New Tool from UC Irvine Could Save the State Millions while Providing Better Data on Truck Activity in California

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Issue

The U.S. population is expected to increase to 389 million by 2045 compared to 321 million in 2015, with economic growth doubling in size. Consequently, freight movements are expected to increase by approximately 42 percent by 2040. Among all freight modes, trucks show the largest expected increase in flows by 2040. However, the ability for transportation agencies to understand and adequately plan for increased truck movement and related impacts is extremely limited due to a lack of data on truck travel patterns.

The main sources of truck data are truck surveys and truck counts collected by infrastructure-based detectors. Surveys provide detailed information (i.e., truck type, Origin-Destination, weight, and vehicle miles traveled) useful for understanding truck activity pattern by industry or associating freight commodities with specific truck types, but because of low response rates, surveys cannot be utilized to provide the actual quantification of truck activity at the geographical level. In-pavement sensor technologies, such as Weigh-in-Motion (WIM) or Automated Vehicle Classifiers (AVCs), provide point observations, such as truck volumes. These existing data sources are used to model and generate truck path flows (i.e., travel routes) and/or travel time estimations.

Research Summary and Findings

TAMS is a new tool from the Institute of Transportation Studies at UC Irvine (ITS-Irvine) helping public agencies gain a better understanding of truck travel in California. In 2012, the California Air Resources Board commissioned ITS-Irvine to develop the Truck Activity Monitoring System (TAMS) with the original purpose of understanding truck activity in the San Joaquin Valley. The TAMS model leverages the state's investment in widely-deployed vehicle sensor technology (specifically Inductive Loop Detectors (ILDs)) to classify and count trucks based on a truck's body-trailer configuration. In 2015, Caltrans expanded TAMS to over 90 locations (see Figure 1). TAMS data has been used by Caltrans to support validation and calibration of the California Statewide Freight Forecasting Model, by the Southern California Association of Governments to improve its Heavy-Duty Truck Model, and by Caltrans District 11 as a pilot test for federally-mandated Highway Performance Monitoring System (HPMS) data reporting.

TAMS provides greater spatial and temporal detail of truck travel patterns, which can be used to provide new industry insights. After the 2016 Clayton Fire in Lake County, TAMS detected a precipitous drop in the number of logging trucks on State Route (SR) 53. The number of logging trucks never rebounded over the next 16 months of observation; providing insights to the reverberating impacts of wildfire in the region. In the Los Angeles area near the City

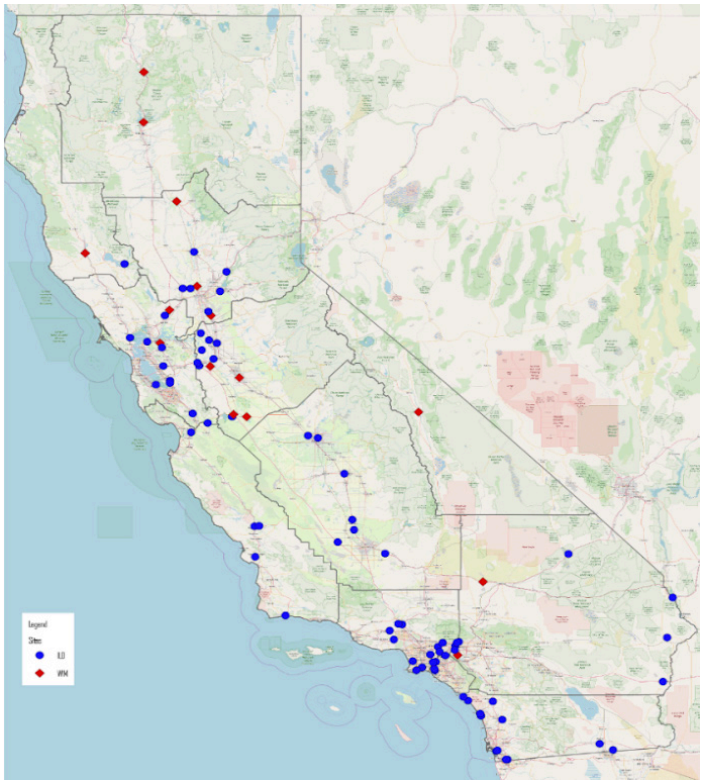

Figure 1. Location of WIM (blue) and ILD (red) sites in California that are part of TAMS. These sites were selected to gain a better understanding of ingress and egress of trucks to other states (and Mexico), inter-regional truck activity, and truck activity along key freight corridors within metropolitan areas.

