Integration of Road Weather Information with Traffic Data

project summary

Objective

The objective of the research is to describe the impacts of weather identified through literature and through prior research conducted by the Center for Transportation Research and Education (CTRE). The report specifically highlights the finds of recently completed research conducted to quantify the impact of weather on traffic flow.

Problem Statement

While the ordinary traveler evaluates travel options based on experience, it might be expected that transportation professionals managing highway and transit systems would have something more analytical than experience to make decisions regarding traveler information, traffic management, and transportation system control. Unfortunately, traffic analysis and operational tools (simulations models) and standards for traffic performance (e.g., the Highway Capacity Manual 2000) assume clear conditions, and transportation managers are left with only their own experience to manage and control the transportation system when faced with inclement weather of varying intensities.

Inclement weather (fog, rain, snow, high winds, and extreme cold) impacts traffic operations during a significant proportion of the year. Inclement weather significantly impacts annual safety performance and the annual vehicle carrying capacity of urban highways.

Technology Description

On Interstate highway 35 (I-35) in northern rural Iowa, traffic counts were extracted from automatic traffic recorders (ATRs) during a number of snowy days (days when more than 1 inch of snow fell in 24 hours) and the researchers found a strong correlation between the percentage of traffic volume reduced (when compared to the volume on a clear day, during the same year, the same month, and the same day of the week) and wind speed and visibility (8).

Khattak et al. compared crash rates on interstate highways for periods when more than 0.2 inches of snow fell per hour to crash rates during the same time period on the same day of the week during the same month when conditions were clear. By comparing crash rates during non-snow and snow periods in this way, they hoped to reduce the im-

Continued on next page

Aurora

working to advance road weather information systems technology

RESEARCH PROJECT TITLE
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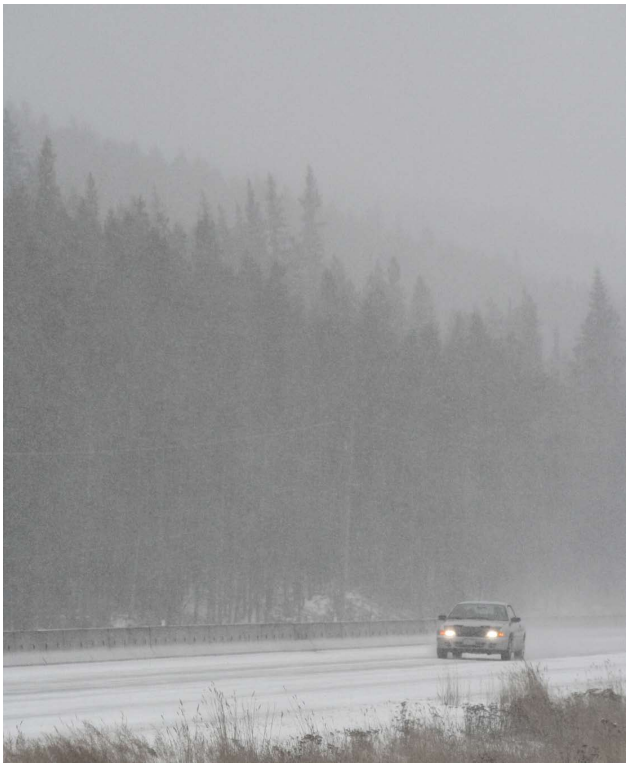
ABOUT AURORA
Aurora is an international partnership of public agencies performing joint research, evaluation, and deployment initiatives related to road weather information systems (RWIS).

Continued from previous page

pact on their findings of seasonal and weekly variations.

To enrich the knowledge of weather's impact on traffic flow and capacity, the study also estimated the relationship between highway capacity and traffic speed on congested freeways in the Minneapolis/St. Paul (the Twin Cities) metropolitan area. The data set included four years of data from traffic detectors on the Twin Cities freeway system, four years of environmental data taken from five Road Weather Information System (RWIS) stations located adjacent to the freeway network, and four years of environmental data from three Automated Surface Observing Systems (ASOS) stations at airports nearby the freeway network.

The Twin Cities freeway traffic management system has employed inductive loop detectors to monitor traffic. A single loop detects only presences of a vehicle (occupancy) and volume. Assumptions about the average vehicle length and detector field length can be used to estimate the speed of vehicles passing over the detector. As the weather becomes more severe, drivers reduce their speed and increase their headway (or reduce density), thus reducing flow and resulting in reduced highway capacity.



Winter weather driving

Key Findings

Through the literature and through analysis of Iowa crash data, it is apparent that snowy weather greatly increases crash frequency and crash rate. Crash severity tends to be slightly lower, but the increase in crash rate greatly exceeded the reduction in crash severity.

Additionally, when working with wind direction and wind speed data from the RWIS stations, the researchers found these data misleading and hypothesized that erroneous measurement of wind direction and speed might be a result of the interaction between the measurement device (anemometer) and the vehicles on the roadway.

The most important conclusion from the work and the findings of other transportation weather researchers is that weather matters. Weather conditions have an important impact on traffic safety, traffic demand, and traffic flow. With the exception of the recent addition of weather into the Highway Capacity Manual 2000 in Chapter 22, highway design, traffic safety, and traffic operations guidance is generally silent on issues related to weather.

Implementation Benefits

The benefit of this report is that we are now aware that weather does have a significant impact on driving conditions, so now we know that more needs to be done to mitigate the impacts of weather on traffic safety, demand, and flow.

Implementation Recommendations

If RWIS environmental sensors are going to be of significant value to traffic managers, then they must more reliably collect different data elements. Clearly, intensity of precipitation matters and the majority of RWIS stations do not currently collect intensity data. Also, visibility data are not commonly collected and visibility is important.

Much more research is needed to measure, understand, and develop management strategies to mitigate the impacts of weather on traffic safety, traffic demand, and traffic flow.