RESEARCH NOTES
TRAFFIC OPERATIONS RESEARCH
Task Order 4215
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Development of a Heavy-Duty Diesel Modal Emissions and Fuel Consumption Module for Smart AHS

Why Was This Research Undertaken?

This research was undertaken to utilize and refine the Comprehensive Emission Model (CMEM), previously developed by the University of California, Riverside, College of Engineering-Center for Environmental Research and Technology (CE-CERT), in order to use it on heavy-duty, diesel (HDD) vehicles to estimate the total fuel consumption and emissions impact from use of automation (vehicle platooning) on a systems-wide basis, using simulation modeling as well as real world experimentation.

What Was Done?

Simulation and real-world experimentation were conducted using a variation of scenarios for a lead and following vehicle traveling on an automated highway, in a platoon formation. Utilizing the Comprehensive Emission Model (CMEM), simulation was done and data collected for the lead vehicle and the following vehicle in order to determine the possible benefits, if any, that could be accomplished by varying the distance between the two vehicles as they travel in a platoon formation. The state-of-the-art Mobile Emissions Research Laboratory (MERL) (that can be attached to a number of heavy duty rigs to measure instantaneous (i.e., modal) emissions in-situ), previously developed by CE-CERT, was utilized for the real-world experiments conducted on the vehicles while traveling in a platoon formation and while varying the distance between the two HDD vehicles. Data was collected and analyzed to determine what benefits in total fuel consumption and emissions could be achieved.

What Can Be Concluded From The Research?

It can be concluded from simulation and real-world experimentation, that significant fuel emissions savings can be achieved when platoon vehicles travel in automation with close inter-vehicle spacing. This was shown in simulation as well as with real-world experimentation. The real-world experimentation results showed benefits overall, however there was a large amount of variation in the data due to the nature of the test (i.e., the testing durations were too short due to the high risk involved in having two HDD vehicle traveling at only 4 to 10 meters apart, and maintaining the spacing constant between the vehicle, at speeds of approximately 50 MPH).

What Do The Researchers Recommend?

Researchers recommend additional testing using a larger number of vehicles. They also recommend using high emissions emitting HDD vehicles and additional on-

road emission testing since there is a large potential to save fuel and cut emissions, while maintaining safe operation of the vehicle while traveling in tandem at close spacing.

Implementation Strategies

In order to implement the results of the research, large sums of public funds need to be allocated in order to build the infrastructure (sensing, communication systems, dedicated lanes, etc.) that would be required for vehicle automation. Due to the extremely high cost of construction, the high cost of equipment required to automate vehicles, the high cost to build the infrastructure needed for automation, and the lack of acceptance by drivers to use the automated lanes, it will take many years before the results of this research are considered for implementation.

For More Information About This Research

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