DRISI
Caltrans Division of Research, Innovation and System Information

Research Notes

TIRTL Evaluation

Comparing the accuracy of The Infra-Red Traffic Logger vehicle detector to inductive loop detectors for count station applications

Transportation Safety and Mobility

OCTOBER 2022

Project Title:
Evaluation of Vehicle Detection Systems Compared to Inductive Loops and Video Ground Truth Using the C1 Reader

Task Number: 4015

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WHAT IS THE NEED?

District 4 of the California Department of Transportation (Caltrans) has installed two TIRTL (The Infra-Red Traffic Logger, by CEOS Pty Ltd) vehicle detectors at count stations on southbound state route 680. These count stations already had functional inductive loop detectors, and the TIRTL devices were installed with their detection zones overlapping the loops. District 4 requested that Caltrans' Division of Research, Innovation and System information (DRISI) test this pilot installation against the loops to determine whether TIRTL detectors could be used effectively instead of loops for future count station installations.

WHAT ARE WE DOING?

DRISI temporarily installed "C1 Reader" devices, developed by DRISI to sample digital output signals from vehicle detectors, between the input files and the controllers in the equipment cabinets at the District 4 count stations. The C1 Readers recorded timestamps for each passing vehicle from the outputs of both the TIRTL detectors and the inductive loop detectors. Video from Caltrans' on-site CCTV surveillance cameras was recorded concurrently with a DVR. A few hours of preliminary C1 data and video were recorded at North Main Street location.

DRISI plans to analyze the C1 data and video using the DRISI-developed VideoSync software. As the name implies, the software allows the user to synchronize recorded video with recorded timestamps output by detectors under test. Occasionally, this process exposes "false positives," where a detector reported a vehicle that wasn't present in the video, and "false negatives," where a detector fails to report a vehicle that was present in the video. The degree of accuracy of a vehicle detector is defined as its "Sensitivity," where:

$$\text{Sensitivity} = \frac{\text{True Positive}}{\text{False Positive + False Negative + True Positive}} \times 100.0$$

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According to this definition, the detector is penalized equally and cumulatively for each false positive and false negative. The more of either, the lower the sensitivity. If there are none of either, the sensitivity equals 100%.

WHAT IS OUR GOAL?

The anticipated outcome of this research is a report that quantifies the accuracy, in terms of sensitivity, of the TIRTL vehicle detectors as compared to the accuracy of the inductive loops.

WHAT IS THE BENEFIT?

This study can give Caltrans districts a quantified account of the typical accuracy of TIRTL vehicle detection systems relative to inductive loops so they can make informed, data-driven decisions when specifying detection systems for vehicle count station designs. Ultimately, it will be up to the district traffic engineers to decide whether the benefit of the ease of installation of the TIRTL detection system, relative to inductive loop detectors, is worth any discrepancy in accuracy that this testing may reveal. On the other hand, if this study were to show the TIRTL system to be equally or more accurate than loops, it would provide strong justification for districts to specify this system, with its more efficient installation process, in their designs.

WHAT IS THE PROGRESS TO DATE?

DRISI has analyzed about 30 minutes of TIRTL and inductive loop detection data, along with the corresponding video, for the North Main Street count station location. Preliminary results indicate that the TIRTL has a Sensitivity of about 98%, which is higher than typical results for other out-of-pavement detectors based on radar or machine vision technology. However, the data analyzed so far is for free-flowing traffic conditions, and Sensitivity values may be different for congested conditions.

More data and video need to be collected for congested conditions at the North Main Street location. Also, data and video need to be collected at the South Main Street location. Once DRISI has enough data and video for various traffic conditions from both locations, it will perform further analysis to determine Sensitivity values and document the results in a report that compares the TIRTL detectors to the inductive loops.

IMAGES

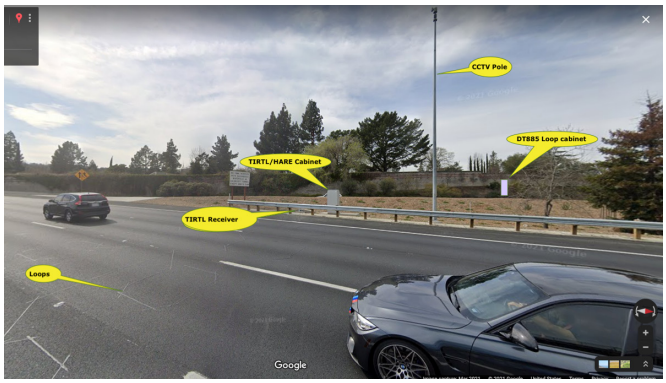

Image 1: North Main Street count station location

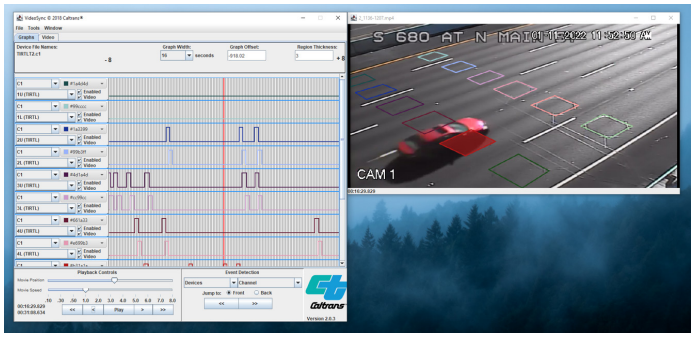

Image 2: Analyzing preliminary data and video from the North Main Street location in VideoSync

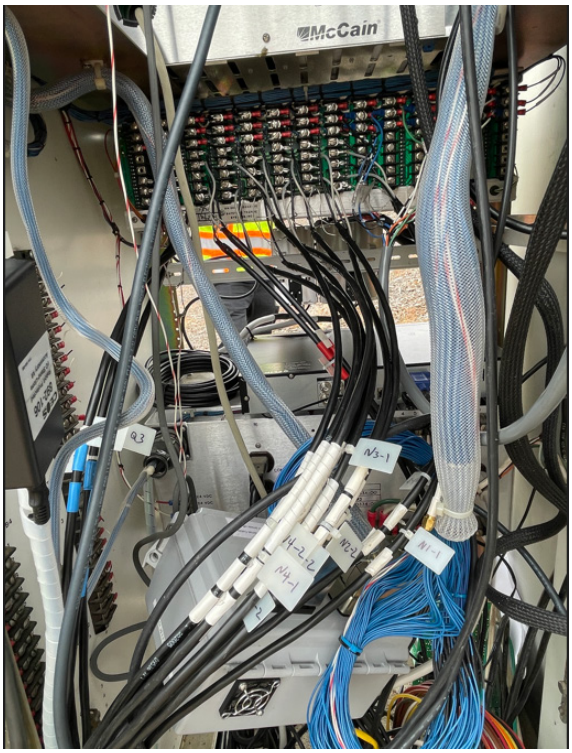

Image 3: The C1 Reader (grey box in lower foreground) installed in the North Main Street count station cabinet