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CA MUTCD Editor
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Date: May 13, 2020

From: Hassan Aboukhadijeh
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Division of Research, Innovation, and System Information (DRISI)
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1727 30th Street,
Sacramento, CA 95816

Subject: REQUEST TO TEST AND EVALUATE THE PERFORMANCE OF TraffiCalm™

In accordance with the Manual of Uniform Traffic Control Devices (MUTCD), the Division of Research, Innovation, and System Information (DRISI) is applying for Request to test and evaluate the performance of Variable Speed Advisory (VSA) on State Route 99, northbound corridor from Elk Grove Blvd. to State Route 50 interchange in Caltrans District 3 in Sacramento. Similar signs have been used in previous studies in Caltrans District D11. UC Berkeley PATH project team has developed a simple, practical VSA algorithm that should improve bottleneck flow and reduce shockwaves along this freeway well known for congestion. This has generated promising results but still needs to be field tested to determine its success.

Attached is the project scope along with information for the temporary use of the VSA signs that will be acquired from TraffiCalm™.

Please contact Hassan Aboukhadijeh if you have any questions at (916) 227-6216.

Request to Experiment

Project Title: Field Test of Combined Coordinated Ramp Metering (CRM) and Variable Speed Advisory (VSA) for Freeway Traffic Control, Contract Number 65A0743

Caltrans Division of Research, Innovation, and System Information is requesting permission to experiment with TraffiCalm™ Variable Speed Advisory (VSA) signs on northbound on State Route 99 from Elk Grove Blvd. to State Route 50 interchange in Caltrans District 3 in Sacramento. This is a 13 miles long corridor with 16 on-ramps and 11 off-ramps. It is expected to use 15 VSA signs along the corridor. We plan to test these signs for 12 months so that the public drivers, particularly the commuters, can adapt to the system. The VSA signs will be tested mainly for AM peak hour (6:00 – 9:00am) which has higher traffic demand than the PM peak hours.

Proposal

Caltrans and UC Berkeley researchers are proposing to experiment with Variable Speed Advisory (VSA) in areas well known for congestion or traffic incidents, which can improve bottleneck flow and reduce shockwaves along the freeway. The VSA algorithm will use data from traffic sensors and radar to advise drivers of the optimum speed to improve traffic flow, reduce travel time, and improve roadway safety.

A. A statement indicating the nature of the problem

Typically, driver behavior is the main cause of traffic on the freeways. To better control this, Coordinated Ramp Metering (CRM) and Variable Speed Advisory (VSA) were introduced onto California freeway corridors. Ramp Metering controls the demand onto the freeway, and Variable Speed Advisory attempts to control driver behavior. UC Berkeley project team has developed a simple, practical VSA algorithm that should improve bottleneck flow and reduce shockwaves along the freeway. This has generated promising results but still needs to be field tested to determine its success.

B. A description of the proposed change, how it was developed, the manner in which it deviates from the standard, and how it is expected to be an improvement over existing standards.

The proposed TraffiCalm signs are CA MUTCD compliant for an advisory condition. However, the proposed use of the signs will not be in warning capacity but rather recommending a speed for drivers to reduce overall congestion and delay along a corridor. We have been instructed that the proposed sign usage would not comply exactly with the function of warning signs as defined in the CA MUTCD since it does not call attention to unexpected conditions. Therefore, we are requiring experimentation under Section 1A.10 of the CA MUTCD.

The proposed overall control systems structure and the preliminary Concept of Operation (ConOps) are shown in Figure 1 below.

