C. Hodge and J. Orrell, *An Access Assessment Framework for Washington State.*

purpose, (3) connections with inter-city transportation service, and (4) affordability to customers. Operationalizing this model would require establishing standards for each of the criteria (suggested minimum and preferred standards are presented in Figure 5) and then determining the percentage of citizens for whom each criterion is met. These computations are performed for both fixed-route and paratransit service and then compared to eliminate overlap in the percentage of citizens meeting the criteria. The information needed to compute these percentages is commonly available from census sources and transportation providers.

While data on the individual criteria would obviously be useful for evaluating and planning service enhancements, a summary index combining these measures could be constructed for the purposes of monitoring overall personal mobility afforded by public transportation services over time. The initial research illustrates application of the criteria to one particular county, and WSDOT plans to test the model in several eastern Washington counties. At some point, this index may be developed for individual counties and on a statewide basis to track personal mobility afforded by public transit over time.

Public Transit Operating, Ridership, and Financial Statistics

Notwithstanding the issues of accessibility and personal mobility, performance measurement in the transit industry has become fairly standardized, due in part to longstanding federal reporting requirements for transit operators receiving financial assistance from the Federal Transit Administration (61). Most state DOTs that have active transit assistance programs collect similar data from their local transit agencies on operations, ridership, and finances, and many of them publish annual reports that present performance measures, often comparing similar types of systems and tracking trends over time (*62, 63, 64, 65*).

Most of the measures tracked by state DOTs are the same kinds of measures often used by individual agencies for their own planning and evaluation purposes, and these measures are usually monitored separately for different systems components, i.e. fixed-route bus service versus paratransit operations, and rapid rail and commuter rail service in larger metropolitan areas. The amount of service provided is measured by vehicle hours

TABLE 7

LOCAL TRANSIT SYSTEMS IN MICHIGAN SELECTED PERFORMANCE MEASURES—FISCAL 1994

Performance Measures	16 Urban Systems	66 Nonurban Systems
Vehicle Hours per Capita	0.71	0.76
Vehicle Miles per Capita	9.84	11.58
Cost per Vehicle	$96,952	$41,253
Miles per Vehicle	31,162	24,600
Hours per Vehicle	2,219	1,464
Passengers per Capita	11.75	4.11
Passengers per Vehicle Hour	15.55	5.60
Passengers per Vehicle Mile	1.13	0.43
Cost per Vehicle Hour	$44.16	$29.56
Cost per Vehicle Mile	$3.15	$1.79
Cost per Passenger	$3.19	$5.69
Farebox Revenue per Passenger	$0.57	$1.27
Farebox Revenue pr 1,000 Population	$6.49	$5.22
Local Share per Passenger	$0.71	$1.39
State Funds per Passenger	$1.15	$2.33
State Funds per 1,000 Population	$11.40	$8.58
Federal Subsidy per Passenger	$0.73	$0.80

Source: Michigan Department of Transportation, Passenger Transportation Division.

and vehicle miles operated, or by revenue vehicle hours and miles operated, eliminating deadheading. Overall capacity is sometimes measured by the number of seatmiles operated. Typically, states track total operating cost for each system and monitor the cost per vehicle hour and/or the cost per vehicle mile as measures of operating efficiency.

Labor productivity is often measured by the number of revenue hours per employee, the number of revenue hours per vehicle operator, and the number of vehicle miles per maintenance employee. Vehicle productivity is also monitored in some cases, using the number of vehicle hours or miles operated per vehicle. Some DOTs also track the number of vehicles operated by local transit agencies, sometimes the number of vehicles operated during peak periods, and the average age of vehicle fleets. Indicators of service quality seem to be monitored less frequently at the state level, but there are exceptions. For example, the Texas DOT tracks measures of on-time performance and the number of vehicle miles operated between mechanical breakdowns as indicators of reliability, and the number of collision accidents per 100,000 vehicle miles operated.

State DOTs monitor ridership by the number of total passenger trips made on transit systems, in some cases separating out originating trips versus transfers. Many DOTs track the number of passenger trips per capita as a measure of the need for, or importance of, public transportation in the service area. The Missouri Department of Transportation monitors the number of individuals served by each demand responsive paratransit system in the state, obtaining from each paratransit operator an unduplicated count of individuals served at least once during the year. This is a worthwhile indicator to track over time, but unfortunately it cannot be easily obtained for conventional fixed-route transit systems whose passengers use the service anonymously. An unduplicated count of fixed-route transit passengers could be estimated, however, from passenger surveys using statistically valid samples, but this would entail considerable effort.

Many DOTs track the number of passenger trips per vehicle hour, or passengers per vehicle mile, as a measure of overall transit system productivity. The cost per passenger trip is the standard measure of cost-effectiveness. Most DOTs compare farebox revenue, or total revenue, versus operating expense across transit systems, and they usually track revenue, expense, and operating deficits over time. The percent cost recovered through earned revenue is often monitored as an indicator of economic efficiency. Many state DOTs also monitor local subsidies, state funding, and federal assistance for transit service, sometimes on a per passenger trip or per capita basis. Table 7 shows data on 17 performance measures for urban and nonurban transit systems that are monitored annually by the Michigan Department of Transportation. These measures, which are all standardized as ratios, allow MDOT to compare individual systems against statewide averages in terms of service provision, ridership, productivity, unit costs, revenue versus expense, and subsidies from different sources as well as to monitor trends in transit system performance over time.

WATER-BORNE TRANSPORTATION

Water-borne transportation comprises an important component of the nation's overall transportation system for moving people and goods. Maintaining the navigability of inland and coastal waterways is primarily the responsibility of the U.S. Army Corps of Engineers, while much of the industry that uses these waterways is owned and operated by the private sector. Many local government authorities own and maintain port or terminal facilities and provide related services. Although many state transportation departments are only involved tangentially, if at all, with this mode of transportation, others are more directly involved at both the operational and policy levels and therefore monitor measures of the performance of these activities.

Ferry Service

DOTs in several states on the East and West coasts (e.g. California, Washington, Maine, Connecticut, Virginia, North Carolina) operate ferry service in intercoastal waterways, while some interior states (e.g. Illinois, Louisiana) operate ferry service over major rivers. Ferry services transport people, and often the vehicles they drive, over water from one piece of land to another, functioning primarily as a link in the highway system. However, operationally they resemble public transit systems with fixed routes and schedules, and the measures used to track their performance tend to be transaction based indicators. The most common measures used by these state DOTs to track ferry service include the following:

- Number of crossings,
- Schedule adherence,
- Nautical miles operated,
- Accidents reported,
- Operating expense,
- Cost per crossing,
- Passengers transported,
- Passenger miles,
- Vehicles transported,
- Cost per passenger trip,
- Cost per vehicle,
- Toll receipts, and
- Revenue to cost ratio.

These ferry operations range from a single vessel making repeated short trips back and forth across a river to systems involving several links. By far the largest ferry system in the country is the Alaska Marine Highway System, which provides essential connections among communities throughout southeastern and southwestern Alaska, where land based highways are not feasible. This system operates a fleet of eight vessels over 35,000 miles of route. Table 8 illustrates for a few selected links some of the measures that are tracked on components of this system on monthly and annual bases. The data show, for example, that although passenger and vehicle counts on these links are substantial, the actual capacity to transport passengers and vehicles on these trips still exceeds demand (*66*).

Ports and Waterways

DOTs in states with deepwater ports usually maintain inventories of those facilities and often monitor shipping activity there. For example, the Michigan DOT tracks the number of Great Lakes ports with highway and/or rail connections and the number of terminals at each port. This information is updated somewhat sporadically because these facilities change quite slowly. MDOT also tracks the annual tonnage of revenue cargo moving through each commercial port in the state, based on information reported by the U.S. Army Corps of Engineers.

On the input side, DOTs in many states, such as Connecticut, Florida, and Louisiana, track the number of port improvement projects completed and the funds invested in these projects. The California Department of Transportation tracks the number of port improvements as well as the number of intermodal access improvements completed at ports in the state. CALTRANS also tracks the number of ships using its seaports and the revenue tonnage of cargo brought into and taken out of these ports, broken down by commodity groups. The DOTS in Maine and New York reported tracking the same indicators. The Missouri DOT tracks the number of barges loading and/or unloading cargo at its river ports, the tons of cargo transported through them, and the revenue earned at these facilities.

The Maryland DOT's Port Administration operates major port facilities and tracks revenue and expense on a quarterly basis. On a monthly basis it tracks the number of vessels calling on the port, the total number of dockage days, as well as the breakbulk tons of cargo shipped into the port and tons of various commodities such as steel, copper, lumber, paper, pulp, automobiles, molasses, asphalt, and latex moving through the port's terminals. In addition the Port Administration monitors the number of container feeder barges working in the port along with the net tons of containerized cargo and the number of empty and loaded containers moving through the port. It also keeps track of the number of railroad cars loaded with cargo at the port and the tonnage of cargo hauled away from the port by rail.

The Illinois Department of Transportation periodically updates its inventory of terminals along the Mississippi river and others that feed into it and regularly monitors the tonnage of various commodities loaded or unloaded in regions along a river, although not at individual privately operated terminals.

TABLE 8

1994 SELECTED LINK VOLUMES ALASKA MARINE HIGHWAY SYSTEM

Link	Passenger Count	Passenger Miles	Capacity Ratio (%)	Vehicle Count	Capacity Ratio (%)	Trips	Vessel Miles
Haines-Juneau	59,738	2,184,683	37.0	14,805	66.1	261	17,748
Juneau-Haines	59,532	4,048,176	37.6	14,205	65.1	253	17,204
Hollis-Ketchikan	24,902	996,080	20.2	7,063	38.8	431	17,240
Ketchikan-Hollis	25,823	1,032,920	21.4	7,815	44.2	425	17,000
Haines-Skagway	39,926	519,038	27.0	8,851	44.8	229	2,977
Skagway-Haines	38,428	499,564	25.4	8,289	41.4	237	3,081
Seward-Valdez	1,424	205,056	43.1	403	63.3	15	2,160
Valdez-Seward	1,317	189,648	39.9	358	54.0	15	2,160

Source: Annual Traffic Volume Report, Alaska Department of Transportation, 1995.

It also tracks the cargo tonnage flowing through specific locks on the waterway system as well as the number of commercial and recreational lockages at these facilities on a monthly basis. All this information is obtained from the U.S. Army Corps of Engineers.

AVIATION

While state transportation departments do in some cases own and operate airports, their primary role is policy planning and providing assistance to maintain and enhance accessibility and capacity, improve safety, and resolve environmental issues around airports. DOTs monitor a variety of measures in these areas, with much of the information coming from secondary data sources.

Service Availability and Activity Levels

Access to air passenger service is considered to be fundamental to the economic health of a region or local area. Thus, the Oregon Department of Transportation tracks the percentage of Oregonians living within 50 miles of a commercial airport, one with daily scheduled airline passenger service. Looking at connectivity with major markets, ODOT also tracks the number of U.S. and international cities over 1 million population that are served by direct or non-stop flights from any Oregon commercial airport. The Maryland DOT also reports tracking the number of non-stop cities served by its commercial airports.

Most of the state transportation departments that have moved more proactively into the aviation area track activity levels at commercial airports. The most commonly reported measures include:

- Number of scheduled commercial airline flights departing and arriving,
- Actual flights versus scheduled flights,
- Airline seat miles available,
- Number of passengers enplaned and deplaned,
- Average load factors, percent seats utilized, and
- Tons of freight and mail enplaned.

The New York Department of Transportation, for example, tracks most of these measures on a monthly basis for each of the 25 commercial airports in the state, broken down by individual passenger and freight carrier. The data are reported by each airport manager who receives them from the airlines. The NYSDOT also tracks data on flight activity at all the general aviation airports in the state.

Aviation Assistance Programs

Many state DOTs support airport development through capital grants to assist in extending or rehabilitating runways, building or rehabilitating terminals and other facilities, and making safety improvements. They usually monitor the number of projects completed in different categories on an annual basis and sometimes monitor the total dollar value of these projects as a percentage of the total airport development needs that have been identified. The Pennsylvania Department of Transportation, for example, is proposing to track the percentage of funds invested in runway rehabilitation projects that will extend the useful life of the pavement a minimum of 2 years. Other DOTs track the value of federal grants awarded for airport development in their state. PennDOT is also proposing to track the percentage of its total airport improvement funds used to leverage federal assistance for projects in the state.

DOTs also track measures relating to their safety oriented programs. For example, the Minnesota DOT tracks the total annual attendance at its pilot safety seminars, the number of state sponsored locations reporting aviation weather, and the number of pilots' requests for weather information receiving responses on a computer terminal. Like many other DOTs, Mn/DOT also tracks the number of airport safety inspections conducted annually.

RAIL FREIGHT TRANSPORTATION

Although state DOTs do work with large railroads on policy issues and specific enhancement projects (such as PennDOT's recently completed project in conjunction with CONRAIL to make the entire rail line from the Port of Philadelphia to Pittsburgh open to "double-stacked" trains), their principal involvement with rail freight transportation has centered on preserving smaller, class 1 railroad operations that are essential from an economic development perspective. Some DOTs have acquired and restored service on short line railroads serving certain industries that may be heavily dependent on them, while others assist private operators in rehabilitating track or extending spurs to new customers as an inducement to maintain their operations.

Several state DOTs track the number of proposed rail line abandonments, as well as the miles of track acquired or rehabilitated for freight service. Departments that have programs in this area also tend to track the number of carloads shipped on project lines, usually broken down by commodities. The Minnesota DOT, for example, not only tracks the number of carloads that are shipped or received on project lines annually, but also estimates the additional revenue earned by farm producers when shipping grain and other commodities via these rail lines. This latter estimate is based on information first solicited through a one-time survey of shippers on project lines conducted in 1990 and updated by information provided by rail shippers associations. This additional revenue was computed to be $ 0.05 per bushel in 1994 and targeted at $0.06 for 1995 through 1997.

Other departments, such as the Kansas DOT, also track profitability and productivity measures for Class 1 railroads in their state, such as their debt/equity ratio and freight revenue versus operating expense. Other measures obtained by KDOT from the Association of American Railroads on an annual

basis include freight car miles operated, average number of cars per freight train, the average tons of cargo per carload and per train, revenue ton-miles per car loaded, revenue ton-miles per employee hour, ton-miles per gallon of fuel consumed, and freight revenue per ton-mile and per ton.

Regarding rail safety, many state DOTs monitor the number of grade crossing accidents per year. The Florida DOT tracks a measure that relates this to potential accident exposure, defined as the number of grade crossings in the state per grade crossing accident. Similarly, with respect to serious train accidents, FDOT measures the number of miles of rail line in the state per derailment on an annual basis.

One area of emerging interest to rail programs is the capacity of intermodal facilities, for example truck/rail facilities and ship/rail or barge/rail facilities. PennDOT is planning to measure congestion at intermodal facilities, assigning DOT technical staff to assist MPOs and LDDs in taking the measures, which have not been defined at this point, assisted by PennDOT technical staff.

DRIVER AND MOTOR VEHICLE SERVICES

While in many states driver licensing and motor vehicle registrations are assigned to other agencies such as the state police or a separate department of motor vehicles, in other states the transportation department has responsibility for these functions. These functions are transaction based activities, and—consistent with the National Quality Initiative—state DOTs have become increasingly concerned with measuring the quality of customer service as well as efficiency in these areas. Regarding overall efficiency, many DOTs track the average cost per transaction completed.

Because these work processes are extremely labor intensive, departments also monitor the number of completed transactions per employee or the number of licenses issued per examiner. The Oregon DOT measures the total number of its DMV business transactions, weighted by standard processing times, divided by the number of full-time equivalent employees working in this area. Most departments track the flow of applications through their processing systems, and some monitor the backlog of cases measured by the number of work days pending in processing drivers licenses and vehicle registrations.

State DOTs often track error rates in these processes, measured by the number of percent of completed transactions in which errors were detected and had to be corrected. By far the most commonly reported measures of performance in these areas concerned processing time, the average number of days required to complete various kinds of transactions, e.g. vehicle titles, initial vehicle registrations, license tag renewals, and automobile or truck dealer title applications, etc. On the licensing side, these measures reflect the number of days required to process driver license applications, deposit license fees, and process requests for restoration of suspended licenses. Other customer service oriented measures were also cited. The Wisconsin DOT, for instance, tracks the number of abandoned calls to its vehicle registration information line on a daily and weekly basis in order to evaluate the effectiveness of outgoing pre-recorded messages used in that system. The Oregon DOT tracks customer satisfaction with the quality of licensing and registration services provided by the department through periodic customer surveys.

The Arizona DOT's Motor Vehicles Division (MVD) monitors the average number of minutes spent by customers waiting for service in each of 65 local offices on a monthly basis. It also tracks the number of customers who had to wait more than 30 minutes for service. The MVD's Communications Unit tracks the number of telephone calls coming in that were answered versus being abandoned before being answered, along with the average waiting time for both answered and abandoned calls. ADOT has recently been authorized to contract with third parties, primarily new and used automobile dealers, to conduct vehicle safety inspections, and it tracks the number of such third-party inspections completed each month, and the estimated number of MVD employees that would have been required to conduct those inspections.

MULTIMODAL AND INTERMODAL TRANSPORTATION DEVELOPMENT

Relatively few states reported tracking measures regarding multimodal or intermodal performance as compared with measures pertaining to specific modes of transportation. Measures that were reported tend to relate either to program inputs and outputs, to access, or to utilization. For example, the Washington DOT monitors the amount of funding for urban and rural bicycle touring routes and the miles of touring routes built every 6 months. Ohio tracks both the transfer of Surface Transportation Program funds from highways to transit and intermodal project expenditures annually. In addition to monitoring numbers of grade crossing accidents, many DOTs also track the number of highway/rail grade crossing improvement projects completed.

In some states, such as Florida and California, DOTs track the percentage of transportation improvement funds invested in highway versus non-highway modes. The Florida DOT also monitors the number of "intermodal access projects" completed annually on a statewide basis, defining intermodal access projects as those that improve either road or rail access to ports and/or airports. With respect to actual usage, the Maryland DOT tracks the number of rail cars and rail tons of cargo loaded at Maryland ports.

Other measures of intermodal access have been contemplated but not implemented as of yet. As part of an effort to develop a governmentwide set of performance measures in Maryland, for example, the DOT proposed to track bicycle and pedestrian access to transit stations as well as the percentage of its population residing within 5 miles of fixed-guideway transit stations or controlled-access highway entrances. Other proposed measures included the amount of new real estate development within one-quarter mile of transit stations, and the number of commuters using park and ride lots. However, these measures have not been selected for inclusion in the statewide system.

