



Transportation Performance Measures in Australia, Canada, Japan, and New Zealand



N O T I C E

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16. Abstract A trend toward greater public accountability in decisionmaking over the past decade has led many U.S. agencies to adopt performance measurement programs. The Federal Highway Administration, American Association of State Highway and Transportation Officials, and National Cooperative Highway Research Program sponsored a scanning study of how agencies in Australia, Canada, Japan, and New Zealand use performance measures in transportation planning and decisionmaking. The U.S. delegation found that transportation agencies in the countries visited use performance measures for setting priorities and making investment and management decisions to a greater extent than is typical in the United States. The team observed the most impressive application of performance management in road safety, where it was used to identify strategies to reduce fatalities. Agencies also used performance measurement to provide greater accountability and visibility to the public and elected decisionmakers. The scanning team's recommendations for U.S. application include encouraging States to implement best practices on safety performance measurement. The team also recommends developing a data exchange and warehousing consortium for benchmarking performance among participating States, and conducting further research on performance measurement-related topics.					
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Transportation Performance Measures in Australia, Canada, Japan, and New Zealand

Prepared by the International Scanning Study Team:

Douglas MacDonald
Washington State DOT
Co-Chair

Connie P. Yew
FHWA
Co-Chair

Robert Arnold
FHWA

John R. Baxter
FHWA

Randall K. Halvorson
Minnesota DOT

Hal Kassoff
Parsons Brinckerhoff

Michael Meyer
Georgia Institute of Technology
Report Facilitator

Ken Philmus
Port Authority of New York and New Jersey

T. Jeffrey Price
Virginia DOT

Douglas R. Rose
Maryland State Highway Administration

C. Michael Walton
University of Texas at Austin

William R. White
FHWA

and
American Trade Initiatives, Inc.
LGB & Associates, Inc.

for the Federal Highway Administration, U.S. Department of Transportation
and the American Association of State Highway and Transportation Officials

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FHWA International Technology Exchange Program

The Federal Highway Administration's (FHWA) Technology Exchange Program assesses and evaluates innovative foreign technologies and practices that could significantly benefit U.S. highway transportation systems. This approach allows for advanced technology to be adapted and put into practice much more efficiently without spending scarce research funds to recreate advances already developed by other countries.

The main channel for accessing foreign innovations is the International Technology Scanning Program. The program is undertaken jointly with the American Association of State Highway and Transportation Officials (AASHTO) and its Special Committee on International Activity Coordination in cooperation with the Transportation Research Board's National Cooperative Highway Research Program Project 20-36 "Highway Research and Technology—International Information Sharing," the private sector, and academia.

FHWA and AASHTO jointly determine priority topics for teams of U.S. experts to study. Teams in the specific areas being investigated are formed and sent to countries where significant advances and innovations have been made in technology, management practices, organizational structure, program delivery, and financing. Scanning teams usually include representatives from FHWA, State departments of transportation, local governments, transportation trade and research groups, the private sector, and academia.

After a scan is completed, team members evaluate findings and develop comprehensive reports, including recommendations for further research and pilot projects to verify the value of adapting innovations for U.S. use. Scan reports, as well as the results of pilot programs and research, are circulated throughout the country to State and local transportation officials and the private sector.

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

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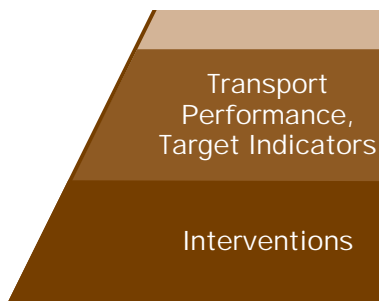
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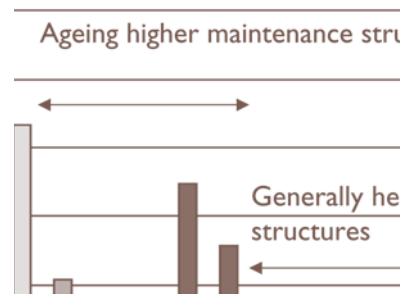
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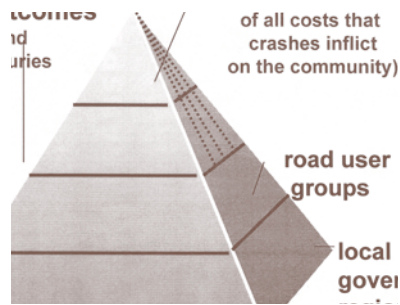
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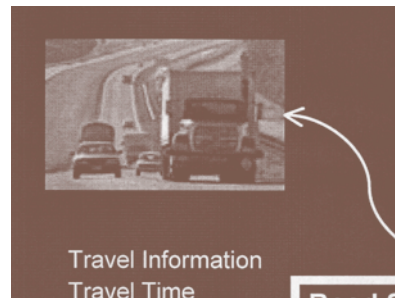
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Abbreviations and Acronyms

AASHTO	American Association of State Highway and Transportation Officials
AHS	Cruise-assist highway system
ARMIS	A Road Management Information System
ATC	Australian Transport Council
CRSC	Community Road Safety Council
DOI	Department of Infrastructure
DSRC	Dedicated short-range communication
EMS	Environmental management system
ETC	Electronic toll collection
FHWA	Federal Highway Administration
FY	Fiscal year
GIS	Geographic information system
GPS	Global positioning system
ICBC	Insurance Corporation of British Columbia
IRI	International Roughness Index
ISO	International Organization for Standardization
ITS	Intelligent transportation system
LTSA	Land Transport Safety Authority
MAE	Multiple account evaluation
MEX	Metropolitan Expressway Public Corporation
MLIT	Ministry of Land, Infrastructure, and Transportation
MVKT	Motor vehicle-kilometers traveled
NHS	National Highway System
OTCI	Overall track condition index
PCR	Post-construction review
PM	Performance measure
RAS	Road asset system
RCIS	Road Crash Information System
RCMP	Royal Canadian Mounted Police
RSM	Road System Management
RSP	Results and services plan
RTS	Roads and Traffic Authority
SCATS	Sydney Coordinated Adaptive Traffic System
SHIP	Strategic Highway Infrastructure Program
TMC	Traffic management center
TransLink	Greater Vancouver Transportation Authority
TSR	Temporary speed restrictions
VicRoads	Roads Corporation of Victoria
VICS	Vehicle information and communication system

Executive Summary

The purpose of this international scan was to investigate the use of performance measures in transportation planning and decisionmaking in selected countries. Performance measures can relate to many different aspects of and be applied at different levels of decisionmaking, so the scan panel represented a diverse set of interests and concerns for both national and State-level decisionmaking.

The Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials (AASHTO) jointly sponsored this scan. In addition to FHWA and AASHTO officials, the panel included representatives of State transportation agencies for the States of Maryland, Minnesota, Virginia, and Washington; representatives of the International Bridge, Tunnel, and Turnpike Association and the American Council of Engineering Companies; and two university professors of transportation engineering and policy. These panel members represented diverse interests and expertise in engineering, intelligent transportation systems, policy, planning, safety, and system operations.

The scan team met with the following types of representatives during its 2.5-week study:

- National ministry of transportation and other national transportation agencies in Canada, Japan, and New Zealand.
- Provincial or state departments of transportation in British Columbia; Japan; and Queensland, New South Wales, and Victoria, Australia.
- State department of infrastructure in Victoria.
- Rail or transit planning organization in Vancouver, Victoria, Queensland, and Japan.
- Police in Victoria.

General Observations

The scan team identified 23 observations on the use of performance measures in the countries visited that would be of interest to officials in the United States. Many of these observations are of broad interest to

transportation professionals, while others might be of interest in a specific context. These observations include the following:

1. The scan team found examples in which **the process of setting priorities and making planning, investment, and management decisions are based on, or use, performance measures to a much greater extent than is typical in the United States.** In those cases where performance measures were used as input to priority setting, the process represented a new level of organizational behavior. The vertical integration of information flow through the use of performance measures characterized the better examples of performance measurement.
2. Perhaps the most impressive application of performance measurement, in terms of showing how the process can influence governmental policy and budget determinations, was in the area of **road safety.** Impressive results in reducing fatalities and injuries have occurred in some of the sites the scan team visited through a comprehensive program of engineering, enforcement, and education.
3. A **common framework** to performance measurement appeared to be present in all cases the team examined. Each effort was related to a broader set of goals and objectives defined either by a legislative body or through a public visioning process. These goals and objectives led to identification of transportation system-specific performance measures, often tied to target values to be achieved in a future year.
4. Transportation officials appeared to have a general understanding of the distinction between the concepts of **outcomes and outputs.** Outcomes were viewed as the ultimate characteristic of transportation system performance, while outputs were the products and services of the organizations that led to these outcomes.

5. In each of the cases the team observed, transportation officials explained the initial movement toward performance measurement as a means of providing **greater accountability and visibility to the public** of their agency's activities.
6. In addition to accountability and public visibility, many officials commented that performance measurement can be used to **educate elected decision-makers and the general public** on the role that transportation plays in society and/or the need for additional investment.
7. Performance measurement was applied at several **different levels of planning and decisionmaking**. For example, many measures were targeted at strategic investment decisions relating to long-term improvements to the transportation system. In other cases, performance measures were used to manage network operations.
8. In Japan, the national ministry established a **core set of 17 performance measures** as a guide for all regional offices and prefectures (states) in the country. This was an example of a phenomenon common to all applications—the need and desire to determine a small set of measures that were really important to an agency.
9. All of the sites visited used measures commonly used in the United States. **Road network congestion** was a transportation system measure found in all of the performance measurement applications examined. Officials often viewed this as one of the important issues facing their region and agency. Other network measures related to **accessibility and mobility** provided by the transportation system, road safety, travel time, and trip reliability.
10. **Environmental measures** were also present in all of the performance measurement efforts examined. The scan team noted that of all the performance measurement categories it examined, the environmental measurement category created the greatest challenge for transportation agencies.
11. **Measures of customer** satisfaction were found in all of the sites visited. The measures most often related to the average scores obtained from public surveys. Also, New Zealand's approach to customer satisfaction measures focused on identifying issues causing customer dissatisfaction and targeting organizational action to deal with the issues.
12. **Measures relating to transportation system security** were not found in any performance measurement examples. In many ways, this was viewed as an American issue, although transportation officials in Queensland and New South Wales did say that security was becoming a more important issue and that some form of a security indicator most likely would be incorporated into their performance management regime in the future.
13. Many performance measurement applications targeted **rural transportation network performance** as a specific category for measurement. This was particularly true in Australia, where each state has one major urban area dominating the economy. This was viewed primarily as a regional equity issue.
14. The level of **integrated data collection strategies** as they related to performance measurement varied from one site to another. Some of the **more successful performance measurement programs occurred in data-rich environments** with a history of strong data collection and analysis.
15. **Before-and-after studies** were important elements of the performance measurement systems in Japan and Australia. Each performance measurement case in the scan countries paid considerable attention to discovering what impacts adopted or implemented actions have had on selected performance measures. The results of these studies act as feedback to the decisionmaking process and help determine likely results to similar actions in other areas.
16. **Graphic (and visual) presentation of performance results** was viewed as a key component of the performance management process, as was identification of measures that the public can relate to. Most officials involved in managing the performance measurement efforts stated that unless top decisionmakers understand the information presented to them, the efforts will be ineffective. Visualization of information is thus critical to successful performance measurement.

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17. **Benchmarking** against peer organizations and jurisdictions was used in Japan, Australia, and New Zealand to understand key factors that distinguished economic and transportation performance among states. This benchmarking was used as a screening tool to identify differences (in both quantity per capita and relative ranking), which then led to a more detailed examination of why those differences occurred.
 18. The key measure of success for performance measurement itself is the degree to which it **influences decisions and budget allocation**. This was a difficult linkage to pin down during the scan study. The most advanced application appeared to be in Queensland and Victoria, where the performance measurement process was important for determining program priorities for safety actions.
 19. The team found few examples in which performance measurement resulted in **multimodal investment tradeoffs**. In most cases, performance measurement is implemented within a modally focused agency, so performance measures were targeted at decisions relating to the performance of that modal network.
 20. **Measures relating to freight movement** were found in many performance measurement efforts. Examples include commercial trucking travel time between economic gateways (British Columbia); mode split for goods movement (Vancouver); increase in average annual truck payload capacity, percent of illegally overloaded trucks, and freight rail delays and travel time variability (Queensland); and freight productivity, access to ports, freight rates, freight-related infrastructure condition, and effects of congestion on freight movement (Victoria).
 21. **Organizational productivity measures** were found in all of the performance measurement applications. Agency managers viewed them as a critical element of the performance measurement exercise in that they indicated the degree to which their agency was delivering the products and services needed to meet other performance objectives.
 22. **Monitoring project delivery** through the use of

performance measures was also a common approach at most of the sites visited. An interesting aspect of this project delivery monitoring was the effort to assess project performance against project expectations.

23. In cases where performance management was most successfully institutionalized within agency operations, **top management leadership and commitment to the process of development and continuous use** was essential to get performance measurement past its infancy. This was particularly important for agencies where the organizational culture and even the culture of the society itself were not conducive to the concept of open and responsive performance-based planning and decisionmaking.

Lessons for the United States

Similar to the scan team observations, a large number of “lessons learned” came out of this scan. The most significant are described below:

1. **Safety was viewed as a strategic use of performance measurement** that has resulted in a significant decline in fatalities. A great deal can be learned from this application of performance measurement, especially as it relates to the identification of strategies and actions that need to be put in place to achieve reductions in road fatalities.
2. Meaningful performance measurement is a **product of extensive outreach, discussion, and collaboration with partners**. Performance measures are readily available and easy to create, but without a comprehensive (internal and external) outreach process their value as a behavioral influencer is limited. Open, inclusive planning processes are fundamental to good performance measurement.
3. In the best examples of performance measurement, officials were **still refining what measures to use, and how to make sense of the political guidance** they received. This suggested that performance-based planning and decisionmaking are never-ending processes, and must be viewed as such by top agency officials. This also implied that an agency should not measure too many objectives; it should measure only what is needed to make business decisions. Too many measures can be a burden on staff.

4. The key to success for measurement is **accountability**. This translates into the need for understandable measures and systematic followthrough to determine the level of failure or success in meeting the objectives defined by the measures. This issue is important across all transportation areas, but has particular short-term relevance and application in the safety area.
5. Performance measurement is most relevant when **linked to decisionmaking, especially resource allocation**. Elements to consider include allocation of funding at the program and project levels, multi-modal tradeoffs, and distributional equity. A multi-modal approach is best, although the scan team found few examples of such an approach. Performance measures position an agency well to engage in debate, but are not necessarily the determining factor in a decision, especially in the legislative arena. Measures sharpen and focus the debate, and help clarify organizational direction.
6. **Quality systems have been put in place** and appear to be replacing externally defined quality criteria (e.g., ISO 9000). Many are redefining quality and finding that the International Organization for Standardization (ISO) process does not meet their needs.
7. For safety, **enforcement strategies were the key to changing driving behavior and affecting overall success**. The best-case examples go beyond the mandatory use of seatbelts (alcohol testing and speed enforcement) and are succeeding at reducing fatalities. In addition, engineering strategies are an important element of an overall safety program, resulting in significant short- and long-term improvements.
8. **Analysis is an important underpinning** for setting targets and determining the effectiveness of actions to reach these targets. The scan team found a much greater use of benefit-cost analysis to determine the desirability of projects, and a desire to determine after the project was implemented whether the initial analysis was close to the resulting performance.
9. **Customer surveys** are an important element of determining organizational performance, if done appropriately and in a valid manner. Many countries appeared to be most successful at getting useful data from customer surveys by asking more focused questions on specific aspects of transportation system performance. Many survey efforts focused on getting feedback from users on what should be changed and how it should be changed.
10. **A strong linkage exists between performance measurement and asset management** in Australia and New Zealand. In both countries, scan participants found that transportation officials have a much better handle on the changing value of their asset base than most transportation agencies in the United States. The team believes the U.S. transportation community could learn from these examples of how to better link asset value to decisionmaking via performance measurement.
11. Although all of the sites the team visited professed concern about environmental quality, **all found it difficult to come up with area-wide environmental measures**. This was the most disappointing aspect of the site visits for the team. New Zealand faces a significant challenge because recent legislation requires the national transportation agency to redefine its mission in the context of sustainability, or how its actions will contribute to a more sustainable land transport system for the country. The resulting actions over the next six months will be worth watching.
12. **Do not measure too many things**. The most important measures are those needed to influence budget allocations and investment decisionmaking. In situations where large numbers of performance measures were considered, lack of focus resulted in little influence on the decisionmaking process.
13. **Post evaluations/assessments should be part of performance measurement**. In many cases in the United States, little effort is made to determine the aftereffects of transportation investment. One of the surprising results of this scan was the widespread use of before-and-after studies as a means of determining the effectiveness of implemented actions.
14. Performance measurement is a **complex, evolving area of opportunity**. The U.S. transportation

industry is advanced in many areas of performance measurement, but still has much to learn. The scan team believes a coordinated, structured approach to sharing and advancing in the performance measurement area would serve the U.S. transportation industry well. This approach should emphasize the business model approach to assessing performance.

Implementation Strategies and Recommendations

The timing of this scan is most conducive to implementation of the scan results because many opportunities exist for disseminating them. For example, the results were reported to several AASHTO committees during 2004, including the Standing Committee on Quality in April, the Standing Committee on Planning in May, and others at the annual meeting in September.

The team has developed the following preliminary recommendations on further activities that should follow from the scan:

- 1. National emphasis area demonstration on safety (FHWA).** The most integrated and impressive application of a performance measurement framework the scan team observed was in the area of safety. The team believes that the Australian model and the significant results achieved in the safety area are worthy of sharing and ultimately implementing in the United States. Two safety implementation strategies are recommended:
 - Bring Australian safety leaders to the United States to tell their story to key groups.
 - Encourage States to implement the best practices learned.
- 2. Data exchange and warehousing consortium for benchmarking (AASHTO).** Develop an action plan to initiate a data exchange and warehousing consortium for benchmarking performance among participating States. The goal is to export State-level performance data to an external source for the purpose of comparing performance in a variety of service areas.
- 3. Performance measure (PM) research.** Initiate research and disseminate findings (through FHWA and AASHTO) on several performance measurement-related topics:
 - Monetizing PMs—Initiate a study on converting measures into cost-based numbers and targets by identifying the cost and/or the benefit of providing the improvement on a monetary basis.
 - Interrelationship of PMs—Initiate a study on the cause-and-effect impacts between PMs that examines the correlation between improving possibly competing transportation attributes.
 - Multimodal tradeoffs—Initiate a study on the interrelationship between modal PMs. The study would expand on the “interrelationship” issue to include tradeoffs between modes.
 - Outcome/output empirical relationships—Initiate a study on translating output indicators to outcome consequences.
- 4. Training (National Highway Institute) or guidance papers (AASHTO).** Develop performance measurement courses and instruction aimed at executive and midlevel leadership. Topics could include the following:
 - Development and use of performance measures
 - Outsourcing of products and services
 - Best practices
- 5. Stand-alone overview document on the scan team’s findings** related to congestion and reliability performance measures. Develop a resource document on international and domestic practices on measuring congestion and reliability. Related publications could include an abbreviated pamphlet for distribution at conferences and meetings.
- 6. Conferences and meetings.** Plan, develop, and implement conferences and meetings specifically oriented to presenting the scan findings and recommendations to a variety of transportation professionals.
- 7. Technical guidance.** Develop and distribute through AASHTO, FHWA, and other stakeholder organizations guidance on various secondary PM topics:
 - Auditable PMs—Provide PM design and tracking methodology for developing verifiable measure numbers and associated impacts.
 - Before-and-after analysis—Prepare best-practice materials on this type of analysis. This would be on implemented actions and their relationship to performance measurement improvement.

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8. **Presentations of findings from the scan** at appropriate regional and national meetings and conferences throughout the United States over the next year. Candidate venues include AASHTO annual, committee, subcommittee, task force, and regional organization meetings; Transportation Research Board annual and committee meetings; and meetings of organizations such as the Institute of Transportation Engineers, Association of Metropolitan Planning Organizations, and the International Bridge, Tunnel, and Turnpike Association.
 9. **Web-based distribution of materials.** Investigate and select a logical Web-based home for the materials emanating from the scan, including reports, presentations, and implementation actions. Options include AASHTO, FHWA, or a university.
 10. **Followup review on the sustainability concept.** New Zealand is attempting to incorporate sustainability into transportation decisionmaking. At the time of the scan, the national transport agency was six months away from proposing how it would incorporate sustainability goals into its performance measurement system. The team recommends that a Transit New Zealand official be invited to the United States after the agency implements the proposal to discuss the topic.

Introduction

A trend toward greater public accountability and transparency in decisionmaking has been an important characteristic of U.S. transportation planning, decisionmaking, and organizational management over the past 10 years. One way this has been accomplished is through the use of performance measures—indicators of transportation system and organizational performance that provide decisionmakers with a sense of whether their decisions are improving transportation system performance or organizational productivity. By monitoring such indicators, other officials, legislators, and the general public can also follow the continuing efforts of transportation agencies to improve the performance of the transportation system.

Scan Context

This international scan investigated the best-case use of performance measures in transportation planning and decisionmaking around the world. Lessons from this scan can help U.S. transportation professionals better understand how performance measures could be used to enhance the effectiveness of decisionmaking and organizational management in Federal, State, regional, and local transportation agencies.

This scan was timely because many transportation officials are thinking about ways to get the best use of the limited funds available for investment. In addition, the transportation profession is devoting considerable attention to how performance measures can improve the technical foundation for decisionmaking (e.g., a second national conference on performance measures was held four months after the scan).

Panel Composition

Performance measures can relate to many different aspects of, as well as be applied at, different levels of decisionmaking. The scan panel, therefore, represented a diverse set of interests and concerns for national and State-level transportation decisions.

In addition to representatives from the Federal Highway Administration (FHWA) and the American

Association of State Highway and Transportation Officials (AASHTO), the panel included officials from State transportation agencies in Maryland, Minnesota, Virginia, and Washington; representatives of the International Bridge, Tunnel, and Turnpike Association and the American Council of Engineering Companies; and university professors of transportation engineering and policy.

These panel members represented a diverse set of interests and expertise in the areas of engineering, intelligent transportation systems, policy, planning, safety, and system operations (see Appendix A). FHWA and AASHTO jointly sponsored this scan.

Organizations Visited

The scan team met with the following types of representatives during its 2.5-week study in Australia, Canada, Japan, and New Zealand:

- National ministry of transportation and other national transportation agencies in Canada, Japan, and New Zealand
- Provincial or state departments of transportation in British Columbia, Japan, and the Australian states of Queensland, New South Wales, and Victoria
- State department of infrastructure in Victoria, Australia
- Rail or transit planning organization in Vancouver, British Columbia; Victoria and Queensland, Australia; and Japan
- Police agency in Victoria, Australia

Given the limited time available to the scan team, several important stakeholders in performance management were not part of the meetings. For example, the team did not meet with representatives from civic, shipper, freight handler, or environmental groups, each of which could have an important role in influencing the development and use of a performance measurement system.

Report Organization

Before the scan, the team sent a set of amplifying ques-

tions to those on the itinerary to clarify the types of information desired. These amplifying questions are in Appendix B.

Chapter Two of this report presents the information gathered from the four countries visited, in the order of the scan team's visits. Thus, the chapter discusses the results of the British Columbia visit, followed by Japan, Australia, and New Zealand. The decision to visit these countries was based on professional communications, literature reviews, and Web searches, and each presented a unique experience with performance measurement that would be of interest to the U.S. transportation community.

Chapter Three focuses on the use of performance measurement for safety programs, which the scan team found to be one of the most impressive uses of performance-based planning and decisionmaking. The final chapters present general observations, overall lessons for the United States, and recommendations for implementing the scan results.

In each of the cases described in the following pages, monetary amounts are reported in the country's own currency unit, followed by a conversion to U.S. dollars. Similar conversions are shown for metric distance measurements. In the case of currency, although much of the financing information is reported from planning and budgetary documents prepared over the past 10 years, the conversion rates used were those for April 20, 2004. Although this suggests the buying power of the monetary estimates might be different from that intended in these documents, it serves the purpose of comparing investment levels consistently from one country to another.

Key Findings

CANADA

Canada has a long tradition of corporate planning in the governmental sector. From the national government to local municipalities, public agencies have spent considerable time developing approaches to policy formation and implementation that provide a long-term perspective on desired outcomes and on the effectiveness of government programs in achieving these outcomes. In visiting Canada, the scan team was particularly interested in identifying best practices on corporate planning, transportation system performance measurement, and the use of performance measures relating to the linkage between transportation and sustainable development.

Governmental Context

Canada is a confederation of member provinces and territories, governed by parliamentary democracy. The Parliament is bicameral, with the Prime Minister choosing the Cabinet from among his own party or from parties in a coalition government. Because of the structure of the national government and of the great distances involved, Canadian provinces tend to be more independent (and more powerful) than comparable U.S. States. Most service and infrastructure provision is the responsibility of the provinces (e.g., provincial and local governments are responsible for most of the roads in Canada). The national government is often the vehicle for collecting revenues (e.g., a national gas tax), returning a portion of these revenues to the provinces in the form of transfer payments. Similar to the United States, there appears to be considerable debate about what constitutes a fair return of the revenues collected in the provinces. Transport Canada

Transport Canada

Transport Canada, the federal ministry of transport for Canada, is responsible for safe and efficient movement on Canada's rail, marine, road, and air transportation system. It establishes policies and sets standards to achieve this goal. Although at one time responsible for

operating Canada's air traffic control system, this system has since been transferred to a nonprofit corporation. Most ports and harbors have also been divested, leaving Transport Canada with little direct operating responsibility. With privatization came a substantial downsizing in staff, resulting in about 4,700 employees working at Transport Canada today. One of the most important legislatively mandated roles for Transport Canada as it relates to this scan is its responsibility to monitor and assess the performance of Canada's transportation system.

A National Highway System (NHS) serves as the backbone of Canada's road network. Representing 3 percent of total road mileage (25,000 kilometers (km) or 15,535 miles (mi)), this system carries 30 percent of all vehicle travel in the country. Transport Canada administers several funding programs that support improvements to the NHS and other critical transportation infrastructure in the country. The Strategic Highway Infrastructure Program (SHIP) committed C\$600 million (US\$441 million) over the past four years to critical components of the network, with \$500 million going to highway construction and \$100 million to national system integration. The funds are allocated to the provinces and territories mainly based on population with consideration of other factors, and require a 50-50 match. A C\$600 million (US\$441 million) Border Infrastructure Fund, administered jointly by Transport Canada and Infrastructure Canada, focuses investment on critical border infrastructure and also requires a 50-50 match. Infrastructure Canada provides C\$2 billion (US\$1.47 billion) to support large-scale infrastructure projects done in partnership with provincial, municipal, or territorial governments. This \$2 billion Strategic Infrastructure Fund was announced in the 2001 federal budget. An additional \$2 billion was set aside for this fund in the 2003 budget. Although regional equity considerations are taken into account, investments will be directed to large-scale projects of national and regional significance. Population is a factor used to determine funding allocations between regions, but not the only factor.

In the 2003 federal budget, a Municipal Rural Infrastructure Fund (CNS\$1 billion) was announced. At least 80 percent of the funds are dedicated to municipalities with a population of less than 250,000, and the remaining funds are available to municipalities with greater than 250,000 population. The federal government contributes, on average, one-third of the eligible costs. Provinces and municipalities will contribute the remainder of the cost.

The Canadian government has a few other infrastructure initiatives related to transportation improvements. Eligible projects under these programs include sustainable transportation projects, transit improvements, and road projects. The projects include the following:

- Infrastructure Canada Program (CNS\$2.05 billion, 2000-2007)
- Green Municipal Funds (CNS\$250 million, ongoing since 2000)
- Green Municipal Investment Fund (CNS\$200 million, ongoing since 2000)
- Prairie Grain Roads Program (CNS\$175 million, ongoing since 2000)

Similar to the U.S. Department of Transportation, Transport Canada produces an annual report on national transportation statistics that focuses on trends in the demand, supply, and financing of the transportation sys-

tem. This report, a parliamentary requirement, not only examines the factors that drive transportation demand (e.g., national economic performance), but also presents the characteristics of transport system performance by mode. There was a sense among those the scan team interviewed that because much of the data for this report comes from the provinces, and because of the aggregate nature of many of the measures reported on, the annual report does not provide a good picture of Canada's "state of transportation." Officials noted, however, that the annual report often adopts a theme, such as international trade, that is useful for focusing attention on a particular issue.

Transport Canada uses a "results chain" as the underlying logic of its more comprehensive performance measurement efforts. Figure 1 shows such a results chain for the goal of achieving a more sustainable transport network. As shown, individual activities in the organization can be targeted at specific audiences, which then lead to various levels of outcomes. An example of the linkage among strategic objectives, ultimate outcomes, and performance indicators is shown in table 1. Note that this table was prepared by Transport Canada to illustrate the framework being developed.

In 2003, Transport Canada's Corporate Audit and Advisory Services unit reviewed the performance

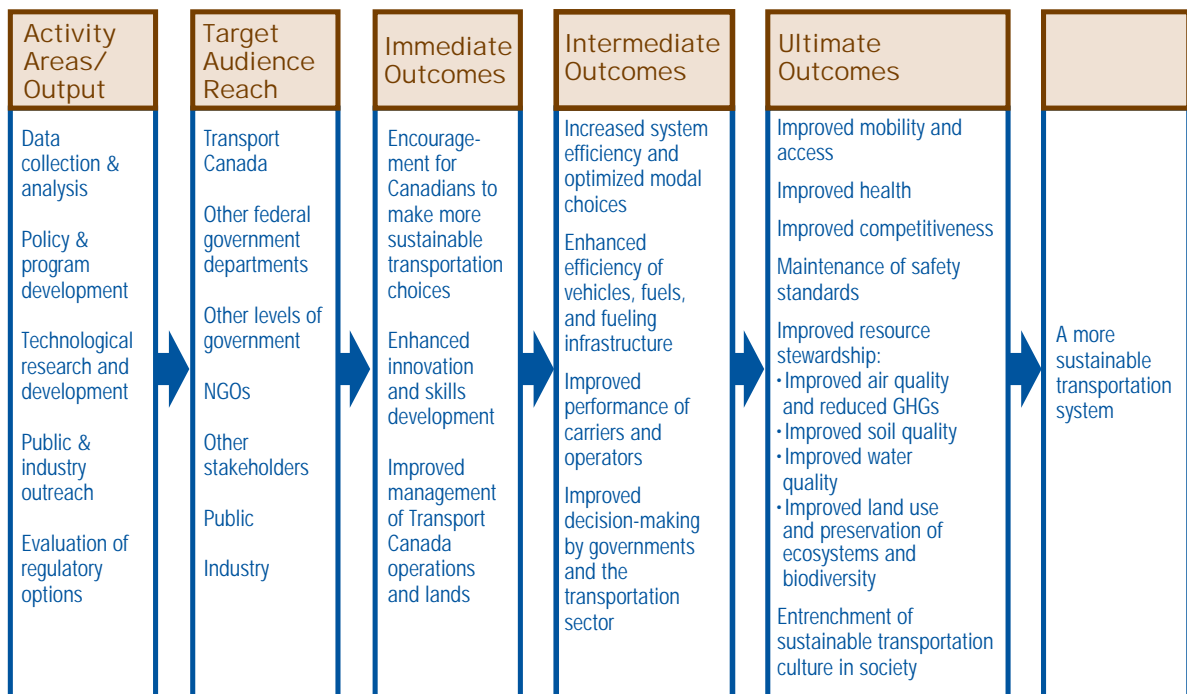


Figure 1. Results chain for Transport Canada.

framework established for the agency’s sustainable development strategy. This review indicated that 80 percent of the agency’s commitments and just over 70 percent of the targets were met or were on track to be met. In addition, this review concluded that the agency’s environmental management system (EMS) was critical to the overall success of improving environmental performance.

Provincial Efforts at Performance Measurement

Many provincial governments in Canada are in various stages of developing and using a performance-based planning and decisionmaking framework. A good example is Alberta, where in 1992 a new government instituted dramatic changes in government operations, including the use of outcome-based performance measurement. The Alberta Ministry of Transportation has been a leader in implementing such change

(visit www.tu.gov.ab.ca/home/index.asp for its latest annual report and to see how performance is measured). To obtain a more detailed understanding of how a province and a metropolitan area undertake performance measurement, the scan team visited Vancouver, British Columbia.

VANCOUVER, BRITISH COLUMBIA

The scan team met with officials from Transport Canada, the British Columbia Ministry of Transportation, and TransLink, Vancouver’s regional transportation agency. To a large extent, the performance management experience in Vancouver and British Columbia is still in a period of development. Both the Ministry of Transport and TransLink have developed a performance-based planning and decisionmaking accountability system in recent

Table 1. Linkage among objectives, outcomes, and indicators at Transport Canada.

Strategic Objective	Ultimate Outcome	Indicators of Progress*
Ensure high standards for a safe and secure transportation system.	<ul style="list-style-type: none"> • Protection of life, health, environment and property • High confidence in the safety and security of the transportation system 	<ul style="list-style-type: none"> • Reduced accident rate • Increased compliance rate • High public confidence in travel • Stakeholder understanding of safety benefits and issues • Reduced security risks • A regulated community that is engaged and well informed
Contribute to Canada's economic growth and social development.	<p>An integrated intermodal transportation system with the following characteristics:</p> <ul style="list-style-type: none"> • Efficient, effective, viable, affordable, and accessible • Responsive to users and communities • Competitive and harmonized, both domestically and internationally 	<ul style="list-style-type: none"> • Service and price levels • Current and prospective viability of system components • Trends in operational costs • Cost to taxpayer • Community and user satisfaction with price and service • Benefits to industry and consumers from improved harmonization
Protect the physical environment.	<ul style="list-style-type: none"> • Environmentally sustainable transportation system for Canadians • Reduction of greenhouse gas emissions and pollution from the transportation sector • Prevention and mitigation of environmental damage from transportation activities 	<ul style="list-style-type: none"> • Increased public awareness of the environmental impact of transportation activities • Increase in the use of more energy-efficient vehicles • Reduction in annual vehicle kilometers • Reduced greenhouse gas emissions and other air pollutants from transportation sources

* This list is not intended to be an exhaustive list of all current and/or future indicators.

SOURCE: Transport Canada, Sustainable Development Principles for Transport Canada, Ottawa, Ontario.

years, and both are still determining how to integrate the system into the decisionmaking process.

British Columbia Ministry of Transportation—In 2001, the provincial government instituted a policy requiring government ministries to establish “service plans that include measurable performance standards and targets for all programs that are annually audited and published.” This requirement was in direct response to a provincial law entitled “Budget Transparency and Accountability Act.” The Ministry of Transportation’s service plan for fiscal years (FY) 2004/05 and 2006/07 was organized by agency goals and core business areas. For each performance measure, a baseline value was identified along with targets for the next three years. The performance measures found in the service plan are shown in table 2.

Several aspects of the performance measurement regimen shown in table 2 merit comment. It is clear from the focus of the performance measurement effort that transportation’s role in fostering economic growth is a key policy direction of the ministry, a focus confirmed in conversation with a ministry representative. In this regard, the measures relating to “leveraged private investment” and “commercial trucking travel time between economic gateways” stand out because the scan team did not find them at other scan sites. The measures on competitiveness, especially those measuring reduction in legal and regulatory barriers, were also unique compared to those found elsewhere.

Another interesting category of measures related to highways. The reliability measure—duration of highway closures longer than 30 minutes—directly linked to the ministry’s and police agency’s ability to remove incidents from the road network.

The team found the use of customer and employee satisfaction surveys all of the cases it examined during this scan. Of interest in the Ministry of Transport’s effort, however, was its attempt to pinpoint those aspects of dissatisfaction that it could address (e.g., maintenance and snow removal efforts). More than 1,000 surveys were used to establish the baseline satisfaction score (6.5 out of 10.0). The Ministry of Transport has established an FY 2006/07 target of 8.0 out of 10.0 for this performance measure.

TransLink—The Greater Vancouver Transportation Authority, known as TransLink, was created in 1999 with a mandate to plan, finance, and manage a regional

transportation system, including Vancouver’s public transit system and major road network. The actual delivery of public transit services takes place through subsidiary companies and contractors, while maintenance and improvement of the major road network is done in partnership with the municipalities. Unlike most such authorities in the United States, TransLink has the ability to assess property taxes, collect tolls, and raise motor vehicle and parking fees to support its programs.

TransLink chose a “balanced scorecard” approach to performance measurement. Based on 1990s research on corporate management, the scorecard was intended to balance the reporting of organizational achievement among financial performance, customer satisfaction, organizational learning and growth, and internal business practices. The scorecard aims to align the strategic directions of an agency with its programs and day-to-day activities. Figure 2 (see page 8) shows where the performance scorecard fits into the decisionmaking context in TransLink. In this construct, the scorecard consists of the customer, financial, best practices, and employee factors.

According to TransLink officials, the process of developing the scorecard highlighted key themes common to most groups participating in the process. These include the following:

- The concept of a balanced scorecard was supported by a range of stakeholder groups.
- Accountability was considered a necessary characteristic of successful organizational performance.
- Balancing finance, operations, and social goals was an important task.
- Performance measurement should include an emphasis on economic development/sustainability, accessibility, and quality of life.
- Safety and security were important priorities.
- Institutional issues relating to modal responsibility and regional governance needed to be resolved.

The most recent version of TransLink’s performance scorecard is shown in table 3 (see page 9).

Congestion

As seen in table 3, a congestion measure is not yet part of the TransLink scorecard. Transport Canada has expressed some interest in developing consistent measures of congestion and greenhouse gas emissions that could be used for Canada’s urban areas. A study on congestion costs is underway to examine a variety of ways that congestion measures could be defined,

Table 2. Performance measures for the British Columbia Ministry of Transportation.

