



Quality of Asphalt Review

KPMG Master Consulting Services for the
Review of Ontario Asphalt Industry Practices

—
November 30, 2017

OAPC Asphalt Seminar



Context for the review

Every industry strives for continuous improvement, and ORBA's review of Ontario asphalt industry practices will guide future efforts. These are serious issues, and the industry understands it needs to get them right. This review represents the largest level of effort of its kind conducted by ORBA.

The Ontario road-building sector has come under increased public scrutiny.

Externally, two high-profile government reports identified significant issues with the procurement of asphalt pavement (Ontario Auditor General, December 2016; Toronto Auditor General, June 2016).

Internally, ORBA as an association knows that it has a number of internal governance and other issues that must be addressed. In early 2017, ORBA hosted several roundtable discussions with broad participation by members that revealed a number of issues that it wanted to address, such as potential bad behaviour by some in the industry related to risky or unethical behaviour that gave the entire industry a bad name.

ORBA, OAPC and all industry and government stakeholders are committed to the safety of Ontario's roads and delivering value for money during construction and maintenance.

In addition to the many technical aspects involved, there are a variety of complex issues that affect everyone, are a shared responsibility and require continual balancing, such as:

 <p>lifecycle costs (as asphalt pavement requires significant attention to maintenance)</p>	 <p>economic impacts (e.g., from closed laneways and traffic disruptions)</p>	 <p>societal impacts (e.g., disruptions to communities)</p>	 <p>worker and public safety (during engineering, construction and maintenance)</p>	 <p>environmental impacts</p>
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Background on the review

In July 2017, ORBA and OAPC engaged KPMG to manage an industry-led review of key issues related to the quality of asphalt in Ontario. ORBA also engaged Global Public Affairs to survey its members, and the Texas A&M Transportation Institute to conduct technical research and testing.

The objective of the review was to produce an independent, fact-based report that assesses various quality, governance and commercial issues cited by:

- a **broad sample of Ontario owners** (municipalities, regions, MTO) interviewed by KPMG and surveyed by Global Public Affairs
- ORBA and OAPC members** interviewed by KPMG and surveyed by Global Public Affairs
- other **subject matter experts** consulted throughout the project
- other **publicly available information**, such as prior government reviews, strategies and policies



KPMG Scope

Coordination and synthesis of third-party reviews (e.g., Texas A&M Transportation Institute, Global Public Affairs) and Industry finding into an independent and objective final report

Interview key Ontario stakeholders (e.g., municipalities, MTO, OGRA, MEA, Academia), as well as international asphalt experts, to collect their views and experience with premature cracking and road asphalt quality issues, both from commercial (contracts, bidding and oversight) and technical (design, construction and maintained practices) perspectives

Assessment of commercial challenges identified to date, including Ontario and Toronto Auditor General reports (ranging from contracts, specifications, delivery strategy, financing, oversight and compliance)

Recommendations for commercial and contract management improvements to foster product quality, durability and owner satisfaction

Benchmarking industry/government practices to comparable jurisdictions (e.g., US, UK, Norway)

Development of a go-forward strategy in the form of a proposed, continuous improvement framework for the industry

Overview of parties involved

ORBA and OAPC engaged KPMG to coordinate an independent review of asphalt industry practices. The Texas A&M Transportation Institute conducted the technical review and forensic analysis of specific roadway sections. Global Public Affairs surveyed members for current perspectives and opportunities for improvement.

 <p>Ontario Road Builders' Association</p>	 <p>Ontario Asphalt Pavement Council</p>	 <p>KPMG Global Infrastructure</p>	 <p>Texas A&M Transportation Institute</p>	 <p>GLOBAL PUBLIC AFFAIRS FROM INSIGHT TO IMPACT</p> <p>Global Public Affairs</p>
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ORBA represents the interests of more than 200 companies in Ontario's transportation infrastructure sector. Its diverse membership consists of contractors and other goods & services providers that employ more than 30,000 people. ORBA's mission is to promote the growth of Ontario's transportation infrastructure industry through a dynamic slate of programs and services.

