Performance Measures for Road Networks: A Survey of Canadian Use

Prepared by:

Transportation Association of Canada

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Disclaimer

This report has been prepared under contract to Transport Canada by staff at the Transportation Association of Canada secretariat. While every effort has been made to accurately report the survey results, Transport Canada and the Board of Directors of the Transportation Association of Canada are not responsible for any errors or omissions.

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Table of Contents

List of Tables

List of Tables in Appendices

Executive Summary

Encompassing 1.4 million kilometres, the road network in Canada is vital to the Canadian way of life. Roads form part of an extensive transportation system that enables much of what is important to Canadians. Managing the road network is becoming increasingly challenging as demands increase and resources are limited, but transportation departments must continue to deliver the services and facilities that are critical to the country's well-being.

In the face of growing 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 transportation agencies, performance measurement has long been used as part of pavement management and bridge management systems. Now many agencies are extending the process to applications in construction and maintenance management systems, operations and safety programs, and administrative structures and processes.

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 report summarizes the results of a survey, which was intended to share knowledge and experiences between jurisdictions on how transportation departments use performance measurement systems. The survey was conducted under the auspices of the Chief Engineers' Council of the Transportation Association of Canada for Transport Canada.

The report provides a brief overview of the extensive literature available on the subject of performance measurement. Reasons to measure performance within transportation departments are cited, but it is noted that the use of performance measurement to benchmark performance of one agency against another can be problematic. Issues to consider when developing a performance measurement program are offered and it is observed that 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 used must depend on the specific conditions of an agency, its goals, its resources, and its audience.

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. 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.

The primary focus of the project was to survey Canadian provincial and territorial jurisdictions regarding current practices for performance measurement of road networks.

This report documents the results of the survey on agency use of specific performance measures related to six outcomes:

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

The survey revealed that all responding agencies track performance in the area of "system preservation," although a variety of measures and approaches are used. This appears to be the most highly developed and mature application of performance measures in Canadian highway agencies.

The survey also indicated that safety performance is a priority interest, with most agencies using accident rates per million vehicle kilometres as a key measure.

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 and different measures tend to be used in different agencies.

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

The report also highlights performance measurement applications in the United States, Europe and Australia to provide an international perspective on trends in performance measurement of road networks. Austroads is cited as having the most ambitious and long-standing performance measurement program, with 72 national performance indicators in ten categories. It is noted that there is considerable commonality amongst the categories of performance measures that are used internationally. Common foci for performance measurement include:

- System condition and preservation,
- Safety,
- Accessibility, and
- Mobility.

The report does not evaluate or recommend any one or set of performance measures but concludes by summarizing areas of commonality between Canadian jurisdictions with regard to the use of performance measurement.

1.0 Introduction

Encompassing 1.4 million kilometres, the road network in Canada is vital to the Canadian way of life. Our roads, as part of an extensive transportation system, enable much of what is important to us. They provide access to work, markets, education and health care. They facilitate our social interaction and support our economy, our competitiveness, and our well-being. The road network has been important throughout history, but now, building, maintaining and managing the system is growing more challenging for all governments and their transportation departments. Demands are increasing and resources are limited, but transportation departments must continue to deliver the services and facilities that are critical to the country.

In the face of these growing challenges, performance measurement has emerged as a useful tool for 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. Defined as a process of assessing progress toward achieving predetermined objectives, performance measurement allows management to evaluate program efficiency and effectiveness and plan improvements where necessary. Performance measurement thereby promotes goal- and standard-setting and program evaluation and improvement. Performance measurements can provide data to justify program expenditures or support requests for allocation of additional resources. As public agencies face demands for greater public accountability, performance measurement and reporting help answer those demands.

In transportation agencies, performance measurement has long been used as part of pavement management and bridge management systems. Now many agencies are extending the process to applications in construction and maintenance management systems, operations and safety program, and administrative structures and processes. 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. A project conducted under the auspices of the Chief Engineers' Council of the Transportation Association of Canada for Transport Canada was intended to share knowledge and experiences between jurisdictions on how transportation departments use performance measurement systems.

The primary objective of the project was to survey Canadian provincial and territorial jurisdictions regarding current practices for performance measurement of road networks. This report documents the results of the survey. The report also provides a review of some relevant literature on the subject of performance measurement and highlights applications in the United States, Europe and Australia to provide an international perspective on trends in performance measurement of road networks. The report does not evaluate or recommend any one or set of performance measures but discusses areas of commonality between Canadian jurisdictions with regard to the use of performance measurement.

2.0 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. Before examining what specific performance measures are used in jurisdictions in Canada and elsewhere, the following sections summarize information extracted from some key references on the theory of performance measurement.

2.1 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.

2.2 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. It will also 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 measurement was 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.

However, 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.

3.0 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.inftra.gov.ab.ca/annualreport.pdf). 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. A tabulated version of the Service Plan is included in Appendix A.

The Ontario Ministry of Transportation (MTO) has published its business plans including descriptions of its core businesses. The 2002-2003 plan, at http://www.mto.gov.on.ca/english/about/bplan/2002_03.htm, lists key performance measures used by the department. 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 sytsem that is reliable, efficient, accessible and integrated, MTO reported on highway accessibility as the percent of population living within 10 kilometres 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. Available at http://www.mtq.gouv.qc.ca/fr/ministere/rapport.asp , 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.

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. The specific performance measures are included in Appendix A.

Other jurisdictions have also made some of their performance measurement process public through other on-line documents, as discussed below.

Nova Scotia Transportation and Public Works publishes its outcome-oriented performance measures in summary tables on line at http://www.gov.ns.ca/tran/publications/publication.asp. 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 100-series 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 performance measurement 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.

3.1 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 specific performance measures related to six outcomes:

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

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. Additional space was also provided for comments or to identify other performance measures. The survey form is included as Appendix B to this report.

The survey was distributed to 12 provinces and territories and responses were received from eight jurisdictions. However, in responding, one jurisdiction declined to provide information, stating that its corporate performance measures had not yet reached a state where it would be appropriate to release them to the Chief Engineers' Council. Another jurisdiction was unable to provide a complete response to all components of the survey. 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 and detailed in 28 tables in Appendix C.