Goal	Objective	Performance Measure
Key transportation infrastructure is improved to drive economic growth and trade.	Regional and local input is used when setting transportation priorities.	Annual reports from Regional Transportation Advisory Committees
	Available provincial investment dollars are used as effectively as possible.	Private investment capital leveraged through public/private partnerships, plus defrayed or reduced costs from efficient land use
	Worsening congestion trend in urban areas is mitigated.	Percentage of urban vehicle-kilometers traveled in congested conditions
	Mobility is improved for highways servicing major economic gateways.	Commercial trucking travel time between economic gateways
British Columbia is provided with a safe and reliable highway system.	Contractors maintain the provincial highway system to a high standard.	Maintenance cost per lane-kilometer
		Rating of maintenance contractors
	Existing main highway system is systematically preserved and replaced at the least life cycle cost.	Percentage of kilometers with good or excellent pavement condition
		Percentage of bridges with good or excellent condition
		Number of lane-kilometers improved
	Road access is improved for resource industries and rural residents.	Percentage of rural kilometers with good or excellent pavement condition
		Number of lane-kilometers improved
	Highway safety and reliability are improved.	Demonstrated safety improvements on a capital project-by-project basis, with measure comparing crash data before and after projects
		Annual total duration of unplanned closures greater than 30 minutes for all numbered highways
	An effective risk management process is established across the ministry.	Risk management plan development and implementation status
British Columbia's transportation industries become more competitive.	Provincial regulatory burden on the public, industry, and stakeholders is reduced by one-third.	Reduction in legislation, regulations, and policies
	Procedures for commercial passenger carriers are simplified, with safety as the primary criterion.	Reduction in the number of motor carrier regulatory requirements
	Third-party regulations and policies that impede British Columbia's ability to compete with other jurisdictions in the transportation market are reduced or eliminated.	Process toward implementation of an amended Canada-U.S. air service agreement
Excellent customer service is achieved and the ministry is recognized as a good employer.	Excellent service is provided to all British Columbians.	Higher user satisfaction with existing ministry services and delivery processes
	Employees are provided with the support, training, and working environment they need to excel at their jobs.	Survey of employee satisfaction with organizational improvements

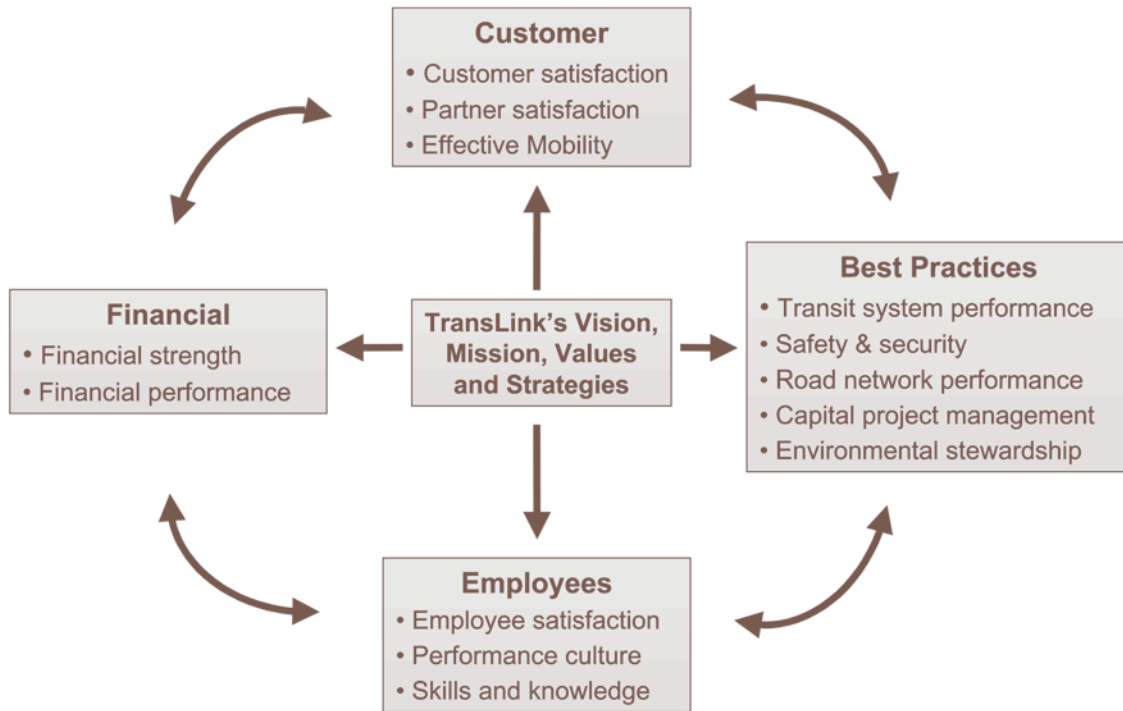


Figure 2. Relationship of performance scorecard factors to TransLink decisions.

ranging from total social cost of congestion to facility delay indicators.

Even though a congestion measure is not yet available, TransLink has developed a set of project evaluation guidelines in support of a multiple account evaluation (MAE) process that has been established by the government for major investment analysis. These guidelines serve as the methodological foundation for project evaluation and development of study recommendations. The criteria are divided into four major accounts—direct sector, indirect sector, external, and social accounts. The direct sector relates to the generalized costs, including travel time of the consumers of transportation, and to the capital and operating costs for the producers of transportation. The indirect sector relates to the economic development and land value changes. External accounts reflect crash, air quality, and noise impacts. Social accounts relate to the intergovernmental transfer, neighborhood, and social impacts. The MAE is used to evaluate larger projects and to assess the larger-scale systems effects of network investment. There was some discussion during the scanning study of the need to link system performance measures with the criteria found in the MAE approach. As one TransLink representative noted, consensus is good on what is important within modal

categories, but across modes little agreement exists on how multimodal performance should be measured.

Observations

The following are the scan team’s key observations from the Vancouver, British Columbia, visit:

- The TransLink scorecard, although still in development, has served some useful purposes. According to TransLink representatives, the stakeholder involvement process leading to the development of the scorecard provided numerous opportunities for a diverse group of constituencies to interact and understand the positions of others. For example, the scorecard is credited with gaining the support of environmental constituencies for TransLink’s program. TransLink representatives believe that the scorecard and the investment decisions it represents were instrumental in convincing voters to approve a 2 cent property tax increase in 2002 that raises \$40 million (US\$29.4 million) per year for transportation investment.
- The TransLink scorecard, because of the way it is structured, focuses not only on system performance, but also on employee objectives. Incorporating a performance culture into TransLink is one of the objectives of the performance approach. The belief is that

Table 3. TransLink's performance scorecard.

CUSTOMER	
Objectives	Measures
Customer Satisfaction	<ul style="list-style-type: none"> • Overall transit system rating • Specific transit service, car/van pool, and AirCare ratings • Ratings of onboard safety and personal safety at transit stops • Rating of major roads/bridges • Public acceptability of TransLink's performance
Partner Satisfaction	<ul style="list-style-type: none"> • TransLink's approach to communication and involvement
Effective Mobility	<ul style="list-style-type: none"> • Proximity and frequency of transit services • Accessibility of transit fleet • Peak hour and weekend travel time between key centers • People movement and mode share • Goods movement and mode share

EMPLOYEES	
Objectives	Measures
Employee Satisfaction	<ul style="list-style-type: none"> • Employee ratings of satisfaction and corporate climate • Employee ratings of internal communications
Performance Culture	<ul style="list-style-type: none"> • Vision, mission, and values implementation • Scorecard implementation • Completion of individual annual review sessions with staff • Assessment of corporate performance against annual plan
Skills and Knowledge	<ul style="list-style-type: none"> • Percentage of employees with professional development plans • Organizational resource capacity to execute current and future strategic objectives

BEST PRACTICES	
Objectives	Measures
Transit System Performance	<ul style="list-style-type: none"> • Transit service effectiveness: ridership growth • Transit service efficiency: peak hours load factor • Service reliability: ontime performance • Service reliability: % of actual service versus scheduled service
Safety and Security	<ul style="list-style-type: none"> • Number of safety-related incidents per transit passenger trip
Road Network Performance	<ul style="list-style-type: none"> • Operating condition of major road network
Capital Project Management	<ul style="list-style-type: none"> • Project performance based on the following: <ul style="list-style-type: none"> –Timeliness –Cost –Quality –Delivery of agreed scope
Environmental Stewardship	TransLink's emission-reduction contribution

FINANCIAL	
Objectives	Measures
Financial Strength	<ul style="list-style-type: none"> • Transportation revenue proportion versus other revenue sources • Debt ratio • Reserve ratio
Financial Performance	<ul style="list-style-type: none"> • Budget versus actual • Transit cost recovered by transit revenues • Road expenditures commitment • New leveraged capital funds committed

if the scorecard does not become institutionalized in the culture of the organization, the benefits of a performance-based decisionmaking approach will not be realized.

- One of the most significant applications of performance measurement occurs in the safety field, although even here, a systems-level analysis of a safety program is not apparent. The Insurance Corporation of British Columbia, a crown corporation that provides universal auto insurance to motorists (2.6 million in British Columbia), invests C\$10 million to \$15 million (US\$7.4 million to \$11 million) per year for road improvements, with special interest in leveraging this investment to obtain other governmental support. Of particular interest in this initiative is that the corporation looks for a minimum rate of return on proposed investments. High fatality and personal injury crash locations are tracked and ranked for priority investment. Road safety audits are also conducted to identify potentially dangerous locations.
- The important linkage between top management support and performance measurement effectiveness was quite evident in this case. In both the TransLink and the British Columbia Ministry of Transportation application, top management support occurred in the early proposal adoption stage. The Ministry of Transportation's efforts have picked up in recent years as the various business units have been required to focus more on how best to report on key performance areas. Ministry officials view this as an impetus for improved reporting in the future. In 2004, the TransLink Executive Board reconfirmed its commitment to the performance scorecard and will use it as the framework for its corporate business planning process.
- TransLink has recognized the importance of context-specific investment, in which the type of transportation investment is linked to the region's land use and political context. The result has been an understanding that transit investment is the right choice in urban areas, and road investment is more appropriate in sub-urban areas.

JAPAN

Japan is a very populous country (127 million people) with much of the population concentrated in coastal cities. Because the country is highly urbanized, the scan

team was particularly interested in performance measures that related to the urban character of the communities in which transportation facilities are built and operated. In addition, Japan is known for its leading-edge application of technology in all aspects of daily life, so the team was interested in identifying how the Japanese use intelligent transportation system (ITS) technologies to collect data for its performance management efforts. The Japanese government adopted a performance-based planning approach to infrastructure decisions just a few years ago, so the team also wanted to see how fast the Japanese had implemented the approach and what they had learned from this experience.

Governmental Context

Japan is a parliamentary democracy with a Prime Minister selected from the majority (or coalition) party. The Prime Minister selects the Cabinet. In transportation, the primary national government agency for transportation is the Ministry of Land, Infrastructure, and Transportation (MLIT). Formerly separate agencies, MLIT consists of 13 bureaus plus the Minister's secretariat. In transportation, the key bureaus are the Road, Railway, Road Transport, Maritime, Ports and Harbors, and Civil Aviation Bureaus. In addition, MLIT has nine Regional Development Bureaus, which plan and manage roads and interact with 47 prefectures (or states).

The scan team spent most of its time with officials of the Road Bureau, an agency of 212 employees with primary responsibility for the nation's road system. The Road Bureau has eight regional offices. A National Institute for Land and Infrastructure Management, MLIT's research arm, has also been established to conduct research on leading-edge applications of technology and urban infrastructure issues. In addition, a semi-independent Institute for Traffic Accident Research and Data Analysis, jointly controlled by MLIT and the National Policy Agency, has been created to provide a central capability for crash assessment.

In addition to the Road Bureau, Japan has created metropolitan and national toll agencies, including the Metropolitan Expressway Public Corporation and the Japan Highway Public Corporation. The government is considering privatizing the toll roads in Japan. The most important high-capacity, high-speed roads in Japan are the responsibility of these toll agencies, under the supervision of the Road Bureau.

Use of Performance Measures

The Japanese government has been shifting to a perform-

ance-oriented focus over the past several years. A 2002 national law on policy evaluation and program performance required that government ministries adopt such a focus in their activities. The road-oriented recommendations made by a Cabinet-level Infrastructure Development Council in 2002 that came from this law were the following:

- Road program administration should shift to an outcome-based approach.
- Policy evaluation that links program and project consequences to these outcomes should be incorporated into this administration.
- Results of this policy evaluation and program monitoring should influence the budgeting process.

MLIT has followed a performance management scheme since its creation in 2001. Performance measurement is considered part of a policy evaluation system consisting of policy assessment, performance measurement, and program evaluation established in response to the 2002 law (see figure 3). Policy assessment—what would be called policy analysis in the United States—is a systematic consideration of the consequences of alternative policy choices in relation to stated goals and objectives. Program evaluation focuses on ex post facto assessment of program outcomes with special focus on understanding the cause-and-effect dynamics that led to these out-

comes. Performance measurement consists of monitoring transportation system and organizational performance in relation to a set of politically defined and publicly reviewed performance indicators.

A major legislative mandate that has strongly influenced the development of MLIT performance indicators occurred in 2003 when the Japanese Diet (Parliament) passed the “Law for the Long-Term Plan on the Main Development of Social Infrastructure.” This law required the government to establish a plan for achieving performance targets in several infrastructure areas, including roads, railroads, ports, navigation channels, and actions relating to flood control and coastal conservation. The MLIT plan, based on indicators listed in the law, included 116 performance indicators, many with targets defined in cooperation with other ministries, including the Ministry of Finance. Long-term targets were established for 2020 and intermediate targets for 2007. A Performance Management Office was created in the Road Bureau in 2003 as a center of responsibility for performance measurement.

The Road Bureau developed a strategy for incorporating an outcome-based road administration decisionmaking framework into the strategic and operational decisions of the agency. A set of 17 core indicators relating to five

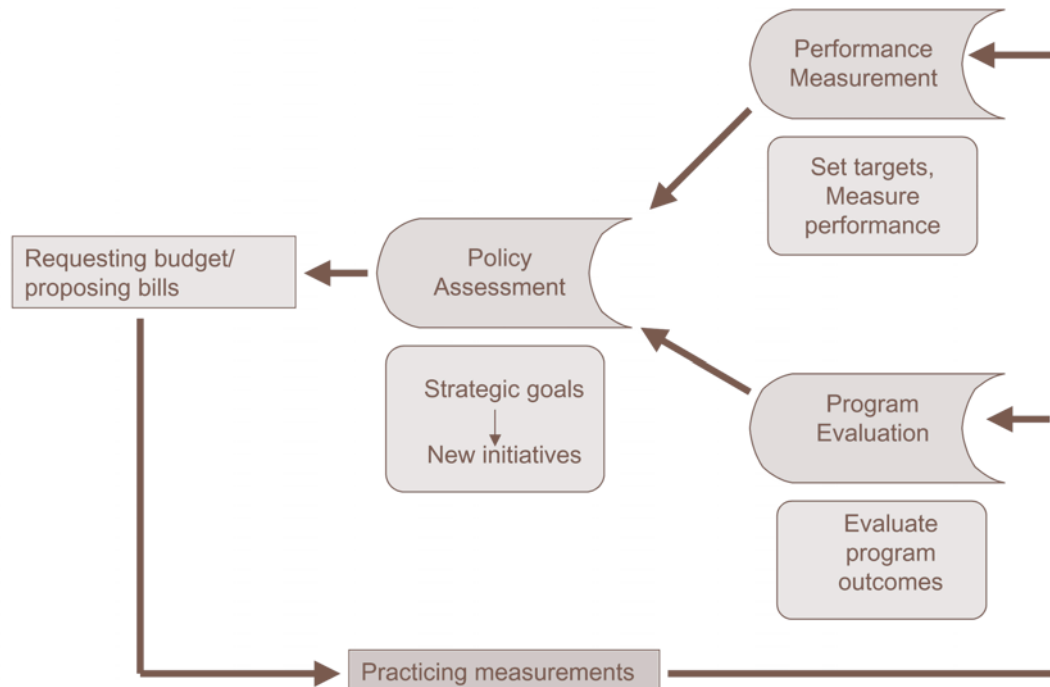


Figure 3. Performance management in the Ministry of Land, Infrastructure, and Transportation in Japan.

policy themes was defined. Regional performance-based plans for each prefecture were to be formulated by MLIT's local National Highway Offices in cooperation with prefecture officials, using selected indicators from these 17 core indicators, along with any others specific to their needs. By March 2004, 31 of 47 prefectures had established their own performance indicators, including 80 measures different from the national indicators. The 17 core indicators are shown in table 4.

Several performance indicators in table 4 are of special note. The "percentage of electronic toll collection (ETC) use on the expressway system" represents an MLIT commitment to advance the use of technology in making network operations more efficient. (Note that this indicator is found in the economic vitality policy category). Also related to network efficiency is the "percentage of targeted traffic flows that diverted to the expressway network from currently used non-expressway roads" indicator. The quality of life indicators include the "percentage of barrier-free road near transit terminals" and the "percentage of main roads in urban areas without utility poles." Both measures were unique to Japan and reflect the importance the Japanese place on walking as a mode of transportation and on community aesthetics. The "percentage of cities having evacuation routes" is not surprising, given the risk from natural disasters in Japan. In the environmental category, the "percent compliance with nighttime noise standards" also reflects the highly urban nature of the country.

Although the scan team did not have the opportunity to review all of the prefecture-specific performance plans, it saw examples of the types of measures that have surfaced from these efforts, including the following topics of interest to the scan team:

<i>Performance Topic</i>	<i>Jurisdiction</i>
• Road sections with winter-related speed reductions	Yamagata Prefecture
• Snow removal from roads in school zones	Aomori Prefecture
• Population access within 60 minutes of advanced hospitals for newborn babies	Aomori Prefecture
• Safe passing areas on highways and local roads for motor vehicles and pedestrians	Niigata Prefecture
• Sidewalks with sufficient width	Toyama Prefecture
• Existence of green space in road right-of-way	Niigata Prefecture

Each performance measure in a prefecture's performance plan has established targets and a list of projects to be undertaken in the coming year related to these targets.

To ensure consistent implementation of the performance measurement concept nationally, the Road Bureau holds annual meetings with its regional offices. These meetings focus on the performance of the road network, detailed analysis of key road facilities, the status of current projects, and the reporting of outcomes of implemented projects.

The original law on administrative reform required the results of performance evaluation to influence budget allocation. It is too early in the process for identifiable changes in the budget process to have occurred, but the Road Bureau has changed its budgeting format from requests for specific road types to requests for outcome categories. An illustrative budget was shown to the scan team that divided the budget into categories on congestion relief, regional collaboration, maintenance and repair, environmental mitigation, safety, and utility relocations. The budget requested for 2004 showed increases for environmental mitigation, safety, and utility location efforts, and decreases for the other three categories.

Congestion

With a population of 127 million people primarily located in coastal cities, it is not surprising that traffic congestion is a major issue in Japan. It was estimated in 2003 that 3.8 billion person-hours per year are lost because congestion, about 30 hours per person per year. Of this national total, one-third occurs in the Tokyo metropolitan area (or what is referred to as the Kanto Regional Development District of the Road Bureau). The Tokyo major road network is primarily oriented radially into the downtown, with several circumferential or ring roads either completed, under construction, or in the planning stage. It was apparent from discussions with Bureau officials that they consider completion of the freeway network, especially the ring roads, a critical element of the region's strategy to reduce congestion.

As shown in table 4, the key congestion measure is "time loss due to congestion," measured in million person-hours per year. The current value for the monitored sections in the Kanto region is 610 million person-hours, and a target value of 530 million person-hours has been established for 2007. It was not clear whether this target was referenced to current values of congestion or whether natural growth in traffic volumes was also assumed as part of the reduction. Some officials

Table 4. Core performance indicators in Japan.

Policy Theme	Performance Indicator	Current value (2002)	Target for 2003	Target for 2007	
Economic vitality	Time loss due to traffic congestion	610 million person-hours	590 million person-hours	About 10% reduction	
	% of ETC use—National	5%	15%	70%	
		Metropolitan Expressway	6%	20%	85%
		Hanshin Expressway	3%	15%	85%
	Hours of roadwork	201 hours/km-year	193 hours/km-year	20% reduction	
	% of traffic diverted to expressways	13%	13%	15%	
	% of roads with access to airports/ports	59%	61%	68%	
	% of main cities connected to national road	72%	73%	77%	
	% of people having safe drive into city of less than 30 minute	63%	64%	69%	
Quality of life	% of barrier-free main roads near transit terminals with >5,000 passengers	17%	21%	About 50%	
	% of urban trunk roads without utility poles	7%	8%	15%	
Safety	Incidence of death and injury accidents	118.4 mvkt	116 mvkt	108 mvkt	
	Road in safe condition—bridge	86%	87%	93%	
		Pavement	91%	Maintain current levels	
	% of cities having safety evacuation routes	6%	68%	7%	
Environment	Reduction in CO2 emissions	—	Reduce transportation sector contribution to 250 million tons of CO2 by 2010		
	% of NO2 environmental goal achievement	64%	67%	About 80%	
	% of suspended particulate matter goal achievement	—	About 10%	About 60%	
	% of compliance on nighttime noise standards	61%	63%	72%	
Road administration	Level of road user satisfaction	2.6 points	2.7 points	3.0 points	
	Number of hits on homepage	15.46 million/year	26 million/year	About 100 million/year	

Figure 4. Visualization of performance data in Japan.

An example of finding trouble spots by means of congestion loss data (Kanto, National Route 16)

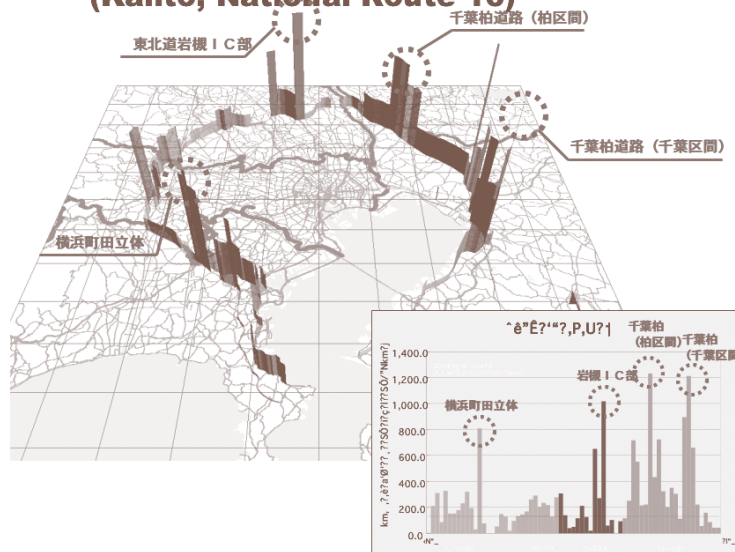


Figure 4a. Congestion on a beltway in Tokyo.

Using road records to confirm status of trouble spots and countermeasures (e.g. Tohoku, National Route 7)

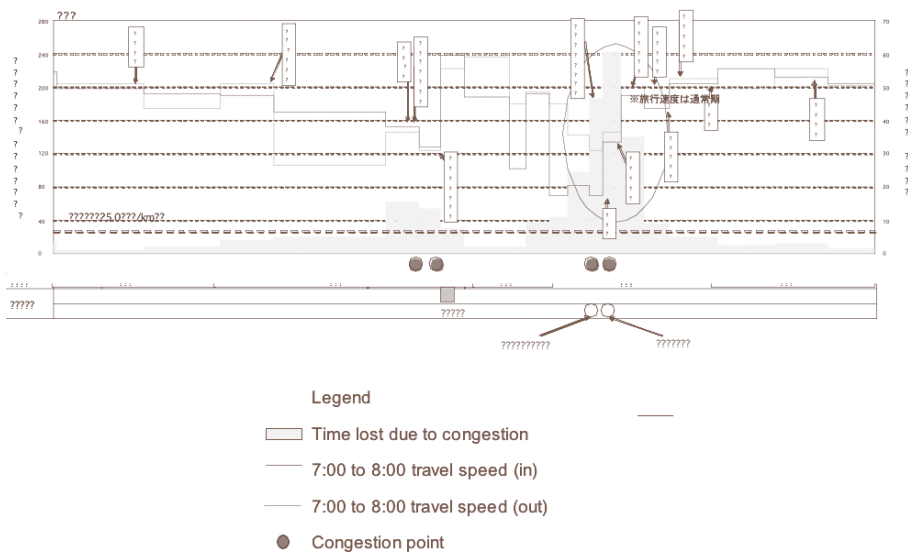


Figure 4b. Congestion on an urban arterial.

suggested that the target takes traffic growth into account, which makes it even more ambitious.

Data collection necessary to estimate this congestion measure includes traditional roadside surveys (23,000 locations in Japan), automated traffic counters, ultrasonic loop detectors at 500 locations to detect travel speed, use of the floating car method along 33,700 sections to determine travel speed, and an evolving program to use probe vehicles for determining travel time. Japan has about 5,000 probe vehicles (3,000 in Tokyo), most of which are buses. Through the use of global positioning system (GPS) satellites, the progress of buses through the arterial road network can be monitored and reported to a central database server. This data can be turned into several important pieces of information—real-time arrival information for transit riders, operations control for bus managers, and road system management and performance measurement for the Road Bureau. In addition, probe data have been used to evaluate the impact of network expansion on congestion. Figure 4a shows an example of how this information is portrayed for one of the ring roads circumventing central Tokyo. Figure 4b shows the use of this information to monitor sections of an individual arterial route.

One of the most important providers of road service in the Tokyo metropolitan area is the Metropolitan Expressway Public Corporation (MEX), formed in 1959 to improve traffic flow in the region. Tokyo now has 281 km (175 mi) of tolled expressways carrying about 30 percent of all arterial traffic and 35 percent of truck volumes in the metropolitan area. About one-third of toll receipts go to pay for new road construction, 37

percent to interest on outstanding bonds, and 30 percent to ongoing road management.

MEX has estimated that 86 percent of expressway congestion is caused simply by lack of road capacity, 12 percent by crashes and breakdowns, and 2 percent by road maintenance and repair. This estimate has led to some unsurprising proposed solutions. Most importantly, expansion of the expressway network, especially the ring roads, has become a key part of the road agencies' strategy. The most recent report for MEX identifies just over 32 km (20 mi) under construction. Road Bureau officials consider a proposed 86-km (53.4-mi) Tokyo Outer Ring Road, located about 15 km (9.3 mi) from downtown, the important missing link in the regional expressway network, but construction has been delayed by public opposition to the disruption that would occur in the neighborhoods through which it passes. The proposal is to build much of the road in tunnel sections, costing more than US\$1 billion per kilometer. At this point, a finance plan for this road has not been developed.

Another ring road, the Metropolitan Intercity Expressway, about 40 to 60 km (24.9 to 37.3 mi) from downtown, is also under consideration. This project is being delayed by difficulties in obtaining right-of-way.

Besides constructing new expressways, MEX is widening lanes, building new ramps to remove bottlenecks, and closing ramps when circumstances require it. Because 30 percent of the congestion on the national toll road network occurs at tollbooths, MEX also is encouraging road users to adopt ETC technology.

Congestion from road maintenance work is mitigated through contract specifications on time and location of the work, advance release of public information, and in-vehicle traveler information systems.

MEX uses several performance indicators to measure service delivery, including the following:

<i>Indicator</i>	<i>Target</i>
Average speed	44 km/h (27.3 mi/h) daytime
Duration of congestion	<363 kilometer-hours/day (226 mile-hours/day)
Number of crashes	<13,000 per year
Average recovery time for crash	<60 minutes
ETC use	>20 percent
Customer satisfaction	>3.0 out of 5.0

Safety

Traffic safety has been a social concern in Japan for several decades. From 1960 to 1970, when the number of automobiles owned in Japan increased twenty fold, annual traffic fatalities increased from 6,379 to 16,765. Even worse, the number of people injured increased from 76,000 to 981,000 over the same period. With the implementation of a variety of safety measures, fatalities have declined dramatically since 1970. MLIT officials are concerned, however, because the number of traffic-related injuries increased to an estimated 1,168,000 in 2002. One important aspect of this safety record is the percentage of crashes involving pedestrians and bicyclists. Close to 40 percent of the fatalities are either pedestrians or bicyclists, 60 percent are elderly, and 60 percent occur within 500 meters (1,640 feet) of home.

As seen in table 4, several of the core 17 performance indicators relate to safety. Besides those listed in the safety category, MLIT considers measures relating to “barrier-free main roads for pedestrians” and the “percentage of roads without utility poles” safety measures as well. Several initiatives have been aimed at each of these measures. From 1996 to 2002, 3,200 locations were identified on trunk roads where at least 24 injury-causing crashes had occurred in four years, where 40 percent of all crashes resulted in fatalities, or where more than two fatalities had occurred in four years. Each location received appropriate measures aimed at reducing crashes. At 1,700 of the locations where treatments had been completed by 1999, the number of traffic-related injury crashes had decreased by 30 percent, even taking into account the growth in traffic volume.

Officials plan to continue this so-called “black spot” removal program in the future. An additional 4,000 locations will be selected where the crash rate is five or more times the average crash rate for that road type. Figure 5 (see page 16) shows how the locations are ranked and intersections selected.

Other initiatives to reduce crashes include removal of illegally parked cars, promotion of safe and barrier-free pedestrian walking areas, and the use of safety reviews by community volunteers to identify unsafe conditions.

Urban Design

Community design can be an important element of an overall strategy for meeting many performance measurement goals. For example, urban design in the con-

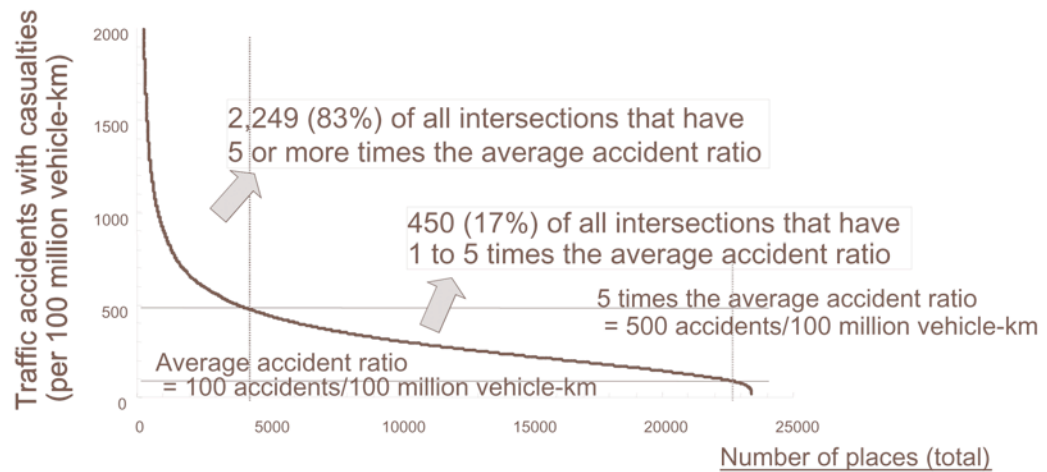


Figure 5. Identification of priority locations for safety countermeasures in Japan.

text of making safer and more walkable neighborhoods is an important initiative for enhancing safety. MLIT participates in large-scale, multiuse development projects with a significant transportation component. One project the scan team visited was a redevelopment of Shinjyuku Station, a transit station in the heart of one of Tokyo’s largest and most important office and retail clusters. With more than 3.2 million passengers per day using Shinjyuku Station, it has become a major node in Tokyo’s transportation system, but one with significant vehicular and pedestrian congestion on the surrounding road network. A narrow sidewalk in front of the station handles more than 430,000 people per day, a challenge that has led to unsafe and severely congested conditions. Given the need to reconstruct a bridge over the commuter rail and subway tracks serving the station, MLIT, local government, neighborhood groups, and railway companies have developed a new intermodal terminal concept that includes significant amounts of mixed-use development. The infrastructure elements of this project are nearing completion, with a new high-rise office complex to follow.

Although the impact and investment magnitude of this project makes it unique, it does illustrate how the national road agency works with a community through the development process to alleviate transportation problems. In such a highly urbanized country as Japan, this linkage between land use/urban design and transportation investment can be an important tool to help meet transportation goals.

Intelligent Transportation System Technologies

One reason the scan team wanted to visit Japan was to identify how intelligent transportation system (ITS) technologies could be used for data collection to support performance measurement. Japan is clearly one of the world leaders in ITS technology development and implementation. MEX uses a surveillance system to monitor road performance and has its own tow truck fleet (privately operated) to respond to incidents. Information is conveyed to road users via graphic information signs, variable message signs, congestion warning boards, local area radio advisories, remote travel kiosks, and in-vehicle navigation systems for motor vehicles so equipped. The data from video cameras and loop detectors is updated every minute. Real-time data is combined with an historical record to predict where congestion is likely to occur in the immediate future. Police agency representatives are located in the traffic management center to coordinate response to an incident. Little of the data collected is archived for planning or system performance management purposes; it is directed primarily to delivering road user information.

The use of electronic toll collection (ETC) technologies on the nation’s toll expressway network is a key MLIT goal. A national standard has been established for ETC technology, along with a capability to serve multiple communication functions. In February 2004, more than 2.5 million ETC units were in operation.

A dedicated short-range communication (DSRC) system has been developed that works in conjunction with ETC

technology to allow two-way communication between a vehicle and a central command center. Officials expect this DSRC system to eventually provide up-to-date information to road users on weather conditions, traffic congestion, traffic regulations and controls, and local services, as well as an ability to make reservations at nearby restaurants. In addition, anticipated functionalities include Internet access, parking fee payment (and possibly fuel payment), and guides to local transit services.

One technology in use is the vehicle information and communication system (VICS). This system provides drivers with real-time information on traffic conditions. The information is transmitted by a radio beacon, infrared or over FM radio. More than 12 million simple navigation systems are found in the vehicle fleet, and as of June 2003, about 7.2 million VICS units had been sold.

Finally, the Japanese are conducting important research on the development of advanced cruise-assist highway systems (AHS). AHS technologies will provide enhanced sensor capability for detecting and responding to obstacles in the road, vehicle control, and monitoring the condition of the road surface. The goal in the use of AHS technologies is to reduce crashes by 50 percent.

The Japanese appear to be in the early stages of thinking about how data collected from ITS technologies could be used to support system performance measurement. The use of probe vehicles for congestion measurement is the most advanced use of such technologies for this purpose. Those involved with developing ITS applications believe they are ideally suited to support a system performance-monitoring concept, as long as the number of measures is limited. The Japanese are also in the early stages of looking at vehicle-to-vehicle communication applications that would allow every instrumented vehicle to serve as a vehicle probe. With the heavy investment in fixed sensors, however, the strategy seems to be to rely on the existing infrastructure for data collection in the foreseeable future.

Observations

Some of the more important observations resulting from the team's visit to Japan are as follows:

- MLIT has in a very short time implemented a performance management decisionmaking structure, with the Road Bureau as the leading expert. The performance indicators have been narrowed to a small number (17) considered to be the most important. These 17 indicators are incorporated into each performance plan developed for the local offices of the eight Regional

Development Bureaus. Relatively quickly, MLIT has established a performance management structure that is consistent across the country.

- Even though the national indicators are found in all regional office and prefecture performance plans, each jurisdiction was encouraged to identify indicators that reflect its own needs and desires. This flexibility in subnational performance measurement has resulted in the identification of numerous jurisdiction-specific performance indicators.
- Given the highly urban character of the country, it is not surprising that several performance indicators emphasized qualities of the community environment, something not found elsewhere on the scan. In particular, the measures for barrier-free roads near transit stations and for removal of utility poles are unique.
- The Japanese are advanced in their application of ITS technologies for conveying user information and paying tolls. Except for probe vehicles, however, ITS technologies are not heavily used as data collection support for planning or performance measurement.
- MLIT's performance measurement framework uses before-and-after studies to assess the actual impact of implemented projects. Figure 6 (see page 18) shows two examples where the consequences of project implementation are determined. This information is

“Just by collecting data, we do not solve problems.”

—Ministry of Land, Infrastructure, and Transport Official

used to identify the most cost-effective strategies to meet transportation program goals.

- One of the most impressive aspects of the MLIT performance measurement effort was the highly visual nature of the presentation of the information. As shown in figure 7 (see page 19), officials make an effort to convey the key points of a particular performance measure in an easily comprehensible manner. Officials said they viewed the use of performance indicators as quite limited unless the implications of the results were clear to decisionmakers and the general public.

Current State of Traffic Congestion

Total time lost due to traffic congestion on National level: 3.8 billion person-hours/year
 → Accounts approximately 30 hours per person/year

● Time lost due to traffic congestion by prefecture



● 3D Congestion map of time loss
 (Central Tokyo: Time lost due to traffic congestion/km)

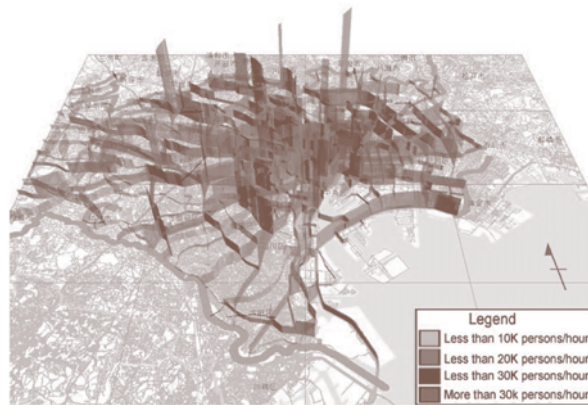


Figure 7. Visualization of network performance data in Japan.

- Although it is too early to tell what impact performance measurement will have on budget allocations, MLIT officials are trying to develop a budgeting scheme that reflects the results of an outcome-based decisionmaking process. The true test of the value of the performance measurement program will be when budget decisions are strongly influenced by system performance measurement.

AUSTRALIA

Roughly the same size as the United States, Australia is a country of vast expanses punctuated by highly vibrant urban areas. The concentration of population in urban areas is due in part to how flat and dry most of the country is. Australia consists of eight states and territories, each with its own unique culture and approach to infrastructure decisionmaking. Because of their long history of innovative approaches to infrastructure planning, and in particular, the use of performance indicators for decisionmaking, the states of Queensland (Brisbane), New South Wales (Sydney), and Victoria (Melbourne) were identified by the scan team as important sites to visit.

Governmental Context

Australia is a parliamentary democracy with the majority party in Parliament choosing a Prime Minister. The Prime Minister, in turn, selects members of the Cabinet. One characteristic of Australia important to understanding the focus and substance of transportation planning activities in the country is that much of the responsibility and power for such planning resides with the states. Most of the substantive use of performance indicators and its effects on budget decisions are found at the state level. The national government does have responsibility for a national highway network, even though it has suggested that its financial commitments to this network should devolve to the states, a suggestion state governments oppose.