The Maryland DOT is conducting a study of access to the 100 rail transit stations in the state, including those on the Washington Metro system as well as Maryland's MARC, the Baltimore Metro, and the Baltimore Central Light Rail systems, looking at sidewalks, bicycle curb lanes, and connectivity to bicycle trails. The results of this study will provide a measure of pedestrian and bicycle access to transit stations which could then be updated periodically in the future. Another measure proposed by the Maryland DOT that focuses on intermodal connectivity is the number of commuters using park and ride lots.

The New Jersey DOT tracks the miles of bicycle compatible roadways on an annual basis. The Minnesota Department of Transportation monitors a similar measure, the miles of trunk highway rated as "good" or "fair" for bicycle travel on an annual basis. In fiscal 1994 Mn/DOT counted 6,310 miles of trunk highway rated as good or fair for bicycle use, which exceeded the target of 6,260 miles; 6,560 miles are targeted for fiscal 1997 (*58*). These ratings of the suitability of trunk highways, primarily rural sections, for bicycle travel are based on records of paved shoulder widths relative to the number of roadway lanes, lane width, and vehicular traffic volumes.

Caltrans produces annual estimates and forecasts of the number of vehicles in use, vehicle miles traveled by mode, fuel consumption and fuel economy, as shown in Figure 6. Measures of the percentage of passenger trips made by various modes, the vehicle miles per capita, and the percentage of different kinds of vehicles using high-occupancy vehicle lanes are included in the same report. This information is reportedly used frequently in identifying or assessing transportation policy issues as well as energy and air quality issues. With respect to energy consumption, the Pennsylvania DOT monitors diesel fuel consumption and the energy efficiency of the state's public transportation systems, as shown in Table 9.

New Jersey Travel Survey

Other state DOTs are concerned with tracking the modal breakdowns for commuter and/or all passenger trips. To support efforts to meet federal Clean Air Act requirements, for example, the New Jersey DOT has employed extensive surveys to establish average vehicle occupancy rates and the use of alternative transportation modes. Because 18 of its 21 counties are classified as severe non-attainment areas in terms of ozone depletion, the state is operating under a federal mandate for employer sponsored trip reduction programs to reduce the use of single-occupancy vehicles (SOVs), particularly with respect to work commute trips.

Thus, the DOT conducted large-scale telephone surveys in 1992 and 1994 focusing on modal choice for work trips. Measures derived from the responses include the percent of short trips (under 5 miles) made by carpooling, vanpooling, transit, bicycles, or walking as opposed to SOVs in each county. The results of the 1994 survey, which collected responses from approximately 8,500 commuters across the state, indicated that 84 percent of employees in New Jersey get to work by driving alone, while 8 percent use carpools or vanpools, 4 percent either work at home or walk to work, and the remaining 4 percent use public transportation. The average vehicle occupancy for these commuter trips was estimated at 1.15 for the state as a whole (*67*). The New Jersey DOT intends to continue monitoring these measures every 2 years and, beginning in 1996, will expand the survey to incorporate all passenger trips.

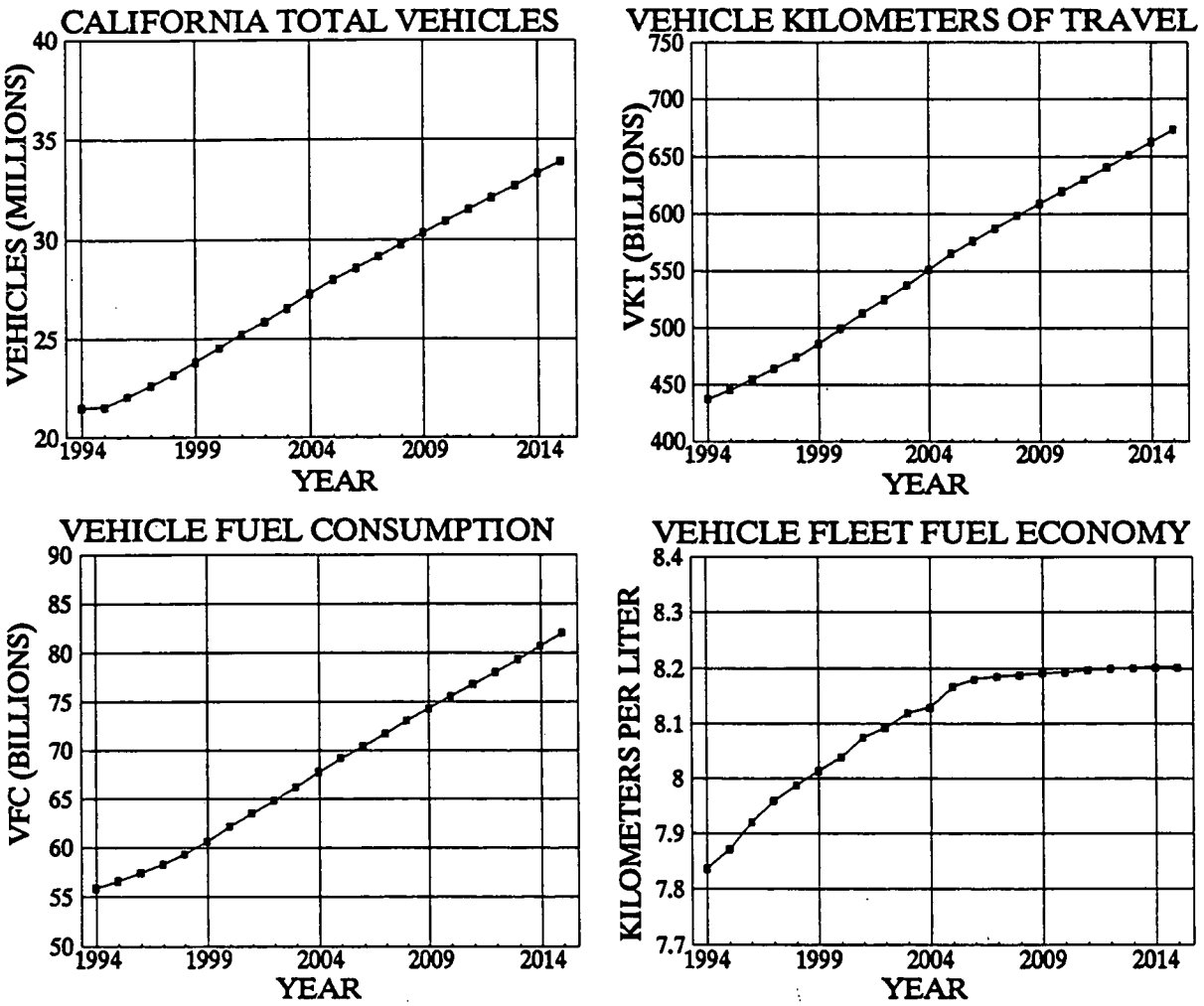
Other states have similar interests in tracking alternative transportation modes. In conjunction with the MPOs in the state's three urbanized areas, the Idaho DOT is planning to conduct a survey to determine the percentages of trips using SOVs, carpools and vanpools, bus transit, bicycles, and walking. This survey will encompass all trips made in those areas, rather than work commuter trips only, and it will also break them down by length and trip purpose. The Idaho DOT would like to expand the geographic scope of this survey to include the entire state and to replicate it every 3 to 5 years, in part to track progress in attaining the goal of doubling the percentage of bicycle and pedestrian trips. The DOT also reports the number of motor vehicular crashes that involve pedestrians or cyclists and is monitoring this performance measure against the goal of reducing these accidents by 10 percent.

Ridesharing Programs

Several state DOTs have initiated ridesharing programs aimed at reducing the use of SOVs by matching motorists whose commuting trips have similar origin-destination patterns in vanpools or carpools. The Georgia DOT, for example, has a rideshare program that advertises the opportunity to form carpools in the Atlanta metropolitan area and uses a GIS-based information system to match individuals with similar trip needs who have called in to request assistance in arranging carpools. The DOT annually tracks the distribution of commuter travel modes of those who have requested information or assistance from the program.

The Virginia DOT funds ridesharing programs in 15 local areas in the state and tracks current travel modes versus previous travel modes through annual surveys of motorists who have contacted these programs. For example, an evaluation of the program in fiscal 1989 revealed that while the use of SOVs among those surveyed decreased from 48 percent to 37 percent and the use of public transit decreased from 19 percent to 10 percent, the use of carpools and vanpools increased from 32 percent to 49 percent (*68*). Key findings reported in this evaluation reflect other relevant performance measures, as follows:

- Almost 11 million vehicle miles of travel were eliminated by rideshares formed through the program,
- More than 560,000 gallons of gasoline were saved,
- An annual reduction of 59 tons of hydrocarbons, 396 tons of carbon monoxide, and 26 tons of nitrogen oxides was achieved,
- Approximately 1,470 parking spaces were not needed, and
- More than $8.4 million in total commuter costs were saved.



CALIFORNIA TOTAL VEHICLES, VKT, FUEL AND KPL FORECAST

YEAR	VEH	VKT	FUEL	KPL	YEAR	VEH	VKT	FUEL	KPL
1994	21.52	437.9	55.88	7.84	2005	27.98	565.5	69.24	8.17
1995	21.56	445.7	56.62	7.87	2006	28.57	576.7	70.50	8.18
1996	22.09	455.0	57.45	7.92	2007	29.16	587.7	71.80	8.19
1997	22.64	464.4	58.34	7.96	2008	29.76	598.6	73.10	8.19
1998	23.20	474.2	59.37	7.99	2009	30.34	609.1	74.35	8.19
1999	23.84	486.2	60.67	8.01	2010	30.93	619.6	75.62	8.19
2000	24.55	499.8	62.17	8.04	2011	31.52	630.1	76.87	8.20
2001	25.24	513.2	63.56	8.08	2012	32.10	640.6	78.12	8.20
2002	25.88	525.0	64.88	8.09	2013	32.70	651.3	79.42	8.20
2003	26.54	537.6	66.22	8.12	2014	33.32	662.5	80.77	8.20
2004	27.26	551.2	67.81	8.13	2015	33.92	673.3	82.09	8.20

FIGURE 6 Motor vehicle stock, travel and fuel forecast. Source: *California Department of Transportation, California Motor Vehicle Stock, Travel and Fuel Forecast*, November 1995.

TABLE 9

PUBLIC TRANSIT ENERGY EFFICIENCY

Measure	FY 1993–1994
Gallons of diesel fuel consumed	65.6 million
Originating passengers/unit of energy*	4.6
Vehicle miles/unit of energy	1.6
Passenger miles/unit of energy	24.5

*1 gallon of diesel fuel or 10 kilowatt hours of electrical energy.
Source: Pennsylvania Urban Transit Statistical Report: 1993–1994.

Cross-Modal Comparisons

As state DOTs engage more systematically in true intermodal transportation systems planning, they need to undertake cross-modal analyses on an objective basis. This requires "modally blind" performance measures and comparable data across different transportation modes. Figures 7 and 8 show comparable measures for transportation supply and demand, respectively, identified by the California DOT's Intermodal Transportation Management System plan (*69*). While such cross-modal comparisons are not often specified, these figures suggest that many of the standard measures discussed elsewhere in this report could indeed be useful for this kind of assessment and planning.

ADMINISTRATIVE PERFORMANCE

In addition to measures designed to track the performance of substantive programs or transportation systems, many DOTs also monitor indicators of administrative performance across their divisions and operating units. The Oregon DOT,

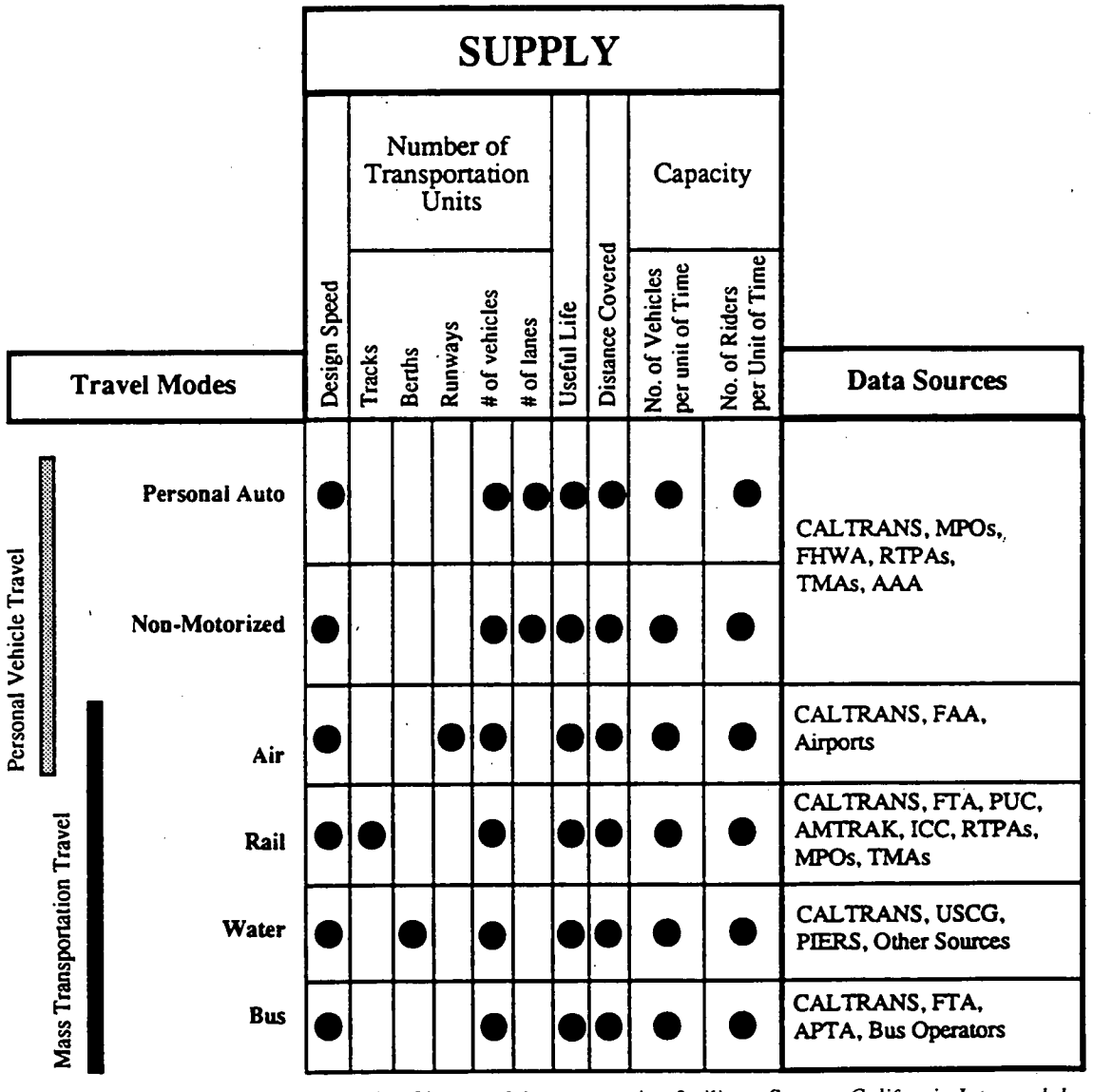


FIGURE 7 Comparable data on supply of intermodal transportation facilites. Source: *California Intermodal Transportation Management System (ITMS),* California Department of Transportation (June 1993).

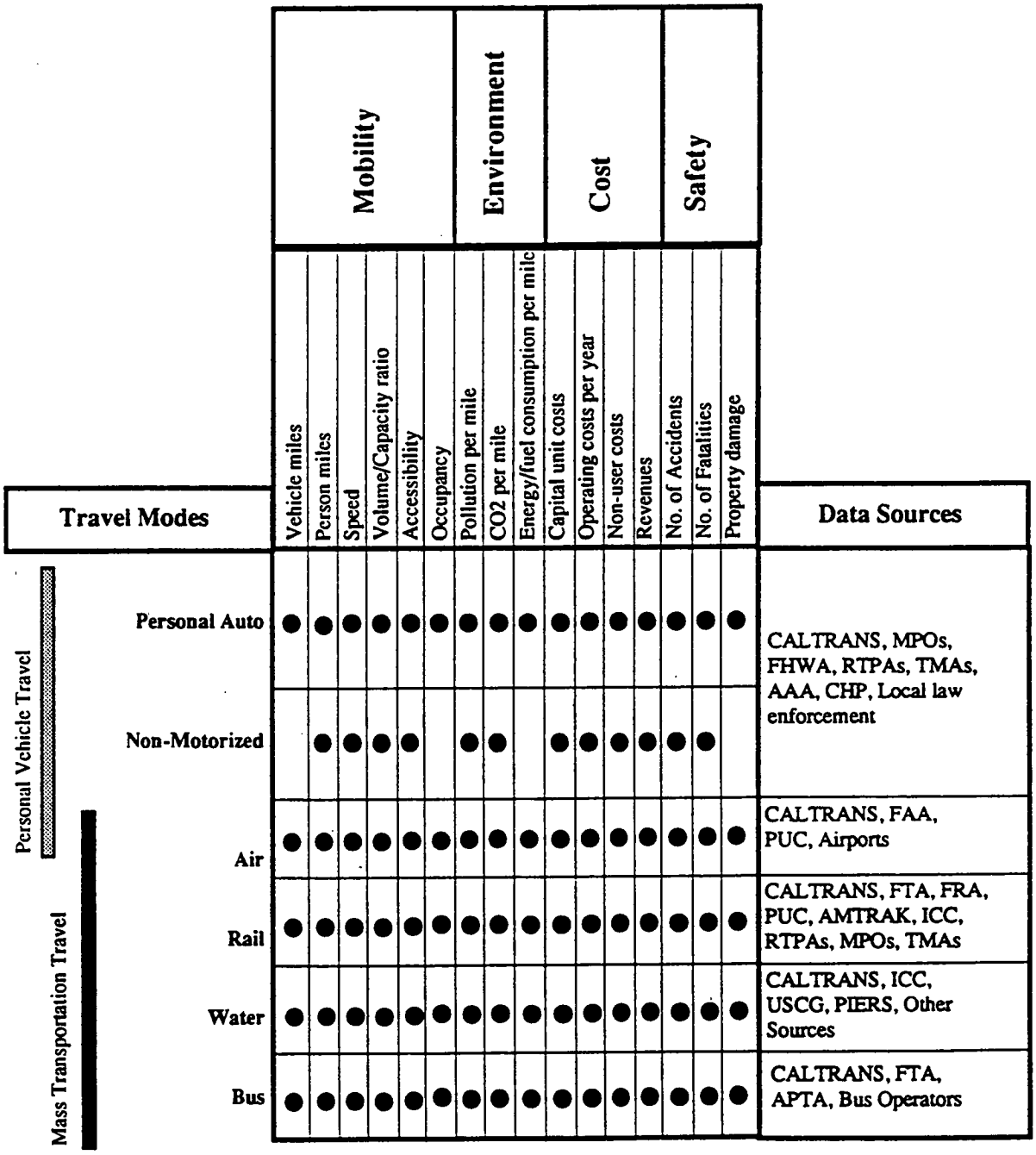


FIGURE 8 Comparable data on demand of intermodal transportation facilities. Source: *California Intermodal Transportation Management System (ITMS),* California Department of Transportation (June 1993).

for example, measures the percent of its total annual budget invested directly in the state's transportation system, as opposed to expenses for support activities or administrative overhead. No respondents to the survey indicated that they track separately the percent of administrative overhead in their budgets, although the Minnesota DOT has proposed to track the percentage of department funds consumed by overhead. That measure apparently could be tracked on each operating unit and then rolled up to the departmental level.

