PLANNING RELIABLE TRANSPORTATION SYSTEMS USING COMMERCIAL REMOTE SENSING & SPATIAL INFORMATION TECHNOLOGY

INTRODUCTION TO THE PROBLEM
Forty-two percent of America’s urban highways are congested, costing the economy an estimated $101 billion in wasted time and fuel annually. One of the major keys to reducing travel time and congestion is regular analysis of the traffic flow on major traffic corridors. In conducting the analysis, “performance measures” are required to evaluate the consistency, dependability and reliability of the roadway for the traveling public.

Currently, the definitions and thresholds of “reliability” varies, which in many cases creates major gaps and challenges in conducting any type of useful large scale performance review. In addition, traffic flow on major roadways is not constant throughout the day or year, so realistically estimating the probable travel times for any future trips becomes very challenging.

Departments of public works and state departments of transportation need the ability to reliably identify congested roadways and rank them based upon reliability to help prioritize and effectively use limited transportation dollars.

Cliff Collins, Transportation Planner of Charlotte Department of Transportation in North Carolina, says, “Practitioners need reliability applications and information to quickly identify the most congested roadway segments (top 10, 50, or 100) around the City to help towards high-level analysis of possible corridors that need further study to mitigate congestion issues.”

RESEARCH APPLICATION
The information and website tools developed from this research helps practitioners and administrators in traffic operations management and decision making.

- The reliability ranking tool can be used to identify and rank roadway segments for project implementation, such as roadway expansion, updated traffic light signal timing, and event center traffic plans.

- The online visualization application can assess how reliable a roadway is during different days of week or times of day.

- The incident effect prediction tool can forecast possible delays as well as alert system users of future delays.

Overall, the research has provided applications and information that will ultimately allow departments of public works and state departments of transportation to better manage our nation’s transportation network.

As Brian Hoeft, Director of Freeway and Arterial System of Transportation (FAST) in Las Vegas, Nevada says, “This ability to query and display reliability data is a key first step. We need to follow up (by considering construction activities, seasonal patterns related to school & tourism, special events, operations strategies, and weather) and turn this information into a story that provides the context all transportation stakeholders and users need to act on.”

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RESEARCH OUTCOME
By computing, comparing, and assessing reliability measures (at the link, corridor, and area level), researchers at the University of North Carolina at Charlotte have made significant progress in developing solutions and data decision tools.

Researchers developed a web-based application that enables transportation planners, traffic engineers, and other practitioners to identify and rank unreliable roadway segments for project implementation. The visualization tool helps assess how reliable a freeway or an arterial street is during different days of week or times of day. The application also allows agencies to examine the performance of each link in the form of a circular heat chart.

In addition, researchers compared several data collection methods to delineate the accuracy and efficiency of each method in its ability to collect and accurately capture vehicle travel time along freeway and arterial roadway segments. The ability to collect travel time data helps assess the quality of data using different available technologies and data sources for different types of roadways.

Collecting travel time data through traditional methods for the entire network is time consuming and expensive. Private data sources such as INRIX - collect, store, and share travel time data for every minute, hour and date. Such data is available for most of the major roadway segments in the transportation network. Availability of this data helps monitor traffic conditions in real-time to provide timely street level traffic congestion information to travelers. Most importantly, it is an excellent data source to assess, plan and prioritize allocations of funds.

In comparing the technologies, researchers found the following:

- Bluetooth traffic detectors ability to identify vehicles fluctuated for freeways and arterial streets (more noise / disturbances lowering detection rate).

- INRIX data and Bluetooth detectors had reasonably close results when compared to manually captured travel time data along the freeway segment.

- For arterial roadways, travel times from INRIX were more promising when compared to the travel times from the Bluetooth detectors.

Similarly, data captured using automatic vehicle location units on transit buses could be used to assess transit system reliability. A new level-of-service (LOS) criteria is researched and developed to evaluate public transportation performance on a percentage basis as a part of the project.

“This research represents years of passion and interest to study travel time related technologies, reliability as a performance measure, and exploring recurring and non-recurring congestion components”
Srinivas Pulugurtha, Principal Investigator

“The proposed percentage-based performance measure would be more reliable than fixed range-based measures (delay or difference in travel time) for planning and assessment of operational performance by transit agencies.”
Venkata Ramana Duddu, Post-Doctoral Researcher

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