[1] *USDOT, "National Freight Strategic Plan." Department of Transportation, US DOT, www.transportation.gov/freight/nfsp*

of Santa Clarita, TAMS was able to reveal how two routes – SR 14 and Interstate 5 (I-5) – located very close to each other were being used quite differently by industry. More construction trucks were utilizing SR 14 while I-5 saw higher volumes of double enclosed vans (e.g., FedEx and UPS delivery trucks). This finding demonstrates that the existing approach to estimating truck activity using standardized factors does not adequately capture the nuance and heterogeneity of truck travel in California.

If expanded, TAMS has the potential to save the state millions of dollars. Currently, most truck count data, which the state is federally-mandated to collect under HPMS, is mainly collected through AVC sites which comprise a system of Piezo and inductive loop sensors (about 300 locations statewide). Unlike inductive loop sensors which usually last the life of the pavement, the typical service life of Piezo sensors used in AVC sites are 3 to 5 years and replacement requires lane closures which are costly and pose a safety hazard to workers. ITS-Irvine has developed the ability within TAMS to generate equivalent (if not better) data to satisfy HPMS requirements. If current Piezos sites are phased out and existing inductive loops co-located at these sites are updated with the requisite hardware to be part of TAMS, then the state could save around $20 million over the next 20 years. This estimate does not include savings of converting existing ILD sites to be part of TAMS in place of constructing new Piezo sites, which could potentially result in an even greater cost savings.

Future applications of TAMS includes providing individual truck travel data. ITS-Irvine is currently developing the ability for TAMS to anonymously track the travel of individual trucks using inductive signature technology (i.e., matching the detailed waveforms triggered by trucks as they traverse inductive loop sensors). ITS-Irvine recently tested this application in the region of the I-5 and CA-78 freeway interchange (Figure 2), tracking trucks westbound on the CA-78 (Tri-City) and northbound on I-5 (Carlsbad) to a detector location several miles north (Camp Pendleton)

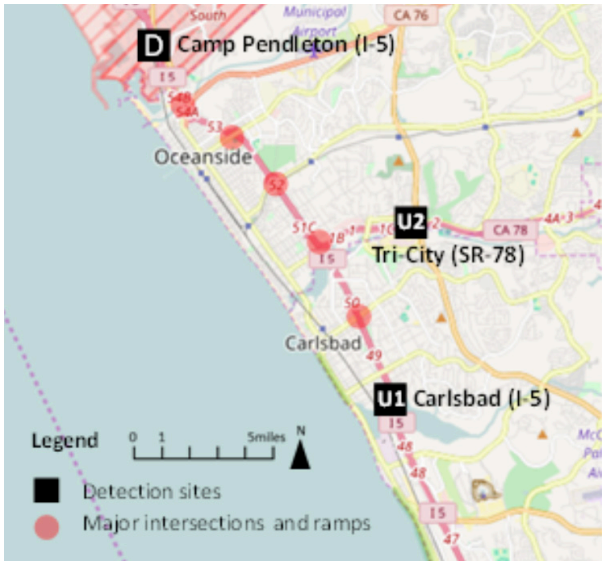

Figure 2. Truck signature data was collected at two upstream locations (U1 and U2) and one downstream location (D) in Southern California. TAMS observed 284 trucks (i.e., matched the truck signatures) that passed through either one of the upstream locations and the downstream location.

spanning several other interchanges with significant truck ingress and egress. Approximately 67 percent of trucks passing the downstream location were observed at either upstream location. Of the trucks observed, the model was able to correctly match over 90 percent of the tractor trailers. The matches were corroborated by video data.

Further Reading

Additional information about TAMS can be found at http://freight.its.uci.edu/tams. Research findings highlighted in this policy brief are drawn from several reports, including:

Ritchie, Stephen G., & Tok, Yeow Chern A. (2016). Development of a new methodology to characterize truck body types along California freeways (California Air Resources Board). Available at: ww3.arb.ca.gov/research/single-project.php?row_id=65098

Ritchie, S. G, Hyun, K., & Tok, A. (2017). New Methods for Monitoring Spatial Truck Travel Patterns in California Using Existing Detector Infrastructure. University of California Institute of Transportation Studies. Available at: escholarship.org/uc/item/0373g7jj

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