As part of its strategic management process, the Arizona DOT monitors several measures of the performance of its Administrative Services Division on an annual basis, such as the number of errors and omissions in the budget document it produces and the percent of inquiries from the state's Office of Strategic Planning and Budget and the Joint Legislative Budget Commision to which it responds within one working day or mutually agreed on time frame, which is targeted at 95 percent. The Division measures the accuracy of its revenue forecasts by computing the percent variance of actual proceeds in the Highway User Revenue Fund and the Regional Area Road Fund from the forecasted values. ADOT also tracks the percent of available funds that are invested, targeted at 99

percent for fiscal 1996 and 99.5 percent for fiscal 1997, and monitors the cost of capital obtained through issuing bonds, targeted at 4 percent or lower (*70*). In addition, as a measure of customer service with respect to accounts payable, ADOT monitors the percent of payments processed within 5 working days of receipt of invoice, targeted at 81 percent for fiscal 1996 and up to 90 percent for fiscal 1997.

Several of the measures cited in this area concern human resources. For example, the Minnesota DOT has proposed to track the number of full-time equivalent employees (FTEs) per supervisor throughout the department. Several DOTs, such as those in Arkansas, Nebraska, North Carolina, and Pennsylvania, indicated that they track statistics on the diversity of their workforce over time. The most commonly used measures along these lines are the percent female employees and the percent minority employees. Sometimes these measures are tracked by major divisions or organizational units and sometimes by position type, for example the percent of managers or supervisors who are female.

The Maryland DOT tracks the percent of employees who are rated as "far exceeding" the work performance standards that have been established for their positions. The Maryland and Pennsylvania DOTs also monitor the percent of employees who have completed training in quality improvement processes. Many DOTs, including Arkansas, North Carolina, and Oregon reported tracking sick leave usage either against targets or in ratio to earned sick leave hours. The Arizona DOT tracks the compensation for sick leave hours as a percent of total personal services paid. As a gross indicator of labor productivity, the Maryland DOT tracks the number of employees in its divisions in ratio to some measure of workload or activity level, for example:

- Vehicle miles traveled per State Highway Administration employee,
- Transit passenger trips per Maryland Transit Administration employee,
- Passengers enplaned per Maryland Aviation Administration employee,
- Transactions per Motor Vehicle Administration employee, and
- Tons of cargo moved per Maryland Port Administration employee.

Other commonly cited measures of administration performance concern safety and risk management. For example, the Nebraska DOT tracks the number of lost-time on-the-job injuries to employees per 20,000 hours of exposure. The Pennsylvania and North Carolina DOTs track similar measures of injury rates, while the Oregon DOT monitors the number of work days lost due to injury per 100 employees.

In an aggressive program designed to minimize lost time and associated costs due to injuries, the Montana DOT keeps close track of individual injuries to assure that injured employees receive appropriate treatment and rehabilitation and return to their regular jobs or other work within the department as expediently as possible. In support of this effort, the DOT monitors the number of accidents and injuries by type, the number of worker's compensation claims filed against it, the associated medical and disability costs, and annual worker's compensation premiums.

The Nebraska DOT also monitors the number of preventable vehicular accidents involving its employees and vehicles. Many state DOTs, including Pennsylvania and New Mexico, track the number of tort claims filed against them and the dollar cost of tort claims settled against them. In addition to monitoring the number of tort claims filed against it, the Arizona DOT tracks the number of follow-up investigations completed by its own investigators and the annual premiums for insurance against tort liability. As DOTs become more concerned with effective risk management, more specific measures along these lines are likely to be tracked on a regular basis.

To flesh out the "supplier component" of its TQM program, the Arizona DOT has moved aggressively into a "partnering" strategy for working with its many contractors and subcontractors. In the partnering process, all parties to a contract, for the construction of a highway interchange or the development of a computer system, for example, work together as a team with common goals for addressing and solving problems. The overall objective is to replace a traditionally adversarial process with a "win/win" cooperative approach. Once contracts have been signed as a result of competitive bidding procedures, all the parties work together in carrying out the project to achieve optimal results. ADOT is nationally recognized for its leadership in this area and has instituted partnering processes in all its divisions. The department monitors the results of this managerial innovation by tracking relevant performance measures on a regular basis. With respect to highway construction, for example, ADOT monitors (1) the percent of allotted contract time actually used to complete partnered projects, (2) the dollar savings in construction engineering costs accrued on partnered projects, and (3) value engineering savings achieved on partnered projects.

CHAPTER FOUR

INDIVIDUAL STATE PROGRAMS

The extent to which state DOTs engage in performance measurement and how they develop and use performance measures vary considerably, as survey responses show. While some agencies have invested substantial time and resources in developing performance measures on a systematic basis and in some cases have integrated measures with other management processes, others have more fragmentary measurement systems. This section profiles selected performance measurement activities in four state DOTs—Oregon, Pennsylvania, Minnesota, and Florida—that represent programs in various stages of development and a sampling of leading edge practices.

OREGON DOT

Performance measurement was introduced in ODOT in 1988 with the initiation of an experimental Performance/Incentive Program in the department's Highway Division. The goals of this program, also known as GAINSHARE, were to measure group performance by highway crews, identify savings generated by improved performance, and motivate improved performance by paying performance based bonuses. The effort was lead by a steering committee of top managers in the division and was intended from the outset to be a highly participative process. The steering committee adopted a measurement approach developed by industrial engineers at the Oregon State University Productivity Center called the Productivity Matrix (*70*).

The Productivity Matrix

The productivity matrix, renamed the performance matrix at ODOT, computes a summary index of the overall performance of an activity or program that can be tracked over time. The process of constructing the matrix requires (1) identifying a set of measures which collectively represent program performance, (2) assigning weights to these measures to represent their relative importance, and (3) scaling each measure from a "0" for baseline performance to a "10" for potential performance and down to a "-10" for deteriorating performance. Data are then collected monthly or quarterly, scaled and weighted, and then summed to produce the overall performance index value that will range from 1,000 to -1,000. Thus, components of performance are measured individually and combined into a composite index used to chart the overall performance of a program over time. Table 10 shows the performance measures, scales, and weights used to measure the performance of ODOT's highway division work crews, as clustered into components focusing on labor, materials, quality, and safety.

The performance measurement/incentive program was piloted by 27 ODOT Highway Division work crews in several phases from 1989 through 1992, with apparent success. Team members were given half-day training workshops in measurement concepts and the mechanics of matrix construction, and the training emphasized the need to measure results rather than activities or work loads, the importance of measuring the performance of teams rather than individuals, and the value

TABLE 10

HIGHWAY MAINTENANCE PERFORMANCE MEASURES, WEIGHTS, AND VALUES
OREGON DEPARTMENT OF TRANSPORTATION

Category	Measure	Relative Weight	Baseline	Potential
Labor	Percent sick leave used vs. sick leave earned	2	76.96	0.00
	Percent earned hours vs. labor hours	30	65.00	90.00
	Percent overtime hours vs. labor hours	2	4.39	0.00
Materials	Equipment hours used vs. base hours	7	85.48	119.67
	Equipment rental costs per earned hours	6	15.08	0.00
	Material and other costs per earned hour	7	27.04	0.00
Quality	Percent deviation earned hours completed vs. scheduled	5	116.81	0.00
	Customer survey percent customers satisfied	15	96.96	100.00
	Maintenance section quality rating	18	75.34	100.00
Safety	Injuries per 100 employees	3	2.15	0.00
	Time loss events per 100 employees	3	2.06	0.00
	Vehicle accidents per 100,000 miles	2	0.89	0.00

of developing measures in work groups rather than individually. The pilot crews were able to develop appropriate measures and implement the matrixes, performance improved steadily over the pilot period, and incentive bonuses were paid out frequently.

However, in the last year of the pilot communications broke down and matrix generation was sporadic. The shared savings component of the program was subsequently discontinued, in part because confidence in the validity of the measures and the reliability of the data was lacking. A major concern frequently expressed was the potential for "slippage" when selected data elements are printed out from existing record keeping data files, in some cases hand computed into performance measures for individual work crews, and then entered into a separate automated system used to maintain the performance measurement program. The steering committee responded by developing performance measurement policies to ensure consistency in the measures within the division. Over the past several years, performance measurement has been implemented throughout the department.

ODOT has since reorganized along corporate style product lines, with a large operations division responsible for driver and motor vehicle services as well as technical services and highway construction and maintenance. This Transportation Operations Division is organized into five regions and numerous highway maintenance districts, which are further organized into work crews. The department has centralized staff functions in financial services, human resources, and information systems, in addition to a Transportation Development Division responsible for policy, planning, public transit, and safety. Performance measures are tracked for the department as a whole, regional operations and technical services, maintenance districts, and individual work crews, as well as for all organizational units and work groups within the central office divisions. ODOT's performance measures program is maintained by the Office of Productivity, a unit within the Information Systems Division. This office has three professional staff members who work principally, but not solely, with the performance measures. In addition, there is a performance measurement specialist in each of the five regional offices.

Simplifying the Measures

An internal audit of the performance measurement program conducted in late 1994 found that 80 percent of ODOT's crews, work units, sections, and branches had developed measures at that point, and that 75 percent of the employees who were surveyed believed the measures were valid. However, only 38 percent of those surveyed believed that they understood the performance matrix, and only 39 percent had a positive assessment of the process by which the measures had been developed. In addition, the audit also found that 70 percent of the work units in the department were not receiving performance reports on a regular basis.

Working with a departmentwide technical advisory committee, the Office of Productivity is moving into a second iteration of the process, which is designed to "tighten up" the performance measures, simplify the report, and teach frontline managers and supervisors how to use the new measurement scheme. To sharpen the focus of the system, ODOT adopted procedures developed by the federal government's General Accounting Office for validating good performance measures. These "measure filtering" concepts have helped to limit the number of performance measures used and to assure that they line up with organizational functions and goals. The resulting new matrix places all responsibility on line managers to establish objectives and priorities. The new system also holds managers accountable for data reliability, and incorporates a new automated system for transferring data elements from transaction based system into the performance measurement system, and generating reports on a routine basis.

In addition, the measures themselves are being simplified dramatically, and the weights and scaling functions have been eliminated. As shown in Figure 9, the new measures for highway maintenance consist of (1) the percent actual cost to average cost, (2) the percent time in mission driven activities, (3) completed hours versus scheduled hours, (4) the percent on budget, (5) a maintenance section quality rating, and (6) a customer satisfaction measure. The cost-efficiency measure compares actual unit costs for a maintenance unit against average unit costs, taken only for work activities identified as

Key Result Areas	Cost Per Unit	% Labor Utilization	% On Time	% Budget Used	Program Quality	Customer Survey
	EFFICIENCY		EFFECTIVENESS			
Key Measures of Performance	Percent Actual Cost/ Average Cost	Percent Time in Mission Driven Activities	Completed vs. Scheduled	Percent on Budget	Maintenance Quality Rating	Customer Satisfaction
Average						
Actual Results						

FIGURE 9 ODOT Evaluation Measures. Source: Oregon Department of Transportation internal memoranda.

being end-results oriented and "actionable," meaning that knowledge of unit costs for a particular activity could prompt managerial action to improve performance. The second measure is an indicator of labor utilization, the total hours spent on so-called mission driven activities taken as a percent of total hours worked including those spent on overhead or support activities.

The first management effectiveness measure is the percent of total hours scheduled for various mission driven and non-mission activities that were actually devoted to each of those particular activities. The percent on-budget measure is simply the percent of total accumulative budget amounts actually spent by the unit by the end of each month. The quality rating measure is based on a survey conducted by district managers, while ODOT is working with Oregon State University to develop a survey process to generate statistically valid information on motorists' satisfaction with the maintenance of the highways they use. Instead of combining these into a single (somewhat abstract) index, the emphasis of ODOT's revised system will be on tracking trends and simple statistical distributions of these individual measures.

Disconcertingly, the internal audit found that only 10 percent of ODOT managers surveyed indicated that they used the performance measurement reports to manage their units. Other issues raised by the report were the lack of linkage to the budgeting process, the questionable fit between the measures and criteria used in outsourcing decisions, and the desire of many in the department to reward high performing work teams with tangible benefits. ODOT plans call for numerous steps to address these issues, including developing mechanisms for more direct accountability for managers, incorporating performance measures in the budgeting process, initiating a pilot program to use performance measures and develop matrices for outside contracts in highway maintenance, and piloting a new incentive program in highway maintenance based on cost savings per unit of work accomplished while maintaining service quality targets.

Clearly, ODOT has made a major commitment to performance measurement over the past several years, and the process is still evolving. Results oriented performance measures are widespread throughout the department, but the challenge now is to make more meaningful use of them through other management processes. In the meantime, the productivity matrix approach, first piloted by ODOT, has subsequently been mandated for use throughout Oregon state government (*71*).

In addition, ODOT's performance measures are linked into the statewide Oregon Benchmarks program cited earlier, which incorporates several transportation related performance measures. These measures are summarized in Table 11, along with 1994 data, where available, and targets that were set for 1995. While most of these individual measures pertain to a particular mode of transportation, collectively they are intended to provide a balanced portrait of the overall transportation system in the state.

TABLE 11

TRANSPORTATION RELATED PERFORMANCE MEASURES INCLUDED IN THE OREGON BENCHMARKS

Performance Measure	1994 Value	1995 Target
Percentage of Oregonians who commute (one-way) within 30 minutes between where they live and where they work	84%	88%
Percentage of limited access highways in Oregon metropolitan areas that are not heavily congested during peak hours		60%
Transit hours per capita per year in Oregon metropolitan areas	0.99	1.3
Percentage of arterial and collector street miles in urban areas that have adequate pedestrian and bicycle facilities	–	–
Percentage of Oregonians who commute to and from work during peak hours by means other than a single-occupancy vehicle	25%	29%
Vehicle miles traveled per capita in Oregon metropolitan areas per year	–	7,864
Percentage of Access Oregon highways built to handle traffic at a steady 55-mile-per-hour rate	82%	82%
Percentage of Oregonians living in communities with daily scheduled intercity passenger bus, van, or rail service	–	99%
Percentage of Oregonians living within 50 miles of an airport with daily scheduled air passenger service	–	90%
Number of U.S., Canadian, and Mexican metropolitan areas over 1 million population served by non-stop flights to and from any Oregon commercial airport	–	20
Number of international cities of over 1 million population (outside Canada and Mexico) served by direct or non-stop flights to and from any Oregon commercial airport	–	6
Backlog of city, county, and state roads and bridges in need of repair and preservation	–	15%
Portland transpacific container export rates compared to those in Seattle and Tacoma (Percentage greater or less)	–	< 5%

Source: Oregon Progress Board, Oregon Benchmarks, 1994.

PENNSYLVANIA DOT

PennDOT has longstanding experience in using performance monitoring systems to help manage operations more effectively and efficiently. In 1989 the department instituted its management objectives reporting system, a three-tiered series of monthly reports that tracks activity levels and work accomplished for the department as a whole, for the 11 engineering districts, and for the 67 county highway maintenance units. Figure 10 shows an illustration from the department level *Management Objectives Report*, reporting selected measures for the Bureau of Motor Vehicles' title and registration function (*73*). This reporting system was developed at a time when one of PennDOT's top priorities was to increase production levels in many areas, and so this report focuses primarily on output measures showing how much work was accomplished. However, as illustrated in Figure 10, this report also tracks the turnaround time of several registration functions as an indicator of customer service.

The *Management Objectives Report*, or "Blue Book" as it is called in the department, tracks measures on a monthly basis for each of PennDOT's major divisions. Current performance levels are compared against the same measures for the previous year and against targeted or "budgeted" levels that have been established in annual business plans, in addition to accumulating many of the measures on a year-to-date basis. While most of the measures focus on how much output has been produced, actual expenditure levels are also tracked over time and against budget, so that cost-efficiency can be assessed in terms of both output levels and expense meeting, exceeding, or falling short of expectations. In addition to the statistical data, the monthly report also provides a brief narrative summary of favorable and unfavorable variances from targets or previous performance levels, as illustrated in Figure 11.

The district level management summary reports, or "Green Books" are formatted to compare performance across the 11 districts in terms of highway construction and maintenance activities, while the county level management summary, or "Red Book," discussed earlier in this report, tracks numerous indicators of maintenance productivity for individual counties clustered within districts. In addition to the monthly "Red Book" reports, the performance of PennDOT's highway maintenance program is monitored at the county level through quality assurance indicators and pavement/roadway condition measures, as discussed earlier.

Like most other state DOTs, PennDOT bureaus and operating units use a variety of program specific measures to assess needs, outputs, and performance in their respective areas of responsibility, some of which have been mentioned in this report. The distinguishing feature of the Blue Book/Green Book/Red Book series of reports is its comprehensiveness in terms of covering all of PennDOT's operations, including administrative and staff support functions, and the "roll up" of many measures on the highway side from individual counties, to districts, to the department as a whole.

Customer Service Indexes

In the early and mid 1980s PennDOT also began to invest in a number of quality improvement initiatives, while in the early 1990s the department focused more specifically on customer service. The department's continuing commitment to quality process improvement and customer satisfaction has led to a recognition of the need for service quality measures and customer surveys to complement the production oriented measurement systems already in use. One outgrowth of this approach has been the development of customer services indexes (CSIs) in various program areas. PennDOT's CSIs adapt the productivity matrix pioneered by the Oregon DOT, with each measure included in the index representing some aspect of service quality or customer satisfaction for a particular service. Furthermore, the weights assigned to each measure are based on data from customer surveys designed to determine the relative importance of each dimension of service quality in the eyes of the customer.

For example, Figure 12 shows the Customer Service Index for PennDOT's driver examinations program, running from October 1994 through June 1995. In this case all the measures are ratings derived from "response card" surveys of customers who have actually gone through the driver examination process in a given month. The measures incorporated in this particular index include ratings of (1) prompt, accurate, and helpful service, (2) courteous, helpful, knowledgeable, and available staff, (3) correct and understandable forms and publications, (4) well-placed exterior and interior signs, (5) accessible locations and convenient parking, and (6) satisfactory exterior and interior appearance, restrooms, etc. The baseline scores for these particular measures, shown at the "0" level in the CSI, are based on data taken in April and May of 1995, while the highest "potential" scores, shown at the "10" level, are fives, representing excellent ratings on the response cards. The CSI is computed each month, and then charted in the upper right corner to show the trend in customer service over time, which is obviously very positive in the case of driver examinations.