The major national transportation agency is the Department for Infrastructure Planning and Natural Resources, which provides policy advice to the ministers and parliamentary secretary for the transport and regional services portfolio. It also administers funding programs (such as a national black spot program to reduce crashes) and conducts research. The Australian Transport Council (ATC) consists of national, state, territory, and

New Zealand ministers responsible for transportation. It is primarily responsible for providing advice to all levels of government on issues important to transportation policy. The National Transport Commission focuses its attention on driver and vehicle regulations, standards, and operating rules relating mainly to freight movement. It serves as an advisor to ATC.

Austroroads is an association of road and traffic authorities in Australia and New Zealand whose purpose is to conduct research and foster collaboration among its members. Established in 1989, Austroroads consists of 11 members (including all three states and Transit New Zealand visited during the scan) with a rotating chairmanship. In 1993, in response to member concerns and interest in outcome-based planning and decisionmaking, Austroroads undertook an effort to identify a set of performance indicators for the road system. Each member is responsible for submitting its data annually. Seventy-two performance indicators were grouped into 10 categories shown in the box.

The 72 indicators, reported by jurisdiction, are on the Web at www.austroroads.com.au. Of these indicators, 21 have been identified as core indicators, or those most important to member jurisdictions:

- Fatalities per 100,000 population
- Dollar per vehicle registration and driver licensing record
- Maintenance cost (\$1,000s) per lane-kilometer to keep road conditions below an acceptable roughness level of 4.2 m/km IRI (International Roughness Index)

Austroroads' Categories for Performance Measures

- Road safety
- Registration and licensing
- Road construction and maintenance
- Environment
- Program/project assessment
- Travel time
- Lane occupancy rate
- User cost distance
- User satisfaction
- Consumption of road transport, freight, and fuel

- Proportion of travel undertaken each year on all roads with a roughness level condition of less than 4.2 m/km IRI
- Percentage of roadside dwellings exposed to noise above a specified level
- Greenhouse gas emissions per vehicle-kilometer
- Percentage of expenditure specified to achieve benefit cost ratios

- A.M. peak actual travel speed—urban
- P.M. peak actual travel speed—urban
- A.M. peak lane occupancy rate (persons/lane/hour)
- P.M. peak lane occupancy rate
- Off-peak lane occupancy rate
- All-day lane occupancy rate
- Operating costs per kilometer
- Cost per ton-kilometer for freight
- User satisfaction index
- Total kilometers traveled by jurisdiction of registration, normalized for economic activity
- Total road ton-kilometers traveled, normalized for economic activity
- Average rate (all fuels) of vehicle fuel consumption in liters per 100 kilometers

Figure 8 provides an example of how this information is presented for one core indicator. Austroroads members use this information not only to monitor trends in their own jurisdiction, but also to support benchmarking comparisons from one jurisdiction to another.

To provide consistency in measurement across jurisdictions, Austroroads develops best-practice guides on how data should be collected and interpreted for each measure. For example, the scan team found the Austroroads methodology for determining travel time measurements being used at each site visited. This methodology focused on a congestion indicator (minutes per kilometer) and a travel time variability measure.

Of interest as a possible model of nationally defined performance indicators, the Austroroads approach clearly represents a state- or jurisdiction-defined “bottoms-up” effort to determine what is really important to agencies most responsible for delivering the road program. In some cases, data were missing from specific measures for certain jurisdictions. When participants were asked why, the response was that these jurisdictions most likely no longer considered such information important to their planning and decisionmaking. Several officials told the scan team that these 72 indicators were being reviewed for relevance, and that some most likely would be dropped from the list, while others might be added. The user-defined characteristics of this national performance indicator program were of great interest to many members of the scan team.

BRISBANE, QUEENSLAND

Queensland, located in northeastern Australia, is two times the size of Texas and five times larger than Japan,

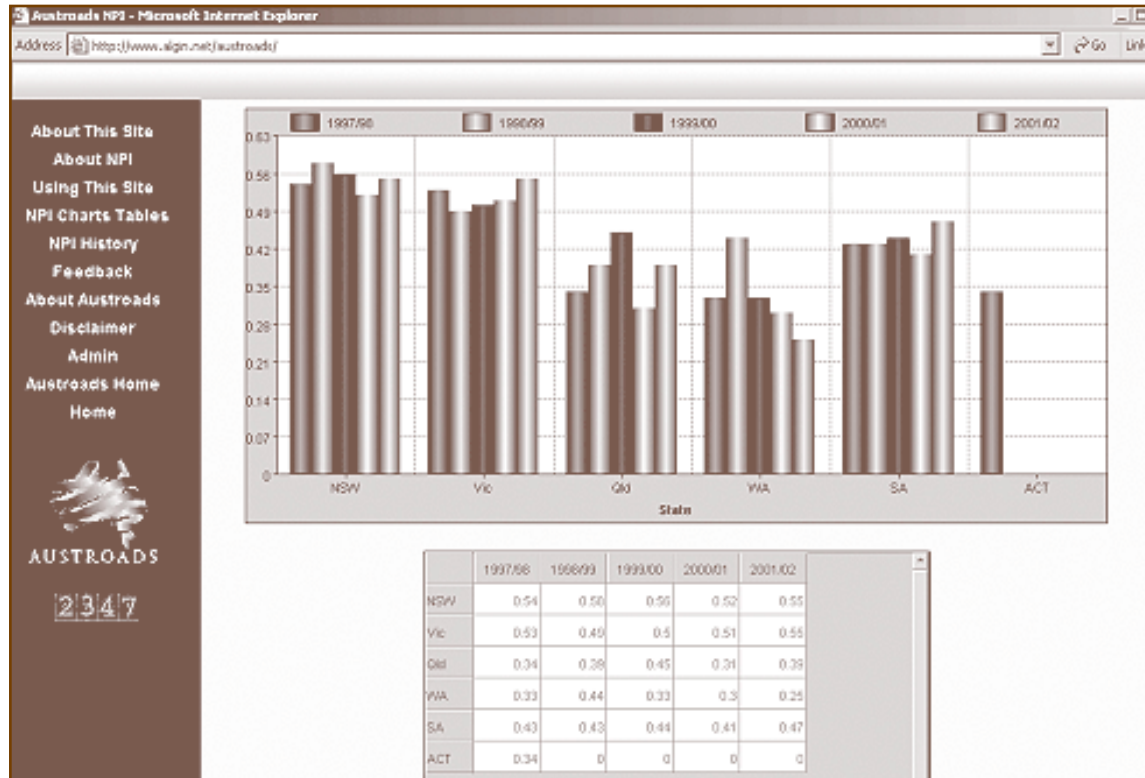


Figure 8. Austroads' congestion indicator for states.

but has only 3.7 million residents, most of whom are located in southeastern Queensland (mainly in Brisbane). Large parts of Queensland are rural and undeveloped, leading to active government provision of transport services (for example, the government has contracted for five long-distance intercity bus and two important air services that serve 48 remote communities). The heavy use of performance-based contracts for service delivery, as well as a long history of corporate strategic planning, were motivations for the scan team to visit Queensland.

Governmental Context

The Queensland government has set five priorities for its activities: provide safer and more supportive communities, create more jobs that focus on technical skills and innovation, enhance community engagement and quality of life, develop rural areas, and protect and create value in the natural environment. The Queensland parliamentary portfolio for transport has a defined vision statement that places transport squarely in the economic and quality-of-life future for the state. According to this vision statement, the transport portfolio will “contribute to government outcomes through consistent, coherent leader-

ship in the development and management of innovative transport solutions for Queensland that connect people, goods, and services.”

The transport portfolio includes two organizations—Main Roads and Transport Queensland. Main Roads owns and manages about 34,000 km (21,127 mi) of roads and is responsible for all aspects of planning, designing, constructing, operating, and maintaining this network. Queensland Transport is the lead agency for “developing and managing the land, air, and sea transport environment” in Queensland, and is responsible for vehicle and vessel registration and licensing. The government has also created government-owned corporations to provide passenger and freight rail services (Queensland Rail) and to manage ports and some airport facilities. Queensland Transport provides overall policy guidance for these efforts.

Use of Performance Indicators

Figure 9 shows the relationship among the different elements of the decisionmaking process in Queensland. The government's broad goals guide the development of transport policies. They, in turn, result in certain levels

of transportation system performance, monitored through performance indicators, which then lead to interventions or actions by transportation agencies to enhance this performance. The scan team observed the relationship among these elements in the many planning documents and processes described during the scan team’s visit. Performance indicators, which related closely to overall government policies for Queensland, were consistently presented in each of these documents and processes, and in many cases, provided the overall structure for the presentation of information to the reader or participant.

Several key documents provide overall guidance to the activities of Main Roads and Queensland Transport.

4Seeable Futures—In 1999, both transport agencies initiated a transportation scenario planning exercise covering 2000-2005. The questions participants in this exercise faced were, “How will we be connecting people, goods, and services in 25 years, and what will that mean for transport?” The outcomes of this effort were intended to inform the strategic planning and policymaking efforts in each agency. Although no performance measures were included in the document, nor in the process followed, the scenario analysis did provide boundaries on the magnitude of expected trends that would likely affect the performance of the transportation system.

Roads Connecting Queenslanders—One of the most important documents for laying the groundwork for decisionmaking in Main Roads is a 15-year planning

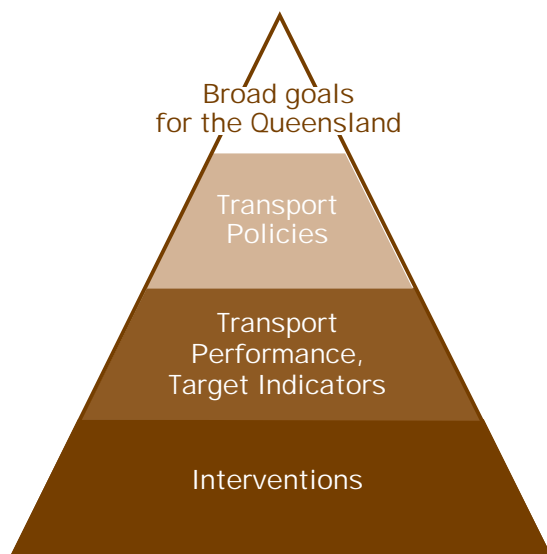


Figure 9. Relationship of performance indicators to agency decisionmaking in Queensland.

Table 5. Relationship among Main Roads outputs and government outcomes.

Main Roads Outputs	Government Outcomes
Safer roads	Safer communities
Efficient and effective transport	Industry competitiveness and growth
Fair access and amenity	Livable communities
Environmental management	Environmental conservation

blueprint entitled *Roads Connecting Queenslanders*. This document provides overall direction in meeting the challenges the agency is likely to face in the future. Main Roads’ officials stated that the document clearly indicated to agency staff that Main Roads had to move away from a focus on outputs to more emphasis on how outputs contribute to outcomes. The relationship between Main Roads’ major outputs to the government’s outcomes described in *Roads Connecting Queenslanders* is illustrated in table 5.

Figure 10 shows the strategic framework for road system asset management that is part of the overall planning framework represented by *Roads Connecting Queenslanders*. As noted in the plan, this framework illustrates a series of integrated steps that provide a logical progression of thinking about program delivery:

- Road system planning—doing the right it!
- Project delivery—doing it right!
- Performance management and review—proof we got it right!

Roads Connecting Queenslanders outlined broad categories for performance indicators, and stated that more definitive indicators would be developed in subsequent efforts. For example, in the “efficient and effective transport” category, *Roads Connecting Queenslanders* states that indicators will be developed in the following areas: measures of freight efficiency, travel time on the state highway network by time periods, stakeholder feedback, and restrictions on commercial traffic due to natural causes (e.g., flooding).

Strategic plans—Government agencies are required to produce strategic plans that link their action plans to overall government policies. According to the strategic plan for Main Roads, “The Main Roads strategic plan is part of a tiered planning framework to enable successful performance management. There is now an

integrated planning process with clear linkages to *Roads Connecting Queenslanders*, Strategic Plan, and all other business planning and policy development and clear accountabilities.... The integrated planning framework requires business plans for each division within Main Roads to demonstrate their contribution to the Strategic Plan. The budgeting framework aligns with the high-level services and products within the Strategic Plan.”

The strategic plan for Main Roads provides an extensive list of strategic issues, objectives, performance measures, strategies, and deliverables, and an implementation timeline. The performance measures as they relate to specific objectives are shown in table 6. The strategic plan for Queensland Transport also includes a long list of objectives and corresponding performance measures.

Road Implementation Program—The Road Implementation Program is a five-year program that includes the priorities and policy choices that Main Roads will implement for the first two years, and “indicative funding and intentions” for the three years that follow. By law, the program must include the policies, financial provisions, and performance targets that guide

“[Moving to a performance orientation] has involved a cultural shift in the way the department operates. It has meant moving from collecting data as audit material, to collecting data as part of a conscious plan to improve performance.”

—Main Roads Official

agency decisions. It also provides accountability for the previous year’s performance by reporting on the attainment of stated targets. Performance indicators are listed for 29 categories.

Annual reports—Both Main Roads and Queensland Transport provide comprehensive annual reports that outline the progress made on each agency’s strategic plan. The performance of each agency’s core business

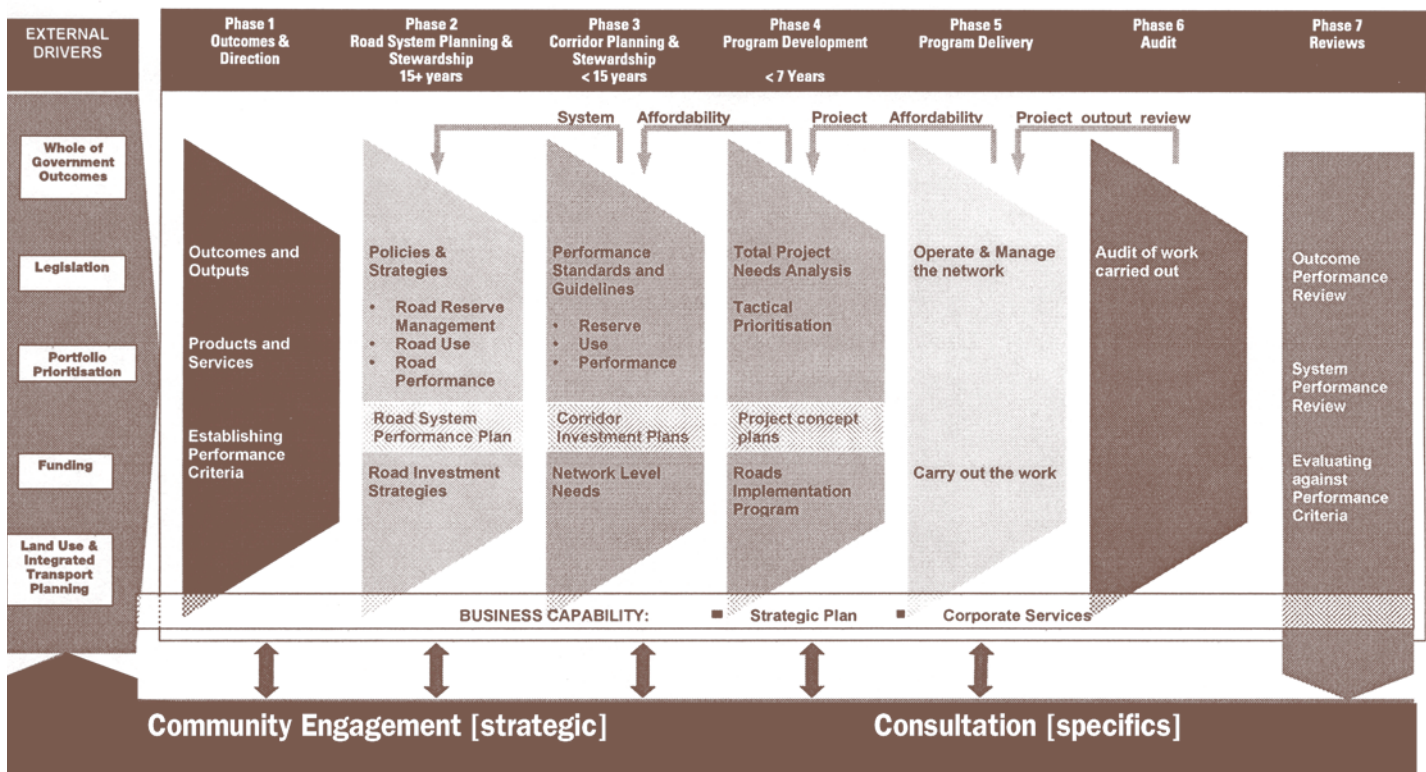


Figure 10. Strategic framework for road system asset management in Queensland.

Table 6. Strategic objectives and corresponding performance measures.

Main Roads Objective	Performance Measure
Road System Strategies	
Meet integrated planning outcomes and focus investment decisions on desired transport outcomes.	% of integrated regional transport plans % of state-controlled roads developed as per the 2001 investment vision
Build relationships and address stakeholder needs for the road system.	Overall stakeholder satisfaction index % of level of stakeholder satisfaction in specific categories % of level of awareness of Main Roads responsibility in road system management
Coordinate road planning, asset, road use, and delivery practices, and manage system risk.	System management \$ costs per kilometer Investment strategies accepted for strategic, regional, and local roads of regional significance
Improve knowledge of system performance.	Annual report on system performance Proportion of investment allocation to Main Roads outcomes
Road Corridor Strategies	
Preserve and plan road corridors for the future.	Total value of properties held for future projects and non-committed projects Value of resumed land as a function of average years to construction
Enhance stakeholder involvement in road corridor management.	% of level of stakeholder satisfaction with corridor access for industry stakeholders by region
Improve planning and management practices for road corridors.	Corridor management \$ costs per kilometer \$ net revenue generated from commercial activities
Improve Main Roads' understanding of trends in corridor use and implications for planning/environment.	Regular reports on population growth, planning timeframes, resumption costs related to land area, accuracy of service location, third party environmental impacts
Road Operation	
Optimize traffic flow and safety performance within a total transport context.	Travel speed variability (urban) Average duration of incident delays Flood immunity per link Network reliability
Optimize performance of the heavy vehicle freight task within a total transport context.	Annual average payload capacity % of illegally overloaded heavy vehicles on network
Enhance stakeholder relationships with road users.	User satisfaction index % of level of stakeholder satisfaction in selected topics
Improve traffic management and road safety systems and processes.	Road operation management \$ costs per kilometer % of corporate traffic management and ITS action plans achieved
Improve traffic management capability.	Regular reports on number of registered vehicles by type, vehicle-kilometers, travel speed, and congestion index Lane occupancy rate—freight (urban), cost per kilometer per vehicle type

Main Roads Objective	Performance Measure
Road Project	
Improve program and delivery performance.	Extent to which program meets primary objectives of investment strategies Program outcomes delivered to budget Link benefit/cost ratios
Support reconciliation with indigenous communities.	% of projects with cultural heritage management plans implemented Number of projects that employ and/or train indigenous people
Ensure stakeholder satisfaction with project delivery outcomes.	% of stakeholder satisfaction with project delivery % of level of acceptance by government and community of Main Roads implementation program
Improve capability in all industry sectors.	Degree of satisfaction from post contractor performance reviews Regular reports on \$ per km for work types, return on construction, road maintenance effectiveness, and % of share of program delivered
Business Capability	
Deliver commercial support functions efficiently and effectively.	Rate of return of revenue and earnings for commercial units from untied work Proportion of tied and untied work for commercial units \$ business capability costs related to total costs Proportion of internal/external work for commercial units
Build external relationships.	% of level of satisfaction with stakeholder engagement process % of level of satisfaction in decisionmaking process
Address internal stakeholder needs	Degree of achievement of service-level agreements Level of staff satisfaction with ability to engage in internal relationships
Improve organizational performance and conformance.	Organizational support costs per full time equivalent % of staff achievement plans in place
Enhance leadership and identify, set direction of, and align values.	Staff rating of leadership
Strengthen knowledge management, networking, and learning.	Clear direction in future capability development supported by appropriate capability development options Staff rating of learning environment Staff rating of access to knowledge and information Time of take-up of new ideas

areas is reported, and transportation system performance is related to key performance indicators (such as road fatalities).

Traffic management reports—Main Roads operates four traffic management centers in Queensland responsible for specific parts of the road network. Each center also acts as a collector of data on network performance.

Strategic performance report—Main Roads has implemented a new performance-reporting scheme for senior management that provides quarterly information on 20 key indicators. The intent of this performance report is to focus senior management attention on the aspects of transportation system performance and the Main Roads indicators that warrant more concentrated attention. The indicator information is presented in red, yellow,

“Performance measurement is fundamentally building partnerships that have gone way beyond the boundaries of our individual agencies.”

—Main Roads Official

and green to highlight the most serious performances, those deserving concern, and those meeting targets.

Performance indicators are also used to produce network and route reports. Figure 11 shows how the data collected for the performance measurement program can be used for more operational decisionmaking.

One interesting characteristic of the performance measurement strategy in Queensland is the continual reevaluation of the process and consequent efforts to

Figure 11. Performance-related data for network and route planning in Queensland.

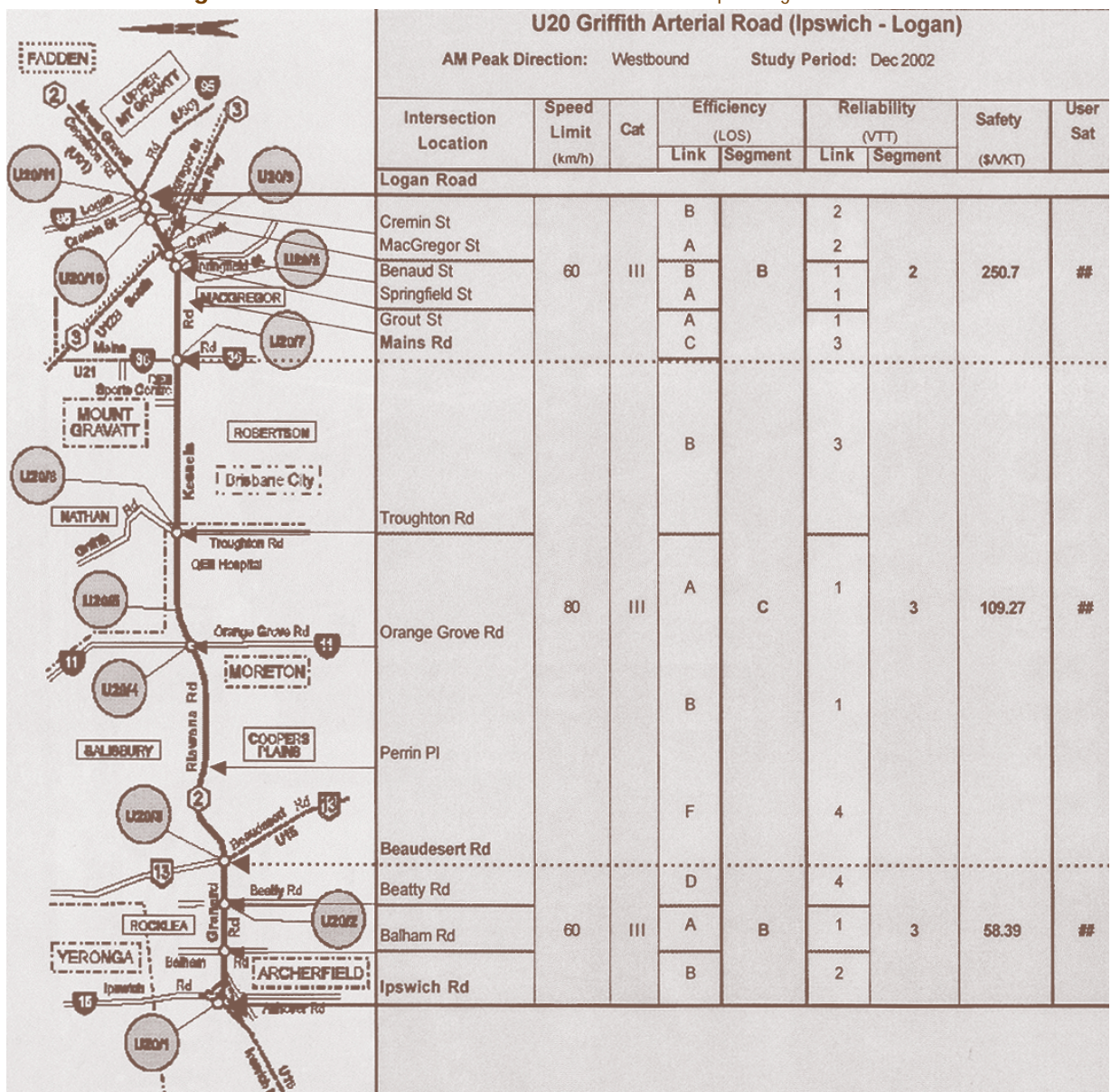


Figure 11a. Route performance report.

improve it. Research and thinking are examining different ways of characterizing transportation system performance and how this performance relates to broader goals. A multimodal performance framework is envisioned that consists of modal characteristics by vehicle type, public and private sector, passenger versus freight, freight task type (e.g., bulk, nonbulk, and light commercial), urban versus rural, and destination characteristics of transportation flows. All of these input dimensions are then related to outcomes, such as system use, safety, pollutant emissions, and user/community costs. The intent is to use this input/output/outcome matrix to monetize the value of

the relationships between cause-and-effect variables. By establishing this monetary relationship, Queensland Transport will be able to prioritize proposed initiatives and projects by the expected value added to outcomes. In addition, the monetary values associated with key input/output/outcome relationships can be used to benchmark Queensland's performance with other Australian states.

Both Main Roads and Queensland Transport have internal audit units whose purpose is to identify operational deficiencies, and to bring to management attention matters relating to agency deficiencies on performance accomplishment. Given the performance management culture of both organizations, the internal audit units have their own performance measures on the outputs that contribute to organizational success (e.g., number of audit reports generated, number of workshops conducted on corruption prevention, and customer feedback).

Safety

The road safety program has benefited the most from a transport performance-based decisionmaking process in Queensland. A *Road Safety Strategy* was adopted in 1993 that

“You can have all the indicators you want, but sooner or later you have to think about it.”

—Main Roads Official

outlined a long-term action plan for reducing fatalities and personal injuries on Queensland's road network. The approach adopted by Main Roads consisted of several steps based on a “knowledge management” structure developed

AM Peak Level of Service (Travel Efficiency) for State Controlled Roads in South Coast Hinterland District



Figure 11b. Network performance report.

in the mid-1990s at Harvard University. The steps included the following:

- Scan for needs, quantify, and rank.
- Identify and assess actions to meet needs, focus on largest needs first, and rank according to effectiveness in reducing the social cost of crashes.
- Monitor the implementation of actions.
- Assess outcomes of actions implemented by comparing macro outcomes to expected outcomes, comparing the scale of macro changes to the scale of changes from road safety actions, and benchmarking performance with other jurisdictions.

The results of this multifaceted road safety strategy have been impressive (and are reported on more extensively in the chapter on safety). The performance indicators used in the safety category include fatalities and serious casualty crashes per million vehicle-kilometers on state-controlled roads, social cost of crashes, and customer perceptions of safe travel.

Congestion

Population growth in southeastern Queensland, primarily the Brisbane metropolitan area, has occurred faster than in most other areas of Australia. In fact, Brisbane is predicted to have the fastest-growing congestion levels in Australia in the future. Not surprisingly, indicators of congestion and mobility comprise some of the core performance indicators for both Queensland Transport and Main Roads. The congestion/mobility indicators for both agencies reported in the 2002-2003 annual reports are as follows:

Queensland Transport

- System stewardship
- Implementation of a freight logistics strategy performance management framework
- Community satisfaction with public transport services
- Average private vehicle occupancy rates on key major urban routes
- Public transit patronage trend for buses, rail, and regulated air and taxi services
- Patronage trend in the corridor impacted by the South East Busway
- Travel times on select transport corridors during peak hours of buses compared to autos
- Proportion of Queensland's public transport services that are wheelchair accessible
- Number of rail corridor sublease integrity breaches
- Level of coordinated and integrated public transport services in southeast Queensland

Main Roads

Road corridors

- Percentage of network that is multimodal
- Percentage of stakeholder satisfaction with corridor management

Road operations

- Percentage of variability of travel time

For road operations, two additional measures relating to traffic flow performance and network use are being developed.

Freight

Because of the substantial expanse of Queensland and the isolation of many rural communities, Queensland has adopted a proactive policy to provide rail and truck transport services to these communities. Unlike the wave of privatization that swept other Australian states several years ago, Queensland has kept government involvement in many aspects of rail freight service and infrastructure. For example, a government-owned corporation called Queensland Rail is responsible for the rail service on many rail lines in the state. The rail infrastructure itself, called "below rail," is owned by the government, which has established a Queensland Competition Authority to regulate competitive access to the rail network for third-party operators. Queensland Transport establishes transport service contracts with service providers that define service and performance requirements. These contracts also specify "community service obligations," activities or services that would not be normally undertaken by a commercial freight operator.

The rail infrastructure contract is for AU\$1.5 billion (US\$1.1 billion) over seven years and covers 6,540 km (4,064 mi) of track (about 70 percent of the rail network). Performance is measured against contractual requirements with financial penalties charged for poor performance. Base service levels are established in the contract for an overall track condition index (OTCI), temporary speed restrictions (TSR), below rail delays, and below rail track availability. Quarterly and annual reports are provided to Queensland Transport that present information on a wide range of performance indicators. The following are the most important:

- Average trains per week (number)
- Capacity use (percentage)
- Average below rail delays (minutes)
- Total below rail delay events (number)
- Below rail track availability (percentage)
- TSR variance against threshold (percentage)
- OTCI last recorded number (number)

Queensland Transport officials pointed to several instances when this performance and condition information led to targeted investments to improve the existing situation.

For passenger rail, Queensland Rail monitors ontime performance (with a desire to have 95 to 98 percent of trains within three minutes of schedule), cancellations, safety, cleanliness, and number of passenger trips. Again, monitoring these indicators has led to specific actions, such as posting security guards in stations at night and painting a blue line in terminals where patrons can stand to be visible to security cameras.

Similar to the rail network, Queensland's ports are owned by the state, with both the Minister of Transport and Main Roads and the state Treasurer as shareholders. Eight port authorities manage the 15 ports, which are oriented primarily toward export trade. The Government Owned Corporations Act requires that ports operate as much as possible on a competitive basis, but the government can establish financial and nonfinancial performance targets or require port managers to undertake community service obligations, the same as for rail operators. Yearly statements of corporate intent and five-year corporate plans are required of port managers. Not surprisingly, given the competitive nature of the port industry, the performance measures reported to the shareholding Ministers must include financial indicators (return on assets, and liquidity and leverage ratios), nonfinancial indicators (tonnage, berth occupancy, and vessel turnaround time), and compliance with public initiatives (labor relations issues, equal employment opportunity, and budgetary compliance with expenditure procedures). Ports are also permitted to develop their own indicators on trade opportunities, security, logistics efficiency, and maintaining competitive position in the market. For example, six ports report on environmental indicators because of local concern about the environmental impacts of port operations on sensitive nearby areas.

Environmental Monitoring

Part of Main Roads' vision includes "enhancing the environmental well-being of Queensland's communities." To achieve this part of the vision, Main Roads has adopted an environmental management policy and strategy that commits the agency to maintaining ecological processes, protecting biodiversity, improving equity within and between generations, and improving individual and community well-being and welfare. In other words, the policy commits Main Roads to the basic principles of sustainability. Although the environmental record of Main Roads

is impressive—and is one of the better records for jurisdictions of comparable size—it was not clear to the scan team how environmental management has been incorporated into the performance measurement regime of Main Roads. Much of the performance measurement relates to monitoring processes and procedures (e.g., 80 percent of traffic management strategies should have an environmental component), as well as monitoring the perceptions of external and internal stakeholders. The team did not find any measures or indicators of ultimate outcomes associated with good environmental management, an observation at almost all the sites it visited.

Queensland Transport has included in its performance indicators several that relate to air quality, including level of noxious motor vehicle emissions, trend in greenhouse gas emissions, and percent of urban bus fleet compliant with Euro 2 and Euro 3 emission standards. These indicators were listed under a "system stewardship" heading.

Data Support

Transport officials in Queensland recognize the need for a strong data collection foundation for performance measurement efforts. One of the most extensive efforts observed during the scan is Main Roads' A Road Management Information System, known as ARMIS. ARMIS is an integrated computer data base management system that processes data collected from numerous sources on Queensland's state-controlled road network. The data collection and quality control for ARMIS occurs in Main Roads' 14 district offices, but the central office coordinates format and operating procedures. Operational systems used in the districts to manage their road systems include road reference/road inventory, bridge information, pavement condition, traffic analysis and reporting, Road Crash 2, and road maintenance performance contracts management systems. The Road Crash 2 system is interesting in that it not only records details of crash characteristics such as contributing circumstances, injuries, and locations, but it also ranks crash locations for remedial treatments through benefit-cost ratios and net present values of benefits and costs. The bridge information system also produces a file exported to a whichbridge maintenance software package for prioritizing maintenance activities.

Observations

Important observations from the visit to Queensland include the following:

- The transport portfolio has developed an integrated, comprehensive performance management framework

in which performance indicators are found consistently in the many plans and programs, reflecting different levels of decisionmaking in the agencies. A clear distinction was made between outputs and outcomes, with a major research effort underway to assign monetary values to many relationships.

- An integrated regional transportation planning approach coordinates the many different plans and programs developed to improve transportation system performance in Queensland. Performance indicators are a major means of assuring that all planning efforts are coordinated.
- Top management commitment to performance management was evident in Queensland. This commitment includes not only directions to the organizations on developing a useful performance management scheme, but a willingness to use the information it produces in decisionmaking. One high-ranking official noted that one of the clear values of the performance management system was that it “got everyone on the same page.”
- Similar to other scan sites, an evolution in performance measurement in Queensland appeared to lead to focus on selected indicators as the most important.
- Public communication and dealing with the media are critical in garnering public and legislative support for performance management efforts. Main Roads, for example, has about 20 staff members devoted to its strategic planning/performance measurement/public outreach activities. Working with a wide variety of stakeholders and other government agencies requires a strong commitment to producing understandable information on what the agency is trying to accomplish and what progress it has made.
- Data collection and analysis are the foundation of the successful performance management effort in Queensland. Data are collected and analyzed on a large number of indicators and factors affecting the economic and quality of life characteristics of Queensland. A data-rich environment was one of the contributing factors to the success of performance measurement in Queensland.
- Given the isolated nature of numerous Queensland communities, the transportation agencies have devoted considerable attention in their performance indicators to impacts of transportation system performance on rural areas. This relates not only to outputs directly under Main Roads’ control, but also to the contracted

services under Queensland Transport’s responsibility. Part of this emphasis was also on freight movement. Of all the groups the scan team visited, Queensland’s transport portfolio was most interested in the operations performance of the freight and logistics system in its jurisdiction.

- Before-and-after analyses conducted on a sample of projects indicate the extent to which expected benefits and costs were realized. This information is fed back into the decisionmaking process so that expectations for similar projects in the future are realistic. In addition, the concept of an “achievement index,” the ratio of benefits to costs before project implementation to that after a project is in place, is one of the national performance indicators for Austroads. It is not surprising such a process is used in Queensland.
- As transportation officials noted, the process of developing a performance measurement system is almost as important as the substance of the system itself in that a good development process can foster ownership in the approach taken. With ownership, it becomes easier to ensure that performance measurement will influence decisions. Along with this process is the need to invest in the people who are part of the performance measurement system—those who collect and analyze the data, and those who are the customers of the information produced.

SYDNEY, NEW SOUTH WALES

New South Wales is the most populous of the Australian states, with seven million people. Between 1991 and 2000, Sydney’s population increased 11 percent, and vehicle-kilometers traveled increased by 25 percent. Freight movement is expected to double in the next 10 years. As the site of the 2000 Summer Olympic Games, Sydney and its transportation system received glowing marks in handling the large numbers of visitors attending the event. The scan team visited New South Wales because transportation planning and decisionmaking in this state has long been considered at the leading edge internationally. In addition, the state government has adopted a performance-based approach to infrastructure investment that was worthy of investigation.

Governmental Context

The Roads and Traffic Authority (RTA) is the agency responsible for road provision, maintenance, management, and use in New South Wales. The highway net-

work in New South Wales consists of about 180,000 km (111,850 mi) of roads, including 14,500 km (9,010 mi) under state control, 3,100 km (1,926 mi) of national roads, and 18,500 km (11,496 mi) of regional roads for which the state provides some financial support. The road network includes 4,700 bridges, which are the responsibility of RTA as well. In addition, RTA manages 32 km (20 mi) of transit ways with 68 km (42 mi) planned. Also, 161 km (100 mi) of bus and transit lanes are on RTA-managed roads, and RTA is responsible for 3,200 sets of traffic signals.

RTA is divided into five major service groups relating to the agency's core businesses: road safety, road maintenance, road development, traffic and transport, and registration/licensing/enforcement.

Other important agencies in the governmental structure of New South Wales that affect transportation policy include the Ministry of Transport, which provides overall policy direction for transport agencies; Department of Infrastructure, Planning, and Natural Resources, which prepares the metropolitan plan for Sydney; RailCorp, a government-owned corporation, which provides passenger rail services; State Transit Authority, which is responsible for bus and some ferry services; and Department of the Treasury, which mandates procedures and processes for performance management.

Use of Performance Indicators

The history of performance accountability in New South Wales reflects some of the challenges that previous transportation service providers have faced in living up to expectations. For example, New South Wales had a plan for developing its rail infrastructure that reflected an overestimation by elected officials of what could be delivered and an underestimation of costs by civil service engineers. The plan, official for more than six years, became discredited when some expected outputs were not delivered and others had unexpectedly high costs. Dissatisfaction with unmet promises and concerns about media monitoring of the lack of progress led to greater interest in developing a system that provided realistic estimates of transportation system performance and what steps needed to be taken to improve performance.

The mission of RTA is to “deliver the best road transport outcomes, balancing the needs of public transport passengers, cyclists, pedestrians, motorists, and commercial operators.” Outcomes are defined in two major categories, community outcomes and business out-

comes. Community outcomes are improving road safety, moving people and goods efficiently, maintaining and renewing the road asset, developing sustainable land use and transport solutions, and serving frontline customers. Business outcomes are building relationships, leading for performance, developing the agency's people, being accountable, valuing the environment, and making the best use of resources.

