RESEARCH
PROJECT CAPSULE [11-2SS]
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TECHNOLOGY TRANSFER PROGRAM

Measuring Effectiveness of Ramp Metering Strategies on I-12

JUST THE FACTS:

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24 months

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State

Principal Investigators:
Sherif Ishak
Associate Professor,
Louisiana State University
225-578-4846

Administrative Contact:
Mark Morvant, P.E.
Associate Director, Research
225-767-9124

Technical Contact:
Technical Chester Wilmot, Ph.D.
Professor, Louisiana State University
225-578-4697

Louisiana Transportation
Research Center
4101 Gourrier Ave
Baton Rouge, LA 70808

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POINTS OF INTEREST:

Problem Addressed / Objective of Research / Mehodology Used Implementation Potential

PROBLEM

Urban freeways in major cities are operating near or beyond capacity conditions during peak periods due to the increased level of demand. Such conditions often result in traffic breakdowns and congestion that spreads over time and space very rapidly. One of the primary causes of congestion on freeways is the breakdown resulting from traffic merging from on-ramps onto the main freeway lanes. At merging locations, bottlenecks can be activated when a sudden influx of traffic from the on-ramp attempts force merging with mainline traffic, causing mainline traffic to slow down. In order to keep the mainline traffic from breaking down, ramp metering strategies have been widely implemented in several states. The main role of ramp metering is to regulate the merging frequency of vehicles from an on-ramp and preserve maximum traffic flow on the mainline. Ramp metering has been successfully used in several other states in the US to reduce congestion, provide safe merging, and improve travel time reliability. Crash analysis in Louisiana shows that most crashes occur during peak periods when ramp metering strategies are most effective. In 2006, the total number of crashes reported on I-12 between Millerville Road and Juban Road (milepost 6.01 to 12.8) in both directions shows two distinctive peaks: one in the morning and one in the evening, which coincide with the two traffic peaks during normal weekdays.

In Louisiana, the ramp metering strategy was recently approved for implementation along I-12 in the Baton Rouge area effective June 2010 to reduce the frequency of breakdowns and improve the operational efficiency of traffic. The initial plan was to have the ramp meters on during the morning peak (6:00 a.m. to 10:00 a.m.) and the evening peak (2:00 p.m. to 7:00 p.m.), in addition to times of special events if needed. Initial simulation studies conducted by ABMB Engineers, Inc. showed significant improvements in travel time and speed as a result of applying ramp metering strategies on I-12. The reduction in travel times was estimated to be 14.6 percent and 15.5 percent for the morning and evening peaks, respectively, before the freeway widening project is completed. When the widening is completed, the reductions are estimated to be 12.4 percent and 2.4 percent for the morning and evening peaks, respectively. The implementation plan for ramp metering began in June 2010 and is expected to be completed by the end of 2011. An evaluation of the effectiveness of ramp metering is proposed to quantify the benefits and identify possible improvements by optimizing ramp metering parameters. This objective will be achieved through the list of tasks identified in this research proposal.

OBJECTIVE

The main goal of this research is to conduct an overall assessment of the effectiveness of the newly implemented ramp metering strategy on I-12 in the Baton Rouge area. The research objectives of this study are to:

1. Conduct a brief literature review of the most recent research findings on ramp metering applications in other states. This is to identify the successful state-of-the-practice techniques for assessment of ramp metering benefits and their relevance to this research study.
2. Identify the ramp junctions (study area) where ramp metering has already been or will be implemented during the course of the study.
3. Collect traffic data at each of the identified locations over a period of at least three months including periods when ramp metering is turned on and off.
4. Conduct thorough analysis to evaluate the effectiveness of ramp metering on I-12 using the collected traffic data.
5. Develop a statistical analysis model to illustrate the impacts to travel along the I-12 corridor and test different ramp metering strategies that would optimize the metering parameters and maximize performance.

METHODOLOGY

This methodology involves conducting a literature review of successful ramp metering installations and documenting lessons learned. The literature review will include national practice and can include informal communication through Internet-based communication media. The study area is then identified, with all merging locations where ramp metering has been implemented or scheduled for implementation on I-12. For each merging junction, the geometric characteristics will be collected for the on-ramp and the mainline segments. In addition to the geometric data, traffic operation data will be collected at each ramp metering location on the mainline and the on-ramp. The operation data will be collected using raw, real-time traffic data collected by the he Louisiana Department of Transportation and Development (LADOTD) Intelligent Transportation Systems (ITS) Section and Bluetooth technology (BlueTOAD). All collected data will be assimilated into traffic information that can be used to measure the effectiveness or impacts of the ramp metering system on the I-12 corridor. Several analyses will be conducted to compare selected performance measures such as reduction in congestion, increased safety, improved corridor reliability, and increased corridor efficiency. The comparison will be based on appropriate statistical analysis and the use of statistical tools such as the tests of hypotheses and analysis of variance.

IMPLEMENTATION POTENTIAL

This research is highly implementable. The success of the new ramp metering implementation on I-12 could lead to significant improvement in terms of operation and safety along the I-12 corridor and possibly other Louisiana freeway corridors in the future.