Pooling Our Research: Automating Winter Maintenance Decision Support

Why a Pooled Fund Study?
Winter maintenance personnel often have to make quick decisions about maintenance strategies that involve the complex interplay of materials, equipment, scheduling, road reporting and changing weather conditions. For many agencies, these decisions have been largely based on the prior experience of maintenance staff and supervisors.

The Federal Highway Administration recognized the benefit of integrating information and technology to support winter maintenance treatment decisions and in 2001 began development of a functional prototype winter maintenance decision support system. An MDSS is an automated software tool that integrates information about weather, road conditions, maintenance practices and available resources to help winter maintenance personnel make proactive decisions about the best treatment to use before and during winter events. FHWA released its prototype MDSS software in September 2002. Interested in enhancing and implementing FHWA’s functional prototype, Mn/DOT and four other state DOTs formed the MDSS pooled fund study in late 2002 in partnership with Meridian Environmental Technology Inc. Today 16 states and the FHWA participate in the study, with South Dakota DOT as the study’s lead agency.

What is the Pooled Fund Study’s Goal?
The goal of this pooled fund study is to develop and deploy a user-friendly MDSS that focuses on operations and tactics to provide weather and road condition forecasts and real-time treatment recommendations for specific road segments. State DOTs can use the MDSS as a guidance tool to maintain or improve levels of service; reduce operating costs by reducing the materials, equipment and labor used on winter maintenance; and make winter roadways safer for the motoring public.

What Have We Learned?
Researchers started by evaluating the FHWA MDSS prototype and used this evaluation to begin development of an MDSS that would optimally meet the needs of front-line maintenance supervisors. The interoperable design of an MDSS includes five systems: weather, pavement forecast, DOT operations and control, MDSS decision logic and the user interface. It also involves two interrelated applications: one predicts and portrays how road conditions will change due to forecast weather and the application of alternative maintenance treatments, and the other suggests optimal maintenance treatments based on agency resources.

First, an MDSS is provided with current road condition data via on-truck instrumentation, in-pavement sensors and manual entry of observations. If no observations are available, the MDSS assesses the road conditions using recent weather and reported maintenance. Next, continuously updated weather forecasts are uploaded in the MDSS, and actual maintenance treatments are entered by the operator or automatically recorded by instrumented snowplows. Computer modeling assesses past and present weather conditions and predicts short- and long-term storm weather. The MDSS uses this information to predict future road conditions with and without treatments. Finally, MDSS decision
logic considers an agency’s available resources and applies agency-defined priorities for level of service and significance of road segments to provide continuously updated maintenance recommendations. Each maintenance alternative includes treatment type, application rate and optimal timing, and the expected effectiveness and costs. MDSS software is expected to improve the consistency and cost-effectiveness of Mn/DOT’s snow and ice control operations. An Mn/DOT study that examined data generated from recent winter events concluded that the MDSS also has the potential to significantly reduce Mn/DOT’s salt use, lessening environmental impacts while still meeting or exceeding existing performance targets.

What’s Going On Now?
The pooled fund study continues to advance research and development of the MDSS software, provide training support and assist new participants in conducting field trials. Mn/DOT began preparing for its MDSS deployment in 2007 with the long-term goal of statewide deployment. Almost 20 percent of all plow routes in the state are entered in the MDSS. Mn/DOT is using Automated Vehicle Location technology to gather real-time information about current road conditions and maintenance activities for entry in the MDSS application. Today nearly 10 percent of all Mn/DOT plow trucks have AVL technology on board. While the MDSS and AVL initiatives are two separate projects, and the MDSS can be implemented without AVL technology, test sections in several areas of Minnesota have demonstrated that combining the MDSS with AVL will significantly enhance the effectiveness of each project.

What’s Next?
As MDSS/AVL deployment continues, Mn/DOT is considering how these applications can be used to leverage other Mn/DOT systems. Possibilities include automating repetitive manual data entry of maintenance activities and material usage, and incorporating AVL/MDSS feedback into a roadway system map depicting driving conditions to enhance Minnesota’s largely audio-based 511 system.


For more than 25 years, FHWA’s Transportation Pooled Fund Program has been providing state DOTs and other organizations with the opportunity to collaborate in solving transportation-related problems. The TPF Program is focused on leveraging limited funds, avoiding duplication of effort, undertaking large-scale projects and achieving broader dissemination of results on issues of regional and national interest.