Ontario's Transportation Technology Transfer Digest
MINISTRY OF TRANSPORTATION

RoadTalk

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In August 2001, Road Talk reported on the Ministry of Transportation's very first purchase of hybrid cars for fleet vehicle use: two Toyota Prius sedans. Since then, the ministry has made considerably greater investments in "greening" its fleet of vehicles. Road Talk provides an update on the ministry's current green fleet, via the article below, reprinted with permission from Rousseau Automotive Communication, Fleetdigest magazine, December 2009.

For more information, please contact:
Shaf Khan, Manager,
Fleet Management Office,
Ministry of Transportation
at (905) 704-2968 or
Shaf.Khan@ontario.ca

Meeting the Green Challenge

The Ontario government is working on a number of ways to limit greenhouse gas emissions to meet its commitment to a greener Ontario.

by Jack Kazmierski

Transportation is the largest and fastest-growing producer of greenhouse gas emissions in Ontario -- and passenger vehicles are a major part of the problem.

As the manager of the Fleet Management Centre for the Ministry of Transportation, Shaf Khan is busy putting into practice the government's commitment to reducing its Green House Gas (GHG) footprint. While each ministry services their own vehicles, Khan and his team provide fleet management services and guidelines for the Ontario Public Service (OPS) fleet consisting of over 10,000 vehicles.

No Magic Bullet

Some would say the answer to fuel-efficiency and clean emissions is simple – stop driving gas-guzzling cars and take public transit. But the problem is more complex and the Ministry of Transportation is tackling the emissions problem with a multi-pronged approach.

"Many of the vehicles in the OPS fleet are hybrid, alternative fuel or fuel efficient vehicles" Khan says.

The government is also using E85, a fuel blend containing 85% ethanol in their Flex Fuel Vehicles (FFVs). FFVs can use either E85 or traditional gasoline. Since ethanol stations are difficult to find, the Ministry operates a number of ethanol fueling stations for government vehicles.

Deputy Minister Bruce McCuaig strongly supports the government's commitment to reducing the emissions of the OPS fleet. "Moving quickly to a greener fleet not only stimulates the economy but it demonstrates environmental leadership," he said. "I am encouraged by the level of commitment to combat global climate change in people like Shaf Khan and others throughout the OPS."

Exploring Alternatives

Khan and his team also encourage the use of alternative fuels like propane and natural gas. Naturally, hybrids are also part of the mix, and the hybrid fleet seems to be growing exponentially. "Four years ago we had less than 20 hybrids. Now we have well over 640," Khan says.

"Four years ago we had less than 20 hybrids. Now we have well over 640"

MTO Deputy Minister, Bruce McCuaig shown with the Manager of the Fleet Office, Shaf Khan.

"That's going to have a significant impact on the reduction on our emissions."

The next step in the quest for lower emissions is the electric car. Ontario is leading by example and will green its operations by purchasing, if available, 50 electric vehicles per year between 2011 and 2020 (500 in total). Twenty per cent of eligible new Ontario Public Service passenger vehicle purchases will be electric by 2020. OPS garages and/or parking facilities will be retrofitted to be able to recharge the fleet.

"Electric vehicle purchases will contribute to the overall OPS Green Transformation and its goal of trying to reduce fuel consumption by five percent annually," explains McCuaig. "The purchasing of electric vehicles will not only help the environment, but it will also strengthen the economy by driving innovation, revitalizing the global auto sector and creating jobs."

It's clear the Ontario government supports green innovation in the automotive sector. "To get to where we need to go there's no single solution," Khan says. "We have to use a combination of strategies to reach our goal of reducing emissions." •

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Maintenance Technology Project
What's New in Winter Maintenance Technology

The Maintenance Technology Project (MTP) is the Ministry's focus for identifying, evaluating, demonstrating, and implementing new technology in highway maintenance. The original objectives have evolved since the project began more than ten years ago, but they still follow the vision of keeping Ontario a highway maintenance leader in effectiveness and efficiency. The Project also supports the ministry's strategic direction of promoting the use of leading-edge technology, materials and equipment for winter operations on provincial highways and municipal roads, to ensure that maintenance operations use road salt, plows and spreaders effectively in providing safe winter driving conditions.

The MTP project has four strategic goals:

1. Protecting the environment through reductions in salt usage;
2. Moving away from methods based specifications;
3. Improvements in operational and contract monitoring; and
4. Moving towards performance based measures and reporting.

Project goals are accomplished through partnerships between MTO Head Office, Regional Offices, other highway agencies, product manufacturers and vendors, and maintenance contractors.

Several new technologies are under review this year as part of the ministry's ongoing commitment to the MTP. Most are in early testing stages and will be evaluated further over the 2009-2010 winter season.

