

Transportation
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Project Title:

Congestion-Responsive On-Ramp
Metering: Recommendations toward a
Statewide Policy

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Congestion-Responsive On-Ramp Metering: Recommendations Toward a Statewide Policy

This research project developed recommendations for updating the statewide Ramp Metering (RM) policy, which could help Caltrans implement 24/7 traffic responsive RM operations on a statewide basis.

WHAT IS THE NEED?

In most Caltrans Districts, the current Caltrans Ramp Metering (RM) systems operate on preselected and fixed times during the AM and PM peak periods; with the exceptions of District 6, District 7 and a few selected freeway corridors in other Districts where the ramp metering is operational over a longer time-range (i.e., extended hours of operation). It has been shown that continuous demand responsive ramp metering (available for operation 24 hours-a-day / 7 days-a-week, as needed depending on prevailing traffic conditions) can improve overall freeway performance. Situations where this 24/7 RM operation is beneficial include when recurrent congestion spreads outside the normal 6-10 AM and 3-7 PM peak periods; or when there is non-recurrent congestion caused by freeway collisions, special events, adverse weather or work zone lane closures. Additionally, 24/7 RM could help on weekends as recurrent traffic congestion is becoming more commonplace on urban freeways during the weekend's midday periods. Accordingly, the Caltrans Division of Traffic Operations is undertaking the challenge of updating the statewide RM policies to take full advantage of these recent advancements in RM operations strategy. This project will provide recommendations to the Caltrans Division of Traffic Operations for updated Caltrans RM policies based on a quantitative cost and benefit analysis of the operation of RM for extended hours currently underway in selected Caltrans Districts.

WHAT WAS OUR GOAL?

The goals of this research project were to develop recommendations for updating the statewide RM policy, which



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could help Caltrans implement 24/7 traffic responsive RM operations on a statewide basis. The recommendations addressed several key issues:

- Maintaining consistency between the current (AM & PM) peak period RM practices and the new demand responsive 24/7 RM strategy.
- Operational features of the RM signals: Should the RM signal-head rest on “green” or “black” – when demands do not warrant metering, should the signal-head be black (turned off) or should they display the solid-green ball.
 - Operational and maintenance costs associated with each option (i.e., bulb life and replacement costs/issues);
 - Motorist expectations and safety implications associated with each option.
- Operation features of the 24/7 strategy: setting appropriate metering rates and activation thresholds (i.e., loop occupancy thresholds for activating ramp metering) to most effectively respond to non-recurrent congestion and weekend congestion.
- Demand responsive RM data system requirements (i.e., loops) and current data systems in each Caltrans District
- Selecting a policy that is consistent, yet flexible such that it can be adapted across all Caltrans Districts with ramp metering needs.

WHAT DID WE DO?

The project performed the following tasks and developed recommendations regarding:

- Assessed the delay savings benefits from extended-hours RM for a set of selected freeway corridors, via empirical “before” vs. “after” comparisons
- Provided information regarding safety concerns and summarized Caltrans info/data regarding local complaints
- Evaluated energy consumption and bulb replacement costs for RM continually active

(“green ball”)

- Explored plausible methods for the unification of statewide RM controllers and software
- Performed an evaluation on the proper (best) use of the limited on-ramp storage capacity (with or without queue over-ride functionality)
- Developed a template which contains the main items necessary for the coordination between Caltrans Districts and local jurisdictions

WHAT WAS THE OUTCOME?

The outcome of this project was meaningful information of recommendations to help Caltrans Division of Traffic Operations develop consistent and implementable congestion-responsive ramp metering policies. This could overcome several of the known hardware, software, and freeway infrastructure and institutional constraints.

WHAT IS THE BENEFIT?

Implementation of Congestion-Responsive RM is expected to improve the freeway performance along the freeway corridors. It will increase the vehicle throughput (Vehicle Miles of Travel-VMT), and decrease the delay or time spent (Vehicles Hours of Travel—VHT). The benefit of this project is to help Caltrans Division of Traffic Operations develop new statewide ramp metering policies – policies that are well suited across a wide range of freeway corridors, yet maintain consistency across all Caltrans Districts – policies that result in statewide safe, efficient and effective ramp metering operations.