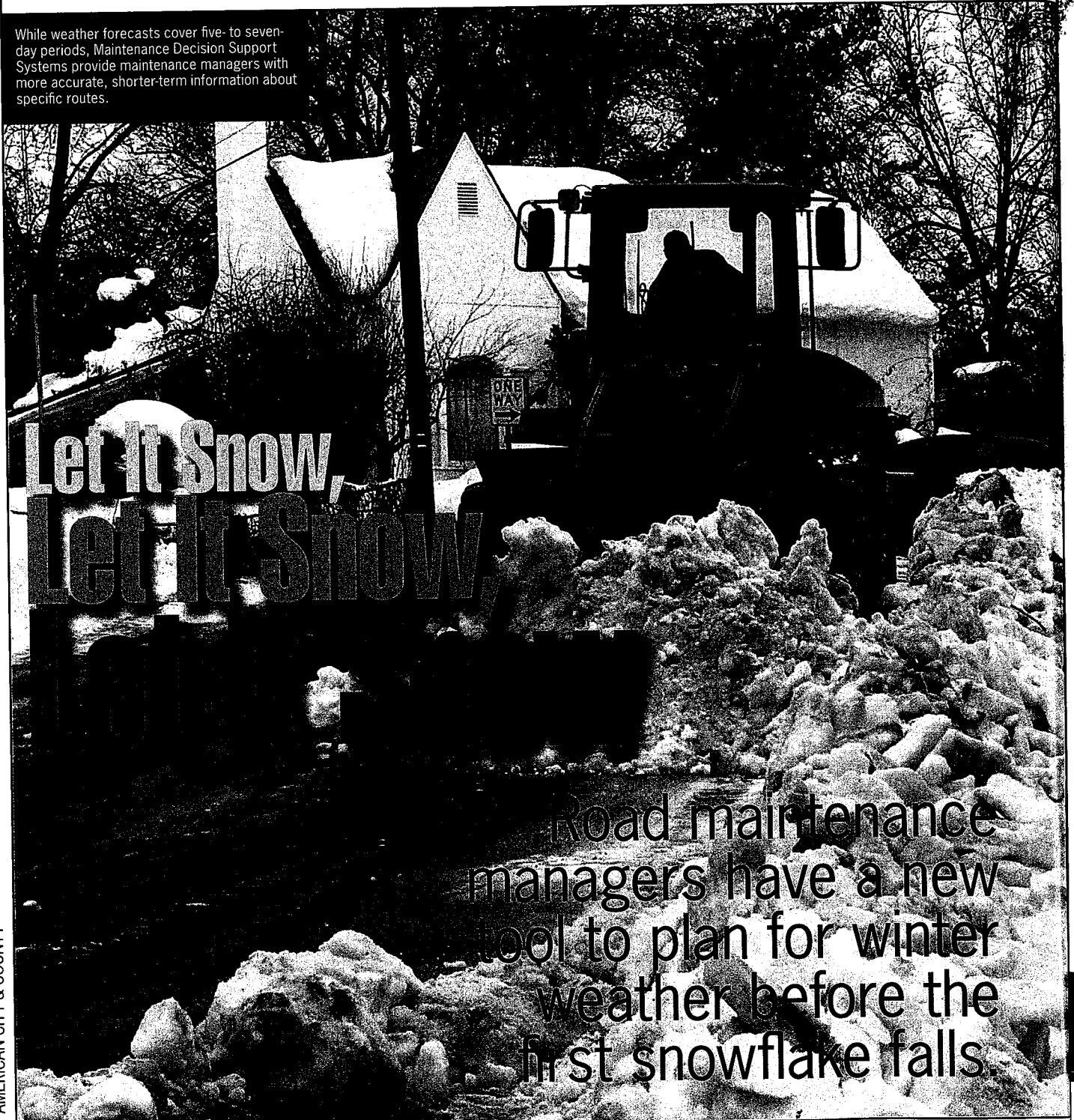


When Old Man Winter starts spewing snow and ice, a handful of state Departments of Transportation (DOTs) will be well prepared to make critical road treatment decisions, thanks to the Maintenance Decision Support System (MDSS). While weather forecasts cover five- or seven-day periods, MDSS provides maintenance managers with more accurate, shorter-term information by routes, according to Paul Pisano, team leader for the Federal Highway Administration (FHWA), Road Weather Management Group.

