Ontario's Transportation Technology Transfer Digest
MINISTRY OF TRANSPORTATION
RoadTalk
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A Runaway Success

This summer, MTO conducted a live demonstration of its new state-of-the-art runaway truck ramp on Thibeault Hill where Highway 11 descends into a busy commercial area of North Bay. Approximately 30,000 cars travel through the intersection at the base of the hill daily, making it one of Northern Ontario's busiest intersections.

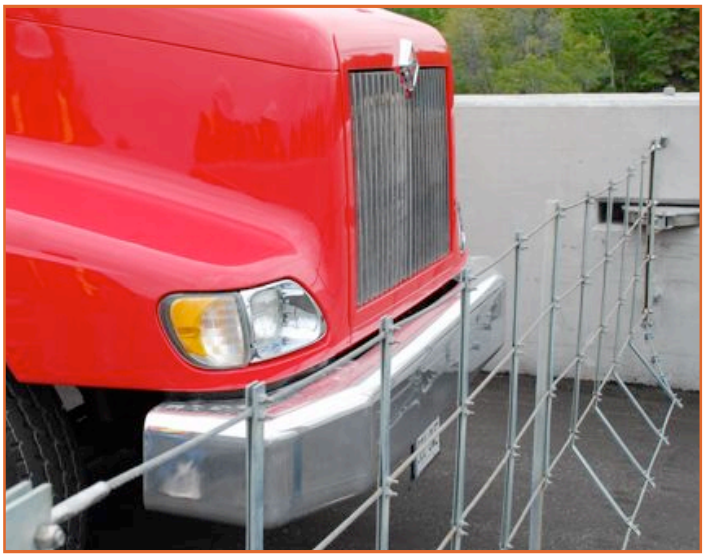
Opened to traffic in December 2008, the new dragnet system replaced a gravel bed arrestor on Thibeault Hill. The new system is based on the technology used to stop airplanes landing on aircraft carriers and consists of seven metal cable nets attached to energy absorbing canisters anchored in concrete barrier walls.

A 61 m spool of 1 mm thick steel alloy tape approximately 40 mm wide is enclosed within the canister. The tape is connected to the net and is pulled from the canister when the net is struck by a vehicle. As the tape is pulled, it passes around a series of 4 pins that are offset and located where the tape exits the canister. As the tape winds through these pins, it creates friction and dissipates the energy of the vehicle that is pulling the tape. For a large, heavy vehicle traveling at highway speeds, it is expected that tapes in the first few canisters will be pulled out completely. After winding through the pins, the stainless ribbons are slightly deformed and extremely hot due to the drag created by the offset pins.

The first net has one canister per side. The second net has two canisters per side and the remaining five nets have three per side. Each canister takes 20 kN (4,500 lbs.) of force to pull the steel tape. More canisters equals more resistance, increasing the stopping power of the net however, the force exerted upon a truck entering the dragnet system is only about 0.6 g – less than what you would experience from a hard, quick stop. Since the resistance of the canisters are designed for a fully loaded truck, lighter passenger vehicles entering the system would experience a much harsher collision than a fully loaded transport truck. By installing fewer canisters on the first two nets, the impact to lighter vehicles has been minimized.

On June 25th, 2009, MTO used a loaded tractor trailer and simulated a brake failure as it descended the hill. A 2004 international tractor with a six axle flatbed aluminum trailer was loaded with almost 60,000 kg, just under the legal gross weight of 60,100 kg and was driven into the runaway truck ramp at 90 km/h. To ensure the truck's brakes were not used, a professional stunt driver was hired.

As the truck entered the ramp, the nets and canisters worked as expected. Rolls of steel alloy tape from the energy absorbing canisters were pulled through the offset pins and converted the truck's momentum into heat and slowing it at a rate of 0.4 g – less than a hard stop. However, after the truck passed through gates 2, 3 and 4 the truck pulled to the right increasing the g force to 1.0 upon impact with the barrier wall near the end of the stop. Although dramatic, the 60 tonne truck experienced a controlled stop in less than 61 m and within five seconds. More importantly, the driver was able to walk away from the incident uninjured and the trailer load remained in place and intact.



Watch the demonstration at:
http://watch.discoverychannel.ca/daily-planet/september-2009/daily-planet-september-08-2009/#clip211406

Please refer to the previous article, State-of-the-Art Technology for Highway 11 Runaway Truck Ramp, published in spring 2009, for more information on the exact assembly of the ramp system.

A review of the demonstration found that the dragnet system performed as expected with both the nets and the barrier wall acting to contain the truck within the ramp. The steel alloy tapes became twisted and deformed as designed and the truck stopped at the distance and time predicted.

The demonstration is part of a broader MTO campaign to educate and encourage commercial vehicle drivers to use the runaway truck ramp in the event of brake failure. A stakeholder film is being produced to reach drivers who were not able to view the demonstration in person or via the project webcast.

