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Maintenance 2001 Project

2001-2002: 6th Season

Maintenance 2001: "Integrating Technology for Winter Road Maintenance"

This season builds on work undertaken to date, through the Maintenance 2001 banner, to evaluate and implement innovations in winter operations on Ontario highways. It marks a shift in emphasis on how the Ministry of Transportation can help its service providers meet the key objectives of:

1. reducing adverse impacts of road salt on the environment
2. integrating equipment, control and monitoring systems and materials to enhance the effectiveness of highway maintenance
3. developing results-based information systems for winter maintenance
4. demonstrating innovative systems and transferring innovations into practice across the province

Most project activities are conducted at Elsinore Patrol Yard, on a section of Highway 21 in the ministry's Owen Sound District. It is equipped with specialized equipment where in-house and contract staff test and monitor the effectiveness of different products or systems using video cameras, environmental sensors and trailers which measure road surface friction. A high level of staffing ensures that safe conditions are maintained throughout test operations. Tests are conducted at other locations when specific conditions are required which cannot be achieved at Elsinore. Once proven under controlled test conditions, innovations are implemented across the province using a phased approach.

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Project Test Site

Location

A 50 km section of Highway 21, between Owen Sound and North Bruce, that includes the communities of Jackson, Alvanley, Allenford, Elsinore Chippewa Hill, Southampton and Port Elgin.

Site Geography

- Weather systems from Lake Huron and Georgian Bay, due to location at the base of the Bruce Peninsula
- Highest snowfall in Ontario (annual average 2.5 to 3.5 meters, falling on 45 to 75 days per year), a shorter winter thaw than most areas of southern Ontario, and areas of severe drifting
- A variety of snow and frost conditions representative of most severe winter areas of the province, partly due to diverse topography and land cover (rolling uplands, flat lowlands, forested and open areas, and swamps)
- Moderate traffic levels and highway speeds provide safer testing conditions than more densely populated areas of southern Ontario

Test Sections

- Eight test sections with an automated measurement site at the midpoint of each
- Changes in snow cover and surface friction monitored intensively in all sections
- ARWIS sensors, video cameras and street lights at measurement test sites can be viewed remotely from the patrol yard
- Weather and snow conditions at all measurement sites are recorded every 10 minutes



2000-2001 Key Results

1. **Pre-wetting:** Analysis of test data and monitoring of initial implementation phase confirmed the environmental and operational benefits, under Ontario conditions, of pre-wetting road salt with small quantities of liquid de-icer.
2. **Variable Salt Application Rates:** A variable salt application rate guide was issued which allows application rates of pre-wetted salt to be varied according to weather conditions.
3. **Combined Operations:** Testing of high speed spreaders confirmed that one type of mechanical spreading device retains salt on the pavement at plowing speeds. This permits spreading and plowing to be combined into a single operation. The results are published in *Transportation Research Record No. 1741, Journal of the Transportation Research Board, Washington*.
4. **AVL Monitoring:** This project demonstrated the feasibility of using an Automated Vehicle Location (AVL) system to monitor road patrolling, surface temperature, spreading and plowing operations in real time, and to archive this information for future use.
5. **System Integration:** An initial step was taken to integrate the AVL system, the Advance Road Weather Information System (ARWIS), and the freeway traffic monitoring camera system (COMPASS) through a linked, password-protected, web-based display.
6. **Fixed Automatic Spray Technology (FAST):** Canada's first FAST system to distribute liquid de-icer on bridge decks proved successful in reducing winter accidents and providing operational efficiencies.
7. **Road Surface Temperature:** An initial analysis of the variance of road surface temperatures was undertaken.
8. **DART:** The De-icing Anti-icing Response Treatment (DART) software program, developed in co-operation with the AURORA group of international highway agencies, was completed as a stand-alone system. A report entitled "Expert System for Maintenance Decision Support" is available on the AURORA web site at www.aurora-program.org.

9. **Snow Cover:** An equation was developed which estimates snow cover on the road surface where friction is measured.

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Overview of Implementation

Implementation Strategies

New technologies and innovations that prove successful are incorporated in ministry operational practices through technology transfer to the private sector.

Vary by Location and Type

Implementation strategies vary by location and type of service delivery, and are facilitated through:

- Innovation Proposals submitted by Area Maintenance Contractors (AMC's)
- Ministry direction to AMC or Managed Outsourcing (MO) contractors.

Success in Implementation

Infra-Red Thermometers Infra-red thermometers have been installed on all patrol trucks and some spreaders to monitor road surface temperature and assist in effective winter operations decision-making.

Salt Application Reduction

Analysis of experimental data showed that salt consumption can be reduced by up to 20% with no loss in effectiveness if it is applied with a small quantity of liquid de-icer, known as pre-wetting. Pre-wetting was implemented at 29 patrol yards, through the use of 53 spreader trucks equipped with saddle tanks and two pre-wetted stockpiles.

Fixed Automated Spray Technology

An automated, bridge deck anti-icing system, using non-corrosive liquid de-icer

with application triggered automatically by Advanced Road Weather Information System, has been installed on a structure at Highway 416 and Highway 401 Interchange.

Anti-icing Liquid (Beginning 2001-02)

Direct Liquid Application (DLA) anti-icing, using tanker trucks to apply chemical ahead of winter storms, is in progress on Highway 417 in Ottawa and on some sections of Highway 401 in Toronto.

High Speed Spreading

Combination spreader/plows using Precision Placement spreaders are used to apply salt at plowing speeds on Highway 401 in the Kingston area.

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2001-2002 Test Plan

Pre-wetting

- **Objectives:** reduce costs of winter maintenance and improve levels of service through alternative liquid and granular antiicing/ de-icing materials, and appropriate variation in application rates

Winter Sand

- **Objective:** improve the level of traction provided by spreading sand on packed snow or ice by retaining it on the surface longer after spreading
- Two methods are being investigated: optimizing the size gradation of the sand; pre-wetting the sand with a small quantity of liquid de-icer

Direct Liquid Application (DLA)

- **Objective:** Prevent snow and ice from forming a bond with the pavement surface, by applying liquid chemicals to the road shortly before the onset of a storm. This increases traffic safety and lessens environmental impacts by

reducing the overall quantity of chemicals needed.

Automated Vehicle Location (AVL)

- **Objective:** Monitor road patrolling, spreader and plow operations and measure road surface temperature in real time, and automatically archive, map and summarize information about plowing, salt and sand spreading operations for future analysis.

Flexible Snow Plow Blade

- **Objective:** reduce application of salt by improving the effectiveness of plowing.
- The flexible plow blade is designed to provide better contact with the pavement, leaving a thinner film of snow behind
- Tests will compare the quantity of snow left behind, as well as the durability and service life of flexible versus rigid plow blades
- Multiple blade systems are designed to remove packed and loose snow and slush

Plow/Spreader Lighting

- **Objectives:** evaluate feasibility of strobe and LED lighting for vehicles performing winter operations.

Smart Spreader

- **Objective:** to automate control functions on a combination plow/spreader including selection and placement of material, plow position, and monitoring of surface conditions

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