

**XXIIIrd WORLD ROAD CONGRESS
PARIS 2007**

CANADA - NATIONAL REPORT

STRATEGIC DIRECTION SESSION ST1

**CHALLENGES FOR THE SUSTAINABLE
DEVELOPMENT OF ROAD SYSTEMS**

Performance Measures for Road Networks: A Survey of Canadian Use

Sarah WELLS
Transportation Association of Canada
Ottawa, Ontario, Canada
swells@tac-atc.ca

Rima RAAD
Transport Canada
Ottawa, Ontario, Canada
raad@tc.gc.ca

ABSTRACT

Encompassing 1.4 million kilometres, the road network in Canada is vital to the Canadian well-being. Managing the road network is becoming increasingly challenging as demands increase and resources are limited. To face those challenges, performance measurement is attracting growing interest from transportation agencies. With the expectation that what is measured can be better managed; performance measurement is being implemented as a core component of management processes in public sector agencies.

In Canada, most provinces and territories use some form of performance measures to evaluate their road networks. However, the type of performance measures used and the implementation practices vary significantly between jurisdictions. This project, conducted under the auspices of the Chief Engineers' Council of the Transportation Association of Canada, was intended to share experiences between jurisdictions on their performance measurement practices.

The report provides an overview of the literature available on the subject. Reasons to measure performance within transportation departments are cited. Issues to consider when developing a performance measurement program are offered. It is observed there is not one measure, or one set of measures, that can be considered the "best" for all cases. In each case, the performance measures practice depends on the specific conditions of an agency, its goals, its resources, and its audience.

The primary focus of the project was to survey Canadian provincial and territorial jurisdictions regarding current practices for performance measurement of road networks. The results of the survey are categorized in six outcomes:

Safety,
Transportation system preservation,
Sustainability and environmental quality,
Cost effectiveness,
Reliability, and
Mobility/accessibility.

The survey revealed the following:

- Transportation system preservation appears to be the most highly developed and mature application of performance measures in Canadian highway agencies;
- Safety performance is a priority interest, with most agencies using accident rates per million vehicle kilometres as a key measure;
- Outcomes of cost effectiveness, reliability, and mobility/accessibility are subject to performance measurement in some jurisdictions with little consistency in application;
- Measures to assess performance on sustainability and environmental quality are used to a limited extent by Canadian agencies.

The report also provides an international perspective on trends in performance measurement of road networks focusing on the United States, Europe and Australia practices. There is considerable commonality amongst the categories of performance measures that are used

internationally. Austroads is cited as having the most ambitious and long-standing performance measurement program, with 72 national performance indicators in ten categories.

1. PERFORMANCE MEASUREMENT: AN OVERVIEW

In the last two decades, interest has grown in the art and science of performance measurement, particularly as it applies to road and transportation systems. The topic is well documented in the literature with significant treatises from many organizations around the world, including the US Federal Highway Administration (FHWA) and the Transportation Research Board (TRB), the Organisation for Economic Cooperation and Development (OECD), Austroads and the Transportation Association of Canada (TAC). In general, the available research and practice reports provide perspectives as to why performance measurement is important, how it should be undertaken, and what is typically measured.

1.1 Why Measure Performance?

The ultimate purpose of measuring performance is to improve transportation services for customers (Kane, 2005). Within that simple statement, two important emphases are contained: one regarding customers and the second regarding improving services. Both of these emphases underlie most of the reasons cited in the literature for the increasing importance of performance measurement to transportation agencies.

In an OECD review of performance indicators for the road sector (OECD, 2000), the authors observed that in the past, the expectations for public administrations were fairly straightforward. The dominant objective was to deliver services to the public at minimum cost. However, public administrations are now expected to meet service level targets at reduced costs and to develop mechanisms for customer feedback. In general, public administrations now operate in an environment in which there is a much greater emphasis on customers. Meeting customers' needs drives business for public sector as well as private sector agencies. That focus on customers has made the assessment of agencies' performance more complex and has been a trigger for the study and application of objective performance measurement.

