Priority, Market-Ready Technologies and Innovations

Maintenance Decision Support System (MDSS)

New

OPERATIONS

Problem: Maintenance managers need better information to make decisions about winter road treatments

Managing winter maintenance activities is a complex endeavor. Ensuring that the plow blades are ready when the first flakes fall is only a small part of the task. Maintenance managers also must know the regulations about chemical applications and environmental impacts and be able to analyze and make sense of multiple and often contradictory weather forecasts. Many maintenance managers also are faced with tight budgets. All of these factors come together, challenging public agencies to meet the traveling public's high expectation that roads be kept free of snow and ice. Thus, today's maintenance managers require the ability to efficiently handle multiple tasks and process high volumes of information, or risk getting left behind in the onslaught of winter weather.

The Federal Highway Administration (FHWA) has long recognized the challenges faced by maintenance managers. With the creation of the Road Weather Management Program in the late 1990s, FHWA began to improve the kind of information that was available for winter maintenance. At that time, weather forecasts were plentiful, and a few companies issued road-specific forecasts; however, there was no link between the available weather information and the decisions made by maintenance managers about winter road treatments, such as when it is best to treat which roads, and whether salting, plowing, or a combination of approaches is most effective. The recognition of this missing link led to the genesis of the winter Maintenance Decision Support System (MDSS). The MDSS project was a collaboration between a pool of maintenance practitioners from several State departments of transportation (DOT) and five national laboratories.

Solution: Customized treatment recommendations for specific routes

MDSS uses state-of-the-art weather forecasting and data fusion techniques and merges them with computerized rules of practice about winter road maintenance. The result is a tool that can provide maintenance managers with precise surface condition forecasts and treatment recommendations for specific routes.

How does MDSS work?
MDSS is a computer-based application suitable for analyzing all winter maintenance conditions.

Putting It in Perspective

Winter road maintenance accounts for approximately 25 percent of State DOT maintenance budgets. Each year, State and local agencies spend more than $2.5 billion on snow and ice control operations and more than $5 billion to repair infrastructure damage caused by snow and ice.

For weather-related crashes, "winter weather crashes" are defined as those occurring in the presence of snow, sleet, sleet/fog, snowy/slushy pavement, and/or icy pavement. According to data from 1995 to 2004 from the National Highway Traffic Safety Administration, each year:

• More than 389,000 crashes (6 percent of all crashes) occur in winter weather.

• More than 133,000 persons are injured in crashes during winter weather. That is equal to more than 4 percent of all crash injuries.

• More than 1,500 people are killed in crashes during winter weather, which is equal to more than 3 percent of all crash fatalities.

Benefits

- Provides real-time winter weather information for both the atmosphere and road surface.

- Includes numerous winter maintenance treatment options, such as various application rates, times, and chemical types.

- Includes a "what if" scenario treatment selector to see how road conditions can, change under warning circumstances.

The software can provide users with a range of treatment options and information, including:

- Timing information about the start and duration of precipitation, including the conditional probability of snow, rain, and ice.

- Information on the type and amount of expected precipitation.

- Optimized treatment times.

- Recommended treatment types and dispersion rates.

- Assistance in the establishment of work completion incentives.

While many users rely on MDSS to provide real-time decision support, MDSS also can be used as a training tool. After the winter season ends, users can reenter conditions to determine if different courses of action would have proved more beneficial. MDSS also can be used to rapidly train new maintenance managers on the rules of practice in their district.

To operate effectively, MDSS requires:

- A display system in the maintenance garages that consists of regular personal computers connected to the Internet and running Java™ applications. A large screen and wideband Internet connection makes the transfer of information faster.

- Access from the user's computer to a server operated by a private sector service provider, who likely will run the algorithms on a computer with dual processors (at least rated at 3 gigahertz), 2 gigabytes of memory, and the Linux™ operating system. To run the weather models, multiple networked computers are required. This may be done by the private sector service provider, or operators may use weather models run by the National Oceanic and Atmospheric Administration's National Weather Service.

Deployment Statement

MDSS is an enabling technology that integrates weather forecasting (both atmospheric and surface weather conditions) with the state of the practice in winter road maintenance. Managers are better prepared for efficient use of personnel and equipment. Maintenance managers can calibrate the types and amounts of chemicals or abrasives to be deployed. All of this can lead to a more cost-effective operation, activities that have less impact on the environment, and the creation of a safer driving environment. In addition, MDSS raises the bar for the entire surface transportation weather industry by encouraging forecasters to use better models.

Deployment Goal

FHWA strongly supports the deployment of MDSS by State DOTs based on the advanced products made available to them by private sector service providers. Due to the complex and advanced nature of the system. FHWA's goal is for three States to make measurable progress at implementing MDSS over the course of 2006.

Deployment Status

Deployment by State DOTs has been progressing along several fronts. The most extensive deployment is a pooled fund effort by eight States, including South Dakota, who is leading the effort, along with Colorado, Indiana, Iowa, Kansas, Minnesota, North Dakota, and Wyoming.

This effort is considered to be a precursor to 'operational' deployment of MDSS. In addition, the Federal MDSS project has been deployed in a developmental mode in Colorado. Over the past several years, in all, 37 States have participated in the development and deployment of MDSS.

Additional Resources

For more information on MDSS, visit **http://www. ops.fhwa.dot.gov/weather** or **http://www.rap. ucar.edu/projects/rdwx_mdss**.