

# Best Practices for Road Weather Management

## Utah DOT Low Visibility Warning System

Due to high traffic volumes and local conditions conducive to dense fog formation, the Utah Department of Transportation (DOT) deployed a low visibility warning system on Interstate 215 to notify motorists of safe travel speeds and to promote more uniform traffic flow. The warning system was installed on a low-lying, two-mile (three-kilometer) highway segment above the Jordan River in Salt Lake City where multi-vehicle, fog-related crashes have occurred.

*System Components:* Four forward-scatter visibility sensors and six vehicle detection sites are installed on the freeway to collect data on prevailing conditions. Visibility distance is measured in real-time and inductive loop detectors record the speed, length, and lane of each vehicle. Through Ultra-High Frequency radio modems these data are transmitted to a central computer system that records field data in a database, processes field data, and posts advisories on two roadside Dynamic Message Signs (DMS).

*System Operations:* The central computer identifies threats by using visibility distance, vehicle speed, and vehicle classification data in a weighted average algorithm to determine when conditions warrant motorist warnings. When visibility distance falls below 820 feet (250 meters), the computer automatically displays a warning on DMS. Based on stopping sight distances, safe travel speeds are posted on DMS when visibility is less than 656 feet (200 meters). Messages displayed for various visibility ranges are shown in the table below.

**Utah DOT Low Visibility Warning System Messages**

Visibility Conditions	Displayed Messages
656 to 820 feet (200 to 250 meters)	"FOG AHEAD"
492 to 656 feet (150 to 200 meters)	"DENSE FOG" alternating with "ADVISE 50 MPH"
328 to 492 feet (100 to 150 meters)	"DENSE FOG" alternating with "ADVISE 40 MPH"
197 to 328 feet (60 to 1000 meters)	"DENSE FOG" alternating with "ADVISE 30 MPH"
Less than 197 feet (60 meters)	"DENSE FOG" alternating with "ADVISE 25 MPH"

*Transportation Outcome:* An evaluation of the warning system indicated that overly cautious drivers sped up when advisory information was displayed, resulting in a 15 percent increase in average speed from 54 to 62 mph (86.8 to 99.7 kph). This increase caused a 22 percent decrease in speed variance from 9.5 to 7.4 mph (15.3 to 11.9 kph). Reducing speed variance enhanced mobility and safety by promoting more uniform traffic flow and minimizing the risk of initial, secondary, and multi-vehicle crashes.

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*Implementation Issues:* In 1993 DOT researchers responded to a federal solicitation to prototype a low visibility warning system. The DOT contracted with a consultant in 1994 to design and install the system on Interstate 215 due to recurring fog. During winter 1995/1996 the DOT collected visibility distance and traffic data before DMS were deployed to assess driver behavior in fog without advisories. By the end of 1997 field, central, and communication equipment was installed, calibrated, and integrated. DMS calibration and verification was carried out with the assistance of the Utah Highway Patrol.

The system was operational by winter 1999/2000 and traffic managers began collecting traffic speed data, vehicle classification data, visibility data, as well as a log of displayed messages. The DOT partnered with the University of Utah to conduct an evaluation of system effectiveness. The University analyzed traffic speeds by time-of-day, lane and direction, vehicle classification, and visibility distance with data collected over four winter seasons. Based on positive results, it was recommended that that speed and pavement condition data be incorporated into control logic, that the warning system be integrated with the DOT's Advanced Traffic Management System, and that further evaluation be conducted. Future studies will include analysis of crash rates in low visibility conditions before and after warning system deployment.

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#### *Reference(s):*

- Perrin Jr., J., et al., "Effects of Variable Speed Limit Signs on Driver Behavior During Inclement Weather," presented at Institute of Transportation Engineers (ITE) Annual Meeting, August 2000.
- Utah DOT Research News, "Utah's Fog Warning System - ADVISE," No. 2000-4, <http://www.dot.state.ut.us/res/research/Newsletters/00-4.pdf>.
- Perrin, et al., "Testing the Adverse Visibility Information System Evaluation (ADVISE) – Safer Driving in Fog," presented at the Transportation Research Board (TRB) Annual Meeting, January 2002.

*Keywords:* fog, low visibility warning system, freeway management, traffic management, control strategy, speed management, advisory strategy, motorist warning system, traveler information, vehicle detection, dynamic message sign (DMS), driver behavior, safety, mobility