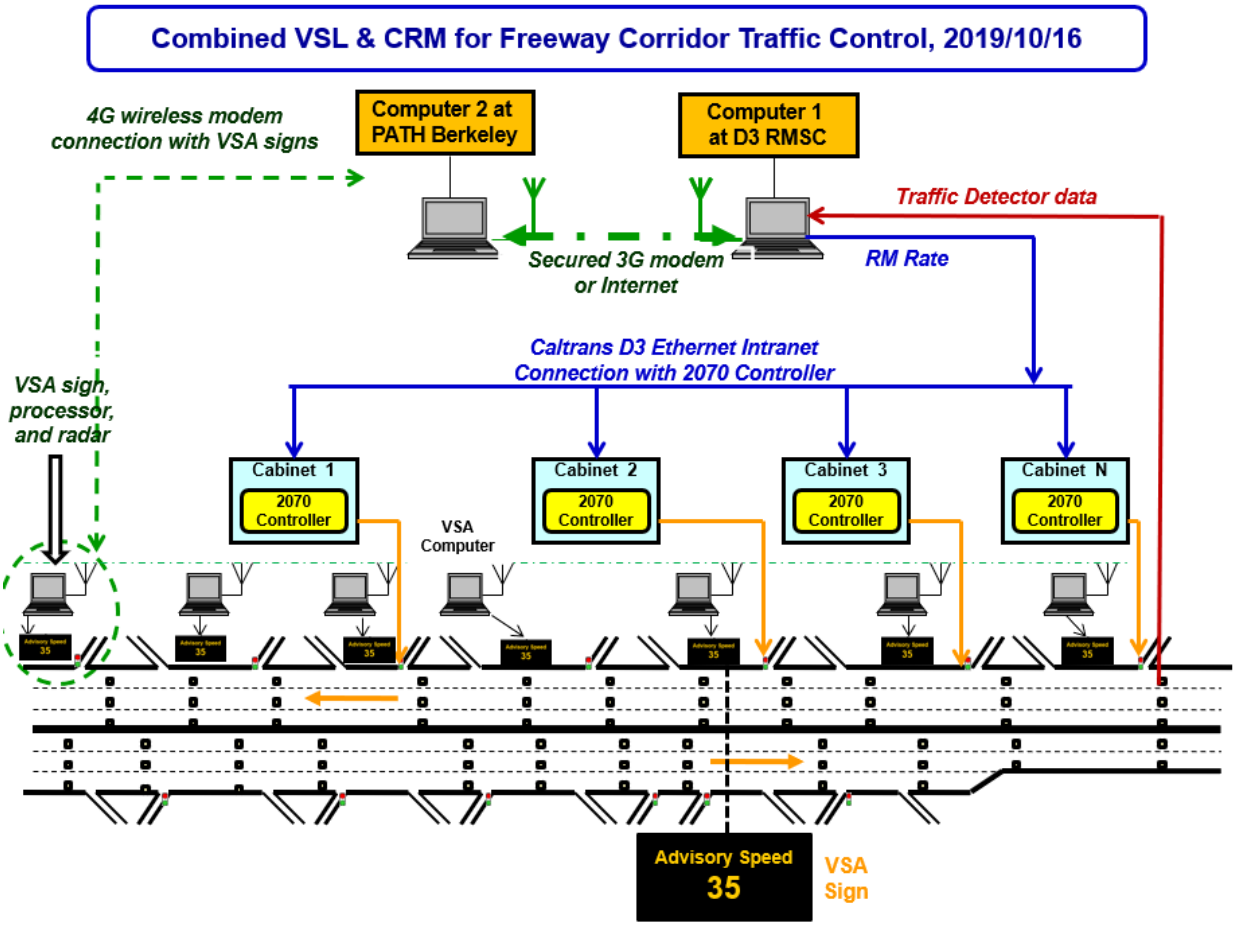

Figure 1. Proposed ConOps System Structure for Combined CRM and VSA

Note: currently, District 3 is using the Coordinated Ramp Metering (CRM) algorithm developed by UC Berkeley PATH. The control computer located in Caltrans District 3 TMC linked with 2070 controllers in the field for daily operation. This computer directly linked through Caltrans intranet with the 2070 traffic controllers on the SR-99 NB corridor for data acquisition, ramp meter rate calculation and sending back the rate for execution. This configuration will be kept for this this project of combined CRM and VSA project.

