

ABSTRACT

Author: McNamara, Margaret L. Ph.D.

Institution: Purdue University

Degree Received: May 2017

Title: Probe Data Dashboards for Interstate Performance Measurement and Winter Operations Management

Major Professor: Darcy Bullock

Performance measurement is vital to the operation of interstates, providing feedback on performance and identifying areas for improvement. An FHWA rule based on the Moving Ahead for Progress in the 21st Century (MAP-21) and Fixing America's Surface Transportation (FAST) Act requires agencies to implement performance measurement for interstates (1). One area in particular need of performance measurement is winter operations, which the Indiana Department of Transportation (INDOT) spends up to \$60 million on each year. Crowdsourced probe vehicle speed data offers broad coverage of the network without the need for physical infrastructure. However, with approximately 2,677 segment speeds reported at one minute intervals on the Indiana Interstate network, probe data generates 3.8 million records per day and 1.4 billion records per year that require substantial processing to provide real-time information.

This contribution of this dissertation is the definition of a series of dashboards and associated processing techniques that provide graphical illustration of interstate performance in many dimensions and a set of quantitative winter operations performance measures that fuse speed and weather data. The dashboards consist of a set of longitudinal dashboards that chart speed ranges, queuing, and travel time, for individual routes or corridors. The Traffic Ticker provides a statewide view of congestion over time, broken down by district, route, and speed. Finally, the Weather Ticker uses both speed and weather data to monitor conditions by snow routes at the district level. The performance metrics, including measures such as time to recovery and storm duration, are integrated with the tool for ease of use by managers.

Several case studies are presented, including a major interstate detour, crashes, snow storms, and an ice storm. The range of events portrays the usefulness of the tools and performance measures for after-action review, which can be applied for training and

planning for future events. Real-time monitoring with these tools, as shown in the detour case, can allow INDOT to respond to conditions as they develop and mitigate congestion. The dashboards allow for performance measurement with greater resolution and ease than previously available, and the fusion of traffic and weather data allows for a quantitative view of winter operations.