OAPC is an ORBA Council that was established on January 1, 2017, from the amalgamation of ORBA and the Ontario Hot Mix Producers Association. OAPC is the respected voice for asphalt producers and asphalt cement suppliers across Ontario. Producer members represent over 95 percent of hot mix asphalt producers in the Province.

KPMG is the largest infrastructure advisory services practice and a leader in providing commercial and financial advisory services for infrastructure development. KPMG has provided commercial, financial, procurement and technical advisory services for major infrastructure projects and programs across North America for more than 30 years.

Texas A&M University's Transportation Institute is a public organization focused on materials research. It provides a variety of technical research activities for U.S. departments of transportation, transportation agencies and other organizations and clients. It is widely recognized as a leading expert in best practices for asphalt design, paving and testing.

Global Public Affairs is Canada's largest privately-owned public affairs and communications firm. Its Infrastructure Lab is a platform to promote collaborative approaches to designing, building and maintaining infrastructure. Global's infrastructure-related client work extends across a multitude of sectors and areas, including transportation and local and municipal governments, among others.

Owner consultations

Owner consultations took place over a period from August to November, 2017.



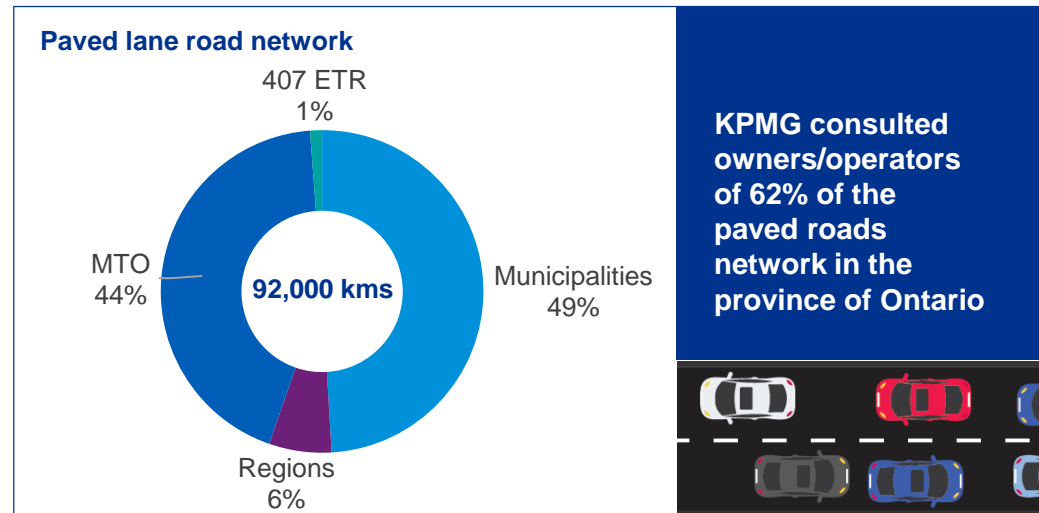
Owner consultations (cont'd.)

KPMG consulted several owners, contractors and subject matter experts, including

- MTO senior leadership
- 1 private toll road (407 ETR)
- 3 regions (Peel, Durham and Waterloo)
- 12 municipalities (London, Mississauga, Brampton, Vaughan, Windsor, Markham, Toronto, Kingston, Middlesex County, Peterborough, Hamilton and East Ferris)

This sample of owners represents approximately 92,000 kilometres of road network (49% owned and managed by municipalities, 6% by regions, 1% by 407 ETR and 43% owned and managed by MTO), which forms over 62% of the paved roads in the province of Ontario.

The paved lane kilometres of road network of various municipalities and regions interviewed are illustrated below.



Paved lane road network	
	km
Municipalities	
Toronto	14,957
Hamilton	6,461
Mississauga	5,290
London	3,664
Brampton	3,143
Windsor	2,322
Markham	2,193
Vaughan	2,115
Kingston	1,777
Middlesex County	1,643
Peterborough	1,434
East Ferris	140
Total - Municipalities	45,139
Regions	
Durham Region	2,372
Region of Waterloo	1,736
Region of Peel	1,652
Total - Regions	5,760
MTO	40,000
407 ETR	1,105
Total paved lane kms	92,004

Industry and subject matter experts consultations

In addition to the extensive industry survey and consultation process undertaken by Global Public Affairs described in [insert section cross-reference], KPMG undertook industry and subject matter expert consultations to supplement its commercial and policy research.

