

# Iowa DOT Weather Information System to Support Winter Maintenance Operations

DENNIS BURKHEIMER

Understanding and interpreting weather information can be critical to the success of any winter snow and ice removal operation. Knowing when, where and what type of deicing material to use for a particular winter weather event can be a challenge to even the most experienced veterans. Knowing where to find the weather information needed to make decisions and what information to use can also be difficult. The Maintenance Division of the Iowa Department of Transportation has taken a number of steps over the past ten years to provide supervisors and operators with the weather information and training they need to make better snow and ice operational decisions. A fifty-site Roadway Weather Information System coupled with a satellite delivered weather information system at nearly every maintenance garage have been sources for real-time weather information. Extensive training has also been included in the process as an important element to understanding how to use this weather information for making operational decisions. The department also provides similar weather information to cities, counties, and the general public through the Internet and rest area kiosks in an effort to educate others on how the weather information can help with their snow and ice operations and provide general traveler information to help motorists make informed decisions on travel.

## INTRODUCTION

The winter maintenance techniques and technologies used today are far different than those used in Iowa less than a decade ago. A few years ago, the standard operational practice was to treat roads with a 50/50 mix of sand and salt after receiving the first call from local law enforcement officials warning that roadway conditions were getting slippery. Often, trucks were not dispatched until a preset amount of snow had already accumulated on the surface of the roadway, which may have lead to potentially hazardous travel conditions for the public. The standard of operation at the time was purely reactive. Today, the Iowa Department of Transportation is taking a more proactive approach to winter maintenance by attempting to have equipment, materials, and personnel on the roadway in advance of or at the very beginning of a winter precipitation event to try to reduce the amount of time the roadways are slippery. Anti-icing, the practice of applying chemical deicers before a storm, has been used in Iowa over the past five years, and today the entire 3,200 lane miles of the interstate system plus an additional 3,000+ lane miles of non-interstate roadways are anti-iced when conditions permit.

The move to a proactive snow and ice operation was needed because traffic was increasing annually at all hours of the day and society's expectations were also increasing as the demand for quick delivery of goods and services became a benchmark

for customer service. Many businesses also moved to a "just-in-time" delivery of goods and services which meant they no longer maintained large quantities of raw materials or finished goods on hand and were dependent on the transportation for quick delivery of goods. An economic analysis conducted by Standard and Poor's DRI indicated that it would cost the state nearly \$68 million dollars a day in economic losses if the roadway system were shutdown because of a winter storm. (1)

To meet the customer expectations for driving conditions during and after winter storms, the Iowa DOT felt that the use of liquid deicing chemicals would be an important element to enhance snow and ice removal, began purchasing new equipment to support the use of more liquids, and invested time and effort in training operators and supervisors about adopting the proactive stance for snow and ice operations. One of the key elements to the success of this transition was having accurate weather information in the hands of the decision-makers. With reliable and accurate weather information, supervisors could determine when, where, and what materials to apply to the roadway providing for a more efficient snow and ice operation and improved traveling conditions for motorists.

## ROADWAY WEATHER INFORMATION SYSTEMS (RWIS)

The department purchased and installed its first RWIS site in Des Moines in 1989 from Surface System, Inc. (SSI). The site consisted of three pavement sensors that collected real-time pavement temperatures and salt concentrations, and a subsurface probe that measured temperatures under the roadway, air temperature, relative humidity, and wind speed and direction. The system was monitored at the local maintenance garage using DOS-based computer software that accessed the weather station with an early form of laptop and telephone modems. Top speed at that time for transfer of data was 1,200 bits per second. In the following years, a number of sites were installed each year, and as new hardware and software were developed, changes were made to the network topology to provide access to the weather information at the local garage and surrounding garages in a timely manner. A central server would call each of the sites every hour to collect current information and, at the same time, drop-off current weather information from the other sites in the state. This data collection process created large cost for long distance telephone calls and the information was often late in arriving to the decision-makers.