While PennDOT's Operations Review Group, an in-house performance monitoring and management consulting unit, has taken the lead in developing the CSIs, the particular measurements to be included and the customer surveys used to determine their relative weights are developed by teams of managers and employees in the individual operating units. This involvement not only assures that the measures selected are appropriate for the particular service delivery circumstances in each case, but also gives the CSI additional credibility in the eyes of employees working in the service area being monitored. Then, working in a continuing process improvement mode, these same teams of managers and employees analyze the results of the CSI and implement changes to further improve service quality and customer satisfaction.

Customer Surveys

As part of its overall drive to improve customer service, PennDOT recently conducted a survey designed to gauge the performance of its county level highway maintenance units from a customer perspective. The department mailed out some 24,000 questionnaires to licensed drivers in the state and

PERSON RESPONSIBLE: DEPUTY SECRETARY FOR SAFETY ADMINISTRATION

PRODUCTIVITY MEASURES

PERIOD: FY 1994-95 MONTHLY

NO	ITEM	UNIT OF MEASURE	L B A	F N		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
	BUREAU OF MOTOR VEHICLES																
			L		LAST YR	7.8	7.4	8.6	8.4	7.4	14.0	13.7	7.7	7.3	8.7	8.7	12.4
	VEHICLE TITLE/REG/	CALENDAR	B		BUDGET	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
1	TAX APPLICATIONS	DAYS	A		ACTUAL	14.3	15.4	13.8	8.3	8.2	9.8	10.3	9.1	6.5	9.1	10.2	12.0
			L		LAST YR	2.0	1.9	1.5	1.9	1.9	2.0	2.9	2.4	4.1	2.3	3.2	3.4
		CALENDAR	B		BUDGET	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
2	RENEWAL APPLICATIONS	DAYS	A		ACTUAL	2.5	3.1	2.9	2.3	2.3	3.4	4.2	3.4	2.4	3.0	2.2	2.6
			L		LAST YR	2.0	2.0	1.5	1.0	1.5	1.0	2.0	1.5	1.0	1.0	2.0	2.0
	MESSENGER PRIORITY	CALENDAR	B		BUDGET	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
3	APPLICATIONS	DAYS	A		ACTUAL	3.0	2.5	1.3	1.5	2.0	2.0	1.5	1.3	2.4	2.0	3.3	3.2
	LEGISLATIVE SERV CENTER	PROCESS	B		BUDGET	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
4	APPLICATIONS	HOURS	A		ACTUAL	3.0	3.0	2.0	1.0	1.0	1.0	1.5	1.5	3.0	3.0	3.0	3.5
			L		LAST YR	2.0	1.8	1.7	1.8	1.8	1.9	1.8	2.1	2.1	1.9	2.2	2.2
		CALENDAR	B		BUDGET	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
5	DEALER TITLE APPLICATIONS	DAYS	A		ACTUAL	2.3	2.1	2.0	2.2	2.2	1.9	1.9	1.7	1.3	1.4	1.3	1.4
	INSPECTION STATION	CALENDAR	L		LAST YR	2.2	2.3	1.8	2.0	2.0	2.1	1.8	3.1	4.1	3.0	2.5	3.2
6	APPLICATIONS	DAYS	A		ACTUAL	2.8	2.9	2.1	2.1	4.7	3.8	5.3	3.8	3.0	3.0	2.8	3.0
	PERCENT I/M	PERCENT	B	X	BUDGET	0	0	0	0	0	0	0	0	0	0	0	0
7	TESTS COMPLETED		A		ACTUAL	0	0	0	0	0	0	0	0	0	0	0	0
	I/M FAILURE RATE		B	X	BUDGET	0	0	0	0	0	0	0	0	0	0	0	0
8	(MODEL YR. 1976 OR OLDER)	PERCENT	A		ACTUAL	0	0	0	0	0	0	0	0	0	0	0	0
	I/M FAILURE RATE		B	X	BUDGET	0	0	0	0	0	0	0	0	0	0	0	0
9	(MODEL YR. 1976 OR NEWER)	PERCENT	A		ACTUAL	0	0	0	0	0	0	0	0	0	0	0	0

LINE 7 - NEW MEASURE, THE NO. OF VEHICLES TESTED COMPARED TO THE NO. NOTIFIED THAT THE TEST WAS REQUIRED
LINE 8 - NEW MEASURE, PERCENTAGE OF VEHICLES IN THIS CATEGORY THAT FAILED THE EMISSION INSPECTION TEST
LINE 9 - NEW MEASURE, PERCENTAGE OF VEHICLES IN THIS CATEGORY THAT FAILED THE EMISSION INSPECTION TEST

FIGURE 10 Performance measures for PennDOT's Department of Motor Vehicles title and registration functions. *Source: Management Objectives Report,* Pennsylvania Department of Transportation (June 1995).

BLUE BOOK VARIANCE
JUNE 95

FAVORABLE VARIANCES

Active CQI Teams For PennDOT stood at 275 Teams during the month of June, 64 teams (30%) more than last June. (Page 1, Line 7)

Telecommunications Costs stood at $3,156,000 for FY 1994-95, $344 Thousand (9.8%) less than budgeted and $384 Thousand (13.9%) more than the prior FY. (Page 5, Line 8)

CQI Overview Training for Highway Administration stood at 59% through FY 94-95, 20% more than the prior FY. (Page 14, Line 4)

Contract Lettings for Maintenance Construction Projects stood at 279 Projects through FY 94-95, 29 Projects (12%) more than the target and 83 (42%) more than the prior FY. (Page 18, Line 7)

GIS Special Projects for Highway Administration stood at 595 through FY 94-95, 319 (116%) more than the target. (Page 30, Line 8)

Legislative Calls per Operator per Day in Safety Administration stood at 131 Calls for the month of June, 16 Calls (14%) more than budgeted and 12 Calls (10%) more than last June. (Page 35, Line 8)

Road Turnbacks Complete for Local and Area Transportation stood at 108.13 Miles through FY 94-95, 8.13 Miles (8%) more than budgeted and 3/4 Mile less than the prior FY. (Page 47, Line 2)

Rail Freight Program Agreements in Effect for Aviation stood at 45 through FY 94-95, 10 Agreements (29%) more than the target and 5 (13%) more than the prior FY. (Page 54, Line 1)

Executive Briefings from Office of Communications and Customer Relations stood at 63 Briefings during FY 94-95, 37 (142%) more than the prior FY. (Page 57, Line 5)

UNFAVORABLE VARIANCES

Accrued Unbilled Costs, Unbilled Under Agreement stood at $30.2 Million for FY 94-95, $22.2 Million (278%) more than budgeted and $14.5 Million (92%) more than the prior FY. (Page 6, Line 1)

Unemployment Compensation stood at $1.5 Million for FY 1994-95, $620 Thousand (67%) more than budgeted and $321 Thousand (26%) more than the prior FY. (Page 9, Line 5)

Contract Management's Anticipated Notice to Proceed Dates Met stood at 149 through FY 94-95, 66 Dates (31%) less than the prior FY. (Page 19, Line 8)

Bridge Maintenance Bearings/Superstructure Cleaning stood at 1,597 Sites through FY 94-95, 186 Sites (10%) less than the target but 502 Sites (46%) more than the prior FY. (Page 20, Line 10)

GENERAL VARIANCES

Surface Improvement Maintenance (A187) SAMI (SP APP) stood at 2 Miles through FY 94-95, 16 Miles (89%) less than budgeted but 2 Miles more than the prior FY. (Page 22, Line 7)

Bureau of Environmental Quality's Environmental Submissions Unreviewed after 45 Days stood at 11 Submissions (1000%) more than last June. (Page 26, Line %)

FIGURE 11 PennDOT's *Management Objectives Report* provides a narrative summary of variances from target or previous performance *(73)*.

CSI PennDOT

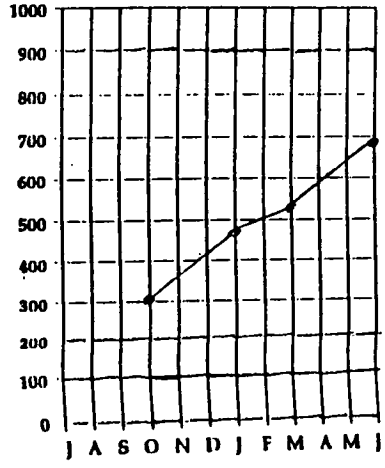
CUSTOMER SERVICE INDEX

ORGANIZATION BUREAU OF DRIVER LICENSING

FUNCTION DRIVER LICENSE CENTERS

DATE JUNE 1995

BASE PERIOD APR, MAY, JUN 95



Total Index Value

695

MEASURES	SERVICE prompt accurate helpful smile	STAFF courteous helpful knowledgeable enough avail.	PRODUCT forms publications understand correct	INFO/INSTRUCTIONS exterior signs interior signs well placed examiners inst.	ACCESSIBILITY location easy to find trailblazing parking	APPEARANCE exterior interior restrooms size
PERFORMANCE	4.58	4.65	4.64	4.42	4.41	4.55
10	5.00	5.00	5.00	5.00	5.00	5.00
9	4.79	4.83	4.84	4.81	4.80	4.79
8	4.60	4.66	4.68	4.64	4.57	4.55
7	4.41	4.47	4.52	4.47	4.34	4.31
6	4.22	4.29	4.36	4.30	4.11	4.07
5	4.03	4.11	4.20	4.13	3.88	3.83
4	3.84	3.93	4.04	3.96	3.65	3.59
3	3.65	3.75	3.88	3.79	3.42	3.35
2	3.46	3.57	3.72	3.62	3.19	3.11
1	3.27	3.39	3.56	3.45	2.96	2.87
0	3.08	3.21	3.34	3.28	2.73	2.63
Score	7	7	7	6	7	8
Weight	25%	20%	20%	15%	10%	10%
Value	175	140	140	90	70	80

FIGURE 12 PennDOT's Customer Service Index. Source: Pennsylvania Department of Transportation, Operations Review Group.

received back nearly 8,000 completed surveys. The survey instrument focused on customer satisfaction with the highways, work zones, and ancillary services. The results of this survey will be used to assess current performance and to construct a CSI for the highway maintenance function; the department intends to replicate it on an annual basis.

A second survey commissioned by PennDOT, and carried out by Penn State University, looked more generally at the importance of various transportation services to Pennsylvania residents, as well as their knowledge, use, and ratings of these services (*74*). The results are based on telephone interviews with 1,133 randomly selected residents of the state over the age of 21, including non-drivers as well as licensed drivers, conducted during the summer of 1995. The ratings produced by this marketing type survey are summarized in Figure 13, which cross-classifies the various services according to their overall quality rating and their importance to Pennsylvania residents. Whereas vehicle registration and titling, for example, are very important to the survey respondents and are graded with a "B," highway repair and maintenance are even more important but are graded with a "C." These ratings can identify which of the department's programs have the greatest need for improvement and, if the survey is replicated annually, can track progress in improving these services over time from the customer's perspective.

Finally, PennDOT updated its strategic plan in 1995 at the outset of a new administration, and the process produced the following eight strategic goals and objectives:

- Advance a "maintenance-first" philosophy for transportation systems and facilities that reflects and anticipates customer expectations.
- Create an intermodal transportation system that strengthens Pennsylvania's competitive position and provides convenient, efficient and environmentally responsible choices for the movement of people and goods.
- Create a user friendly, customer-driven PennDOT with special emphasis on driver and vehicle services.
- Invest strategically to achieve a high level of transportation services and economic return.
- Identify and implement technological improvements that support the strategic direction of PennDOT and the Commonwealth.
- Maximize transportation safety through improved design, enforcement, and educational activities.
- Foster ongoing communications with our partners and customers with the goal of improving the services we deliver.
- Move PennDOT forward with a team effort to achieve our goals (*75*).

One concern expressed repeatedly during the strategic planning process was the need to measure PennDOT's progress toward these goals. While PennDOT has many measurement systems in place, some of which may be helpful along these lines, they tend to have been developed within existing organizational units and programs. Reflecting a contemporary customer driven, intermodal approach to transportation, however,

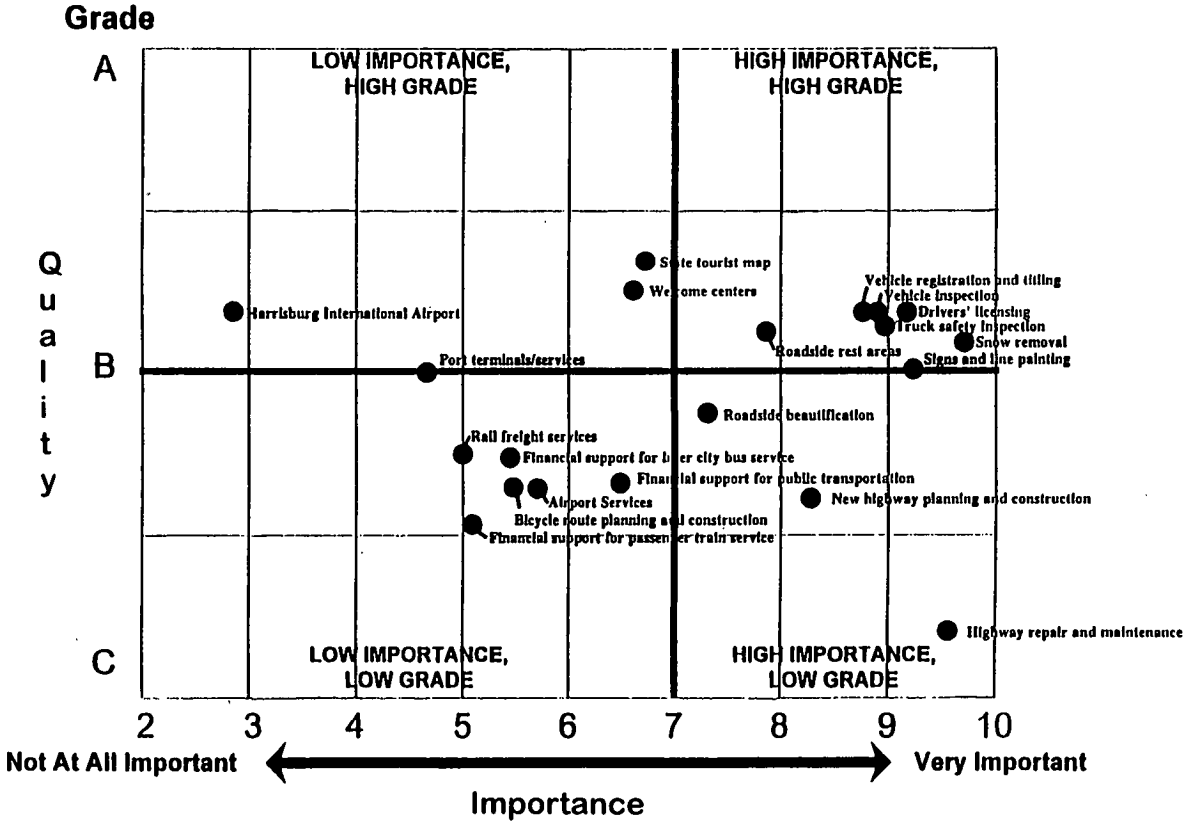


FIGURE 13 PennDOT services Importance/Quality Matrix *(74)*.

many of the strategic goals cut across the traditional organizational and modal lines and therefore are likely to require new kinds of performance measures. At this point PennDOT is committed to developing a performance reporting process to monitor its progress in achieving these strategic goals. Currently, the department is developing a new monthly Progress Report to complement the kind of statistical digest it has used in the past. The Progress Report will be organized according to the strategic goals, emphasize common initiatives across modes (i.e. maintenance or safety indicators pertaining to several modes), present topical measures and annual comparisons when they are timely, in addition to the routine statistical measures, and provide more narrative interpretation.

MINNESOTA DOT

The Minnesota DOT already has a measurement system in place to track performance in key areas throughout the department on an annual basis, and it is currently in the process of revamping that system to make it more responsive to the needs of top management. The measures included in Mn/DOT's *Annual Performance Report* were developed in 1994 and again in 1996, to satisfy the mandate from the statewide Minnesota Milestones program and legislation for each state agency to develop and report macro level performance measures (*58*).

The 1994 measures were developed on a short timeline and in parallel to the internal measurement system. The 1996 Annual Performance report was developed from the Mn/DOT measurement system and most measures reported are the same in both reports. The process has generated an appreciation for the potential utility of meaningful performance measures and a commitment within the DOT to develop a performance measurement system that really will be useful in improving the department's performance.

Mn/DOT has found that the process of developing performance measures has improved the clarity and purpose within divisions, offices, districts, and project groups. As an example, the goal of the Office of Research Administration was to evaluate the research administration process and move from anecdotes to more effective feedback concerning the impact of the research projects throughout Mn/DOT. The 16 mission related issues were condensed into three:

1. Rightness of projects (i.e., are the right projects being selected and funded?)
2. Impact of projects (i.e., are the projects delivering the desired results?)
3. Project management (i.e., is the project management process meeting our needs and out customers' needs?)

The measures are also used to provide information for the Agency Performance Report, which is being used by the state legislature to look at the effectiveness of state programs and for budgeting purposes. Mn/DOT executives now recognize that developing and institutionalizing meaningful performance measures is a long-term proposition, and one that requires sustained participation and commitment. Mn/DOT's current measurement system is the "Family of Measures," a somewhat condensed set of measures intended to track outcomes in key results areas that reflect both the diverse dimensions of the department's mission and its strategic agenda. The Family of Measures is being developed by the department's top management team, but is intended to reflect a public perspective on what the department's performance should look like.

While Mn/DOT maintains a variety of data bases and operating statistics, like other state DOTs, a principal purpose of the Family of Measures is to provide accountability to external constituencies. The new system is intended to track indicators of performance in critical areas which the Commissioner can use in briefing the Governor, legislative committees, other external stakeholders, and the media when the need arises or opportunities present themselves. Thus, a key question underlying the development of the measures has been "What information does the Commissioner need in representing the department's progress and issues to these external audiences?"