SUBJECT MATTER EXPERTS

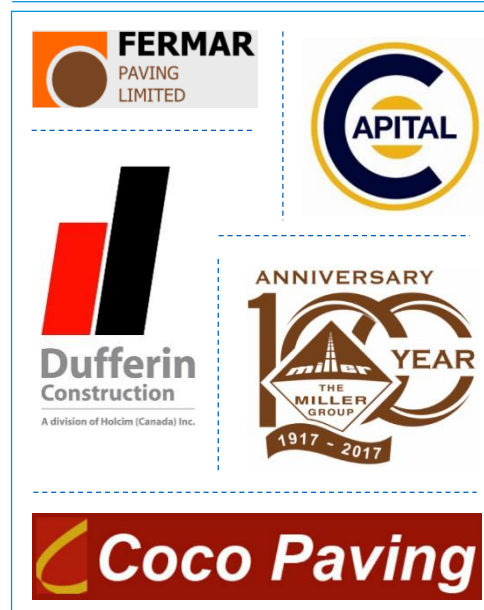


CCIL
Canadian Council of Independent Laboratories

Queen's
UNIVERSITY

CPATT
CENTRE FOR PAVEMENT AND
TRANSPORTATION TECHNOLOGY

CONTRACTORS



FERMAR
PAVING
LIMITED

CAPITAL

Dufferin
Construction
A division of Holcim (Canada) Inc.

ANNIVERSARY
100 YEAR
THE MILLER GROUP
1917 - 2017

Coco Paving

OTHER KEY STAKEHOLDERS



Office of the
Auditor General of Ontario

Imperial

CANADIAN ASPHALT

Husky Energy

What we heard



There is widespread dissatisfaction in Ontario with an increase in premature cracking on roads that should last 15 to 20 years.

A large majority of owners had a positive view on contractor construction execution performance, including limited or no concerns over construction methods, equipment, supervision, and quality of workmanship by contractor crews. The majority of owners attributed the quality issues being experienced by the industry to a decline in the quality of asphalt cement and hot mix asphalt.



The ORBA-MTO relationship has deteriorated over the last few years, which is holding back mutually beneficial collaboration on improving asphalt quality. Causes that contributed to this deterioration include less than desirable consultation between MTO and the industry on changes to specifications, as well as a lack of effort by ORBA and the contractors to involve MTO and the municipalities in key initiatives or discussion groups on asphalt quality issues.



There is a perception that the procurement model used by almost all non-MTO owners – lowest-compliant bid with no prequalification process – has led to some contractors finding new ways to reduce costs of manufacturing HMA (largely by adding excess RAPP, other products such as shingles, or by purchasing asphalt cement with excess REOB) as they strive to remain profitable. Other jurisdictions, such as Indiana or Michigan in the US, New South Wales in Australia, or the UK Government, have elaborated performance based contracting strategies, and prequalification processes that are seen as superior than those of Ontario owners in terms of yielding performance results.



Technical asphalt expertise across the construction industry (including both owners and contractors), has declined. There is a general perception across most contractors in the industry that due to a lack of technical expertise, specifications are not consistent across many owner organizations, and many owner inspectors don't have enough technical expertise to perform effective oversight. This is contributing to an increase in quality issues in asphalt paving contracts.

What we heard



Quality Assurance (“QA”) processes and practices across non-MTO owners are insufficient to prevent dishonest contractors and/or suppliers from “gaming the system”. There are not enough qualified inspectors at a municipal level to provide adequate supervision and inspection of road pavement contracts. This has been associated to budgetary restrictions.



The limited assessment of quality factors under the current low-bid procurement model is leading to modified hot mix asphalt designs that may meet specifications but nevertheless have a lower than desired lifespan. While still debated, there is broad-based agreement that revised specifications either banning or limiting certain inputs (e.g., REOB, RAP), when combined with proper QA, will address these issues.



Most asphalt pavement contracts at the municipal level currently lack incentives for exceeding expectations, appropriate warranty terms, and/or effective performance evaluation processes to prevent asphalt quality issues in future bidding.



