DRISI

Caltrans Division of Research, Innovation and System Information

Research Notes

Hybrid Data Implementation

Discover an integrated data fusion methodology for Daily Vehicle Hours of Delay (DVHD) that can be estimated in multiple ways with a flexible mix of data.

Transportation Safety and Mobility

AUGUST 2020

Project Title:
Alternative Data Detections

Task Number: 3643

Start Date: June 1, 2019

Completion Date: November 30, 2020

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

WHAT IS THE NEED?

California Department of Transportation (Caltrans) relies on over 40,000 individual vehicle detection zones to provide information on vehicle data such as volume, occupancy, and speed. This information is in turn used for various system operations and management activities. Gigabytes of data every day is collected and used to provide support for traffic management, real-time traveler information, and system performance monitoring. These functions are vital in supporting Caltrans mission, vision, and goals – Goal 1: Safety and Health, Goal 2: Stewardship and Efficiency, Goal 3: Sustainability, Livability and Economy, and Goal 4: System Performance.

Operating this vast detection system requires extensive resources in the form of engineering and maintenance support along with millions in capital funds to keep them running. Recently, Caltrans programmed over $150 million in State Highway Operation and Protection Program funds to address failed or failing detection stations across the state.

With the increased availability of third-party, probe-based data to provide some of the same data currently obtained through existing detection systems, there should be a renewed effort to look at how those data sources may be able to supplant or augment existing data collection methods. Most third-party data providers can now provide detailed travel time or speed data on any route. In addition, data samples will continue to grow as more cellular devices are used.

To properly integrate this data into the existing reporting platform and into deliverables such as the Mobility Performance Report, research is needed to determine how to incorporate the third-party data to provide both real-time and historical performance metrics. This will require evaluating and modifying algorithms currently used in the Caltrans Performance Measurement System (PeMS).

WHAT ARE WE DOING?

The research team will:

- Assemble a survey of commercial forms of third-party data and work with Caltrans to identify what is the most relevant to the needs of the existing Caltrans data pipeline and PeMS. Investigate existing methods for data fusion, standards for mobile data, and the panoply of available products.
- Define a reporting methodology for Daily Vehicle Hours of Delay (DVHD) and estimation algorithms, using a flexible mix of third-party probe data and standard vehicle detection.
- Review the key roles and usage of physical, point-based data (such as that from loops, radar, etc.) in the Caltrans data pipeline including PeMS, and propose a strategy for more efficient collection of point-based data.
- Evaluate emerging opportunities for using third-party data to improve coverage of existing Caltrans infrastructure.
- Propose a strategy for incorporating third-party data into the Caltrans data pipeline including PeMS, identifying key challenges and alternative solutions. Highlight key considerations for a future procurement strategy when defining data requirements, quality, and ownership.

WHAT IS OUR GOAL?

One objective of this project is to develop a new reporting methodology for DVHD that can be estimated in multiple ways with a flexible mix of data, including both traditional sensor data as well as third-party, probe-based data. In addition, this project will determine required data levels to achieve satisfactory DVHD reports and propose a strategy for including DVHD in PeMS.

WHAT IS THE BENEFIT?

A benefit of this project is to reduce the use of traditional vehicle detection systems, thereby reducing maintenance cost, addressing sustainability and stewardship goals, while limiting exposure of construction, maintenance, and operations personnel to traffic, thus improving worker safety.

Additionally, third-party detection will provide broader coverage of the state routes to include those areas not currently monitored.

This will mean that performance measurement will be more comprehensive, and highlight needs in areas not previously captured. Overall, an integrated data fusion method will provide a more reliable and complete data set that will enable more efficient and effective system performance monitoring and evaluation.

WHAT IS THE PROGRESS TO DATE?

As of August 2020, the researchers have completed the following:

1. Conflated the flow data from the Vehicle Detector Stations (VDSs) to the desired locations to better match with the third-party travel time. After selecting the desired algorithm, the performance of the flow conflation algorithm was evaluated with the Connected Corridors I-210 simulation model. The performance of the hybrid method was compared to the single point detector-based estimation method.

2. Explored preliminary ides to categorize VDS into Fully Accounted Traffic Volumes (FATVs). This organizational principal would help to clarify locations of VDS. In addition, it would enable automated checking of configuration and data integrity.

