RESEARCH
PROJECT CAPSULE [14-1SS]
October 2013
TECHNOLOGY TRANSFER PROGRAM

DOTD Support for UTC Project: Development of an Optimal Ramp Metering Control Strategy for I-12

JUST THE FACTS:

Start Date:
July 1, 2013

Duration:
24 months

End Date:
June 30, 2015

Funding:
SPR: TT-Fed/TT-Reg

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Sponsored jointly by the Louisiana Department of Transportation and Development and Louisiana State University

POINTS OF INTEREST:

Problem Addressed / Objective of Research / Methodology Used Implementation Potential

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This project is associated with the Louisiana Transportation Research Center (LTRC) partnership with the National Center for Intermodal Transportation for Economic Competiveness (NCITEC). The NCITEC is a university transportation center housed at Mississippi State University funded by the Research and Innovative Technology Administration (RITA) of the U.S. Department of Transportation (DOT).

PROBLEM

From June to November of 2010, the Louisiana Department of Transportation and Development (DOTD) deployed ramp metering control, using a simple pre-timed operation with a fixed cycle length (2 seconds of green/2 seconds of red), along a 15-mile section of I-12 in Baton Rouge, LA. Ramp metering was implemented to reduce congestion, provide a safer merge operation at freeway entrances, and improve travel time reliability of the corridor. A recent evaluation of the effectiveness of the ramp metering strategy was inconclusive in determining whether the fixed time operation of the control system yielded significant reductions in congestion along the corridor. Therefore, the study recommended further investigation to examine the feasibility of applying dynamic ramp metering algorithms on I-12, wherever applicable. Demand responsive and coordinated ramp metering strategies involve a system where the signals change every few seconds in response to freeway conditions locally or at adjacent interchanges. The signals may work as individually or in coordinated clusters to resolve complex traffic problems and reduce congestion along the freeway. In either case, the dynamic control of the signals is feasible through Freeway Control Regulators (algorithms) that tend to optimize the capacity of the freeway.

OBJECTIVE

The main objective of this research is to identify the optimal ramp metering control strategy for I-12 (most effective algorithm) and the anticipated operational benefits over the existing fixed time strategy.

METHODOLOGY

A traffic simulation tool will be used to model the existing traffic conditions on the I-12 corridor, using collected and calibrated traffic data. The most suitable algorithms to the conditions on I-12 will be tested to find the one that is capable of optimizing traffic throughput, travel-time reliability, and delays on the mainline. Based on the results, the optimal strategy may be tested in the field over a short period of time before the implementation recommendation is made.

More specifically, the following tasks will be used to accomplish the goals of the project:

Task 1
Review the state of practice of the different ramp metering strategies and applications in other metropolitan areas in order to learn from similar experiences and identify points of strengths and weaknesses of the various strategies. This includes identification of the ramp metering strategies that proved to be effective to improving traffic conditions in similar study areas as I-12.

Task 2
Identify and collect the geometric and traffic data required to simulate the I-12 corridor under the selected ramp metering strategies.

Task 3
Select a microscopic simulation platform and build the simulation network for the study corridor.

Task 4
Calibrate the selected simulation model with the collected data to replicate the actual traffic conditions on the study corridor.

Task 5
Identify a set of parameters and performance measures for the ramp metering strategies. Examples include travel time, delay, throughput, etc.

Task 6
Conduct and analyze the results of multiple runs for each of the selected ramp metering strategies with different traffic demand scenarios in order to minimize the probability of breakdowns along the corridor.

Task 7
Make final recommendations based on the main findings of the study.

IMPLEMENTATION POTENTIAL

Implementation of the results of this comprehensive evaluation of various ramp metering strategies in order to identify the optimum algorithm can ultimately help improve traffic conditions on I-12.

Ramp meter on I-12 at Essen Lane