3.1.1 General Information

General information collected during the survey, and presented in Table C1, 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.

3.1.2 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. Survey results are summarized in Tables C2 through C8.

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.

3.1.3 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).

The survey did not find that one index was commonly used by all responding agencies, although most agencies use several from the list above. The results are tabulated in Tables C9 through C15. 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. The survey results regarding these measures are summarized in Tables C16 through C18.

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 that define good, fair or poor conditions for ranges of IRI values as tabulated below.

Table 1. Alberta Infrastructure and Transportation Criteria for Highway Physical Condition Rating (Jurgens and Chan, 2005)

Condition	110 km/h highways (m/km)	Other highways (m/km)
Good	IRI < 1.5	IRI < 1.5
Fair	1.5 < IRI <1.9	1.5 < IRI < 2.1
Poor	IRI <1.9	IRI < 2.1

3.1.4 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, as shown in Table C19. Alberta also reported conducting environmental evaluations, Table C20, but no other agency reported using any measures to assess performance on sustainability and environmental quality.

3.1.5 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. Tables C21 through C24 summarize the survey results on this issue.

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.

3.1.6 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 in Table C25, 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).

Percent delay is used only by British Columbia, according to the survey results shown in Table C26. 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.

3.1.7 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 (Table C27) and traffic volumes (Table C28) 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 travelled could be a measure of mobility/accessibility, none of the responding agencies indicated that it is used to that end.

4.0 Performance Measurement in the United States

Following trends around the world, 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.

In addition to the synthesis referenced above, 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:

1. Accessibility
2. Mobility
3. Economic Development
4. Quality of Life
5. Environmental and Resource Conservation
6. Safety
7. Operational Efficiency
8. System Condition and Performance

For each category, the guidebook further groups measures into different sub-categories (e.g. by mode) and highlights those in the comprehensive list that are most frequently used. Commonly used measures relating to the highway network are presented in Table 2 below, as extracted from the Guidebook (TRB, 2000). Some measures are repeated in different categories as they may be used to measure performance towards more than one agency goal.

Table 2: Performance Measures Used in the United States

Accessibility	Average travel time from facility to destination (by mode)
	Average travel time from facility to major highway network
	Average trip length
	Overall mode split
	Mode split by facility or route
	Number of structures with vertical (or horizontal) clearance less than X ft.
	Bridge weight limits
Mobility	Origin-destination travel times
	Total travel time
	Average travel time from facility to destination
	VMT by congestion level
	Lost time due to congestion
	Delay per VMT
	Level of service
	Intersection level or service
	Volume/capacity ratio
Economic Development	Direct jobs supported or created
	Economic costs of accidents
	Economic costs of lost time
	Indirect jobs supported or created
Quality of Life	Lost time due to congestion
	Accidents (or injuries or fatalities) per VMT
	Customer perception of safety in system
	Tons of pollution (or vehicle emissions) generated
Environmental and Resource Conservation	Overall mode split
	Tons of pollution (or vehicle emissions) generated
	Fuel usage
	Number of accidents involving hazardous waste
Safety	Number of accidents per VMT
	Number of accidents per year
	Number of accidents per trip
	Number of accidents per capita
	Number of accidents per ton-mile traveled
	Response time to incidents
	Customer perception of safety while in system
	Accidents (or injuries or fatalities) per VMT
	Percentage of highway mainline pavement (or bridges) rated good or better
	Average response time for emergency services
	Railroad/highway-at-grade crossings
	Number of accidents involving hazardous waste
Operational Efficiency	Origin-destination travel times
	Total travel times
	Average travel time from facility to destination
	Average travel time from facility to major highway network
	Volume/capacity ratio
	Overall mode split
	Cost per ton-mile
	Average vehicle occupancy
System Preservation	Percent of roadway/bridge system below standard condition
	Age distribution
	Percentage of highway mainline pavement (or bridges) rated good or better

5.0 Performance Measurement in Other Countries

Performance measurement of road networks is gaining prominence not only in North America but also in many 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.

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 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
- Program performance

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

1. Average road user cost: Average cost of running a medium car, a light diesel truck, and an articulated six-axle truck for both rural and urban operation.

2. Level of satisfaction regarding travel time, reliability and quality of road user information: Expressed on a scale from one to ten on a market survey. Elements that contribute to this indicator are still being developed in most countries.

3. Protected road user risk: Drivers' and vehicle passengers' fatalities. From a road traffic perspective, the fatalities are compared to the number of registered vehicles. From a health perspective, the fatalities are compared to the total population. The OECD report suggested that fatality risk is not a suitable measure of safety performance of a road administration. More specific indicators (such as average speed, seat belt use, drunk drivers) should be developed.

4. Unprotected road user risk: Vulnerable road users (pedestrians, motorcyclists and cyclists) fatalities. From a road traffic perspective, the fatalities are compared to the number of registered vehicles. From a health perspective, the fatalities are compared to the total population.

5. Environmental policy/programs: A yes/no indicator not commonly used. More measurable indicators should be developed.

6. Processes in place for market research and customer feedback: A yes/no indicator that requires further development. Agencies using surveys were cautioned to phrase questions to ensure customers prioritize their needs, considering cost as a factor.

7. Long term programs: A yes/no indicator. Long term programs are considered useful management tools to help organizations achieve their goals.

8. Allocation of resources to road infrastructure: A yes/no indicator to evaluate the existence of a system covering broad issues related to resource allocation such as asset management systems.

9. Quality management/audit programs: A yes/no indicator to evaluate if agencies have a quality management system or plans to establish one.

10. Forecast values of road costs versus actual costs: An indicator that can serve as a measure of road administrations' managing ability.

11. Overhead percentage: The fixed costs of a road administration compared to the total costs it incurs. It provides a measure of the cost effectiveness of an administration in delivering and maintaining the road sector.

12. Value of assets: Calculated in many different ways, this indicator provides a measure of the net economic value of road infrastructure.

13. Roughness: A key determinant of pavement quality, travel cost and user satisfaction, it also reflects the structural quality of the road. The international roughness index is widely used.