Discussing the customer focus during the 2000 Transportation Research Board conference on performance measures, Pickrell and Neumann (2001) explained that publicly-funded agencies have come under increasing pressure to be accountable to the public – the owners and customers of the agencies and the transportation systems they deliver. In fact, the need to be accountable to the public is the reason most commonly offered in the literature for performance measurement. There is a growing expectation that the public should be advised on the performance of the transportation system upon which it depends. As well, there is a need to report how public funds are used to maintain the system and the effect of expenditures upon it. Performance measurement is essential to that process.

It is interesting to note that the use of performance measurement is considered useful not only for reporting *to* the public but also for communicating *with* the public. It is seen as a tool that can help educate the public as well as senior decision makers and legislators regarding the importance of transportation and the merits of making appropriate investments in the system (Federal Highway Administration, 2004).

A synthesis of highway practice on performance measurement, conducted for the National Cooperative Highway Research Program (Poister, 1997), drew attention to strategic planning as a driving force behind performance measurement. Government agencies are often mandated to have strategic plans with goals and objectives defined within those plans. Performance measurement provides important inputs to set priorities and it provides critical information that helps agencies detect potential problems and make corrections en route to meeting goals and objectives. Performance measurement is a fundamental component of an effective management strategy as it allows process management and improvement.

A recurring theme in the literature on performance measurement relates to funding limitations and asset management. As agencies experience funding constraints while maintaining mature infrastructure systems, effective management of all assets is important to their success. The TAC framework for asset management (TAC, 2001) suggests performance measures be used for planning and programming. Performance measures are needed to evaluate the state of assets, which is a first step in developing priorities and allocating resources amongst competing priorities. Consequently, performance measures have been called the “backbone” of asset management systems and are considered to be a critical tool to report successes and opportunities (Bradbury, 2004).

In the modern era of sustainability, performance measurement is also seen as key to measuring progress on that front. Transportation systems are recognized for the benefits they provide to the economy in terms of access and mobility but are also recognized for putting pressure on our environment. Widely held policy goals are to make progress towards sustainability while increasing economic prosperity and quality of life. In order to understand whether our systems are becoming more or less sustainable, measurement of performance against related indicators is necessary (Gudmundsson, 2001).

While many good reasons exist to measure performance of the road network so that it can be monitored and improved, some caveats are also offered in the literature. In particular, Pickrell and Neumann (2001) noted that the use of performance measurement to benchmark performance of one agency against another can be problematic. Benchmarking may help an agency to initially define a reasonable or desirable level of performance but it may not be useful as an ongoing comparison. While there is some interest in obtaining a national ranking by performance measures, it will not be informative if agencies are operating in different circumstances or are not truly peers. Differences in measures may be the result of divergent objectives, differing resource availability or external factors and not the result of agencies' performance.

1.2 Developing Performance Measures

Transportation departments are fortunate to have a wealth of data available to them regarding the services they provide and the infrastructure they build, operate and maintain. However, in a data-rich environment, the challenge is to determine how best to gather, analyze and present the data so that it is meaningful to stakeholders, and this is especially important for performance measures that are reported to or used by a broad range of audiences. In developing a performance measurement process and implementing it as a management system, the selection of the “right” performance measures is a critical step.

When developing performance measures, the literature emphasizes that the process should begin by defining an agency's vision, its mission and strategic objectives. While these may be long-range in focus, performance measures used by an agency must be related to those broad goals. Long-term strategic goals can be translated into specific annual goals, against which performance is measured. Policy-makers and agency staff must be educated to understand the performance measures and to accept the link between them and the agency's goals (Poister, 1997).

Performance measures should cover the full range of an agency's strategic objectives, but should nonetheless be few in number. In Japan, for example, the national ministry has established a core set of 17 performance measures (Federal Highway Administration, 2004). Limiting the selection of measures to those that reflect the issues that are important to an agency will simplify data collection and reporting and increase the likelihood the measures will be understood by the public and used effectively by agencies.

