CADD-Based Expert System
For Passive Control of Blowing Snow

NYSDOTIRC Subcontract 28311-5823
Project C-01-67

Final Summary Report

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16. **Abstract**  
Properly engineered passive snow control measures can significantly reduce the safety hazards and winter maintenance costs associated with the problem of blowing and drifting snow. There are two possible mitigation strategies: roadway (cross section) design and snow fencing. This project developed and deployed a software application, named SnowMan (for Snow Management), to run within the NYSDOT’s MicroStation-based CAD environment to assist highway designers and maintenance users in the design of such passive control measures. This effort thus extends the applicability of the earlier PASCON expert system software (Kaminski and Mohan 1991) and incorporates well-established knowledge regarding snow transport and deposition, evaluating roadway cross sections for drift susceptibility, design of passive and living snow fences, and earthwork modification for reducing drifting (Tabler 2003). The SnowMan software brings the science of engineered mitigation of blowing and drifting snow to the desktop. Benefits include reducing maintenance costs and closure times and improving crash incidence by improving visibility, preventing drifting on the road, and reducing road icing.

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Snow fences, snow drift, blowing snow, drifting snow, snow control, highway maintenance, road design, software

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Executive Summary

Properly engineered passive snow control measures can significantly reduce the safety hazards and winter maintenance costs associated with the problem of blowing and drifting snow. There are two possible mitigation strategies: roadway (cross section) design and snow fencing. This project developed and deployed a software application, named SnowMan (for Snow Management), to run within the NYSDOT’s MicroStation-based CAD environment to assist highway designers and maintenance users in the design of such passive control measures. This effort thus extends the applicability of the earlier PASCON expert system software (Kaminski and Mohan 1991) and incorporates well-established knowledge regarding snow transport and deposition, evaluating roadway cross sections for drift susceptibility, design of passive and living snow fences, and earthwork modification for reducing drifting (Tabler 2003). The SnowMan software brings the science of engineered mitigation of blowing and drifting snow to the desktop.

The scope of this contract originally covered 12 use cases (Chen 2004). When the work got underway, however, it was determined in close consultation with NYSDOT that some of these cases were either impractical or redundant. Thus, the original 9 snow fence cases (Cases 1 - 9) were consolidated with NYSDOT approval into the 6 snow fence cases implemented in SnowMan, and the original 3 earthwork cases (Cases 10 – 12) were consolidated with NYSDOT concurrence into the two earthwork cases implemented in SnowMan.

This contract work made user interface improvements, upgraded the code to be compatible with MicroStation V8, incorporated the revised use cases described above, and extensively revised the software code to reflect the modifications and improvements required by NYSDOT in a maintainable, customizable, and extensible platform as a MDL (MicroStation Development Language) application. Evolving software was reviewed a number of times in consultation with NYSDOT. A statewide climatological database was developed but then not implemented directly; an interpolation equation based on that database developed by Dr. R. D. Tabler is implemented in SnowMan instead. SnowMan has been deployed statewide within the New York State Department of Transportation. Revised CADD level standards were implemented that enable SnowMan to be used in conjunction with standards-compliant 3D MicroStation CADD surface design (DGN) files statewide.

Statement on Implementation

The SnowMan software has been implemented as a MDL application for use in the MicroStation environment and deployed in NYSDOT. It could be adapted and extended for use in other regions beyond New York State having similar concerns with blowing and drifting snow.
Project Personnel

The main project personnel involved in producing the as-delivered SnowMan software were as follows:

- Joseph F. Doherty, M.B.A., P.E., NYSDOT Main Office, Overall Project Director
- Stuart S. Chen, Ph.D., P.E., University at Buffalo, Principal Investigator
- Michael F. Lamanna, M.S., University at Buffalo (now Lamanna Consulting), chief software architect and programmer
- Darrell F. Kaminski, M.Eng., P.E., NYSDOT Region 5 Chief Design Engineer
- Ronald D. Tabler, Ph.D., P.E., Tabler and Associates

Project Deliverables

The following list summarizes the specific deliverables of this project:

- Working MDL application software, dubbed “SnowMan,” running in the NYSDOT MicroStation CAD (Computer-Aided Design) environment to assist both highway designers and maintenance users design passive snow control solutions,
- A training seminar conducted in NYSDOT Region 5 on March 15, 2007 (Chen et al., 2007a),
- A journal paper manuscript (Chen et al., 2008),
- A programmer’s (developer’s) manual (Lamanna and Chen 2008),
- A user’s manual (Chen and Lamanna 2008), and
- This summary report.

At this writing, discussions were ongoing regarding engaging Lamanna Consulting for possible further development and ongoing maintenance of the SnowMan software.

References