MTO also provided interviews and film clips to the Discovery Channel to highlight this innovative engineering project on the Daily Planet program and worked with Cogeco Cable to develop a feature program on the demonstration. •

For more information on the demonstration, please visit the project website at:www.highway11northbay.com or contact:
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Road with a View:
MTO's Installation of Transparent Noise Barriers

In April 2007, the Ministry of Transportation awarded its largest ever capital contract investing over $167 million dollars (CAD) to widen the Queen Elizabeth Expressway (QEW) to 6 lanes through St. Catharines. Along with the road work, the project has 26,000 m2 of noise barriers that include 3,000 m2 of transparent window panes in specific locations. Extending from the Henley Bridge to west of the Garden City Skyway, the transparent sections of the barrier improve highway aesthetics through the city and decrease noise levels for residences and businesses.

In this highly developed area, the transparent noise barriers are well worth their premium cost since they allow more light to enter properties, continue to provide adjacent businesses with exposure and provide a sense of open space. As of September 2009, construction of the barriers through St. Catharines is over 50 percent complete.

Lightweight sound absorptive panels are stacked between steel 'H' posts to form the noise barrier. Additional design considerations were required to strategically place the reflective and absorptive panels in a manner to reduce noise reflected between the parallel barriers on the highway.

The transparent element is made from a composite plastic product that is sound reflective and placed at the top of the barrier within the posts like a window. Unlike the windows in your home, the plastic product is self cleaning. The glazing material on the composite plastic is so smooth that dirt and grime will not stick to it. The transparent barriers in Fort Erie have been in place for three winters and have never required cleaning.

To ensure the composite plastic windows could withstand climate and weather conditions advance testing was performed and included weatherometer, freeze thaw, anti-fracturing and ultraviolet tests. Their suitability was confirmed and transparent noise barriers are now an essential tool in MTO's catalogue of less intrusive noise barriers.

Our transparent trend continues – MTO has announced further construction of transparent noise barriers along Highway 401 and Highway 3 in Windsor this fall. •

Figure 1 - Retention of commercial visibility through reduced visual height of barriers on QEW near Fort Erie

Figure 2 - Improved aesthetics along the QEW as it travels through a primarily residential section of St. Catharines.

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After the Rain:

New Application for Compost from Canadian Landfills

In the summer of 2007, MTO partnered with the University of Guelph on a research project to improve source water quality. With the assistance of Toronto and the Regional Conservation Authority, Ontario Centres of Excellence, Alltreat Farms, Region of Waterloo, Region of Peel and Filtrexx Canada, the University of Guelph installed automatic water samplers and water level sensors for monitoring flow rate and water quality on the east side of Highway 8 near Cameo Drive in Kitchener, Ontario. These monitors are in place to evaluate biofilters, a new water filtration system for urban stormwater runoff, which are anticipated to have significant environmental and economic benefit.

A relatively new innovation, biofilters are made from a mesh photodegradable tubular sock filled with a filter material made of inexpensive, surplus, natural non-hazardous waste from compost production (i.e. coarser compost material remaining on the 1.27cm (0.5") sieve). Compost has the natural ability to absorb heavy metals, oil and grease, and to break down contaminants making it a natural, organic filter. Preliminary research of biofilters as an effective treatment for stormwater shows promise as they are expected to reduce levels of zinc, copper and petroleum hydrocarbons in runoff.

During a rainstorm, pollutants from tire wear, engine oil leaks, break pad wear, metal rust, car fumes and atmospheric deposition which have settled onto pavement surfaces combine with stormwater runoff reducing its quality. Compared to natural areas, runoff from impervious roads has increased pollutant loads that can be harmful to birds, humans, plants and aquatic life.

Traditional stormwater management has concentrated on flood prevention with little focus on contamination removal. Recently, the heavy metal pollutants from automobiles and their toxicity to the natural environment have been of particular interest. While grass swales, vegetative buffers, concrete riprap, silt fences, and straw bales are common treatments to filter out most solid pollutants and particles, biofilters are able to remove particulate contaminants and have the added advantage of creating a permeable dam to promote settling ponds upstream.

Based on studies in Sweden and the USA, key factors that influence the concentrations of urban water contaminants include: annual average daily traffic, antecedent dry days and total event rainfall depth. Information on these parameters is required to calculate the biofilter size for a given site. Biofilters must be designed large enough to manage flow-through capacity as well as reduce contaminant concentrations.

The Kitchener site was categorized as a medium-sized catchment area because of its medium to high average annual traffic rate of 23,000 vehicles per day over four lanes. Installation was performed by Filtrexx Canada and was completed in July 2007. After its installation, an ISCO 3700 portable flow-weighted sampler collected runoff samples upstream and downstream for 20 monitored storm events over 2007 and 2008.

Compost Biofilter installed in the ditch on the East Side of Highway 8 near Cameo Drive, Kitchener, Ontario. Holding the survey rod is Karen Finney, a University of Guelph graduate student who led this research project.