In selecting a set of performance measures, it is important to recognize the distinction between input, output and outcome measures. Input measures reflect the resources that are dedicated to a program, output measures reflect the products of a program, and outcome measures look at the impact of the products on the goals of the agency (Dalton et al, 2005). Input- and output-based performance measurements were more common in the past, but current trends are to increased use of outcome-based performance measures, in conjunction with output-based measures. The distinction between output and outcome measures can be explained as follows: "Output measures are often used as indicators of organizational activity or performance, but stop short of identifying results as viewed by intended beneficiaries. Output measures provide necessary information for the proper management of resources and, therefore, are critical in any performance-based approach. (...) Outcome measures, on the other hand, reflect an agency's success in meeting stated goals and objectives and focus on the beneficiaries of the agency's service." (TRB, 2000). Outcomes can be more difficult to measure but are considered important to measure because they directly relate the activities an agency undertakes to its strategic goals.

Transportation agencies must consider the availability of data, the cost and time to collect the necessary data and the quality of the data in selecting performance measures. It must be possible to generate the measure with the technology and resources available to an agency if the performance measure is to be adopted.

Other issues that should be considered when selecting performance measures to evaluate a road network include the following (TRB, 2000):

- Forecastability: is it possible to compare future alternative projects or strategies using this measure?
- Clarity: is it likely to be understood by transportation professionals, policy makers and the public?
- Usefulness: Does the measure reflect the issue or goal of concern? Is it an indicator of condition, which could be used as a trigger for action? Does it capture cause-and-effect between the agency's actions and condition?
- Ability to diagnose problems: Is there a connection between the measure and the actions that affect it? Is the measure too aggregated to be helpful to agencies trying to improve performance?

- Temporal Effects: Is the measure comparable across time?
- Relevance: Is the measure relevant to planning and budgeting processes? Will changes in activities and budget levels affect a change in the measure that is apparent and meaningful? Can the measure be reported with a frequency that will be helpful to decision makers?

In summary, the list of performance measures that could be adopted by a transportation agency to evaluate its road network is essentially limitless. There is no one measure, or one set of measures, that could be identified as the “best” for all cases. Furthermore, although there are many common issues to be considered, there is not just one good way to develop a set of performance measures or establish a performance measurement system. In each case, the performance measures used must depend on the specific conditions of an agency, its goals, its resources, and its audience.

2. PERFORMANCE MEASUREMENT IN CANADIAN TRANSPORTATION DEPARTMENTS

Provincial and territorial governments in Canada are in various stages of developing and using performance-based planning but some have been actively pursuing performance measurement in their public agencies for several years. In some cases, performance measurement has been entrenched as a key part of business plans and is used to assess progress against a wide variety of goals and objectives with results presented to stakeholders and the general public through annual reports. Several of these are available on the World Wide Web, as summarized in the following paragraphs.

In Alberta, as a matter of policy, the department of Infrastructure and Transportation has been using outcome-based performance measurement since the early 1990s for planning and monitoring of the highway network. Its annual report is available on line at (<http://www.finance.gov.ab.ca/publications/budget/budget2005/infra.html#8>). The report describes five core business areas for the department, under which nine goals are defined. For each goal, a set of strategies and measures to evaluate performance are listed. For the road network, the department measures highway infrastructure performance in three categories: physical condition, functional adequacy and utilization.

In British Columbia, government ministries are required to establish service plans that include measurable performance standards and targets. The Ministry of Transportation publishes its Service Plan (<http://www.bcbudget.gov.bc.ca/2005/sp/trans/default.htm>), which describes the core business of the ministry and major projects and initiatives in its multi-year Transportation Investment Plan. The Service Plan also defines the vision, mission and values of the ministry, connects these to its goals and objectives and describes the strategies that will be used to accomplish those aims. Furthermore, the Plan sets out the targets against which performance will be measured and emphasizes that it will be possible to gauge how well strategies are working by comparing the performance targets with actual measured results that will appear in annual reports.

