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New Data Platforms Can Help Fill Gaps in Understanding Truck Travel in California

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Issue

Determining where trucks are traveling is crucial for planning and maintaining transportation networks. In California, information about truck movements is primarily derived from a network of fixed monitoring stations. These include weigh-in-motion stations (truck scales) and traffic count stations. Information from these locations can be used to classify passing trucks (light, medium, or heavy-duty), determine their travel direction, and estimate their proportion of the general traffic; however, the data provides limited information about trip origins and destinations and the routes taken in between stations. Estimating truck movements within a region thus largely depends on extrapolating data between known collection points. While this can be done with relative ease in simple networks containing few alternate routes, it can be a difficult task in complex networks without significantly increasing the number of fixed monitoring stations.

Real-time truck tracking data (i.e., probe-data) from third-party commercial vendors, such as StreetLight and INRIX, can be used to fill this gap. Probe data is collected from onboard monitors or from GPS-enabled navigation devices in the vehicle. Fleet operators use this information to manage their businesses, but it can be obtained by subscription. This data can be used to identify the routes typically taken by trucks and any detours used to bypass road closures or other delays. It is also a valuable source of travel time data. However, its ability to produce reliable traffic volume estimates has been less-well studied. The research team used StreetLight data to estimate truck movements within Caltrans District 1 to assess the potential for using probe data to provide a more accurate picture of truck travel not available from roadside monitors alone.

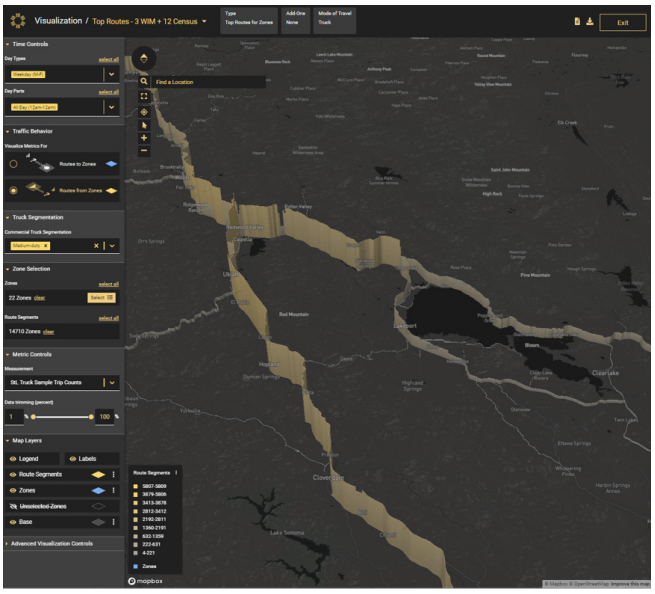

Figure 1. StreetLight "Top Route" analysis showing estimated relative volumes for medium-duty trucks near Clear Lake based on observations from 3 weigh-in-motion and 13 traffic count stations.

Key Research Findings

StreetLight data can be used to analyze truck routing patterns. As illustrated in Figure 1, probe data platforms can be used to quickly identify roadway segments or areas

with heavier truck traffic. The figure illustrates the routes taken by trucks observed passing 15 observation points spread throughout District 1, with the height of the bar reflecting the estimated relative intensity of truck volumes associated with each segment.

Probe-data platforms can be used to obtain reasonable estimates of truck movements between fixed sensors. Estimated truck volumes at the three District 1 weigh-in-motion stations using StreetLight data (calibrated with consistent and reliable observed counts) ranged between 80% and 120% of actual traffic volumes, showing that StreetLight can be used to estimate truck movements if adequate calibration data are provided.

The quality of traffic predictions can be improved with larger tracking data samples. Predictions based on larger samples are more likely to produce reasonable estimates of truck traffic than those based on small samples. For example, District 1 StreetLight estimates between January and April 2021 were less accurate than in previous months due to an unexpected significant drop in sample truck data reaching the platform.

Better estimates can be obtained by calibrating probe data using data from fixed monitoring stations. The StreetLight analyses aligned reasonably well throughout the year with the observed counts at all three District 1 weigh-in-motion stations but varied more from truck volume data from 13 other fixed sensors spread throughout the region.

The current truck classification system limits more accurate data collection. Probe data analytical platforms typically utilize only two truck weight categories: vehicles with gross vehicle weight between 14,000 lbs. and 26,000 lbs. as medium-duty trucks and vehicles weighing more than 26,000 lbs. as heavy-duty trucks. Light-duty trucks are not included due to difficulties in tracking them. This makes it impossible to convert probe data to match the 15 axle-based weight classes used by Caltrans without additional information. This limits the ability to use such platforms to determine per axle truck weights and to perform load analyses for the design of pavement and bridges.

Policy Recommendations

The research demonstrates that probe data analytical platforms can be used to obtain reasonable estimates of truck movements along roadway segments provided sufficient underlying data samples are collected. Before adopting such platforms, Caltrans should investigate whether accurate volume estimates could be obtained from other districts as well, and determine what minimum sample sizes might be required for producing reasonable estimates.

More Information

This policy brief is drawn from the report "New Data and Methods for Estimating Regional Truck Movements" prepared by Dr. Francois Dion, Mingyuan Yang, and Dr. Anthony Patire with Partners for Advanced Transportation Technologies (PATH) at the University of California, Berkeley. The report can be found at www.ucits.org/research-project/2022-25. For more information about the findings presented in this brief, please contact Dr. Francois Dion at fdion@path.berkeley.edu.

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