By 1999, the department had installed fifty RWIS sites throughout the state, and although most of the weather sensors remained basically the same, the data collection process and software used

---

Iowa Department of Transportation, 800 Lincoln Way, Ames, Iowa 50010.

to view the information changed to reduce long distance charges and to provide faster and easier-to-use information. The communication link between the weather tower and the garage has remained the same with the use of modems of telephone or radio links, but now, virtually all calls are local calls with nominal monthly fees, and access rates have been increased to 56,000 bites per second. Once the weather data is moved from the tower to the workstation in the garage, information is now moved back to headquarters using the department's high speed Local Area Network (LAN). Many of the site garages are connected to the LAN by T-1 lines, while the rest are connected with dedicated 56kps lines with plans to upgrade to T-1 lines in the near future. The central collection center of the system consists of two servers used to collect the information from the fifty sites: one server for archiving data and one server for Web access.

In 1989, the concept of using computers in maintenance facilities was still relatively new, and the DOS-based software used to access the weather information was not easy-to-use for many supervisors and operators. A large amount of training effort at that time was geared toward understanding computers and the software used to access the information, rather than understanding how to use the information to make decisions during winter storms. Today, the system data are available in Hypertext Mark-up Language (HTML) which allows users to access the data with any Internet browser. The department felt that many future applications would be developed using HTML and that using it for accessing RWIS data would reduce the amount of training required for using the software and allow for more concentrated effort on understanding how to use the information for decision-making.

## **OTHER WEATHER INFORMATION**

Having access to local roadway weather information from RWIS was very important for making decisions but access to other weather information was needed to understand the larger weather picture and the impact of approaching weather on operations. In 1994, the department leased satellite delivered weather systems from Data Transmission Network (DTN) for nearly all of its maintenance garages. The systems provide near real-time radar and satellite information along with current and forecast information from across the United States. This information provides supervisors and operators with the ability to watch winter storms as they develop, to check conditions before, during and after a storm to predict the impact on their roadways, and also to use the system in conjunction with their local RWIS data to help make informed decisions. These systems were equipped with only eight buttons to help users find the weather information they needed and were considered to be a very powerful, easy-to-use resource for weather information.

In 1996, with the success of the DTN systems at maintenance garages, the department decided to move data from the RWIS onto the DTN so that access to RWIS information could be available to all maintenance employees in one easy to use box. An agreement was also brokered between DTN and SSI to provide RWIS and DOT forecasts to other government entities in Iowa through the DTN systems for \$35 per month with the proceeds split among the three parties. This allowed the department to share RWIS and forecast information to all snow fighters in the state in the hope that it would provide uniformity between systems for the traveling public.

The Internet was also identified as a valuable source of weather information and access was provided to all maintenance garages in 1999. The Internet has also proven to be an excellent resource for other snow and ice information that can be used for training and research.

## **WEATHER INFORMATION FOR THE PUBLIC**

The department felt that providing the traveling public with real-time weather information was an important element for making important travel decisions. It was believed that if motorists could see impediments in the direction of their travel they may seek shelter or make changes in their travel plans.

In 1996, the department installed DTN systems in all rest areas along the Interstate system mounted behind plexiglass and located near the entry. The systems were designed to provide 15 weather and travel related screens to the viewer, changing every 10 seconds. The screens were pre-selected for their ability to provide travelers with near real-time weather information that included radar, satellite, current and forecasted road condition reports, and current weather observations such as temperatures, winds, snowfall and others. The system screens are modified in the summer months to provide more information on roadway construction and summer weather events such as tornadoes, hail, or flooding. One page in the system is being used by the local National Weather Service office to provide motorists with real-time weather watches and warning alerts as they occur.

In January 2000, the department opened a new internet web site called Weatherview (<http://www.weatherview.dot.state.ia.us>) that combines weather information from the fifty RWIS stations with information from thirty-three Automated Weather Observation Stations (AWOS) used at airports and managed by the department. This site provides current weather information from all reporting sites, is updated approximately every thirty minutes, and provides links to the National Weather Service forecast site and the road condition report operated by the Iowa State Patrol. In one storm, the site received over 10,000 hits from people seeking information. Plans are currently being developed to provide additional enhancements to this site by the winter of 2000-2001, providing the public with more information to help with their travel plans.

