

## Primer

# Transportation Asset Management Best Practices for Canada

## Introduction

Canada ranks seventh in the world in terms of road network size, with a two-lane equivalent length of 1.04 million kilometres, and 37<sup>th</sup> in the world by population, with a tax base of 35 million people to support this infrastructure. The Canadian road network is largely rural in nature. The roadway infrastructure is aging, with increased demands for maintenance and rehabilitation.

Federal agencies including the Treasury Board of Canada Secretariat, Parks Canada and Transport Canada, provincial highway agencies such as Alberta, Saskatchewan, Ontario and New Brunswick, municipalities such as Vancouver, Calgary, Toronto and Ottawa and public-private partnerships such as the Sea to Sky, Highway 407 ETR and Route 1 Gateway have established asset management business frameworks to assist in the efficient and cost-effective management of their transportation assets.

This primer provides an overview of the transportation asset management practices followed by Canadian provincial, regional, municipal and transit agencies across Canada.

## Transportation Asset Management

The term “asset management” has been used for decades in the financial and business world. Definitions of asset management by North American transportation agencies began to appear in the mid-1990s, spurred by increased interest in the potential for applying business principles to the transportation sector. These included the U.S. Department of Transportation definition:

“Asset Management is a framework for making cost-effective resource allocation, programming and management decisions. It combines engineering principles with sound business practices and economic theory, and provides tools to facilitate a more organized, logical and comprehensive approach to decision making.”

This definition was adopted in TAC’s 1999 *Primer on Highway Asset Management Systems*.



## CANADA

Unlike many countries around the world, Canada does not have a central federal authority responsible for road infrastructure. Transportation assets (roads, rail, airports, traffic control, transit, pipelines, ports, etc.) are generally the largest component of civil infrastructure. Provincial, territorial and municipal governments are responsible for a significant portion of the assets in Canada. Road infrastructure by jurisdiction is generally classified as follows:

- Federal – Roads under the jurisdiction of federal agencies;
- Provincial – Roads under provincial or territorial jurisdiction;
- Municipal – Roads under municipal jurisdiction;
- Access roads – Roads that are located on public land and are typically constructed and maintained by private industry to provide access to resources (forest, mineral extraction, recreation areas, etc.); and
- Private road infrastructure – Roads built and maintained by private interests.

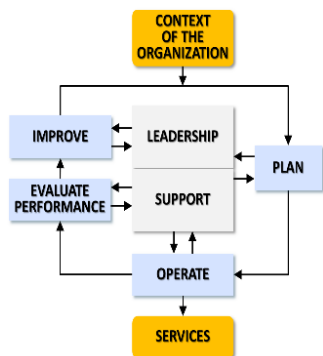
Approximately 80 percent of the public roadways in Canada are maintained by municipal governments.

In 2008, the Canadian Public Sector Accounting Board (PSAB) introduced Regulation 3150. The PSAB 3150 was approved by the Canadian provincial governments and requires all municipal governments in Canada to record and include all tangible capital assets in financial statements under the care and control of the municipality. It requires that all assets be recorded at their historical cost and depreciated to the current period. Since 2009, all public sector municipal agencies in Canada are required to comply with PSAB 3150.

The *Guide to Accounting for and Reporting Tangible Capital Assets* was published by the Public Sector Accounting Group of the Canadian Institute of Chartered Accountants (CICA) to provide a handbook for municipal governments to comply with the PSAB 3150. As a result of the logical development of asset management practices, the enactment of the PSAB 3150 regulations and the global trend towards sustainable infrastructure, a large number of public agencies are adopting an asset management approach to managing their transportation assets.

## UNITED STATES

In the United States, the *Moving Ahead for Progress in the 21st Century Act* (MAP-21) was enacted to integrate performance into many federal, state, and local transportation decision making programs. Specifically, MAP-21 requires federal, state and local transportation agencies to establish risk-based asset management plans that include all infrastructure assets within the right-of-way of highways. In the U.S., overall leadership on transportation asset management is the purview of the Federal Highway Administration (FHWA), the American Association of State Highway and Transportation Officials (AASHTO) and the Transportation Research Board (TRB). Recent efforts have included publishing the AASHTO *Transportation Asset Management Guide – A Focus on Implementation* and convening FHWA's 10<sup>th</sup> National Conference on Transportation Asset Management.