The Ontario Ministry of Transportation (MTO) has published its business plans including descriptions of its core businesses. The 2002-2003 plan lists key performance measures used by the department (http://www.mto.gov.on.ca/english/about/bplan/2002_03.htm). For its core

business of road user safety, MTO reported the number of fatalities per 10,000 licensed drivers and the mechanical fitness rate of commercial motor vehicles. For its core business of providing a transportation system that is reliable, efficient, accessible and integrated, MTO reported on highway accessibility as the percent of population living within 10 kilometers of provincial highways. Finally, for its core business of highway management and cost efficiency, MTO reported the percent of total highway capital cost spent on actual construction.

The Ministère des transports du Québec also publishes an annual report which identifies the priorities of the government. The report includes statements of each ministry goal, along with specific objectives and the results that are envisioned. Indicators of performance are associated with each objective, and the rating in the current and recent years are reported. The report is available at <http://www.mtq.gouv.qc.ca/fr/ministere/rapport.asp>.

Saskatchewan Highways and Transportation prepares an annual Performance Plan which outlines the ministry's plan for making progress on its strategic outcomes. Available at http://www.highways.gov.sk.ca/docs/reports_manuals/reports/report_transition.asp, the 2005/06 Plan identifies three goals to meet the vision of transforming Saskatchewan's transportation system to address the social and economic opportunities of the 21st century. For each goal, the Performance Plan specifies objectives and states the performance measures which will be used to evaluate progress.

Nova Scotia Transportation and Public Works publishes its outcome-oriented performance measures on line at <http://www.gov.ns.ca/tran/publications/publication.asp> in summary tables. For its core business area of highway operations, two outcomes are identified. The first is that highway services address customers' needs. To measure performance, the department relies heavily on customer surveys and reports the percent of Nova Scotians who are satisfied or very satisfied with the provincial highway system. In addition, four service areas (filling cracks and potholes, paving sections of the highway, surface conditions of shoulders, helpfulness of non-commercial highway signs) are identified. Performance is measured considering the percent of Nova Scotians that indicate those services are very important but rate them less than excellent. The Nova Scotia department's second outcome is that highway infrastructure supports economic growth. In this case the performance measure used is the level of comfort as described by the international roughness index for the 100series highways. Finally, another core business area for the department is public works, within which improving highway safety is an outcome related to the road network. Casualty (fatality and injury) rates per 10,000 motor vehicles registered are used as the performance measure.

The Yukon Department of Highways and Public Works publishes reports on the condition of its pavements at <http://www.gov.yk.ca/depts/hpw/trans/highways/bst.html>. One report presents the pavement condition indices on its highways. Another report summarizes the results of annual rating of bituminous surface treated road sections in a variety of categories (rutting, ravelling, bleeding, etc) and the overall bituminous condition index.

2.1 Survey of Provincial and Territorial Jurisdictions

While it is clear from a review of published materials that most departments of transportation use some form of performance measures to evaluate their road networks, it is equally clear that the type of measures used and the implementation practices can vary significantly between jurisdictions. A survey of provincial and territorial agencies was conducted to synthesize information on agency use of performance measures related to six outcomes.

For each outcome, the survey provided a list of possible performance measures and respondents were asked to indicate which are collected and to describe the method of collection as well as the frequency of collection and coverage of the network. Where benchmarks or standards or thresholds are used, respondents were invited to identify those and to describe how performance measures are used in their jurisdiction.

The survey results, based on information provided by departments of transportation in Alberta, British Columbia, Manitoba, New Brunswick, the Northwest Territories, Quebec, and the Yukon, are summarized below.

The information collected during the survey indicates that for reporting agencies, performance measures are used to evaluate road networks regardless of the size of the jurisdiction, its population or the length of its road network. However, only two agencies reported using performance measures that incorporate client surveys. The intended audience for performance measures is generally senior management within the agencies. In most cases, elected officials and the general public also receive reports on the performance measures through departmental annual reports.

2.1.1 Outcome: Safety

The first outcome examined in the survey addressed safety. Society wants to remain safe while using the highway system to attain the benefits it bestows so transportation departments aim to minimize the risk of death, injury or property loss.

The survey listed a variety of indices were identified that could measure safety performance. They included: Accident rates per million vehicle kilometres (MVK); Fatalities per MVK; Injuries per MVK; Property damage only incidents; Percent of incidents involving trucks per MVK; and Rail grade crossing incidents.