The main functions of the proposed TraffiCalm™ VSA signs are listed below:

- Large enough size for LED display
- With solar panel and battery for sustainable power supply; solar panel will charge the battery; the number of batteries is flexible
- Change message in real-time: update rate less than 10 second
- Mounted on trailer already, which meet Caltrans (California Department of Transportation) traffic safety requirement
- Modem connection for remote control; we can add the modem

- Radar interface: we can add the radar unit for traffic detection; but the processor needs to be powerful enough for raw radar data processing

C. Any illustration, photograph, or videos, which would help, explain the experimental device or use of this device.

The proposed TraffiCalm™ VSA Sign that meet all the project technical requirement is shown in Figure 2 below.

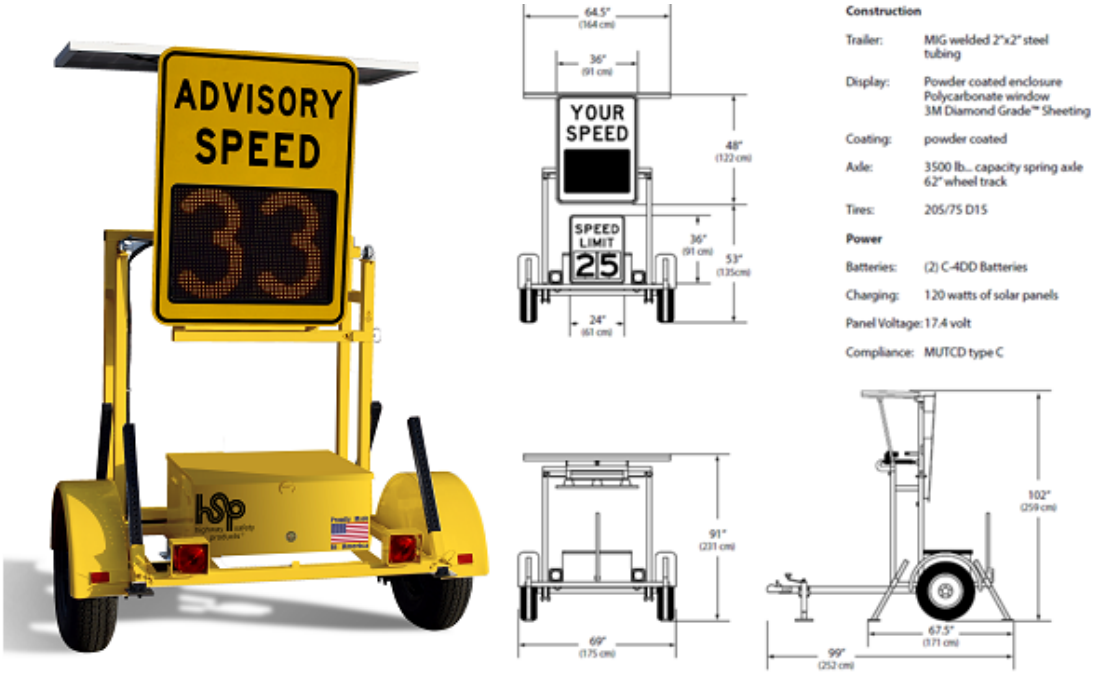

Figure 2. TraffiCalm™ VSA Sign -dimensions with Black on Yellow Background

It is noted that this trailer has been approved and used by Caltrans before. Mr. Yong Pak of Caltrans has utilized these trailers on his projects:

Mr. Yong Pak
I-5 North Coast Corridor
Phone: 858-688-1481
Email: yong.pak@dot.ca.gov

D. Any supporting data as to how the experimental device was developed, if it has been tried, in what ways it was found to be adequate or inadequate, and how was this choice of device or application arrived at.

The following two previous projects generated promising results that need to be field tested.

- Caltrans initiated a Variable Speed Advisory (VSA) pilot project on State Route 78 in District 11 to help manage vehicle speeds in areas well known for congestion or traffic incidents. The VSA algorithm used data from traffic sensors to advise drivers of the optimum speed to improve traffic flow, reduce travel time; minimize traffic delays caused by incidents. The variable speed advisory system that was developed increased morning traffic efficiency by 8.71% and afternoon by 2.8%.

