RESEARCH
PROJECT CAPSULE [17-5SS]
May 2017
TECHNOLOGY TRANSFER PROGRAM

Development of Guidelines for Ramp Metering Implementation and Performance Evaluation on I-12

JUST THE FACTS:

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30 months

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POINTS OF INTEREST:

Problem Addressed / Objective of Research / Methodology Used Implementation Potential

PROBLEM

Urban freeways in most metropolitan areas are operating near or beyond capacity during peak hours due to the significant increase in travel demand. The transportation community and policymakers recognize the need for better traffic management of the road network's available capacity as a viable alternative to capacity-expansion projects. Recent emphasis has been placed on Active Traffic Management (ATM) strategies, e.g., ramp metering, speed harmonization, and managed lanes, to alleviate recurrent congestion and improve mobility.

Successful implementation of a ramp metering strategy depends on geometric and traffic conditions. While ramp meters control traffic flow onto a freeway, traffic spillback from ramps onto adjacent surface streets will sometimes occur. To solve this problem, traffic management centers can coordinate multiple ramp meters and use a local queue-override strategy.

In a recent simulation-based study regarding current ramp meters along I-12, the fixed-time control strategy was compared to the dynamic feedback local control strategy (ALINEA) and the heuristic coordinated control strategy (HERO). Although the study recommended a hybrid implementation of ALINEA and HERO strategies to improve overall operational conditions, some sections of I-12 remained locally congested. This raised a question regarding the effectiveness of the ramp meters at certain locations along I-12.

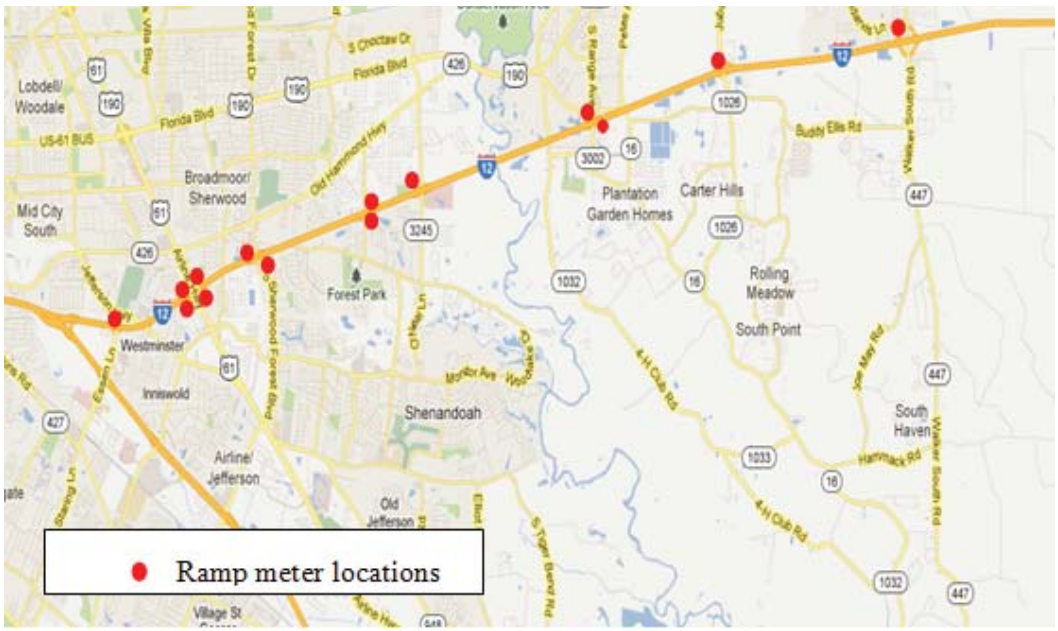

Figure 1
Ramp meter locations

OBJECTIVE

This project proposes re-evaluation of the current ramp meters on I-12 and associated queue-override strategies. A comparative performance evaluation of different control solutions for each ramp location will be conducted. The control solutions may include changing the ramp metering strategy and/or adding length/width to the ramps and/or auxiliary lanes. Based on results, the research team will develop guidelines for implementation of ramp meters in Louisiana.

METHODOLOGY

Initially, the research team will conduct a comprehensive review of ATM strategies and applications that are used elsewhere. The team will also identify data requirements for evaluation of the existing ramp meters/queue-override strategies along I-12.

The ITS lab at LTRC is a significant source of freeway data, including real-time video feeds along the Baton Rouge interstate routes. Another data source is a new Bluetooth system (BlueTOAD) for collection of travel time data along I-12.

As a supplement to the simulation model used in the previous study, the research team will build additional models to account for different combinations of control solutions at each ramp location. The models will be calibrated with the data obtained from the aforementioned data sources.

A set of simulation scenarios will be constructed in order to compare the performance of different solutions. For each scenario, multiple runs will be conducted to account for the random variation in simulation results. The simulation network with the existing ramp meters and queue-override strategies will serve as a base case for this study.

Evaluation criteria will be established for the comparative performance evaluation of the different control solutions. The research team will conduct a detailed statistical analysis of the output from the modeled simulations and estimate the costs required to implement each control solution.

The pros and cons of each control solution will be assessed and the optimal control solution for each ramp location will be identified. The study results will be summarized in the form of guidelines for implementation of ramp meters in Louisiana.

IMPLEMENTATION POTENTIAL

The guidelines developed during this project will serve as a checklist for implementation of ramp meters in Louisiana. Improved operation of state freeways is expected.