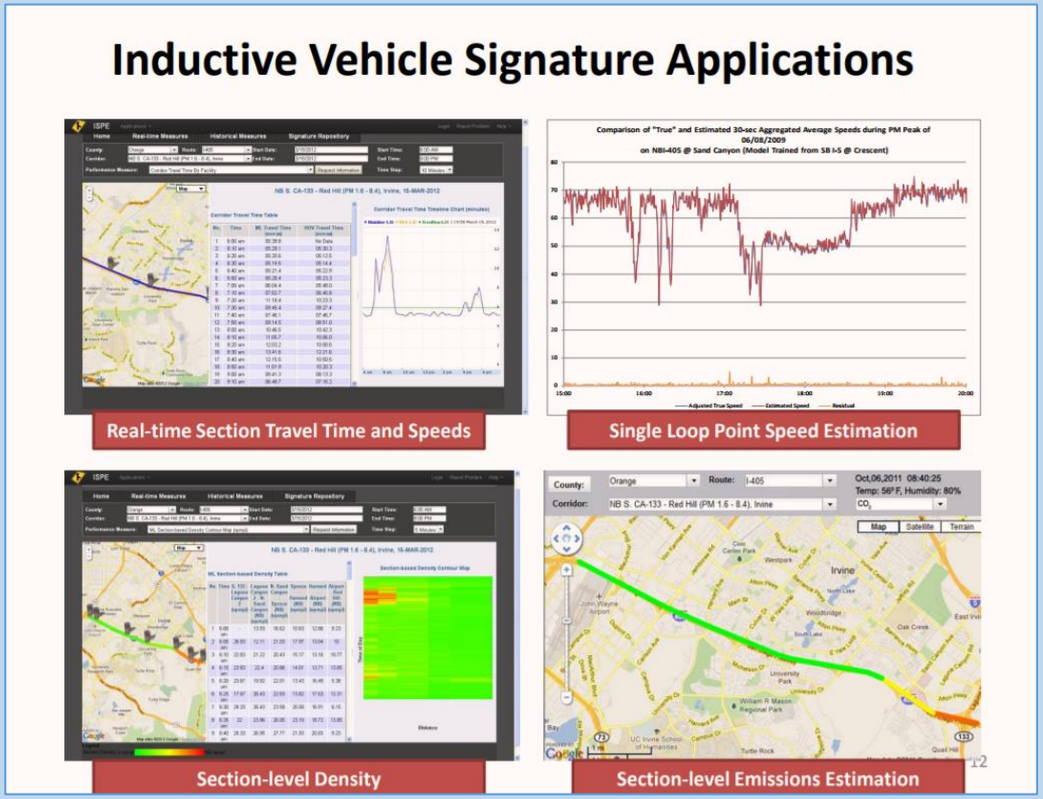
California Truck Activity Monitoring System

CASE STUDY

Developing a truck classification model using existing traffic detection infrastructure.

Freight Challenges	Congestion
Data Sources Used	Inductive Loop Detectors
Analytical Approaches	Classification



Truck Signature Application

Source: University of California, Institute of Transportation Studies, "Truck Activity Monitoring System (TAMS)". Available at: http://freight.its.uci.edu/tams/

WHAT ARE THE FREIGHT CHALLENGES?

Although commercial vehicles account for only a small fraction of the traffic on the roads, their impacts on overall mobility, congestion, safety, environmental emissions, and the asset condition of infrastructure is disproportionately large. Commercial vehicles come in different sizes and configurations which may affect their impacts on traffic. A common challenge in vehicle classification studies is dealing with expensive and cumbersome methods of data collection which can offer detailed data, but only for specific points in the network and very limited durations.

WHAT WAS THE GOAL OF THE PROJECT?

The Truck Activity Monitoring System (TAMS) project is sponsored by Caltrans. The goal of this project is to use the existing traffic detector sites with embedded sensors across California's highway system to develop high-resolution truck activity data based on Federal Highway Administration (FHWA) vehicle configuration classes. Developing a commercial vehicle classification model can provide a better understanding of truck travel routes, origins and destinations.

