Project Sponsored by
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
Project Overview

• Goal: Quantify the Fuel and Emissions Impacts of Driver Training for Drayage Operators in Paso Del Norte Region
  
  – Develop a training module for border drayage drivers
  – Train drivers on driver behaviors that can help reduce fuel consumption and emissions
  – Through data collection and analysis, quantify the effectiveness of the training
Project Overview

• Project included 3 major tasks:

  - Review of State of Practice
  - Development and Delivery of Training Materials
  - Fuel and Emission Impact Evaluation
Driver Behavior and Training Strategies

- Anti-Idling
- Shifting and Gearing
- Accelerating, Braking, and Momentum
- Maintenance
- Speed
- Route Selection

44–48% Reduction in Fuel Consumption
Development and Delivery of Training Program

The developed training covers well-known techniques that would allow drivers to reduce their fuel and emissions by changing **how they drive**.

- Anti-Idling
- Shifting and Gearing
- Accelerating, Braking, and Momentum
- Speed
- Maintenance
- Planning Ahead
- Other Techniques
Development and Delivery of Training Program

- Initial training was presented to drayage operators in El Paso–Ciudad Juarez region.

- Training materials were updated based on feedback from the initial participants in the program.

- Training can be adapted for either online or in-person trainings for future participants.
Fuel and Emission Impact Evaluation

Before-Training PAMS-GPS Data Collection
- First 2 Weeks of Data Collection by Drayage Truck Drivers

Driver Behavior Training

After-Training PAMS-GPS Data Collection
- Second 2 Weeks of Data Collection by Drayage Truck Drivers
Fuel and Emission Impact Evaluation (2)

• Data collected using Portable Activity Measurement System (PAMS) and GPS
Fuel and Emission Impact Evaluation (3)

Data Collected Before and After the Training

- **Speed Data**
- **Location and Route Data**
- **OBD Engine Parameters**
Fuel and Emission Impact Evaluation

- The evaluation of the impact the training had focused on two aspects of driver behavior:

  **Idling**
  - Only events under Driver Control

  **Acceleration Patterns**
  - Rate of acceleration
Fuel and Emission Impact Evaluation - Idling

1 Minute Minimum Duration

Only non-road, non-border locations

Compared 4 drivers, before and after training
Fuel and Emission Impact Evaluation – Idling

Only Truck DT01 showed a statistically significant change, with a reduction of 22% in average idle duration.

Trucks DT03 and DT04 showed 35% and 7% reductions, DT02 had a 5% increase.

Combined data from all trucks showed a 12% decrease, although this was not statistically significant.
The idling impact at different times of the day, in both Mexico and the U.S. were also considered.

Truck DT01, and the overall average, both showed significant improvements for idle events in Mexico.

All other location/time combinations either showed small reductions, or stayed the same, although none of these results were significant.
Fuel and Emission Impact Evaluation – Idling

Overall reduction in idling duration due to training.

Results were statistically significant in limited cases, but the presence of outliers and limited data set must be considered.

Idling at the border accounted for 51.9% of all idling, emphasizing the importance of reduced border wait times.
Fuel and Emission Impact Evaluation - Acceleration

- An acceleration event was defined as any with at least 5 consecutive seconds of increased speeds.
- Slight decreases in speed were allowed to be in idling events, to account for shifting, as long as the speed was accelerating again within 2 seconds.
- Data analyzed for 5 speed ranges:

  - 0-10
  - 10-20
  - 20-30
  - 30-40
  - 40-50
Fuel and Emission Impact Evaluation – Acceleration

10 vehicles included in the analysis

All speed ranges had statistically significant reduction in acceleration rates

Acceleration rates decreased between 3% and 11%

Some trucks had slightly higher acceleration rates, but none were statistically significant
Fuel and Emission Impact Evaluation – Acceleration

20-30 MPH Speed Range

Acceleration Rates (mph/s)

Truck ID

Before Acceleration Rates
After Acceleration Rates
Fuel and Emission Impact Evaluation – Emissions

• To determine the emission impact of the training program emissions testing were conducted on a sample truck.
• Rates were supplemented with emission rates from the MOVES model where necessary.
• Testing done with both loaded and empty trailers, giving two sets of rates.
• The loaded and empty emissions rates were weighted, based on data from the Bureau of Transportation Statistics, which show that 64.5% of vehicles that crossed the border in 2016 were loaded.
Fuel and Emission Impact Evaluation – Emissions (2)

**Daily Emissions - Idling**

<table>
<thead>
<tr>
<th></th>
<th>CO2 (KG)</th>
<th>NOX (G)</th>
<th>PM (G)</th>
<th>FUEL (GAL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>11</td>
<td>138.04</td>
<td>5.27</td>
<td>1.61</td>
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<tr>
<td>After</td>
<td>7</td>
<td>92.08</td>
<td>3.59</td>
<td>1.1</td>
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</tbody>
</table>

**Potential Idling Emissions Savings – Per Vehicle**

<table>
<thead>
<tr>
<th></th>
<th>CO2 (KG)</th>
<th>NOX (G)</th>
<th>PM (G)</th>
<th>FUEL (GAL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly</td>
<td>68</td>
<td>0.859</td>
<td>0.034</td>
<td>10.2</td>
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<tr>
<td>Yearly</td>
<td>821</td>
<td>10.31</td>
<td>0.403</td>
<td>122.4</td>
</tr>
</tbody>
</table>
Potential daily savings from reduced emissions, per vehicle:

- 5.7 kg CO$_2$
- 28.4 g NO$_x$
- 3.9 g PM
- 0.46 gal fuel

Monthly and yearly savings shown on graph.
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