## INTERNATIONAL

Internationally, there has been a significant amount of work done in the advancement of asset management. This has included the development and update of the *International Infrastructure Management Manual*. This manual was first published in 1995 in response to a public infrastructure crisis in New Zealand and Australia. In 2008, the United Kingdom published Publicly Available Specification (PAS) 55 in response to demand from industry for a standard for asset management. It is applicable to any organization where physical assets are a key or critical factor in achieving its business goals. PAS 55 is published in two parts:

- PAS 55-1: *Specification for the Optimized Management of Physical Assets*; and
- PAS 55-2: *Guidelines for the Application of PAS 55-1*.

In 2014, ISO published 55000:2014, *Asset Management – Overview, Principles and Terminology*. ISO is a worldwide federation of national standards bodies. ISO 55000 provides an overview of asset management and asset management systems and provides the context for and terminology applicable to ISO 55001 and ISO 55002. ISO 55001 specifies the requirements for the establishment, implementation, maintenance and improvement of a system for asset management. ISO 55000 outlines specific processes and procedures that are recommended for the successful implementation of an asset management program.

## Canadian Agency Asset Management Readiness

The best practices and lessons learned from agencies that have been active in transportation asset management are documented in the TAC *Synthesis of Asset Management Best Practices*. Most Canadian transportation agencies surveyed during development of the synthesis are at a moderate level of readiness for each fundamental element of the ISO 55000 standard. Organization and leadership elements are strong in developing and implementing asset management systems, but agencies reported a lower level of readiness in the remaining elements such as continuous improvement within their asset management system. Since most agencies are still in the development stages of their asset management programs, the continuous improvement ranking is expected to increase as asset management systems become more mature.

## Performance Indicators

Performance measures are the backbone of asset management. The use of asset condition performance measures in planning rehabilitation investments ensures that the right investment is made at the right time in the right location over the long term. Asset condition performance measures allow the agency to gauge how well it is doing in providing a safe and effective road network.

Transportation asset management typically has focused on the higher cost elements of infrastructure, such as pavements and bridges. The agency bases its needs and funding requests on meeting specific performance measures for pavement and bridge condition. It is also important to ensure that the agency can achieve a steady state “good” condition and eliminate any infrastructure debt over the long term. Infrastructure debt is defined as the cost of the backlog of rehabilitation needs when the budget is fully spent. Targets are set for both the short term on a year-by-year basis and to meet long-term objectives. Targets are based on the life cycle of an asset, the amount of work that is reasonable in a construction period, available funding levels, eliminating a backlog of deficiencies and maintaining any future infrastructure debt at a reasonable level.

As an example, the Province of Ontario sets performance targets for pavements and bridges in “good” condition at 67% and 85%, respectively. In general a pavement in good condition does not require rehabilitation/reconstruction for six or more years and has a pavement condition index of 65 or higher. A pavement in fair condition will require treatment in one to five years and a pavement in poor condition is currently in need of rehabilitation or reconstruction (in other words, it has reached the end of its service life). This is based on a time interval of 15 years between significant pavement treatments. The need for rehabilitation or reconstruction depends on the age of the entire pavement structure (when was it originally built), the condition level to which a pavement is allowed to deteriorate, changes in traffic and local conditions and the quality and timeliness of maintenance during the pavement life.

For a bridge to be considered in “good” condition, it would have a bridge condition index of 70 or higher. The bridge condition index consists of the combination of weighted condition ratings from all major bridge components.

A municipal example is provided by the City of Edmonton, which evaluates the condition of assets according to the following three criteria:

- Physical condition – Condition of the physical infrastructure that allows it to meet the intended level of service;
- Demand/capacity – The capacity of the physical infrastructure and its ability to meet the service needs; and
- Functionality – The ability of the physical infrastructure to meet program delivery needs.