3. Performed analysis to calculate performance measures on freeway-freeway connectors. The researches will also explore to calculate performance measures on connector on-ramps and off-ramps, as these are not currently tracked.

IMAGES

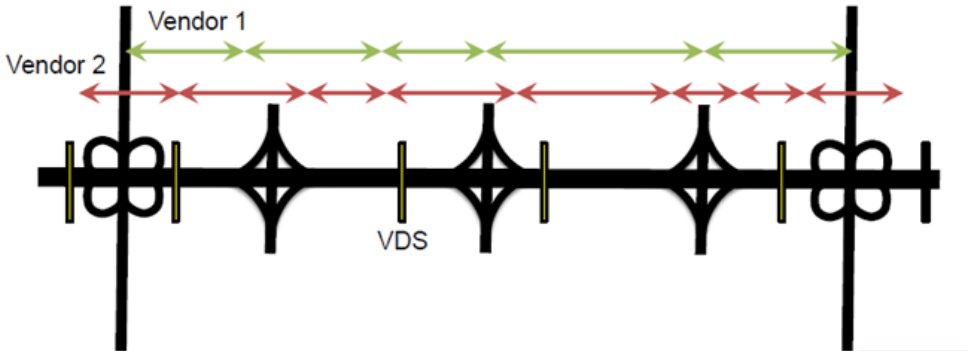

Image 1: Sample of existing point sources and potential third-party data vendors.

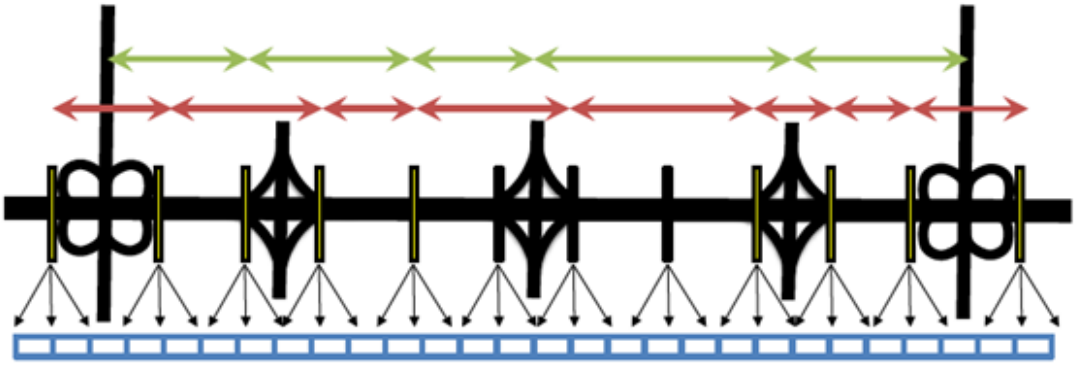

Image 2: Vector segment containing both existing point sources and potential third-party data vendors.

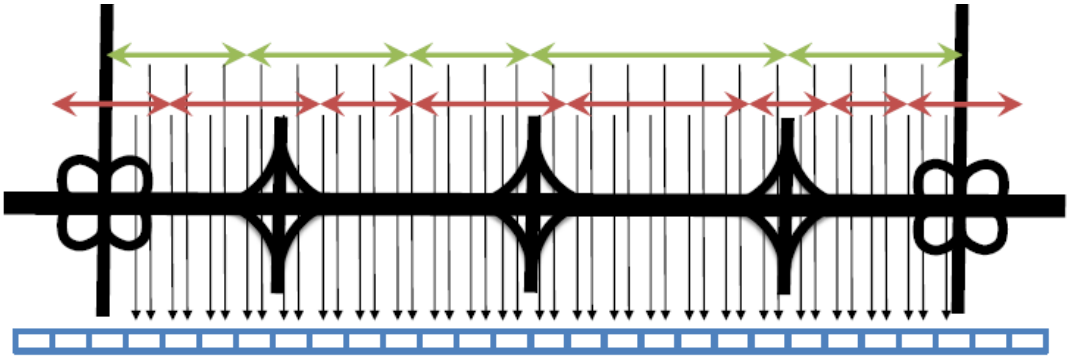

Image 3: Sample of hybrid data segmented distributions of all sources.