Asset Management Plans are not effectively addressing asset health and condition issues at most owner organizations.

A blue truck is shown from a low angle, driving on a road that stretches into the distance. The road has a double yellow line and is flanked by green grass. The sky is bright and clear. A teal vertical bar is on the left side of the image. A white circle is overlaid on the teal bar, containing the text 'Jurisdictional scan' in teal. The truck's side mirror and part of its body are visible on the left.

Jurisdictional scan

DRAFT

Introduction

Mandate

KPMG will analyze **leading pavement procurement construction and operations and maintenance (O&M) practices** from other **comparable jurisdictions** by leveraging knowledge and insights from KPMG’s global network of infrastructure practitioners.

Methodology

Step 1 - KPMG performed initial research to understand the pavement industry and practices around the world. These countries include US (Indiana, Michigan), Canada (Newfoundland, British Columbia, Saskatchewan), UK, New Zealand, Norway, Finland, Australia, Singapore, and Sweden.

Step 2 – From the initial research, KPMG selected Indiana, US; Michigan, US; UK; and New South Wales, Australia to assess the procurement, design, construction, and O&M processes. These jurisdictions were selected based on the similarities with Ontario’s environment, population demographics, and network scale.

General quality of asphalt in other comparable jurisdictions

There are many jurisdictions where the quality of asphalt binders and other issues around testing and specifications have led to poor performing pavements.

Table 1 below shows that Ontario is not alone in experiencing poor condition pavements.

Jurisdiction	% pavement in poor condition
Ontario, Canada	34% ²
Indiana, US	17%
Michigan, US	39% ⁴
UK	17%
New South Wales, Australia	29% ⁶

Ontario Situation

The 2016 Ontario Auditor General report identified problems in **75 km of roads in Ontario**, which is a small percentage (0.4%)¹ of the overall Ontario network. Poor performing pavements and premature cracking are known issues in the industry, and the Ministry of Transportation of Ontario (MTO) has been working on and **investigating these for the last two decades**. Many issues experienced appear to be related to poor performing asphalt cement, and the lack of availability of tests to ensure high quality of Asphalt Cement.

In fact, **MTO is one of the most progressive and proactive public authorities** in leading numerous research initiatives in this field and advancing testing procedures and specification changes that help deal with quality performance issues. The following Table 2 provides examples of MTO’s leadership in asphalt pavement research.

Table 2: Sample MTO Research Studies²

Trial/Study	Year	Notes
Highway 655 – Phase 1	2003	6 trial sections
Highway 417	2006	7 trial sections
Highway 655 – Phase 2	2007	8 trial sections
Highway 427	2008	5 trial sections
Analysis of pavement performance in eastern and northwestern Ontario	2009	20 Pavements
Acceptance Method Pavement Trial	2011-2015	38 Trial section

Jurisdictional Overview of CapEx and OpEx

	Ontario, Canada	Indiana, US	Michigan, US	UK	New South Wales, Australia
Highway Capital Expenditure	CAD0.8 Billion ⁸ (2015)	USD0.9 Billion ¹⁴ CAD1.2 Billion (2015)	USD1.1 Billion ²⁰ CAD1.3 Billion (2016)	GBP2.0 Billion ²⁶ CAD3.3 Billion (2016)	AUD4.4 Billion ^{32**} CAD4.3 Billion (2015)
Highway Operational Expenditure	CAD0.4 Billion ⁹ (2015)	USD0.4 Billion ¹⁵ CAD0.5 Billion (2015)	USD0.3 Billion ²¹ CAD0.4 Billion (2016)	GBP0.7 Billion ²⁷ CAD1.1 Billion (2016)	AUD1.2 Billion ^{33**} CAD1.2 Billion (2015)
Area	1,100 thousand km ²	94 thousand km ²	251 thousand km ²	242 thousand km ²	809 thousand km ²
Population	14.2 million ¹¹	6.6 million ¹⁷	9.9 million ²³	65 million ²⁹	7.7 million ³⁵
Total km	18,571 km (centerline)	17,703 km (centerline)	15,559 km (centerline)	6,900 km (centerline)	20,998 km (centerline)
Total Highway Capital Expenditure (CAD'000) per Total km	43.08	67.79	83.55	478.26	204.78 *
Total Highway Operational Expenditure (CAD'000) per Total km	21.54	28.24	25.71	159.42	56.67 *
Total Highway Expenditure (CAD'000) per Total km	64.62	96.03	109.26	637.68	261.45*
% of Roads in Poor condition	34% (2012) ¹³	17% (2016) ³	39% (2016) ²⁵	17% (2016) ³¹	23% (2014) ³⁷
Municipal Examples	Toronto, Mississauga	Indianapolis	Detroit	London	Sydney