The FHWA-funded MDSS is based on diagnostic and prognostic research systems (high-resolution numerical forecast models and experimental algorithms) of weather and road behavior. It offers a full suite of tools to aid maintenance managers, including pavement chemical concentration forecasts, optimized treatment times and

By Nikki Swartz

While weather forecasts cover five- to seven-day periods, Maintenance Decision Support Systems provide maintenance managers with more accurate, shorter-term information about specific routes.



**Let it Snow,
Let it Snow**

Road maintenance managers have a new tool to plan for winter weather before the first snowflake falls.

AMERICAN CITY & COUNTY

strategies, roadway snow depth forecasts, surface frost prediction, material application amounts, pavement surface temperature forecasts, crew scheduling, road mobility forecasts and snow drift prediction. MDSS technologies include Decision Support Logic (which recommends road maintenance courses of action), Chemical Concentration, GIS display, Snowdrift Algorithm, video image processing, Weather Prediction System, Ensemble Modeling and Sensing.

In addition, maintenance managers can look at the weather parameters and find out what is predicted to happen on their routes over two days within a specific district. The system then can recommend actions to take depending on the weather and road conditions.

"This is really what distinguishes MDSS from any typical weather forecast-type product," Pisano says. "It's one thing to say that it's going to snow on these roads or the pavement is going to freeze, but it's another to say, 'Because it's going to snow and because the pavement is going to freeze at midnight but the precipitation is going to start falling at 4:00 a.m., we recommend that you apply 300 pounds per lane mile of salt on these roads at this time.'"

If managers do not agree with MDSS's guidance, the system offers "what if" scenarios to reveal the predicted conditions if, rather than putting down three applications, they apply two instead. Either way, MDSS provides the tools necessary to make decisions about how many applications to make, and the required equipment and labor resources. That can save precious time in the face of an impending blizzard or ice storm.

The system does not require a cadre of IT personnel or massive service upgrades, says Dennis Burkheimer, Iowa DOT winter operations administrator. "The actual MDSS application is always running at the forecaster's office, so most of the complex number-crunching calculations and computer processing is done at a remote location, and we access the information through the Internet," he says.

Testing MDSS

The MDSS functional prototype was field tested in Iowa over two winters in 2002-2003 and 2003-2004. During the tests, the MDSS core components (e.g., Road Weather Forecast System, Road Condition and Treatment Module and data server) were operated centrally at

Not another forecast

The Maintenance Decision Support System (MDSS) resulted from a survey, "Surface Transportation Weather Decision Support Requirements," conducted by the Federal Highway Administration (FHWA) and its MDSS stakeholder group, which included universities, private contractors and state DOTs. FHWA shaped the program by finding out how winter road maintenance managers make decisions. Through that process, the agency recognized a gap that existed between the information that was being provided to maintenance managers and the decisions they were making, says Paul Pisano, team leader for the FHWA Road Weather Management Group.

MDSS was created to fill the perceived gap. Before MDSS, Pisano says, the decision support tools needed to help maintenance managers perform better did not exist, and the roadwide information that was being provided to them was deficient. Managers did not need a better weather forecast; they needed to translate that forecast into specific winter maintenance action. To accomplish that, a prototype was developed in 2001, and for the next two years, FHWA demonstrated and evaluated the MDSS prototype through DOT field tests.

In 2001, a consortium of organizations — the Army Cold Regions Research and Engineering Laboratory, the National Center for Atmospheric Research (NCAR), the Massachusetts Institute of Technology/Lincoln Laboratory, the NOAA Forecast Systems Laboratory and the NOAA National Severe Storms Laboratory — were tapped to help develop the prototype. Many of the technologies that could address road weather problems existed at the laboratories but had to be integrated, refined and tailored to address road maintenance weather issues.

The prototype:

- fuses data to create an open, integrated and understandable presentation of current environmental and road conditions;
- processes data to generate diagnostic and prognostic maps of road conditions along road corridors, emphasizing a one- to 48-hour period; and
- displays the state of the roadway and provides a tool that recommends courses of action for road maintenance.

