DRISI
Caltrans Division of Research, Innovation and System Information

Research Results

Transportation Safety and Mobility

Field Experiment of Variable Speed Advisory (VSA)

Researchers conducted Variable Speed Advisory field test to manage vehicle speeds in areas well known for congestion and traffic incidents.

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Project Title:
Field Experiment of Variable Speed Advisory (VSA)

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Task Manager:
Hassan Aboukhadijeh
Transportation Engineer (Electrical)
hassan.aboukhadijeh@dot.ca.gov

WHAT IS THE NEED?

Typically, driver behavior is the main cause of traffic on the freeways. To better control this, Local Responsive Ramp Metering was introduced onto U.S. freeway corridors years ago, but Variable Speed Advisories (VSA) was still missing.

Ramp Metering controls the traffic flow into the freeway, and VSA attempts to control driver behavior. Since then, and partly due to over-simplified algorithms, there has only been limited testing to improve mobility.

Through simulation, the research team developed a simple, practical algorithm that can improve bottleneck flow and reduce shockwaves along the freeway, which generated promising results but still needed field tests to determine its success.

WHAT WAS OUR GOAL?

The goal of this project was to determine the potential for VSA to improve mobility in a congested corridor. Researchers conducted a field test on State Route 78 Eastbound (SR-78E) in San Diego, which was selected through judicious traffic data analysis.

Figure 1 below shows the system scope, road geometry, planned VSA sign locations and construction area.

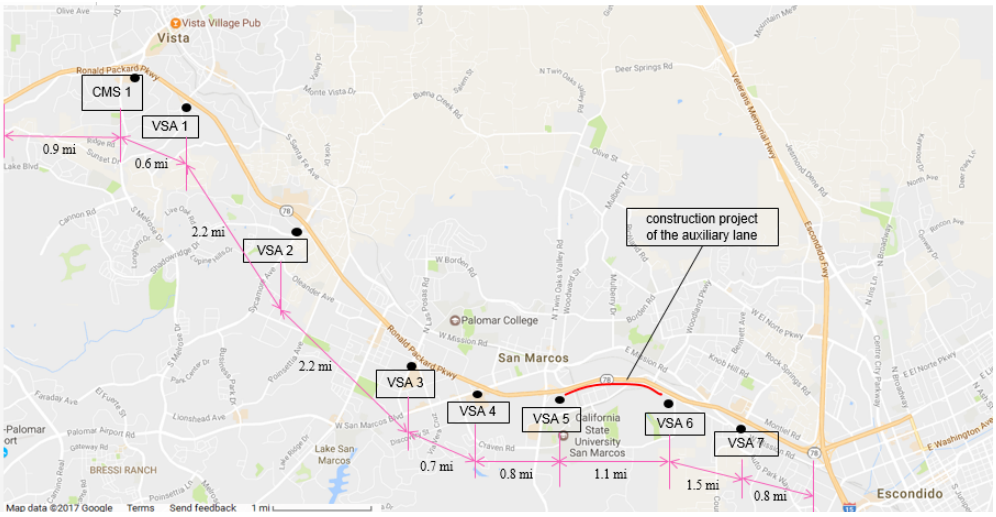

Figure 1 Overview of system scope: VSA and Changeable Message Sign locations, and construction area

WHAT DID WE DO?

The research team conducted the VSA field test on SR-78 to help manage vehicle speeds in areas well known for congestion and traffic incidents. The VSA algorithm used data from traffic sensors and radar in the signs to advise drivers of the optimum speed to improve traffic flow and reduce travel time; minimize traffic delays caused by incidents, work zone lane closures and recurrent congestion; improve roadway safety and reduce emissions and energy consumption.

The VSA field test ran from April 9 to May 4, 2018. The researchers worked closely with District 11 traffic engineers on system tuning (hardware/ software and VSA algorithm tuning).

Three main freeway performance indices, Vehicle-Miles-Travelled (VMT), Vehicle-Hours-Travelled (VHT), and Q (=VMT/VHT, defined as average speed) have been used as performance evaluation parameters. Performance Measurement System (PeMS) data has been used for evaluation for objectiveness since it is independent from the VSA system used data.

WHAT WAS THE OUTCOME?

The field test of VSA along the 10.8-mile long freeway corridor on SR-78E between Vista Village and the interchange with I-15 at Escondido (Figure 2), was reasonably successful based on the performance analysis using PeMS hourly VMT and VHT data.

The outcome of the performance analysis illustrated an improvement in all three PeMS performance measures. During the morning peak hours (6:00-9:00AM), VMT increased by 2.72%, VHT decreased by 6.28%, and Q increased by 8.71%. During the afternoon peak hours (2:00-7:00PM), two of the three performance measures improved. VMT did not have noticeable improvement, while VHT decreased by 1.47% on average, and therefore Q increased by 2.80% on average.

In the afternoon peak hours, SR-78E experienced higher traffic demand, as well as a greater percentage of non-commuters. These two factors may have had some influence in the lower afternoon performance improvements. As for driver compliance, it gradually improved as the test progressed and the increase in

driver compliance was generally in line with an improvement in system performance.

WHAT IS THE BENEFIT?

Implementation of VSA system is expected to improve the safety and performance along the freeway corridors. The research results show an increase in vehicle throughput (VMT), and decrease in the delay or time spent (VHT). Reduced total travel time also directly benefits the environment by less emission and energy consumption caused by freeway traffic congestion.

The speed harmonization effect of VSA reduces or removes shockwaves which makes up a large percent of collisions/accidents on freeways. In turn, driver injuries are reduced. The expected improvement in all aspects strongly supports California Department of Transportation's strategic goal on improving mobility and safety.

IMAGES

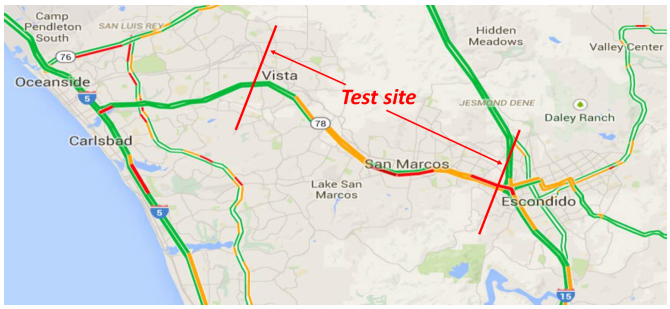

Figure 2 Test Site: 10.8-mile long freeway corridor on State Route 78 Eastbound (SR-78E) between Vista Village and the interchange with I-15 at Escondido