## **TRAINING**

Providing weather information at the garage level was a very important to helping move from a reactive snow and ice operation to one that is more proactive and also important to providing training on how to understand and use the information to make operational decisions. When RWIS was first installed, training on how to access the information was provided to the few garages that had systems, but the vast majority of garages received little if any training on RWIS and weather. Once more garages received RWIS sites and the information became more widely available, more training was provided on how to access the information, plus a once-a-year, two-day training session on how to use the information for operational decisions was presented by SSI. The training was excellent but may have been too technical for the users in the audience. In 1997, the department began a "train-the-trainer" program that provided training to a core group of 26 RWIS users from around the state that were expected to

provide training and support to garages in their areas. This would allow more one-on-one training at the garage level and would also help reduce the anxieties often associated with classroom training. It also provided local garages with a peer that understands how to use RWIS and other weather information to make operational decisions and provide guidance on how to get the most from the weather systems.

A six-part video series, covering a number of topics related to winter maintenance, was also developed recently for operators and supervisors. The final video in this series concentrates on weather information and resources available to the users and talks about how to use that information to make operational decisions.

**FUTURE**

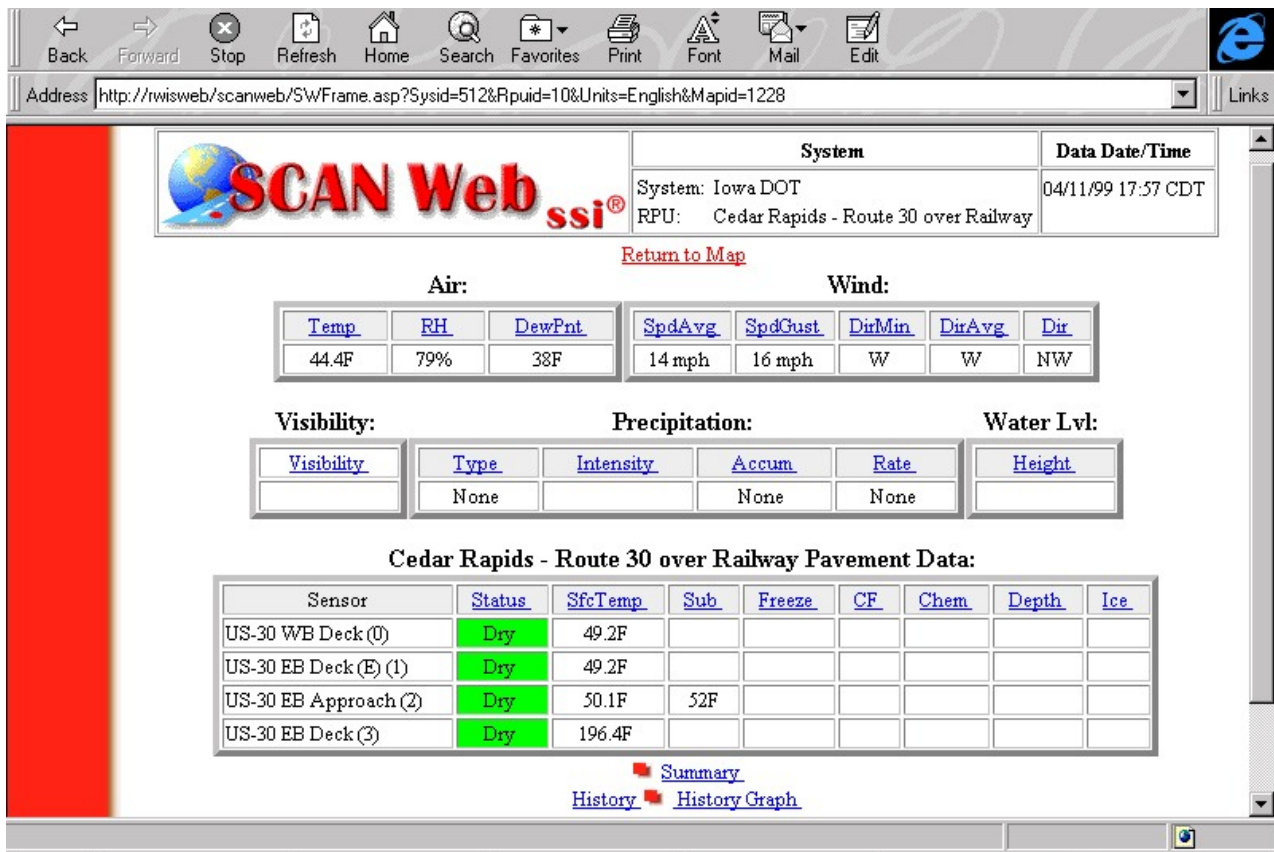
Traffic counts and customer expectations are both expected to increase in the future which will require maintenance forces to search for better and faster ways to remove snow and ice from the roadways. The department continues to research new equipment, deicing chemicals, technologies, and techniques to help meet the demands for better service. Efforts are also being made to pro-

