

MTO Reducing Greenhouse Gas Emissions with Warm Mix Asphalt

MTO has a strong history of pavement research, development, and implementation of innovative paving technologies, advanced specifications and testing protocols, including the use of Warm Mix Asphalt (WMA).

WMA is defined as a group of technologies that promote temperature reduction for the production and placement of asphalt mixtures, compared to traditional Hot Mix Asphalt (HMA). WMA temperature reductions typically vary from 10 to 30 degrees Celsius. Producing and paving asphalt at these lower temperatures result in fewer greenhouse gas (GHG) emissions and require less energy than HMA, while supporting Ontario's pavement performance specifications.

WMA Performance Benefits

WMA is a green technology due to its environmental and performance benefits, including:

- Reduces energy use required in asphalt production resulting in reduced GHG
- Improves compaction and asphalt joint construction resulting in longer pavement life
- Reduces potential for aging asphalt cracking due to the production process
- Lower mix temperatures improve on-site worker safety due to fewer respirable fume exposures
- Extends the paving season into the cooler weather
- Potential to lower fuel usage resulting in contract cost savings

The ministry estimates that since 2008, over 1.5 million tonnes of WMA were used to pave Ontario roads, employing various processes. Several WMA test sections were built in conjunction with HMA control sections to evaluate the performance and environmental benefits of WMA. Data collected on WMA performance and environmental benefits are supplemented by asphalt plant and paving site emissions measurements. >



Warm Mix Asphalt paving operation showing pavement roller.

Figure 1a: Hot Mix Asphalt thermal image showing temperature ranges from a minimum temperature of 157.0°C to maximum 160.4°C, averaging 159.1°C.

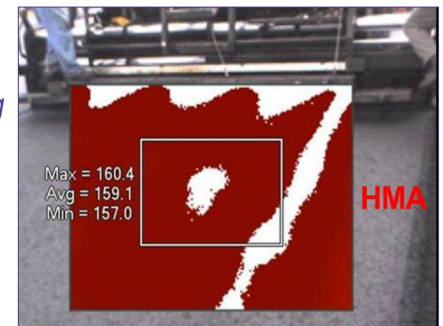


Figure 1b: Warm Mix Asphalt thermal image showing temperature ranges from a minimum temperature of 125.6°C to maximum 135.9°C, averaging 130.4°C.



Reducing Greenhouse Gas Emissions with Warm Mix Asphalt, *continued*

The pavement performance of WMA is comparable to HMA; however, WMA shows a slightly better joint quality (see Figures 2 and 3). WMA pavement performance is based on pavement distress data collected and analyzed over the past decade by [MTO's Automated Road Analyzer \(ARAN\)](#).

In 2012, because of WMA positive outcomes, MTO adopted a permissive specification allowing contractors to use WMA in lieu of HMA after conducting consultation with asphalt cement suppliers, asphalt producers and contractors represented by the [Ontario Asphalt Pavement Council \(OAPC\)](#). OAPC is part of the [Ontario Road Builders' Association \(ORBA\)](#).

Figure 4 shows the historic WMA use across Canada.

WMA Environmental Benefits

Each year, MTO uses approximately 2.5 million tonnes of HMA to pave provincial highways. Replacing HMA with WMA for all MTO projects could mitigate an estimated 8,600 tonnes of Carbon Dioxide equivalent emissions, per year.

Assuming a temperature reduction of 20°C for WMA use, instead of HMA, the energy savings from using WMA is about 25 per cent. This translates to a savings of 62.4 Mega Joules of energy per tonne of WMA: an energy saving equal to saving 1.8 litres of diesel fuel (each litre of diesel gives 34.6 Mega Joules of energy). Assuming \$1.25 for a litre of diesel, the estimated saving is equal to \$2.25 per tonne of WMA. >