- In addition, Caltrans tested Coordinated Ramp Metering (CRM) on SR99 NB in Sacramento. The CRM that we used controlled a series of ramps to help improve efficiency and safety of the entire freeway system. Caltrans District 3 traffic engineers monitored traffic on SR99 and determined that Coordinated Ramp Metering (CRM) strategy algorithm showed positive results, increasing system efficiency by 7.25% over locally traffic responsive ramp metering.

Since CRM and VSA affect the freeway traffic from different aspects, it would make sense to test those two freeway traffic management measures jointly on a freeway corridor and evaluate the performance for traffic improvement.

E. A legally binding statement certifying that the concept of the traffic control device is not protected by a patent or copyright

To the best of our knowledge, the concept of using CRM/VSA algorithm to for freeway traffic control are not protected by patents or copyrights.

F. The time period and location(s) of the experiment.

The experiment will be for a one-year period.

G. A detailed research or evaluation plan that must provide for close monitoring of the experimentation, especially in the early stages of its field implementation. The evaluation plan should include before and after studies as well as quantitative data describing the performance of the experimental device.

TraffiCalm Driver Feedback Signs are manufactured in the USA in an ISO 9001:2008 certified facility, meeting and exceeding industry standards and state testing requirements. The radar speed data from these signs, and the speed data collected from the dual loop detectors/2070 controllers will be used to evaluate the driver compliance rate. The discrepancy of the two indicates the driver compliance rate. We will use the following metric for the compliance rate: [(fused radar speed & dual loop detector speed) - posted speed (VSA)] / posted speed (VSA) at each VSA location. The proposed work plan includes collecting and comparing quantitative data. SafetyCalm configuration and Traffic Data Collection Software allows you to program these signs from laptop and collect and graphically display traffic data.

Figure 3 shows the proposed locations of VSA signs on Caltrans District 3 SR-99 NB Corridor. Based on the road geometry, exact location of each sign will be determined with Caltrans Regional Transportation Management Center (RTMC) in District 3. UC Berkeley PATH will provide semi-annual progress reports for the duration of the experiment. The above information will be presented in a final report within 3 months following the completion of the experiment. We plan to use 15 VSA signs to cover the whole corridor as shown in Figure 3. The following is a tentative short-term schedule for system preparation:

Actions/Activities	**Start date**	**End Date**	**Comments**
First VSA sign acquisition	4/15/20	6/15/20	
System development	6/15/20	8/15/20	
Acquisition of the rest 14 VSA sign	7/15/20	8/15/20	Ready to go to field
John to work at D3 Maintenance Yards for system integration	8/15/20	9/4/20	VSA ready for installation in the field
Trailers and VSA signs to be mounted in the field	9/7/20	9/11/20	VSA signs ready in field
System integration and verification in the field	9/14/20	9/25/20	VSA signs ready for test
Preliminary test	9/28/20	10/9/20	System tuning
Extensive formal tests	10/12/20	9/12//21	12 months field tests
Remove trailers from field to D3 Maintenance Yards	9/12/21	9/20/21	

H. An agreement to restore the site of the experiment to a condition that complies with the provisions of this Manual within 3 months following the end of the time period of the experiment. This agreement must also provide that the agency sponsoring the experimentation will terminate the experimentation at any time that it determines significant safety concerns are directly or indirectly attributable to the experimentation. The FHWA's Office of Transportation Operations has the right to terminate approval of the experimentation at any time if there is an indication of safety concerns. If, as a result of the experimentation, a request is made that this Manual be changed to include the device or application being experimented with, the device or application will be permitted to remain in place until an official rulemaking action has occurred.

Caltrans DRISI and UC Berkeley PATH agree to the above conditions.

I. An agreement to provide a progress report at 6 months for the experimentation and an agreement to provide a copy of the final results of the experimentation to the FHWA's Office of Transportation Operations within 3 months following completion of the experimentation. The FHWA's Office of Transportation Operations has the right to terminate approval of the experimentation if reports are not provided in accordance with this schedule.

Caltrans DRISI and UC Berkeley PATH agree to the above conditions, however based on the information that FHWA is looking to collect, all of this will be available within the final report.

