

Weather and Highways



Highlights of a Policy Forum
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“T

wo Killed, 30 Injured in 100 Car Pile-up Due to Heavy Fog.” “Heavy Snows Snarl Evening Rush Hour.” “Ice Skid Ends in Death for Three.” Each day, headlines

like these appear in newspapers throughout the country. More than 200 million cars and trucks use the national highway system, forcing many parts of the highway system to reach their maximum capacity.ⁱ Adverse weather, including rain, snow, sleet, fog, smoke, dust, etc., can quickly reduce roadway capacity and compromise both efficiency and safety.

A crash in the state of Maryland due to fog



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In the United States each year, approximately 7,000 highway deaths and 800,000 injuries are

associated with about 1.2 million weather-related accidents. The estimated annual economic cost from these weather-related crashes (deaths, injuries, and property) amounts to nearly \$42 billion.ⁱⁱ Many goods and services are based on just-in-time delivery, and so disruption in mobility brings considerable negative economic impact as well. Clearly, the societal and economic impacts of adverse weather on the highway system are huge.

The traveling public is the ultimate user of the road transportation system. People rely on the system as commuters, tourists, and consumers. In addition, police, fire fighters, school transportation systems, and emergency medical service providers, along with many others, rely on the transportation system to meet the vital needs of the public. The public clearly understands the relationship between weather and highway safety and congestion, and they seek solutions to enhance mobility.

Operating today’s highways presents many challenges. The system is owned and managed by the 50 states and tens of thousands of local governments. This decentralization of the U.S. highway system hinders efforts in maintaining consistency across the system and in transferring new technologies into nationwide use. Judicious increments in highway funding would allow the states to keep pace with the growth in demands for increased capacity, better environmental mitigation, and improved system management. The challenges of the nation’s highways in combination with the demands of the public create a critical situation. According to the American Association of State Highway and Transportation Officials (AASHTO), “The motoring public demands passable roadways everyday no matter what the weather brings!” Since we cannot control the weather, what is being done to meet their transportation needs?

The good news is that many services and technologies are commercially available now that, if implemented, would go a long way in aiding the transition of the transportation system from a reactive to proactive system with respect to weather.



A CLOSER LOOK

Data and Infrastructure

If the traveling public and highway managers are to make good decisions during adverse weather, they must have reliable, accurate, up-to-the-minute information on weather and road conditions. Currently, a variety of weather and road condition information is available from multiple sources across the country, including:

- **Road Weather Information System (RWIS)** – RWIS is a combination of technologies that collects, transmits, models, and disseminates weather and road condition information. The element of an RWIS that collects weather data is called the environmental sensor station (ESS).
- **Meteorological Assimilation Data Ingest System (MADIS)** – MADIS is a framework for a national clearinghouse of RWIS data. Some State Departments of Transportation (DOTs) provide the information to be entered into the database, which can then be distributed to users of road weather information.
- **Maintenance Decision Support System (MDSS)** – The MDSS project takes road weather data and information and merges them into a computerized winter road maintenance program that can help to guide maintenance managers in making better road treatment decisions.

The information gathered from these systems can be difficult to access, and the format and quality vary greatly. Robust deployment and utilization of RWIS have been limited by cost and by strong competition for limited funds within state DOTs. Depending on constraints imposed by state DOTs, the information entered into MADIS does not necessarily provide the full dataset.

Users of Road Weather Data and Information

With systems such as RWIS, MADIS, and MDSS in place, there are multiple users interpreting this data and information for the benefit of the driving public. Potential users of road weather data include:

- **Weather Information Providers** – They provide information to the public and to transportation managers. They collect and analyze measurements of rain, snow, sleet, and fog.
- **Traffic Managers** – They are responsible for the day-to-day operation and management of the roadway system and for managing congestion and maintaining safety.
- **Emergency Managers** – They are responsible for responding to incidents on the transportation system, such as crashes, disabled vehicles, and other potentially life-threatening situations.

A POLICY FORUM: Weather and Highways

In some cases, weather information is not presented in a way that is useable by traffic or highway managers or in a format that can be handled by their systems. Then, the potential users become frustrated and move on with their operations without the benefit of the latest weather information. Moreover, users vary in their understanding of the information, which makes it difficult for some of them to utilize the data. This means that many available technologies are not being employed effectively in user operations.

The Traveling Public

A Gallup public opinion poll conducted in 2002 indicated that 40% of the potential users of the national 511 system identified weather and road condition as the most important information element.ⁱⁱⁱ The systems that are available or will be available in the near future for the traveling public include:

- **National 511 System** – 511 has been designated as the national traveler information number. The information disseminated could include traffic congestion, weather conditions, road closures, local information/points of interest, etc. The program is coordinated by the state DOT but is implemented through public/private partnerships.
- **In-Vehicle Road Information** – In-vehicle capabilities provide a powerful combination of information that not only helps drivers to avoid or respond better to hazardous driving weather, but can also offer alternative routes that would improve mobility. Dashboard-mounted electronics could include cell phones, telematics, and data collection and navigation systems, which could configure voice alerts for traffic, weather, and incidents.