Winter Performance Measures using Friction Data

In the winter of 2006/07, MTO Head Office and Eastern Region Contracts Office studied the applicability of winter friction testing. Their primary objective was to measure road performance during and after winter events with a quantifiable and objective measure to determine if a consistent correlation could be found between the road surface condition (e.g. bare and wet, snow covered, icy, etc.) and the coefficient of friction. Development of a reliable, repeatable relationship could potentially lead to province-wide adoption of friction-based performance measures for defining bare pavement.

The study included a jurisdictional scan to identify agencies already using winter friction as part of their current maintenance policy. A detailed overview of winter maintenance practices, and specifically the use of winter friction, was provided for Ontario, Norway, and Ohio.

This winter, MTO will be conducting further winter friction testing using three different monitoring devices (two are shown in the photos) in the Ottawa, North Bay, Thunder Bay and Guelph areas to support the development and validation of friction-based performance measures comparable with bare pavement monitoring.

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The Halliday RT3 Friction Meter is used to model relationships between surface conditions and surface friction during winter storm events.

During data collection, trucks towed the Traction Watcher One (TWO) device in the left wheel track. Continuous friction measurements were transferred to a laptop mounted inside the vehicle. The device captured 10 readings per second, which were averaged per second and exported in MS Excel format for visual presentation and data analysis. To assist with data analysis, both tow vehicles were equipped with a digital video camera, GPS, and Automatic Vehicle Location (AVL) capabilities.

What's New in Winter Maintenance Technology, *continued*

Hot Water Sander

This sanding method is simply based on a mixture of hot water and sand. Water is heated to a temperature of 90°C to 95°C and then lightly applied to the sand before being dispersed. Heat causes the sand to embed itself into the ice or snow pack and then freeze in place. Compared to other methods that require frequent re-application to replace sand that is blown off the road by traffic, hot water sanding results in a longer-lasting application. Traffic gradually wears away the top layer, but enough sand remains embedded in the snow or ice to continue to provide friction.

Hot water sanding offers environmental benefits as well. The longer the sand remains in place, the fewer spreading cycles are required, which translates to a reduction in emissions. In addition, hot water sanding does not require the use of salt—unlike dry and pre-wet sanding mixtures, which include 3 to 5% salt by volume. Eliminating salt from the mixture reduces the amount of salt applied to the roads, lowering costs and supporting the ministry's salt management objectives.

The hot water spreader is ideal for lower volume highways that are maintained in a driveable but snow packed condition for most of the winter. The hot water units have been used on Highway 599 in Northwestern Region and on Highways 603 and 533 in Northeastern Region. Further testing and evaluation is underway to monitor friction levels, material and equipment use and costs.

Directional Salt Spreading

The conventional method of spreading salt on highways is by distributing salt through a chute positioned perpendicular to the truck and aimed at the crown (centre) of the road. As the truck travels, salt is spread down the centre of the road, and as it melts, the brine runs across both sides of the road, clearing both directions at once. Recently, the ministry has been exploring an alternative—directional spreading. Using this method, the chute is positioned to distribute salt underneath the truck so that it is applied only to the lane in which the truck travels. This puts salt on the road more quickly since each lane can be salted as it is plowed, rather than salting only on the return trip after the outbound lane has been plowed.

Testing for directional spreading was conducted in Eastern Region on Highways 34 and 138 during the winter of 2008-2009. Results are currently under review and are expected to be reported in 2010.

The hot water sander method is simply based on a mixture of hot water and sand.

Underbody Finger Plow

Video available here:
http://www.mto.gov.on.ca/graphics/english/transtek/roadtalk/rt16-1/fingerplow.mpg

The ministry is currently evaluating an off-the-shelf product—a plow that features flat tines that move independently of one another, allowing the sectional moldboard to reach deep into wheel ruts and uneven surfaces. Manufactured by Viking-Cives, the Underbody Finger plow is designed to remove more snow mechanically and minimize wheel tracking (ruts), resulting in less chemical required to obtain a bare and safe driving surface. Viking-Cives is providing all of the equipment, including the truck, at no cost to the ministry.

Testing is scheduled to be conducted in January 2010 on Class 4 highways near Kapuskasing, Ontario.

Highway Frost Forecast Map

The Ministry's Road Weather Information System (RWIS) provides weather and road condition observations and forecasts at approximately 120 monitoring sites across the highway network. These include temperature, humidity and salinity information that is used by road maintainers to plan and schedule plowing and salting operations during winter storms.

Road-weather conditions vary along the tens to hundreds of kilometres between monitoring sites and this requires patrol staff to make educated guesses about the intervening conditions to plan operations that are suitable for an entire route. Lack of information about intervening conditions—especially where variations in temperature and relative humidity result in unobserved frost or black ice—increases the risk of slippery road conditions. >

What's New in Winter Maintenance Technology, *continued*

Recent advances to instrumentation on maintenance patrol vehicles including GPS, infrared thermometers, and mobile dew point sensors, provide detailed information about some of the factors that control winter road conditions between RWIS sites. These can be used to develop fingerprints of temperature and dew point conditions to provide a forecast of variations in the potential for frost or black ice along a maintenance route.