The most commonly used performance measure is accident rates per million vehicle kilometres. With the exception of Yukon, all responding agencies reported using this measure. Most agencies collect data through control sections with excellent coverage of the network on an annual basis. Almost all agencies report using the measure for planning purposes and several also use it for evaluation and investment decisions.

Several agencies also reported using collisions or collision rates as a safety performance measure. As an example, the New Brunswick DOT Planning and Land Management Branch, Systems Planning Unit calculates collision rates on arterial and collector highways on an annual basis. In its survey response, the department reported that collision data is also used in the preparation of highway needs studies. Equivalent-property-damage-only (EPDO) are used to develop an EPDO/MVK collision rate on highway links being evaluated for needs purposes.

EPDO is based on the International Municipal Signal Association's process where a fatal collision is given a weight of twelve, a personal injury collision is given a weight of six and a property damage only collision is given a weight of one. This methodology incorporates the dimension of severity in the calculation of collision rates. Highway safety performance is then measured by comparing the observed EPDO collision rate with the highway class 75th percentile worst EPDO collision rate. The observed collision rate divided by the 75th percentile worst collision rate for the specific highway class provides a measure of safety performance. In terms of priority, the highway links exhibiting the higher "observed" over "75th" ratios should be considered first. Spot collision rates are calculated for highway sections with a length of 300 metres or less where 5 or more collisions have occurred during the last three years. The spot collision rate is in terms of EPDO/MEV (million entering vehicles). Priority for highway improvement is based on the actual collision rates. The locations having the higher rates should be considered for improvements first. The Highway Safety Section of the Maintenance and Traffic Branch perform more in-depth analysis of collision data when preparing improvement proposals under the Highway Safety Program. These analyses are however not performed on a network-wide basis.

2.1.2 Outcome: Transportation System Preservation

System preservation refers to the physical condition of infrastructure and is an important outcome for highway agencies as system managers. Assessing transportation system preservation is the most traditional application of performance measurement for transportation agencies. As might be expected, all agencies responding to the survey reported using various performance measurements to that end, with well-developed methods of collection and established benchmarks. These measures are extensively used for planning, evaluation, and investment purposes as well as for day-to-day operations.

The survey separated measures for maintaining the physical assets of the transportation system into two categories: pavement management and bridge management. Typical measures of pavement performance include the following indices: Riding comfort (RCI); Surface distress (SDI); Structural adequacy (SAI); Pavement condition (PCI); Roughness (IRI), and Pavement quality (PQI).

With five respondents citing it, the surface distress index is the most frequently reported measure of transportation system preservation performance. Four agencies also reported using structural adequacy, pavement condition and international roughness indices as performance measures. Yukon reported using a bituminous condition index, like a pavement condition index, for its bituminous surface treated roads.

Bridge management systems have long incorporated performance measures such as a bridge condition index or a live load rating factor. In particular, the bridge condition index is used by six of the seven agencies that responded to the survey; only Manitoba does not. The Northwest Territories reported using a sufficiency rating index in addition to the bridge condition index.

Alberta Infrastructure and Transportation (AIT) uses asset management including performance measurement to monitor highway infrastructure performance, and can provide an example of measuring the transportation system preservation outcome. The department measures physical condition using the international roughness index (IRI). While specifically a measure of roughness, AIT uses IRI as an indicator of overall condition at the network level. IRI data are

collected annually on the provincial highway network and are compared against criteria which define good, fair or poor conditions for ranges of IRI values.

2.1.3 Outcome: Sustainability and Environmental Quality

Like safety, the protection of resources, the environment, and quality of life is a desirable outcome while the benefits of the transportation system are enjoyed. The survey sought information on the use of measures to assess performance in maintaining and enhancing the quality of the natural and human environment. It was hypothesized that agencies might use smog, greenhouse gases, particulates or noise as performance measures in this regard. However, according to the survey results, Manitoba is the only agency that uses any of these measures. In that case, the department reported that it conducts spot noise studies for planning purposes. Alberta also reported conducting environmental evaluations, but no other agency reported using any measures to assess performance on sustainability and environmental quality.