The overall planning framework for RTA's performance measurement is shown in figure 12 (see page 32). As the figure shows, RTA has several reporting linkages to other planning elements and governmental agencies. The legislature requires an annual report, which must show the past year's activities and their alignment with the agency's corporate plan (updated every two years). Budgets are established with specific performance agreements put in place to assure the linkage between the monies provided and the program activities. Each unit is expected to have a business plan, and senior executives sign performance agreements that indicate expected annual achievements.

As seen in figure 13 (see page 33), RTA's corporate plan, *The Journey Ahead*, provides a five-year strategy for RTA, including identification of performance indicators that guide investment decisions. Each RTA core business area has a set of performance indicators that provides an overall framework for operating decisions. For example, the following performance indicators were identified for two areas:

Infrastructure Development

Network and route performance measures

- Rural levels of service (A to F), total crashes, injury crashes per 100 motor vehicle-kilometers traveled, total crashes per kilometer
- Metropolitan area travel time surveys and modeled volume-to-capacity ratios

Project and program delivery measures

- Scope control (project as originally proposed plus variations)
- Cost control (estimates versus actual costs)
- Expenditure control (expenditure versus forecasts)
- Monthly program reviews

The manner of collecting this data provides RTA with the capability of disaggregating performance information to the individual route level. For rural areas, the road network sample consists of 1,000 sections, which are classified by similar functional characteristics. The

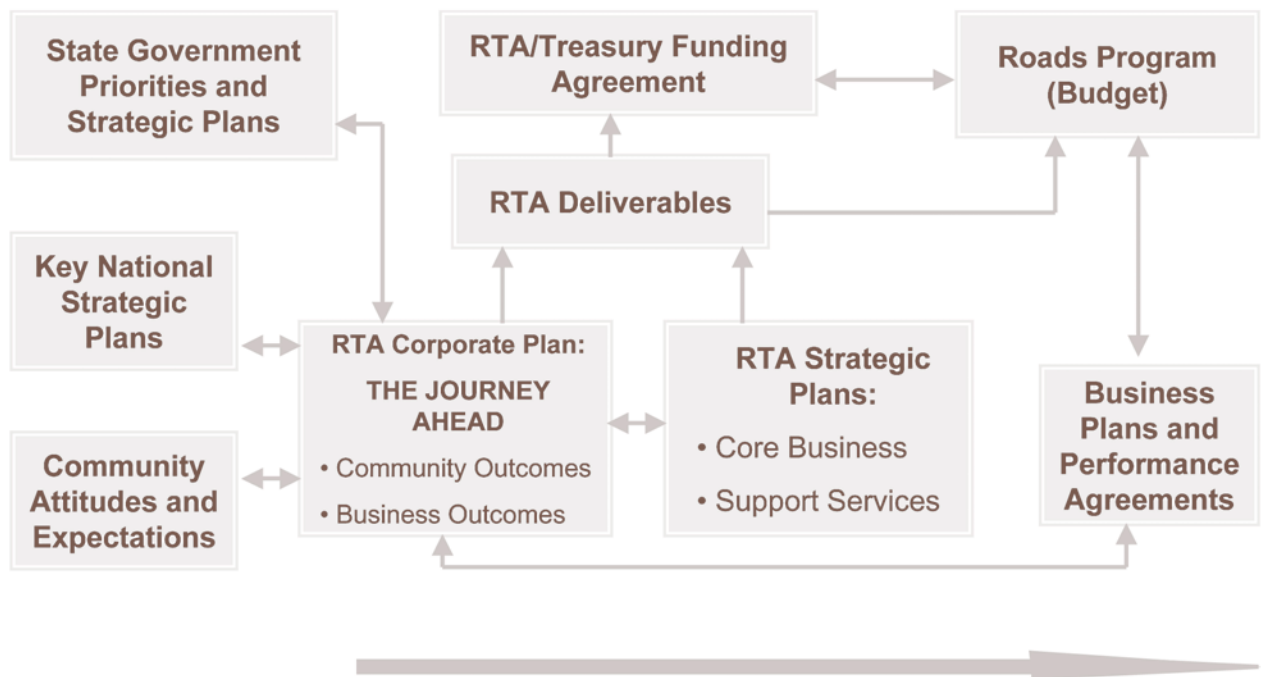


Figure 12. Performance planning framework for the Roads and Traffic Authority in New South Wales.

urban network is divided into links, and the data collected for each link includes a.m. and p.m. peak travel speed (by the floating car method), business hours travel speed, current and forecast volume/capacity ratios, current and forecast crashes per kilometer, and a composite performance indicator. With such a disaggregation, RTA can develop visuals such as figure 13, which shows performance for a rural highway.

According to RTA officials, these measures are used to develop route-level strategies as well as an overall investment program. Strategic plans are created for road corridors with different options considered for highly deficient links.

Business Area: Road Maintenance

The government has adopted a policy of asset management that views infrastructure as a long-term renewable asset, and that requires agencies to manage assets on a life cycle basis. RTA has developed a road asset policy that links maintenance decisions to network performance. A hierarchy of outcomes and outputs has been developed for measuring performance of maintenance efforts. This hierarchy consists of the following:

Commitments

- Business management

- Financial assistance
- Disaster repairs

Safety

- Availability for travel
- Provision of safe travel

Retained value

- Minimization of risks to asset integrity

Reliability

- Provision of consistent route conditions
- Productivity/level of service

The performance framework for infrastructure maintenance includes the specific measures shown in table 7.

Performance reporting, which covers all of the performance measure categories shown in table 7, includes such measures as community satisfaction levels, number of structurally deficient bridges on state roads, asset valuation, distribution of construction period for state and national roads, average age of bridges, ride quality, pavement, and durability of paved rural roads. Contractor assessments are also part of the maintenance program assessment, including quality of work, time management, environmental management, contract administration,

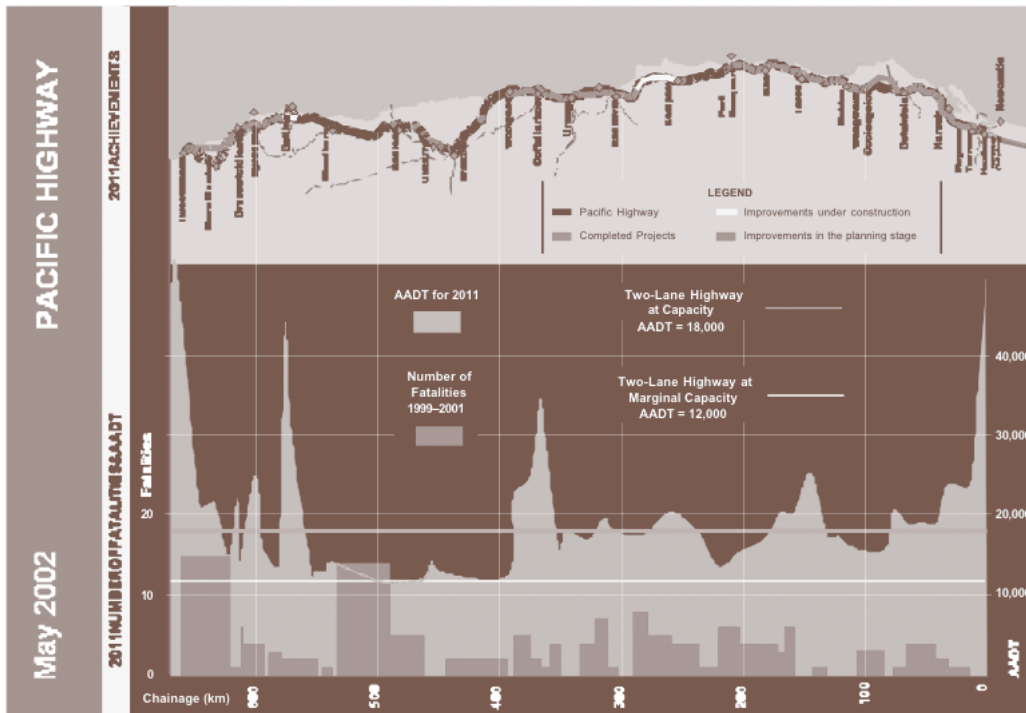


Figure 13. Rural highway performance in New South Wales.

Table 7. Maintenance program performance measures.

Infrastructure Maintenance Program Performance	
Network Performance <i>Customer Outcomes</i>	<ul style="list-style-type: none"> • Achievement of Customer Needs • Delivery of Government Commitments
Client Performance <i>Strategy, Policy, Standards, Program</i>	<ul style="list-style-type: none"> • Adherence to Govt's Total Asset Management Policy • Process Benchmarking
Purchaser Performance <i>Asset Management</i> – Planning – Pre-construction Contract Management	<ul style="list-style-type: none"> • Adherence to Policies • Adherence to Management System • Program Administration/Project Management Measures
Contractor Performance <i>Time, Cost, Quality of Outputs</i>	<ul style="list-style-type: none"> • Delivery of Planned Outputs • Compliance to System and Standards • Price Competitiveness of Works

RTS'S Aging Bridges

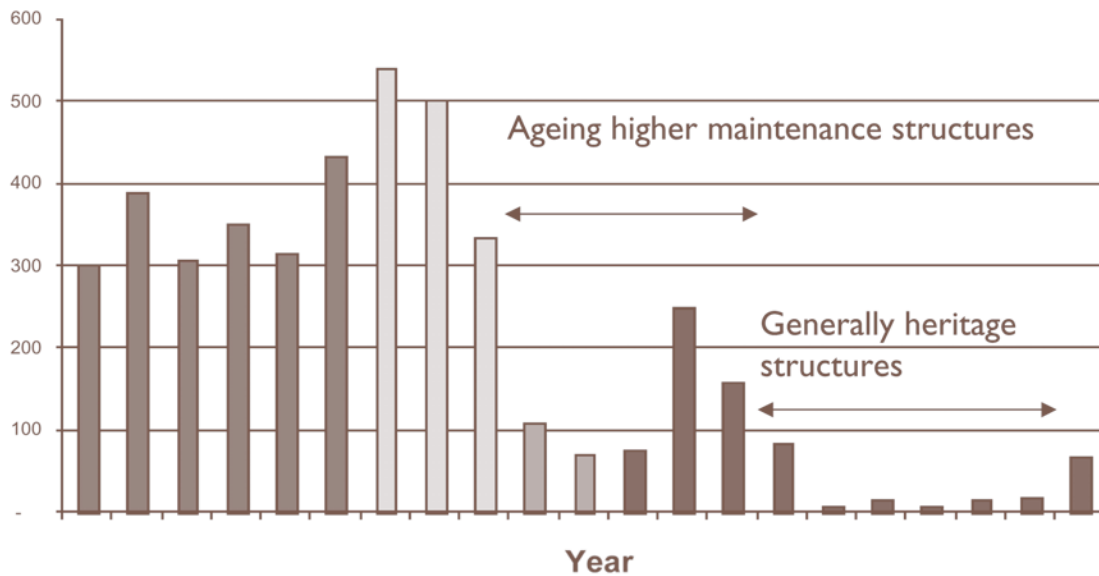


Figure 14. Sample presentation of asset management information in New South Wales.

and level of cooperation with RTA engineers. Figure 14 provides an example of how this information is presented to agency decisionmakers.

The New South Wales Treasury provides guidelines for reporting government agency outcomes. Each agency is required to develop a results and services plan (RSP) to “demonstrate the relationship between the services the agency delivers and the results it is working towards.” The questions the RSP is supposed to answer include the following:

- What results for the community is your agency trying to achieve? What services does your agency provide, and how much do those services cost?
- How do you know that your agency is doing a good job?
- How can your agency do better? How will you measure “better” and what are your targets? What process improvements can you make?
- What are your agency’s least important services? What services can be scaled back or temporarily suspended?
- What policy and regulatory constraints does your agency face?
- What are the major risks your agency faces and how do you manage them?

To make this reporting more user-friendly and understandable to nontechnical audiences, the Treasury has

developed a new “results logic” that each agency must follow in its reporting (see figure 15). The major changes from the old approach and terminology are shown in table 8.

In this approach, the terms are defined in the following way:

Results

- Are end points to be aimed for, rather than individual activities or strategies.
- Will be influenced by a broad range of factors, many of which are beyond the control of an individual agency.

Services

- Are the end products that the agency delivers to society.

Intermediate results

- Are concrete objectives that the agency can contribute to in the short to medium term (12 months to three years).

Result indicators

- Indicate a change in the community, environment, or economy.
- Reflect the effectiveness of the agency’s services in contributing to results.

- Help determine whether anyone is better off as a result of the services delivered.
- Will probably be influenced by more than just the agency.

Service measures

- Look at how efficiently the agency delivers its services, as well as quality, access, and timeliness of service delivery.

The key philosophy of this approach to performance reporting and budget approval is that each agency must constantly demonstrate value received for the money it gets from the government.

Other performance accountability documents used as part of this framework include an annual report, budget submittals, and individual employee performance agreements (usually targeted at advancing specific projects through the project development process).

RTA officials stated that the performance management framework provides a constant, high-level focus on road safety, customer interaction, network reliability, infrastructure asset condition, and employee time lost because of injuries.

Congestion

The 2000 Olympics provided Sydney with a great incentive to upgrade its traffic management system. With the expected surge in vehicles and people using Sydney’s transportation system, RTA officials put in place advanced traffic surveillance and control systems that are a legacy of the Olympic Games. Perhaps the greatest benefit was an enhanced traffic management center (TMC) that provides 24-hour-a-day, seven-days-a-week management of the road network. TMC has 170 staff members, with up to 18 traffic controllers working per shift. More than 400 closed-circuit cameras feeding into TMC monitor and control traffic flows. Electronic lane changing (with actual movement of low-rise barriers from one lane to another controlled from TMC) is used to optimize throughput at key bottleneck points, such as the Sydney Harbor Bridge. Variable message signs, variable speed limit signs, radio communication with all public transit buses, and rapid response incident management patrols are all managed from the operations center. A memorandum of agreement has been signed with the police for handling incidents on the state road system. Transit and police representatives at the center coordinate responses to incidents requiring a multiagency response. In addition, TMC has

Table 8. Change in performance terminology in New South Wales.

Old	New
Outcomes	Results
Intermediate outcomes	Intermediate results
Outcome achievement indicators	Result indicators
Outputs	Services
Output performance measures	Service measures
Intervention logic	Results logic

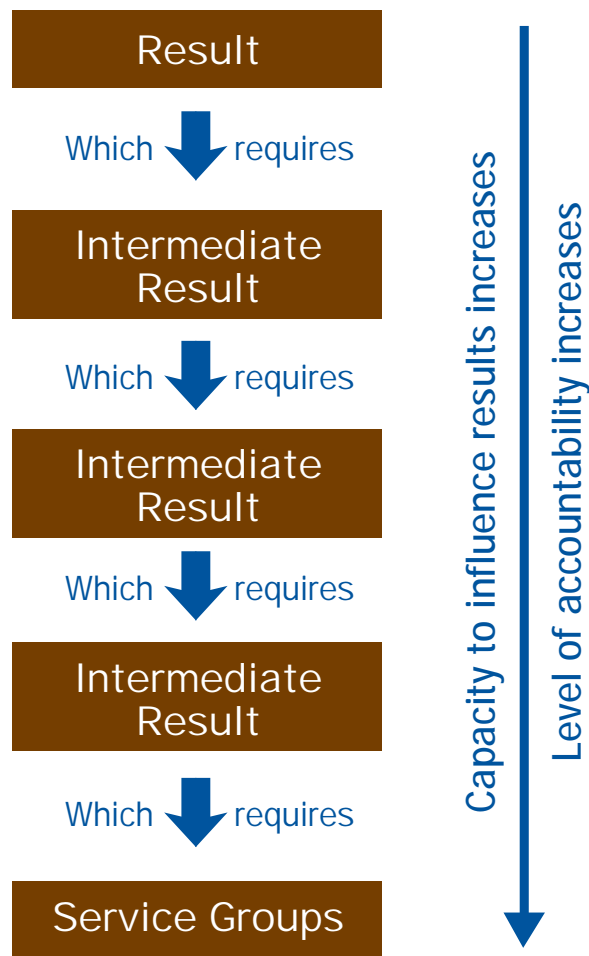


Figure 15. Results logic for performance monitoring used by the New South Wales Department of Treasury.

adopted a policy of sending customer calls directly to operators on the TMC floor. As might be expected from this wide-ranging data collection capability, much of this network control is accompanied by the ability to collect data on network performance.

Another substantial data collection asset is the Sydney Coordinated Adaptive Traffic System (SCATS), developed by RTA to provide coordinated traffic signal strategies for the road network. Not only does SCATS allow for the optimal control of a signal network, but it also can be used to provide a “green light corridor” that expedites emergency vehicles through the network by giving them a green light progression. For the recent rugby world championship in Sydney, this capability was used to speed teams and other officials to different locations in the city (100 green light corridors were used in one day). Through its commercial unit, RTA has sold SCATS to 85 metropolitan areas in 15 countries. Because of the ubiquitous nature of the SCATS application at intersections in Sydney, RTA is able to collect a range of data on traffic flows and delays.

The final ITS-related data collection capability for RTA comes from the widespread use of electronic toll collection (ETC) technology for toll roads and bridges in the state. Dual protocol systems allow interoperability with ETC systems in Brisbane and Melbourne. Sydney has

about 450,000 ETC tags, a number expected to grow to 1.5 million in two years. More than 900,000 ETC tags are in use in Melbourne. All buses use ETC technology, as do 85 percent of Sydney’s taxis.

The Roads and Traffic Management section of RTA has established several outcome and output measures that relate to the operational performance of the road network. Outcome measures include travel speeds, congestion, traffic volumes, and community satisfaction. Congestion measures were the same as those provided to the Austroads national performance indicator database. The team noted that, given the data-collecting capability of SCATS, RTA also monitors intersection congestion for total minutes of delay (see figure 16). Output measures included the following:

- Number of incidents on the road network
- Time taken to respond to and clear incidents on the network
- TMC telephone call statistics for the average 3,000 calls per day (e.g., number of calls responded to within 30 seconds, with a target of 75 percent answered within 30 seconds and 95 percent answered within 60 seconds)
- Provision of bus lanes/transit lanes/transit ways in kilometers
- Enforcement of bus priority lanes
- Provision of bicycle ways in kilometers

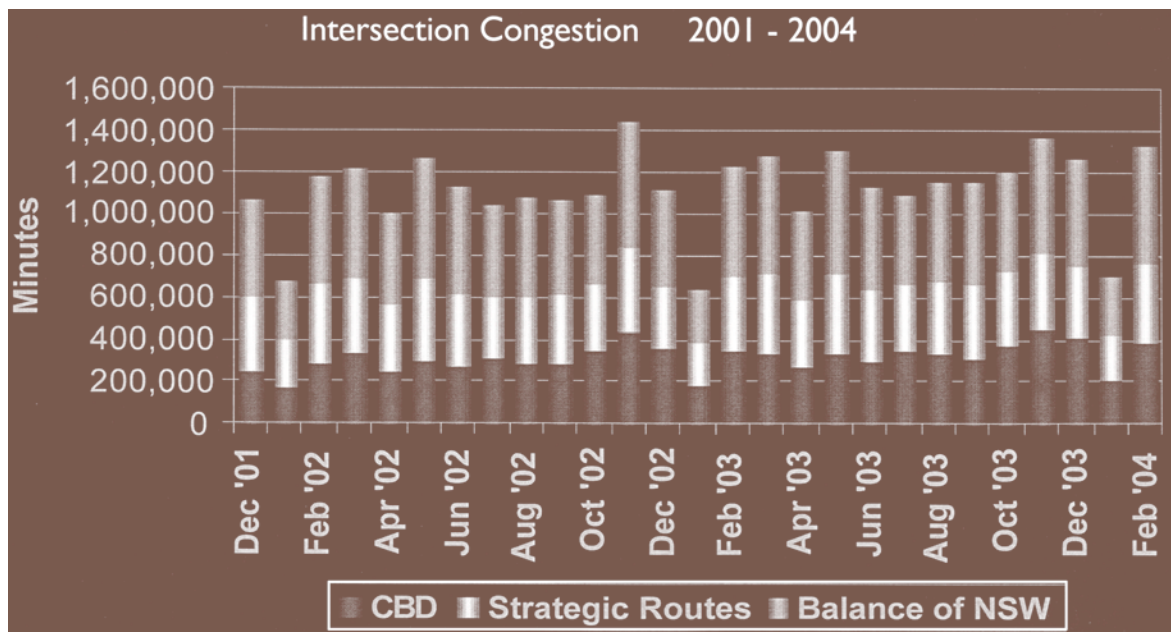


Figure 16. Monitoring intersection delay in Sydney.

- Number of minutes without signal detection capability
- Development of pedestrian facilities and access plans

Most measures are reported on a monthly basis, although the number of kilometers provided for certain facility types is reported annually.

For other modes of transportation, SCATS is used proactively to monitor and manage bus reliability. Bus lane monitoring is used to measure bus travel speeds, and vehicle occupancy data is collected as well.

Safety

RTA is the lead agency for road safety in New South Wales, spending about AUS\$120 million (US\$87.6 million) each year. The safety program emphasizes engineering, behavioral, enforcement, and regulatory strategies. Although RTA focuses on engineering design as a strategy to improve safety (e.g., divided highways, guardrails, rumble strips, etc.), it also funds police to enforce speed laws on the state road network.

Over the past 50 years, New South Wales has had a significant impact on road fatalities, recording only 553 deaths in 2003, the second lowest fatality level since 1949, even though population, vehicle-kilometers traveled, and number of drivers have grown significantly. To achieve this impressive record, RTA has developed close partnerships with the New South Wales Police, Motor Accidents Authority, Department of Corrective Services, Department of Education and Training, Department of Health, local governments, and many others.

Key performance indicators for safety include the following:

- Fatalities and fatality crashes
- Injuries and injury crashes
- Fatalities per 100,000 population
- Fatalities per 100 million vehicle-kilometers
- New South Wales fatality rates benchmarked against other states and countries
- Year-to-date and 12-month trends compared to previous-year and three-year averages
- Measurements by road types, speed zones, age groups, class of road user, and RTA regions

For program goals, one purpose of national and state road safety plans is to define achievement targets. For example, the *National Road Safety Strategy for 2001-2010* states that the number of road fatalities per 100,000 population should be reduced by 40 percent from 9.3 in 1999 to no more than 5.6 in 2010. The New

South Wales *Road Safety 2010* strategy has a more aggressive target of reducing the number of fatalities on New South Wales' roads by 50 percent by 2010.

Similar to the United States, fatality and injury data are collected by the police and forwarded to RTA. Crash data are analyzed to discern significant causal factors (e.g., speed, fatigue, drunk driving, etc.) and programs are redirected or created to deal with the most significant factors. For established programs, RTA conducts benefit-cost analyses to determine which are most effective in helping RTA achieve its safety goals. For example, RTA officials state that crash statistics show that the most effective prevention strategies have been compulsory seatbelt use and random breath testing.

RTA officials stated that the key lessons from many years of aggressive safety programs are that engineering solutions are the ultimate consideration for developing a safe system, agencies should target resources (people and dollars) at problems identified through analysis of crash data, and "silver bullets" are rare. They emphasized that it takes a lot of work and commitment to make a difference.

Post-Construction Reviews

All of the sites visited conducted post-construction and post-implementation reviews of a sample number of projects. The New South Wales approach is a good example of the process followed in this review program. As noted in the RTA guidelines, "project post completion reviews provide a principal means of obtaining lessons learned from previous projects. They represent a feedback loop to inform future projects and facilitate a culture of continuous improvement for both project delivery and project outcomes."

The process for post-construction reviews (PCRs) is shown in figure 17 (see page 38). The review is undertaken about two years after construction has been completed. Teams of reviewers are used to assess different stages of project development, delivery, and impact. Each team is involved with some aspect of total project review. For example, team A could assess project development, and team B could conduct both the project implementation and outcomes assessment effort. Team C might participate in the assessment of some portions of the project development process, as well as work with team B on the outcomes assessment. The primary method for conducting a PCR is to hold a workshop at which officials and engineers answer specific evaluation questions.

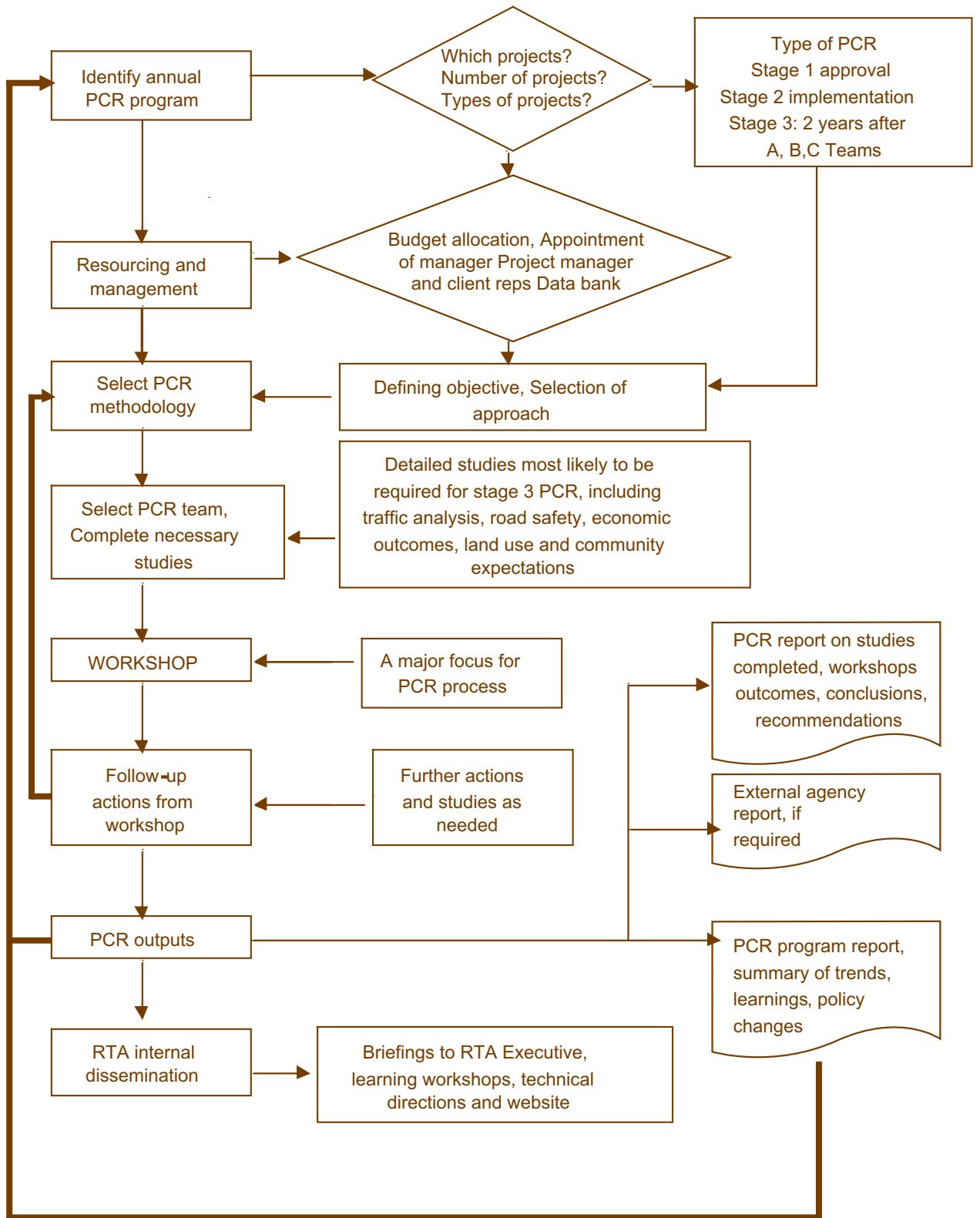


Figure 17. Post-construction review process in New South Wales.

Observations

The scan team's most important observations from the visit to New South Wales include the following:

- As with other scan sites, the best example of applying performance measurement in a decisionmaking or policymaking context was found in RTA's safety program. With many years of historical data, the cause-and-effect linkage between actions taken by RTA and other agencies in response to analysis and system monitoring has been shown decisively. The effectiveness of these efforts is impressive.
- RTA devotes considerable effort to identifying customer needs, which several officials said drives their business model. Surveys are conducted not only on the perceived effectiveness of RTA, but also to determine what aspects of transportation system performance need the most improvement. This information is fed into the corporate decisionmaking process.
- RTA uses benchmarking in several core business areas to identify how its activities compare with other jurisdictions. In addition, benchmarking of maintenance contractors is used to assess the performance of each contractor compared to others working for RTA.
- RTA is advanced in its use of ITS technologies for surveying system performance. Both the existence of a state-of-the-art traffic management center and the extensive use of the SCATS traffic signal monitoring program provide RTA with substantial data-collection capabilities, which it uses to good effect in monitoring system performance.
- Asset management and the information produced through RTA's asset management system are becoming more important in the overall scheme of RTA decisionmaking.
- RTA has developed an extensive and structured approach to post-construction review to assess the effectiveness of implemented projects. This process requires significant commitments of time and effort by RTA to provide this feedback information to the decisionmaking process in the agency.
- RTA has made considerable progress in developing an environmental policy that relates to the goals and objectives of the organization. In fact, in 2002 the New South Wales Audit Office gave RTA accolades for the progress it has made with such linkage. Since 1998, the

RTA annual plan has reported on the progress made in the environmental management arena. The issues of greatest importance were listed as air quality/greenhouse gases, water quality, biodiversity, noise, land use, waste, and cultural heritage. As the team noted at other scan sites, however, RTA has not developed indicators that link transportation system performance to environmental outcomes. The RTA staff has decided to adopt a top-down approach by asking the RTA director-general and other key agency officials what is really important to measure for environmental management. Some indicators under consideration include the extent of externalities caused by transportation recovered in fees, level of resource recycling and substitution in construction activities, and degree of roadside quality maintenance. For the latter issue, any contractor with a maintenance contract with RTA of more than \$1 million must have an environmental management system as part of its business operations.

MELBOURNE, VICTORIA

Victoria is a relatively small state geographically, representing just three percent of Australia's landmass, but it is Australia's second most populous state, with 4.8 million people (24 percent of the country's population). Just over 70 percent of these 4.8 million live in the Melbourne metropolitan area. Victoria has more than 3.3 million licensed drivers driving 4.1 million vehicles, one-third of Australia's motor vehicle fleet. Victoria also handles one-quarter of Australia's road freight (or as the Australians call it, "road freight task"). Victoria has a long history of being at the cutting edge of transportation policy and planning, including the use of performance measures, which is why the scan team visited the state.

Governmental Context

Two agencies in particular are important actors in transportation planning and decisionmaking in Victoria. VicRoads, the state road and traffic management authority, has five goals: 1) assist economic and regional development by improving the effectiveness and efficiency of the transport system; 2) assist the efficient movement of people and freight, and improve access to services for all transport system users; 3) achieve a substantial reduction in the number and severity of road crashes and the resultant cost of road trauma; 4) be sensitive to the environment through responsible management of the transport network; and 5) provide efficient, effective, nationally consistent, customer-oriented driver licensing, vehicle registration, revenue collection, and driver and vehicle

information services. The chief executive of VicRoads reports to the Minister of Transport. Four core businesses have been defined for VicRoads—road system management, road safety, traffic and transport integration, and registration and licensing.

The Department of Infrastructure (DOI) is responsible for essential infrastructure in Victoria, including transport, major development, information and communication technology, energy and security. DOI's primary objectives are 1) linking the transport system of road, rail, air, and sea channels to promote economic and social development through increased mobility and access, and a more cost-effective freight and logistics sector; 2) promoting efficient and integrated transport services across different modes while managing road and freight traffic growth to address the needs of the traveling public and industry; 3) delivering the government's major transport infrastructure investments; 4) providing strategic policy advice, analysis, and support to government, stakeholders, and communities on energy policy, information and communication technologies, and transport systems; and 5) delivering a wide range of other major projects on behalf of government departments and agencies.

Use of Performance Indicators

The Victorian government has adopted a performance-based approach to government delivery of services. Government policy is intended to drive state agency strategic planning (known as corporate

planning), which, in turn, drives the business or shorter-term output planning. Figure 18 shows how DOI views the relationship among these three levels of decisionmaking. Note the relative location in this pyramid of both outcomes and outputs. Investments in infrastructure, according to DOI officials, are driven by performance indicators and system performance gaps determined through a continual monitoring of these indicators.

Government policy stands at the apex of the pyramid in figure 18. For Melbourne, two such policies provide important guidance to infrastructure planning and decisionmaking—*Growing Victoria Together*, a statement of desired future directions for Victoria, and *Melbourne 2030*, a land use/transport plan developed by Victoria's Department of Sustainability and Environment. The DOI corporate plan includes modal investment strategies aimed at meeting government policy targets. The government has set targets as part of a public process, to some extent supported by technical analysis. Although these targets are considered aspirational, they reflect government leaders' understanding that they are based on some level of assessment of technical and political feasibility.

The key targets for transport include the following:

- Public transport mode share in Melbourne will reach 20 percent of motorized trips by 2020.
- Road fatalities and serious injuries will decline 20 percent by 2007.
- Freight tonnage to and from commercial ports will have a 30 percent rail modal share by 2010.

DOI Corporate Planning Elements

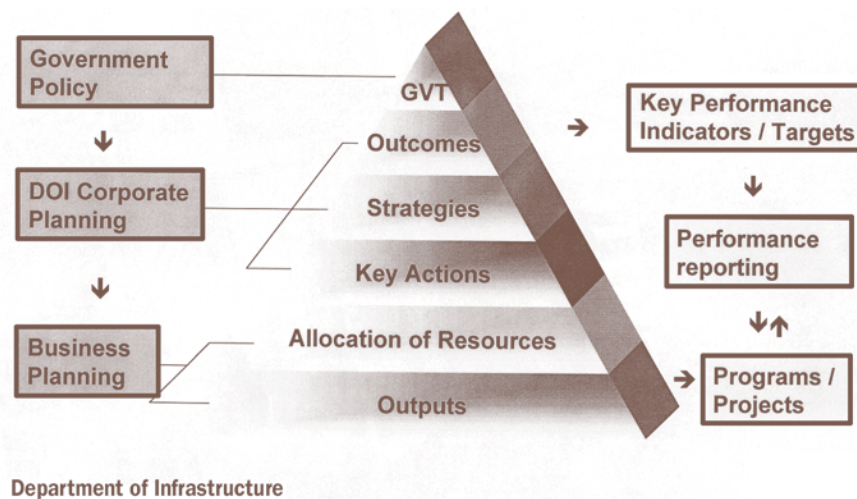


Figure 18. Role of performance measurement in corporate planning in Victoria.

Of these three targets, achieving the 20 percent mode share for public transport appears to be the most ambitious and challenging. As noted by some VicRoads officials, quantifying the costs of congestion for travelers, for the freight sector, and on the economy is considered key in convincing government leaders that the potentially most controversial strategies might be necessary. To achieve such a share would

most likely require some type of congestion pricing scheme, similar to that implemented in London.

DOI transportation-related performance indicators include the following:

Public Safety and Security

- Road deaths and serious injuries
- Public transport passenger deaths, incidents near railway station, and customer satisfaction
- Marine deaths and serious injuries
- Adequacy of security risk management of cities' infrastructure

Infrastructure Delivery and Management

- Percentage of projects delivered within plus or minus 10 percent of budget, time, and scope
- Completion of key projects by specified completion dates
- Rail track condition (network temporary speed restrictions)
- Rail signal condition (signal equipment failures)
- Rail traction power condition (traction power equipment failures)
- Road travel undertaken on “smooth” roads

Access and Mobility

- Public transport
 - Percentage of motorized trips in Melbourne
 - Compliance with law requiring access to the public transport system and vehicles for disabled persons
 - Response times for taxis for the disabled
 - Reliability of service provision and customer services (level of fully operating ticketing machines)
 - Customer satisfaction
 - Network average speed for trams and buses
- Road congestion delays on urban arterial roads

Rural and Regional Development

- Proportion of specified roads developed for minimum safe travel time
- Public transport
 - Reliability of service provision
 - Customer satisfaction
 - Compliance with law requiring access to the public transport system and vehicles for disabled persons

Seamless Freight and Logistics System

- Freight productivity
 - Share of freight tonnage transported to and from Victoria's commercial ports by rail
 - Freight rates for containers by road and rail

- Freight rates for specified commodities
- Container movements to and from freight terminals (percent empty vehicles and percent empty container slots on vehicles)
- Freight Infrastructure
 - Percentage of travel undertaken on “smooth” roads
 - Rail track condition (network temporary speed restrictions)
 - Percentage of arterial road network accessible to legal freight vehicles
 - Traffic delays because of congestion on urban arterial roads

Organizational Capability Building

- Completion of a workforce management framework
- Staff profiles that match desired profiles
- Percentage of staff managing projects greater than \$50 million who have contract management accreditation
- Participation rates by women in senior executive professional development programs
- Number of government agencies contracting with DOI for corporate service

Several performance indicators are different from those found in other locations, mainly because of DOI's unique role in Victoria's government. DOI was the only agency the scan team visited that attempted to incorporate infrastructure security into its performance management framework. The issue of security has been a complicated one from the perspective of performance measurement in that it is not clear how security can be measured. The DOI indicator is simply the degree to which agencies are in compliance with their risk management plans, certainly not a measure of actual security, but rather a measure of preparedness for potential incidents.

The emphasis on mobility and vehicle access needs of disabled persons was also an unusual performance measure, compared to other scan sites. This emphasis was provided for both urban and rural areas of Victoria.

The focus on rural areas was another interesting characteristic of the DOI performance indicators. In addition to mobility opportunities for disabled persons, rural emphasis was also given to road development and provision of transit services for the general public.

Another interesting set of performance indicators is seen in the category for freight and logistics. Although other jurisdictions had freight-related measures, DOI had a much higher level of detailed indicators (except possibly those found in Queensland), again reflecting the unique

role of DOI and the government in freight infrastructure. The concern about freight reflected both the issue of economic competitiveness (e.g., freight rates) and the environmental consequences associated with freight movement (mode share to commercial ports).

The final category emphasized the organization’s capability to deliver promised services and products. The team observed concern about training and professional development in other cases, but the focus on participation rates for women in professional development programs was unique.

Figure 19 illustrates DOI reporting of key performance indicators.