14. State of road bridges: Engineering soundness of bridges; an indicator recommended for all road administrations.

15. Satisfaction with road system: Broader than the second listed performance measure, this indicator provides insight to the road users' overall satisfaction with the road system. It is considered a very useful indicator for many agencies.

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 are listed in Table 3, and are also published online at http://www.algin.net/austroads/.

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. However, the review suggested that 16 of the 72 measures should be abandoned, as noted in Table 3. The remaining 10 measures do cover important outcome areas but do not meet the criteria and therefore should be replaced, also indicated in Table 3. 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.

Table 3: Performance Measures Used by Austroads

Road Safety	Serious Casualty Crashes (Population Basis)
	Serious Casualty Crashes (Veh-km Travelled Basis)
	Road Fatalities (Population Basis)
	Road Fatalities (Veh-km Travelled Basis)
	Persons Hospitalised (Population Basis)
	Persons Hospitalised (Veh-km Travelled Basis)
	Social Cost of Serious Casualty Accidents (Population Basis)
	Social Cost of Serious Casualty Accidents (Veh-km Travelled Basis)
Registration and Licensing	User Transaction Efficiency [Core Indicator] *[New indicator to be developed]*
	User Transaction Efficiency (Drivers Licenses) *[New indicator to be developed]*
	User Transaction Efficiency (Vehicle Registration) *[New indicator to be developed]*
	User Transaction Additional Cost for Drivers Licenses *[New indicator to be developed]*
	User Transaction Additional Costs for Vehicle Registration *[New indicator to be developed]*

(continued)

Table 3 (continued)

Road Maintenance	Road Maintenance Effectiveness *[Data no longer collected]*
	Road Maintenance Effectiveness Urban (110NRM) *[Data no longer collected]* (NRM = National Roughness Measurement)
	Road Maintenance Effectiveness Rural (110NRM) *[Data no longer collected]*
	Road Maintenance Effectiveness All (110NRM) *[Data no longer collected]*
	Road Maintenance Effectiveness Urban (140NRM) *[Data no longer collected]*
	Road Maintenance Effectiveness Rural (140NRM) *[Data no longer collected]*
	Road Maintenance Effectiveness All (140NRM) *[Data no longer collected*
	Smooth Travel Exposure Urban (110 NRM)
	Smooth Travel Exposure Rural (110 NRM)
	Smooth Travel Exposure All (110 NRM)
	Smooth Travel Exposure Urban (110 NRM) National Highway
	Smooth Travel Exposure Rural (110 NRM) National Highway
	Smooth Travel Exposure All (110 NRM) National Highway
	Smooth Travel Exposure Urban (140 NRM)
	Smooth Travel Exposure Rural (140 NRM)
	Smooth Travel Exposure All (140 NRM)
	Smooth Travel Exposure Urban (140 NRM) National Highway
	Smooth Travel Exposure Rural (140 NRM) National Highway
	Smooth Travel Exposure All (140 NRM) National Highway
Environmental	Greenhouse Gas Emissions
	Total Road Transport Greenhouse Gas Emissions *[New indicator to be developed]*
	Traffic Noise Exposure *[New indicator to be developed]*
Program/Project Assessment	Return on Construction Expenditure
	Achievement Index *[Under review]*
	Non-Road Interventions *[New indicator to be developed]*
	Return on Non Road Intervention Decisions *[New indicator to be developed]*
	Post Implementation Review on Non Road Safety Interventions [*New indicator to be developed]*
Travel Speed	Actual Travel Speed (Urban) AM
	Actual Travel Speed (Urban) PM
	Actual Travel Speed (Urban) Off Peak
	Actual Travel Speed (Urban) All Day
	Nominal Travel Speed (Urban)
	Congestion Indicator (Urban) AM
	Congestion Indicator (Urban) PM
	Congestion Indicator (Urban) Off Peak
	Congestion Indicator (Urban) All Day
	Variability of Travel Time (Urban) AM
	Variability of Travel Time (Urban) PM
	Variability of Travel Time (Urban) Off Peak
	Variability of Travel Time (Urban) All Day
	Actual Travel Speed (Rural) *[New indicator to be developed]*
	Nominal Travel Speed (Rural) *[New indicator to be developed]*

(continued)

Table 3 (continued)

Lane Occupancy Rate	Lane Occupancy Rate (Persons) AM
	Lane Occupancy Rate (Persons) PM
	Lane Occupancy Rate (Persons) Off Peak
	Lane Occupancy Rate (Persons) All Day
	Car Occupancy Rate AM
	Car Occupancy Rate PM
	Car Occupancy Rate Off Peak
	Car Occupancy Rate All Day
	Lane Occupancy Rate (Freight) *[Data no longer collected]*
User Cost Distance	User Cost Distance (Passenger Car) *[New indicator to be developed]*
	User Cost Distance (Urban Freight) *[New indicator to be developed]*
	User Cost Distance (Rural Freight) *[New indicator to be developed]*
	User Cost Distance (Urban Courier) *[New indicator to be developed]*
User Satisfaction Index	User Satisfaction Index *[Under review]*
Consumption of Road, Transport, Freight and Fuel	Consumption of Road Transport Indicator *[Data no longer collected]*
	Consumption of Road Freight Indicator *[Data no longer collected]*
	Consumption of Road Fuel Indicator *[Data no longer collected]*

6.0 Summary

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 solicited information on agency use of specific performance measures related to six outcomes:

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

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.

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Appendix A

Some Additional Jurisdictional Information

British Columbia Ministry of Transportation Service Plan

Table A1 presents the British Columbia Ministry of Transportation's service plan, which displays the linkages between government strategic goals and the ministry's mission, goals, objectives and performance measures. The goals and objectives shown emphasize that fostering economic growth is a key policy direction for the department. As a result, some of the performance measures used, such as "leveraged private investment" and "commercial trucking travel time between economic gateways", are considered unusual for transportation departments (FHWA, 2004).