2.1.4 Outcome: Cost Effectiveness

Cost effectiveness, in other words maximizing the current and future benefits from public and private investments, is generally considered an important outcome for transportation departments. It refers to the effectiveness with which resources are used to produce a given transportation output. Typical performance measures of cost effectiveness include net present value, net benefit/cost ratio, and internal rates of return.

British Columbia most actively pursues measurement of cost effectiveness, using all of the identified indices for planning, evaluation and investment. Alberta and the Yukon do not report using any of the listed values, although Alberta calculates replacement value of its assets annually and the Yukon uses life cycle cost analysis when planning some projects.

2.1.5 Outcome: Reliability

Customers of the transportation system in general and the road network in particular increasingly expect reliability: reasonable and dependable levels of service. To measure performance in this regard, possible indices would include level of service or percent delay experienced in the system.

Level of service is a typical measure used to describe the ability of traffic to move freely. According to the survey results, level of service is used as a performance measure by Alberta, Manitoba and New Brunswick. In Alberta, the department of Infrastructure and Transportation uses level of service as a measure of utilization, one of three categories of highway infrastructure performance it monitors. Utilization is defined as the percentage of the provincial highway network that is equal to or better than a target level of service "C" using the Highway Capacity Manual (TRB, 2000).

According to the survey, percent delay is used only by British Columbia. Among its objectives, the Ministry of Transportation includes two that relate to reliability. The first objective is that worsening congestion trends in urban areas are mitigated. The department uses the percentage of urban vehicle-kilometres travelled in congested conditions as its measure of performance against this objective. A second ministry objective states that highway safety and

reliability will be improved. A key performance measure for reliability is the annual total duration of unplanned highway closures greater than half an hour for all numbered highways in BC.

2.1.6 Outcome: Mobility/Accessibility

A desirable outcome for transportation departments is mobility and accessibility – ensuring that customers reach their desired destinations with relative ease within a reasonable time, at a reasonable cost and with reasonable choices. These are fundamental functions of transportation systems. The survey found that average speeds and traffic volumes serve as measures of mobility and accessibility. Traffic volume is used most commonly and has applications in planning and evaluation. Although it was posited that hours of delay per thousand vehicle kilometres traveled could be a measure of mobility/accessibility, none of the responding agencies indicated that it is used to that end.

3. PERFORMANCE MEASUREMENT IN OTHER COUNTRIES

Performance measurement of road networks is gaining prominence other developed nations around the world. The international perspective is interesting and the literature reflects a common desire to learn from others in this growing field.

Many agencies in the United States have significantly changed the way they conduct business in the last ten years. The movement towards transportation performance measurement for business planning and decision-making has been adopted in most states with priority placed on satisfying customers' needs.

In a synthesis of practice on performance measurement in state departments of transportation, Poister (1997) observed that the most widely used performance measures pertain to "traditional" program areas such as highway maintenance (pavement and bridge condition) and safety. Many states also reported using performance measures in the areas of highway construction. Poister also observed that many states are moving beyond traditional operating level measurements to monitoring inputs and outputs. Such "new generation" performance measures (e.g. cost-effectiveness) tend to be more strategically focused with more emphasis on quality and the impact on the customers' perspectives of the transportation (not just highway) system.

The US National Cooperative Highway Research Program has published *A Guidebook for Performance-Based Transportation Planning* (TRB, 2000) which presents a rationale for performance-based planning and includes a comprehensive "performance measures library." The library provides a structured inventory of the performance measures used in the United States in eight categories representing typical agency goals, as follows: Accessibility; Mobility; Economic; Development; Quality of Life; Environmental and Resource Conservation; Safety; Operational Efficiency; and System Condition and Performance.

The US Federal Highway Administration conducted an "international scan" with a delegation of professionals visiting Australia, New Zealand, Japan and Canada to study how agencies in those countries use performance measurement in transportation planning and decision-making. The study team found that transportation agencies they visited used performance measures for setting priorities and making investment and management decisions to a greater extent than is

typical in the United States. Amongst the lessons learned, the study team recommended that agencies consider implementing safety performance measurement for safety as this was considered the most impressive application and, used strategically, had resulted in a significant decline in fatalities. It was also observed that the use of indicators to measure performance on environmental matters proved the most challenging for transportation agencies in the countries visited (Federal Highway Administration, 2004).

