DRISI

Caltrans Division of Research, Innovation and System Information

Research Notes

Planning
Policy
Programming

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Eco-Driving Feedback for Heavy-Duty Trucks

Develop and test driver feedback technology that will improve fuel efficiency of heavy-duty trucks.

Project Title:
Environmentally-Friendly Driving Feedback Systems Research and Development for Heavy-Duty Trucks

Task Number: 2822

Start Date: October 1, 2014

Completion Date: September 30, 2015

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WHAT IS THE NEED?

In California, heavy-duty trucks account for more than 20% of greenhouse gas (GHG) emissions from road transportation. This is equivalent to almost 8% of the total GHG emissions from all sources in the state. Any strategies that reduce fuel consumption of these trucks will also reduce their GHG emissions, which can help California achieve its GHG reduction goals.

Among several strategies to reduce fuel consumption and GHG emissions from heavy duty trucks, "eco-driving" is one that has the potential to be very cost effective. Eco-driving can be defined as fuel-efficient operation of a vehicle to achieve better fuel economy and lower tailpipe emissions while not compromising the safety of oneself and other road users. The core of eco-driving programs is to provide drivers with a variety of advice and feedback to reduce fuel consumption. The advice and feedback can be provided through various means including websites, classes or training, and in-vehicle driving feedback systems.

University of California, Riverside (UCR) Bourns College of Engineering-Center for Environmental Research and Technology (CE-CERT) researchers have developed a variety of next-generation driver feedback technologies for light-duty cars as part of a three-year Department of Energy research program. These technologies include:

- Eco-Friendly Fleet Planning
- Eco-Routing Navigation
- Connected Eco-Driving Feedback
- Eco-Score and Eco-Ranking System

Research is needed to apply these technologies to heavy-duty trucks and determine their potential at improving fuel efficiency.

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WHAT ARE WE DOING?

In this project, we will adapt three of the four driver feedback technologies (numbers 2, 3, and 4, above) for heavy-duty trucks, and integrate them with a state-of-the-art truck driving simulator located at UCR. Then, we will recruit professional truck drivers to comprehensively test the technologies across a range of truck driving scenarios. By establishing a baseline of driving, and then introducing the driver feedback technologies, it will be possible to quantitatively measure the potential fuel and GHG emission benefits. The various tasks to complete this work are as follows:

- Task 1.0 – Adapt Driver Feedback Technologies for Heavy-Duty Trucks.
- Task 2.0 – Develop and Expand the Truck Simulator Driving Scenarios.
- Task 3.0 – Test Driver Feedback Technologies.
- Task 4.0 – Analysis and Reporting.

WHAT IS OUR GOAL?

The goal of this project is to develop and test driver feedback technologies that will improve fuel efficiency of heavy-duty trucks.

WHAT IS THE BENEFIT?

By integrating driver feedback technologies across several dimensions (i.e., routing, driving, and performance monitoring), it is expected that overall fuel savings and GHG reduction will range from 5% possibly up to 15%. It will create a framework that enables the drivers to improve and optimize their own driving habits and also enables fleet managers to monitor performance and make adjustments to training and policies. Over time, it develops a database of driving conditions in the fleet's operating area, which will drive algorithm modifications to continually improve performance. This applies to any heavy-duty truck fleets, including Caltrans'. The fuel savings will help reduce operating costs of the fleet while the corresponding GHG emission reduction will help contribute to California meeting its GHG reduction targets.

Given that heavy-duty trucks travel primarily on the California freeway system, reducing fuel consumption of these trucks will also reduce GHG emission contribution from Caltrans' roadway facilities.

WHAT IS THE PROGRESS TO DATE?

We have completed Task 1, which is to adapt eco-driving technologies previously developed for light-duty cars for use with heavy-duty trucks. These applications have been incorporated into an interface that works with the truck driving simulator's operations data stream. Task 2, which is to develop and expand driving scenarios for the truck driving simulator, is nearing completion. So far, the driving scenarios were programmed into the simulator and consisted of trucks driving on highways and arterial roadways, under different degrees of traffic congestion.

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