

# DRISI

CALTRANS DIVISION OF RESEARCH,  
INNOVATION AND SYSTEM INFORMATION

TRANSFORMING IDEAS INTO SOLUTIONS

# Research

# Notes

Advanced  
Research

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Project Title:  
Roadway Detector System  
Evaluation

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Task Manager:  
Jerry Kwong  
Transportation Engineer, Electrical  
jkwong@dot.ca.gov

## Next Generation C1 Loop Detector Reader

Develop an inexpensive tool to diagnose loop problems and collect accurate data for evaluating vehicle detection system.

### WHAT IS THE NEED?

According to California Department of Transportation (Caltrans) Performance Measurement System (PeMS), the department-wide traffic database repository, approximately 30 percent of the data generated at the Caltrans' roadside traffic detection stations is questionable in accuracy and therefore unusable.

Due to the challenges of determining the causes for the inaccuracies, the problem has remained unsolved over the last decade, during which time considerable effort was spent with little improvement to the malfunctioning stations.

### WHAT ARE WE DOING?

The objective of this project is to develop the ability to collect 100% of the real-time data flowing through Caltrans controller cabinets, validate this data, and make it available on the intranet for both existing and anticipated new Caltrans applications.

Freeway applications:

- The data can be aggregated and fed into Caltrans Performance Measuring System (PeMS) via XML. This raw data is two to three orders of magnitude more resolved than the data currently available in PeMS.
- Real-time detector diagnostics based on this high-resolution data developed by past research can tell if the detector, splice, or loop are going out of calibration.

Data Validation:

- Data is validated to international ASTM 2532 standards using VideoSync, which synchronizes the real time data with real time video.



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## WHAT IS OUR GOAL?

The project's goal is to develop effective tools and techniques to diagnose and troubleshoot detection station malfunctions, thus allowing Caltrans to repair as many of the unreliable units as possible.

## WHAT IS THE BENEFIT?

The C1 Loop Reader collects traffic data, which is used to evaluate new vehicle detection systems. This, in turn, enables Caltrans to select the most reliable vehicle detection system. A reliable and accurate vehicle detection system can direct traffic more efficiently and effectively, and ultimately improve traffic flow.

## WHAT IS THE PROGRESS TO DATE?

Two locations in District 4 have been identified for the evaluation of the Infra-Red Traffic Logger (TIRTL). Traffic data and videos will soon be collected, and C1 reader will be used to collect data for the evaluation. We are currently waiting for the Hare harness which connects the Hare to the Type 334 cabinet terminal block. The vendor should soon be completing assembling the harness. The TIRTL and loops evaluation had been scheduled with District 4 (Ahmad Fahimi and Keith Aidun) on January 11, March 9 and July 6, 2022, at Walnut Creek onramp. Data/video were collected for those dates. The second location has been identified at the exit ramp from I-680 to South Main Street in Walnut Creek.

Staff from OTOR had completed the project plan to develop the next generation C1 box prototype with ESP32 microcontroller that supports WiFi since current one (Rabbit microcontroller) is no longer in production. At this point, the next generation C1 was able to read all data from the C1 connector and save into the SD card. In addition, wireless data retrieval was also developed as well.

The next generation C1 reader has been fully built out and assembled for the first time. This was built using the ESP32 device. The coding for the Next Gen C1 reader was also completed to replicate the same functions as the previous C1 Reader. During this time testing also began for the Next generation C1 reader device.

The Next Generation C1 reader went through its first real world tests. These tests also brought out an issue with the wireless connectivity that caused it to lock up and fail to collect data properly. This connectivity issue was repaired, and tests resumed. The Next Gen C1 performed its first roadside test at 28 and X street in Sacramento and additional test at D4 Walnut Creek onramp. Being tested in D4, an additional bug of the device appending files together incorrectly was discovered and subsequently corrected.

The current student has departed to work at Intel. We hired a new student to continue the effort of improving this project, collecting, and analyzing video and data.

Another location has been identified for evaluation of the new hybrid (Radar and Camera) detection system from No Traffic at Palo Alto (El Camino Real and Embarcadero Rd). A date and time have been scheduled with D4 (Michael Lee and Bill Jang) for this evaluation on February 23, 2023, and a second evaluation on May 10, 2023. Video and Data were collected at this location. A thorough analysis using VideoSync was completed on multiple selected periods. The results of the evaluation have been shared with Michael Lee of D4 and No Traffic.

The second TIRTL location has been identified at District 4 on the exit ramp from I-680 to South Main Street in Walnut Creek. C1 data and video have been collected on August 23, 2023. Completed analysis of the collected C1 data and video for the TIRTL detection system and the inductive loop detectors. A final report for TIRTL evaluation had been submitted to D4 (James Kung).