Compare to other jurisdictions, Ontario total highway expenditures per road km is lower than its peers.

* Includes non road asset costs



Key Insights



PROCUREMENT

- **Prequalification processes used by MTO are in line** with methods used by many other jurisdictions. MTO implemented a Registry, Appraisal, and Qualification System in 2001, that considers the contractor's financial status, as well as performance appraisals and infractions reports at the end of each project, to establish an overall performance rating. Refer to appendix for details.
- Most municipalities in Ontario **lack a rigorous prequalification process**, such as the one applied by MTO. However, the majority of cities examined by KPMG also lack a stringent prequalification system for road contracts, so Ontario municipalities are not alone in this respect.
- MTO applies a **low bid evaluation system** to for the award of construction contracts. For traditional pavement rehabilitation contracts, this method does not weigh in technical or quality factors. Other jurisdictions have gone further than MTO in utilizing a life cycle methodology.
 - INDOT uses **alternate bids process** on pavement tenders which uses a life-cycle approach to determine the winning bid. Refer to appendix for details.
 - MDOT uses **performance-based incentives** to decrease motorist delays and increase pavement performance.
 - Highways England and New South Wales Roads and Maritime Services award contracts base on the **best value for money**. Refer to appendix for details.

High maturity



Low maturity

Key Insights



DESIGN

- MTO allows up to 40%⁵⁷ **Reclaimed Asphalt Pavements** (RAP) with 20% on surface course in the hot mix asphalt (HMA) mixtures. Other agencies reviewed by KPMG allow for lower percentages of RAP in their mixtures. Refer to appendix for details.
- Most municipalities in Ontario have lower limits of **RAP** (with Toronto's allowing up to 20%, Markham and Sudbury allowing up to 15% for surface coarse and 30% for road base) than the specifications set by the MTO with some cities banning the use of RAP in new pavement projects. The majority of cities examined by KPMG follow the standards and specifications of their local transportation agency.

High maturity



Low maturity

Key Insights



CONSTRUCTION / TESTING

- MTO is one of the few road authorities to have implemented **leading asphalt quality tests** such Extended Bending Beam Rheometer (EBBR), Ductile Failure Using Double Edge Notched Tension Test (DENT), and Multiple Stress Creep, and Recovery Test (MSCR). Other jurisdictions apply alternative methods of testing, but not all jurisdictions apply EBBR, DENT, and MSCR. Refer to appendix for details.
- Some municipalities in Ontario are using a combination of **EBBR, DENT, and MSCR** to test the asphalt quality.
- Unlike MTO, other jurisdictions (like Indiana Department of Transportation and Michigan Department of Transportation) **conduct training and certification programs** for pavement technicians.

High maturity



Low maturity

Key Insights



O&M

- MTO implemented a seven (7) year **warranty program** for road pavement contract which is the only program of its kind in North America. Most other jurisdictions examined by KPMG implement warranty periods of between 2 and 5 years. From the researched jurisdictions, only New South Wales have longer warranty period. Refer to appendix for details.
- Most municipalities in Ontario implement a **1 to 2 year warranty program** for pavement contracts.

High maturity



Low maturity



Infrastructure projects are demanding and complex.

This is where we thrive
DRAFT

Augusto Patmore, P.Eng, MBA

Partner

T: 416 777 3277

E: apatmore@kpmg.ca

Clark Savolaine, MSc.

Senior Manager

T: 416 777 3203

E: csavolaine@kpmg.ca

Eric Wolfe

Senior Manager

T: 416 777 3713

E: ewolfe@kpmg.ca



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