Table A1: Performance Measures for the BC Ministry of Transportation

Government Strategic Goals		Ministry Mission To create an integrated and safe transportation network that incorporates all modes of transport, reflects regional priorities, and provides a strong foundation for economic growth. To maintain and improve the provincial highway system, ensuring the safe and efficient movement of people and goods provincially, nationally and internationally.				
		Ministry Goals		**Ministry Objectives**		**Performance Measures / Indicators**
A strong and vibrant provincial economy.	→	1. Key transportation infrastructure is improved to drive economic growth and trade.	→	1. Regional and local input is used when setting transportation priorities.	→	Survey of RTAC members' satisfaction with ministry consideration of RTAC recommendations.
			→	2. Available provincial investment dollars are used as effectively as possible.	→	Partnerships investment leveraged. Federal funding investment leveraged. Project performance: – completed on budget – completed on schedule.
			→	3. The worsening congestion trend in urban areas is mitigated.	→	Level of traffic congestion.
			→	4. Improved mobility for highways servicing major economic gateways.	→	Commercial trucking travel time between economic gateways.

(continued)

Table A1 (continued)

→	2. B.C. is provided with a safe and reliable highway system.	→	1. Contractors maintain the provincial highway system to a high standard.	→	Maintenance cost per lane kilometre. Contractor Assessment Program.
		→	2. The main highway system is maintained and rehabilitated on a lowest life cycle cost basis.	→	Pavement condition. Bridge condition. Number of lane kilometres resurfaced.
		→	3. Improved road access for resource industries and rural residents.	→	Surface condition. Number of lane kilometres treated.
		→	4. Improved highway safety and reliability.	→	Crash reduction after construction on safety improvement capital projects. Annual total duration of unplanned highway closures.
		→	5. An effective risk management process is established across the ministry.	→	Risk management plan.
→	3. B.C.'s transportation industries become more competitive.	→	1. Reduction or elimination of third party regulations and policies that impede B.C.'s ability to compete with other jurisdictions in the transportation market.	→	Progress toward implementation of liberalized air service agreements.
→	4. Excellent customer service is achieved and the ministry is recognized as a good employer.	→	1. Excellent service is provided to all British Columbians.	→	Customer Satisfaction Survey.
		→	2. Employees are provided with the support, training and working environment they need to excel at their jobs.	→	Employee Satisfaction Survey.

Saskatchewan Highways and Transportation Performance Plan

Table A2 lists the goals, objectives and measures used by Saskatchewan Highways and Transportation in its Performance Plan.

Table A2: Saskatchewan Highways and Transportation Performance Measures

Goal	Objectives	Performance Measures
A sustainable transportation infrastructure	Preserved principal highway network to meet the future economic needs of the Province.	Percent of the principal highway network in "good" condition
		Amount of principal pavements beyond their service life
	Transformed regional transportation network to meet the future needs of rural Saskatchewan	Percent of regional highway network in "good" condition (by surface type).
	Reduced damage on the highway system caused by overweight trucks	Percent of overweight trucks on the highway system
	Increased funding from additional sources	Additional funding from non-provincial government sources
		Ratio of road operations to overhead
The transportation system strengthens economic development and serves social needs	Reduced cost of moving goods and people by road, rail and air	Value of economic development generated by the Department's trucking programs
		Percent of principal highway network available at primary weights on an annual basis
	Targeted infrastructure investment for economic growth and social utility	Cumulative percent of twinned highway opened to traffic
	Improved connections to the north	Cumulative percent of improved northern community access roads
Safe movement of goods and people	Reduced collisions on the road	Percent of collisions involving an injury or fatality
		Ratio of partnership trucking fleet collision rate compared to Canadian commercial trucking fleet collision rate
		Percent of commercial vehicles inspected that are not mechanically fit and placed out of service
		Number of Commercial Vehicle Safety Alliance inspections conducted per year
		Percent of provincial railway operators with approved safety management plans
	Increased workplace safety	Number and severity of at-work injuries

Appendix B

Survey Form

SURVEY ON THE USE OF PERFORMANCE MEASURES FOR THE EVALUATION OF ROAD NETWORKS

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 can vary significantly between jurisdictions. In order to share knowledge and experience between jurisdictions on how transportation departments are meeting current demands to develop and implement performance measurement systems for their capital, operation and maintenance budgets, the Transportation Association of Canada is surveying provincial and territorial agencies across Canada regarding performance measurements of road networks. It should be noted that the measures referred to in this survey are network-based and not project-based performance measures. Please also note that the types of performance measures and not the collected data are of interest in this survey.

Background Information

1. Contact Person: _____
2. Title: _____
3. Agency: _____
4. Address: _____
5. City/Province/Postal Code: _____
6. Phone: _____ 7. Fax: _____
8. E-mail: _____
9. Web site _____
10. What is the population of the area for which your agency has jurisdiction?

11. How many two-lane equivalent kilometres of roadways are under your agency's direction, control and management? What percentage is paved?

12. Does your agency currently use performance measure in the evaluation of road networks?

Yes □ If yes, please continue with the survey.
No □ If no, please specify why your agency does not use performance indicators. This completes your survey; thank you for your participation.

13. Does your agency have any performance measures incorporating client surveys?

Yes □ If yes, please list the measures below.
No □

14. On the following pages, please complete the tables of typical performance measures grouped into separate agency "outcomes." Please indicate all of the performance measures that your jurisdiction collects, the method and frequency of collection, the percentage of your network covered by the measure, and benchmarks or standards (e.g. TAC, FHWA) and thresholds that your agency uses for infrastructure condition rating. Please also identify any additional measures that you use at the end of each table.

Outcome: Safety
Minimize the risk of death, injury or property loss.

Performance Measure	Collected / Evaluated	Method of collection	Frequency of Collection and % of Network Covered	Benchmarks, Standards, Thresholds	Use
Accident Rates/MKV	□ Yes □ No	□ Control Section □ GPS □ Other			□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Fatalities/MVK	□ Yes □ No	□ Control Section □ GPS □ Other			□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Injuries/MVK	□ Yes □ No	□ Control Section □ GPS □ Other			□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Property Damage Only	□ Yes □ No	□ Control Section □ GPS □ Other			□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
% Incidents involving trucks per MVK	□ Yes □ No	□ Control Section □ GPS □ Other			□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Rail grade crossing incidents	□ Yes □ No	□ Control Section □ GPS □ Other □ Mileage			□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Specify other:					

Outcome: Transportation System Preservation
Maintaining the physical assets of the transportation system.