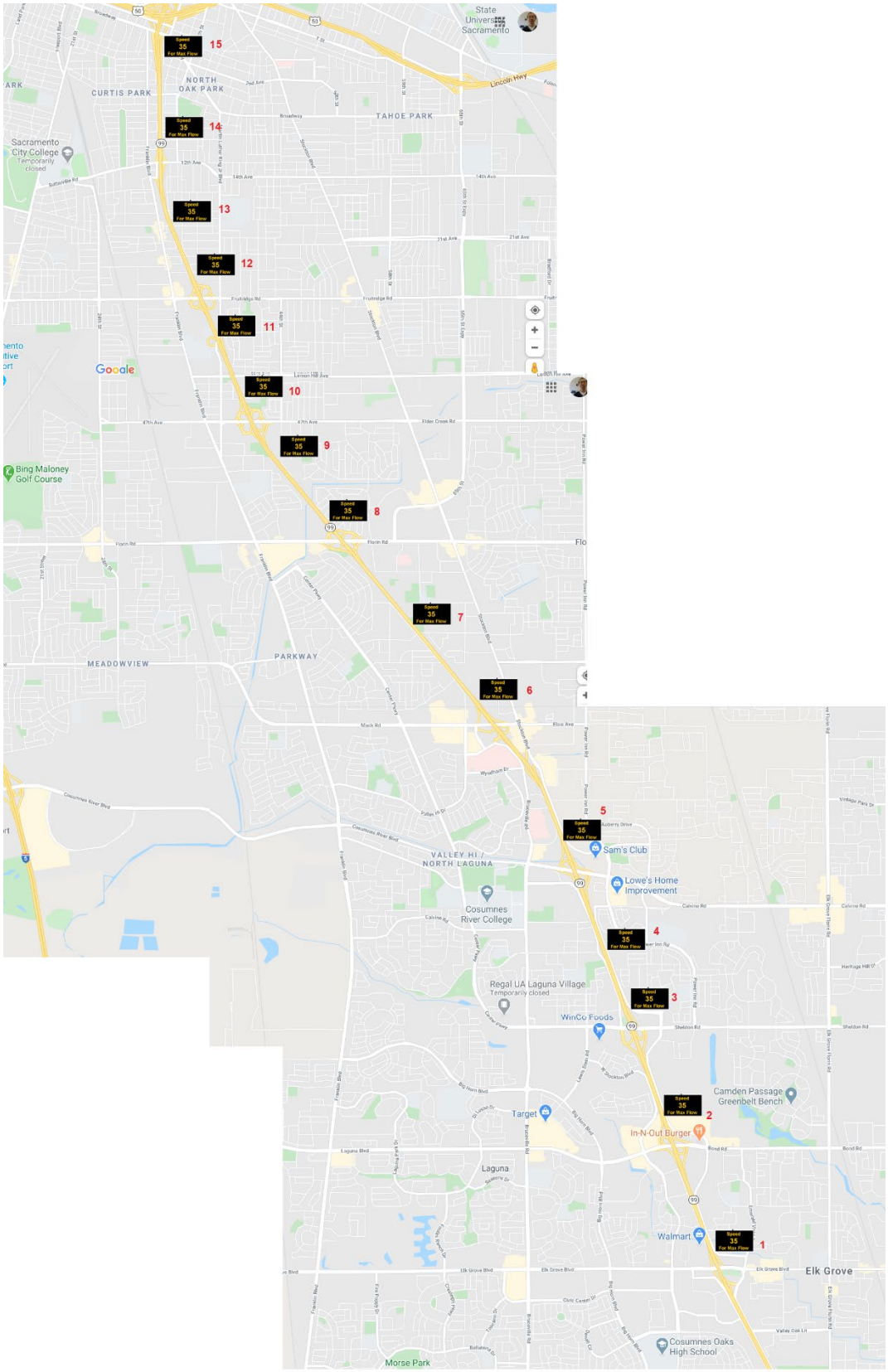

Figure 3. SR-99 NB Road Geometry and the schematic locations of VSA signs.