DOI became involved in another performance-related application when the tram and passenger rail system was privatized in 1999. Because a significant reduction of the transit agency’s size in the 1990s affected its performance and a transit strike disrupted transportation in Melbourne, the government decided to privatize the rail systems serving metropolitan Melbourne. Five franchises were awarded to three companies, with fairly stringent patronage, revenue, cost, and subsidy fore-

casts (and thus economic justifications) incorporated into 10- to 15-year contracts. The philosophy at the time was to transfer as much risk as possible to the franchisees. Minimum service levels were specified, financial incentives were provided to improve reliability, and franchisees were required to own or lease the infrastructure. The franchisees were required to maintain the infrastructure in good long-term condition, and to purchase AU\$1.5 billion (US\$1.1 billion) in new vehicles. Although service performance improved under the franchise agreements, revenue expectations did not materialize, leading one franchisee operating three systems to withdraw from its contract. In response, the government refranchised the rail system with new conditions.

What to include in the new agreements became an important part of the negotiations with the franchisees. Many considerations became performance requirements in the new franchise agreement. Because performance-based service contracts are an important means of institutionalizing performance measures, it interesting to note the reasoning behind the inclusion or exclusion of these measures in the franchise agreement.

Key Performance Indicators Reporting

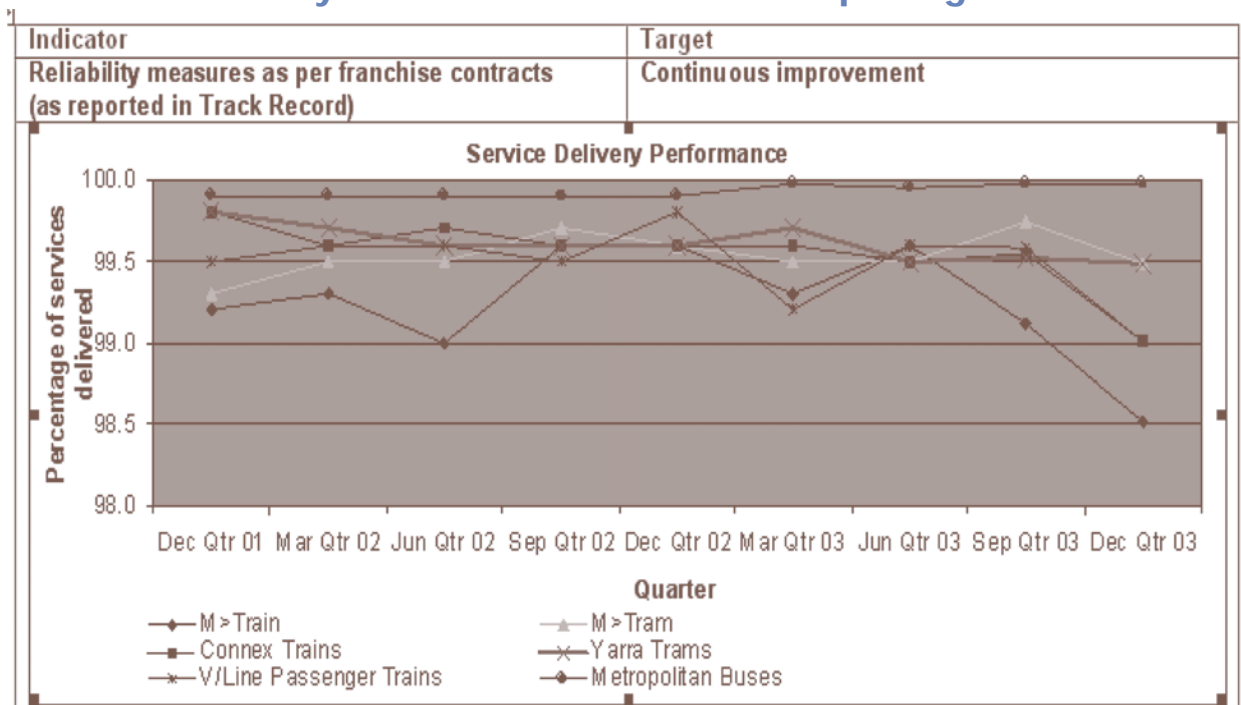


Figure 19. Illustrative reporting of key DOI performance indicators in Victoria.

Performance Indicator	Performance Indicator Rationale	
Passenger growth incentive	At specific thresholds of fare box growth, the franchisee would be required to invest in strategies to increase services. Because of uncertainties associated with future fare box revenues, this indicator was not used in the agreement.	VicRoads has its own performance management framework that links high-level policy outcomes with day-to-day operations of the agency. Three types of management efforts constitute this framework—strategic planning, business planning, and performance planning and management (see figure 20 on page 44). The strategic planning activities establish desired outcomes based on statutory obligations and government policy statements, such as <i>Growing Victoria Together</i> , <i>Victorian Freight and Logistics Strategy</i> , <i>Metropolitan Strategy</i> , and <i>arrive alive! The Road Safety Strategy</i> . The corporate plan identifies the key outcomes and objectives that VicRoads targets as part of its mission. For example, the 2002-2004 corporate plan identified four key action areas—listening to the community, working with others, getting things done, and improving its capabilities. Actions were defined for each of these areas. Progress in implementing these actions is reported monthly to the executive management committee and yearly in an annual report, and is part of employee performance evaluations.
Operational performance regime	Rewards or penalties would be assessed based on the degree to which actual service conformed to the schedule. By informing the public of delays, any penalty would be reduced by 50 percent. This indicator was retained in the new franchise agreements with \$12 million set aside for bonuses associated with improved schedule reliability.	The business-planning component of the performance management framework consists of two major efforts, developing the program and creating business plans. Core business areas in VicRoads develop a three-year rolling strategic plan for their areas of responsibility. In the context of these strategic plans, a program of projects is developed for the desired performance indicators established by VicRoads. Core business plans are approved by the Minister of Transport, as well by the government’s Economic Review Committee for projects over AU\$10 million (US\$7.3 million).
Speed	Reducing travel times (increasing speeds) would be rewarded with bonuses. VicRoads agreed to spend AU\$15 million (US\$11 million) a year for two to four years for bottleneck removals. With increased ridership, and thus increased fare revenues and savings in operating costs, the franchisee would pay VicRoads AU\$3.6 million (US\$2.6 million) a year for each 1 km/h average speed increase on trams. This indicator was retained in the agreements.	Based on the approved core programs, business plans are developed that outline the many capabilities necessary to deliver the program (see figure 21 on page 44). The executive management committee reviews these business plans to ensure they conform to agency budget targets.
Service growth incentive	Reductions in total weighted wait time for passengers was to be rewarded up to an annual capped amount. This indicator was kept in the agreements.	Performance planning and management, the third component of the performance management framework, represents the feedback loop for the corporate decisionmaking process. The basis for this reporting is a set of performance measures based on those reported to Austroads, DOI, and the government, as well as VicRoads’ own measures to manage its program. These measures include the following:
Customer satisfaction index	Given the vagaries of the cause-and-effect relationship between organizational action and user perceptions of service quality, this indicator was not recommended as a contractual element, although its monitoring will continue.	
Key performance indicators	Indicators for security, safety, and service quality would be monitored, but no incentives provided because these were considered something the franchisee would want to do anyway to foster ridership.	

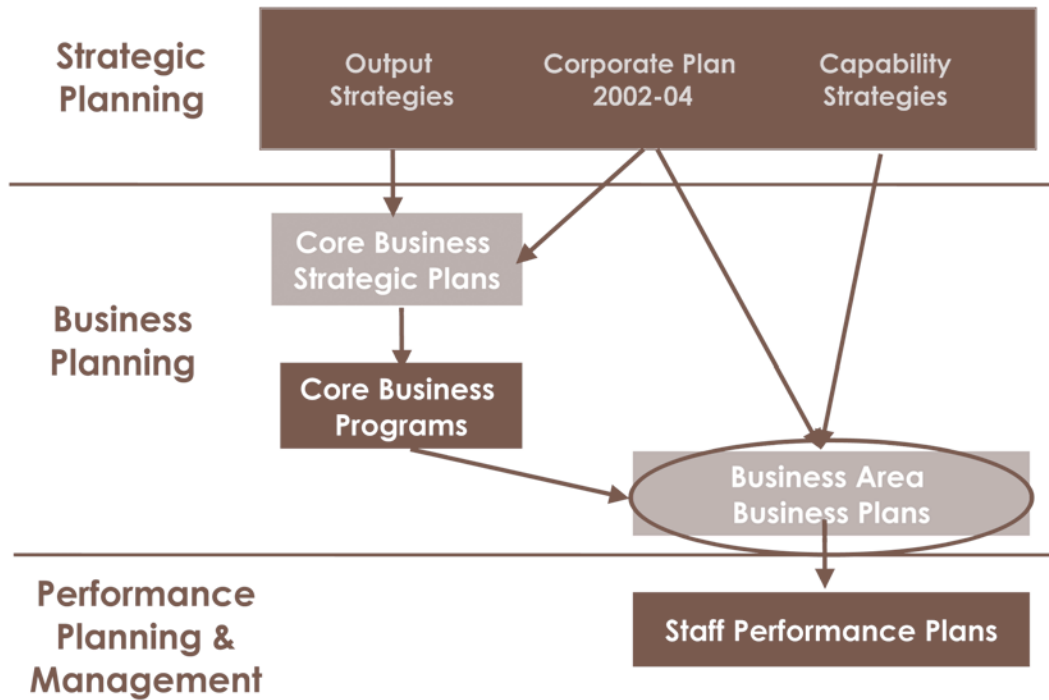


Figure 20. Performance-based management activities at VicRoads.

A Business Plan typically consists of:



Figure 21. Business plan development for VicRoads.

External

Road system

- Safety
- Travel times/congestion
- Road smoothness
- Lane/vehicle occupancy
- Environment
- User costs
- User satisfaction

Programmed project delivery

- Achievement index
- Expenditure versus budget
- Project scope and cost control

Program effectiveness

- Road maintenance effectiveness
- Smooth travel exposure
- Return of construction expenditure
- Return on nonconstruction-related initiatives

Customer service

- User satisfaction
- Customer waiting times
- Responding to priority correspondence
- Calls lost and time taken to answer telephone

Internal

Business efficiency

- User transaction efficiency for registration and licensing transactions and benchmarking unit costs of road maintenance

Business unit profitability (VicRoads has developed an affiliated technical consulting group that works internationally on a competitive basis.)

- Current and forecast profit and loss for off-budget business areas
- Return-on-asset indicators monitor the effective use of assets

Team and individual capability and performance

- Individual and/or team key result areas, linked to business plans

Workforce productivity, health, and safety

- Overtime use, annual leave, sick leave, accidents

Several performance management systems are used to collect the data to support this framework. An asset management system collects data on road and bridge conditions, a traffic management system collects data on

traffic flows, and a customer service management system keeps track of customer service characteristics.

Safety

The scan team observed perhaps the most impressive application of a performance-based planning and decisionmaking process of any site visited in Victoria's road safety program. The program has existed for many years, providing the opportunity to identify through absolute numbers and trends what impact it has had in achieving safety goals. The specific characteristics of Victoria's safety program are so impressive (by U. S. standards) that they are described in more detail in the chapter on safety.

As noted previously, VicRoads monitors a large number of performance measures on road safety, classifying these measures by total amount and rate of incidence, user type, and fatality-related causal factors (e.g., illegal blood-alcohol concentrations). Victoria's road safety strategy—called *arrive alive!*—represents a five-year plan to improve road safety in the state. Three government ministers have supported the plan, which in essence becomes the guiding strategy for all road safety-related agencies in the government. The government has established a 2007 target of a 20 percent reduction in fatalities and serious injuries, and has created a ministerial coordinating group to oversee the program.

Figure 22 (see page 46) shows the status of road safety in Victoria and the goals established. VicRoads has been designated the lead agency in coordinating the activities of various agencies to achieve these outcomes. In conjunction with achieving these outcomes, VicRoads is also involved with 17 safety challenges outlined in *arrive alive!* (See table 9 on page 46.)

An important foundation for safety performance monitoring efforts is a database and data analysis system that provides VicRoads and others with, in their terms, “knowledge.” To support the safety-related planning and decisionmaking process, data are collected from VicRoads, Victoria Police, Transport Accident Commission, Department of Justice, Institute of Forensic Medicine, hospitals, research agencies, and a limited number of local governments. To be useful in the VicRoads performance framework, crash data must have associated with it a large number of attributes (e.g., location details, participant characteristics, prevailing conditions, vehicle characteristics, etc.). In addition, this data must be input into a data management system called the Road Crash Information

The arrive alive! Challenge

	Before (1999- 2001 Av)	Target 2007	% Change Needed	Actual 2002	Actual 2003
Deaths	414	331	↓20%	397	330
Deaths per 100,000 population	8.7	6.6	↓24%	8.15	6.72
Deaths per 10,000 vehicles	1.24	0.84	↓32%	1.2	0.95

Figure 22. VicRoads' safety targets.

System (RCIS), which provides numerous crash reports to VicRoads. The director general, for example, gets daily updates on fatalities, with a one-day turnaround for data from the originating authority to arrive on the director general's desk. RCIS is also used to establish priorities, understand types of crashes and their locations (e.g., run-off-the-road crashes), allow the public to conduct its own analysis of crash data, and benchmark different communities in Victoria.

The performance measures discussed above are reported primarily to the VicRoads leadership and, through VicRoads, to the public and elected representatives. A Ministerial Council for Road Safety—consisting of the Ministers of Transport, Police/Emergency Services, and the Transport Accident Commission—has a much higher-level perspective on performance measures and includes additional measures of concern. For example, the council monitors the number of hours of actual operation for mobile blood-testing laboratories compared to required hours of operation during expected high-risk times (e.g., holidays). This is really more an output measure than one focusing on outcomes, but something that the council believes it can control.

Another output-oriented measure relates to a VicRoads-led partnership with local governments, Victoria Police, Transport Accident Commission, Municipal Association of Victoria, and Royal Automobile Club of Victoria. Called the Saferoads Partnership, the program encourages (with \$5,000 and a required one-to-one match) development of local road safety strategies, such as older

driver safety programs, child restraints, land use planning, young driver safety education, and motorcycle safety. The VicRoads' performance measures associated with this program include the following:

- Number of local governments participating (78 of 79)
- Number of road safety officers/coordinators employed by local governments (22)
- Number of areas with safe driving policies (15 of 24)

Increased investment on high-crash local road sections A similar program for 24 Community Road Safety Councils (CSRCs), in which each council is eligible to receive up to AU\$35,000 (US\$25,620), has the following types of performance measures: number of programs that target key issues and have sustained effort, number of programs that support statewide initiatives, and number of joint programs involving CSRS, local government, and schools.

Freight

As noted above, the Victoria government has incorporated a policy concern for freight movement into the DOI

Table 9. Seventeen safety challenges for VicRoads.

Safety challenges for VicRoads.
Enhanced crash information
Speed and speeding
Road design and roadside safety
Drunk driving
Fatigue
Drugs and driving
Occupant protection
Post-crash trauma
Young/novice driver safety
Older driver safety
Pedestrian safety
Motorcycle safety
Bicycle safety
Heavy vehicle safety
Driver issues
Working with the community
Public transport safety

performance indicators. The corporate plans for both VicRoads and DOI include references to government policies that encompass freight issues, such as *Growing Victoria Together*, *Victorian Freight and Logistics Strategy*, and *Metropolitan Road and Traffic Management Strategy*. With an expected 70 percent increase in freight movement over the next 20 years, Victoria will face significant bottlenecks in its rail and road logistics network unless this network is, in VicRoads' terms, "optimized." Such optimization includes managing congestion, facilitating freight in the existing transportation system, giving priority to freight and public transport on transportation networks, and adopting a full societal cost recovery pricing scheme.

Besides DOI and Austroads performance indicators, the Victorian Road Freight Advisory Council, an advisory group to the Minister of Transport, publishes a set of indicators every three years relating to road freight efficiency, road safety, regulatory compliance, industry trends, and environmental quality. These indicators, however, are simply reported and not used by VicRoads in management decisionmaking.

Congestion

VicRoads was one of the major proponents for developing Austroads' National Performance Indicators, so Austroads' indicators on road network performance serve as the core measures for VicRoads' efforts. These indicators include urban and rural average travel time and road use for people (person-kilometers) and freight (ton-kilometers). These indicators are determined for seven road categories: freeways; divided and undivided arterials and undivided arterials with trams for an inner area; and freeways, divided arterials, and undivided arterials in the outer areas of Melbourne. For each road category, a representative sample of at least 15 percent of total travel and network length is used for data collection. Data are collected twice a year in each direction for three time periods and for each weekday. Four indicators are calculated from this data—actual travel time (minutes per kilometer), nominal travel time (min/km), congestion (min/km) and variability of travel time (percentage). Figure 23a shows a typical reporting of this information.

VicRoads operates a traffic management center (TMC) that serves as a major source of data for performance indicators. The center operates 24 hours a day, seven days per week, and requires 12 staff members working 12-hour shifts. TMC connects to 2,500 SCATS-controlled traffic signals, and uses 170 surveillance cameras, with access to another 240 cameras on the regional toll road

network. Freeways have loops every 500 meters (1,640 feet), 320 in all, that collect data on vehicle speeds, volumes, and lane occupancy. This data is updated every 20 seconds. Speed cameras are used throughout the region to enforce speed limits. VicRoads is also developing an approach to track trucks on Victoria roads and to equip all buses and taxis with global positioning system (GPS) units that, in essence, would turn them into probe vehicles. All of these ITS applications will provide VicRoads with a strong data collection capability to support its performance measurement efforts.

VicRoads has developed a performance monitoring system for the freeway system that relies on data collected from loop detectors. The data are blocked into 15-minute time intervals, with performance reporting on crash rates, speeds, volumes, free-flow speed, travel times, hours of delay, all per segment or, in the case of crash rates, per 100 million vehicle-kilometers traveled and per kilometer (see figure 23b). The next version of this system will allow a lane-by-lane analysis. VicRoads' officials stated that this performance monitoring system strongly influenced investment priorities by providing for the first time a systems view of trouble spots. Before this, the use of the traffic management center as a data input to such prioritization naturally focused attention on the specific locations monitored. It was clear to the scan team that VicRoads is using ITS applications most effectively as a source of data for performance indicators, and is developing additional applications that could be important in the future.

Multimodal Transportation

Melbourne is one of the most multimodal cities in the world. With an extensive tram system (third largest in the world) and a large bus network, public transport plays an important role in providing mobility to city residents (90 million boardings per year representing 9 percent of total motorized trips). As noted earlier, the government has established a target of 20 percent public mode split by 2020. Operations measures used to monitor service delivery include tram and bus travel time (targets are 25 percent reduction for trams and 10 percent reduction for buses). The transit agency collects data on service reliability, while VicRoads monitors travel time variability for roads carrying transit vehicles.

The government's transportation policy also includes a commitment to enhance the bicycle network in the state. Bicycle projects will be provided as part of major road projects, with a target value of one kilometer of off-road bike lanes per 1,000 population. The types of performance indicators developed

Figure 23. Examples of congestion reporting in Victoria.

Melbourne's Travel Time Results				
AUSTRROADS INDICATOR	TIME OF DAY	FINANCIAL YEAR RESULTS		
		2000/01 FINANCIAL YEAR	2001/02 FINANCIAL YEAR	2002/03 FINANCIAL YEAR
ACTUAL TRAVEL SPEED- ATS (km/h)	AM PEAK	37.9	36.7	36.8
	PM PEAK	41.2	39.3	40.3
	OFF PEAK	45.9	44.9	45.3
	ALL DAY	42.8	41.4	42.0
NOMINAL TRAVEL SPEED - NTS		66.9	66.6	66.7
DELAY - DLY (min/km)	AM PEAK	0.69	0.74	0.73
	PM PEAK	0.56	0.63	0.59
	OFF PEAK	0.41	0.43	0.42
	ALL DAY	0.51	0.55	0.53
VARIABILITY OF TRAVEL TIME - VTT	AM PEAK	19.6%	24.0%	21.2%
	PM PEAK	18.4%	19.1%	17.3%
	OFF PEAK	14.2%	14.5%	12.7%
	ALL DAY	16.5%	17.6%	15.6%
CHANGE IN NETWORK TRAVEL		2.7%	1.6%	0.1%

Figure 23a. System performance measurements.

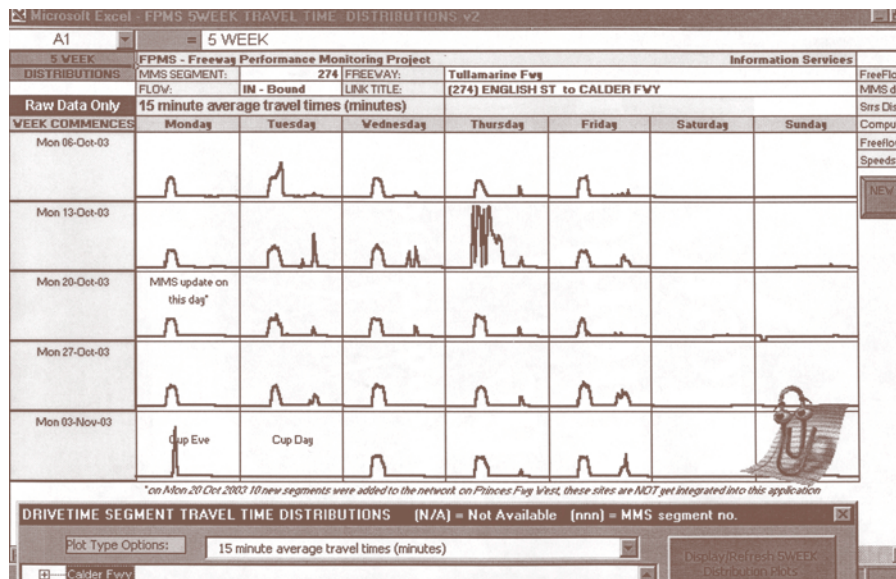


Figure 23b. Freeway performance measurements.

for this program include level of program expenditure, number of kilometers in place, bicycle as a mode for work travel, bicycle as a mode for recreational and sport activities, crashes, and hospital admissions.

Road System Management

One of the most important core businesses in VicRoads is the Road System Management (RSM) group, the unit responsible for the strategic development of the road

network. Besides DOI and other indicators described previously, the RSM unit has its own set of core performance indicators, several of which are benchmarked against other Australian states. These indicators include the following:

- Road maintenance effectiveness
 - Cost per kilometer to maintain sealed urban and rural roads in smooth condition
 - Ratio between total maintenance expenditures and length of road with surface roughness less than defined levels of roughness (4.2 IRI)

Smooth travel exposure

- Proportion of travel undertaken each year on urban or rural roads with surface roughness less than 4.2 IRI

Return on construction expenditure

- Benefit-cost ratio based on discounted community benefits divided by the difference in discounted road life cycle costs

Achievement index

- The ratio of the benefit-cost ratio before a project to the calculated benefit-cost ratio after project completion

A review of the achievement index suggests that the benefit-cost analysis in recent years has been a valid exercise in estimating what will actually occur (based on a sample of 80 projects out of about 1,200 per year).

VicRoads uses a road asset system (RAS) to collect data on the condition of road assets. Data collected include bridge condition and risk rating, pavement surface condition (updated yearly), and pavement roughness (or what is called “smooth travel exposure”). Other data sources used for performance measurement include results from regional models, census data, public input, land use, and traffic surveys. VicRoads officials stated that for asset

management, priorities are driven by pavement condition modeling, reducing roughness, preventive maintenance treatments, resurfacing low skid resistance sites, bridge conditions, and roadside inventory problems.

VicRoads is undertaking several initiatives to enhance program delivery. For example, new legislation has been introduced to clarify the responsibility for managing arterial roads. VicRoads is also evolving to a triple bottom line approach to project evaluation, defining new indicators that are more relevant to decisionmaking, and introducing a new risk management framework for benefit and cost estimation. In addition, VicRoads is making efforts to develop new indicators for social and environmental concerns, use new data collection methods, and create multimodal evaluation methodologies.

In response to questions posed by the scan team, VicRoads officials stated that the key barriers to a performance-oriented decisionmaking process are that 1) many indicators are not understood by those outside of VicRoads, and 2) supporting data are difficult (and expensive) to collect for some indicators. Inherent conflicts also exist between several performance categories. For example, reducing speeds for safety purposes could conflict with desired higher speeds for improved regional accessibility, or enhancing freight access could conflict with community preservation desires. Key lessons for others engaged in performance measurement include assuring that performance indicators can be readily and cost effectively obtained, are closely tied to program and investment decisions, and are outcome-oriented.

Observations

The scan team's most more important observations from the visit to Victoria are as follows:

- Victoria's approach to performance-based management, as seen in its transportation program, is probably the most advanced such effort found during this scan. Great thought has been given to what measures are most important, as well as to realizing that many politically defined targets could be difficult to attain. The scan team found a performance measurement mindset integrated into planning and decisionmaking at VicRoads and DOI.
- The most advanced application of a performance-based policy, planning, and decisionmaking structure was found in road safety. The approach to achieving the government's safety targets illustrates well how important performance indicators can be used to focus governmental efforts. The results are impressive.

Internal Monitoring of VicRoads' Program

- Financial progress against forecast
- Physical works against program
- Initial versus final project cost
- Post project evaluation for major improvements
- Environmental impact

Source: VicRoads

- The targets established for key performance indicators appear ambitious, but VicRoads officials stated that these targets, although defined politically, did benefit from technical analysis before they were established. This was in contrast to other locations, where target values appeared to represent the desires of politicians. To the extent that targets are useful in a performance measurement scheme, the way Victoria has established its targets is worthy of imitation.
- Although other scan sites incorporated freight into the performance framework, DOI has devoted much more attention to the important role that freight movement plays in Victoria's economy and its performance indicators. The level of attention to freight, especially given expected growth in freight movement, is commendable and worthy of application elsewhere.
- Using performance-based service contracts is one way government agencies can institutionalize performance concerns in service delivery. Victoria is not unique, but the thought process associated with renegotiating the transit franchises in Melbourne and identifying performance indicators to include in the new contracts was an excellent example of how such agreements should be constructed. DOI clearly learned from the problems associated with earlier agreements, and applied these lessons in renegotiations that have placed public transit in Melbourne on a strong foundation.
- Because of the multimodal nature of Melbourne's transit system, coordination on investments and operations appears to be close among DOI, VicRoads, and the transit franchisees. This coordination also appears to be part of the performance measurement structure of each agency or firm. For example, VicRoads undertakes road improvements as part of its performance measurement structure to reduce bottlenecks for the tram system, which is a performance target for DOI.
- Although the concept of an "achievement index" is found in the Austroads national performance indicators, the application in Victoria is impressive. VicRoads

conducts about 80 post-implementation evaluations annually to determine how close the actual benefits and costs are to those forecast by the initial analysis. This interesting concept provides important feedback to the decisionmaking process and credibility to the technical analysis that precedes decisionmaking.

- VicRoads is much further along than others in determining how ITS technologies can be used to support performance management through their data collection capabilities. Not only are ITS applications used for data collection, but the scan team also learned about planned expansions of this capability that will make Melbourne one of the most monitored transportation systems in the world. VicRoads understands the necessity of having the most cost-effective and flexible data collection program feasible to support performance-based planning and decisionmaking.

NEW ZEALAND

The mission statement for the national road agency in New Zealand states that it wants to be a world leader in transportation service provision. In many areas, New Zealand has accomplished this, earning a reputation for innovative and forward-looking approaches to transportation system management. In combination with its public and governmental concern for natural resources, New Zealand includes many best practices on how the transportation system can best be developed and managed to support much broader community goals. The scan team was particularly interested in how transportation officials in New Zealand used performance measures to manage their transportation system, and the extent to which performance measures have been identified for social, environmental, and cultural outcomes.

Governmental Context

New Zealand is a parliamentary democracy with a unicameral Parliament. The country is divided into 16 administrative regions and 74 territorial authorities, all of which are road-controlling authorities. A minister oversees a Ministry of Transport that consists of six agencies—Civil Aviation Authority, Transport Accident Investigation Commission, Maritime Safety Authority, Land Transport Safety Authority, Transfund New Zealand, and Transit New Zealand. Three agencies in particular were of interest to the scan team. Transit New Zealand is the agency responsible for a national highway system consisting of 10,786 km (6,702 mi) of a road network of 92,600 km (57,450 mi). About 48 percent of

New Zealand's 38 billion vehicle-kilometers per year (23.6 billion vehicle-miles) use the national highway network. About NZ\$674 million (US\$493 million) will be spent on the national road network in 2004.

Transfund New Zealand is the agency that allocates all revenues collected from the fuel excise tax, gas taxes, and vehicle registration fees to national transport and safety agencies. The initial allocation from the National Roads Fund (similar to the U.S. Highway Trust Fund) goes to the New Zealand Police and the Land Transport Safety Authority for road safety enforcement. The remaining funds are transferred to the National Roads Account, which provides full funding of the road program of Transit New Zealand, together with financial assistance to the programs of the local government road-controlling authorities. Transfund New Zealand uses its own performance measures to monitor progress on government and agency goals.

The Land Transport Safety Authority (LTSA) is a crown entity with a mandate to promote land transport safety, including safety on New Zealand's road and rail network. LTSA is governed by a government-appointed board. With its responsibility targeted to safety, LTSA has established goals on the number of annual deaths and hospitalizations in New Zealand. Its outreach efforts are divided among education, enforcement, and engineering. Given that it must rely on achieving its goals through the actions of other agencies (e.g., New Zealand Police and Transit New Zealand), LTSA develops and nurtures partnerships with many other agencies at the national, state, and local levels.

Use of Performance Indicators

Similar to Australia, New Zealand has developed an integrated approach to performance-based planning and decisionmaking. Consistent performance measures are found in documents ranging from its corporate strategic plan to performance specifications in private service contracts. Figure 24 shows the hierarchy of management decisionmaking and its relationship to performance measurement. Several inputs and products of this process merit special attention.

Enabling legislation—More than in many other countries, the New Zealand government has established strong goals for the transportation sector as it relates to the general well being of the country. For example, a Land Transport Management Act passed in 2003 requires Transit New Zealand (and other major agencies) to operate in a way that “contributes to an integrated, safe,

responsive, and sustainable land transport system.” The important word in this phrase is “sustainable,” because the government has set a June 30, 2005, target date for all land transport programs to be fully compliant with the policy directions in the act. At the time of the scan visit, Transit New Zealand officials were struggling with how the transportation program should be restructured and system performance measures defined to lead to a more sustainable land transport system for New Zealand.

A law expected to pass shortly after the scan visit would change the way transportation governance occurs in Auckland, New Zealand’s largest city. Under the law, a new planning organization would be established for the region with a requirement for local land use plans to be closely tied to roads and public transport plans. This new law was expected to change in significant ways how transportation planning occurs in Auckland, and once again, challenge planners and decisionmakers to develop a performance measurement scheme that measures progress toward this goal.

New Zealand Transport Strategy—The government produced a strategy document in 2002 that outlined its strategic vision for transportation: “By 2010, New Zealand will have an affordable, integrated, safe, responsible, and sustainable transport system.” Four principles underpinned this vision—sustainability, integration, safety, and responsiveness. Although no specific performance indicators were identified in this document, the Land Transport Management Act required that all related actions by the national transportation agencies be consistent with this strategy.

Strategic Plan—Each agency must develop a strategic plan that describes what the agency is trying to achieve and how it will achieve it. The most recent strategic plan for Transit New Zealand, for example, stated its mission, vision, values, key strategic areas, and key goals. As the plan noted, Transit New Zealand is focused on performance in several areas, including state highway network management, social and environmental responsibility, funding, industry leadership, communication, and

working relationships. The strategic plan observed that Transit New Zealand wanted to reexamine its performance measures, which it concluded focused primarily on delivering physical outputs. Instead, Transit New Zealand’s aim was to develop performance measures that reflected “the full range of Transit New Zealand’s role, accountabilities, and performance; performance targets in the Strategic Plan and the National State Highway Strategy; and Triple Bottom Line reporting.”

Statement of Intent—A 1989 public finance law required all government agencies to prepare a document that provided information on a range of corporate management factors, including performance targets, objectives, and scope of activities. For example, the Ministry of Transport’s Statement of Intent for 2003/2004 observed that, “Sustainable Transport is the Ministry’s vision. As the government’s principal transport advisor, we will continue to identify solutions with longer-term benefits. Decisions will be based not only on monetary costs and benefits, but will also take into account the social, regional, economic, health, and environmental impacts of all projects.”

Transit New Zealand’s statement of intent provides a more detailed set of performance measures that relate to the goals established in the strategic plan. In addition, these performance measures include measures that are part of a performance agreement between the

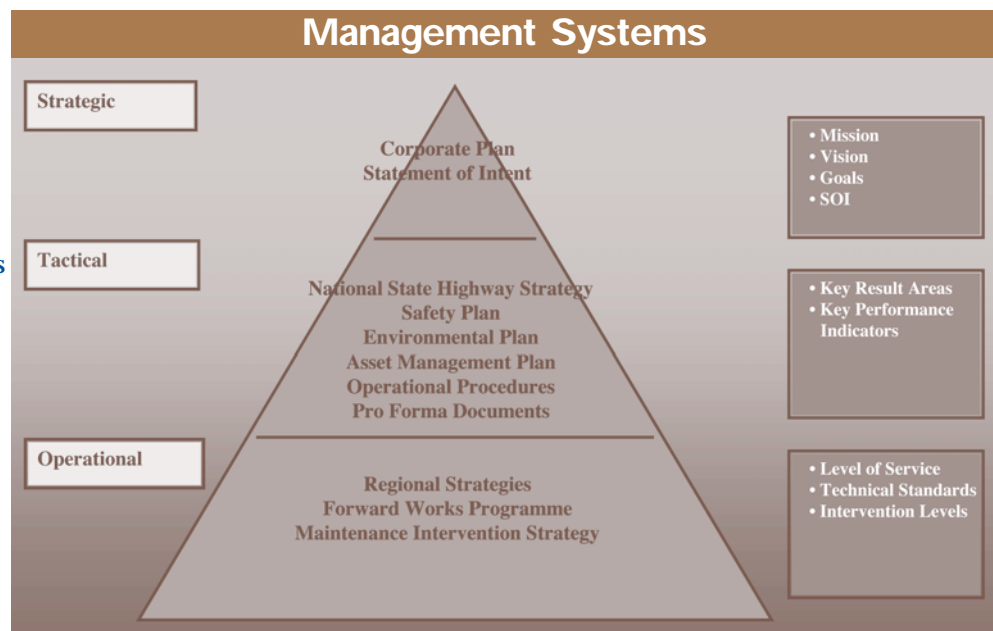


Figure 24. Role of performance measures in management decisionmaking in New Zealand.

Minister of Transport and Transit New Zealand (see below). As noted in the statement of intent, given the changes in the law and increasing pressure on Transit New Zealand to broaden its interests, these performance measures are a starting point for future performance measure evolution. Indeed, during the scan meeting, it became clear that some measures were considered placeholders until more substantive measures could be defined. One consequence of this was that customer surveys are used in Transit New Zealand’s performance measurement system more than in other cases the team observed. The performance measures for Transit New Zealand are found in Appendix C, identified by the three areas found in the triple bottom line approach to performance measurement.

Performance Agreements—The Land Transport Management Act requires that Transfund and Transit New Zealand provide the Minister of Transport with an annual performance agreement that specifies how the agency will conduct its activities during that year. Of the 11 topics covered in this agreement, eight relate to some form of performance measurement, including a proposed statement of output objectives, how the agency will measure achievement of the government’s goals, management and financial systems that will guide agency action, and an assessment of the agency’s actions on achieving an integrated, safe, responsive, and sustainable highway system.

The latest performance agreement between the Minister of Transport and Transit New Zealand sets targets for seven measures during the year covered by the agreement, and commits to information-gathering activities for other performance measurement areas that will lead to identified targets for the following year. An example of a performance agreement target is that the variance between actual and forecasted expenditures for maintenance should not be more than 2 percent. Given the focus of the performance agreement, the scan team was not surprised to find that all quantifiable targets were focused on organizational outputs, although indications were strong that system performance measures would be incorporated into future performance agreements.

Ten-Year Highway Plan—Transit New Zealand is required to develop a 10-year plan that consists of an annual work program and an “indicative” plan for the remaining nine years. The relationship between this plan and all other performance-based planning documents is found in its linkage to the New Zealand Transport Strategy and Transit New Zealand’s National Highway

Strategy. In both cases, the 10-year plan states the specific goals the plan is helping to achieve.

Annual Program—An annual program of activities is prepared for each government agency. For example, in the safety area, the annual program includes the engineering, education, and enforcement efforts the government will conduct. Specific performance measures are used to gauge the level of program activity. In the area of speed control, for example, the New Zealand police (all police are part of a national police force) are charged with delivering enforcement efforts that meet the following performance criteria:

<i>Measure</i>	<i>Standard</i>
Quantity	
• Number of speed control campaigns and specified police hours compared to target number	100%
• Tickets issued from	
– On-road speed enforcement	275,000 to 325,000
– Traffic camera operations	400,000 to 460,000
Quality	
• Number of approved plans	100%
• Percentage of local authorities and Transit New Zealand satisfied with effort	Equal to or better than previous year
• Percentage of annual survey respondents who believe the probability of being detected for illegal speeding is high	Equal to or better than previous year
Timeliness	
• Speeding tickets issued no later than 30 days after camera detection	100%
Cost	
• Delivery within budget	100%

The strategic framework for safety performance has led the Land Transport Safety Authority to expand the focus of performance management beyond road user measures to measures relating to the roads themselves. To some extent this was done in recognition of how difficult it might be to use additional behavioral strategies to reduce fatalities. As noted in the safety program document, “roads must be used properly if they are to be safe, and it is up to the engineers who design them

to make them as safe as possible and to inform us of the limitations so that we can use the roads safely.”

Safety

As in Australia, safety was one of the best examples of the application of performance measurement the scan team observed in New Zealand. Figure 26 shows the overall framework of performance management adopted by the Land Transport Safety Authority, including identification of performance targets for variously defined outcomes and outputs. These different levels of outcomes relate to targeted interventions by the government, and to better measurement of the effectiveness of safety programs on different user groups. Figure 25 also shows the hierarchical nature of the relationship among these outcome levels. The Road Safety to 2010 strategic plan for the Land Transport Safety Authority provides more detail on desired levels of achievement. For example, the following outcome categories are found in this strategic plan:

Overall Outcomes

The social cost of a crash is the measure of all costs that the crash inflicts on a community.