Since 2002, the City of Edmonton has used a standardized rating system to determine the state and condition of its infrastructure. This five point system (A - Very good, B - good, C - fair, D - poor and F - very poor) is used to assess each aspect of municipal infrastructure in terms of the criteria listed above. Pavement surface distress and other condition ratings such as smoothness are used to calculate a condition rating on a scale of 0 to 10. This scale is then divided to five equal portions to determine the rating categories.

## Asset Condition Assessment



All agencies have established procedures for asset condition assessment. Pavements usually are assessed in terms of surface distress, smoothness and rutting. For bridges, condition ratings are completed on individual components and an overall bridge condition index calculated.

The most comprehensive performance measure requirements in Canada are in the concession agreements for public-private-partnership (PPP) projects. For example, for the Sea to Sky Highway Concession, highway sections are managed in 50 m per lane intervals with smoothness, rutting and distress asset preservation performance measures (APPMs) along with an overall distribution of condition required for the entire length of roadway.

The assets to be evaluated in PPP projects are defined in the concession agreements. Most agreements include all of the major elements within the right-of-way including:

- Pavements (main lanes, shoulders, side roads, pullouts);
- Structures (bridges, tunnels, retaining walls);
- Electrical systems (lighting, cameras, digital signs);
- Right of way (landscaping, fencing, noise walls);
- Safety appurtenances (barrier walls, pavement markings; attenuators, signs); and
- Drainage.



The maintenance and rehabilitation treatments for each asset are not specified. The concessionaire is free to select the method of treatment as long as the result meets the requirements of the pre-defined asset preservation performance measure. The Ontario Ministry of Transportation has established performance-based measures/specifications for projects that have been delivered through a PPP (also called alternative financing and procurement projects) with specific performance requirements required to be met during the concession and at the hand back of the concession period (typically 30 years).

## Tools to Analyze Investment Choices



There is a large variation in the transportation asset management tools employed by agencies in Canada. The majority of agencies have different databases and software applications to manage their transportation infrastructure. The software systems used are typically commercial off-the-shelf applications, frequently modified for individual agency use. For most Canadian agencies, pavement management is a mature process. The legacy of national coordinated efforts on pavement design and management date back to the 1950s and the Canadian Good Roads Association (CGRA) committee on pavement design and evaluation. This led to the Roads and Transportation Association of Canada (RTAC) Pavement Management Committee and the publication of the first *Pavement Management Guide* in 1977. Subsequently, the first two international conferences on managing pavement assets took place in Toronto in 1985 and in 1987. The current edition of the TAC *Pavement Asset Design and Management Guide* was published in 2013. Each successive publication has moved more and more towards providing up-to-date guidance for the management of transportation assets.

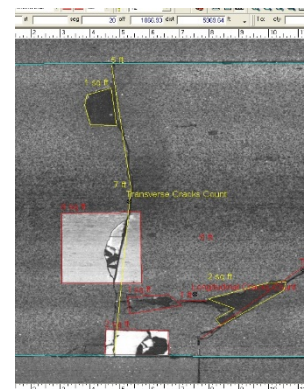
The Province of Alberta has a comprehensive and integrated transportation asset management system, including an in-house asset management system that includes asset inventory, condition monitoring, performance modelling, risk analysis and costing all driven by a geographic information system (GIS) interface.

The City of Edmonton has separate systems for individual asset classes (roads, bridges, sidewalk, drains, traffic lights, etc.). The Sea to Sky Highway concessionaire has a centralized asset inventory and condition database for annual reporting of asset preservation performance measures to the Province. The City of Ottawa is in the process of completing the implementation of a comprehensive asset management (CAM) application. CAM is an integrated business approach involving planning, finance, engineering and maintenance and operations. The City of Calgary has adopted an approach that has integrated risk management and life cycle as the basis for their asset management. Ville de Montréal has a process similar to the City of Ottawa with their overall integrated business approach scheduled to be fully operational in 2017.