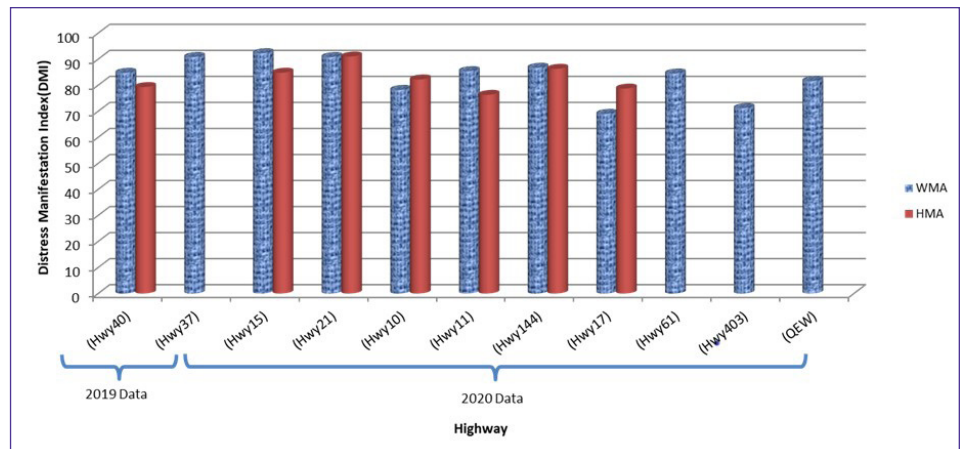


Figure 2: ARAN iVision data comparing performance of WMA and HMA test sections after 9 to 10 years in service. WMA continues to perform equally to HMA in various contracts. Each WMA contact contained a small HMA test section and the rest was WMA.

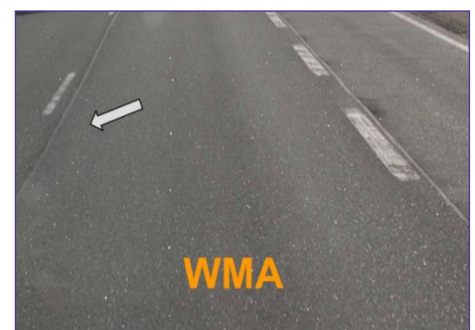
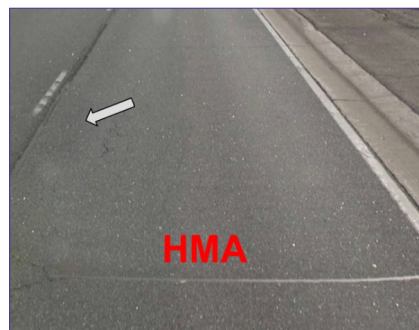


Figure 3: Photographs HMA and WMA sections on Highway 11, showing a better WMA centreline joint quality.

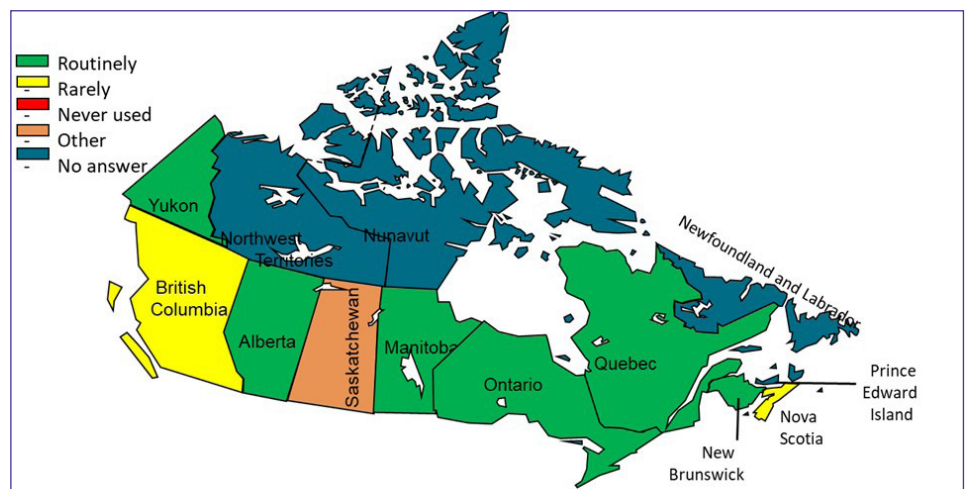


Figure 4: 2015 Canadian WMA Usage Survey conducted by the University of Waterloo, for MTO, under the [Highway Infrastructure Innovation Funding Program \(HIIFP\)](#).

Reducing Greenhouse Gas Emissions with Warm Mix Asphalt, *continued*

If WMA completely displaces HMA across all municipalities in Ontario, GHG emissions could be reduced by 35,000 tonnes of Carbon Dioxide equivalent emissions per year - this is equal to permanently removing 10,000 cars from provincial roads.

WMA Moving Forward

According to the asphalt industry, MTO's use of asphalt makes up approximately 25 per cent of provincial paving, with the other 75 per cent paved by Ontario municipalities.

MTO continues to specify the use of WMA, due to its performance and environmental benefits. After further consultation with the asphalt industry, a new specification mandating WMA use for certain targeted contracts is currently underway. Its implementation is planned for 2022. •

For more information, please contact:

Gelu Vasiliu,
Head, Bituminous Section,
Transportation Infrastructure
Management Division, at
+1 (416) 235-3725,
or Gelu.Vasiliu@ontario.ca

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