Target Types Required

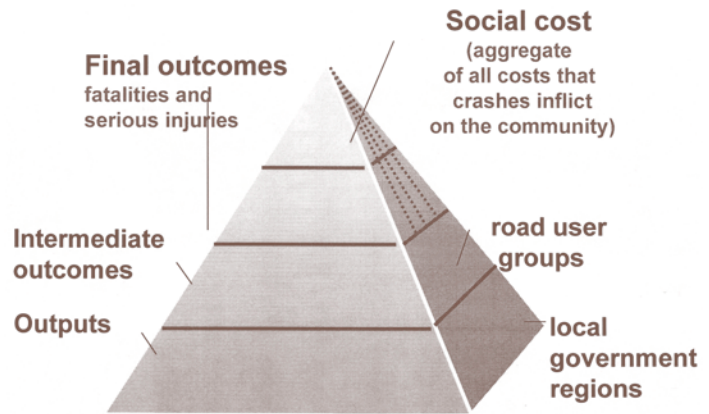


Figure 25. Hierarchical relationship of safety performance measures in New Zealand.

Intermediate Outcomes

The focus of the intermediate outcomes is to be able to determine the effect of interventions in three key areas—speed management, drunk driving, and passenger/driver restraints.

Measure	How Measured	2004 Not Exceeding	2010 Not Exceeding
Social Costs	• \$ billion (US\$)	2.75 (2.01)	2.15 (1.57)
	• ¢ per vehicle-kilometer (US¢ per vehicle-mile)	6.7 (3.1)	4.4 (2.0)
	• \$ per person (US\$)	700 (512)	650 (476)
	• \$ per vehicle (US\$)	1,020 (747)	945 (692)
Deaths	• Total not greater than	400	300
	• Rate per billion vehicle-kilometers (per billion vehicle-miles)	9.9 (6.2)	6.1 (3.8)
	• Rate per 100,000 persons	10.2	7.3
	• Rate per 10,000 vehicles	1.5	1.1
Hospitalizations	• Total not greater than	5,870	4,500
	• Rate per billion vehicle-kilometer (per billion vehicle-miles)	140 (87)	90 (55.4)
	• Rate per 100,000 persons	150	110
	• Rate per 10,000 vehicles	22	16
	• Hospitalizations >1 day	2,750	2,200
	• Hospitalizations >3 days	1,750	1,400

Note: Values in parentheses indicate comparable U.S. amounts

Intermediate Outcome	Measure	Units	2004 Not Exceeding
Speed (Open Road)	• Mean speed	km/h (mi/h)	99 (61.5)
	• 85th percentile speed	km/h (mi/h)	107 (66.5)
Speed (Urban Road)	• Mean speed	km/h (mi/h)	55.2 (34.2)
	• 85th percentile speed	km/h (mi/h)	61 (37.9)
Alcohol	• Driver deaths with excess alcohol	Number	48
		% of all driver deaths	21%
Restraints	Vehicle occupants wearing safety belts	% in front % in back	At least 92% At least 75%
	Children <12 restrained	%	90%

User Group Outcomes

These outcomes focus on the social costs associated with crashes in two groups—pedestrians and cyclists—because of their particular vulnerability when involved with motor vehicles.

User Group	Measure	2004 Deaths plus hospitalization not exceeding
Pedestrians	Total	700
	More than 1 day hospitalized	390
	More than 3 days hospitalized	290
Pedestrians per million hours traveled	Total	3.1
	More than 1 day hospitalized	1.7
	More than 3 days hospitalized	1.3
Cyclists	Total	270
	More than 1 day hospitalized	130
	More than 3 days hospitalized	90
Cyclists per 100 million km	Total	100
	More than 1 day hospitalized	50
	More than 3 days hospitalized	35

Regional Outcomes

Outcomes can also be disaggregated by region to determine the effectiveness of regional and local road safety projects.

Region	2004 deaths plus hospitalization	2004 deaths plus hospitalization of >1 day	2004 deaths plus hospitalization of >3 days
Northland	440	200	120
Auckland	2,120	840	600
Waikato	740	420	320
Bay of Plenty	490	270	160
Gisborne	70	40	30
Hawke's Bay	250	140	100
Taranaki	120	70	50
Manawatu-Wanganui	390	240	160
Wellington	320	200	120
Nelson-Marlborough	140	80	50
West Coast	90	40	20
Canterbury	700	380	260
Otago	250	150	100
Southland	150	100	60

A similar outcomes hierarchy is being developed for rail safety.

Safety Partnership

Transit New Zealand is an important implementing partner with the Land Transport Safety Authority, as is the New Zealand police agency. Indeed, before the most recent redefinition of Transit New Zealand's goals as manifested in the Land Transport Management Act of 2003, the principal purpose of the agency was defined as providing "a safe and efficient state highway system." In response, Transit New Zealand undertook several initiatives to incorporate a concern for safety into its daily activities.

Of interest to the scan team was development of a state highway safety management system, defined as "a systematic process that has the goal of reducing the number and severity of road crashes by ensuring all opportunities to improve state highway safety are identified, considered, implemented, and evaluated as appropriate, in all phases of highway planning, design, construction, operation, and maintenance." This management system has three major elements—primary components, secondary components, and partnerships. Figure 26 shows how the management system functions in influencing decisions and budgets. Because many of Transit New Zealand's operations and maintenance activities are contracted to private firms, many contracts include specifications and performance targets that relate to the measures identified in the National Road Safety Plan. Transit New Zealand conducts annual reviews of the State Highway Safety Management System manual, hires independent auditors to conduct random audits every year and a full audit every three years of compliance with the safety management system, and annually certifies the state highway network on its safety performance.

Agency strategies are used in particular for integrating safety concerns into both ongoing maintenance activities and new construction. The key safety strategies are safety inspections (both day and night), crash databases by highway location, "gray spot" analysis (locations with three crashes), crash reduction studies (conducted where gray spot analysis/treatment has not reduced crashes), road safety audits of new and existing networks, and a strong focus on maintenance of wet road skid resistance.

Congestion

There was a growing sense in the late 1990s that roads in Auckland and Wellington were becoming severely

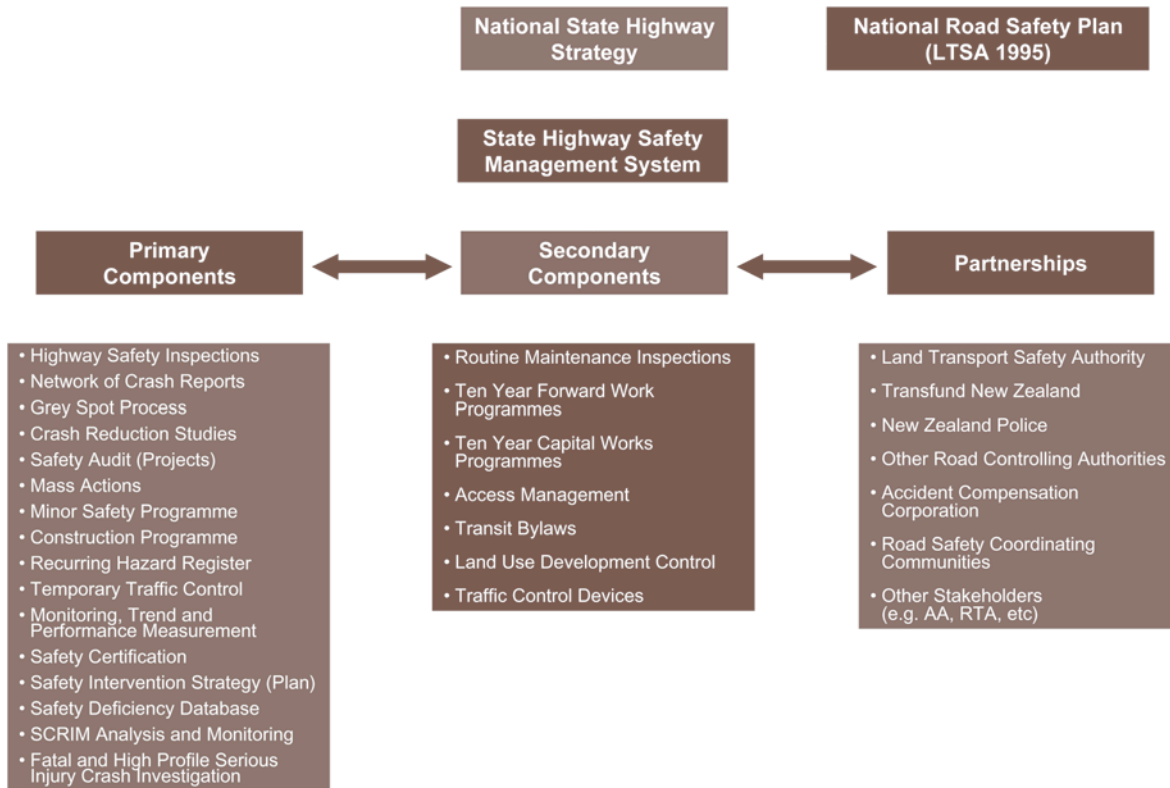


Figure 26. Safety management system's impact on planning and decisionmaking.

congested. Although Transit New Zealand had conducted travel time surveys over many years, this data collection had not occurred in the context of a clearly defined congestion performance indicator. In 2002, Transit New Zealand and the Regional Councils in Auckland and Wellington introduced a data collection program that would systematically feed into an annually measured congestion indicator. The Austroads definition of this indicator—actual travel time minus speed travel time divided by distance traveled—and Austroads’ floating car methodology are used in this performance-monitoring effort. The road sample for Auckland included 70 percent of the freeway length, 100 percent of state highways, and 44 percent of regional arterials. In Wellington, the sample included 100 percent of the freeway, 45 percent of state highways, and 21 percent of regional arterials. The results for Wellington are shown in table 10. The results for Auckland were considered unreliable because of methodological issues that are being addressed (congestion was so bad that the floating car method could not meet its quality control standards). Note in table 10 the use of travel time variability (or in U. S. terms, reliability). Given the successful experience in Wellington, the

urban congestion indicator approach is being implemented in two additional cities, Tauranga and Christchurch.

Customer Satisfaction

Transit New Zealand gives considerable attention in its performance management framework to customer satisfaction. In 1998, road users, as a generic group, were surveyed on a range of desirable and undesirable characteristics of the road network and overall level of satisfaction. In 2000, the survey focus was changed

Table 10. Congestion measurement in Wellington.

	Period	Nov. 2002
Congestion Indicator	A.M. Peak	0.27 min/km
	Interpeak	0.11 min/km
	P.M. Peak	0.29 min/km
	All Day	0.20 min/km
Variability	A.M. Peak	16%

to identify satisfaction and dissatisfaction by market segment, such as commercial truck drivers and short- and long-distance travelers. In 2003, fewer, more targeted questions were incorporated into the survey to “gain a better understanding of the prioritization” of key characteristics of the road system by road users. As noted in the report summarizing the 2003 survey results, “this would lead to the overall performance ratings of Transit New Zealand being more transparent.” In addition, “reasons for dissatisfaction were sought, to ensure results were actionable.”

The survey was conducted on a regional basis, with a minimum of 200 surveys per region. A total sample size of 1,500 usable surveys formed the basis of the results, and conclusions were drawn only where a 95 percent confidence level could be obtained.

The survey results provided important information to Transit New Zealand. Only 22 percent of the respondents rated the state highway network as either fair or poor, while 78 percent rated it good, very good, or excellent. The survey showed a clear linkage between overall satisfaction with the state highway network and satisfaction with safety, pavement quality, and congestion. In 2000, of all user groups, the one showing the most dissatisfaction was commercial truck drivers, where dissatisfaction was most related to poor ride quality. In response, Transit New Zealand developed a truck ride indicator that measured the pitch-and-roll response of trucks to the road surface. Segments of the road network that fared poorly by this new indicator were targeted for improvement through Transit New Zealand’s maintenance program. More than NZ\$7 million (US\$5.1 million) has been spent specifically on poor truck ride sections of highway. This so-called “truckie survey” and Transit New Zealand’s proactive response to the results won national honors in the Market Research Effectiveness Award program of New Zealand’s Market Research Society.

Asset Management

Transit New Zealand is a world leader in the use of asset management for guiding road investment decisions. A State Highway Asset Management Plan links the day-to-day activities of asset management with the strategic framework represented by the National State Highway Strategy and the statement of intent. The performance measures incorporated into the asset management plan are referred to as “levels of service.” The definition of these levels of service is directly tied to the values associated with different customer groups. Transit New Zealand

uses a variety of mechanisms to gather input on these values, including customer surveys, corridor management plans, input from targeted user groups, and input from other national agencies such as Transfund and the New Zealand Police.

The asset management plan includes an extensive list of level of service measures for all facets of the road infrastructure business. Many measures are used at the operating levels of the organization to guide maintenance decisions, while others include those identified in the statement of intent. Some level of service measures highlighted in the plan include the following:

Safety

- Number and cost of crashes
- Number of curves per kilometer compatible with speed environment
- Number of bridges with inadequate width
- Percentage of state highway system that conforms to paved width standards
- Number of passing lanes

Efficiency

- Percentage of curves that meet the threshold ratio of “travel time if all curves meet target design speed to current travel time”
- Percentage of compliance with the target of restoring single-lane access within 12 hours of a substantial end to an emergency event (such as avalanches, rock falls, washouts, and flooding)
- Number of bridges that are weight restricted below what is legally permitted without an overweight permit
- Percentage of the state highway network meeting pavement condition thresholds for roughness, rutting, skid resistance, and texture

Road users

- Percentage of satisfied (“good” or “better”) users for overall network, traffic flow, road safety, road surface, road markings, rest areas, and environment

Table 11 shows how the asset management plan is relevant to the key goals adopted by Transit New Zealand.

Transit New Zealand values its asset base at close to NZ\$15 billion (US\$11 billion) for replacement cost and NZ\$12 billion (US\$8.8 billion) for depreciated replacement cost. The sense of the scan team was that Transit New Zealand has a much better handle on asset valuation and asset management than most U.S. State highway agencies.

Table 11. Relationship between asset management and Transit New Zealand's goals.

Key Goal	Asset Management Plan Relevance	Key Customer Values
Plan and develop an integrated, safe, responsive, and sustainable state highway system.	The goal establishes the need for sound asset management planning with a focus on long-term asset sustainability.	Accessibility Aesthetics Affordability Communication Consistency Convenience Core Effectiveness Efficiency Environmental Stewardship Integration Involvement Knowledge and Skill Leadership Navigation No Surprises Protection of the Asset Relationships Reliability Responsiveness Safety Social Benefits Sustainability Understanding
Maintain, operate, and protect the state highway system.	Achieving this goal is the purpose of the life cycle management section of the plan—asset integrity is a fundamental outcome.	
Exercise social and environmental responsibility in all our activities.	Triple bottom line reporting measures for assets—social, environmental, and economic.	
Obtain funding that is adequate to ensure an affordable, integrated, safe, responsive, and sustainable state highway system.	Long-term funding requirements to achieve this goal are documented in the 10-year plan.	
Lead the transport industry in terms of roading solutions and the skills of our people.	The plan is a means of demonstrating best-practice asset management.	
Interact and communicate effectively with road users, communities, and their representatives.	The levels of service need to be based on effective consultation about tradeoffs and available alternatives.	
Maintain good relationships and work effectively with stakeholders and related organizations.	The plan is a means of communicating with stakeholders about state highway assets.	

Private Delivery of Services

When Transit New Zealand was created by the Transit New Zealand Act of 1989, the legislation also required all highway maintenance and construction contracts to be competitively bid. With more than NZ\$500 million (US\$366 million) of maintenance and capital improvement projects each year, the requirement to bid all maintenance services competitively presented a significant challenge to Transit New Zealand. For maintenance, the agency identified three types of procurement models, and made a strategic decision to target by expenditure about one-third of all maintenance work for each model. These three models were the following:

- **Traditional**—Transit New Zealand staff supervise professional service consultants who manage maintenance service contracts, known as Network Maintenance Management Contracts. These service contracts were written to require specific activities (such as maintenance, vegetation control, pavement marking, etc.), each subject to a physical works contract, making this an output-based model. Contract length was for three years.
- **Hybrid**—This model used a similar tiered structure

for responsibility, but the lump-sum service contracts were written as outcome-based contracts that relied on performance measurement, reporting, and self-auditing. These contracts were designed for a five-year timeframe.

- **Performance Specified Maintenance Contract (PSMC)**—These lump-sum, 10-year contracts cover all products or services associated with road maintenance. Similar to the hybrid model, performance criteria are incorporated into the contract that relate to the overall goals of Transit New Zealand.

The differences in these three types of models are shown in table 12 (see page 58).

The interest of the scan team in these different forms of service delivery relates to the linkage between organizational outcomes and strategic performance measures defined by corporate management. By using performance-based contracts, Transit New Zealand is providing a means for vertically integrating strategic corporate directions and decisionmaking with the day-to-day operations of the organization,

Table 12. Comparison of different maintenance business models in New Zealand.

Model	Traditional	Hybrid	PSMC
Contract Type	SOR with LS elements	LS with SOR elements	LS
Delivery Method	Independent suppliers	Independent suppliers	Single supplier
Focus	Output	Output-Outcome	Outcome
Scope	Divided large	Undivided medium	Undivided large

Note: SOR is schedule of rates; LS is lump sum.

“Key performance indicators will be dramatically different if sustainability is the key driver for decisionmaking.”
 —Transit NZ Official

Observations From Transit New Zealand on Performance Measurement

- Determining what should be the key measures or indicators is difficult because of a lack of clarity in goals.
- More is not necessarily better.
- Cost and difficulty of collecting and reporting data is regularly underestimated.
- Are we interested in trends or absolutes?
- How do we influence organizational or individual performance with performance measures?
- Intense focus on achievement sometimes has unexpected outcomes.
- Careful consideration of performance measures helps clarify organizational direction.
- “Sticks and carrots” associated with performance do change both individual and organizational behavior.

and the decisions made in the field relating to ultimate outcomes.

Observations

Transit New Zealand and other New Zealand government agencies face a potentially important shift in the policy context of their strategic and tactical activities. The government’s new policy on sustainability and the requirement that government agencies show how their actions will help achieve a sustainable New Zealand represent an organizational culture shift of great significance. Before this policy change, Transit New Zealand was a highway agency operating with environmental constraints. Now, there is encouragement to mitigate, to a wider extent, the environmental health effects of the state highway network. Transit New Zealand officials expect that the agency will have to do things differently, and that key performance indicators will have to be developed that reflect transportation’s contribution to sustainability. This means Transit New Zealand will have to become more involved with actions traditionally outside its purview, such as demand management, land use management, and pricing. This policy shift will be implemented in a short timeframe. Transit New Zealand engineers are already looking at environmental mitigation investments and less intrusive designs (e.g., tunnels).

Such a shift in focus, of course, does not occur easily if the organization is incapable of understanding and implementing the change. As one Transit New Zealand official noted, “A new skills set is needed. . . . In responding to this new policy, we could very well have an organization of the wrong type.”

The scan team also found the following observations of great interest:

- Transit New Zealand uses customer/stakeholder surveys to provide data for certain performance measures. In some cases, officials admitted that the survey data was a placeholder until other types of measures could be defined. They made the point, however, that the survey results of greatest interest relate to customer dissatisfaction and, in particular, agency activities those surveyed were most dissatisfied with.
- Transit New Zealand's performance measures are aligned with the levels of decisionmaking that occur in the organization. For example, more strategic measures are used in reports to the Minister of Transport (and agreed on in the annual performance agreement between Transit New Zealand and the minister). Organizational measures are used internally to determine how well Transit New Zealand is doing. Operations-level performance measures are used to assess specific types of performance (e.g., pavement condition measures). Finally, some performance measures are used simply as a reporting means to other organizations, such as Transfund and Austroads.
- Transit New Zealand has undertaken a process over time of focusing on the most important targeted measures. In the 1990s, for example, officials identified about 240 different performance measures/indicators being used in the organization. This was filtered down to 34 key measures, with five ministerial measures at the top of the list. As the scan team observed at other sites, Transit New Zealand was trying to define what was really important to the organization.
- The Land Transport Safety Authority has adopted a total social cost approach to estimating crash costs as part of its performance indicator effort. Thus, more than just the immediate costs of crashes are incorporated into its monitoring of transportation system performance.
- Uncertainty surrounding the measurement of government-defined policy goals (e.g., sustainability) has led to questions on whether the current suite of performance monitoring can realistically provide a sense of whether the transportation sector is contributing to their achievement. As noted above, Transit New Zealand officials are struggling with this issue. No matter how this effort turns out, the desire to achieve higher levels of sustainability and the implications to programs such as those in the Ministry of Transport's portfolio provides Transit New Zealand with a license to engage in a national dialogue that can lend clarity to the issues. As one Transit New Zealand official noted, "Simply measuring the trend toward sustainability achievement is perhaps more valid than measuring absolutes."
- Having the right people involved with an outcome-oriented organization becomes a critical challenge to corporate management. Transit New Zealand has instituted a graduate training program designed to expose its employees to different customer/stakeholder perspectives on road program development and management. A new graduate rotates on an annual basis within the agency, then with a contractor or consultant to gain external experience in design and project management, before final placement at the agency. Through each rotation, the respective organizations agree on the trainee's employment arrangements. Although officials noted that some trainees leave the agency for higher-paying jobs, the desire to work overseas and gain wider experience was the main driver for leaving. They believe this exposure to different perspectives serves the long-term growth of the agency well.

Safety: From Platitudes to Performance

As noted in preceding chapters, the scan team observed one of the most impressive applications of performance measurement—including its impact on agency decisionmaking and resulting outcomes—in the area of safety. Particularly in Australia and New Zealand, but also in British Columbia and Japan, government policy has been to focus resources—engineering, enforcement, and education—on the goal of reducing road fatalities and injuries. The way this has occurred illustrates well the impact performance measurement can have on ultimate outcomes.

Before discussing the steps resulting in these outcomes, it is perhaps most appropriate to begin with what countries have been able to accomplish. Figure 27 shows the trends in road-related fatalities for two Australian states. As can be seen, the record is impressive.

Although each country and state has approached road safety in its own way, several common steps in their approaches provide important lessons to those interested in putting in place a planning and decisionmaking process that could have as significant an impact. These steps are illustrated below with examples from sites visited during this scan.

Step 1: Understanding the Problem

Before one can identify the types of strategies or investments that could reduce the road toll, one must understand the problem itself. This means not only understanding the big picture from the perspective of numbers and incidence of road-related fatalities and injuries, but also becoming knowledgeable about the leading factors that cause such an outcome. The best examples of a performance-based approach to improving road safety began with the comprehensive collection and analysis of data, which often included conducting research on the most important factors leading to a fatality or personal injury.

For example, the Japanese know through detailed analysis of crash data that a disproportionate number of crashes involve pedestrians and bicyclists, and that a large percentage of these involve elderly individuals in crashes close to home. This knowledge led the Ministry of Land, Infrastructure, and Transport to emphasize pedestrian-oriented safety measures in its performance measurement and in the strategies adopted to improve this record.

In Victoria, analysis of crash data showed that in rural areas, run-off-the-road crashes were by far the most significant type of fatality crashes, while in urban areas, side hits were at the top of the list. In addition, in Victoria, New South Wales, Queensland, and New Zealand, the high incidence of alcohol-related fatal crashes and excessive speeds led to targeted enforcement measures that have had an important impact. As seen in figure 28 (see page 62), VicRoads research indicates that in a 60 km/h (37 mi/h) speed zone, for every increase in travel speed of 5 km/h (3 mi/h) above the limit, the risk of casualty crash involvement doubles. This result has been a cornerstone for a public education/marketing safety campaign.

Another example of understanding the characteristics of the crash phenomenon is found in Queensland, where Queensland Transport conducted detailed analysis of crash data to determine which factors are more likely to be present when fatalities occur. Figure 29 (see page 62) shows the type of analysis that served as the foundation of this assessment.

Step 2: Establish Institutional Leadership, Responsibility, and Accountability

All of the countries, states, and provinces the scan team visited had fairly clear lines of responsibility for implementing the safety program. In Victoria, a ministerial

Figure 27. Record of road fatalities in New South Wales and Victoria.

Road Toll, Registered Vehicles, Licences and Population in NSW, 1949 - 2003 (Base Year = 1949)

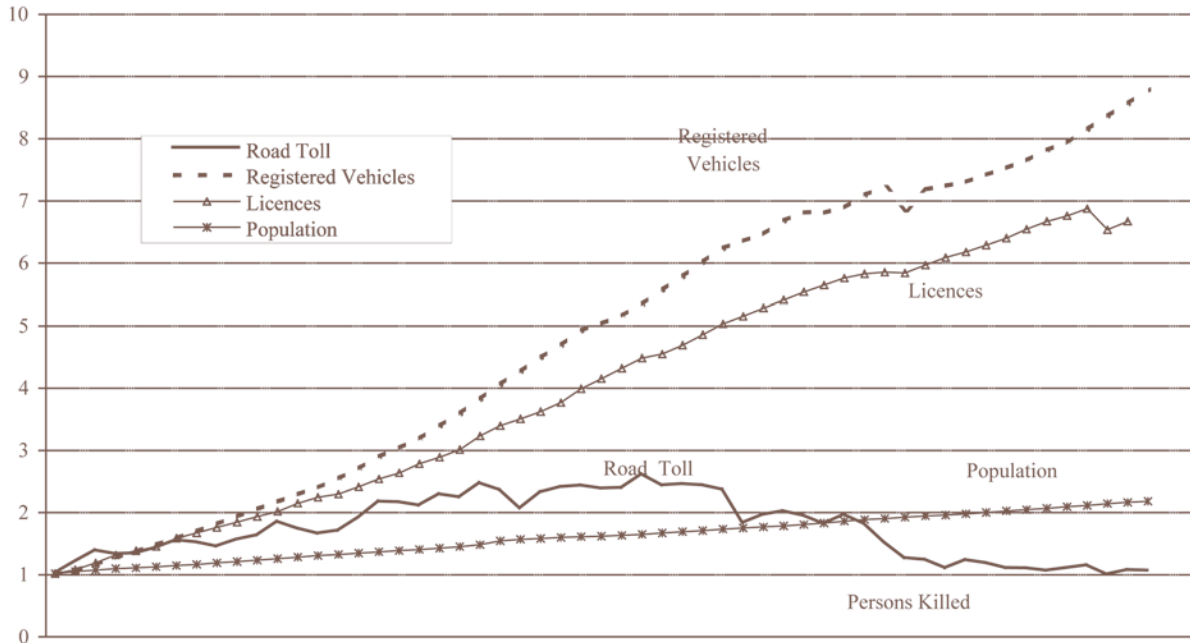


Figure 27a. New South Wales road crash toll.

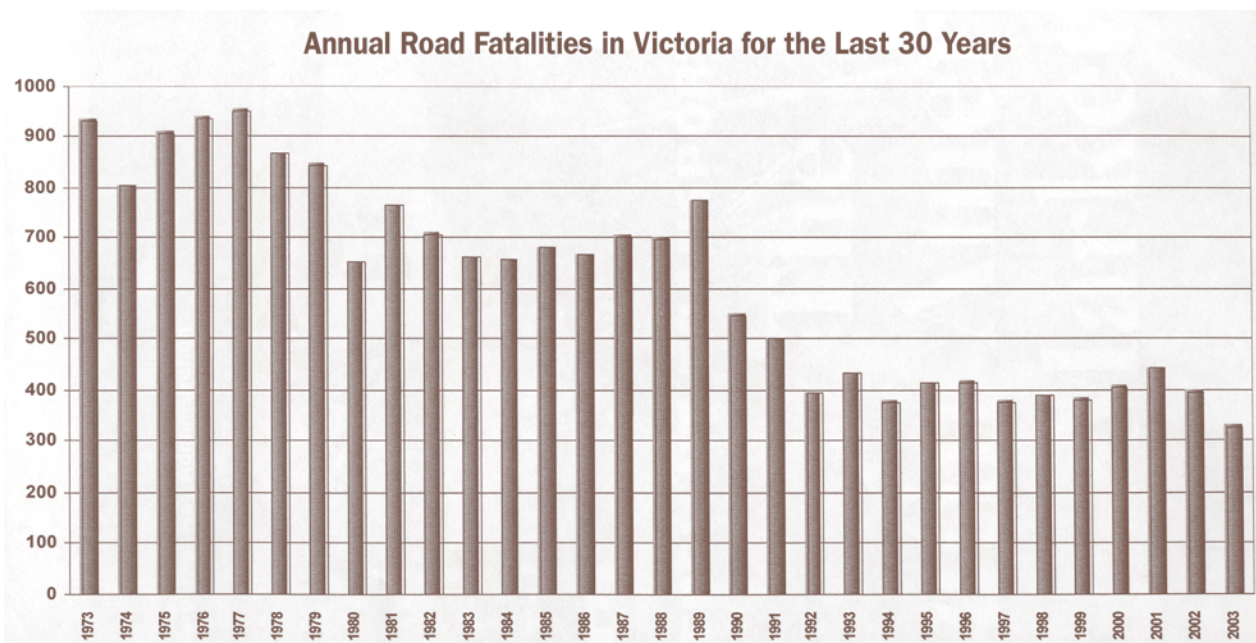
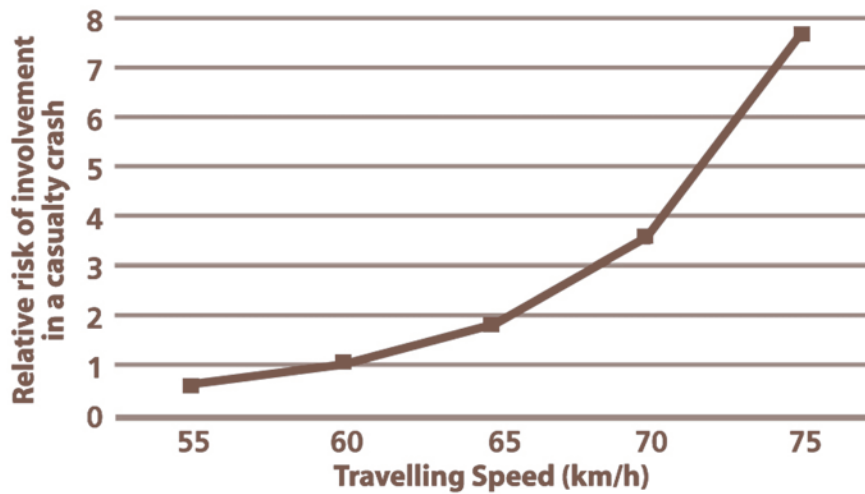


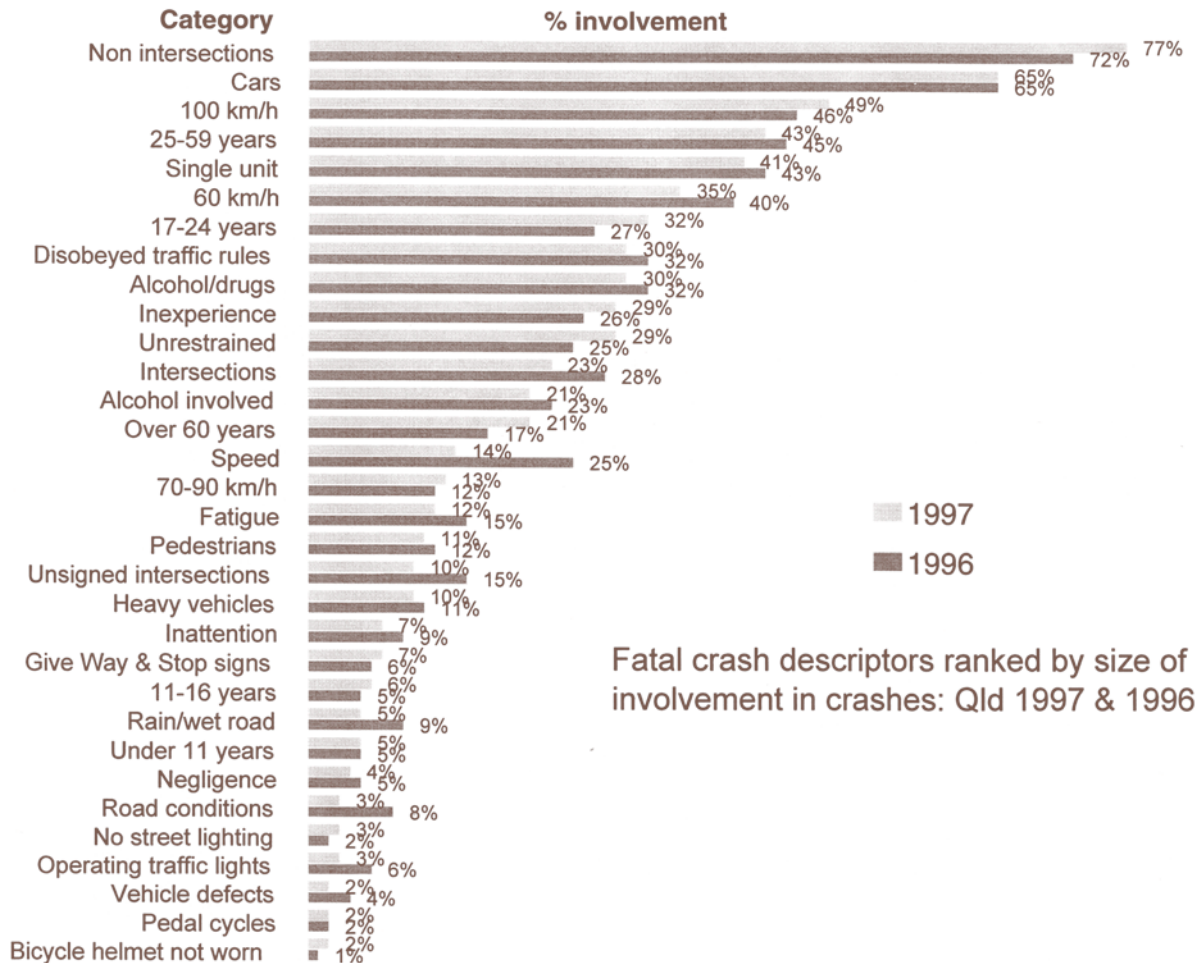
Figure 27b. Victoria road crash toll.

Crash Risk by Travel Speed in a 60km/h Zone



road safety executive committee has been established consisting of the Ministers for Roads, Transport, Police, and the Transport Accident Commission. In New Zealand, a National Road Safety Committee includes representatives from the Land Traffic Safety Authority, Ministry of Transport, Transit New Zealand, Transfund New Zealand, New Zealand Police, Accident Commission, and local governments. The purpose of this committee was to act as a forum for “communicating, coordinating, and agreeing to top-level strategy between agencies on road safety issues.” In New South Wales, RTA is the lead road safety agency, and to carry out its mission it has developed strong partnerships

Figure 28. Crash research results in Victoria.



Fatal crash descriptors ranked by size of involvement in crashes: Qld 1997 & 1996

Figure 29. Ranking crash-related factors in Queensland.

with the New South Wales Police for enhanced enforcement, Motor Accidents Authority for education campaigns, Department of Corrective Services for alcohol programs, Department of Education and Training for school and youth education programs, local governments for a Road Safety Officer program, Department of Health for injury risk management research, and many others such as the attorney general, transport service providers, and community groups.

In British Columbia, the Ministry of Transport meets regularly with representatives of the Insurance Corporation of British Columbia (ICBC) and Royal Canadian Mounted Police (RCMP) and other agencies to coordinate approaches to enhancing highway safety. The Ministry of Transport and ICBC use a common database derived from police reports. The Ministry of Transport's Highway Accident System is both a database and a main analysis tool to support business cases for capital improvement projects. RCMP and the Ministry of Transport have been proactive about sharing experiences and conclusions to advance safety initiatives. ICBC prepares an exhaustive annual report on traffic collision statistics (available at www.icbc.com/Library/research_papers/Traffic/index.html.)

Two observations from the scanning study on the institutional structure for safety are of interest. The first relates to the role of the police in the safety program. Similar to the United States, police agencies are critical partners in any road safety program and, in Australia and New Zealand in particular, work closely with the transportation agencies to implement the government's safety policy. The team's impression was that this coordination is much closer than often found in the United States, most likely because in several instances the police agency is a state (or in New Zealand's case, a national) organization. That means police agencies answer to the same executive authority as transportation agencies, and have their own performance measures linked to the desired outcomes of the government's policy. Second, in British Columbia, Australia, and New Zealand, government-created third-party insurance corporations play important roles in road safety. In both British Columbia and Victoria, for example, these public corporations annually invest in projects aimed at improving the safety record, including road safety construction projects.

Step 3: Define Desired Outcomes

The best examples of performance-based safety planning were based on clear desired outcomes, most often ema-

nating from government policies. In Japan, the government has established a target of 30 percent reduction in injury crashes at the country's top crash locations. In Victoria, the government has established a 20 percent reduction in road-related fatalities as its 2007 goal. In some cases, desired outcomes could relate to specific markets or user groups, such as reducing fatality and personal injury crashes involving young drivers, while in others they could focus on specific causes of crashes, such as reducing alcohol- or drug-related crashes. No matter the focus of the desired outcome, a key factor in all of the effective performance measurement efforts found in this scan was establishment of an achievement target. By setting such a target, the agencies responsible for helping achieve this outcome became more involved in understanding how their actions could help its achievement.

Step 4: Identify Performance Indicators

Once a goal has been established or articulated, the next step is to identify performance indicators that relate to both the desired outcome and the organizational outputs expected to lead to that outcome. Chapter Two described the types of indicators used to monitor both transportation system performance and process accomplishment in the countries the team visited. In most cases, transportation agencies have adopted a range of indicators, usually with "number of fatalities" as the most important measure. In several cases, this was reported along with fatalities per 100,000 inhabitants, fatalities per 10,000 motor vehicles, and crash rate per million vehicle-kilometers traveled.

Another important observation on fatality indicators is that, in some instances, the agencies have adopted a total societal or social cost approach to measurement. This implies that the impact on society of a death is valued in a fairly broad context.

Step 5: Compare With Other Experiences

All of the sites the team visited compared their safety (as well as other) performance measures with those found in other jurisdictions. This was done primarily to determine whether the record was out of the ordinary. In most cases, this comparison became a screening tool to identify major differences. If significant differences were found, this led to further examination to determine why. Was it simply because such significant differences existed among the jurisdictions that the comparisons were invalid? Or could the differences in the results be linked to government actions that had affected the outcomes?