vide decision-makers with more accurate weather forecasting through efforts with Iowa State University on a new frost forecast model and participation in a multi-state, FHWA-sponsored operational test of advanced weather forecasting called FORETELL. FORETELL is expected to deliver more accurate weather and roadway specific forecasts at greater resolutions than ever before.

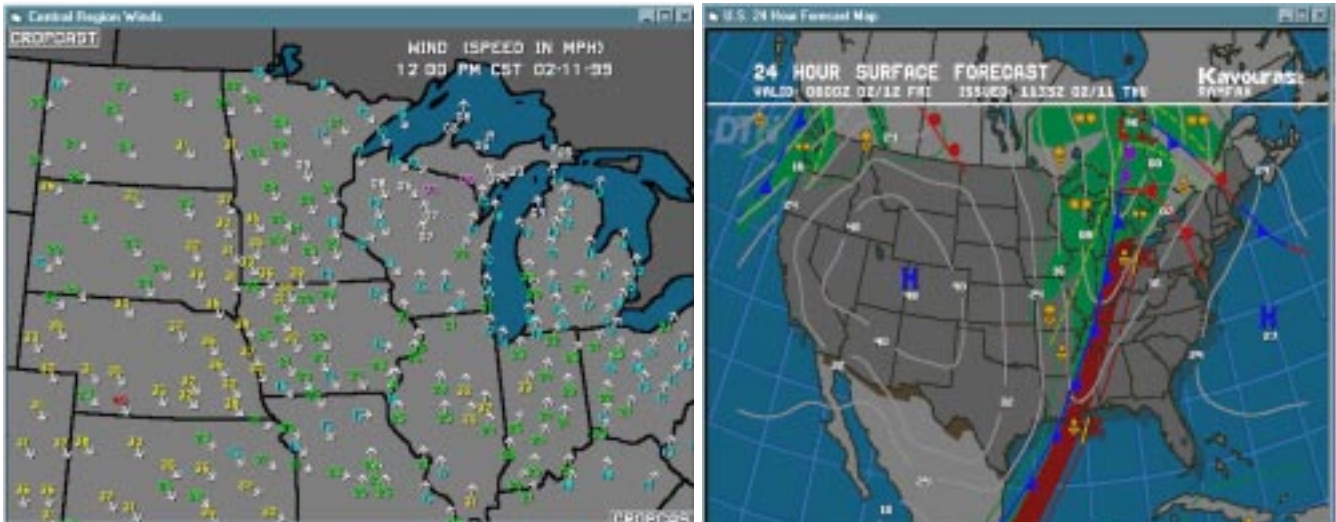
The department is also investing in Global Positioning/Automated Vehicle Location system technology that will automatically track resources and roadway conditions. The system is designed with sensors on snowplows to measure pavement and air temperatures as well as plow and wing positions, truck speed, truck location, and the amount and type of materials being used. This technology may be combined with current efforts with WeatherView to provide the public with the locations of snowplows to help with their travel planning and road condition assessment.

**REFERENCES**

1. Roberts, Paul D. *The Economic Costs of Disruption from a Widespread Snowstorm in Iowa*. Prepared for the Salt Institute by Standard and Poor's DRI, Washington, D.C.