Although all of these technologies address road weather concerns, they still have their own impediments. The National 511 system is still in the early deployment stage. Many states have not fully developed their system because of funding problems. In-vehicle technologies are futuristic; most have not been fully implemented. There is also controversy surrounding their implementation, because some believe, without confirmation, that more information may distract the driver and cause more accidents.

The Current Issues

Weather has a huge impact on the performance of the highway system. Potentially huge benefits could be realized if weather information was used more effectively by road operating agencies and the public. Given this, what has or has not been done to promote surface transportation weather services, what opportunities are emerging, and what impediments are in place that have impacted progress to date? What policies, if any, are needed at the federal and/or state levels?

To explore these questions, the Atmospheric Policy Program of the American Meteorological Society developed a two-day forum on how to improve the safety and operations of the nation's highway system through better application of weather information. The forum brought together representatives of the weather information providers; transportation managers and users; and policy makers knowledgeable about the nation's highway system. Representatives came from the public and private sectors at the national, state, and local levels. The forum focused on present and near-term potential in providing weather information to improve the highway system, public and industrial development of strategies to effectively respond to weather information, and policy issues in implementing effective application of weather services to the management of the nation's highway system. The forum discussions led to the following six recommendations directed at improving the safety and efficiency of the roads for the ultimate benefit of the traveling public.

OVERARCHING RECOMMENDATIONS

1. Congress should authorize and provide long-term funding for the appropriate federal agencies to develop a national road weather research, development, and applications program, to improve the application of weather information for highway safety and operations.

The program should

- be a multi-faceted interdisciplinary road weather research program focused on addressing the needs of road operating agencies and the traveling public;
- be designed to support the operational decision making process of the traveling public and operational personnel involved in traffic, incident and emergency management, construction, and maintenance activities;
- include technology transfer components that provide mechanisms for the resulting technologies to be applied nationally in a timely manner;
- result in technologies that are consistent with and complimentary to the Intelligent Transportation System (ITS) architecture and framework;
- be designed for drivers and transportation managers to take advantage of and augment current and emerging transportation technologies, including intelligent vehicles, telematics, mobile sensing systems, 511 systems, dynamic navigation systems; and
- include mechanisms, such as rapid prototyping and model deployments, to assess user feedback and the potential benefits of the new technologies.

2. The federal and state departments of transportation should closely coordinate with public, private, and academic sector road weather stakeholders to improve the safety and efficiency of the nation's highway system during adverse weather.

The coordinated activities should include

- aggressively reviewing and quickly implementing, where appropriate, currently available weather and ITS technology to highway operations—in particular, technology that responds to weather conditions (e.g., variable message signs, dynamic speed limits, ramp metering, and road condition information kiosks);
- promoting the use and expansion of road weather and road condition measurement and information systems;
- developing and applying national standards for Road Weather Information Systems (RWIS) that include accuracy, data format, and siting requirements; and
- working with organizations (e.g. AAA and AMS) to implement programs of education and public awareness, including effective driver education programs that provide instruction on appropriate driving responses to hazardous weather and better utilization of advanced automotive capabilities.

GENERAL RECOMMENDATIONS

3. DOT/FHWA and NOAA, working with state DOTs, should establish a national road weather and road condition data collection, processing, and dissemination infrastructure to improve the safety and efficiency of the roadway system.

4. NOAA/NWS, commercial weather providers, and weather information users should work cooperatively to improve the observation system, develop and improve

forecasts, and enhance the delivery of information and services on road weather.

5. Federal and state DOTs should train the road management community to more effectively integrate weather into the decision process. In addition, the atmospheric science community, particularly academia, should develop course curricula focusing on road weather science and engineering.

6. DOT/FHWA should provide incentives for vehicle manufacturers and highway engineers to raise public and private sector demand for in-vehicle road weather information.

CONCLUSION

Meaningful actions in response to all of the forum recommendations will require cooperative efforts by all organizations and individuals involved in providing road weather information and those involved in developing responses to that information at the federal, state, and local levels and within the public, academic, and private sectors. Leadership by the FHWA in cooperation with NOAA and NSF, under the oversight and support of Congress, is vital if these recommendations are to be successfully applied to improve the safety and efficiency of our nation's roads.

For more information about the recommendations, please read our report, "Weather and Highways," available online at www.ametsoc.org/atmospolicy.

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Cover Image – Credit and Copyright: Milwaukee Journal Sentinel - An accident on U.S. Highway 41, just north of county Highway Q in Germantown, Wisconsin
Photographer: Michael Sears

ⁱ OFCM (Office of Federal Coordinator for Meteorological Services and Supporting Research), 2002: *Weather Information for Surface Transportation: A National User Needs Assessment*. U.S. Department of Commerce/NOAA, FCM-R18-2002. [Available online at http://www.ofcm.gov/wist_report/wist-report.htm.]

ⁱⁱ Lombardo, Louis, 2000: *Overview of U.S. Crashes & Environment*. OFCM WIST II Forum, 4-6 December 2000. [Available online at <http://www.ofcm.gov/wist2/presentationstartpage1.htm>]

ⁱⁱⁱ ITSA (Intelligent Transportation Society of America), 2002: *511's Weather and Road Condition Reports Most Valuable, Survey Shows*. [13 March 2002 press release available online at <http://www.itsa.org/511.html>]