Under the auspices of the Organisation for Economic Co-operation and Development, a scientific expert group conducted a study of performance indicators for the road sector (OECD, 1997) which was followed by a field test to refine and better define selected indicators (OECD, 2000). The OECD work revealed that most countries are working with performance measures in many of the same broad categories as in Canada and the United States. Dimensions, or goals, against which performance is measured include: Accessibility/mobility; Safety; Environment; Equity; Community ; Program development ; Program delivery ; and, Program performance.

In its field work, the OECD study tested 15 performance measures, listed below from the study report (OECD, 2000):

- Average road user cost
- Level of satisfaction regarding travel time, reliability and quality of road user information
- Protected road user risk
- Unprotected road user risk
- Environmental policy/programs
- Processes in place for market research and customer feedback
- Long term programs: A yes/no indicator
- Allocation of resources to road infrastructure
- Quality management/audit programs
- Forecast values of road costs versus actual costs
- Overhead percentage
- Value of assets
- Roughness
- State of road bridges
- Satisfaction with road system

Outside of Europe and North America, arguably the most ambitious application of performance measurement exists in Australia and New Zealand. In 1993, Austroads (the Australasian association of road transport and traffic authorities) established a program to develop and implement a set of national performance indicators for the road system and road authorities. A total of 72 performance indicators in ten categories were originally selected as the best representation of the economic, social, safety and environmental performance of the road system and road authorities. The indicators by category published online at <http://www.alqin.net/austroads/>. The ten categories include: Road Safety; Registration and Licensing; Road Maintenance; Environmental; Program/Project Assessment; Travel Speed; Lane Occupancy Rate; User Cost Distance; User Satisfaction Index; Consumption of Road, and Transport, Freight and Fuel.

It is interesting to note that Austroads has recently embarked on a major review of the indicators it uses. Evaluated against the criteria of being relevant, feasible to collect data and comparable,

it was found that 46 of the 72 measures are generally satisfactory and should therefore continue to form part of the national performance reporting process. Work to develop different indicators, and to refine some of those that will be retained, is expected to be conducted over the next two to three years.

4. SUMMARY AND CONCLUSIONS

The state of practice related to transportation performance measurement is developing rapidly in North America and around the world. There is an abundance of material on the subject that describes the theory, offers recommendations for performance measurement programs, and documents experiences of agencies building and implementing their own programs. The assembled material suggests that agencies recognize there is potential to improve performance through measurement and to improve accountability to the public and policy makers. Interest is growing in enhancing management processes by including performance measurement as a core component.

When developing performance measurement programs, the literature emphasizes that outcome measures should be included, where these relate the activities an agency undertakes to its strategic goals. Output and input measures, which reflect the resources that are dedicated to, and the products of, a program, may also be included in a performance-based management program. Data constraints must be considered and measures should be implemented only when it is feasible to collect the data necessary to generate them. The number of measures included in a performance-based program should be limited to those that reflect the issues that are important to an agency. This will simplify data collection and reporting and increase the likelihood the measures will be understood by the public and used effectively by agencies.

Reasons to measure performance within transportation departments are many, but the use of performance measurement to benchmark performance of one agency against another can be problematic. Benchmarking may help an agency to initially define a reasonable or desirable level of performance but it may not be useful as an ongoing comparison. While there is some interest in obtaining a national ranking by performance measures, it will not be informative if agencies are operating in different circumstances or are not truly peers. Differences in measures may be the result of divergent objectives, differing resource availability or external factors and not the result of agencies' performance.

Similarly, it was observed that there is not one measure, or one set of measures, that can be considered the best for all transportation agencies. In each case, the performance measures used must depend on the specific conditions of an agency, its goals, its resources, and its audience.

In road authorities around the world, common foci for performance measurement include: System condition and preservation, Safety, Accessibility, and Mobility.