Performance Measure	Collected / Evaluated	Method of collection (technologies, methodologies, protocols)	Frequency of Collection and % of Network Covered	Benchmarks, Standards, Thresholds	Use
Pavement Management System (PMS):					
Riding Comfort Index (RCI)	□ Yes □ No				□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Surface Distress Index (SDI)	□ Yes □ No				□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Structural Adequacy Index (SAI)	□ Yes □ No				□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Pavement Condition Index (RCI)	□ Yes □ No				□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Roughness (IRI)	□ Yes □ No				□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Pavement Quality Index (PQI)	□ Yes □ No				□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Specify Other:					□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____

Performance Measure	Collected / Evaluated	Method of collection (technologies, methodologies, protocols)	Frequency of Collection and % of Network Covered	Benchmarks, Standards, Thresholds	Use
Bridge Management System (BMS):					
Bridge Condition Index	□ Yes □ No				□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Live Load Rating Factor	□ Yes □ No				□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Specify Other:					

Outcome: Sustainability / Environmental Quality
Helping to maintain and enhance the quality of the natural and human environment.

Performance Measure	Collected / Evaluated	Method of Collection (Technologies, methodologies, protocols)	Frequency of Collection and % of Network Covered	Threshold	Use
Smog	□ Yes □ No				□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Greenhouse Gases	□ Yes □ No				□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Particulates	□ Yes □ No				□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Noise	□ Yes □ No				□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Specify other:					

Outcome: Cost effectiveness
Maximizing the current and future benefits from public and private transportation investments.

Performance Measure	Collected / Calculated	Specify time period, discount rates.	Frequency of Collection and % of Network Covered	Threshold	Use
Benefit/Cost Ratio:					
Net Present Value	□ Yes □ No				□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Net B/C ratio	□ Yes □ No				□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Internal Rate of Return	□ Yes □ No				□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Specify other:					

Outcome: Reliability
Providing reasonable and dependable levels of service.

Performance Measure	Collected	Method of Collection (Technologies, methodologies, protocols)	Frequency of Collection and % of system covered	Benchmarks, Standards, Thresholds	Use
Level of Service	□ Yes □ No				□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
% Delay	□ Yes □ No				□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Specify other:					

Outcome: Mobility/Accessibility
Reaching desired destination with relative ease within a reasonable time, at a reasonable cost with reasonable choices.

Performance Measure	Collected / Evaluated	Method of Collection (Technologies, Methodologies, Protocols)	Frequency of Collection and % of Network Covered	Benchmarks, Standards, Thresholds	Use
Average Speed	□ Yes □ No				□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Traffic Volumes	□ Yes □ No				□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Hours of delay/1000 vehicle kilometres traveled.	□ Yes □ No				□ Planning □ Evaluation □ Investment □ Day-to-day operations □ Other:_____
Specify other:					

15. Who is your audience for performance measures?
    - □ Elected officials
    - □ Public
    - □ Agency management
    - □ Other:

16. How are the measures reported?

17. If a summary of the performance measures employed by your agency is available, please provide a copy or a link to a web site with your response to the survey.

Web site location:_____

Thank you for your participation.

Appendix C

Detailed Survey Results

Table C1: General Survey Information

Jurisdiction	Population (000s)	Road Length[1] (km)	Performance measures used?	Performance measures incorporate client surveys?	Audience	Reporting
Alberta	2,907.8	30,800	Yes	Yes - % of municipal clients satisfied with overall quality of service	Elected officials Public Agency management	Some measures are reported in annual report and business plans for the department. Others are kept in pavement management and safety systems, or other department systems.
British Columbia	4,200.0	41,675	Yes	No	Elected officials Agency management	First presented to ministry executives for approval. Once approved the results are posted on line.
Manitoba	1,174.6	19,112	Yes	No	Elected officials Public Agency management	Annual reports and project reports
New Brunswick	730.0	14,849	Yes	No	Not yet determined	Not yet determined
Northwest Territories	43.0	2,200	Yes	No	Elected officials Public Agency management	Annual reports (public and internal)
Quebec	7,568.6	29,724	Yes	Yes	Elected officials Public	Annual report
Yukon	30.0	4,847	Yes	No	Agency management	Traffic counts are published each year. Copies of the report are circulated to those on a mailing list and posted on the department's web site. All other information is used internally by planners, maintenance managers and designers to develop plans for upgrading and resurfacing programs.

[1]Two-lane equivalent kilometres of roadways under agency's direction, control and management.

Table C2: Accident Rates per MVK as a Measure of Performance on Safety

Jurisdiction	Accident Rates / MVK	Method of Collection	Frequency of Collection and % of Network Covered	Benchmarks, standards, thresholds	Use
Alberta	Yes	Control section, GPS	Annually, 100%		Planning Evaluation Investment Day-to-day operations
British Columbia	Yes	From the police	Collected monthly, evaluated yearly, 95%	Crash reduction target set by BC Ministry	Planning Evaluation Investment Day-to-day operations
Manitoba	Yes	Control section	100%	1.0/MVK	Planning Evaluation
New Brunswick	Yes	Control section	Collision rates are calculated for rating sections, i.e. subsections of control sections, on an annual basis		Planning
Northwest Territories	Yes	Collision reports and traffic volume reports	Ongoing, 100% of network		Information only
Quebec	Yes		Annually, 100%, provincial and municipal		Planning Evaluation
Yukon	No				

Table C3: Fatalities per MVK as a Measure of Performance on Safety

Jurisdiction	Fatalities / MVK	Method of Collection	Frequency of Collection and % of Network Covered	Benchmarks, standards, thresholds	Use
Alberta	Yes	Control section, GPS	Annually, 100%		Planning Evaluation Investment Day-to-day operations
British Columbia	Yes	From the police	Collected monthly, evaluated yearly, 95%	Crash reduction target set by BC Ministry	Planning Evaluation Investment Day-to-day operations
Manitoba	Yes	Control section	100%		Planning Evaluation
New Brunswick	No				
Northwest Territories	No				
Quebec	Yes		Annually, 100%, provincial and municipal	650 fatalities Transportation Safety Policy 2001-2005, road component	Planning Evaluation Investment
Yukon	Yes	Control section	Continuous collection by RCMP, 100%		Planning Evaluation