**FIGURE 1** Statewide look at pavement temperatures using drop-down boxes that are part of an internet-based software package



FIGURES 2 and 3 Data transmission sample displays available at maintenance garages and interstate rest areas

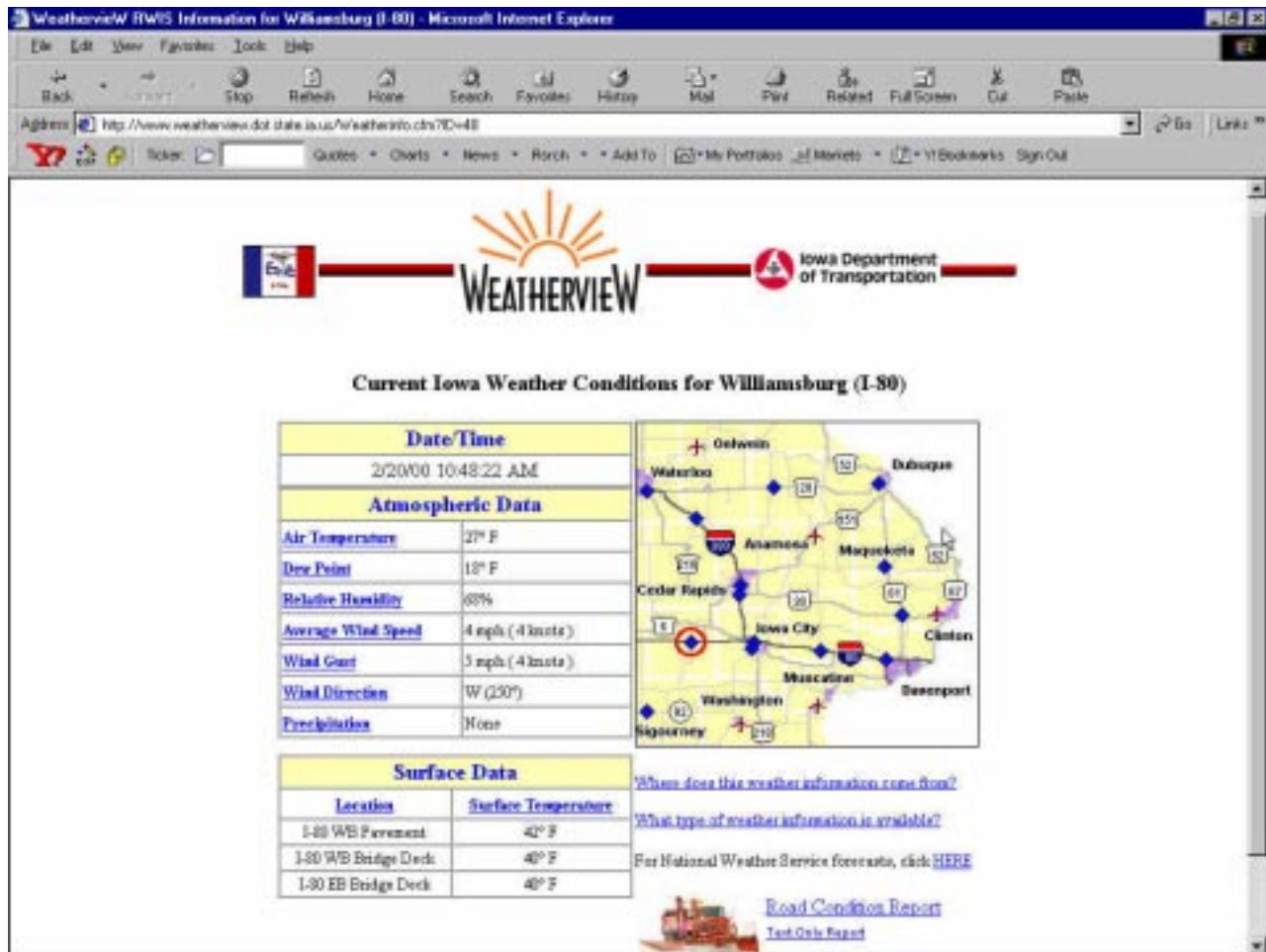


FIGURE 4 Public access to near real-time weather information from the department run Roadway Weather Information System along roadways and the Automated Weather Observation Stations at airports. Links at this site will take users to the current road condition report operated by the Iowa State Patrol and forecast information provided by the local National Weather Service office.