DRISI

CALTRANS DIVISION OF RESEARCH, INNOVATION AND SYSTEM INFORMATION

TRANSFORMING IDEAS INTO SOLUTIONS

Research Notes

Reimagining Sensor Deployment

Provide a practical guidance to suggest the best placement of detection stations assuming that third-party speed data are used to achieve wide geographic coverage.

Traffic Operations

MAY 2023

Project Title:
Reimaginig Sensor Deployment

Task Number: 3942

Start Date: May 11, 2022

Completion Date: October 31, 2023

Task Manager:
Melissa L. Clark,
Transportation Engineer (Electrical)
melissa.clark@dot.ca.gov

WHAT IS THE NEED?

California Department of Transportation (Caltrans) collects gigabytes of data every day using dedicated traffic sensing infrastructure. The data provide support for traffic management and system performance monitoring that are crucial for supporting Caltrans mission, vision, and strategic goals to strengthen stewardship and drive efficiency. Operating this vast detection system is becoming unsustainable, as it requires extensive resources in the form of engineering and maintenance support along with millions in capital funds to keep it running. Recently, Caltrans programmed over $150 million in State Highway Operation and Protection Program (SHOPP) funds to address failed or failing detection stations across the state.

Alternate data collection models utilizing a hybrid approach with purchased or third-party data to augment existing data collection systems may enable a reduction in the number of physical detection stations while maintaining suitable accuracy for Caltrans business purposes. In addition to the potential for cost savings, such an approach with fewer physical sensors would reduce exposure of Caltrans employees to the occupational hazard of maintaining roadside detection stations, in alignment with the strategic goal of safety first.

Most third-party data providers can now provide detailed travel time or speed data on any route. In addition, data quality will continue to improve as mobile devices continue to proliferate.

Recent research has provided practical methods to integrate third-party data into the existing reporting platform and into deliverables such as the Mobility Performance Report (MPR). Based on prior analyses, a hybrid approach provides better estimates of performance measures than using only fixed

Caltrans

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

roadside detection stations. These results hold for both freeway-mainline and freeway-freeway connectors, and at different times of day during weekday hours. For almost all tested scenarios, the inclusion of third-party travel-time data reduces the estimation errors. These benefits hold when the number of fixed detectors is reduced.

WHAT ARE WE DOING?

This project reimagines sensor deployment in the context of a near-term possibility where third-party data is procured to obtain travel times and speed data across the state. In this potential future the role of dedicated roadside detection stations would change. It would no longer be necessary to target the deployment of detection stations at every half-mile. Therefore, a new paradigm is required to guide the decisions on where detection stations should be placed to provide the most informational value.

WHAT IS OUR GOAL?

The goal of this project would be to achieve the following objectives:

- Providing guidance on roadside detector locations to prioritize in a hybrid data solution
- Offering a menu of sensor deployment targets that will achieve suitable accuracy while reducing the number of sensors in the field.

WHAT IS THE BENEFIT?

This project aims to provide practical guidance to suggest the best placement of detection stations assuming that third-party speed data are used to achieve wide geographic coverage. Another benefit is to reduce the use of traditional vehicle detection stations, thereby reducing maintenance cost, addressing sustainability and stewardship goals, while limiting exposure of construction, maintenance, and operations personnel to traffic, thus improving worker safety.

WHAT IS THE PROGRESS TO DATE?

1. Technical Memo: Survey of Data Trends was completed and delivered/approved by Caltrans.
2. Technical Memo: Selected Freeways for Analysis completed and delivered/approved by Caltrans.
3. Research team recommended following corridors for use in subsequent project analyses:
   - San Francisco Bay Area
     I-880, I-680, I-280
   - Area around Modesto, Tracy, and Stockton
     I-5, SR-99, I-205
   - Area around Anaheim Triangle
     I-5, SR-91, SR-55, SR-57

IMAGES

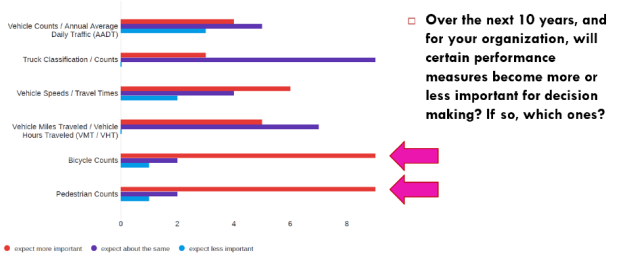

Image 1: Performance measure increase survey results from DOT responses

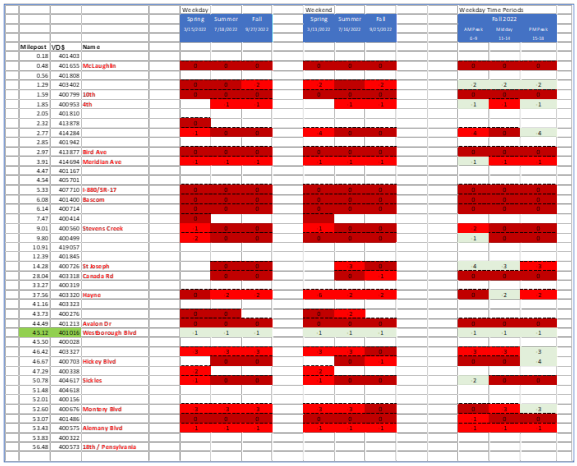

Image 2: Corridor Analysis Example on I-280 North