Mn/DOT's Family of Measures includes three clusters of measures: System Performance, Public Values/Issues, and Organizational Performance and Values. For each of these areas, the management team has defined desired outcomes and identified one or more indicators to measure progress in achieving each outcome. For example, one of the specified outcomes for the system performance cluster is: "A predictable travel time for length of trip is maintained so that customer expectations are met." Three indicators are tied to this outcome, including (1) the number of congested miles, (2) minutes variation in trip time in the Twin Cities metropolitan area, and (3) the average Twin Cities metropolitan area commuter time by mode. Similarly, one of the outcomes specified for the public values/issues cluster is that "Mn/DOT is a proactive responsible environmental steward," which is tracked with the following measures: (1) the number of residents in incorporated areas exposed to freeway and expressway noise exceeding established standards, (2) the amount of chemicals (salt, herbicides . . .). Used on roadways by Mn/DOT, and (3) the number of wetland acres impacted and replaced by Mn/DOT. Beyond the outcomes indicators, the Mn/DOT performance measurement scheme extends to customer satisfaction within the Family of Measures framework. Figure 14 shows the three clusters of customer service indicators, which will be measured through market research surveys.

An Iterative Process

Given the focus on the Family of Measures as indicators of Mn/DOT's overall performance, a principal guideline in establishing the individual measures has been to include only indicators that the department wants to, and should be able to, improve. Once issues about individual measures are resolved, the next step will be to set targets for each indicator. The general approach to establishing targets will be incremental, obtaining reliable data on existing performance levels and then determining what to aim for.

The measures and targets are being developed by Mn/DOT's top management team, supported by a performance measures

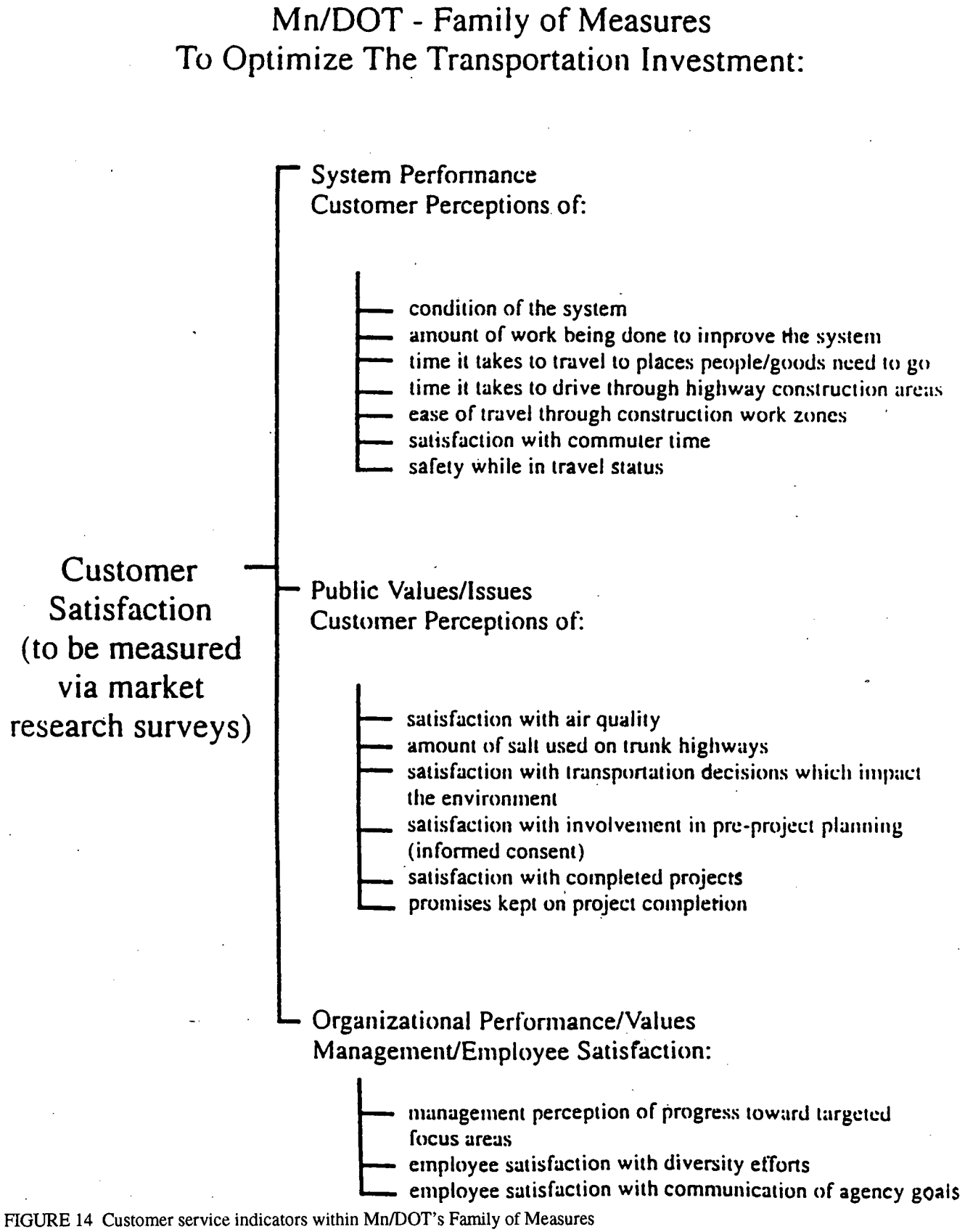


FIGURE 14 Customer service indicators within Mn/DOT's Family of Measures

staff group within the Management Data Services Office of the Division of Transportation Research and Investment Management. The process began with the top management team identifying measures they thought would be useful, tempering those ideas with considerations of feasibility and data availability. Professional staff members collect the data to operationalize the measure, but in some cases the resulting "answers" to the initial questions posed are not particularly useful. At that point, the management team changes the question, and the measure is redefined through this iterative process. In mid 1996 Mn/DOT began to institutionalize this process by assigning assistant commissioners as "owners" for each set of outcomes. The responsibilities of these "outcome owners" include serving as champions of the outcomes and measures, serving as liaison between the executive team and the professional measurement staff, assuming accountability for clarifying and defining outcomes and measures, presenting problems to the executive team, assigning accountability for data collection, working with professional measurement staff to set targets, and initiating action for data analysis and developing improvement opportunities.

Not all of the indicators included in the Family of Measures have been operationalized at this point. The executive team decided that a few of the original set of indicators did not fit the department's real objectives closely enough and that they needed to be revised. Indeed, the second version of Mn/DOT's Family of Measures is somewhat different from the initial version, and it has raised several issues that are still unresolved. The underlying principle in developing Mn/DOT's Family of Measures is to "get them right" rather than "get them quickly."

For example, one outcome under the public values and issues category is defined as "Services are provided to meet personal travel and shipping needs," and one of the measures tied to this outcome was defined as the percentage of goods moved with an option of more than one modal choice. That indicator has subsequently been further specified to focus on modal choices for moving the top three commodities in the state's economy including farm produce, timber, and mining products. Another indicator that was defined to reflect this outcome was the percentage of people in the Twin Cities metropolitan area with more than one modal choice. However, this measure is being reevaluated to determine if maximizing it might increase trip making by SOVs in urban areas.

Organization-Specific Measures

Mn/DOT is also extending the performance measurement development down into individual organizational units, within the overall framework of its Family of Measures. The department's six divisions are being asked to define the outcomes their customers expect and develop measures that represent the degree to which they are being achieved. The department's performance measures group leads teams of division personnel in developing their own measures. After the division measures have been established, this process will eventually be repeated for all the offices and districts in the divisions. Each unit will be responsible for collecting the data for its measures, but the performance measures group will assemble the data into an overall departmentwide performance report. Five full-time staff professionals are being dedicated to this effort.

At this point, Mn/DOT has not gone directly to the public for input on the measures, but the department now has marketing experts on staff. Through targeted surveys, focus groups, and other mechanisms they intend to solicit feedback to help ensure that the refined performance measures do indeed reflect expectations of customers and the public regarding the department's performance. Mn/DOT is also participating in the international performance measurement project being developed by the OECD, as mentioned earlier in this report. It is working through the OECD project to develop a field test of the international performance measures to determine their application in the United States.

FLORIDA DOT

Transportation related performance measures are, or will be, monitored at several levels in the state of Florida. The Florida Commission on Government Accountability to the People (*26*) is currently in the process of developing a benchmark system similar to the benchmark programs in Oregon and other states. The purpose of the benchmark report will be to forge stronger connections between the state government's budget and the outcomes produced by the wide spectrum of agencies and programs funded by the budget. While the Florida benchmarks are still being drafted, the transportation related measures are likely to include (1) traffic congestion, (2) accessibility to airport, rail, and seaport facilities, (3) highway safety, and (4) bicycling and pedestrian safety.

Second, the Florida Transportation Commission provides the Governor and the legislature with an annual report on the Florida Department of Transportation's performance (*76*). The Commission's report focuses more on the performance of the department than on transportation system performance. The primary performance measures identified by the Commission are shown in Figure 15. It's annual report contains performance measures and explanatory material organized by the following reporting areas:

- Cost-effective business practices (Production),
- Disadvantaged/minority business programs,
- Quality and cost-saving initiatives (Production),
- Cost-effective and effective business practices (Finance and Administration),
- Preservation of the current state system,
- Safety initiatives, and
- Capacity improvements (Highways and all public transportation modes).

At the departmental level, the FDOT work program for all transportation modes and activities is formalized annually based on forecasted revenues allocated to specific programs and districts. The work program becomes the "benchmark" against which all performance is measured by the department.

PRIMARY PERFORMANCE MEASURES

1. Number of Construction Projects Let vs. Planned for Letting.
2. Number of Projects Certified (when all needed parcels have been acquired) vs. Number of Projects Scheduled for Certification
3. Number of Consultant Contracts Executed vs. Total Contracts Planned.
4. Of Federal Aid Funds Subject to Forfeiture at the End of the Federal Fiscal Year, the Percent that was Committed.
5. Administrative Costs as a Percent of Total Program. Dollar Amount of Administrative Costs vs. Dollar Amount of Total Program.
6. Original 36-month Forecast of Revenues and Expenditures Reconciled to Actual Revenues and Expenditures.
7. Bridge Repair and Replacement:
   - Reduce the Backlog of Bridges on the State Highway System Requiring (1,145 bridges) to the 1983 Level by the End of 1999/2000.
   - Reduce the Backlog of Bridges on the State Highway System Requiring Replacement (278 bridges) to the 1983 Level by the End of 1999/2000.
   - Replace 7 Major Bridges over a 10-year Period from 1984/1993.
8. Reduce the Backlog of Structurally Deficient State Highways to the 1983 Level (5,020 lane miles) by the End of 1996/97.
9. Achieve a Maintenance Rating of 80 on the State Highway system in 1994/95.
10. Highway Capacity Improvement Projects let vs. Highway Capacity Improvement Projects Planned.
11. Dollar Volume of Disadvantage Business Enterprise Utilization as a Percentage of Total Federal Funded Contracts (10% Statutory Goal).

FIGURE 15 Primary Performance Measures. Source: *Transportation Performance and Productivity Measures*, Florida Transportation Commission (January 1992).

Thus, FDOT performance measures primarily track planned phase and project commitments promised to the public in the work program for a given year. The performance measures monitored by the department's annual performance report (*77*) have been established over time and are routinely assessed and updated by a standing committee including representatives from FDOT, the Florida Transportation Commission, and the consultant and construction industries.

Given a growing emphasis on working through partnerships in the state, not only for transportation planning purposes but also for completing many portions of its overall work program, FDOT is concerned with measuring its own performance in the eyes of its partners. Thus, the department undertook two slightly different mail-out surveys designed for its clients and partners to rate FDOT's performance in the areas with which they were most familiar. The first survey was oriented toward MPOs, local governments, and various transportation authorities. A total of 685 of these surveys were mailed out, of which 223 or 32 percent were returned and analyzed. The results, shown in Figure 16, are summarized as

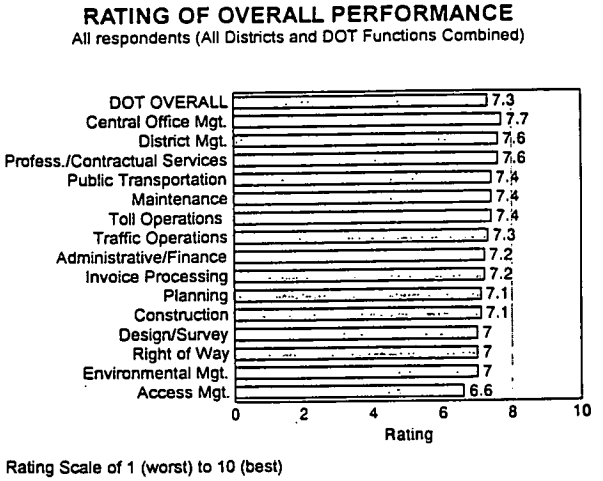


FIGURE 16 Responses to FDOT's survey of agency partners. Source: *Performance and Production Review of the Department of Transportation*, Florida Transportation Commission (August 1995).

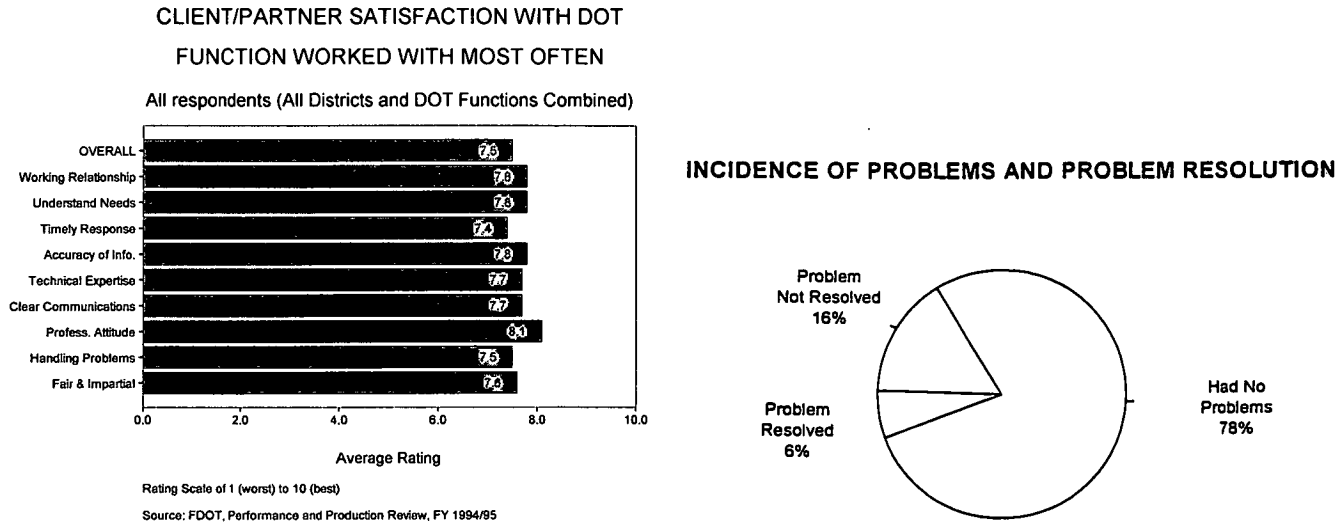


FIGURE 17 Responses to FDOT's Survey of clients. Source: *Performance and Productivity Review of the Department of Transportation.* Florida Transportation Commission (August 1995).

average ratings of various department functions, such as district management, traffic operations, invoice processing, and planning.

The second survey was targeted to contractors, consultants, permittees, and vendors doing business with the department. This instrument asked respondents to rate the department's performance on a number of functional dimensions, such as the accuracy of information provided, timeliness of responses to inquiries or requests, and technical expertise. A total of 5,878 surveys were mailed to this group, of which 993 or 18 percent were completed. The results of this "partners survey" are summarized in Figure 17, showing average ratings in the range of 7 to 8 on an overall scale of 1 (worst) to 10 (best). FDOT plans to replicate these surveys periodically to track partners' ratings of departmental performance over time.

CHAPTER FIVE

CONCLUSIONS

The information presented in this synthesis reflects a renewed and growing interest in the use of performance measures among state DOTs. In response to a variety of external pressures as well as internal motivation to strengthen programs and management capacity, many DOTs are devoting considerable effort to developing and tracking measures of their performance. The most frequently reported management uses of performance measures are program planning and evaluation, strategic planning and management, and external reporting. State DOTs traditionally have been data rich agencies, and performance monitoring systems have been in place in some areas for years. These traditional systems tend to be oriented to programs at the operating level and to focus on indicators of inputs and immediate outputs.

Currently, however, many DOTs are developing new generations of performance measures, intended to help manage more effectively in an era characterized by increased demands for accountability, threats of privatization, statewide mandates for strategic planning, emphasis on intermodalism, and concern for meeting the needs of customers. Collectively, the "new" performance measures tracked by state DOTs tend to be:

- outcome oriented,
- tied to strategic goals and objectives, and
- focused on quality and customer service.

Often these newer systems have been initiated through strategic planning or TQM processes undertaken by state DOTs. Many departments are continuing to develop the kinds of performance measures required to support the management systems originally mandated by ISTEA, although those provisions have been withdrawn by the National Highway Systems Act. In addition, while DOTs in some cases have developed performance measures as part of governmentwide systems mandated by state legislatures, many are continuing to develop or refine measures internally designed to enhance their own decision making and management capacity. Figure 18 presents a complete list of the performance measures identified through the survey of state DOTs, organized by generic type rather than transportation mode or program.

Innovative measures focusing both on the performance of states' transportation systems and the performance of the DOTs' own programs and operations have been identified in this synthesis. In the transportation systems category are such measures as:

- the percentage of Minnesota motorists satisfied with their commute times to work, and the percentage of Pennsylvania motorists who give high ratings to the state highways they use,
- the numbers of vehicle miles and person miles traveled on New Jersey highways with volume/capacity ratios indicating relatively high congestion levels,
- the transit mobility index being developed by the Washington DOT to be applied on a county level,
- estimates of the additional revenue earned by farm producers in Minnesota who ship grain and other commodities on project rail lines, and
- the percentage of Oregon residents living within 50 miles of a commercial airport with daily scheduled airline passenger service.

Examples of innovative measures designed to monitor the performance of DOT programs or operations include:

- the corporate and functional measures used by the Wisconsin Division of Highways to track the quality of highway design and construction activities as seen by contractors and the quality of construction as perceived by maintenance supervisors, in addition to on-time and on-budget performance, delivery costs, control of unprogrammed costs, and productivity;
- the number of transit trips per Maryland Transit Administration employee and the number of passengers enplaned per Maryland Aviation Administration employee; and
- the time savings, the value engineering savings, and the reduction in construction engineering costs produced by the Arizona DOT's partnering efforts.

Review of the information accumulated in this synthesis of successful practices prompted several observations regarding the process of performance measurement. First, DOTs tend to maintain a variety of measurement systems focusing on specific modes and program areas and at different organizational levels. The new measurement systems tend to be driven by a DOT's strategic agenda in terms of what is measured and how the performance measures are reported and interpreted, and these strategically oriented performance measures often cut across traditional modal or program lines.