A study is under development to determine the benefits of utilizing thermal mapping—the process of using vehicle-mounted thermometers to measure temperature variations along the highway—to determine when and where cold temperatures occur. This would assist in forecasting when icing will occur on cold, clear nights in a particular location, and in developing a directed response to those conditions.

Vaisala Friction Sensors

MTO has been investigating two new remote optical pavement sensors for monitoring road surface conditions, as compared to traditional in-situ pavement sensors and visual observations:

Figure 1

Figure 2

Fig. 1: Vaisala Remote Road Surface State Sensor (DSC111) – A device that sends infrared light beams to the road surface and detects the backscattered signals at selected wavelengths. Based on observed difference in light absorption, it can differentiate pavement contaminant layers and determine the surface state (i.e. dry, moist, wet, icy, snowy/frosty or slushy). The sensor also provides a measure called grip level, which represents the level of friction of the road surface.

Fig. 2: Vaisala Remote Road Surface Temperature Sensor (DST111) – An infrared temperature sensor that measures the long wave infrared radiation reflected from the road surface. This can be calibrated to a known temperature difference and used to estimate the pavement temperature. Data collected by this sensor includes pavement surface temperature, air temperature, dew point temperature, and relative humidity.

One set of Vaisala sensors was installed on the eastbound lanes of Highway 417 near Casselman, Ontario. The sensors are installed on a pole at the roadside and positioned 8.3 metres over the roadway.

One set of the Vaisala sensors was installed on Highway 417 about 56 km east of Ottawa, near Casselman, Ontario. Data collected by the Vaisala sensors was compared to data collected in the same location by a traditional in-situ pavement sensor approximately one metre away. Initial testing showed excellent correspondence between temperatures monitored by this device and a conventional, in-pavement temperature sensor. Grip levels did not correspond as well and additional work is planned for this winter to learn why there were differences. •

MTO Maintenance Open House

Each spring, new, state-of-the-art winter maintenance technologies are showcased at the MTO Maintenance Open House. This well-attended and anticipated event is an opportunity for ministry staff, contractors, vendors, and industry partners to observe and discuss new winter maintenance equipment and to find out how winter maintenance operations may be changing in Ontario. This year, MTO will be hosting its Open House in late February 2010.

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What's New in Winter Maintenance Technology, *continued*

From Investigation to Implementation

The success of the Maintenance Technology Project is best demonstrated by the innovations that are now implemented across the province. All of the following projects were originally tested and/or evaluated through the MTP initiative.

Road Weather Information Systems (RWIS) – *The first RWIS installations began in 1988. In 1996-1997, the ministry evaluated pavement and roadside sensors and by 2001, the systems were fully implemented. Today, there are 115 sites across the province. Benefits include: better atmospheric and pavement forecasting and informed operational response (right action, right time, right amount).*

Anti-icing/De-icing – *Testing and evaluation began in 1996-1997 with full implementation in 2002, including development of variable salt application rates and evaluation of pre-treated salt. Benefits include: reduced salt usage (up to 11%, with local variations), better salt retention, and proactive snow and ice response.*

Infrared thermometers – *The technology was evaluated and implemented province-wide in 1998-1999. Benefits include: improved monitoring and response to winter storms and improved operations.*

Friction trailers – *MTO has evaluated the technology/devices, which are now in use for data collection on other MTP projects. Benefits include: practical evaluations of new technology/devices through MTP and development of performance based standards.*

Flexible plow blades – *Improvements in blade technology have resulted in improved snow removal, and reduced salt and sand use.*

Automated Vehicle Location (AVL) – *The ministry has implemented AVL systems and road patrol diaries. Benefits include: improvements in patrolling operations and winter storm response, real-time monitoring and decision making.*

Fixed-Automated Spray Technology (FAST) – *These systems have been implemented at eight MTO sites to improve anti-icing for bridges. Benefits include: proactive automated anti-icing strategies at bridge decks and reduced salt use.*

Pre-wet salt – *Use of this material has been tested in Huntsville, Ontario, and is now accepted for use, resulting in more effective salt use.*

Tow Plow – *MTO has evaluated the trailer plow, which has led to improvements in snow removal. The tow plow is now permitted for use in Ontario and is currently in use on an AMC contract (York) and 407 ETR.*

For more information, contact:
Steve Birmingham,
Maintenance Standards Section,
Highway Standards Branch,
at Steve.Birmingham@ontario.ca
or (905) 704-2852.