Table C4: Injuries per MVK as a Measure of Performance on Safety

Jurisdiction	Injuries / MVK	Method of Collection	Frequency of Collection and % of Network Covered	Benchmarks, standards, thresholds	Use
Alberta	Yes	Control section, GPS	Annually, 100%		Planning Evaluation Investment Day-to-day operations
British Columbia	Yes	From the police	Collected monthly, evaluated yearly, 95%	Crash reduction target set by BC Ministry	Planning Evaluation Investment Day-to-day operations
Manitoba	Yes	Control section	100%		Planning Evaluation
New Brunswick	No				
Northwest Territories	No				
Quebec	Yes		Annually, 100%, provincial and municipal	4750 seriously injured people Transportation Safety Policy 2001-2005, road component	Planning Evaluation Investment
Yukon	Yes	Control Section	Continuous collection by RCMP, 100%		Planning Evaluation

Table C5: Property Damage Only Incidents a Measure of Performance on Safety

Jurisdiction	Property damage only	Method of Collection	Frequency of Collection and % of Network Covered	Benchmarks, standards, thresholds	Use
Alberta	Yes	Control section, GPS	Annually, 100%		Planning Evaluation Investment Day-to-day operations
British Columbia	Yes	From the police	Collected monthly, evaluated yearly, 95%	Crash reduction target set by BC Ministry	Planning Evaluation Investment Day-to-day operations
Manitoba	Yes	Control section	100%		Planning Evaluation
New Brunswick	No				
Northwest Territories	No				
Quebec	Yes[1]	Control section[2]	Annually, 100%, provincial		Planning Evaluation Investment
Yukon	Yes	Control section	Continuous collection by RCMP, 100%		Planning Evaluation

[1]Since 1999, reports on PDO accidents are not mandatory
[2]The provincial road network is divided in Route-Tronçon-Section-Chaînage (RTSC) on which accidents may be located

Table C6: Percent of Incidents Involving Trucks per MVK as a Measure of Performance on Safety

Jurisdiction	% Incidents involving trucks /MVK	Method of Collection	Frequency of Collection and % of Network Covered	Benchmarks, standards, thresholds	Use
Alberta	Yes	Control section, GPS	Annually, 100%		Evaluation Day-to-day operations
British Columbia	Yes	From the police	Collected monthly, evaluated yearly, 95%	Crash reduction target set by BC Ministry	Planning Evaluation Investment Day-to-day operations
Manitoba	No				
New Brunswick	No				
Northwest Territories	No				
Quebec	Yes		Annually, 100%, provincial and municipal		Planning Evaluation Investment
Yukon	No				

Table C7: Rail Grade Crossing Incidents as a Measure of Performance on Safety

Jurisdiction	Rail grade crossing incidents	Method of Collection	Frequency of Collection and % of Network Covered	Benchmarks, standards, thresholds	Use
Alberta	Yes	Control section, GPS	Annually, 100%		Evaluation Day-to-day operations
British Columbia	Yes	Mileage, from the police	Collected monthly, evaluated yearly, 95%	Crash reduction target set by BC Ministry	Planning Evaluation Investment Day-to-day operations
Manitoba	Yes	Control section	100%		Planning Evaluation
New Brunswick	No				
Northwest Territories	No				
Quebec	Yes		Annually, 100%, provincial and municipal		Planning Evaluation Investment
Yukon	No				

Table C8: Other Measures of Performance on Safety

Jurisdiction	Other	Method of Collection	Frequency of Collection and % of Network Covered	Benchmarks, standards, thresholds	Use
British Columbia	Crash reduction	Using data from other measures	Before and after study for projects	Crash reduction target set by BC Ministry	
New Brunswick	Collision rates		Annually		
Northwest Territories	Collisions / 100 drivers Collisions / 100 vehicles Collisions / 100 people	Collision reports	Ongoing, 100%		Information
Yukon	Collisions	Collision reports	Continuous collection by RCMP, 100%		Planning

Table C9: Riding Comfort Index as a Measure of Transportation System Preservation

Jurisdiction	Riding comfort index	Method of Collection	Frequency of Collection and % of Network Covered	Benchmarks, standards, thresholds	Use
Alberta	No				
British Columbia	Yes	Infrared	Primary hwy – every 2 years Secondary hwy – every 3 years Side/rural road – every 4 years	Primary and secondary hwy: 76% good, PCI>7 Side Road: 46% Good, PCI>7	Planning Evaluation Investment Day to day operations
Manitoba	No				
New Brunswick	Yes	Convert IRI to RCI	3 years	To be determined	Evaluation
Northwest Territories	Yes	Subjective judgement/experience	Annually, 100%	TAC	Planning Evaluation Day to day operations
Quebec					
Yukon	No				

Table C10: Surface Distress Index as a Measure of Transportation System Preservation

Jurisdiction	Surface distress index	Method of Collection	Frequency of Collection and % of Network Covered	Benchmarks, standards, thresholds	Use
Alberta	Yes	Maintenance Contract Inspectors	Every 2nd year, 50% of network per year		Planning Evaluation Day to day operations
British Columbia	Yes	Infrared	Primary hwy – every 2 years Secondary hwy – every 3 years Side/rural road – every 4 years	Primary and secondary hwy: 76% good, PCI>7 Side Road: 46% Good, PCI>7	Planning Evaluation Investment Day to day operations
Manitoba	Yes	Cracking by manual means, rutting by automated means – laser vision system	Cracking annually, 100% Rutting biannually, 100%	Department standard: cracking 0-5-10&>10 mm Rutting 0-10-20&>20mm	Planning Evaluation Investment Day to day operations
New Brunswick	Yes		3 years – entire network	To be determined	Evaluation
Northwest Territories	Yes	Measurement area lineal depth	Annually, 10%	TAC	Planning Evaluation Day to day operations
Quebec					
Yukon	No				

Table C11: Structural Adequacy Index as a Measure of Transportation System Preservation