Second, useful performance measures tend to be the product of iterative design processes in which DOTs experiment with various measures, developing and revising new approaches to performance measurement as they grapple with issues regarding substance, methodology, reliability, cost, and usefulness. While the objective is to develop straightforward measures of performance, this can be a time-consuming enterprise.

Third, performance measures are used increasingly to report on DOTs' performance to external audiences—governors' offices, legislatures, the media, and the public—in addition to internal users, in response to demands for increased accountability. However, measurement systems appear to be perceived

Accessibility/Availability

- Percent population residing within 10 minutes or 5 miles of state aided public roads.
- Percent of wholesale and retail sales occurring in significant economic centers served by unrestricted market artery roads.
- Number and percent of bridges with weight restrictions.
- Percent population residing in areas served by local public transit systems.
- Number of small urban and rural communities with public transportation service.
- Percent population residing within 5 miles of fixed-guideway transit stations.
- Public transit vehicle hours and vehicle miles operated.
- Number of ferry crossings made; nautical miles operated.
- Percent population residing within 50 miles of a commercial airport.
- Number of cities over 1 million population served directly by nonstop commercial airline flights from airports in state.
- Airline seat miles available.
- Miles of bicycle compatible highway, or miles of highway rated as "good" or "fair" for bicycle or pedestrian use.
- Number of ports with rail connections.
- Rail freight car miles operated.
- Number of proposed and actual rail line abandonments.

Condition/Service Quality

- Percent highway miles built to target design and operational standards to handle traffic at a steady 55 miles per hour rate.
- Increase in the percent of total lane miles of highway rated "fair" or better in terms of compliance with AASHTO standards.
- Miles of highway that need to be reconstructed; number of bridges that need to be rebuilt.
- Percent trunk highway miles with good to excellent sufficiency ratings.
- Average International Roughness Index (IRI) or Overall Pavement Index values for state highways, by functional class.
- Percent roads with score of 80 or higher on overall highway maintenance ratings scale.
- Percent of limited access highways in metropolitan areas that are not heavily congested during peak hours.
- Percent vehicle miles traveled on roads with high volume/capacity ratios.
- Percent person miles traveled in private vehicles and public transit buses on roads with high volume/capacity ratios.
- Percent motorists indicating they are satisfied with travel times for work and other trips.
- Percent motorists indicating they are satisfied with snow and ice removal, or roadside appearance.
- Public transit vehicle miles operated between mechanical breakdowns.
- Percent on-time ferry service departures.
- Actual commercial airline flights versus scheduled flights.
- Average days to complete driver licensing or vehicle registration transactions.
- Percent customers satisfied with quality of licensing and registration processes.
- Ratings of performance in various service areas drawn from surveys of clients such as metropolitan planning organizations, local governments, and transportation authorities.

System Usage/Mobility

- Vehicle miles traveled on state highways.
- Passenger trips made on public transit systems.
- Transit passenger trips per capita.
- Transit passenger trips per vehicle hour operated, or per vehicle mile operated.
- Number of commuters using transit park and ride facilities.
- Passenger trips on ferry systems.
- Revenue tons of cargo loaded or unloaded in ports.
- Number of ships using sea ports; number of dockage days.
- Number of passengers enplaned and deplaned at commercial airports.
- Tons of freight and mail enplaned and deplaned at commercial airports.
- Carloads shipped on project rail lines.
- Revenue ton miles shipped by rail; revenue ton miles shipped per rail car loaded.
- Rail cars and rail tons of cargo loaded at ports.
- Percent passenger trips under 5 miles made by means other than single-occupancy vehicles (SOVs).

Safety

- Number or percent of vehicles exceeding posted speed limits on state highways.
- Estimated percent of motorists driving under the influence of alcohol or drugs.
- Percent motorists using seatbelts, child restraints, or motorcycle helmets.
- Vehicular accidents per 100 million vehicle miles traveled.
- Accidents resulting in fatalities or injuries per 100 vehicle miles traveled.
- Accidents involving injuries per 1,000 residents.
- Percent change in highway miles in high accident locations (HALs).
- Percent accident reduction due to completed highway construction or reconstruction projects.
- Reduction in highway accidents, injuries, and fatalities at locations where safety improvement projects have been completed.
- Number of accidents occurring in highway construction zones.
- Number of highway/rail grade crossing accidents.
- Highway accidents involving pedestrians or bicyclists.

FIGURE 18 State DOT Performance Measures Summary.

- Number of pedestrians killed on state highways.
- Public transit collision accidents per 100,000 vehicle miles operated.
- Ferry service accidents reported.
- Number of lost-time injuries to DOT employees per 20,000 hours of exposure.
- Work days lost due to on-the-job injuries per 100 employees.

Fuel Efficiency

- Highway vehicle miles traveled per gallon of fuel, or kilometers per liter of fuel.
- Transit passengers per gallon of fuel; passenger miles per gallon of fuel.
- Rail ton miles per gallon of fuel.
- Percent commuter trips using carpools, vanpools, or public transit.
- Percent vehicles using high-occupancy lanes.

Cost-Effectiveness

- Cost per percentage point increase in lane miles rated fair or better on pavement condition.
- Cost per accident avoided by virtue of completed highway safety improvement projects.
- Cost per public transit passenger trip.
- Percent fare recovery on public transit systems; ratio of farebox revenue to operating expense.
- Public transportation grant dollars per passenger trip.
- Ferry service cost per passenger trip.
- Revenue/expense ratio for ferry services.
- Rail freight revenue versus operating expense.

Labor Productivity

- Units of highway maintenance work completed per production hour worked.
- Revenue vehicle hours operated per public transit system employee, operator, or maintenance employee.
- Vehicle miles traveled per state highway administration employee.
- Transit passenger trips per public transportation administration employee.
- Passengers enplaned per aviation administration employee.
- Tons of cargo moved per port administration employee.
- Transactions completed per motor vehicle division employee.

Operating Efficiency

- Engineering costs as percent of total highway construction project cost.
- Design engineering costs, or construction engineering costs, as percent of highway construction dollars let.
- Percent cost of preliminary engineering rework.
- Highway construction production index: Cost of contract lettings, utilities, real estate acquisition, construction, change orders, and cost overruns divided by staff costs, consultant contracts, and design construction change orders.
- Dollar savings in construction engineering costs accrued on "partnered" projects.
- Value engineering savings achieved on "partnered" highway construction projects.
- Cost per mile of highway constructed; cost per lane mile constructed in urban and rural areas.
- Cost per unit of highway maintenance work completed; labor cost per unit completed.
- Cost per public transit vehicle hour or vehicle mile operated.
- Cost per ferry crossing.
- Percent of the total DOT budget invested directly in the state's transportation system.

Work Quality

- Percent difference between bid prices and engineering estimates for highway construction projects.
- Number of change orders required to complete highway construction projects.
- Percent construction projects completed on time; number of time extensions and additional days required to complete projects.
- Actual highway construction costs versus bid prices.
- Percent of engineering work requiring rework.
- Unprogrammed highway construction costs as a percent of total contract costs.
- Percent plans ready for letting in scheduled year.
- Percent projects requiring few or no significant changes due to plan errors.
- Percent completed highway construction projects determined to have no premature maintenance problems.
- Percent completed highway maintenance projects rated good to excellent in quality audits.
- Percent variance between actual versus predicted DOT revenues.
- Percent payments processed within 5 working days of receipt of invoice.
- Ratings of quality of work (e.g. technical expertise, accuracy of information, timely responses, clear communications, working relationships, etc.) drawn from surveys of "partners," consultants, contractors, permittees, and vendors.

FIGURE 18 (Continued)

as more useful when they are created out of a genuine commitment on the part of DOT managers to measure and manage performance, rather than simply to comply with external mandates.

Fourth, while individual DOTs need to fit measures carefully to their own purposes and programs, they can often benefit from learning what other departments are doing along the same lines. For example, PennDOT borrowed the productivity matrix from the Oregon DOT and adapted it to develop customer service indexes, while Mn/DOT made use of ideas obtained from the Wisconsin DOT's Division of Highways in developing its own performance measures. Rather than "reinventing the wheel" in every case, DOTs can probably profit more from sharing their performance indicators and their experiences in using them.

Fifth, the number of measures that are tracked in a given system varies widely, from a handful of critical indicators to extensive statistical digests. There is no "magic number" of indicators that should be included. Rather, the optimal number of measures depends on purpose, what performance dimensions are being monitored and how the data will be used. To keep the number of measures both manageable and meaningful, some DOTs employ decision rules in building performance measurement systems, such as tracking only those performance dimensions the department proactively seeks to influence and believes it can feasibly impact.

Sixth, most state DOTs have numerous information systems scattered throughout their operating divisions as well as central office support functions. Collectively they generate much more detailed data than could be absorbed or used by any centralized monitoring system, but they have been designed for a variety of purposes and for use at different levels of the organization. The strategically oriented performance measurement systems currently being developed by DOTs draw on these existing data systems as appropriate, but in defining indicators of success in key results areas they are by no means limited to those variables already being counted.

Seventh, the degree to which these various systems are useful as management tools depends in part on the extent to which they afford meaningful comparisons. For example, in addition to tracking performance trends over time, some monitoring systems provide comparisons across operating units, highway engineering districts or motor vehicle offices, for example, or local transit agencies or airports receiving state assistance. In some cases, the data are "rolled up" to provide a measure of performance for the department as a whole in addition to the disaggregated county level or district data. In some of these performance measurement systems DOTs establish clear performance targets, for all highways in a given classification to exceed a score of 80 on a pavement quality index for example, and actual performance levels are compared against the standards or targets. Furthermore, some state DOTs are beginning to explore opportunities for assessing their performance by comparing their own measures against benchmarks from other organizations, public and private, that provide the same functions.

Finally, the observations noted above suggest the following outstanding issues with respect to performance measurement in state DOTs:

- How can DOTs integrate their measurement systems to assure that the most meaningful information comes to the attention of decision makers at various levels and achieve the most cost-effective approach to measuring performance?
- To what extent can state DOTs develop valid external benchmarks that provide fair and useful comparisons of performance levels?
- How can DOTs maximize their performance measures as effective management tools to provide reliable information that is valuable in making policy decisions and managing performance?

In summary, state DOTs are investing substantial resources in performance measures to help manage more effectively in a period of unprecedented change. The new generation of performance measures being grafted onto the conventional information systems is more outcome oriented and more strategically focused, with greater emphasis on quality and service levels from the customer's perspective. Developing these performance measures tends to be an iterative process, and currently there is considerable experimentation along these lines among state DOTs. In at least some instances, state DOTs have successfully borrowed or adapted particular approaches to measuring performance from other DOTs that have piloted them, and this can reduce the lag time required for "trial and error" in developing such systems. Work being carried out by organizations such as AASHTO and OECD in conjunction with the World Bank should facilitate the sharing of measurement approaches among DOTs and help advance the state of the practice. Hopefully, this synthesis will serve to clarify the state of the practice in this area and expand the range of possibilities for DOTs currently working to refine their own performance measures.

REFERENCES

1. Osborne, D. and T. Gaebler, *Reinventing Government: How the Entrepreneurial Spirit is Transforming the Public Sector*, Addison-Wesley, Reading, Mass. (1992).
2. National Performance Review, Executive Office of the President, *From Red Tape to Results: Creating a Government That Works Better and Costs Less*, U.S. Government Printing Office, Washington, D.C. (September 1993).
3. Bryson, J.M., *Strategic Planning for Public and Nonprofit Organizations*, Jossey-Bass, San Francisco (1995).
4. Eadie, D.C., "Building the Capacity for Strategic Management," in *Handbook of Public Administration*, J.L. Perry, ed., Jossey-Bass, San Francisco (1989).
5. Koteen, J., *Strategic Management in Public and Nonprofit Organizations*, Praeger, New York (1991).
6. Swiss, J.E., "Adapting Total Quality Management (TQM) to Government," *Public Administration Review*, Vol. 52, No. 4 (1992) pp. 356–362.
7. Cohen, S. and R. Brand, *Total Quality Management in Government: A Practical Guide for the Real World*, Jossey-Bass, San Francisco (1993).
8. Hatry, H. and D. Fisk, *Improving Productivity and Productivity Measurement in Local Government*, The Urban Institute, Washington, D.C. (1971).
9. Hatry, H.P., L.H. Blair, D.M. Fisk, J.M. Greiner, J.R. Hall, Jr., and P.S. Schaenman, *How Effective are Your Community Services?* The Urban Institute, Washington, D.C. (1977).
10. Wholey, J.S., *Evaluation and Effective Public Management*, Little-Brown, Boston (1983).
11. Steiss, A.W. and G.A. Daneke, *Performance Administration*, Lexington Books, D.C. Heath, Lexington, Mass. (1980).
12. Epstein, P.D., *Using Performance Measurement in Local Government*, Van Nostrand, New York (1984).
13. Swiss, J.E., *Public Management Systems: Monitoring and Managing Government Performance*, Prentice-Hall, Englewood Cliffs, New Jersey (1991).
14. Grizzle, G. "Performance Measures for Budget Justifications: Developing a Selection Strategy," *Public Productivity Review*, Vol. 8 (1985) pp. 328–343.
15. Brown, R.E. and J.B. Pyers, "Putting the Teeth into the Efficiency and Effectiveness of Public Services ," *Public Administration Review*, Vol. 48, No. 3 (1988) pp. 735–743.
16. Wholey, J.S. and H.P. Hatry, "The Case for Performance Monitoring," *Public Administration Review*, Vol. 52, No. 6 (1992) pp. 604–610.
17. Bouckaert, Geert, "Measurement and Meaningful Management," *Public Productivity & Management Review*, Vol. 17, No. 1 (1993) pp. 31–44.
18. Ammons, D.N., "Overcoming the Inadequacies of Performance Measurement in Local Government: The Case of Libraries and Leisure Services," *Public Administration Review*, Vol. 55, No. 1 (1995) pp. 37–47.
19. Governmental Accounting Standards Board, *Resolution on Service Efforts and Accomplishments Reporting*, Norwalk, Connecticut (July 1989).
20. National Academy of Public Administration, *Performance Monitoring and Reporting by Public Organizations*, Washington, D.C. (November 1991).
21. American Society for Public Administration, *Resolution Encouraging the Use of Performance Measurement and Reporting by Government Organizations*, Washington, D.C. (April 1992).
22. National Governors' Association, Strategy Group on Performance-Based Governance, *Performance-Based Governance: An Action Agenda to Redesign State Government*, Washington, D.C. (1993).
23. National Academy of Public Administration, *Toward Useful Performance Measurement: Lessons Learned From Initial Pilot Performance Plans Prepared Under the Government Performance and Results Act*, Washington, D.C. (November 1994).
24. General Accounting Office, *Managing For Results: State Experiences Provide Insights for Federal Management Reforms*, Washington, D.C. (December 1994).
25. Oregon Progress Board, *Oregon Benchmarks: Standards for Measuring Statewide Progress and Institutional Performance*, Report to the 1995 Legislature, Salem (December 1994).
26. Florida Commission on Government Accountability to the People, *The Florida Benchmarks Report*, Tallahassee (September 1995).
27. Minnesota Planning, *Minnesota Milestones: A Report Card for the Future*, St. Paul (December 1992).
28. Office of the Legislative Auditor, Program Evaluation Division, *Performance Budgeting*, State of Minnesota, St. Paul (February 1994).
29. Legislative Budget Board, State of Texas, *Texas Tomorrow: Strategic Planning and Performance Budgeting*, Austin (August 1994).
30. Federal Highway Administration, *Highway Performance Monitoring System Field Manual*, Washington, D.C. (December 1987).
31. Hyman, W.A., R.M. Alfelor, and J.A. Allen, *Service Efforts and Accomplishments Reporting: It's Time has Come: Highway Maintenance*, Governmental Accounting Standards Board, Washington, D.C. (1993).
32. Transportation Research Board, *Highway Capacity Manual*, National Research Council, Washington, D.C. (1989).
33. Fielding, G.M., *Managing Public Transit Strategically*, Jossey-Bass Publishers, San Francisco (1987).
34. Ewing, R., "Measuring Transportation Performance," *Transportation Quarterly*, Vol. 49, No. 1 (1995) pp. 91-104.
35. Rutherford, G.S., *NCHRP Synthesis 201: Multimodal Evaluation in Passenger Transportation*, Transportation

