DRISI

CALTRANS DIVISION OF RESEARCH, INNOVATION AND SYSTEM INFORMATION

TRANSFORMING IDEAS INTO SOLUTIONS

Research Notes

TPF-5(494) Vehicle Detection on Rural Roads Using Optical Fiber Sensing Technology

Using existing fiber communication cables to detect traffic on rural highways

Rural

MAY 2025

Project Title:
Vehicle Detection on Rural Roads Using Optical Fiber Sensing Technology

Task Number: 4296

Start Date: November 17, 2024

Completion Date: August 31 2026

Task Manager:

Andres Chavez
Senior Transportation Engineer, Electrical (Specialist)
Andres.Chavez@dot.ca.gov

WHAT IS THE NEED?

Detection is an integral part of managing the State Highway System. Detection systems are used to determine metrics such as vehicle count, classification, occupancy, and speed. The data can then be used to communicate travel times and queue warning messages to the traveling public via inroute traveler information.

Detection systems can provide rural TMC Operators the ability to provide travel times and warn motorists of slow or stopped traffic ahead. System-wide detection can be cost-prohibitive, especially in small rural districts with limited resources. Per the Caltrans 2022 Transportation Asset Management Plan (TAMP), detection station costs are over $151k per element, not including the operation cost to support each site.

Optical fiber detection is an emerging technology in the transportation market. Caltrans needs to understand how to leverage existing fiber optic infrastructure and the Middle-Mile Broadband Network (MMBN) effort, to find a cost-effective alternative to detection station deployment for resource-limited Districts.

WHAT ARE WE DOING?

We will procure, install, and operate an optical fiber vehicle detection system on I-5 near Redding. Once deployed, we will ground truth and make fine-tuned adjustments to improve the accuracy of the system during the project. We intend to develop this system so it will be usable with other optical fiber infrastructure statewide, including Broadband Middle Mile network infrastructure. We will also document this system's design, installation, integration, operation, and maintenance processes.

Caltrans

DRISI provides solutions and knowledge that improves California's transportation system.

WHAT IS OUR GOAL?

An alternative detection system technology that can be deployed using existing infrastructure and requires little-to-no Construction resources. The optical fiber vehicle detection system data may be used for rural travel time messages, queue warning messages, and vehicle count statistics.

WHAT IS THE BENEFIT?

Climate change is not going away. As severe winter storms and ravaging wildfires continue to cripple the state highway system, having the ability to monitor and communicate incident-induced travel delay times and slow or stopped traffic on rural routes will be crucial to maintain the safety, operational efficiency, and goods movement of our roads.

WHAT IS THE PROGRESS TO DATE?

The technical advisory panel is soliciting scope of work statements from research teams.

- UC Davis AHMCT was selected as the research institute.
- Details of the research are being put together and SOW is being finalized.
- Luna's OptaSesnse has been selected as the vendor technology.
- Contract was executed on 10/17/2024
- A comprehensive study of existing Fiber Optic Technologies (FOT) for traffic monitoring is ongoing focused on Distributed Acoustic System (DAS) technology.
- A detailed document is under development to explain basics of traffic monitoring, use of Fiber Optics, and finally expanding on the working of the DAS.
- Vendors have been contacted to understand the capabilities and limitations of their products. Detailed discussion with vendors (5+) has been completed to help us understand their products, estimated costs, support services etc.