Preliminary results of the outlet runoff samples are promising. The Ontario Provincial Water Quality Objective (PWQO) has minimal acceptable levels for various contaminants such as total suspended solids, zinc, and copper. Before filtration at the Highway 8 site, runoff contaminant levels exceeded the minimum standard guidelines. Samples after filtration showed a significant improvement in quality to within minimum acceptable PWQO standards – total suspended solids levels were reduced by half; and both zinc levels and polycyclic aromatic hydrocarbons were reduced by a third. Though post filter copper levels are not yet below the minimum, they have been reduced by 29 percent. A second biofilter installed downstream reduces copper levels to below the PWQO minimum level.

There are many existing urban stormwater management technologies which stabilize and filter out contaminants, but often these do not meet the provincial water quality guidelines. With proper design, compost biofilters, when used alone, or in combination with other stormwater management systems, are a cost effective treatment that will continue to improve runoff water quality. •

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Moving Forward Together

New consistent approach to Materials Acceptance Testing

As part of a modernized approach to contract delivery and oversight, the Ministry of Transportation is revising the acceptance approach for all highway engineering materials. In doing so, the ministry intends to implement a common acceptance framework across material areas. It is expected this will result in more efficient specifications, and less onerous administration.

Materials acceptance testing is how the ministry determines whether materials such as concrete, soils, asphalt and aggregates are acceptable for use in highway construction projects. With this initiative, materials will be tested for acceptance by either independent testing laboratories retained by the ministry or, in some specialized cases, by the ministry's own laboratory.

The current system includes a variety of approaches to acceptance testing: contractor's Quality Control (QC), owner Quality Assurance (QA), or a combination of these. Referee testing is not applied uniformly or with a consistent philosophy. An overall lack of consistency regarding acceptance testing has created difficulty understanding specifications and led to delays in field decisions, and possibly mistakes. A lack of consistency also creates challenges for development of new specifications and initiatives such as performance based acceptance.

In examining the existing systems, several areas were identified for improvement. Consistent payment methodologies across material areas were required to clarify and improve the administration of specifications. More efficient QC requirements were needed to foster contractor innovation and focus on priority areas, optimizing contract administration resources and reducing costs. In addition, MTO recognized that payment systems needed improvements to ensure they were fair, transparent and defendable from a public trust perspective.

Together with industry partners, MTO has developed a uniform set of principles that will guide specification development in each material area. These principles are:

1. **QC testing is the responsibility of the contractor.**
   The ministry will not specify requirements for QC activities, and existing mandatory QC testing will be eliminated. In some cases were appropriate this will be accomplished through a phased approach. Contractor QC test results will not be submitted to the ministry. Contractors will continue to be responsible for the sampling of materials and delivery to the designated QA laboratory for owner testing.
2. **Material acceptance is based on QA test results.**
   QA testing will be conducted by independent laboratories, retained by owner, or where necessary conducted by the owner. A lot/sublot system will be applied to all material received to ensure that all material has an equal chance of being sampled. QA test results will be provided to the contractor in a timely fashion.

At the MTO laboratory in Downsview, ministry staff monitor the equipment and test set-up used to evaluate the air void system (AVS) parameters of hardened concrete. The same test is done in commercial laboratories that perform acceptance testing on concrete for MTO contracts. This is one of the tests that will change from being a QC test (performed by the contractor or a laboratory working for the contractor) to a QA test (performed by a laboratory working for the ministry).

3. **Referee testing will be used for dispute resolution for all materials.**
   All materials will have a binding referee process for the purpose of resolving material acceptance issues. This process can be invoked by the contractor without pre-condition.
4. **Personnel and labs will be appropriately qualified.**
   The ministry will continue to operate correlation programs for QA and referee laboratories, and will continue to monitor capacity and performance of the same. MTO will continue to require appropriate industry certifications (e.g. Canadian Council of Independent Laboratories, Canadian Standards Association) for QA and referee labs and their staff. QC labs will be encouraged to participate in both correlation and certification programs.

Using a harmonized set of principles as the basis for materials acceptance testing will improve consistency, while recognizing the expertise of industry partners to establish and implement QC processes.

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Moving Forward Together:
New consistent approach to Materials Acceptance Testing, continued

Over the summer of 2009, the committee completed the Terms of Reference to guide the individual material workgroups with the specification development. The ministry and its industry partners have identified the areas of priority and developed an implementation plan to make the necessary modifications to the specifications to introduce this initiative. Changes will be phased in gradually as specifications are revised.

Three internal task groups, with representatives from regional and head offices, have been established, one for each major material area: Bituminous, Concrete, and Soils and Aggregates. Industry is similarly represented by groups such as the Ontario Road Builders Association (ORBA), Ontario Hot Mix Producers Association (OHMPA), Ready Mixed Concrete Association of Ontario (RMCAO), and the Ontario Stone, Sand and Gravel Association (OSSGA). These three groups will review and finalize the changes to the specifications in line with the established principles.

To ensure these changes occur over a reasonable time period, certain items will be considered out of scope, including:

- technical changes to specifications;
- modifications to acceptance parameters and limits;
- changes to bonus and penalty; and
- review of test data.

With a documented set of principles for material acceptance, MTO intends to have specifications across all material areas, for use now and in the future, that follow a consistent set of acceptance principles based on QA testing. These specifications will be intuitive in their interpretation, transparent in their approach and efficient to administer. ●

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