### Resources for Asset Management

Resources for transportation asset management vary widely across Canada. Some agencies have departments of asset management while others have identified a single individual with responsibility for asset management. Some have completed asset management gap analyses (e.g., Manitoba Infrastructure and Transportation, Region of York in Ontario and the City of Regina), to determine the necessary resources in terms of personnel, skills and software application to support their asset management objectives. The Region of Waterloo, in Ontario, is undergoing a reorganization to better align their services with asset management objectives. The majority of agencies in Canada use in-house developed systems or a combination of commercially available software and in-house systems for asset management. While most complete asset management activities in-house, others such as the Sea to Sky Highway concession use a combination of in-house and consulting engineering firms.

Most large Canadian transportation agencies have implemented a GIS for pavement management. One example is Alberta Transportation’s Transportation Infrastructure and Management System (TIMS). TIMS is a sophisticated web-based system that allows efficient user interaction with fully integrated data, information and expertise through internet enabled computers or wireless devices. The system uses a central data repository containing current and historical information. Data is accessed by both internal and, in some cases, external applications. This enterprise GIS, shown in Figure 1, provides a single consolidated data warehouse architecture and the ability for clients to dynamically segment the road network based on attributes or performance criteria, query the database and report the results.



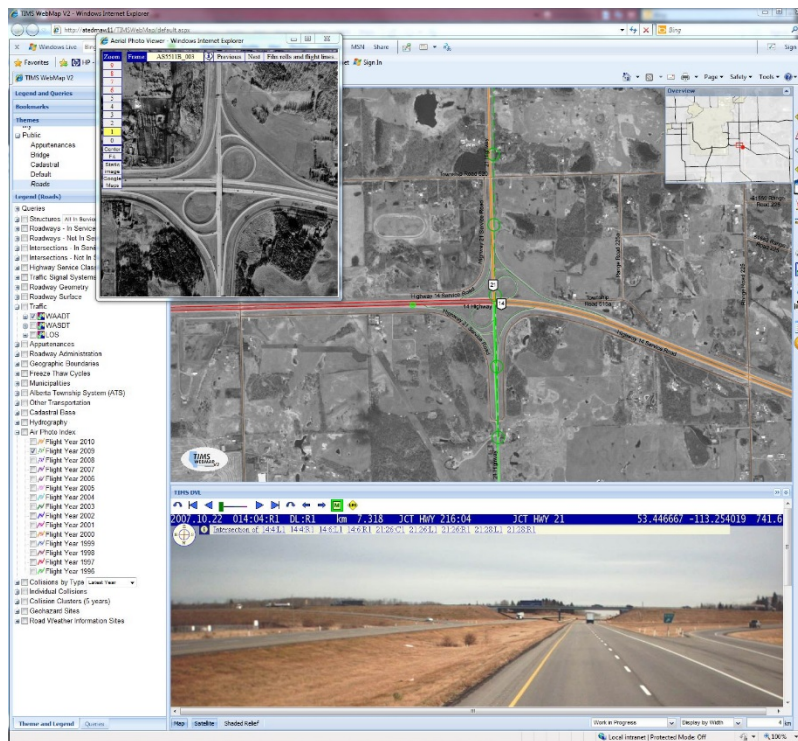


Figure 1 – Alberta Transportation TMS Interactive Web Environment

At the municipal level, GIS tools are rapidly becoming the user interface for all infrastructure-related asset data. In some cases, the infrastructure data and valuation are centralized. For example, the Ontario Good Roads Association (OGRA) has sponsored the development of Municipal Data Works (MDW), a web-based database and repository for asset inventory and condition information for bridges (317 municipalities), roads (234), water supply systems (65) and wastewater systems (61).

### User Satisfaction

A key factor in both the road authority’s business plan and a road asset management system itself is explicit recognition of stakeholder group interests through provision of service.

In terms of the understanding of the needs and expectations of stakeholders, most agencies have some sort of stakeholder surveys or public meetings to assist in meeting expectations. At the municipal level, stakeholders typically include the public, while at the provincial level, the first-line stakeholders are typically regional offices or other government agencies.

The City of Ottawa Asset Management Branch (AMB) has developed a comprehensive guide outlining the roles and responsibilities of the branch and to demonstrate the corporate linkages since many departments have a role to play in the overall management of the City’s infrastructure assets. The AMB has also developed Service Understanding Agreements (SUA) with all client departments within the City. These define service expectations for different client groups.



