



**working to advance road weather  
information systems technology**

RESEARCH PROJECT TITLE  
Expert System for Maintenance  
Decision Support  
(Aurora Project 1997-03)

REPORT DATES  
August 2000 (Feasibility  
Demonstration)  
November 2002 (DART Database)

PROJECT TEAM  
Ontario Ministry of Transportation  
Minnesota DOT  
Iowa DOT  
Swedish National Road Authority  
Environment Canada  
Pennsylvania DOT

KEY WORDS  
decision, maintenance

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ABOUT AURORA  
Aurora is an international partnership of  
public agencies performing joint research,  
evaluation, and deployment initiatives  
related to road weather information systems  
(RWIS).

The opinions, findings, and conclusions  
expressed in this publication are those of  
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# Decision Support for Winter Maintenance

project summary

## Project Objective

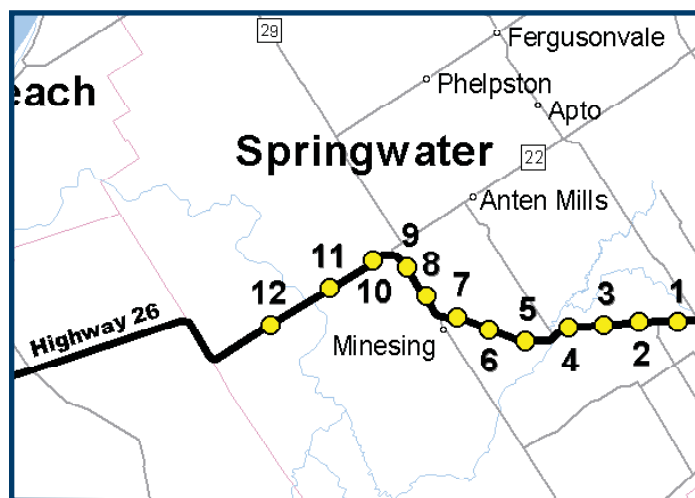
The objectives of this project were as follows:

- Report on existing work in developing decision support tools to select chemical applications appropriate to winter weather conditions.
- Describe in detail those which are at or near an operational state.
- Assess the feasibility of implementation as part of a road weather information system (RWIS).

A review and assessment focused on an expert system developed in Sweden in the early 1990s, the FHWA manual of practice for anti-icing published in 1996, and the De-Icing Anti-Icing Response Treatment (DART) system developed in Ontario in 1999.

## Methodology

The project included a review of published information, personal interviews with agencies or persons involved with existing systems, detailed description and demonstration of existing systems, comparison of data requirements in comparison with outputs from RWIS, and assessment of the feasibility of implementation. A review and assessment focused on an expert system developed in Sweden in the early 1990s and the FHWA's *Manual of Practice for an Effective Anti-icing Program* published in 1996.



*Surveillance camera sites on Highway 26, Barrie, Ontario, Canada, 1995–96 to 1998–99.*

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## Key Findings

The expert system developed by the Swedish National Road Authority (SNRA) and the FHWA's manual of practice are based on the same general types of inputs. The differences between them are largely a matter of detail as opposed to principle.

The FHWA's manual of practice was considered for implementation by the Ontario Ministry of Transportation (MTO) in 1996 but could not be used directly for three reasons:

1. The detailed tabular format is too complex for field operations.
2. Field staff would be required to make too many decisions. For many of the weather conditions, the recommended treatments included a wide range of application rates and more than one choice of salt form (e.g., dry salt versus pre-wetted salt versus brine).
3. The recommended treatments did not include road weather conditions at temperatures colder than  $-10^{\circ}\text{C}$  or snow-packed conditions.

MTO developed the De-icing Anti-icing Response Treatment program to address these problems. Its purpose was to adapt the FHWA manual to a computerized format and to evaluate the effectiveness of the recommended treatments.

Based on testing and experience in Ontario, DART applies nested logic to access recommended salt and sand application rates appropriate to different temperature and snow conditions. It also provides an archive function to track the success of operations, providing a dataset that can be analyzed to refine the application recommendations. A demonstration copy of DART was provided to Aurora.

The Swedish Road and Transport Research Institute (VTI) is constructing a knowledge base of application guidelines used by operational staff. Confidence will be determined by the degree of similarity among knowledge sources.

Both MTO and VTI plan to integrate decision support systems with existing RWIS.

## Implementation Readiness

In the case of MTO, this will require changing some of the input parameters for DART or output from RWIS. One parameter, snow accumulation on the road, cannot be provided by any available RWIS. A new sensor or method of estimation will have to be developed, or the program logic changed so that snow accumulation is not a required input. However, the preliminary analysis indicates that initial snow cover is a very important parameter.