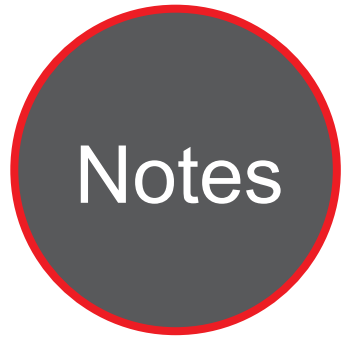




Caltrans Division of Research,  
Innovation and System Information

# Research



Transportation  
Safety and  
Mobility

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Project Title:  
Roadway Detector System  
Evaluation

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## Evaluating the Performance of Traffic Detection Devices

Development of VideoSync, a software tool enabling easy verification of data gathered from Traffic Detection Devices through comparison with video ground truth.

### WHAT IS THE NEED?

Efficiently managing and operating California's highway system requires round-the-clock reliable and accurate information on traffic speed and flow. This information is derived from data collected throughout the state by vehicle detection devices, which California Department of Transportation (Caltrans) obtains from various vendors. However, the devices do not always perform exactly as advertised. Testing often reveals that vendors' accuracy claims are overstated or based on ideal conditions measured during the middle of the day when the devices are easiest to check manually. Under less ideal conditions, such as twilight, fog, poor weather, and traffic congestion, they might have problems with accuracy.

However, many of the traffic sensors do not operate properly, making the data unreliable. To maximize the return on the investment made in these traffic detectors, tools are needed that can diagnose and fix the problems.

### WHAT ARE WE DOING?

The research team is developing a software tool called VideoSync, which can utilize video footage captured simultaneously with vehicle detection state data. This vehicle detection state data is gathered in real-time using the C1 Reader, a hardware device that is connected between the detector and a traffic controller. While this data collection is occurring, video footage of the traffic will also be captured. By comparing the collected data and the video footage, the accuracy of the vehicle detection device can easily be assessed.



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The software will read both the captured data and video footage files. It will then generate line graphs for the captured data. When a detector's state is high, the line on the graph will be high. When the state is low, the line on the graph will be low.

These graphs will scroll in the window from right to left as the video plays, with the center of the graph lining up with the current video frame. By scrolling the graphs, users can see a particular detector channel go high or low at the same time a vehicle passes the detector in the video footage. In addition, a square overlay can be placed over the video footage which will fill with a translucent color when the corresponding detector is high. This makes for easy visual verification of the data.

The video footage can be played back at different speeds to ensure proper analysis or stepped through on a frame by frame basis. Users can also step through every instance of a detector going high or low in the vehicle state data, with the video footage jumping to the corresponding time. The displayed graphs can be set to different time scales, allowing broader or narrower views of the state data in relation to the current frame.

The captured video footage and vehicle data often will not line up perfectly. To compensate for this, VideoSync can apply a time offset. VideoSync can attempt to find this offset automatically by analyzing the video footage or it can be entered manually.

## WHAT IS OUR GOAL?

The objective of this project is to develop tools and techniques to test the round-the-clock performance and accuracy of vehicle detection devices while they are operating in the field.

## WHAT IS THE BENEFIT?

Caltrans now has a method to improve the reliability of the vehicle detection information received at its Traffic Management Centers. Additionally, this method can be used to evaluate new vehicle detection technology as it comes to market by comparing available products to traditional inductive loops and video ground truth. For example, a prototype has been developed and used to assess the ability of a new detector to recognize bicycles and distinguish them from cars and trucks.

For existing vehicle detection systems, this method can be used to diagnose issues. For example, if a detector has a high false positive rate, this tool can be used to assess possible causes. If vehicles from nearby lanes are triggering the faulty detector, it will be clearly visible in the video footage when jumping to each false positive in the graph.

Furthermore, this system can compare traffic detection systems to each other if they are both watching the same intersection. This allows the comparison to inductive loops, video detection, infrared, and new methods developed by prospective vendors.

## WHAT IS THE PROGRESS TO DATE?

A new feature had been added for easier settings and configurations of the computer vision algorithms. Improvements to the computer vision algorithms were also accomplished.

The Offset Detector has also been improved, which allows consistent and reliable vehicle detections even with camera movement. Although this functionality works fine in daytime, it does not yet perform satisfactorily at night time. Enhancements are being implemented to improve the "night mode."

## IMAGES



Image 1: VideoSync Prototype Video Screenshot

This image corresponds to the main window screenshot. Video regions are only enabled for two detectors, placed and sized using the mouse. The “Lead 3” detector has just transitioned into a high state, displayed as having a filled in box. Note that “Lead 2” is currently in a low state, but its graph in the main window shows that it is about to enter a high state.

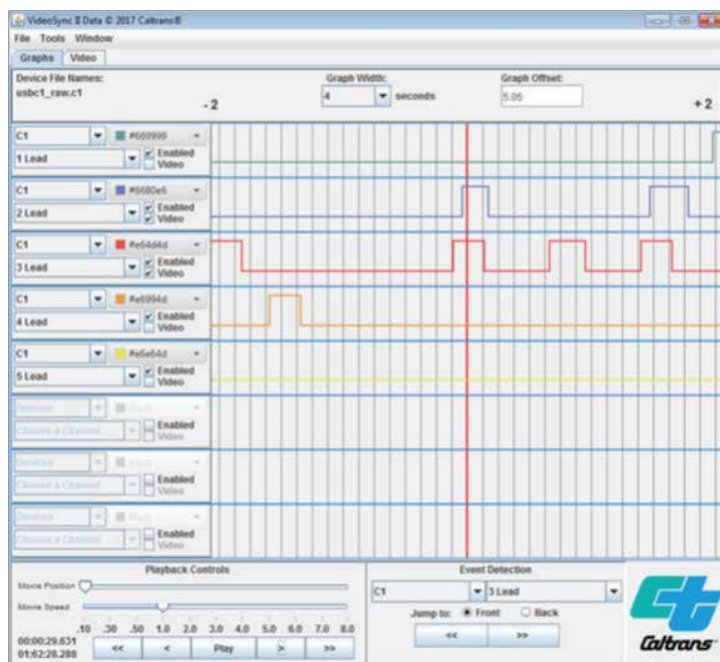


Image 2: VideoSync Prototype Main Window

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