Jurisdiction	Structural adequacy index	Method of Collection	Frequency of Collection and % of Network Covered	Benchmarks, standards, thresholds	Use
Alberta	Yes	Falling weight deflectormeter (consultants)	Network FWD collected on 7-9 year cycle, 100%		Planning Evaluation Investment Pavement design
British Columbia	Yes	Infrared PCI and SDI are used to generate SAI	Primary hwy – every 2 years Secondary hwy – every 3 years Side/rural road – every 4 years	Primary and secondary hwy: 76% good, PCI>7 Side Road: 46% Good, PCI>7	Planning Evaluation Investment Day to day operations
Manitoba	Yes	Benkelman Beam, introducing FWD for 5% of the network	Annually, from Apr 15 to May 20, 30%	Department standard: pavement design. Setting spring restrictions – BBR (mean+ 2 std deviations) > 1.5 mm	Planning Evaluation Investment
New Brunswick	Yes	Convert IRI to RCI	3 years – arterials and collectors	To be determined	Planning
Northwest Territories	No				
Quebec					
Yukon	No				

Table C12: Pavement Condition Index as a Measure of Transportation System Preservation

Jurisdiction	Pavement condition index	Method of Collection	Frequency of Collection and % of Network Covered	Benchmarks, standards, thresholds	Use
Alberta	No				
British Columbia	Yes	Infrared	Primary hwy – every 2 years Secondary hwy – every 3 years Side/rural road – every 4 years	Primary and secondary hwy: 76% good, PCI>7 Side Road: 46% Good, PCI>7	Planning Evaluation Investment Day to day operations
Manitoba	No				
New Brunswick	Yes	Convert IRI to RCI	3 years – arterials and collectors	To be determined	Planning Evaluation Investment
Northwest Territories	Yes	Visual Combination of frequency and severity	Annual 10%	TAC	Planning Evaluation Day to day operations
Quebec					
Yukon	Yes	Manual collection through on-site inspection	Annually, 252 km or 5.2% (total paved roads)		Planning Evaluation Basis for resurfacing programs typically delivered by maintenance staff.

Table C13: International Roughness Index as a Measure of Transportation System Preservation

Jurisdiction	International roughness index	Method of Collection	Frequency of Collection and % of Network Covered	Benchmarks, standards, thresholds	Use
Alberta	Yes	Consultants	Annually, 100%	Standards developed for good, fair, poor condition	Planning Evaluation Investment Day to day operations
British Columbia	Yes	Infrared PCI and SDI are used to generate IRI	Primary hwy – every 2 years Secondary hwy – every 3 years Side/rural road – every 4 years	Primary and secondary hwy: 76% good, PCI>7 Side Road: 46% Good, PCI>7	Planning Evaluation Investment Day to day operations
Manitoba	Yes	Automated, laser visual system	Biannually, 100%	Department standard: Expressways 1.9 & 2.4 mm/m Arterials 2.4 Collectors 3.0	Planning Evaluation Investment
New Brunswick	Yes		3 years – entire network	To be determined	Planning Evaluation Investment
Northwest Territories	No				
Quebec					
Yukon	No				

Table C14: Pavement Quality Index as a Measure of Transportation System Preservation

Jurisdiction	Pavement quality index	Method of Collection	Frequency of Collection and % of Network Covered	Benchmarks, standards, thresholds	Use
Alberta	Yes	Calculated through PMS	Annually, 100%	Triggers are set for various functional classes	Planning Evaluation Day to day operations
British Columbia	Yes	Infrared PCI and SDI are used to generate PQI	Primary hwy – every 2 years Secondary hwy – every 3 years Side/rural road – every 4 years	Primary and secondary hwy: 76% good, PCI>7 Side Road: 46% Good, PCI>7	Planning Evaluation Investment Day to day operations
Manitoba	No				
New Brunswick	No				
Northwest Territories	No				
Quebec					
Yukon					

Table C15: Other Measures of Transportation System Pavement Preservation

Jurisdiction	Other	Method of Collection	Frequency of Collection and % of Network Covered	Benchmarks, standards, thresholds	Use
Yukon	Bituminous condition index (PCI for BST surfaces)	Manual collection through on site inspections	Annually, 2124 km or 42.3% (total BST roads)		Planning Evaluation Basis for resurfacing programs typically delivered by maintenance staff.

Table C16: Bridge Condition Index as a Measure of Transportation System Preservation

Jurisdiction	Bridge condition index	Method of Collection	Frequency of Collection and % of Network Covered	Benchmarks, standards, thresholds	Use
Alberta	Yes	Level 1 Visual Inspection System to assess the condition and functionality of the provincial bridge network. This work is done by contracted consultant inspectors on behalf of the province's assets and provincially certified inspectors on behalf of the local road bridges in the province. Level 2 Inspections, which require specialized equipment or skills, is performed as part of ongoing programs and on an as needed emergency basis.	Level 1 inspections occur at the following intervals; 2 digit No Highway structures – 21 months 3 digit No. highway structures – 39 months Major Bridges on Local Roads- 39 months Standard Bridges and Culverts on local roads- 57 months Excludes private structures, city structures, federal structures, otherwise 100% of the provincial and local road system is covered.	A 1-9 condition rating system is used ranging from 9(Very Good), 7(Good), 5(Adequate), 3(Poor) to 1(Immediate Action) A threshold value of 4 indicates the item is below minimum acceptable condition and is used as a trigger to determine rehabilitation strategies. These ratings also reflect the priority of urgency for maintenance.	Planning Evaluation Day-to-day operations The information gathered from these inspections is intended to feed the decision making routines being developed to produce the long term preservation and rehabilitation strategies for the provincial bridge network.
British Columbia	Yes	Bridge Assessment System (BSAII) Funding Need Assessment (FNA)	Annually, 100%	Canadian Highway Bridge Design Code	Evaluation Investment
Manitoba	No				
New Brunswick	Yes	Excel spreadsheet	2 year cycle	To be determined	Planning Evaluation Investment Day to day operations
Northwest Territories	Yes	Visual Chain drag Half cell	Annually, 20%	Alberta Bridge Inspection and Maintenance System	Planning Evaluation Investment
Quebec	Yes	General inspection	Every 3 years: 33% of network covered each year		Planning Evaluation Investment
Yukon	Yes	Manual collection through on site inspections	Every 2 years	Locally adapted version of the Alberta Bridge Management System	Planning Evaluation To develop rehabilitation programs