In many cases, a user satisfaction index is reported which may be estimated from customer surveys or built from component measures such as those listed above. Interestingly, the environment – its protection and sustainability – is cited as an important goal for most transportation agencies and there is a common desire to be able to measure performance in

this regard. However, the identification of effective measures seems to be challenging and further work is necessary in this area.

Through the survey conducted for this project, there was ample evidence that Canadian provincial and territorial departments of transportation are working to incorporate performance measurement into their management practices. While some agencies have only recently embarked on this kind of program development, several others are well advanced in the processes. Many have entrenched their performance measurement in their business and strategic planning process and provide regular updates in published annual reports.

The survey revealed that all responding agencies use a variety of measures to assess performance on transportation system preservation. This is the most traditional application of performance measurement and is the best developed application in most Canadian agencies. However, the survey did not find that one index of pavement performance was used by all responding agencies. The surface distress index was the most frequently reported measure, with structural adequacy, pavement condition and international roughness indices also used by several agencies. For bridge performance, a bridge condition index was reported as the measure typically used by Canadian agencies.

The survey also suggested that safety is another outcome for which agencies have commonly established practices of performance measurement. In that case, most agencies reported using accident rates per million vehicle kilometres as a key measure. Most agencies collect data for this measure through control sections with excellent coverage of the network on an annual basis. Almost all agencies reported using the measure for planning purposes and several also use it for evaluation and investment decisions.

The outcomes of cost effectiveness, reliability, and mobility/accessibility were subject to performance measurement in some Canadian provincial and territorial departments of transportation. There was little consistency in application however. Not all agencies measure these outcomes, and among those that do, different measures tend to be used in different agencies.

Finally, according to the survey, measures to assess performance on sustainability and environmental quality are used to a very limited extent by Canadian agencies.

5. REFERENCES

Austrroads (1997). *Benchmarking Framework*. Austrroads Incorporated, Sydney, Australia.

Bradbury, Alison (2004). "Performance Measures Critical for Business" in *Road Talk*. Volume 10, Issue 2. Ministry of Transportation of Ontario, St. Catharines, ON.

Dalton, Doug, Joseph Nestler, John Nordbo, Bob St. Clair, Ernest Wittwer and Mark Wolfgram (2005). "Transportation Data and Performance Measurement" in *Performance Measures to Improve Transportation Systems: Summary of the Second National Conference*. National Academy Press, Washington, D.C.

Jurgens, Roy and Jack Chan (2005). "Highway Performance Measures for Business Plans in Alberta" in *Proceedings of the 2005 Annual Conference of the Transportation Association of Canada*. Transportation Association of Canada, Ottawa.

Kane, Tony (2005). "Opening Session Welcome" in *Performance Measures to Improve Transportation Systems: Summary of the Second National Conference*. National Academy Press, Washington, D.C.

Federal Highway Administration (2004). *Transportation Performance Measures in Australia, Canada, Japan, and New Zealand*. US Department of Transportation, Washington, D.C.

Gudmundsson, Henrik (2001). *Indicators and performance measures for Transportation, Environment and Sustainability in North America*. National Environmental Research Institute, Denmark.

Organisation for Economic Co-operation and Development (OECD) (1997). *Performance Indicators for the Road Sector*. OECD, Paris.

Organisation for Economic Co-operation and Development (OECD) (2000). *Field Test of Performance Indicators for the Road Sector*. OECD, Paris.

Pickrell, Steven and Lance Neumann (2001). "Use of Performance Measures in Transportation Decision Making" in *Performance Measures to Improve Transportation Systems and Agency Operations*. National Academy Press, Washington, D.C.

Poister, Theodore (1997). *NCHRP Synthesis of Highway Practice 238: Performance Measurement in State Departments of Transportation*. National Academy Press, Washington, D.C.

Transportation Association of Canada (TAC) (2001). *Measuring and Reporting Highway Asset Value, Condition and Performance*. Transportation Association of Canada, Ottawa.

Transportation Research Board (TRB) (2000). *NCHRP Report 446: A Guidebook for Performance-Based Transportation Planning*. National Academy Press, Washington, D.C.