Metro Vancouver’s regional transportation authority (TransLink) provides a regional transportation system that moves goods and people in support of the region’s growth strategy, provincial and regional environmental objectives and the economic development of the Metro Vancouver service region in B.C.

The City of Regina publishes a roadways preservation flyer to explain the current City practices for pavement maintenance and rehabilitation. In addition, they complete a regular citizen survey to determine the public perception of the condition of the transportation assets within the City.

### Accountability

Many agencies in Canada produce an annual state-of-the-infrastructure report (report card). Alberta Transportation has developed a network performance evaluation and decision application tool to support their TIMS in identifying and fine-tuning performance measures. The Ontario Ministry of Transportation uses the annual funding request process to report on asset performance and rationalize funding requests. The Ministry also publishes annual reports noting past years’ accomplishments and planned highway work projects for the upcoming five years (Northern and Southern Highway Programs). While most agencies produce a report on an annual basis, the City of Calgary publishes theirs on a three-year basis. An example asset condition report from the City of Ottawa is shown in Figure 2.

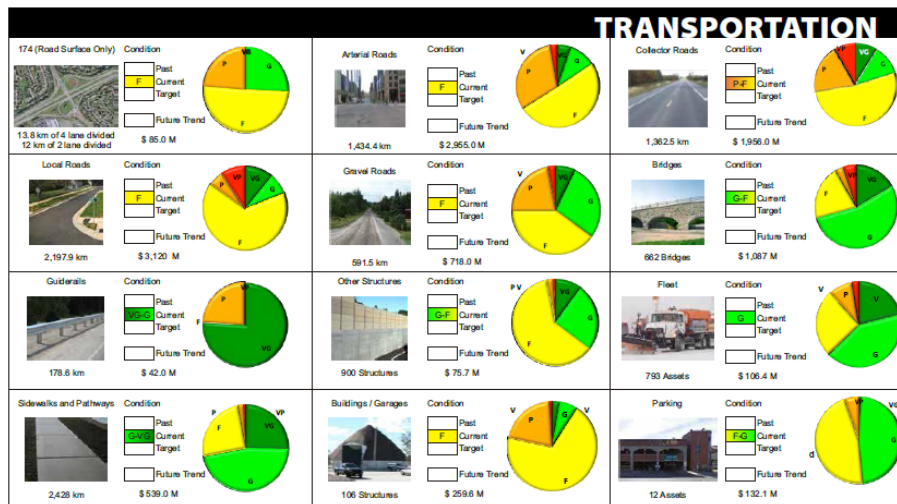
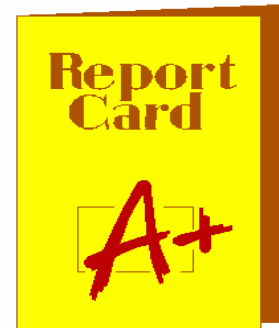


Figure 2 – Transportation Asset Condition Distribution – City of Ottawa

### Summary

Roadway agencies in Canada are at various levels of maturity in the implementation of transportation asset management programs and systems. While provincial highway agencies and the larger cities generally are more advanced because they have more resources than smaller municipalities, strong leadership and champions within the agencies are moving forward to implement comprehensive systems to assist in the stewardship of our aging infrastructure.





There is a strong movement in Canada for agencies to integrate investment planning and programming and move away from traditional silo-based infrastructure management systems into one comprehensive system. Agencies are moving toward systems that track asset performance from construction to retirement and use life cycle cost to make whole life maintenance and rehabilitation investment decisions. These systems report on achievements in maintaining and improving asset condition as measured by key performance measures.

### ***More Information***

This primer is based on the Transportation Association of Canada publication *Synthesis of Transportation Asset Management Best Practices*, which readers can purchase from TAC's online bookstore at [www.tac-atc.ca](http://www.tac-atc.ca). The synthesis can be used to help agencies to develop a new asset management plan or identify gaps and deficiencies for continued improvement to an existing plan.

### ***Disclaimer***

Every effort has been made to ensure that this primer is accurate and up-to-date. The Transportation Association of Canada assumes no responsibility for errors or omissions. The primer does not reflect a technical or policy position of TAC.

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