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LAND INFORMATION Bulletin

from the National Consortium for Rural Geospatial InnovationS
Great Plains, University of North Dakota

Making Road Travel Safer

GIS Paves the Way for Advanced Transportation Weather Information System

The University of North Dakota's Regional Weather Information Center has taken a big step in making road travel safer across the northern Great Plains. America's first rural, multistate, in-vehicle travel-information center began as a research project several years ago. Now, more than 6 million people in three states (North Dakota, South Dakota, Minnesota) have access to this advanced weather forecasting system that covers more than 27,000 miles of interstates, U.S. highways and state highways. RGIS—Great Plains played an important role by integrating geographic information system (GIS) technology into the field of automated, computer-based weather forecasting and information delivery.

Winter driving in the Dakotas

More than a century ago, pioneers traveled slowly across the Great Plains, but were prepared for the elements. Today, people cover hundreds of miles in a day through areas that have differing weather conditions. Checking the "local" weather on television or radio is not the best way to monitor conditions for long-distance travel.

Drivers traversing the expanse of the northern Great Plains now have some added travel insurance: the Advanced Transportation Weather Information System (ATWIS). Commonly referred to as the "pound safe" (#SAFE) system, ATWIS is the nation's first in-vehicle, rural, multistate traveler-information system. Begun as a research project at the University of North Dakota's Regional Weather Information Center in 1995, its purpose was to demonstrate how state-of-the-art weather analysis could be teamed with other technologies to deliver up-to-the-minute road and weather conditions to drivers.

An innovative weather forecasting decision-support system (DSS) combines "nowcasts," forecasts and information from road-surface sensors with a geographic information interface to improve the accuracy of weather and road reports for specific road segments. The DSS evaluates complex information making it possible to identify specific travel corridors, providing—via cellular phones, pagers and other portable devices—present and forecast weather information for travelers in a matter of minutes.

John D. Odegard School of Aerospace Sciences, home of the University of North Dakota Regional Weather Information Center

A traveler uses the ATWIS #SAFE Cellular Interface

An example of a site-specific weather forecast message

The following road conditions report and weather forecast is sponsored in part by the North Dakota Department of Transportation. For travelers on North Dakota Interstate 94 eastbound from mile marker two hundred seventy-two traveling toward Fargo North Dakota. Traffic speeds are reduced due to poor visibility. Roadway is snow-covered. Drivers should stay alert to changing conditions. The Forecast until nine o'clock Central Time this Tuesday evening: Skies will be overcast becoming mostly cloudy. Visibility will be less than one-quarter mile changing to near zero with blowing snow. There will be frequent moderate snow ending. Winds will be ten miles per hour gusting to fifteen miles per hour from the north-northwest changing to thirty-five miles per hour gusting to forty from the northwest. Temperatures will range from eight to ten degrees decreasing to minus two to minus six degrees.

Integrating Technologies

When developing the system, Regional Weather Information Center staff were seeking a way to combine short-term, site-specific forecasts that could be rapidly disseminated to travelers. They set out to seamlessly merge weather forecasting and analysis, telecommunications, geographic information systems (GIS), and road-condition monitoring. Specifically, the system requirements included:

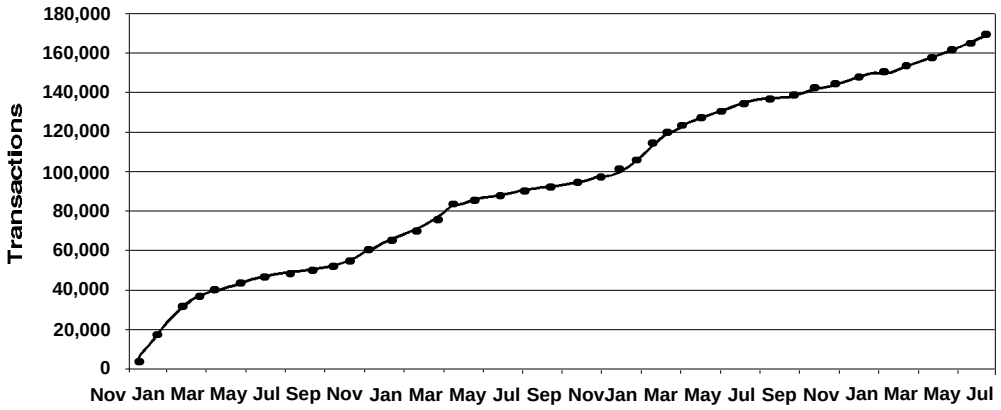
- Twenty-four-hour-per-day operations for timeliness
- Application of research in high-resolution weather prediction modeling for detailed site-specific forecasts,
- A geographic information system interface that would reference the road layer with the weather layer
- A central database location accessible by the traveling public, and
- Clear, direct lines of communication between the operational forecast center and all weather and road condition data sources available.

How the System Works

The forecasts and road condition reports are provided upon request by the user through a computer-telephone interface, known as a computer telephony (CT). A traveler simply accesses the CT with a wireless device—typically a cell phone—through a special switch number: #SAFE (#7233). Users answer three to four questions to determine their location and direction of travel. The system determines the traveler's next 50 to 60 miles and constructs a weather forecast and road-conditions report for the specific lane of travel. Within a minute and 35 seconds, a traveler has site-specific information for making travel decisions.