The result is a system that uses a single platform to display the results and recommended courses of action, together with anticipated consequences of action or inaction.

According to FHWA, the goal of MDSS is to help state DOTs provide better road-specific forecasts and a higher level of service on roadways, and to reduce chemicals and manpower. By using timely, accurate, route-specific environmental data, managers can effectively counter weather-related congestion and delay, reduce weather-related crashes and disseminate relevant information to drivers.

— Nikki Swartz

the National Center for Atmospheric Research (NCAR) in Boulder, Colo. An NCAR server communicated over the Internet with local PCs running the display application at three of Iowa's state DOT maintenance garages. Data were exchanged between the display and server over the Internet. As new updates became available, the data were pushed to the display.

"We were selected [to test MDSS], but it was still something that we felt very strongly about," Burkheimer says. "We felt it was an important step in trying to help provide the best service we could to the public. It's going to allow us to, hope-

fully, be more efficient in our operations and use just the right amount of materials at the right time in the right locations so that we're not treating areas that may not need it."

Since then, Iowa and six other states — Colorado, Indiana, Kansas, North and South Dakota, and Minnesota — have pooled their funds to work with a private company to test and build out MDSS even further. The states are using their research dollars to perform more testing, evaluation and development before purchasing the systems.

Pisano says that Iowa, Kansas, Virginia and Wisconsin have issued an RFP

to procure and deploy MDSS services independent of the pooled fund study. None are fully operational yet, but a few, including Iowa's, will be by this winter.

"It will become a key part of our application so all of our garages out in the field will get a forecast, and it will also provide them [with] a recommendation on the amount of material to use, when to apply the material, and how much to use when they go out to treat the roadways," Burkheimer says. "It's a total recommendation to a supervisor as to how they should be deploying their forces and how they should be treating the roadway based on the storm situation."

He says a "tremendous amount" of training on the MDSS system will be required "because it's something that's a little bit different for people to understand." The system will be available at all of Iowa's 110 garages. "It does not replace the person out in the road; they are still ultimately going to have to make the decision on how to treat the roadways," Burkheimer says. "It's intended primarily as a guidance tool."

Potential partnerships

Using only state funds, DOTs purchase MDSS from private companies. FHWA will reimburse the states for travel costs to attend stakeholder meetings. Still, procuring, implementing and maintaining MDSS is not a budget-breaker. "We're just at the process right now of getting our bids in [from vendors] for this year, and I don't see a huge difference in our costs at this point in time

for adding the MDSS, so it's minimal at best," Burkheimer says.

Because MDSS may seem more expensive for a city or county with a smaller budget, Pisano suggests that they join with state DOTs to buy MDSS services. He says it may not cost much more for the vendor to add routes to the MDSS system and allow cities and counties to tap into the state DOT's servers.

"As long as the server has enough capacity to handle more than a handful of users, then it would be easy for the state or city or county to use the system," he says.

Burkheimer admits the state has not decided whether cities and counties will

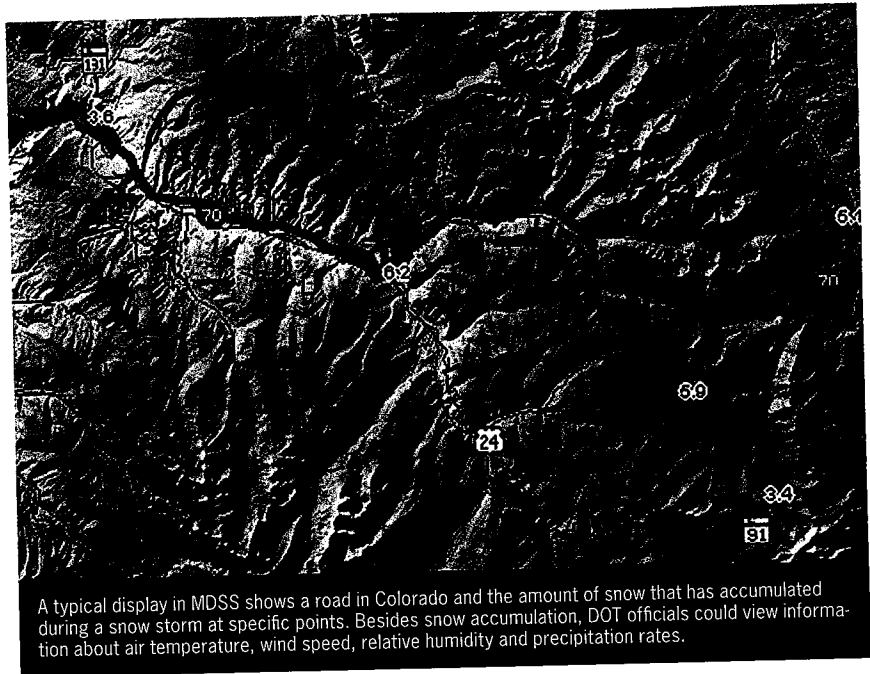
be able to access Iowa's MDSS. In previous years, local governments have had access to most of Iowa DOT's weather information, forecasts and pavement temperatures, he says, but cities and counties most likely will not get the MDSS information. "Without proper training, it may not be to their advantage because they're basing the projection of how to treat the roadways on our highway system," he says. "The treatment of Interstate 35 would be different from that of a city street because of traffic counts and the structure of the roadway and the winds that are more problematic in the rural areas."