WHAT DATA SOURCES WERE USED?

The data obtained from existing Inductive Loop Detectors and Weigh-in-Motion Sensors (WIM) is integrated and communicated to operations centers using telecom fiber. These data inform the advanced truck body classification model through a fusion of analytical techniques. The existing WIM sensors measure axle weights and can provide vehicle count and classification data according to FHWA's 14 axle configuration classes. The data obtained from inductive loop detectors can also provide vehicle classification information when connected to new high-fidelity sensors to capture detailed vehicle signatures. Video data is also collected to verify the type of the commercial vehicle traversing the detectors.

California Truck Activity Monitoring System

SR-505 n/o Vaca Valley (WIM), WIM site
Summary Data for Tuesday, Dec 26 2017

Click on individual summary volume counts to obtain detailed hourly breakdown by body class

Vehicle Category	NB (Truck Lanes Only)	SB (Truck Lanes Only)
Passenger Vehicle	1968	5278
Single Unit Truck	830	2463
Truck with Single Trailer	58	67
Tractor with Semi-Trailer	407	651
Tractor with Multiple Trailers	19	23

SR-505 n/o Vaca Valley (WIM): NB (Truck Lanes Only), Tier 2 Class Semi: Breakdown by Hour of Day

Body Class	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total
20ft Container					1	1	3	1		3	1	3	3												16
40ft Container									2	1	1														4
40ft Container Reefer						2	2		1			2	1												8
53ft Container						1				2		1													4
Agriculture								1	3		1	3	1												9
Auto	2	1		3	1	7	6	4	7	15	10	12	6												76
Beverage					1								1												2
Bulk Waste		1							1				1												3
Cross Frame Van		1			4	1		7	1	3	2	3	1												23
Dump					1	1					1	1													4
Enclosed Van (FHWA 8)						1			2	1	2	1	1												8
Enclosed Van (FHWA 9)				2	1	5	2	8	4	12	7	8	5												55
Enclosed Van Reefer (FHWA 9)						1		3		1	2	7													14
Logging		1							2				2												5
Low Boy Platform	1	2		2		4	2	4	5	11	16	10	6												65
Open Top Van					1					1	2	1													5
Platform	1			1	3	5	3	8	15	14	15	9	9												88
Tank	1			1	2	2	1		2	5	2	1	1												18

Sample Data Summary Visualization
Source: University of California, Institute of Transportation Studies, "Truck Activity Monitoring System (TAMS)". Available at: http://freight.its.uci.edu/tams/

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WHAT ANALYTICAL APPROACHES WERE APPLIED?

The truck classification model is developed using over 140 hours of data from 18 sites across California. More than 40,000 truck movements were recorded and analyzed to model and verify different vehicle profiles. The inductive signature and WIM data are manually combined in a custom database interface together with descriptive entries of each vehicle class including the drive unit axle configuration and body type as well as trailer unit axle configuration and body type. This information is then used to extract drive unit and body unit signatures to be linked with each commercial vehicle class.

WHAT WERE THE RESULTS?

The resulting truck classification model has the ability to recognize over 60 truck configurations at WIM locations and about 40 truck configurations at inductive loop detector sites, respectively. The data obtained from the model can be used to (1) Estimate the share of freight from the overall traffic, (2) Determine truck travel patterns by industry, (3) Estimate the number of long/short haul trips along major and restricted truck corridors, (4) Analyze empty movements of freight trucks.

Currently, the TAMS is deployed at 95 sites across 12 Caltrans districts, using data from 73 inductive loop sites and 22 WIM locations.

HOW WERE THE RESULTS VISUALIZED OR COMMUNICATED?

The resulting truck activity monitoring system (TAMS) web-based interface provides detailed real-time 24/7 truck movement data. The truck activity data is processed on a nightly basis to be uploaded into the TAMS interface. Clicking on each data collection station on the map provides detailed information about truck activity including directionality, seasonality and time-of-day characteristics. The visualized truck activity data and configuration (picture at left) provide a reliable database for future economic and transportation models and research.