DRISI

CALTRANS DIVISION OF RESEARCH, INNOVATION AND SYSTEM INFORMATION

Research Notes

Route based Freight Activity Metrics along the California State Highway System through a Pilot Multi Sensor Fusion System

This study leverages multi-sensor truck tracking detector testbeds to estimate path-based volumes by vehicle categories.

Traffic Operations

MAY 2024

Project Title:
Truck Traveler Information, Parking, and Operations

Task Number: 3473

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WHAT IS THE NEED?

Currently Caltrans has over 140 Weigh-in-Motion (WIM) and approximately 4000 Census stations, however the data collected at multiple locations cannot be correlated as trucks drive along the State Highway System (SHS). If data from multiple locations could be correlated in a way that would identify a truck with its weight and class data along its route, then highly accurate freight route heatmaps and freight origin-destination (O-D) maps could be developed.

Through prior research with Caltrans, UC Irvine has developed inductive loop signature cards that plug directly into controller cabinets to upgrade them from vehicle counting stations into vehicle classification stations. Each truck has a unique inductive loop signature, like a fingerprint, and when supplemented with additional sensors can be used to identify vehicles as they pass over other locations along the SHS. Third-party data could also be utilized to supplement WIM and Census data to provide information on vehicle movements outside the limits of existing Caltrans infrastructure (e.g., capturing first/last-mile delivery locations on local roadways).

WHAT ARE WE DOING?

The research develops a means of leveraging existing Caltrans WIM and traffic census stations with inductive loop signature technology and additional sensors as necessary to identify freight truck movement along the State Highway System (SHS) with associated truck characteristics including weight, classification, commercial industry designation, and other characteristics. The expected duration for research into this development is 12 months.

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WHAT IS OUR GOAL?

The goal is to use advanced technology to develop a heavy truck tracking system that integrates existing technologies to estimate path-based volumes by vehicle categories.
The researcher is expected to develop a user interface to be used as a tool by Caltrans and other target customers to automate the development of freight route heatmaps and O-D maps. Such maps will be producible through user selected fields and correlate the data obtained between multiple existing WIM and census stations to provide qualitative freight route information.

WHAT IS THE BENEFIT?

The information derived from these maps will be used to identify statewide, regional, and project level infrastructure investment needs. Some benefits include the ability to track current/trend freight movement over time, as well as the ability to identify locations of bottlenecks, high freight concentrations, entry/exit points, and different types of industry distribution centers. More specifically, freight route heatmaps and O-D maps could be used to identify current, seasonal, and yearly trends. Some examples include the following.

- Trends in container truck concentrations and O-Ds along specific industry utilized freight hauling routes to and from maritime ports along with their in-state distribution centers or out of state exit points.
- Trends in produce truck concentrations and O-Ds along specific routes used to haul produce from specific agricultural areas to their major distribution centers.
- Trends for types of trucks hauling freight between the CA US-Mexico border including specific truck concentrations, O-Ds, and their routes used to reach their destination locations.
- Trends in overall truck movement along the SHS for the purpose of improving pavement deterioration models and site-specific load factors or improving law enforcement Commercial Vehicle enforcement.

The target customers for the product are the Division of Traffic Operations, the Division of Transportation Planning, district traffic operations and planning offices, regional MPOs, state/local law enforcement agencies, and freight interest groups. Other potential customers include the Air Resources Board and FHWA.

WHAT IS THE PROGRESS TO DATE?

The project was approved in March 2024 and fulfilled its first project management task with a kickoff meeting in April 2024. The next task is to deploy additional inductive loop signature sites at two locations which will be identified by Caltrans and the researcher.