Research Board, National Research Council, Washington, D.C. (1994).
36. National Research Council, Board on Infrastructure and the Constructed Environment, *Measuring and Improving Infrastructure Performance*, National Academy Press, Washington, D.C. (1995).
37. U.S. Department of Transportation, *1995 Status of the Nation's Surface Transportation System: Condition and Performance Report to Congress*, Washington, D.C. (1995).
38. Bureau of Transportation Statistics, U.S. Department of Transportation, *Transportation Statistics: Annual Report 1994*, Washington, D.C. (1995).
39. Transportation Research Board, Special Report 234: *Data for Decisions: Requirements for National Transportation Policy Making*, National Research Council, Washington, D.C. (1992).
40. Anderson, D.R., *NCHRP Synthesis of Highway Practice 110: Maintenance Management Systems*, Transportation Research Board, National Research Council, Washington, D.C. (1984).
41. Burke, C.A., "Trends and Countertrends in Maintenance Management Systems," in *Transportation Research Record 951*, TRB, National Research Council, Washington, D.C. (1984).
42. Kardian, R.D. and W.W. Woodward, "Virginia Department of Transportation's Maintenance Quality Evaluation Program," in *Transportation Research Record 1276*, TRB, National Research Council, Washington, D.C. (1990) pp. 90–96.
43. Haas, R. and W.R. Hudson, *Pavement Management Systems*, McGraw-Hill, New York (1978).
44. Federal Highway Administration, *Pavement Management Systems with State Highway Agencies*, Washington, D.C. (1988).
45. Miller, J.H., "The Use of Performance-Based Methodologies for the Allocation of Transit Operating Funds," *Traffic Quarterly*, Vol. 34, No. 4 (1980) pp. 555–574.
46. Hartman, R..J., E.M.Kurtz and A.B.Winn, *TCRP Synthesis 6: The Role of Performance-Based Measures in Allocating Funding for Transit Operations*, Trasnportation Research Board, National Research Council, Washington, D.C. (1994).
47. Greiner, J.M., Hall, J.R. Jr., Hatry, H.P. and P.S. Schaenman, *Monitoring the Effectiveness of State Transportation Services*, Urban Institute, Washington, D.C. (1977).
48. Poister, T.H. and T.D. Larson, "The Revitalization of PennDOT: A Case Study in Effective Public Management," *Public Productivity Review*, Vol. XI, No. 3 (1988) pp. 85–103.
49. Poister, T.H., *Performance Monitoring*, D.C. Heath & Company, Lexington, Mass. (1983).
50. Albertin, R., J. Romeo, L. Weiskopf, J. Prochera, and J. Rowen, "Facilitating Transportation Agency Management through Performance Measurement: The NYSDOT Experience with the Management Performance Indicators Report," in *Transportation Research Record 1498*, TRB, National Research Council, Washington, D.C. 1995, pp. 44–50.
51. Etmanczyk, J.S., "Strategic Planning, Total Quality, and Performance Measurement: A Quality Director's View," in *Transportation Research Record 1498*, TRB, National Research Council, Washington, D.C. (1995) pp. 65–70.
52. Dilger, R.J., "ISTEA: A New Direction for Transportation Policy," *Publius: The Journal of Federalism*, Vol. 22 (Summer 1992).
53. National Academy of Public Administration, in cooperation with The University of North Carolina, *NCHRP Report 371: State Departments of Transportation: Strategies for Change*, Transportation Research Board, National Research Council, Washington, D.C. (1995).
54. Reed, M.F., R.A.Luettich, and L.P. Lamm, *NCHRP Report 357: Measuring State Transportation Program Performance*, Transportation Research Board, National Research Council, Washington, D.C. (1993).
55. Stein-Hudson, K.E., Sloane, R.K., Jackson, M.C., and A.J. Block, *NCHRP Report 376: Customer-Based Quality in Transportation*, Transportation Research Board, National Research Council, Washington, D.C. (1995).
56. *Average Vehicle Occupancy Survey for the 21 Counties of New Jersey*, The Eagleton Institute, Rutgers University (January 1995).
57. *Division of Highways Quality Plan*, Wisconsin Department of Transportation, Madison (October 1995).
58. *Annual Performance Report:1994*. Minnesota Department of Transportation, St.Paul (September 1994).
59. *Traffic Congestion Management System Guide*, Pennsylvania Department of Transportation, Harrisburg (April 1995).
60. Hodge, D.C. and J. Orrell, *Measuring Level of Service and Performance in Public Transportation*, Working Paper 2.2, Washington State Transportation Center, University of Washington, Seattle (1995) 14 pp.
61. *National Transit Summaries and Trends for the 1993 National Transit Database Section 15 Report Year*, Federal Transit Administration, Washington, D.C. (1995).
62. *Annual Report on Public Transportation Assistance Programs in New York State*, New York State Department of Transportation, Albany (November, June 1995).
63. *Texas Transit Statistics*, Texas Department of Transportation, Austin (May 1994).
64. *Pennsylvania Urban Transit Statistical Report: 1993–94*, Pennsylvania Department of Transportation, Bureau of Public Transportation, Harrisburg (1995).
65. *Georgia Transit Fact Book*, Georgia Department of Transportation, Office of Intermodal Transportation, Atlanta (1995).
66. *Annual Traffic Volume Report of the Alaska Marine Highway System: January 1 through December 31, 1994*, Alaska Department of Transportation and Public Facilities, Juneau (March 1995).
67. *Average vehicle Occupancy Survey for the 21 Counties of New Jersey*, Eagleton Institute of Politics, Rutgers University, New Brunswick, New Jersey (1995).
68. *Virginia Ridesharing Program Evaluation*, Virginia Department of Transportation, Rail and Public Transportation Division, Richmond (1989).

69. *California Intermodal Transportation Management System (ITMS)*, California Department of Transportation, Sacramento (June 1993).
70. *Fiscal Year 1996-1998 Strategic Plan & Budget*, Arizona Department of Transportation, Phoenix (October 1995).
71. Riggs, J.L. and G. Felix, *Productivity by Objectives*, Prentice-Hall, Englewood Cliffs, N.J. (1983).
72. Felix, G., *Performance Monitoring for Oregon State Government: Using the Productivity Matrix*, Howard Publishing Company, Tualatin, Oregon (1991).
73. *Management Objectives Report*, Pennsylvania Department of Transportation, Operations Review Group, Harrisburg (June 1995).
74. *Quality Use Importance Knowledge: Survey of Pennsylvania Citizens About PennDOT Services*, the Pennsylvania State University & Diagnostics Plus, University Park (November 1995).
75. *Moving PennDOT Forward*, Pennsylvania Department of Transportation, Harrisburg (July 1995).
76. *Performance and Production Review of the Department of Transportation: Year-End FY 1994/95*, Florida Transportation Commission (August 1995).
77. *Program Objectives and Accomplishments*, Florida Department of Transportation, Program Development Office, Office of Management and Budget (March 1995).

GLOSSARY

STATE TRANSPORTATION DEPARTMENTS

ADOT	Arizona Department of Transportation
CALTRANS	California Department of Transportation
FDOT	Florida Department of Transportation
MDOT	Michigan Department of Transportation
Mn/DOT	Minnesota Department of Transportation
NYSDOT	New York State Department of Transportation
ODOT	Oregon Department of Transportation
O-DOT	Ohio Department of Transportation
PennDOT	Pennsylvania Department of Transportation
VDOT	Virginia Department of Transportation
WisDOT	Wisconsin Department of Transportation
WSDOT	Washington Department of Transportation

OTHER ORGANIZATIONS

AASHTO	American Association of State Highway and Transportation Officials
ASPA	American Society for Public Administration
BICE	Board on Infrastructure and the Constructed Environment
BTS	Bureau of Transportation Statistics (U.S. Department of Transportation)
GASB	Government Accounting Standards Board
HUA	Highway Users Alliance
NAPA	National Academy of Public Administration
OECD	Organization for Economic Cooperation and Development
TRB	Transportation Research Board
U.S. DOT	U.S. Department of Transportation

OTHER TERMS

CAOs	Chief Administrative Officers
CSIs	Customer Service Indexes
DMV	Department of Motor Vehicles
DOTs	Departments of Transportation
FARS	Fatal Accident Reporting System
FTEs	Full-Time Equivalents
GIS	Geographic Information Systems
GPRA	Government Performance and Results Act of 1993
HAL	High Accident Location
HPMS	Highway Performance Monitoring System
IMMS	Integtrated Maintenance Management Systems
IRI	International Roughness Index
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
LDDs	Local Development Districts
LOS	Level of Service
MBO	Management By Objectives
MPI	Management Performance Indicators
MPOs	Metropolitan Planning Organizations
MVD	Motor Vehicles Division
NQI	National Quality Initiative
NTDB	National Transit Data Base
NTPMS	National Transportation Performance Monitoring System
OPI	Overall Pavement Index
PQI	Pavement Quality Index
PSI	Pavement Serviceability Index
PSR	Pavement Serviceability Rating
SOVs	Single Occupied Vehicles
STAMPP	Systematic Technique to Analyze and Manage Pennsylvania Pavements
TQM	Total Quality Management

APPENDIX A

State DOT Performance Measures Survey

Transportation Development

1. Does your DOT track indicators of multimodal transportation development on a regular basis? These might include such measures as the percent of transportation improvement funds invested in non-highway modes, the percent of urban areas with bicycle and pedestrian networks, the percent trips made by modes other than single occupancy vehicles, or VMT per capita in metropolitan areas.

___ Yes ___ No ___ Not Applicable

If Yes, please provide examples of how the most useful indicators in this area are measured, and indicate the frequency and geographic basis on which they are reported.

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

In general, to what extent are these kinds of performance measures used in each of the following management functions in your DOT?
Please use the following code: 0 = "Little or No Use", 1 = "Moderate Use", 2 = "Substantial Use".

___ Tracking Organizational Performance ___ Determining Budget Allocations

___ Setting Performance Targets ___ Evaluating Managers' Performance

___ Strategic Planning ___ Program Planning and Evaluation

___ Operationalizing Incentive Systems ___ External Reporting

Whom may we contact in order to learn more about the use of these particular performance measures?

Management/Measurement System: _____
Contact: _____
Telephone: _____

Management/Measurement System: _____
Contact: _____
Telephone: _____

Highway Construction

2. Does your DOT track indicators of preconstruction project development on a regular basis? These might include such measures as the ratio of preconstruction planning and design costs to construction awards, actual versus projected construction costs, percent engineering rework, or the number of change orders per construction project, or cost per rural lane mile constructed.

___ Yes ___ No ___ Not Applicable

If Yes, please provide examples of how the most useful indicators in this area are measured, and indicate the frequency and geographic basis on which they are reported.

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

In general, to what extent are these kinds of performance measures used in each of the following management functions in your DOT?
Please use the following code: 0 = "Little or No Use", 1 = "Moderate Use", 2 = "Substantial Use".

___ Tracking Organizational Performance ___ Determining Budget Allocations

___ Setting Performance Targets ___ Evaluating Managers' Performance

___ Strategic Planning ___ Program Planning and Evaluation

___ Operationalizing Incentive Systems ___ External Reporting

Whom may we contact in order to learn more about the use of these particular performance measures?

Management/Measurement System: _____
Contact: _____
Telephone: _____

Management/Measurement System: _____
Contact: _____
Telephone: _____

Highway Construction continued

3. Does your DOT track indicators of the quality of highway construction activities on a regular basis? These might include a variety of measures such as the percent construction projects completed on time; measures of the workmanship, materials, and smoothness on completed projects; and traffic accidents or motorists' time lost due to work zone location and conditions.

___ Yes ___ No ___ Not Applicable

If Yes, please provide examples of how the most useful indicators in this area are measured, and indicate the frequency and geographic basis on which they are reported.

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

In general, to what extent are these kinds of performance measures used in each of the following management functions in your DOT?
Please use the following code: 0 = "Little or No Use", 1 = "Moderate Use", 2 = "Substantial Use"

___ Tracking Organizational Performance ___ Determining Budget Allocations

___ Setting Performance Targets ___ Evaluating Managers' Performance

___ Strategic Planning ___ Program Planning and Evaluation

___ Operationalizing Incentive Systems ___ External Reporting

Whom may we contact in order to learn more about the use of these particular performance measures?

Management/Measurement System: _____

Contact: _____

Telephone: _____

Management/Measurement System: _____

Contact: _____

Telephone: _____

Highway Construction continued

4. Does your DOT track indicators of the overall adequacy and effectiveness of your state's highway system on a regular basis? These might include such measures as the percent lane miles in conformity with ASSHTO standards, numbers of weight restricted roads and bridges, measures of congestion, average travel times, areas underserved, and motorists' satisfaction with commute times.

___ Yes ___ No ___ Not Applicable

If Yes, please provide examples of how the most useful indicators in this area are measured, and indicate the frequency and geographic basis on which they are reported.

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

In general, to what extent are these kinds of performance measures used in each of the following management functions in your DOT?
Please use the following code: 0 = "Little or No Use", 1 = "Moderate Use", 2 = "Substantial Use".

___ Tracking Organizational Performance ___ Determining Budget Allocations

___ Setting Performance Targets ___ Evaluating Managers' Performance

___ Strategic Planning ___ Program Planning and Evaluation

___ Operationalizing Incentive Systems ___ External Reporting

Whom may we contact in order to learn more about the use of these particular performance measures?

Management/Measurement System: _____

Contact: _____

Telephone: _____

Management/Measurement System: _____

Contact: _____

Telephone: _____

Highway Maintenance

5. Does your DOT track indicators of highway maintenance program efficiency on a regular basis? These might include such measures as the percent of all maintenance dollars that are "put on the road", the cost per ton of mechanized patching material applied, the cost per mile of shoulder grading completed, or the total operating cost per production hour of work completed.

___ Yes ___ No ___ Not Applicable

If Yes, please provide examples of how the most useful indicators in this area are measured, and indicate the frequency and geographic basis on which they are reported.

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

In general, to what extent are these kinds of performance measures used in each of the following management functions in your DOT?
Please use the following code: 0 = "Little or No Use", 1 = "Moderate Use", 2 = "Substantial Use".

___ Tracking Organizational Performance ___ Determining Budget Allocations

___ Setting Performance Targets ___ Evaluating Managers' Performance

___ Strategic Planning ___ Program Planning and Evaluation

___ Operationalizing Incentive Systems ___ External Reporting

Whom may we contact in order to learn more about the use of these particular performance measures?

Management/Measurement System: _____
Contact: _____
Telephone: _____

Management/Measurement System: _____
Contact: _____
Telephone: _____

Highway Maintenance continued

6. Does your DOT track measures of the quality and productivity of highway maintenance activities on a regular basis? These might include such measures as the number of production hours per lane mile resurfaced, task hours completed per maintenance employee, the proportion of maintenance jobs performed in accordance with prescribed methods, and maintenance rework required.

___ Yes ___ No ___ Not Applicable

If Yes, please provide examples of how the most useful indicators in this area are measured, and indicate the frequency and geographic basis on which they are reported.

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

In general, to what extent are these kinds of performance measures used in each of the following management functions in your DOT?
Please use the following code: 0 = "Little or No Use", 1 = "Moderate Use", 2 = "Substantial Use".

___ Tracking Organizational Performance ___ Determining Budget Allocations

___ Setting Performance Targets ___ Evaluating Managers' Performance

___ Strategic Planning ___ Program Planning and Evaluation

___ Operationalizing Incentive Systems ___ External Reporting

Whom may we contact in order to learn more about the use of these particular performance measures?

Management/Measurement System: _____
Contact: _____
Telephone: _____

Management/Measurement System: _____
Contact: _____
Telephone: _____

Highway Maintenance continued

7. Does your DOT track indicators of overall highway condition on a regular basis? These might include such measures as pavement roughness or rideability ratings; survey ratings of pavement distress and/or indicators of shoulder and drainage condition; bridge sufficiency ratings; cost per percent improvement in pavement condition; or motorists' ratings of pavement condition.

___ Yes ___ No ___ Not Applicable

If Yes, please provide examples of how the most useful indicators in this area are measured, and indicate the frequency and geographic basis on which they are reported.

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

In general, to what extent are these kinds of performance measures used in each of the following management functions in your DOT?
Please use the following code: 0 = "Little or No Use", 1 = "Moderate Use", 2 = "Substantial Use".

___ Tracking Organizational Performance ___ Determining Budget Allocations

___ Setting Performance Targets ___ Evaluating Managers' Performance

___ Strategic Planning ___ Program Planning and Evaluation

___ Operationalizing Incentive Systems ___ External Reporting

Whom may we contact in order to learn more about the use of these particular performance measures?

Management/Measurement System: _____
Contact: _____
Telephone: _____

Management/Measurement System: _____
Contact: _____
Telephone: _____

Traffic Safety

8. Does your DOT track indicators of accidents and accident reduction on a regular basis? These might include such measures as the number of fatal accidents per 100 million vehicle miles travelled, the percent of motorists using seat belts, the percent intrastate motor carriers receiving high safety ratings, or reductions in accident rates at locations where safety improvements have been completed.

___ Yes ___ No ___ Not Applicable

If Yes, please provide examples of how the most useful indicators in this area are measured, and indicate the frequency and geographic basis on which they are reported.

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

In general, to what extent are these kinds of performance measures used in each of the following management functions in your DOT?
Please use the following code: 0 = "Little or No Use", 1 = "Moderate Use", 2 = "Substantial Use".

___ Tracking Organizational Performance ___ Determining Budget Allocations

___ Setting Performance Targets ___ Evaluating Managers' Performance

___ Strategic Planning ___ Program Planning and Evaluation

___ Operationalizing Incentive Systems ___ External Reporting

Whom may we contact in order to learn more about the use of these particular performance measures?

Management/Measurement System: _____
Contact: _____
Telephone: _____

Management/Measurement System: _____
Contact: _____
Telephone: _____

Traffic Safety continued

9. Does your DOT track indicators of traffic safety cost effectiveness on a regular basis? These might include such measures as the estimated cost per accident avoided at locations where safety improvements have been completed or the cost of tort claims paid per $1 million in the highway maintenance and traffic operations budget.

___ Yes ___ No ___ Not Applicable

If Yes, please provide examples of how the most useful indicators in this area are measured, and indicate the frequency and geographic basis on which they are reported.

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

In general, to what extent are these kinds of performance measures used in each of the following management functions in your DOT?
Please use the following code: 0 = "Little or No Use", 1 = "Moderate Use", 2 = "Substantial Use"

___ Tracking Organizational Performance ___ Determining Budget Allocations

___ Setting Performance Targets ___ Evaluating Managers' Performance

___ Strategic Planning ___ Program Planning and Evaluation

___ Operationalizing Incentive Systems ___ External Reporting

Whom may we contact in order to learn more about the use of these particular performance measures?

Management/Measurement System: _____
Contact: _____
Telephone: _____

Management/Measurement System: _____
Contact: _____
Telephone: _____

Public Transportation

10. Does your DOT track indicators of the availability of public transportation on a regular basis? These might include such measures as the percent of communities over 25,000 population with local transit service, the percent of rural communities connected by intercity bus service, the number of counties with county-wide paratransit systems, or the percent population with access to public transportation.

___ Yes ___ No ___ Not Applicable

If Yes, please provide examples of how the most useful indicators in this area are measured, and indicate the frequency and geographic basis on which they are reported.

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

In general, to what extent are these kinds of performance measures used in each of the following management functions in your DOT?
Please use the following code: 0 = "Little or No Use", 1 = "Moderate Use", 2 = "Substantial Use".

___ Tracking Organizational Performance ___ Determining Budget Allocations

___ Setting Performance Targets ___ Evaluating Managers' Performance

___ Strategic Planning ___ Program Planning and Evaluation

___ Operationalizing Incentive Systems ___ External Reporting

Whom may we contact in order to learn more about the use of these particular performance measures?

Management/Measurement System: _____
Contact: _____
Telephone: _____

Management/Measurement System: _____
Contact: _____
Telephone: _____

Public Transportation continued

11. Does your DOT track indicators of the quantity, quality, or cost of public transportation in your state on a regular basis? These might include such measures as the number of vehicle miles or vehicle hours operated, schedule reliability, service interruptions, accident rates, operating cost per vehicle mile or vehicle hour, or the cost per passenger trip.

___ Yes ___ No ___ Not Applicable

If Yes, please provide examples of how the most useful indicators in this area are measured, and indicate the frequency and geographic basis on which they are reported.

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

In general, to what extent are these kinds of performance measures used in each of the following management functions in your DOT?
Please use the following code: 0 = "Little or No Use", 1 = "Moderate Use", 2 = "Substantial Use".

___ Tracking Organizational Performance ___ Determining Budget Allocations

___ Setting Performance Targets ___ Evaluating Managers' Performance

___ Strategic Planning ___ Program Planning and Evaluation

___ Operationalizing Incentive Systems ___ External Reporting

Whom may we contact in order to learn more about the use of these particular performance measures?