Table C17: Live Load Rating Factor as a Measure of Transportation System Preservation

Jurisdiction	Live load rating factor	Method of Collection	Frequency of Collection and % of Network Covered	Benchmarks, standards, thresholds	Use
Alberta	No				
British Columbia	Yes	Bridge Assessment System (BSAII) Funding Need Assessment (FNA)	Annually, 100%	Canadian Highway Bridge Design Code	Evaluation Investment
Manitoba	No				
New Brunswick	No				
Northwest Territories	Yes		As required	CAN/CSA-S6-00	Planning Evaluation Investment
Quebec	Yes	Bridge load capacity evaluation	Before a major rehab for bridges designed for less than H20-S16	FCS<1.0	Planning Evaluation Investment
Yukon					

Table C18: Other Measures of Transportation System Bridge Preservation

Jurisdiction	Other	Method of Collection	Frequency of Collection and % of Network Covered	Benchmarks, standards, thresholds	Use
Northwest Territories	Sufficiency rating index		Annually, 20%	Alberta Bridge Inspection and Maintenance System	

Table C19: Noise as a Measure of Sustainability and Environmental Quality

Jurisdiction	Noise	Method of Collection	Frequency of Collection and % of Network Covered	Benchmarks, standards, thresholds	Use
Alberta	No		Only when roadway is to be near urban centres		Planning
British Columbia	No	Not within scope of Ministry service plan			
Manitoba	Yes	Spot studies		Provincial Environmental Guidelines	Planning
New Brunswick	No				
Northwest Territories	No				
Quebec					
Yukon	No				

Table C20: Other Measures of Sustainability and Environmental Quality

Jurisdiction	Other	Method of Collection	Frequency of Collection and % of Network Covered	Benchmarks, standards, thresholds	Use
Alberta	Environmental evaluations	Fisheries, wildlife (including birds), vegetation, wetlands, historical resources			

Table C21: Net Present Value as a Measure of Cost Effectiveness

Jurisdiction	Net Present Value	Time period, discount rates	Frequency of Collection and % of Network Covered	Thresholds	Use
Alberta	No				Project specific basis
British Columbia	Yes	Every 3-5 years	After project completion and every year after	Internal targets	Planning Evaluation Investment
Manitoba	No				
New Brunswick	No				
Northwest Territories	Yes	20 years	100%		Planning
Quebec					
Yukon	No				

Table C22: Net Benefit/Cost Ratio as a Measure of Cost Effectiveness

Jurisdiction	Net B/C Ratio	Time period, discount rates	Frequency of Collection and % of Network Covered	Thresholds	Use
Alberta	No				Project specific basis
British Columbia	Yes	Every 3-5 years	After project completion and every year after	Internal targets	Planning Evaluation Investment
Manitoba	Yes				Planning
New Brunswick	Yes	For federally-funded projects only			Evaluation
Northwest Territories	No				
Quebec					
Yukon	No				

Table C23: Internal Rate of Return as a Measure of Cost Effectiveness

Jurisdiction	Internal rate of return	Time period, discount rates	Frequency of Collection and % of Network Covered	Thresholds	Use
Alberta	No				Project specific basis
British Columbia	Yes	Every 3-5 years	After project completion and every year after	Internal targets	Planning Evaluation Investment
Manitoba	No				
New Brunswick	No				
Northwest Territories	No				
Quebec					
Yukon	No				

Table C24: Other Measures of Cost Effectiveness

Jurisdiction	Other	Time period, discount rates	Frequency of Collection and % of Network Covered	Thresholds	Use
Alberta	Replacement value		Calculated annually		
Yukon	Life cycle cost analysis				Planning for specific projects

Table C25: Level of Service as a Measure of Reliability

Jurisdiction	Level of Service	Method of Collection	Frequency of Collection and % of Network Covered	Thresholds	Use
Alberta	Yes	Calculated using Highway Capacity Manual 2000, and using traffic data and physical inventory collected by department	Annually, 100%	LOS C or better acceptable	Planning Evaluation
British Columbia	No				
Manitoba	Yes			LOS, Passing Opportunities	Planning
New Brunswick	Yes	Spot analysis			Day to day operations
Northwest Territories	No				
Quebec					
Yukon	No				

Table C26: Percent Delay as a Measure of Reliability

Jurisdiction	% Delay	Method of Collection	Frequency of Collection and % of Network Covered	Thresholds	Use
Alberta	No				
British Columbia	Yes	GPS	Annually	Compared the actual truck travel time to the ideal truck travel time (posted speed limit) on selected highway routes in BC 80% and above	Planning Evaluation Investment
Manitoba	No				
New Brunswick	No				
Northwest Territories	No				
Quebec					
Yukon	No				

Table C27: Average Speed as a Measure of Mobility/Accessibility

Jurisdiction	Average speed	Method of Collection	Frequency of Collection and % of Network Covered	Thresholds	Use
Alberta	No				
British Columbia	Yes	GPS	Annually	Actual truck travel time vs ideal truck travel time	Planning Evaluation Investment
Manitoba	Yes	Spot speed studies			Planning Evaluation
New Brunswick	No				
Northwest Territories	No				
Quebec					
Yukon	No				

Table C28: Traffic Volume as a Measure of Mobility/Accessibility

Jurisdiction	Traffic Volumes	Method of Collection	Frequency of Collection and % of Network Covered	Thresholds	Use
Alberta	No		100%		Planning
British Columbia	Yes	Traffic Count	Monthly or when the data becomes available		Planning Evaluation Investment
Manitoba	Yes	Spot counts, permanent counters			Planning Evaluation
New Brunswick	Yes				Planning Evaluation
Northwest Territories	Yes	Traffic counters Short term classifications Ferry traffic classifications	Annual report 100% of network		Planning Evaluation Investment
Quebec					
Yukon	Yes	Approximately 20 permanent sites in Yukon plus seasonal data on several secondary roads over summer months	Permanent sites provide 100% data Seasonal sires provide data over 4 months		Planning Evaluation