John Burkhardt, Indianapolis Department of Public Works and Winter Maintenance Committee manager, is not waiting for the Indiana DOT to implement MDSS. Indianapolis contracts with St. Louis-based Surface Systems (SSI) for SCANCast forecasts and storm warnings. Burkhardt will test its MDSS version this winter and will compare it against the city's manual procedures to see if it can help improve operations.

"We're very 'weather aware' and consider ourselves to be pretty proactive, maybe too proactive, resulting in waste," he says. "If I can compare what we do to the MDSS, I can either help them adjust or learn how to operate more effectively and efficiently."

Come wind, rain or snow

From the beginning, FHWA has given private meteorological service providers free MDSS software so they can incorporate it into their product lines and



A typical display in MDSS shows a road in Colorado and the amount of snow that has accumulated during a snow storm at specific points. Besides snow accumulation, DOT officials could view information about air temperature, wind speed, relative humidity and precipitation rates.



The new computer-based weather and road behavior system will suggest ways maintenance managers can address a specific problems, including determining appropriate chemical concentrations and application amounts, optimizing treatment times and strategies, and scheduling crews.

develop applications tailored to state DOTs' needs. However, only three companies provide MDSS service, Pisano says. "The types of weather forecasting required for the system to work well are cutting-edge within the weather community. This is not something that weather forecasters are accustomed to doing or have a lot of experience doing," he says.

Burkheimer adds that few meteorological services forecast highway transportation in the first place, and most forecasters have not yet embraced MDSS. "They understand weather, and they understand weather forecasting, but when it's required that they have to understand a little bit about deicing materials, traffic, and how deicing materials work on snow, that's a little bit of a different world for them," he says. "It pushes them into a place [where] they're not as comfortable; they haven't had the same kind of training in this area."

Burkheimer expects it will take several years for MDSS to be fully accepted and deployed. When others begin to catch on, he is confident MDSS will provide consistency in state DOT operations. "If we have treatment recommendations suggesting that you use 200 pounds [of salt] a lane mile and your neighbor gets the



Iowa field tested the prototype of the Maintenance Decision Support System over two winters between 2002 and 2004. The National Center for Atmospheric Research in Boulder, Colo., operated the system's core components and used the Internet to communicate with three of the state's garages.

same suggestion, that would mean that your roads should be pretty uniform," he says. "That can make a difference."

Burkheimer adds that the system has tremendous potential to save DOTs money because, assuming accurate forecasts, it will enable them to apply materials where they are required, at the right time, in the right amount and at the right locations rather than everywhere. Pisano is optimistic about MDSS' future largely because at least 53 state DOT rep-

resentatives from 23 states plan to attend the next stakeholder meeting in October in Colorado. "That's a huge number," he says. "That they find it to be worth their while to come to a meeting such as this means that this is something they believe in." **ACC**

For more information, visit: www.rap.ucar.edu/projects/rdux_mdss/index.html. Nikki Swartz is a freelance writer based in Kansas City, Mo.