Management/Measurement System: _____

Contact: _____

Telephone: _____

Management/Measurement System: _____

Contact: _____

Telephone: _____

Public Transportation continued

12. Does your DOT track indicators of the consumption and utilization of public transportation on a regular basis? These might include such measures as the number of transit trips per capita, the percent of urban area work trips utilizing transit, the number of passenger trips per vehicle hour, or the number of passenger miles per vehicle mile.

___ Yes ___ No ___ Not Applicable

If Yes, please provide examples of how the most useful indicators in this area are measured, and indicate the frequency and geographic basis on which they are reported.

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

In general, to what extent are these kinds of performance measures used in each of the following management functions in your DOT?
Please use the following code: 0 = "Little or No Use", 1 = "Moderate Use", 2 = "Substantial Use".

___ Tracking Organizational Performance ___ Determining Budget Allocations

___ Setting Performance Targets ___ Evaluating Managers' Performance

___ Strategic Planning ___ Program Planning and Evaluation

___ Operationalizing Incentive Systems ___ External Reporting

Whom may we contact in order to learn more about the use of these particular performance measures?

Management/Measurement System: _____

Contact: _____

Telephone: _____

Management/Measurement System: _____

Contact: _____

Telephone: _____

Ferry Service

13. Does your DOT track indicators of the provision and utilization of ferry service in your state on a regular basis? These might include such measures as the number of ferry crossings made, measures of schedule adherence, accidents per 1,000 crossings, the numbers passengers transported, vehicles transported, the cost per crossing, or the cost per passenger trip.

___ Yes ___ No ___ Not Applicable

If Yes, please provide examples of how the most useful indicators in this area are measured, and indicate the frequency and geographic basis on which they are reported.

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

In general, to what extent are these kinds of performance measures used in each of the following management functions in your DOT?
Please use the following code: 0 = "Little or No Use", 1 = "Moderate Use", 2 = "Substantial Use".

___ Tracking Organizational Performance ___ Determining Budget Allocations

___ Setting Performance Targets ___ Evaluating Managers' Performance

___ Strategic Planning ___ Program Planning and Evaluation

___ Operationalizing Incentive Systems ___ External Reporting

Whom may we contact in order to learn more about the use of these particular performance measures?

Management/Measurement System: _____

Contact: _____

Telephone: _____

Management/Measurement System: _____

Contact: _____

Telephone: _____

Aviation

14. Does your DOT track indicators of the availability and amount of airline service in your state on a regular basis? These might include such measures as the percent of communities within 30 miles of a commercial airport, the number of communities over 50,000 population without commercial airline service, or the number of commercial airline flights originating in the state per day.

___ Yes ___ No ___ Not Applicable

If Yes, please provide examples of how the most useful indicators in this area are measured, and indicate the frequency and geographic basis on which they are reported.

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

In general, to what extent are these kinds of performance measures used in each of the following management functions in your DOT?
Please use the following code: 0 = "Little or No Use", 1 = "Moderate Use", 2 = "Substantial Use".

___ Tracking Organizational Performance ___ Determining Budget Allocations

___ Setting Performance Targets ___ Evaluating Managers' Performance

___ Strategic Planning ___ Program Planning and Evaluation

___ Operationalizing Incentive Systems ___ External Reporting

Whom may we contact in order to learn more about the use of these particular performance measures?

Management/Measurement System: _____

Contact: _____

Telephone: _____

Management/Measurement System: _____

Contact: _____

Telephone: _____

Aviation continued

15. Does your DOT track indicators of the performance of aviation assistance programs on a regular basis? These might include such measures as the number of safety projects or airport expansion projects completed, or the operating cost per flight served or the cost per passenger arrival at publicly operated airports.

___ Yes ___ No ___ Not Applicable

If Yes, please provide examples of how the most useful indicators in this area are measured, and indicate the frequency and geographic basis on which they are reported.

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

In general, to what extent are these kinds of performance measures used in each of the following management functions in your DOT?
Please use the following code: 0 = "Little or No Use", 1 = "Moderate Use", 2 = "Substantial Use".

___ Tracking Organizational Performance ___ Determining Budget Allocations

___ Setting Performance Targets ___ Evaluating Managers' Performance

___ Strategic Planning ___ Program Planning and Evaluation

___ Operationalizing Incentive Systems ___ External Reporting

Whom may we contact in order to learn more about the use of these particular performance measures?

Management/Measurement System: _____

Contact: _____

Telephone: _____

Management/Measurement System: _____

Contact: _____

Telephone: _____

Railroads

16. Does your DOT track indicators of rail transportation on a regular basis? These might include such measures as the number of industrial areas not served by rail lines, miles of rail line acquired and/or rehabilitated for freight service, carloads shipped or received on project lines, number of grade crossing accidents, or the number of physical impediments to double-stacked cars.

___ Yes ___ No ___ Not Applicable

If Yes, please provide examples of how the most useful indicators in this area are measured, and indicate the frequency and geographic basis on which they are reported.

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

In general, to what extent are these kinds of performance measures used in each of the following management functions in your DOT?
Please use the following code: 0 = "Little or No Use", 1 = "Moderate Use", 2 = "Substantial Use".

___ Tracking Organizational Performance ___ Determining Budget Allocations

___ Setting Performance Targets ___ Evaluating Managers' Performance

___ Strategic Planning ___ Program Planning and Evaluation

___ Operationalizing Incentive Systems ___ External Reporting

Whom may we contact in order to learn more about the use of these particular performance measures?

Management/Measurement System: _____

Contact: _____

Telephone: _____

Management/Measurement System: _____

Contact: _____

Telephone: _____

Ports and Waterways

17. Does your DOT track measures of performance regarding ports and waterways in your state on a regular basis? These might include such measures as the capacity of ports to move bulk cargo, break of bulk cargo, or containerized cargo; the number of ships unloaded, tons of revenue cargo moved, port improvements and expansions completed, or return on investment of completed improvements.

___ Yes ___ No ___ Not Applicable

If Yes, please provide examples of how the most useful indicators in this area are measured, and indicate the frequency and geographic basis on which they are reported.

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

In general, to what extent are these kinds of performance measures used in each of the following management functions in your DOT?
Please use the following code: 0 = "Little or No Use", 1 = "Moderate Use", 2 = "Substantial Use".

___ Tracking Organizational Performance ___ Determining Budget Allocations

___ Setting Performance Targets ___ Evaluating Managers' Performance

___ Strategic Planning ___ Program Planning and Evaluation

___ Operationalizing Incentive Systems ___ External Reporting

Whom may we contact in order to learn more about the use of these particular performance measures?

Management/Measurement System: _____

Contact: _____

Telephone: _____

Management/Measurement System: _____

Contact: _____

Telephone: _____

Licensing and Registration

18. Does your DOT track indicators of the effectiveness and efficiency of licensing and registration programs on a regular basis? These might include such measures as the average days elapsed in renewing a vehicle registration, auto dealer certificate processing times, error rates in processing license renewals, or the cost per driver's license or vehicle registration issued.

___ Yes ___ No ___ Not Applicable

If Yes, please provide examples of how the most useful indicators in this area are measured, and indicate the frequency and geographic basis on which they are reported.

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

In general, to what extent are these kinds of performance measures used in each of the following management functions in your DOT?
Please use the following code: 0 = "Little or No Use", 1 = "Moderate Use", 2 = "Substantial Use".

___ Tracking Organizational Performance ___ Determining Budget Allocations

___ Setting Performance Targets ___ Evaluating Managers' Performance

___ Strategic Planning ___ Program Planning and Evaluation

___ Operationalizing Incentive Systems ___ External Reporting

Whom may we contact in order to learn more about the use of these particular performance measures?

Management/Measurement System: _____

Contact: _____

Telephone: _____

Management/Measurement System: _____

Contact: _____

Telephone: _____

Organizational Performance

19. **Does your DOT track indicators of overall organizational performance on a regular basis? These might include such measures as the percent of total budget invested in transportation improvements or direct service, the dollar cost of tort claims and other liability claims per employee, the number of injury claims per 100 employees, or measures of work force diversity.**

___ Yes ___ No ___ Not Applicable

If Yes, please provide examples of how the most useful indicators in this area are measured, and indicate the frequency and geographic basis on which they are reported.

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

Measure: _____

___ Monthly ___ Quarterly ___ Annually ___ Other: _____

___ Statewide ___ Region/District ___ County ___ Urban/Local

In general, to what extent are these kinds of performance measures used in each of the following management functions in your DOT?
Please use the following code: 0 = "Little or No Use", 1 = "Moderate Use", 2 = "Substantial Use".

___ Tracking Organizational Performance **___ Determining Budget Allocations**

___ Setting Performance Targets **___ Evaluating Managers' Performance**

___ Strategic Planning **___ Program Planning and Evaluation**

___ Operationalizing Incentive Systems **___ External Reporting**

Whom may we contact in order to learn more about the use of these particular performance measures?

Management/Measurement System: _____

Contact: _____

Telephone: _____

Management/Measurement System: _____

Contact: _____

Telephone: _____

APPENDIX B

Reported Use of Performance Measures by Individual State DOTs

State	Highway Construction: Preconstruction Project Development	Highway Construction: Quality of Highway Construction	Highway Construction: Adequacy of Highway System	Highway Maintenance: Highway Maintenance Efficiency	Highway Maintenance: Quality and Productivity	Highway Maintenance: Overall Highway Condition
Alabama	____	____	____	Yes	Yes	Yes
Alaska	____	____	____	____	____	Yes
Arizona	Yes	Yes	Yes	Yes	Yes	Yes
Arkansas	____	____	____	Yes	Yes	Yes
California	____	____	Yes	____	____	____
Connecticut	Yes	____	____	Yes	Yes	Yes
Florida	Yes	Yes	Yes	Yes	Yes	Yes
Georgia	Yes	Yes	Yes	Yes	Yes	Yes
Hawaii	____	____	____	____	____	____
Idaho	____	____	____	Yes	Yes	Yes
Illinois	Yes	Yes	____	Yes	Yes	____
Kansas	____	____	____	Yes	Yes	Yes
Louisiana	____	Yes	____	____	____	Yes
Maine	Yes	____	Yes	Yes	____	Yes
Maryland	Yes	Yes	____	Yes	Yes	Yes
Michigan	____	Yes	____	Yes	Yes	Yes
Mississippi	Yes	Yes	____	____	____	Yes
Missouri	Yes	Yes	____	Yes	Yes	Yes
Nebraska	____	Yes	Yes	Yes	Yes	Yes
New Hampshire	____	Yes	____	____	____	Yes
New Jersey	____	____	____	Yes	Yes	____
New Mexico	Yes	____	____	Yes	____	Yes
New York	Yes	Yes	Yes	____	____	Yes
North Carolina	Yes	Yes	Yes	Yes	____	Yes
North Dakota	Yes	Yes	____	____	____	Yes
Ohio	____	____	____	Yes	Yes	Yes
Oklahoma	____	____	____	Yes	Yes	Yes
Oregon	Yes	Yes	Yes	Yes	Yes	Yes
Pennsylvania	____	____	Yes	Yes	Yes	Yes
Rhode Island	____	____	____	____	____	Yes
Texas	Yes	____	Yes	Yes	____	Yes
Utah	Yes	____	____	Yes	Yes	Yes
Virginia	____	____	____	Yes	Yes	Yes
Washington	____	____	____	Yes	Yes	Yes
Wisconsin	____	____	____	____	____	____
Wyoming	Yes	Yes	Yes	Yes	Yes	Yes
	17	16	12	26	21	30

Highway Safety

State	Accidents & Accident Reduction	Traffic Safety Cost-Effectiveness	Licensing and Registration
Alabama	Yes	____	____
Alaska	Yes	____	____
Arizona	Yes	____	Yes
Arkansas	Yes	____	NA
California	Yes	Yes	NA
Connecticut	Yes	____	Yes
Florida	Yes	Yes	NA
Georgia	Yes	____	NA
Hawaii	Yes	Yes	____
Idaho	Yes	____	Yes
Illinois	Yes	Yes	NA
Kansas	Yes	____	NA
Louisiana	____	____	____
Maine	____	____	NA
Maryland	Yes	____	Yes
Michigan	Yes	____	NA
Mississippi	____	____	NA
Missouri	Yes	Yes	____
Nebraska	____	____	NA
New Hampshire	Yes	____	Yes
New Jersey	Yes	Yes	____
New Mexico	Yes	Yes	NA
New York	Yes	Yes	NA
North Carolina	Yes	Yes	Yes
North Dakota	Yes	____	____
Ohio	Yes	____	NA
Oklahoma	Yes	Yes	____
Oregon	Yes	Yes	Yes
Pennsylvania	Yes	Yes	Yes
Rhode Island	____	____	____
Texas	Yes	____	Yes
Utah	Yes	____	____
Virginia	Yes	Yes	____
Washington	____	____	NA
Wisconsin	Yes	____	Yes
Wyoming	Yes	Yes	____
	30	13	10

Public Transportation

State	Public Transportation Availability	Quantity, Quality, and Cost	Consumption and Utilization
Alabama	____	Yes	Yes
Alaska	____	____	____
Arizona	____	Yes	Yes
Arkansas	____	Yes	____
California	Yes	Yes	____
Connecticut	____	____	____
Florida	____	Yes	Yes
Georgia	____	Yes	____
Hawaii	____	____	____
Idaho	____	____	____
Illinois	____	____	____
Kansas	____	Yes	Yes
Louisiana	____	Yes	Yes
Maine	Yes	Yes	____
Maryland	Yes	Yes	Yes
Michigan	____	Yes	Yes
Mississippi	____	____	____
Missouri	Yes	Yes	Yes
Nebraska	____	____	____
New Hampshire	Yes	Yes	Yes
New Jersey	Yes	Yes	Yes
New Mexico	____	____	____
New York	Yes	Yes	Yes
North Carolina	Yes	Yes	Yes
North Dakota	Yes	____	____
Ohio	____	____	____
Oklahoma	____	____	____
Oregon	Yes	Yes	Yes
Pennsylvania	____	Yes	Yes
Rhode Island	____	____	____
Texas	Yes	Yes	Yes
Utah	____	Yes	Yes
Virginia	Yes	Yes	Yes
Washington	Yes	Yes	Yes
Wisconsin	____	____	____
Wyoming	____	____	____
	13	22	16

Ferry Service and Ports & Waterways

State	Ferry Service	Ports and Waterways
Alabama	NA	____
Alaska	Yes	____
Arizona	____	____
Arkansas	____	____
California	Yes	Yes
Connecticut	Yes	Yes
Florida	NA	Yes
Georgia	NA	____
Hawaii	NA	Yes
Idaho	NA	Yes
Illinois	Yes	Yes
Kansas	NA	____
Louisiana	Yes	Yes
Maine	Yes	Yes
Maryland	NA	Yes
Michigan	Yes	Yes
Mississippi	NA	____
Missouri	____	Yes
Nebraska	NA	NA
New Hampshire	NA	____
New Jersey	NA	____
New Mexico	____	____
New York	Yes	Yes
North Carolina	Yes	NA
North Dakota	NA	NA
Ohio	____	____
Oklahoma	____	____
Oregon	NA	NA
Pennsylvania	NA	____
Rhode Island	____	____
Texas	Yes	____
Utah	Yes	____
Virginia	Yes	____
Washington	Yes	____
Wisconsin	____	____
Wyoming	NA	NA
	13	12

Aviation and Rail Transportation

State	Availability of Airline Service	Aviation Assistance Programs	Rail Transportation
Alabama	NA	NA	Yes
Alaska	____	____	____
Arizona	____	Yes	____
Arkansas	____	____	Yes
California	____	____	____
Connecticut	Yes	____	____
Florida	____	Yes	Yes
Georgia	____	Yes	____
Hawaii	____	____	____
Idaho	____	____	Yes
Illinois	____	____	____
Kansas	Yes	Yes	Yes
Louisiana	____	____	____
Maine	Yes	Yes	____
Maryland	Yes	Yes	Yes
Michigan	Yes	Yes	Yes
Mississippi	Yes	Yes	Yes
Missouri	____	Yes	Yes
Nebraska	____	NA	Yes
New Hampshire	____	____	Yes
New Jersey	____	Yes	____
New Mexico	Yes	____	____
New York	Yes	Yes	Yes
North Carolina	Yes	____	____
North Dakota	Yes	Yes	Yes
Ohio	____	Yes	____
Oklahoma	____	____	____
Oregon	Yes	NA	____
Pennsylvania	Yes	Yes	Yes
Rhode Island	____	____	____
Texas	____	Yes	____
Utah	Yes	____	Yes
Virginia	____	____	Yes
Washington	____	____	____
Wisconsin	Yes	____	____
Wyoming	Yes	Yes	____
	15	16	

Transportation Development and Organizational Performance

State	Multimodal Transportation Development	Administrative Performance
Alabama		
Alaska		
Arizona		
Arkansas		
California	Yes	Yes
Connecticut		
Florida	Yes	Yes
Georgia		
Hawaii		
Idaho	Yes	
Illinois		
Kansas		Yes
Louisiana		
Maine		
Maryland	Yes	Yes
Michigan		
Mississippi		
Missouri		
Nebraska		Yes
New Hampshire		
New Jersey	Yes	Yes
New Mexico		
New York		Yes
North Carolina		Yes
North Dakota		
Ohio	Yes	
Oklahoma		
Oregon	Yes	Yes
Pennsylvania		Yes
Rhode Island		
Texas		Yes
Utah		Yes
Virginia		
Washington	Yes	
Wisconsin		Yes
Wyoming		

THE TRANSPORTATION RESEARCH BOARD is a unit of the National Research Council, which serves the National Academy of Sciences and the National Academy of Engineering. It evolved in 1974 from the Highway Research Board, which was established in 1920. The TRB incorporates all former HRB activities and also performs additional functions under a broader scope involving all modes of transportation and the interactions of transportation with society. The Board's purpose is to stimulate research concerning the nature and performance of transportation systems, to disseminate information that the research produces, and to encourage the application of appropriate research findings. The Board's program is carried out by more than 400 committees, task forces, and panels composed of more than 4,000 administrators, engineers, social scientists, attorneys, educators, and others concerned with transportation; they serve without compensation. The program is supported by state transportation and highway departments, the modal administrations of the U.S. Department of Transportation, and other organizations and individuals interested in the development of transportation.

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

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

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

The National Research Council was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both Academies and the Institute of Medicine. Dr. Bruce Alberts and Dr. William A. Wulf are chairman and interim vice chairman, respectively, of the National Research Council.

Transportation Research Board
National Research Council
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

ADDRESS CORRECTION REQUESTED

NON-PROFIT ORG.
U.S. POSTAGE
PAID
WASHINGTON, D.C.
PERMIT NO. 8970

000021-02 *
Materials Engineer
Idaho DOT
P O Box 7129
Boise ID 83707-1129