California-Mexico 2030 Summit

Freight Mobility Living Laboratory (FML2)
For Truck Identification, Classification & Activity Monitoring

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Sample of Our Truck Freight Transport Research

- FML2 - Freight Mobility Living Laboratory
- TAMS - Truck Activity Monitoring System
- FLEET - Fleet Electrification and Energy Technology model (for grid interactions)
- Alternative Fuel Choice and Adoption Behavior in Heavy-Duty Vehicle Fleets
- Low-Carbon Transportation Incentive Strategies Using Performance Evaluation Tools for Heavy-Duty Trucks and Off-Road Equipment
- Impacts of zero emission connected & autonomous drayage trucks on I-710 (Prof Saphores & Dr Monica Ibarra)
- Monitoring Out-of-State Trucks Entering California at Major Gateways
- Truck Data Collection Using LiDAR Sensing Technology
- California Truck Data Collection Improvement Project
- Air pollution & health impacts of shifting San Pedro Bay Port’s freight from truck to rail in Southern California
- California Natural Gas Vehicle Incentive Project
- Initial pilot for California heavy duty vehicle inventory and use survey (Cal-VIUS)
- California Statewide Freight Forecasting Model
Truck Configurations

Logging

Conventional cab

Wrecker

Sleeper cab

Basic Platform

Dump

Reefer Enclosed van

Utility

30ft bus

Light van

Beverage

Service

Multi stop

Low loading

Garbage

Tank

Conventional Enclosed van

Cab over Enclosed van

Cab over cab

RV

Dumpster transport

Concrete mixer

20ft bus

Crane
Trailer Configurations

- Bulk waste
- Logging
- Livestock
- Pneumatic tank
- Hopper
- Bottom Dump
- End dump
- Beverage
- 40ft Box container
- 20ft Box container
- Food tank
- Platform with device
- Basic Platform
- Curtain side van
- Agricultural
- 20ft. Box container
- Lowboy Platform
- Deep drop tank
- Auto transport
- Enclosed Van
- Skirted Enclosed Van
- Petroleum Tank
- Open top van
- 53ft. Box container
Truck Activity Monitoring System (TAMS)

A heavy duty vehicle classification & counting system that is...

**Temporally Continuous**
- Vehicle data collected and transmitted real-time 24/7

**Spatially Representative**
- Deployed at over 90 major truck corridors across the State of California

**Sustainable**
- Leverages existing Inductive Loop and Weigh-In-Motion Detector infrastructure

**Advanced**
- Adopts Inductive Loop Signature technology (combined with Weigh-In-Motion technology where available)

**Accessible and Automated**
- Hosted on a publicly accessible, interactive GIS-enabled web-based user interface at http://freight.its.uci.edu/tams

**High Fidelity**
- Identifies over 40 tractor / trailer body configurations
The Next Generation of TAMS: Freight Mobility Living Laboratory (FML2)

FML2 is an open innovation ecosystem for exploring field deployment of innovative technologies for freight data collection.

Real-time, scalable system

Provides tractor/trailer body type, axle class, GVWR class, and truck counts, speeds, and weights (at WIM stations), and Automated License Plate Recognition (ALPR) and LiDAR analytics

- Freight planning & policy
- Environmental analysis (truck model, year, fuel type, emission characteristics)
- Freight system management & operations
- Federal & state reporting
- Pavement design
FML2 Deployment

126 total sites (95 = original TAMS sites)

Currently: **36 active sites**
- 4 with stationary side-fire LiDAR
- 10 with ALPR

Spans 7 counties **mostly in S CA**

In 2023:
- Caltrans District 8 (“Inland Empire”) deploying about **80 new sites**, serving as operational sites for D8, and research sites for ITS
- ITS will deploy additional TAMS & ALPR & LiDAR sites in Central Valley, and near the Ports of Los Angeles/Long Beach (in new Caltrans and CARB research projects)
- ITS also now expanding FML2 to rail freight and incoming locomotive identification at border gateways
FML2
Sensor Installation
@ I-15 Mountain Pass
(Nevada Border, between Los Angeles & Las Vegas)