A typical comparison effort is shown in figure 30. In this case, VicRoads compared the safety experience in Victoria with that of other Australian states and selected other countries. It is interesting to note that Australian officials looked mainly at the Netherlands, Sweden, and the United Kingdom as models to emulate.

Step 6: Develop and Implement a Systematic Safety Data Collection and Analysis Process

A key to the success of national and state road safety programs is the existence of a data collection and analysis system that provides continual information on the safety performance of the transportation system.

“There is no need to collect all of this data on crashes if you are not going to use it to make decisions!”

—VicRoads Official

This information is used to monitor progress toward performance targets, identify topics or areas where further action is necessary, educate officials and the public on the importance of the topic, and evaluate the effectiveness of implemented projects and strategies. The best road safety programs had at their foundation a systematic and comprehensive database management and analysis program. These programs were called by different names, including the Crash Analysis System in New Zealand and the Road Crash Information System in Victoria. The key was to take the data being collected on a wide range of factors linked to road safety and turn it into information that transport and road safety officials could use to determine the most cost-effective actions to meet their performance targets (see figure 31 on page 66).

In each case where this database management capability existed, it used geographic information system (GIS) technology to portray the locations and characteristics of the most recent crash history. In Victoria’s case, this was done daily. VicRoads’ Road Crash Information System provided up-to-date information on the status of program and project implementation, identification of the worst locations for different types of crashes (e.g., where did most of the run-off-the-road crashes occur?),

public information on crash statistics, updates on the government’s performance indicators, and trends in safety characteristics that allow transport, safety, elected officials, and the public to determine the severity of the road safety challenge.

Step 7: Develop a Safety Plan and Integrate it into Agency Decisionmaking

In the Australian states and New Zealand, the government developed a road safety plan that outlined the road safety problem, challenges being faced, performance targets that had been established, actions being considered, and institutional responsibilities for carrying out the plan. Often, these plans were not developed by the transportation agencies, but by the government. Because of the way government is structured, these policies have been incorporated into the planning, program development, and performance monitoring activities of the transportation and safety agencies in each jurisdiction. As noted in the VicRoads’ *Road Safety Strategic Plan 2004/05*, the government’s strategy called *arrive alive!* “continues to provide the overarching strategic direction for VicRoads’ Road Safety Program, with a target to reduce annual death and serious injuries from road crashes by 20 percent by 2007.”

Safety plans usually consisted of a range of strategies, actions, and projects. Identifying the most appropriate combination of actions comes from both a technical process that identifies the likely effectiveness of different strategies and a political/public assessment of what might be feasible. Figure 32 (see page 66) illustrates conceptually the process that the Land Transport Safety Authority in New Zealand went through to identify the most appropriate direction for its safety program. This process included a technical analysis of strategies most likely to have the greatest impact, and a public outreach effort that sought feedback from groups on what they thought was the best direction. In this case, the package of actions chosen included a mix of enforcement and engineering strategies.

Step 8: Monitor Effectiveness of Implemented Strategies and Actions

One of the most important (and impressive) actions undertaken by the Japanese, Australians, and New Zealanders was determining the effectiveness of implemented strategies and actions. For example, in New Zealand and all of the Australian states visited, transportation officials had a good sense of the impact each implemented strategy had on reducing fatalities and personal injuries. Figure 33 shows an assessment from

National Comparisons						
State	Deaths per 10,000 vehicles (12 months to Feb)			Deaths per 100,000 pop (12 months to Feb)		
	2004	2003	2002	2004	2003	2002
NSW	1.42	1.47	1.40	8.44	8.57	8.06
VIC	0.92	1.15	1.29	6.58	8.11	8.99
QLD	1.29	1.27	1.36	8.79	8.49	8.92
SA	1.43	1.44	1.50	10.14	10.12	10.44
WA	1.23	1.30	1.21	9.15	9.53	8.82
TAS	1.35	1.07	1.65	9.63	7.60	11.65
NT	4.98	5.48	4.65	26.21	28.78	24.27
ACT	0.46	0.62	0.58	3.10	4.04	3.75
AUST	1.25	1.33	1.37	8.36	8.76	8.89
AUST minus Vic	1.37	1.40	1.40	8.95	8.97	8.86

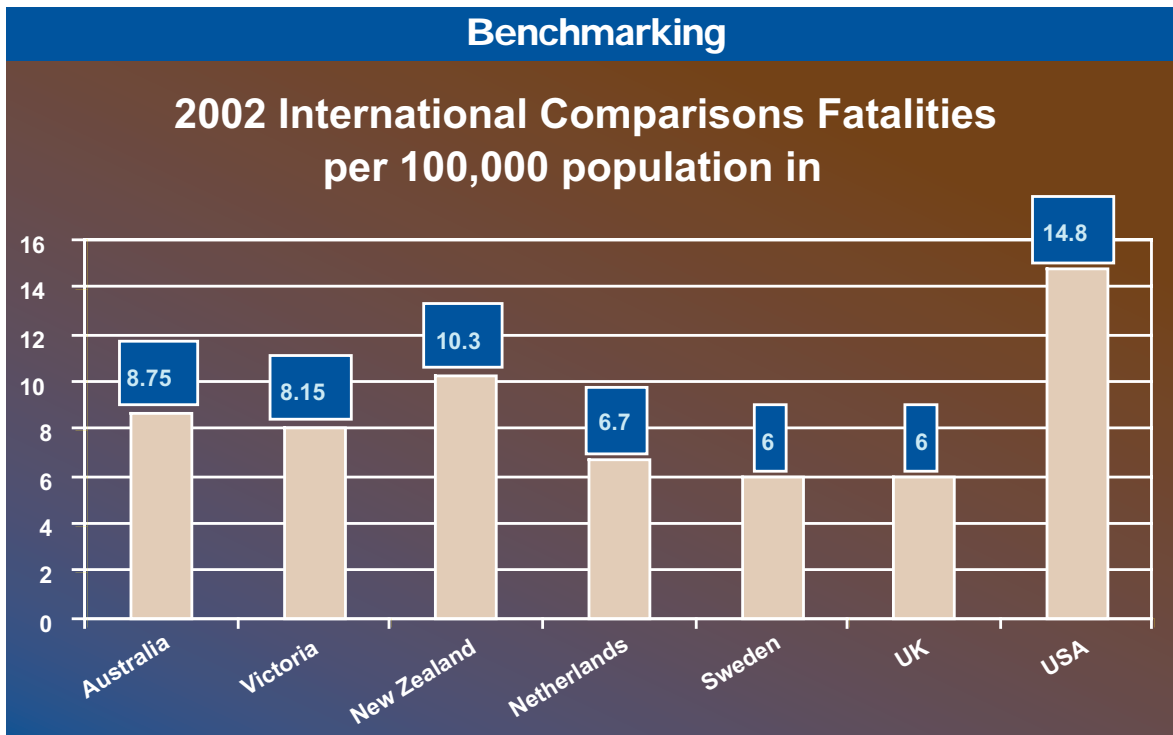


Figure 30. Examples of crash data comparison by VicRoads.

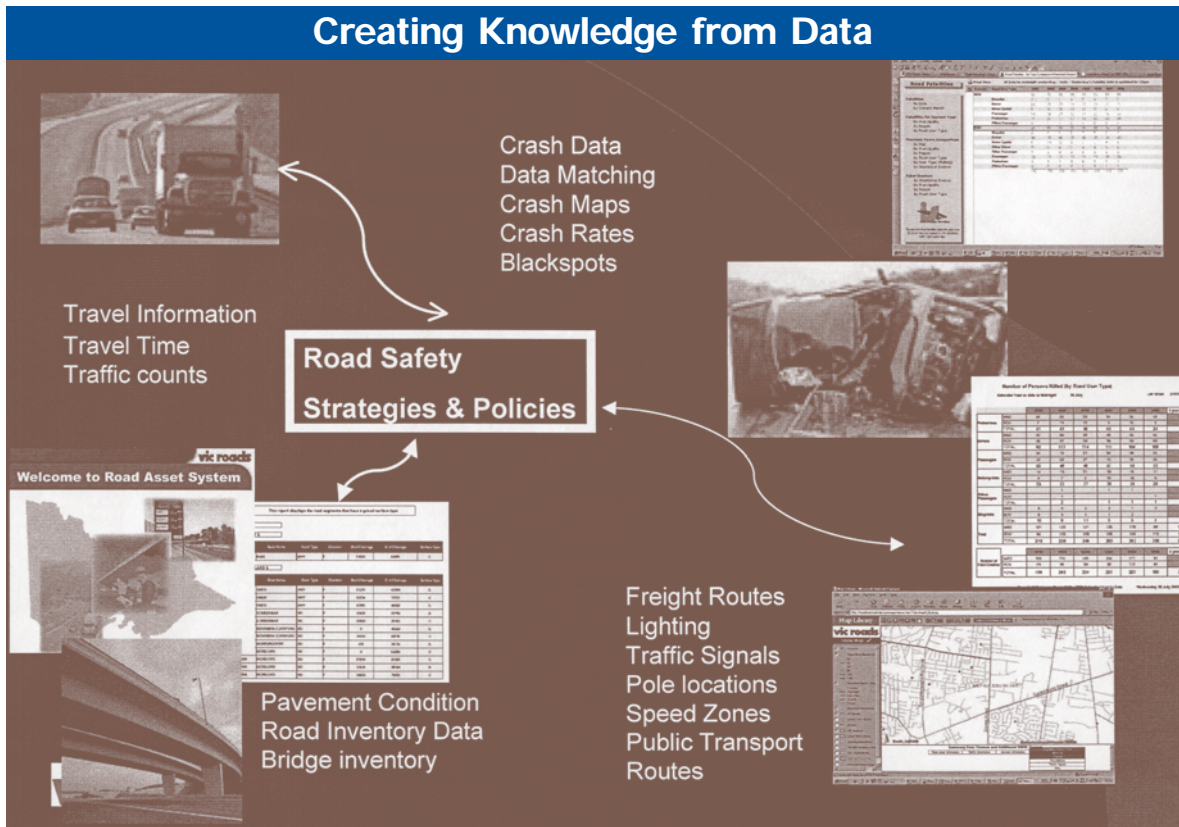


Figure 31. Creating road safety knowledge from data at VicRoads.

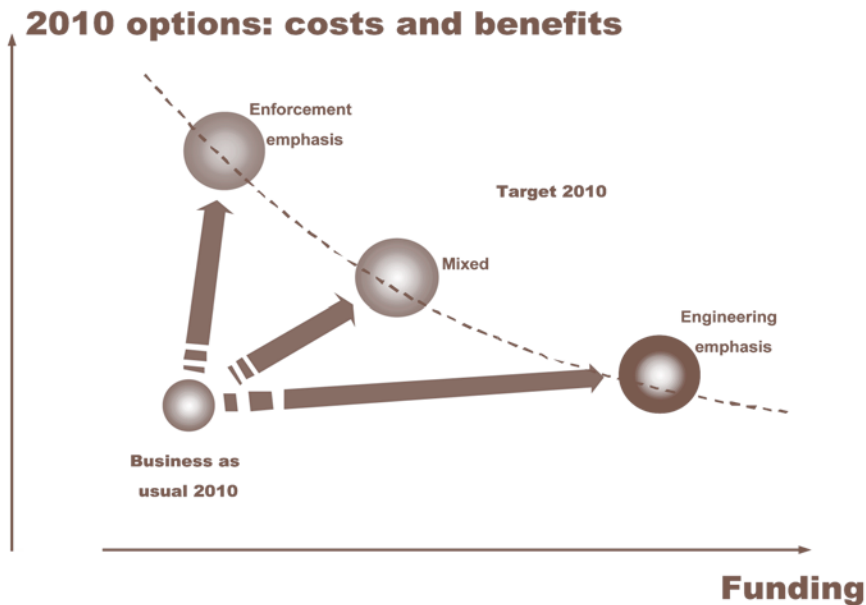


Figure 32. Safety program analysis in New Zealand.

Queensland and Victoria that relates reduction in fatalities to government action.

The team observed another interesting example showing the effectiveness of safety actions in Melbourne, where Victoria police use speed cameras (with advance warning signs) and ticketing through the mail to reduce the high levels of speeding occurring on Melbourne roads. When research showed that high speeds were a major contributor to fatalities, the government implemented an aggressive speed-enforcement effort. Using of both fixed and mobile speed cameras has had a significant impact on speeds, as figure 34 (see page 68) shows.

Road fatality models Queensland by year: comparison of program and system performance: last 10 years

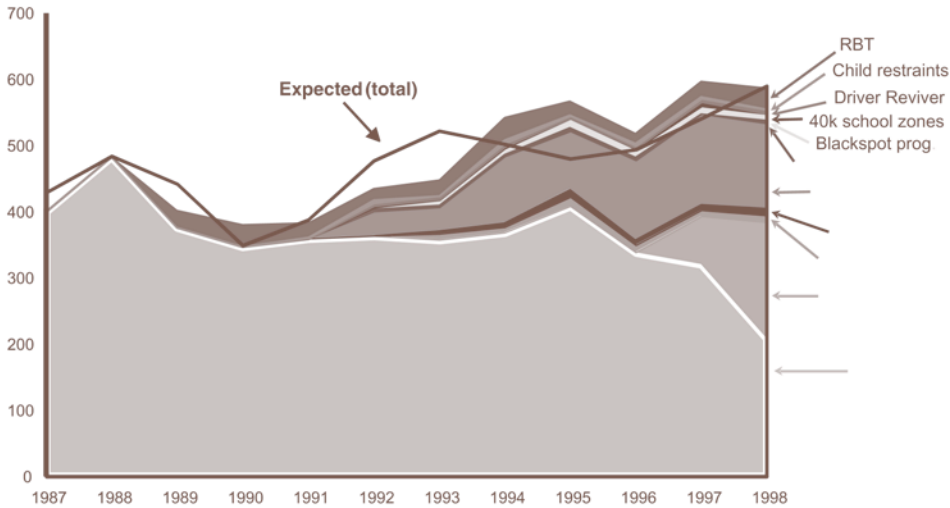


Figure 33a. Effectiveness of safety actions in Queensland.

The most effective safety programs the scan team observed in its study used the eight steps described above. Although some actions used in these programs could be difficult to implement in many U.S. jurisdictions, such as random breath and blood tests and widespread use of speed cameras, the scan team believes much can be learned from the Australian and New Zealand experience. In particular, the way road and safety officials have integrated safety concerns into their agency's planning and decisionmaking and the importance they place on safety performance measures present a useful roadmap on how the United States could elevate safety concerns to a higher level.

Victoria's Road Toll 1970-2003

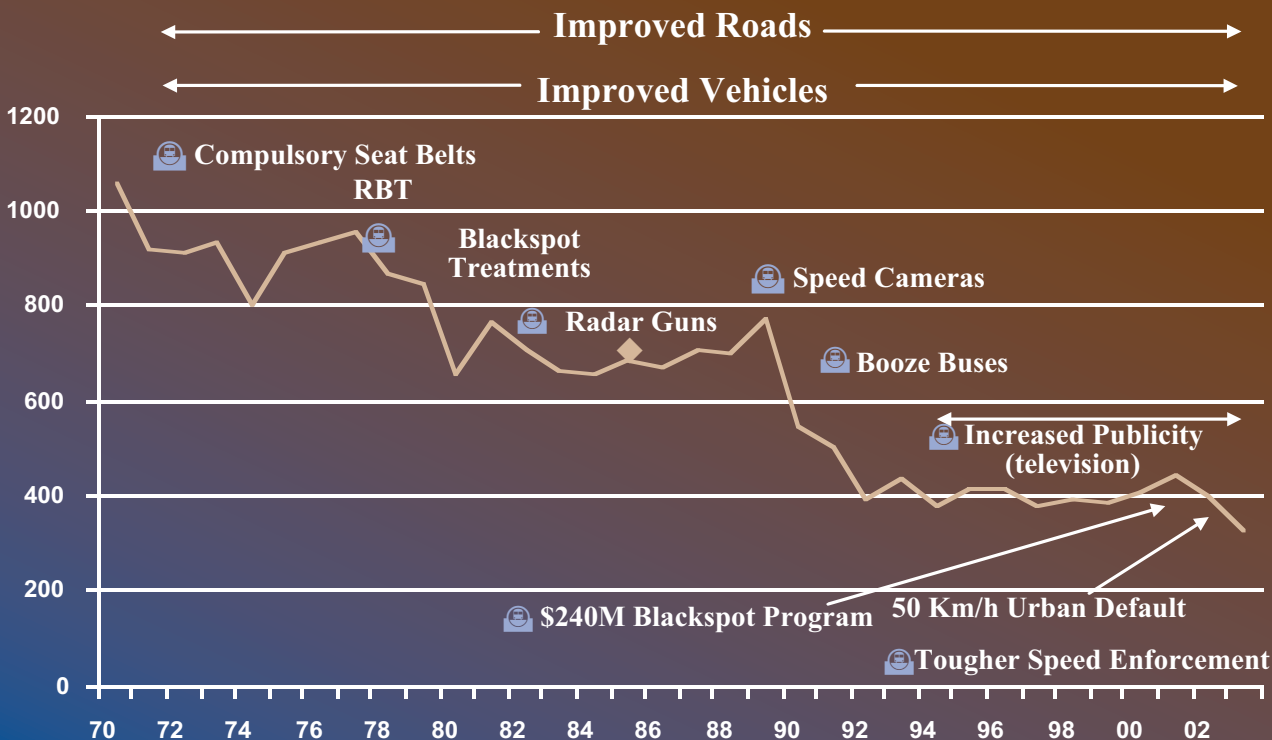


Figure 33b. Effectiveness of safety actions in Victoria.

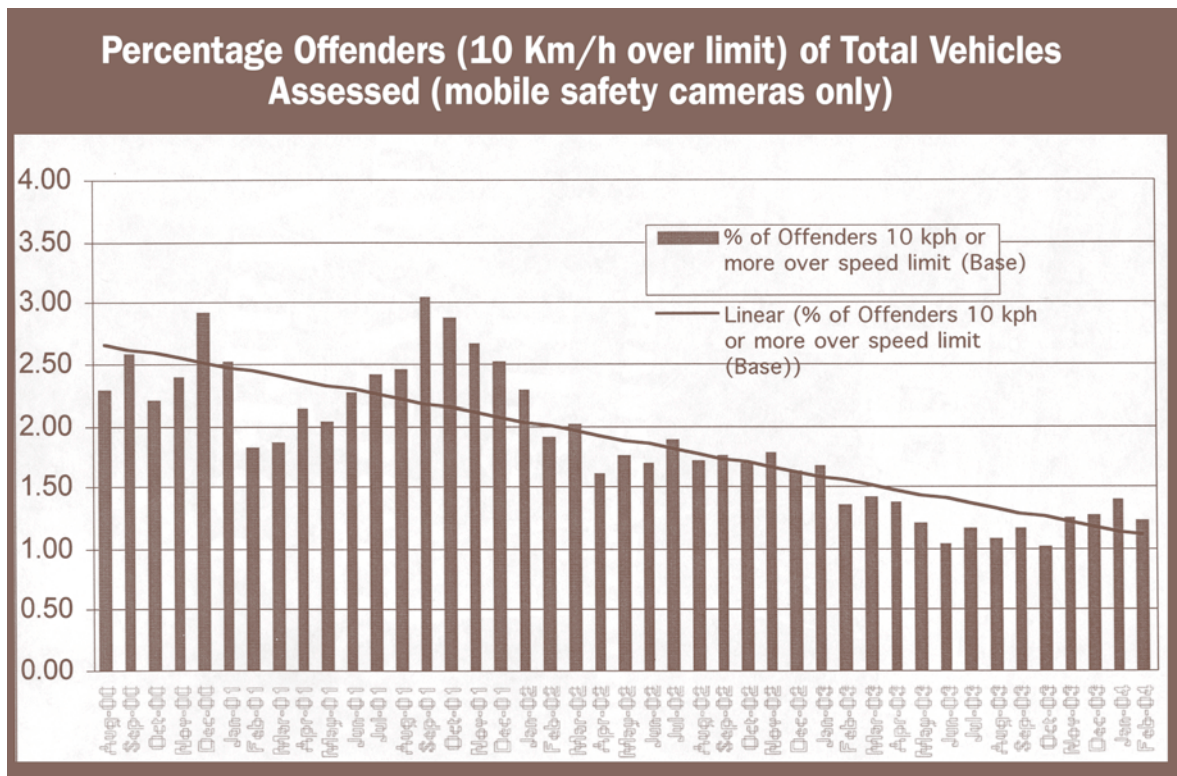
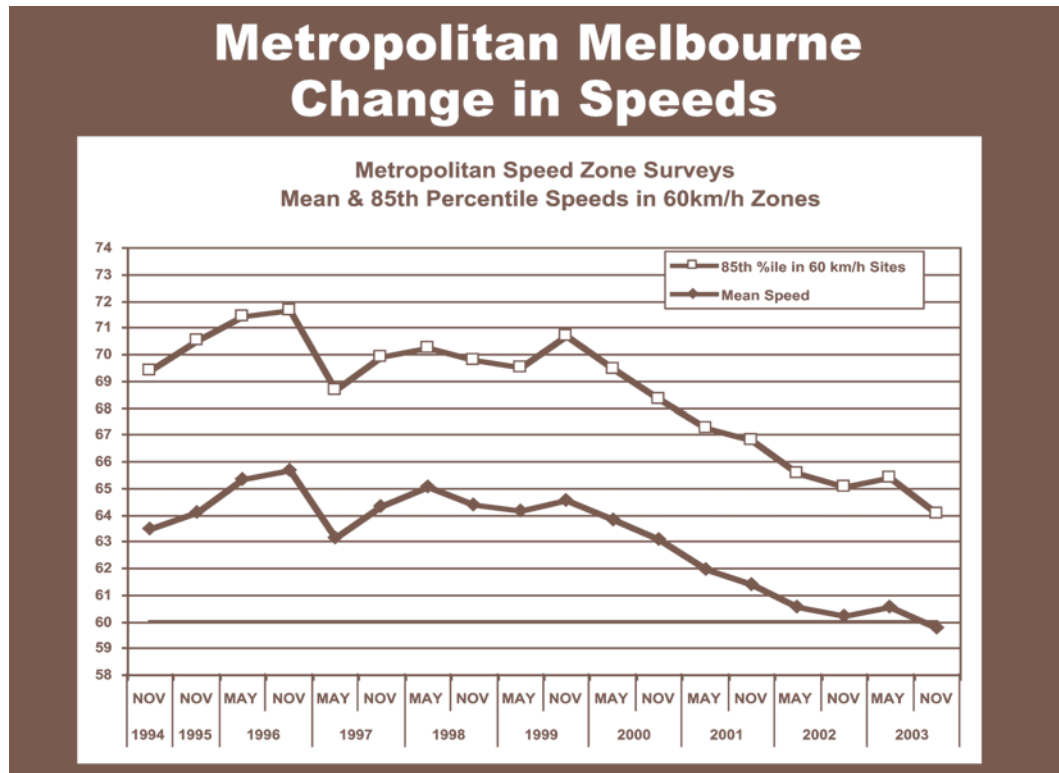


Figure 34. Impact of speed camera enforcement on road speeds in Melbourne.

Observations and Lessons Learned

General Observations

The scan team has identified the following observations on the use of performance measures that would be of interest to officials in the United States. Many of these observations are of broad interest to transportation professionals, while others are of interest in a specific context.

1. The scan team found examples in which **the processes of setting priorities and making planning, investment, and management decisions use performance measures to a much greater extent than is typical in the United States**. In cases where performance measures were used for priority setting, the process of using such measures represented a new level of organizational behavior. The vertical integration of information flow represented in the use of performance measures for different levels and purposes of decisionmaking characterized the better examples of performance measurement. The scan team did note that where overall policy goals and important performance measures were set primarily in a political process, transportation agencies often struggled to determine how the desired performance could be achieved.
2. Perhaps the most impressive application of performance measurement, in terms of showing how the process can influence governmental policy and budget determinations, was in the area of **road safety**. Impressive results in reducing fatalities and injuries have occurred in some of the sites the team visited through a comprehensive program of engineering, enforcement, and education. Especially in Australia, the team noted that performance measurement activities of VicRoads in relation to safety were impressive, and should be understood and considered carefully by U.S. officials.
3. A **common framework** to performance measurement was apparent in all cases the team examined. Each effort was related to a broader set of goals and objectives defined either by a legislative body or through a public visioning process. These goals and objectives led to the identification of transportation system-specific performance measures, often tied to the target values to be achieved in a future year. Strategies and investment actions were then chosen on their effectiveness in achieving desired performance outcomes, as well as on political considerations.
4. Transportation officials in the countries visited appeared to have a general understanding of the difference between the concepts of **outcomes and outputs**. Outcomes were viewed as the ultimate characteristic of transportation system performance, while outputs were the products and services of the organizations that led to these outcomes.
5. In each case, transportation officials explained the initial movement toward performance measurement as a means of providing **greater accountability and visibility to the public** of the agency's activities. Different targets for credibility were apparent in the approach taken to performance measurement. In some cases, the initiative to enhance agency credibility reflected a desire to show legislative bodies that the agency was managing the transportation program efficiently and effectively. In others, the performance management effort targeted the general public to increase perception of agency performance. In still others, the effort resulted in enhancing the credibility of agency activities in the eyes of other agencies that held an important place in transportation program development (e.g., the environmental protection agency in Brisbane allowed transportation agencies to self-certify their environmental activities).
6. In addition to accountability and public visibility, many officials commented that performance measurement can be used to **educate both elected decisionmakers and the general public** on the role trans-

portation plays in society and/or the need for additional investment.

7. Performance measurement was applied at several **different levels of planning and decisionmaking**. For example, many measures were targeted at strategic investment decisions on long-term improvements to the transportation system. In other cases, performance measures were used to manage network operations (e.g., the rail system in Queensland and the tram system in Melbourne). Different levels of application usually meant the use of different performance measures.
8. In Japan, the national ministry established a **core set of 17 performance measures** as a guide for all regional offices and prefectures (states) in the country. In addition, the prefectures could **establish their own measures** appropriate to their circumstances. This was an example of a phenomenon common to all applications—the need and desire to determine a **small set of measures that were really important to an agency**.
9. All of the sites visited used measures commonly used in the United States. **Road network congestion** was a transportation system measure found in all of the performance measurement applications examined. Officials often viewed this as one of the important issues facing their region and agency. Other network measures included **accessibility and mobility** provided by the transportation system, **road safety, travel time, and trip reliability**. The latter measure was found in the performance measures in Australia, British Columbia, and New Zealand. Understanding trip and travel time reliability is an important underpinning for developing incident management programs and implementing other actions to deal with nonrecurring congestion.
10. **Environmental measures** were also present in all of the performance measure efforts the team examined. Of all the performance measurement categories examined in this scan, environmental measurement was the one creating the greatest challenge to transportation agencies. The team found few examples in which environmental outcomes had been identified and the relationship between outcomes and transportation system performance had been defined, although Transport Canada has developed an important framework for establishing this relationship. An interesting challenge is occurring in New Zealand, where government policy requires transport agencies to define how their programs will help achieve a sustainable land transport system for the country.
11. **Measures of customer satisfaction** were found in all of the sites visited. The measures most often related to the average scores obtained from public surveys (target values in some cases were quite low, e.g., exceeding 50 percent public acceptability in Vancouver). Also, New Zealand's approach to customer satisfaction measures focused on identifying issues for which the customers were dissatisfied, and targeting organizational action to deal with those issues. One concern expressed by scan members was that customer surveys seemed to be used by many as a placeholder or crutch when more quantifiable measures could not be defined.
12. Measures relating to **transportation system security** were not found in any of the highway and port performance measurement examples. In many ways, this was viewed as an American issue, although transportation officials in Queensland and New South Wales did say that security was becoming a more important issue and that a security indicator would most likely be incorporated into their performance management regime in the future. Also, the scan team did not interview many transit officials; the transit industry has made greater strides in measuring security than the highway sector.
13. Many performance measurement applications targeted **rural transportation network performance** as a specific category for measurement. This was particularly true in the Australian states visited, where each state has one major urban area dominating the state's economy. This was viewed primarily as a regional equity issue.
14. The level of **integrated data collection strategies** as they related to performance measurement varied from one site to another. In Japan, ITS technologies were used to collect data to support operations planning and decisionmaking, and they fed into system performance measurement (e.g., the use of probe vehicles). In Queensland, a data collection strategy is related to each performance measurement category that defines the overall performance measurement program. In New South Wales, a traffic management center is the cornerstone of RTA's efforts to collect data for system performance meas-

urement. In Victoria, VicRoads has an extensive data collection program that relies on ITS-type technologies. Some of the **more successful performance measurement programs occurred in data-rich environments** with a history of strong data collection and analysis.

15. **Before-and-after studies** were important elements of the performance measurement systems in Japan and Australia. The performance measurement cases the team examined in those countries paid considerable attention to discovering what impacts adopted or implemented actions have had on selected performance measures. The results of these studies act as feedback to the decisionmaking process and to determine the likely results of similarly adopted actions in other parts of the region.
16. **Graphic (and visual) presentation of performance results** was viewed as a key component of the performance-management process, as was the identification of measures that the public can relate to. Most officials involved in managing performance measurement efforts stated that unless top decisionmakers understand the information presented, performance measurement efforts will be ineffective. Visualization of information is thus critical to successful performance measurement.
17. **Comparing performance** against peer organizations and jurisdictions was used in Japan, Australia, and New Zealand to understand better the key factors distinguishing economic and transportation performance, compared to other states. This comparison effort was used simply as a screening tool to identify differences (in both quantity per capita and relative ranking), which then led to a more detailed examination of why those differences occurred.
18. The key measure of success for performance measurement itself is the degree to which it **influences decisions and budget allocation**. This was a difficult linkage to pin down during the scan visits. The most advanced application appeared to be in Queensland and Victoria, where the performance measurement process was important in determining program priorities for safety actions.
19. Few examples were found where performance measurement resulted in **multimodal investment tradeoffs**. In most cases, performance measurement was implemented in a modally focused agency, so

performance measures were targeted at decisions relating to the performance of the respective modal network.

20. **Measures relating to freight movement** were found in many performance measurement efforts. Examples of measures included commercial trucking travel time between economic gateways (British Columbia); mode split for goods movement (Vancouver); increase in average annual truck payload capacity, percent of illegally overloaded trucks, and freight rail delays and travel time variability (Queensland); and freight productivity, access to ports, freight rates, freight-related infrastructure condition, and congestion effects on freight movement (Victoria).
21. **Organizational productivity measures** were found in all of the performance measure applications studied. Agency managers viewed these as a critical element of the performance measurement exercise because they indicated the degree to which their agency was delivering the products and services needed to meet other performance objectives.
22. **Monitoring project delivery** through performance measures was also a common approach in most of the sites visited. An interesting aspect of this project delivery monitoring was the effort to assess project performance against project expectations.
23. In cases where performance management was most successfully institutionalized in agency operations, **top management leadership of and commitment to the process of development and continuous use** were essential to get performance measurement past its infancy. This was particularly important for agencies where the organizational culture and even the culture of the society itself were not conducive to open and responsive performance-based planning and decisionmaking.

Lessons for the United States

Similar to scan team observations, a large number of “lessons learned” came out of this scan:

1. **Safety was viewed as a strategic use of performance measurement** that has resulted in a significant decline in fatalities. The team believes a great deal can be learned from this application of performance measurement, especially as it relates to identifying strategies

and actions that need to be in place to achieve reductions in road fatalities.

2. Meaningful performance measurement is a **product of extensive outreach and discussion and collaboration with partners**. Performance measures are readily available and easy to create, but without a comprehensive (internal and external) outreach process, their value as a behavioral influencer is limited. Open, inclusive planning processes are fundamental to good measurement of performance.
3. In the best examples of performance measurement, officials were **still refining what measures to use and how to make sense of the political guidance** they received. This suggested that performance-based planning and decisionmaking are never-ending processes, and must be viewed as such by top agency officials. This also implied that an agency should not measure too many objectives, only what it needs to make business decisions. Too many measures can be a burden on staff.
4. The key to success for measurement is **accountability**. This translates into the need for understandable measures, and a systematic followthrough to determine the level of failure or success in meeting the objectives defined by the measure. This issue is important across all transportation areas, but has particular short-term relevance and application in the safety area.
5. Performance measurement is most relevant when **linked to decisionmaking, especially resource allocation**. Elements to consider include allocation of funding at the program and project level, multimodal tradeoffs, and distributional equity. A multimodal approach is best, although the team found few examples of such an approach. Performance measures position agencies well to engage in debate, but may not necessarily be the determining factor in a decision, especially in the legislative arena. Measures sharpen and focus the debate, and help clarify organizational direction.
6. **Quality systems have been put in place** and appear to be replacing externally defined quality criteria (e.g., ISO 9000). Many agencies are redefining quality and finding that the ISO process does not meet their needs.
7. For safety, **enforcement strategies were the key to changing driving behavior and affecting overall success**. The best-case examples go beyond the mandatory use of seatbelts (alcohol testing and speed enforcement) and are succeeding at reducing fatalities. In addition, the team found that engineering strategies were important elements of an overall safety program resulting in significant short- and long-term improvements.
8. **Analysis is an important underpinning** for setting targets and determining the effectiveness of actions to reach these targets. The scan team found a much greater use of benefit-cost analysis as a method to determine desirability of projects, and a desire to determine after the project was implemented whether the initial benefit-cost analysis was close to the resulting performance.
9. **Customer surveys** are an important element of determining organizational performance, if done appropriately and in a valid manner. Many countries appeared to be most successful at getting useful data from customer surveys by asking more focused questions on specific aspects of transportation system performance. Many survey efforts focused on getting feedback from users on what should be changed and how it should be changed.
10. **A strong linkage exists between performance measurement and asset management** in Australia and New Zealand. Scan participants had a sense that, in both cases, transportation officials have a much better handle on the changing value of their asset base than most transportation agencies in the United States. The team believes U.S. agencies could learn from these examples of how to better link asset value to decisionmaking via performance measurement.
11. Although all of the sites visited professed interest and concern for environmental quality, all found it **difficult to come up with area-wide environmental measures**. This was the most disappointing aspect of the site visits for the scan team. New Zealand faces a significant challenge because recent legislation requires the national transportation agency to redefine its mission in the context of sustainability, or how its actions will contribute to a more sustainable land transport system for the country. The resulting actions over the next six months will be worth watching.
12. **Do not measure too many things**. The most important measures are those needed to influence budget

allocations and investment decisionmaking. In situations where large numbers of performance measures were considered, a lack of focus resulted in little influence on the decisionmaking process.

13. **Post evaluations/assessments should be part of performance measurement.** In many cases in the United States, little effort is made to determine the aftereffects of transportation investment. One of the surprising results of this scan was the widespread use of before-and- after studies as a means of determining the effectiveness of implemented actions.
14. Performance measurement is a **complex, evolving area of opportunity.** The U.S. transportation industry is advanced in many areas of performance measurement, but still has much to learn. A coordinated, structured approach to sharing and advancing in the performance measurement area would serve the U.S. transportation industry well. This approach should emphasize the business model approach to assessing performance, which represents a shift to a corporate business model for management.

Implementation Strategies and Recommendations

The timing of this scan is most conducive to implementing the scan results because many opportunities exist for disseminating them. For example, the scan results were reported to several AASHTO committees during 2004, including the Standing Committee on Quality in April, Standing Committees on Planning and on Highways and Traffic Safety in May, and others at the annual meeting in September. The team also planned to contact the Association of Metropolitan Planning Organizations, National Association of Regional Councils, and other groups to present results at relevant meetings. Several scan team members were scheduled to make presentations at the Transportation Research Board's second national conference on performance management in August 2004.

The scan team has developed the following preliminary recommendations on further activities that should follow from the scan:

1. **National emphasis area demonstration on safety (FHWA).** The most integrated and impressive application of a performance measurement framework the scan team observed was in the safety area. Among the four countries, Australia demonstrated the most advanced process of understanding the problems, benchmarking against others, setting targets, identifying strategies, monitoring effects, and feeding results into future planning efforts. The scan team believes that the Australia model and the significant results achieved in the safety area are worthy of sharing and ultimately implementing in the United States. Two safety implementation strategies are recommended:
 - Bring Australian safety leaders to the United States to tell their story to key groups.
 - Encourage States to implement the best practices learned.
2. **Data exchange and warehousing consortium for benchmarking (AASHTO).** Develop an action plan to initiate a data exchange and warehousing consortium for benchmarking performance among participating States. The goal is to export State-level performance data to an external source for the purpose of comparing performance in a variety of service areas. It would also be a forum for sharing performance objectives, measures, and targets, and the rationale behind them.
3. **Performance measure (PM) research.** Initiate research and disseminate findings (through FHWA and AASHTO) on several PM-related topics:
 - Monetizing PMs—Initiate a study on converting measures into cost-based numbers and targets by identifying the cost and/or benefit of providing the improvement on a monetary basis.
 - Interrelationship of PMs—Initiate a study on the cause-and-effect impacts between PMs that examines the correlation between improving possibly competing transportation attributes.
 - Multimodal tradeoffs—Initiate a study on the interrelationship between modal PMs. The study would expand on the “interrelationship” issue to include tradeoffs between modes.
 - Outcome/output empirical relationships—Initiate a study on translating output indicators to outcome consequences. Since output PMs tend to be more quantitative (versus a more subjective outcome), the tendency is to gravitate toward them. Most times, however, the service improvement is difficult to recognize. This area of study would identify the relationship between one or more output PMs and relate them to a desired outcome target.
4. **Training (National Highway Institute) or guidance papers (AASHTO).** Develop performance measure-

ment courses and instruction aimed at executive and midlevel leadership. Topics could include the following:

- Development and use of performance measures
- Outsourcing of products and services
- Best practices
- Before-and-after analysis of implemented actions and their relationship to performance measurement
- Relationship between the practices of asset management (self-assessment tool) and performance measurement

5. **Stand-alone overview document on the scan team's findings** related to congestion and reliability performance measures. Develop a resource document on international and domestic practices on measuring congestion and reliability. Related publications could include an abbreviated pamphlet for distribution at conferences and meetings.