The computer telephony system needs specific geographic information to link driver location to the site-specific weather information and road conditions provided by the computer. This is where GIS enters. A digital data set of all roads within the project area, partitioned into one-mile segments, resides within the GIS. Position information in latitude and longitude has been calculated for the endpoints of every mile segment,

Total number of site-specific requests since inception of ATWIS, November 1995 to July 1999

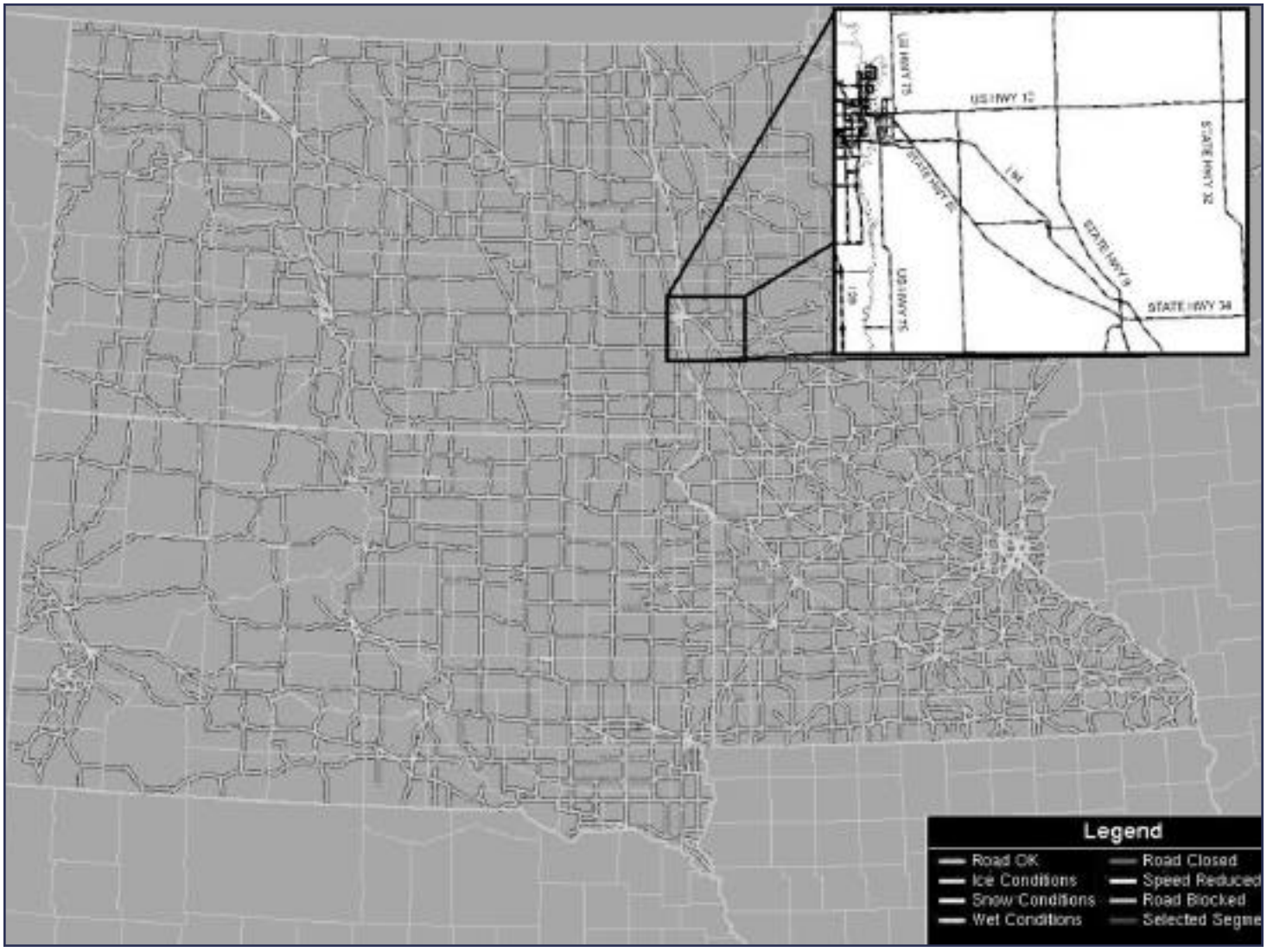


Forecasters use the decision-support system to provide weather forecasts

and this information has been entered into the main database where it is linked with current and forecasted conditions.

In the beginning of the ATWIS project, road segments were grouped into roughly 60-mile increments to conform to the forecasting area size and abilities of the meteorologist to generate forecasts. Travelers were either in one segment or another, although the technology did have the ability to recognize if they were just about to leave one segment and enter another. As the technology improved, spatial resolution of the forecast models increased, allowing the length of the forecast segments to decrease. This makes for a much more dynamic system—it allows the decision-support system to relate small-scale weather features, such as isolated thunder showers, to only those travelers that are affected by the weather event.

Road coverage of ATWIS totals approximately 27,000 miles in North Dakota, South Dakota and Minnesota



About RGIS

The National Consortium for Rural Geospatial Innovations–Great Plains (RGIS-Great Plains) is located in the John D. Odegard School of Aerospace Sciences, home of the University of North Dakota's Regional Weather Information Center. It is a USDA program designed to promote the use of geospatial information and technologies by communities in rural America. RGIS is dedicated to helping communities understand the concepts and benefits of using geospatial data and assisting them in all aspects of GIS development.

Acknowledgements

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Selected References

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