Weigh-In-Motion (WIM) Sensor
- Measures axle weights
- Measure axle spacings (when paired with inductive loop sensors)

Inductive Loop Sensor
- Trigger for ALPR
- Provides inductive signature data

ALPR Camera
Velodyne VLP-16 LiDAR
Example FML2 LiDAR Truck Images
(least costly, relatively low resolution LiDAR)
Mexico-California Border Annual Truck Crossings
(from US DOT, and US Customs & Border Protection)

https://explore.dot.gov/views/BorderCrossingData/Annual?%3Aembed=y&%3AisGuestRedirectFromVizportal=y

- **Total** = 1,026,358
  - **Total** = 1,572,053
  - 65% increase

- Since Global Financial Crisis - 65% increase overall
  - 2022 totals exceed pre-pandemic levels

- FML2 has:
  - Active site & LiDAR testbed on SR-7 at **Calexico East**
  - TAMS site near **Otay Mesa**
# ALPR Truck Data Summary at Calexico

<table>
<thead>
<tr>
<th>2022 Month</th>
<th>US CBP Truck Count</th>
<th>FML2 Calexico ALPR Total Vehicle Count</th>
<th>FML2 Calexico ALPR Truck Count</th>
<th>FML2 Calexico ALPR Truck Count %</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>35,430</td>
<td>85105</td>
<td>27483</td>
<td>77.6%</td>
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<tr>
<td>February</td>
<td>35,481</td>
<td>81207</td>
<td>29852</td>
<td>84.1%</td>
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<td>March</td>
<td>41,547</td>
<td>95659</td>
<td>36213</td>
<td>87.2%</td>
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<td>April</td>
<td>36,667</td>
<td>47122</td>
<td>23325</td>
<td>63.6%</td>
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<tr>
<td>May</td>
<td>38,791</td>
<td>90592</td>
<td>32591</td>
<td>84.0%</td>
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<tr>
<td>June</td>
<td>39,269</td>
<td>86271</td>
<td>32149</td>
<td>81.9%</td>
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<tr>
<td>July</td>
<td>37,174</td>
<td>84025</td>
<td>30735</td>
<td>82.7%</td>
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<tr>
<td>August</td>
<td>40,649</td>
<td>76286</td>
<td>27083</td>
<td>66.6%</td>
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<td>September</td>
<td>37,682</td>
<td>49717</td>
<td>17461</td>
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<td>October</td>
<td>37,932</td>
<td>38934</td>
<td>13038</td>
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<td>November</td>
<td>37,071</td>
<td>71164</td>
<td>25567</td>
<td>69.0%</td>
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<tr>
<td>December</td>
<td>36,083</td>
<td>75028</td>
<td>26926</td>
<td>74.6%</td>
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<tr>
<td>Total</td>
<td>453,776</td>
<td>881,110</td>
<td>322,423</td>
<td>71.0%</td>
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</tbody>
</table>

- Of the 322,423 reads 79,688 are unique truck reads
2022 Distribution of the Jurisdiction of Trucks at Calexico (for uniquely identified trucks)

- Top 5 Jurisdictions: CA*, IN, MO, NV and ID

- Sixth Largest share = Unknown (ZZ)*

- Country Share:
  - USA - 91%*
  - Canada - 5.5%
  - Unknown - 3.5%*

* Many “CA” trucks likely have dual registration (Mexico) plates

* many are likely Mexican plated trucks
Concluding Comments

• Relatively inexpensive advanced technology exists to obtain automated, real-time detailed heavy duty truck characteristics and activity patterns, including HD ZEVs (for CA trucks), necessary for policy and planning.

• However, while FML2 is expanding, additional installations are needed to more comprehensively monitor California, Mexico and other Out-of-State trucks.

• With respect to HD truck border crossings and activity patterns, a strategic California-Mexico collaboration would help to identify key bilateral challenges, data needs, current data availability (especially on the Mexico side), data sharing possibilities, & most beneficial future research & development.