6. **Conferences or meetings.** Plan, develop, and implement conferences or meetings specifically oriented to presenting the scan findings and recommendations to transportation professionals, State commissioners and DOT senior staff, top representatives of USDOT, State governors, local mayors and other officials, and members of Congress and their staffs. The purpose of these meetings would be to increase awareness of performance measures (how and where transportation agencies use them) and present the findings, lessons learned, and recommendations of the performance measures scan.

7. **Technical guidance.** Develop and distribute through AASHTO, FHWA, and other stakeholder organizations guidance on various secondary PM topics:

- Auditable PMs—Provide PM design and tracking methodology for developing verifiable measure numbers and associated impacts.
- Before-and-after analysis—Prepare best-practice materials on this type of analysis. This would be on implemented actions and their relationship to performance measurement improvement.

8. **Presentations of findings from the scan** at appropriate regional and national meetings and conferences throughout the United States over the next year. Candidate venues include AASHTO annual, committee, subcommittee, task force, and regional organization meetings; Transportation Research Board annual and committee meetings; and meetings of organizations such as the Institute of Transportation

Engineers, Association of Metropolitan Planning Organizations, and International Bridge, Tunnel, and Turnpike Association. Develop a core presentation and a frequently asked questions sheet that could be customized, depending on the venue. Initial versions of this material have been produced for use by team members. Team members would make the presentations, starting with those who would normally be at the meetings to minimize costs.

9. **Web-based distribution of materials.** Investigate and select a logical Web-based home for the materials emanating from the scan, including reports, presentations, and implementation actions. Options include AASHTO, FHWA, or a university. Request links to the site on home pages of a number of organizations and launch the site with a notification posted on these home pages. Disseminate scan findings and recommendations via various organizations' Web sites. Develop information packets, sample Web pages, and use guidelines.

10. **Followup review on the sustainability concept.** New Zealand is attempting to incorporate sustainability into transportation decisionmaking. At the time of the scan, the national transport agency was six months away from proposing how it would incorporate sustainability goals into its performance measurement system. The team recommends that a Transit New Zealand representative be invited to visit the United States after implementation to discuss the topic.

Scan Team Members

Contact Information *(at time of scan)*

Douglas MacDonald
(AASHTO Co-Chair)
*Secretary, Washington State
Department of Transportation*
PO Box 47316
Olympia, WA 98504-7316
Telephone: 360/705-7054
E-mail: macdond@wsdot.wa.gov

Connie P. Yew (FHWA Co-Chair)
*Highway Engineer, Office of
Professional and Corporate
Development, Federal Highway
Administration*
HCM, Room 4208
400 Seventh Street, SW
Washington, DC 20590
Telephone: 202/366-1078
E-mail: connie.yew@fhwa.dot.gov

Dr. Michael (Mike) Meyer
(Report Facilitator)
*Professor, School of Civil &
Environmental Engineering
Georgia Institute of Technology*
790 Atlantic Drive
Atlanta, GA 30332
Telephone: 404/385-2246
E-mail: mike.meyer@ce.gatech.edu

Robert (Bob) Arnold
*Division Administrator
Federal Highway Administration
New York Division*
Leo W. O'Brien Federal Building,
Room 719
Albany, NY 12207
Telephone: 518/431-4127
E-mail: robert.arnold@fhwa.dot.gov

John R. Baxter
Director, Office of Safety Design
HAS-10, Room 3419
Federal Highway Administration
400 Seventh Street, SW
Washington, DC 20590
Telephone: 202/366-9198/1795
E-mail: john.baxter@fhwa.dot.gov

Randall K. Halvorson
*Director, Program Management
Division, Minnesota Department
of Transportation*
Mail Stop 120
395 John Ireland Boulevard
St. Paul, MN 55155-1899
Telephone: 651/296-1344
E-mail: randy.halvorson@dot.state.mn.us

Hal Kassoff
*Senior Vice President,
Parsons Brinckerhoff*
1401 K Street, NW
Washington, DC 20005
Telephone: 202/783-0241, ext. 271
E-mail: kassoff@pbworld.com

Ken Philmus
*Director, Tunnels, Bridges, and Bus
Terminals, Port Authority of
New York and New Jersey*
1 Madison Avenue, 5th Floor
New York, New York 10010
Telephone: 212/435-4800
E-mail: kphilmus@panynj.gov
Representing: International Bridge,
Tunnel, and Turnpike Association

Dr. T. Jeffrey Price
*Senior Policy Analyst, Virginia
Department of Transportation*
1401 East Broad Street
Richmond, VA 23219
Telephone: 804/786-2826
E-mail: jeff.price@virginiadot.org

Douglas (Doug) R. Rose
*Deputy Administrator,
Chief Engineer for Operations
Maryland State Highway
Administration*
707 North Calvert Street
(MS C-402)
Baltimore, MD 21202
Telephone: 410/545-0360
Fax: 410-209-5010
E-mail: drose@sha.state.md.us

Dr. C. Michael (Mike) Walton
*Professor, Department of Civil
Engineering
The University of Texas at Austin*
1 University Station C1761
Austin, TX 78712
Telephone: 512/471-1414
E-mail: cmwalton@mail.utexas.edu

William R. (Gary) White
*Manager, Federal Highway
Administration Midwest
Resource Center*
19900 Governors Drive, Suite 301
Olympia Fields, IL 60461
Telephone: 708/283-3507
E-mail: gary.white@fhwa.dot.gov

Biographic Sketches

Douglas MacDonald (AASHTO co-chair) is the secretary of transportation for Washington State. MacDonald directs 6,500 employees of the Washington State Department of Transportation responsible for operation, maintenance, and capital planning and projects for the State highway system and Washington State Ferries, the largest passenger and auto ferry system in the country, as well as programs supporting other transportation modes. Before joining the department in 2001, MacDonald served for nine years as executive director of the Massachusetts Water Resources Authority, where he implemented a \$6 billion program of new facilities for sewage treatment and drinking water delivery and treatment for 61 communities in the greater Boston area. MacDonald holds bachelor's and law degrees from Harvard University. He serves as chair of the American Association of State Highway and Transportation Officials' Standing Committee on the Environment.

Connie Yew (FHWA co-chair) is a highway engineer for the Federal Highway Administration in the Office of Professional and Corporate Development in Washington, DC. Yew works with various program offices to develop, analyze, and report on key agency performance measures. She recently led an agency-wide effort to develop a corporate strategy on obtaining and responding to customer feedback. Before joining the Office of Professional and Corporate Development in 1999, she was the special assistant to the FHWA executive director. Yew holds a bachelor's degree in civil engineering from the University of Maryland and a master's degree in public administration from The George Washington University. Yew is a registered professional engineer in Maryland and serves on several technical committees of the Transportation Research Board and the World Road Association.

Dr. Michael Meyer (report facilitator) is professor and former chair of the School of Civil and Environmental Engineering at the Georgia Institute of Technology. From 1993 to 1998, Meyer was director of transportation planning and development for the State of Massachusetts, where he was responsible for statewide planning, project development, traffic engineering, and transportation research. Before that, he was a professor in the Department of Civil Engineering at the Massachusetts Institute of Technology (MIT). Meyer has written more than 120 technical articles and has authored or coauthored numerous textbooks on transportation planning, policy and education, environmental impact analysis, and intermodal transportation. He

received a bachelor's degree in civil engineering from the University of Wisconsin, a master's degree in civil engineering from Northwestern University, and a Ph.D. in civil engineering from MIT. He is a registered professional engineer in Georgia.

Robert (Bob) Arnold is the New York Division administrator for the Federal Highway Administration. The office works primarily with its partner, the New York State Department of Transportation (NYSDOT), to ensure the State's highway system is an integrated, effective, and efficient part of the Nation's transportation system. As unit leadership, Arnold identifies relevant performance objectives, measures, and goals for the office. This is done in conjunction with NYSDOT and other highway partners when appropriate. He has worked on several FHWA performance measure and quality improvement initiatives, including developing and teaching the FHWA Performance Measures course, serving on the FHWA Environmental "Vital Few" team, and speaking on these topics at numerous national transportation conferences. He received a bachelor's degree in civil engineering from Ohio Northern University, and he has worked for FHWA since 1983. Arnold is a member of the American Society for Quality, an organization dedicated to the advancement of the theory and practice of quality.

John R. Baxter is the director of the Office of Safety Design at the Federal Highway Administration. He leads a multidisciplinary staff in developing and incorporating road and roadside features that impact highway safety performance. Before this appointment, he was FHWA's Indiana Division administrator. Baxter has held numerous FHWA positions during his 21-year career. From 1988 to 1992, he held positions in traffic operations and intelligent transportation systems at the national level. From 1992 to 1995, he was a planning and program management engineer in New Mexico, working with New Mexico's metropolitan planning organizations and national laboratories. From 1995 to 1999, he served as assistant division administrator in the Utah Division, assisting in the development of plans for the 2002 Winter Olympic Games and delivering the \$1.59 billion Interstate 15 megaproject. As Indiana Division administrator, he administered a \$700 million-plus Federal-aid highway program in partnership with the Indiana Department of Transportation, metropolitan planning organizations, and others. Baxter has a bachelor's degree in civil engineering and a master's degree in transportation engineering from Clemson University in South Carolina. He is a registered professional engineer in Utah.

Randy Halvorson is director of the Minnesota Department of Transportation's (Mn/DOT) Program Management Division. This group is responsible for a broad range of planning and operational activities, including all statewide highway investments and modal programs. Before assuming the position in January 2003, Halvorson held a number of positions at Mn/DOT, including assistant director of program delivery (1999-2002), assistant commissioner for the Transportation Research and Investment Management (TRIM) Division (1998-1999), assistant division director for TRIM (1994-1998), director of the Transit Office (1985-1994), and director of national relations (1983-1985). Halvorson has master's and bachelor's degrees in political science from the University of Minnesota. He is a member of several national transportation organizations, including the Transportation Research Board's Committee on Performance Measures and the American Association of State Highway and Transportation Officials' Standing Committee on Planning.

Hal Kassoff is a senior vice president and director of the Highway Practice Area with Parsons Brinckerhoff. Among his varied responsibilities, Kassoff is an instructor on performance measurement at the American Association of State Highway and Transportation Officials' National Transportation Management Conferences, held five times a year. Kassoff has written articles and delivered talks on performance measurement. In October 2000, he participated in the Transportation Research Board's National Conference on Performance Measures and presented one of the major papers, "Implementing Performance Measures in Transportation Agencies." He also served on the team that developed the recent AASHTO-adopted *Transportation Asset Management Guide*. From 1984 to 1996, Kassoff served as administrator of the Maryland State Highway Administration, where he introduced total quality principles, including performance measurement. Kassoff is a civil engineer with a bachelor's degree from the City University of New York and a master's degree in transportation from Northwestern University. He is involved in numerous national organizations, including the American Council of Engineering Companies, American Road and Transportation Builders, International Road Federation, and Institute of Transportation Engineers.

Ken Philmus is director of the Port Authority of New York and New Jersey's Tunnels, Bridges, and Bus Terminals in New York, NY. Philmus oversees operations, capital, and planning for the George Washington Bridge,

Lincoln Tunnel, Holland Tunnel, Goethals Bridge, Bayonne Bridge, Outerbridge Crossing, Port Authority Bus Terminal, and George Washington Bridge Bus Station. The facilities under Philmus' responsibility see about 1.5 million travelers per day between New York and New Jersey and collected more than \$750 million in revenue in 2003. The George Washington Bridge is the busiest bridge in the world with upwards of 350,000 vehicles per day, and the Port Authority Bus Terminal is the busiest bus terminal in the world with more than 200,000 travelers per day. To carry out the effective movement of both people and goods across the New York/New Jersey metropolitan region, Philmus manages more than 1,500 employees, \$360 million in operating expenses, and a \$1.1 billion five-year capital investment plan. Earlier, Philmus served as the deputy general manager of John F. Kennedy International Airport, one of the premier airport gateways in the United States and the busiest international cargo airport in the country. Philmus has a bachelor's degree in industrial engineering from the State University of New York at Buffalo and a master's degree in public administration from New York University. He serves on the Executive Board of the International Bridge, Tunnel, and Turnpike Association, Intelligent Transportation Society of America, E-ZPass Interagency Group, and TRANSCOM, and is vice chairman of the I-95 Corridor Coalition.

Dr. T. Jeffrey Price is a senior policy analyst in the Management Services Division of the Virginia Department of Transportation (VDOT). In his position, he performs planning and development functions, develops policies, and conducts organizational, process review, and re-engineering studies. He brings a breadth of experience to the division, including two years' experience with the U.S. Department of Agriculture, conducting policy analysis for the Office of the Chief Economist (focusing primarily on motor fuels and other energy issues), and 10 years' experience as a consultant, conducting energy market research and cultural resource management studies. In addition, Price spent a year teaching economics at Ambo College in Ethiopia. His areas of expertise include statistics, econometrics, productivity analysis, public policy development, and project management. Since joining VDOT, Price has developed presentations and written letters and reports for the commissioner and his staff, contributed to the 2003 VDOT Workload Assessment, conducted a review of the Asset Management Division, assisted in developing the Asset Management System's Paving Schedule module, conducted statistical analyses of work orders and their relationship to contract schedules, and contributed to agency-

wide performance reports. He is familiar with the Highway Economic Requirements System (HERS) model developed by FHWA, as well as the planning model used by VDOT and the agency's performance measures. Price holds bachelor's and master's degrees in anthropology with specialization in archaeology from the University of Georgia, and a Ph.D. in agricultural and applied economics with specialization in decision modeling and policy analysis from the University of Georgia.

Douglas (Doug) R. Rose is the deputy administrator and chief engineer for operations at the Maryland State Highway Administration (SHA). Rose directs SHA's seven district offices, traffic and safety operations, materials and research operations, maintenance, construction, and ITS program. Rose was recently named a member of the American Association of State Highway and Transportation Officials' new Subcommittee on Operations and Management and is chair of the Performance Measurement Task Team. Rose graduated from Clarkson College of Technology with a bachelor's degree in civil and environmental engineering, and he has a master's degree in civil engineering from the University of Maryland. Rose is active in AASHTO, most recently serving as executive member of the AASHTO-AGC-ARTBA Joint Committee of the American Association of State Highway and Transportation Officials, Associated General Contractors of America, and American Road and Transportation Builders Association. He also served for four years on the Task Force on Strategic Highway Research Program (SHRP) Implementation and is a member of AASHTO's Technology Implementation Group. He chairs the Transportation Research Board Committee on Superpave Education and Communications. Rose is vice president of the Maryland Association of Engineers and is a member of the American Society of Civil Engineers, American Society of Highway Engineers, and American Public Works Association.

Dr. C. Michael (Mike) Walton is professor of civil engineering and holds the Ernest H. Cockrell Centennial Chair in Engineering at the University of Texas at Austin. Walton's research focuses on intelligent transportation systems and intermodal freight logistics, in addition to transportation systems engineering, planning, operations, and policy analysis. He holds a master's degree and a Ph.D. in civil engineering from North Carolina State University. Walton is a member of the National Academy of Engineering, the nation's highest honor for engineering professionals. He has served on or chaired a number of national study panels, including serving as past chair of

the Transportation Research Board's (TRB) Executive Committee and current chair of the Research and Technology Coordinating Committee. Walton is a founding member of the Intelligent Transportation Society of America. He is also a member of the American Society of Civil Engineers and the Institute for Operations Research and the Management Sciences, to name a few. Walton has also served as senior editor or contributing author for a variety of technical reference books and manuals, and as a member of the editorial board for several international journals. He has published more than 200 articles and reports, and has presented more than 250 technical lectures, presentations, and keynote addresses.

William R. (Gary) White is a Resource Center manager in Olympia Fields, IL, for the Federal Highway Administration. White is responsible for two of the Resource Center's technical service teams, the Operations Team and the Safety and Highway Design Team. The Resource Center is charged with providing training, technical assistance, and technology deployment to its transportation partners and customers. A significant part of the Resource Center's responsibility is providing technical assistance and technology deployment to the transportation industry to assess the performance of the highway system to determine where it is best to focus the available resources. In the past, White spent five years as an assistant division administrator in the Indiana Division Office of FHWA, where performance measurement became a key element in the operation of the office. The Indiana Department of Transportation, FHWA's principal partner in carrying out the Federal-aid Highway Program in Indiana, also was just beginning to develop performance measures to assess its program. White has a bachelor's degree in civil engineering from the University of Illinois, and a master's degree in civil engineering from Ohio State University. White is a registered professional engineer in Ohio.

Amplifying Questions

Overview of Performance Measures

1. Please briefly describe the process of transportation system performance measurement used by your agency. Why did your organization begin using performance measures? How long has system performance measurement been used in your agency? What do you consider innovative about the process you are using for measuring transportation system performance?
2. What performance measures are being used by your organization to monitor transportation system performance? Why were these measures selected?
3. For what purposes have these measures been used (e.g., reporting to the public, reporting to oversight groups, internal management, prioritizing programs and projects, etc.)? How would you describe the benefits your agency gets from using performance measures?
4. Which measures have you found to be the most important to your agency for the purposes identified in question 3 above? Which measures have not proved to be very successful for the purposes identified in question 3 above?
5. Some agencies use measures simply to monitor transportation system performance over time. Others establish desired targets or goals for each measurement category (e.g., for safety, a national goal of reducing fatalities by x percent). Do you establish targets or goals for any of your system performance categories? If so, who established these targets and why were these target values chosen?
6. Does your agency use measures that describe the linkage between transportation system performance and the economy, (e.g., contribution of transportation to gross domestic product)? Are measures defined for any other non-transportation areas, such as transportation's impact on environmental quality or international trade?
7. To what extent is performance measurement common in other agencies in your government? If other agencies use performance measurement, do those agencies that have some policy linkage to transportation (for example, agencies relating to safety and enforcement, trade, environmental quality) use transportation-related performance measures?
8. If your agency is focused on only one part of the transportation system (for example, the road network), are you aware of other agencies that use measures to monitor the performance of other parts of the transportation system, such as airports, ports, rail services, urban transit, etc.?
9. If you represent a national organization, do you have agencies at the provincial/state or metropolitan levels that also use performance measures? If so, to what extent are these measures similar or different from the measures you use?
10. Do you believe that the use of performance measures has measurably changed how your agency does business? If so, which measures have been most important to your agency? Do you think that the monitoring of a selected number of measures could appreciably affect transportation system performance over the long term?
11. Given the importance of transportation to society and to individuals, are you using (or thinking of developing) performance measures that track "how much transportation costs?" To individuals? To communities? To different sectors such as the freight sector? Do you make a distinction (or envision making one) between private costs to the individual (e.g., vehicle, fuel, insurance, etc.) and public costs (e.g., infrastructure, control systems, and maintenance)? Do you track the share of various users' contributions to the costs of transportation (e.g., the revenues generated for transportation from trucking fees)? To the share of economic

benefit they derive from investment in the transportation system?

12. In the United States, we often measure the costs of congestion as the value of time lost. Do you measure congestion costs? Do you use, or are you considering, system performance measures that go beyond congestion measures, for example, measures of urban mobility, accessibility, and system reliability?
13. How are transportation costs tracked or considered in assessments of economic productivity and economic health in your country, state/province, or metropolitan area, if at all?
14. To what extent is a “customer focus” included in your performance measures? How do you define your customers? What strategies or techniques are used to collect data on customer satisfaction or dissatisfaction with transportation system performance?
15. From your experience, what are the key lessons in using performance measures in your agency’s planning and decisionmaking processes? What has been your greatest success?
16. From your experience, what are the key barriers to effective use of performance measures in your agency’s planning and organizational decisionmaking processes?
17. From what you know about how transportation system performance measurement is done in the United States, what do you consider to be the best parts of our approach toward performance measurement? What do you do better than the United States?

System Performance Measurement and Decisionmaking

1. If your agency has a strategic plan, business plan, or core business strategy, to what extent are your system performance measures integrated into this plan? To what extent have performance measures actually affected investment decisions? How do you make sure that the agency’s decisions and actions reflect the desired performance outcomes?
2. Do you use performance measures to determine the overall effectiveness of investment in the transportation system? If so, to what extent do you believe such performance measures are meaningful or useful

to your agency? To important stakeholders? To top decisionmaking officials outside your agency?

3. If targets or performance goals are used as part of your agency’s performance measurement (e.g., a maximum level of crashes on the road system), how are these targets or goals chosen? Who decides what these values should be?
4. Are you using any methodology that is based on a “benefit/cost” to choose investment strategies among different modes of transportation?
5. Does your performance measurement system allow for a direct comparison between investment for new infrastructure versus rehabilitation and operations-oriented investment?
6. Does your jurisdiction use an asset management approach to capital planning and investment decisionmaking? If so, what measures are used to track infrastructure condition? Do you track “system needs” over time? If so, how do you forecast future demands for transportation services?
7. Do you track how transportation investment is made (e.g., how much is financed through debt as contrasted to other forms of investment)? How much is borne by user costs versus costs of general government? Have you noticed a change in the mix of financing over time? Does your agency have performance targets for cash balances, revenues, expenditures, etc.?
8. Have you faced a situation where two or more performance measures might have been incompatible from the perspective of agency decisionmaking (e.g., a safety performance measure that results in slowing traffic that might be in conflict with a performance measure oriented to improving vehicular flow)?
9. To what extent are decisions relating to human and capital resource allocation in your agency tied to desired levels of system performance as specified by your performance measures? For example, if infrastructure condition is an important performance measure, do you think a higher level of staff resource has been dedicated to system maintenance because of this measure?

Specific Types of Performance Measures Safety

1. What are the types of measures used to monitor transportation system safety? Why have you defined these

measures as you have (e.g., some countries use fatality rates while others simply use number of fatalities)? Do you have different measures as a function of geographic scale (e.g., national versus state/provincial versus metropolitan), or by level of congestion?

2. Which of the measures identified in question 1 have really made a difference in the way your agency makes investment decisions?
3. Improving highway safety requires many different types of strategies (e.g., actions relating to engineering, education, enforcement, and emergency services). In most countries, this means that many different organizations are important participants in the road safety program. Are there other agencies (e.g., police, civil aviation, maritime security, etc.) that use safety-related transportation system performance measures? To what extent have government and nongovernment organizations in your country/state/province/region adopted a common set of safety-related performance measures?
4. Are these performance measures primarily used for engineering decisions (e.g., what types of crashes do we need to focus on), or are they used by agency leaders and political decisionmakers (e.g., how much money do we need to devote to transportation system safety)? Are the performance measures used to benchmark your system's performance with that of other countries or other agencies?
5. Has your agency or government established specific safety targets or goals? If so, what are they, and what has been your recent experience in meeting these targets?
6. What data do you collect for the performance measures identified in question 1? Who collects this data? What type of data management system or information technology do you use to collect and manage safety-related data as it relates to system performance measurement? Do you use the Internet for reporting safety data?
7. Are you tracking performance of the total transportation system or are you classifying your data by type of crash or geographic area? Do you have the capability to do both?
8. To what extent is safety performance recorded and reported in relation to the cause of the incident (e.g.,

driver performance or pedestrian behavior, engineering design or other human factors issues)?

9. Do you collect data on pedestrian and bicycle injuries and/or fatalities? Do you collect data on freight-related injuries and/or fatalities (e.g., truck crashes)? Does the data identify who or what caused the incident?
10. Is your tracking of safety data used to predict what might happen in the future with respect to expected safety performance, given changing design and demographic characteristics? For example, is the changing age distribution of the population at all considered as a possible factor in future safety experience?
11. Have you been able to demonstrate cause and effect between system investments and changes in system safety performance?
12. To what extent has safety performance monitoring affected program decisions at the administrative or legislative level? To what extent has the use of performance measures led to improved safety on your transportation system? Have specific safety strategies or project designs been adopted by your agency because of safety performance measurement?
13. From your experience, what are the key lessons in using safety performance measures in your agency's planning and decisionmaking processes? What has been your greatest success?
14. From your experience, what are the key barriers to effective use of safety performance measures in your agency's planning and organizational decisionmaking processes?

System Optimization

1. How do you measure desired system operational performance? For example, do you use some indicator of level of service such as travel speed, delay, maximum throughput, congested hours, etc?
2. Have you developed a measure of transportation system reliability that responds to the needs and desires of system users (both freight and public users)? Reliability is defined as the degree to which travel time on a particular transportation facility or on a transportation system is similar over repeated trips, that is, the variance of travel time for repeated trips is quite small.

3. If such measures are used, how useful are they in conveying to administrators and/or legislators in your jurisdiction the magnitude of the problems facing the transportation system?
4. If some indicator of delay is one of the measures used, how is delay defined (e.g., as a matter of time or cost or both)? Is the delay for shipping, goods delivery, and other freight movement included in your system performance determination?
5. Do you make a distinction in your performance measurement between delay that is caused by accidents and vehicle breakdowns (referred to as nonrecurring delay), and recurring delay due to high levels of demand and insufficient capacity?
6. In several countries of the world, data collection is being conducted by both public agencies and private firms to provide better information to the users of the transportation system. To what extent are public and private organizations involved with providing travel information to travelers in your country?
7. Do you have information that indicates the amount of improvement that will occur when a particular type of change is made to the transportation system (this could result from physical improvements or changes in pricing and demand management)? For example, if your country/province or state/metropolitan area has implemented intelligent transportation system technologies, how are you tracking the performance and benefits of these investments?
8. From your experience, what are the key lessons in using system optimization performance measures in your agency's planning and decisionmaking processes? What has been your greatest success?
9. From your experience, what are the key barriers to effective use of system optimization performance measures in your agency's planning and organizational decisionmaking processes?

Transportation System Performance and Environmental Quality

1. Do you measure the impacts of transportation system performance on the natural environment and on communities? For example, do you track the transportation system contribution to the following:
 - a. To air quality such as greenhouse gases? By mode or region? Changes in fleet performance and mix

- (e.g., increasing use of alternative fueled vehicles)?
- b. To habitat and species preservation? Have performance measures begun to emerge from the COST Action 341 initiative of the European Community?
- c. To water quality? Do you have measures relating to the amount of impermeable surface associated with transportation facilities? If your agency deals with snow and ice removal, how do you monitor the environmental impacts of your removal strategies?
- d. To noise levels? Do you have measures that track the extent and severity of noise impacts on communities or on sensitive land uses?
- e. To environmental compensation (e.g., the number of wetlands replaced or restored due to transportation construction)?
- f. To land use? Is the relationship between transportation investment and urban form an important social, economic, or political issue in your jurisdiction?

Program Delivery and Accountability

1. Do you monitor specific characteristics of your agency's program delivery (e.g., time for project development, project quality, project cost, use of consultants versus your own staff, etc.)? Do you have intermediate steps in the project development process that serve as benchmarks allowing you to monitor project progress? What are your greatest barriers to efficient program/project delivery?
2. Have you changed agency project delivery procedures in response to monitoring of program progress (e.g., a greater use of value engineering, increased use of design/build consultants, use of incentive/disincentive clauses, etc.)?
3. How are agency managers held accountable, if at all, for obtaining improved system performance as defined by your performance measures?
4. How do you report your agency's financial performance (a public sector version of a balance sheet, cash flow tables, return on investment, etc.)?
5. How do you convey to the public that you are accountable for delivering and maintaining a good transportation system? How do you evaluate whether your information-disseminating strategy is being successful (e.g., through the number of hits on your Web site)? If you have a customer-focused set of performance measures, do you think that the public has a more positive impression of your agency's activities because of the public reporting of system performance?

New Zealand Transit's Strategic Plan and Performance Measures

The Key Goals of Transit New Zealand's Strategic Plan (as of October 2003)

Key Goal 1

Plan and develop an integrated, safe, responsive and sustainable state highway system.

Key Goal 2

Maintain, operate and protect the state highway system.

Key Goal 3

Exercise social and environmental responsibility in all our activities.

Key Goal 4

Obtain funding which is adequate to ensure an affordable, integrated, safe, responsive and sustainable state highway system.

Key Goal 5

Lead the transport industry in terms of roading solutions and the skills of our people.

Key Goal 6

Interact and communicate effectively with road users, communities and their representatives.

Key Goal 7

Maintain good relationships and work effectively with stakeholders and related organizations.

Performance Measures by Key Goals

Key: ● Environmental ● Social ● Economic

Measure	Comment
<p>● ● ●</p> <p>Change (due to investment, revocation or depreciation) in the dollar value of the state highway asset</p>	<p>The value of the state highway network is approximately \$12 billion.</p> <p>Key Goal 1,2</p>
<p>● ● ●</p> <p>The percentage change in returns from state highway property rentals</p>	<p>The measure is intended to demonstrate the annual return on funds invested in property, monitor the trend over time, and compare returns against property market indicators.</p> <p>Key Goal 1</p>
<p>● ● ●</p> <p>The percentage of properties in the tenantable portfolio that have been vacant for 6 months or more</p>	<p>The target is a rate of vacancies of less than 10% for properties which have been vacant for 6 months or more. This will enable measurement of vacancy rates over time.</p> <p>Key Goal 1</p>
<p>● ● ●</p> <p>Rate of surplus property disposal from projects completed in the previous financial year</p>	<p>The target is 98% of projects completed in the previous year have been reviewed to assess surplus property. This measure will ensure that residual properties post construction will be made available for disposal as quickly as possible.</p> <p>Key Goal 1</p>
<p>● ● ●</p> <p>Percentage change in maintenance costs per 1,000vkt traveled</p>	<p>This can be measured by the change in dollars spent on maintenance per 1,000 vehicle kilometres traveled.</p> <p>Key Goal 2</p>
<p>● ● ●</p> <p>Forecast annual dollar benefits from annual construction project programme</p>	<p>This will be measured by total benefit dollars for total cost dollars.</p> <p>Key Goal 1</p>
<p>● ● ●</p> <p>Actual project dollar benefits compared to the forecast benefits</p>	<p>Report on the estimated dollar benefit to be gained from the amount spent on projects. Information will come from post-construction audits completed in the given year based on:</p> <ul style="list-style-type: none"> •Traffic volumes x project savings •Actual accident history •Audits would normally be 3-5 years after completion. <p>Key Goal 1</p>

Performance Measures by Key Goals *(continued)*

Key: ● Environmental ● Social ● Economic

Measure	Comment
<p>● ● ●</p> <p>Dollars spent on environmental measures</p>	<p>This is an interim measure until Transit's environmental strategy is further developed. Initially the measure will be of the dollars spent on landscaping, noise control, run-off control, flora, fauna and cultural protection measures, and monitoring.</p> <p>Key Goal 3</p>
<p>● ● ●</p> <p>Transfund New Zealand's satisfaction with Transit's performance</p>	<p>The Stakeholder Survey can provide a subset of results from Transfund responses. Key results would cover:</p> <ul style="list-style-type: none"> • Average score "best practice" items • Average score "values" items. <p>Key Goal 7</p>
<p>● ● ●</p> <p>Local and regional authority satisfaction rating for the quality of the relationship with Transit</p>	<p>The Stakeholder Survey can provide results for territorial authority respondents, both elected and staff. Results will come from values ratings including those for:</p> <ul style="list-style-type: none"> • Innovation • Timeliness • Helpfulness • Integrity • Customer-focus <p>Key Goal 6,7</p>
<p>● ● ●</p> <p>Local and regional authority satisfaction with the state highway network</p>	<p>A report can be gathered from the Stakeholder Survey which asked the "satisfaction with state highways" question.</p> <p>Key Goal 1,2</p>
<p>● ● ●</p> <p>Iwi and recognized social and environmental interest groups satisfaction rating for the quality of the relationship with Transit</p>	<p>The Transit Stakeholder Survey records the satisfaction rating of Iwi and recognised social and environmental interest groups satisfaction rating for the quality of the relationship with Transit. Covers same values ratings as for local authorities plus responsiveness to Iwi and the interest groups.</p> <p>Key Goal 6,7</p>
<p>● ● ●</p> <p>Iwi and recognized social and environmental interest group satisfaction with the state highway network</p>	<p>The Stakeholder Survey asks the "satisfaction with state highways" question of:</p> <ul style="list-style-type: none"> • Iwi • Community groups/usergroups. <p>Key Goal 1,2</p>

Measure	Comment
<p>● ● ●</p> <p>Proportion of non-motorised road users who feel safe using state highways (other than motorways)</p>	<p>No relevant data source at this stage. Key Goal 1,6</p>
<p>● ● ●</p> <p>Road user satisfaction rating for the quality of the relationship with Transit</p>	<p>No relevant data source at this stage. Key Goal 6,7</p>
<p>● ● ●</p> <p>Road user satisfaction with the state highway network</p>	<p>The Road User Surveys report on this. There are target levels set for a number of criteria. The target for each of these is 90% as set out in the <i>National State Highway Strategy</i>. Key Goal 1,2</p>
<p>● ● ●</p> <p>The social costs of road accidents</p>	<p>The assessed social costs of accidents is evaluated by the use of Value of Statistic Life (VOSL). Key Goal 1,2</p>
<p>● ● ●</p> <p>Congestion through travel time delays</p>	<p>Transit has carried out travel time surveys in Auckland and Wellington. The surveys, based on Austroads methodology, measure congestion in the morning peak, the afternoon peak, and the inter-peak periods. Annual results will be compared to measure the trend in congestion. Key Goal 1,2</p>
<p>● ● ●</p> <p>Percentage forecast and actual annual dollar variance against State Highway Maintenance and Improvement programme</p>	<p>Currently reported under Output Class 1 and Output Class 2. Key Goal 1,2</p>
<p>● ● ●</p> <p>The variance between the funding allocation for state highways in the current year and the 10-year forecast for the asset management and capital forward works programmes</p>	<p>Work has to be done in the current year to refine this measure but essentially it will aim to show both if there is a gap between available funding and identified need, and the accuracy of forecasting. The initial report may cover a five-year forecast. Key Goal 4</p>

Performance Measures by Key Goals *(continued)*

Key: ● Environmental ● Social ● Economic

Measure	Comment
<p>● ● ●</p> <p>The number of projects where the benefits and/or costs have changed sufficiently from those forecast at the conclusion of the Investigation & Reporting Phase to result in them being halted or significantly delayed</p>	<p>Unanticipated costs, or an over-estimation of benefits may be identified at either the design or construction stages.</p> <p>Key Goal 1</p>
<p>● ● ●</p> <p>The percentage of capital projects delivered on time, within budget</p>	<p>This applies to projects to be completed in the current year. Projects will be split by value for reporting purposes. A target of 95% has been set.</p> <p>Key Goal 1</p>
<p>● ● ●</p> <p>Percentage of state highway network complying with agreed levels of service and standards for road condition and geometry (i.e. up to design standards)</p>	<p>There are different targets set for the agreed level of service for the range of road conditions. These are:</p> <ul style="list-style-type: none"> • Roughness <ul style="list-style-type: none"> —by smoothness —by smooth travel exposure • Rutting • Skid resistance <ul style="list-style-type: none"> —good skid exposure • Texture <p>Key Goal 1,2</p>
<p>● ● ●</p> <p>The percentage of emergencies on highways having single-lane access restored within 12 hours after the substantial end of the event</p>	<p>Transit currently has a target for this of 95%. The goal is to move towards showing the total lane kilometre closures for periods greater than 12 hours due to an event.</p> <p>Key Goal 2</p>
<p>● ● ●</p> <p>The proportion of the assessed media coverage that is positive</p>	<p>Transit currently measures media coverage and categorises articles into positive, balanced and negative.</p> <p>Key Goal 6</p>
<p>● ● ●</p> <p>Description of significant social and environmental achievements</p>	<p>They are likely to cover issues such as special protection of fauna, e.g., building fish passages, and significant social gains such as handing back land to the community, the donation of trees from acquired land and awards for Transit projects and programmes.</p> <p>Key Goal 3</p>

Measure	Comment
<p>● ● ●</p> <p>The percentage of projects where design commenced in the current financial year that considered, as part of their design brief, the provision of walking and cycling features</p>	<p>A target of 100% has been set. Key Goal 3</p>
<p>● ● ●</p> <p>Compliance with legislation, legislative instruments and external policy requirements</p>	<p>This will be measured by the number of significant non-compliances in such areas as the Competitive Pricing Procedures (CPP), the Resource Management Act, Health and Safety Act, Building Act, etc. Key Goal 1,2,3</p>
<p>● ● ●</p> <p>The percentage of state highway network with a current corridor management plan or a state highway plan</p>	<p>A target has been set for 85% of the state highway network to have a current plan. A current plan is one that has been reviewed within the last five years. Key Goal 1</p>
<p>● ● ●</p> <p>Dollars invested in research and development</p>	<p>This will be a report on funding spent on Canterbury Accelerated Pavement Testing Indoor Facility (CAPTIF), and aims to highlight investment in potentially innovative approaches to highway developments. More refinement is required during the current year. Key Goal 5</p>
<p>● ● ●</p> <p>Peer and industry perception of Transit's leadership in the New Zealand transport Industry</p>	<p>The Stakeholder Survey can provide results for peers in the industry plus territorial authority respondents, both elected and staff. Results will come from values ratings for:</p> <ul style="list-style-type: none"> • Innovation • Technical expertise • Continuous improvement. <p>Key Goal 5</p>
<p>● ● ●</p> <p>Total dollar spent on achievement of Strategic Training Plan as a percentage of payroll</p>	<p>This will provide a measure of investment in targeted training programmes. Further work is required. Key Goal 5,7</p>

Performance Measures by Key Goals *(continued)*

Key: ● Environmental ● Social ● Economic

Measure	Comment
<p>● ● ●</p> <p>Achievement of the Strategic Training Plan measured through the implementation of individual employee-agreed training plans</p>	<p>This will enable the success of individual training programs to be measured against the Strategic Training Programme. Further work is required.</p> <p>Key Goal 5,7</p>
<p>● ● ●</p> <p>Staff satisfaction rating with Transit as an innovator and good employer</p>	<p>Staff satisfaction survey include some performance items and ratings scales from the Stakeholder Survey, for comparability. Areas covered include:</p> <ul style="list-style-type: none"> • Innovation, and • Business practices and ethics. <p>Key Goal 5,7</p>
<p>● ● ●</p> <p>Staff satisfaction with Transit as a fiscally, socially and environmentally responsible organization</p>	<p>Staff surveys are carried out annually. Surveys include some performance items and ratings from the Stakeholder Survey for comparability.</p> <p>Key Goal 1,2,3</p>

Office of International Programs

FHWA/US DOT (HPIP)
400 Seventh Street, SW
Washington, DC 20590

Tel: (202) 366-9636

Fax: (202) 366-9626

international@fhwa.dot.gov

www.international.fhwa.dot.gov

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