

Data on the move

As highlighted by the advances in RWIS, weather information is a much sought-after component of ATMS. In the future, however, vehicles may be able to collect real-time details on environmental conditions, ensuring efficiency and safety for all

by Sheldon Drobot, National Center for Atmospheric Research (NCAR), USA

During a typical year, there are 1.5 million weather-related vehicle crashes in the USA, leading to 673,000 injuries and nearly 7,400 fatalities. Adverse weather and the associated poor roadway conditions are also responsible for 554 million vehicle-hours of delay each year, with the associated economic costs reaching to billions of dollars.

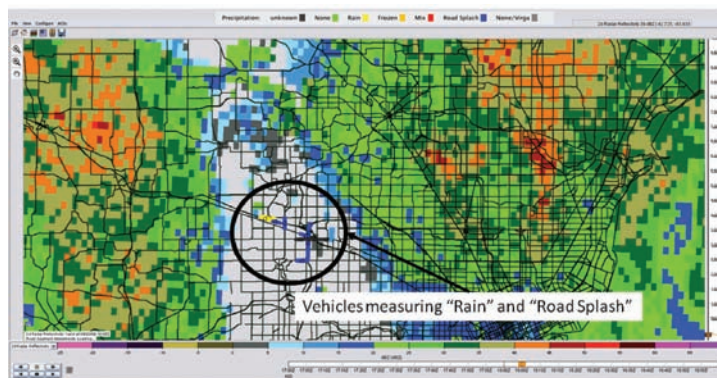
One possible solution for mitigating the adverse impacts of weather on the transportation system is to provide improved road and atmospheric hazard products to road maintenance operators and the traveling public. With funding and support from the USDOT's Research and Innovative Technology Administration (RITA) IntelliDrive initiative, and direction from the FHWA's Road Weather Management Program, the National Center for Atmospheric Research (NCAR) is conducting research to develop a Vehicle Data Translator (VDT) that incorporates vehicle-based measurements of the road and surrounding atmosphere with other, more traditional weather data sources, and creates road and atmospheric hazard products for a variety of users.

The initial VDT prototype was developed and tested using data from 11 specially equipped cars driven within the IntelliDrive testbed near Detroit, Michigan. These cars sensed and recorded more than 500,000 temperature and pressure observations and several million other vehicle data elements – with an emphasis on collecting data during rain and snow – over 11 days in April 2009.

A critical component of the VDT is rigorous data filtering and quality-checking



↑ Adverse weather is responsible for 554 million vehicle-hours of delay per year



← Example of a Vehicle Data Translator display, with the vehicles measuring rain and road splash

(QCh) routines, because bad data can be worse than no data. Some of the QCh routines are similar to those used at traditional, fixed weather-sensing stations, but vehicle data also poses additional QCh challenges. For example, outside air temperature measurements from vehicles may not be representative of the true ambient conditions if the vehicle speed is less than approximately 25mph, so this data can be filtered out. After these procedures are complete, the VDT statistically generates road and atmospheric variables, as well as hazard condition products, for user-specified road segments. As a default, it calculates information on one-mile road segments, with a five-minute update cycle.

WHATEVER THE WEATHER

Keeping in mind the need to serve a variety of users, the VDT also generates a wide range of information and products, roughly grouped into three categories. First, the system outputs and displays information about 'derived observations' on the road segments, computing the mean and standard deviation for ambient air temperature and the number of times a vehicle's ABS system was engaged. Second, it combines individual vehicle data observations and ancillary data via statistical processing to generate road and atmospheric hazard products for defined road segments. For example, a major hazard for the surface transportation industry is precipitation (both liquid and frozen), which lowers friction between the tires and the roadway and increases

the probability of accidents. The VDT has a 'road precipitation' fuzzy logic algorithm that blends vehicle data elements (such as wiper status distribution, or air temperature) with radar data, nearby weather station data, and weather model and satellite data. The end result is an indication of whether a motorist might encounter various precipitation-related conditions, such as rain, frozen precipitation, mix, road splash, none/virga, or uncertain. Road splash occurs when precipitation is no longer falling, but vehicles are still reporting significant wiper activity. Although there is a tendency to think that the impact of precipitation on the roadway is confined to when it is falling, the period immediately after – when roads are wet, snowy, or slushy – can be equally (if not more) dangerous as friction and visibility are reduced. On the other hand, the VDT can classify a none/virga condition even in the presence of radar returns if the precipitation is evaporating before it hits the ground, as information is known about wiper usage. In this case, the precipitation would not be significantly influencing the motoring public as it is not reaching the ground. Finally, the VDT collects and displays ancillary data, such as radar and satellite data, and observations from nearby fixed RWIS.

Now that the prototype has been successfully tested, NCAR and USDOT are moving toward increasing its capabilities. ■

For more information, please contact Sheldon Drobot at NCAR by calling +1 303 497 2705, emailing drobot@ucar.edu, or alternatively visit the website at www.rap.ucar.edu/projects/intellidrive/