Project Summary

Texas Department of Transportation

0-6237: Characterization of Exhaust Emissions from Heavy Duty Diesel Vehicles in the HGB Area

Background

Many areas in Texas, including the Houston-Galveston-Brazoria (HGB) area face air quality issues and are in nonattainment (NA) of Federal ambient air quality standards. In these areas, state and local transportation agencies seek to implement various strategies to reduce mobile-source (i.e., vehicular) emissions. During the previous decade, the contribution of heavy-duty diesel vehicles (HDDVs) to overall mobile source emissions has increased, due to other vehicle types (such as light-duty gasoline vehicles) reducing their emissions levels through improved vehicle technology and fuel efficiency. HDDVs are an important target category for emissions reduction efforts in NA areas in Texas. Among the existing HDDV fleet, previous research has indicated that vehicles identified as "high emitters (HEs)" contribute disproportionately to the overall HDDV emissions. The characterization of emissions from HDDVs and HEs can be helpful in the development of appropriate emissions reduction policies and strategies.

What the Researchers Did

This project characterized the in-use emissions of HEs and vehicles representative of the general HDDV fleet and compared their emissions. Following a literature review and state of practice assessment, the research team developed an approach to identifying high emitter vehicles through a process of opacity testing. Vehicles from the City of Houston's fleet were screened using opacity testing, and 12 HEs were selected for emissions testing.

Emissions testing was conducted using portable emissions measurement systems (PEMS) on the 12 selected HEs, as well as on 18 vehicles randomly selected to be representative of the overall fleet (i.e., non-HEs). These vehicles belonged to three categories, referred to as Class 4, Class 6, and Class 8. Testing for vehicle idling was conducted under environmentally controlled conditions at TTI's Environmental and Emissions Research Facility. Researchers also conducted emissions testing for vehicle driving, following drive cycles developed to be representative of actual vehicle usage patterns. These drive cycles were developed based on GPS data collected from the vehicles while they were in regular use.

Research Performed by:

Texas Transportation Institute (TTI),
The Texas A&M University System

Texas Southern University (TSU)

Research Supervisor:
Josias Zietsman, TTI

Researchers:
Reza Farzaneh, TTI
Jeremy Johnson, TTI
Doh-Won Lee, TTI
Fengxiang Qiao, TSU
Lei Yu, TSU

Project Completed: 8-31-11

The research team analyzed the collected test data for various gaseous emissions, particulate matter, as well as mobile source air toxics. Researchers compared the collected data to estimated emissions rates based on the EPA's emissions model (MOVES). The team studied the relationship between particulate matter emissions measurement methodologies and opacity readings to determine whether opacity testing was a robust method for identifying high emitters.

What They Found

In general, vehicles identified as high emitters differed in their emissions characteristics from the randomly selected vehicles. In the case of class 8 vehicles tested under idling conditions, the HEs consumed 21 percent more fuel than the randomly selected test vehicles, and produced between 24 percent and 87 percent higher levels of pollutants (depending on the pollutant type). Similar results were observed for the driving emissions as well. By replacing HEs with non-HEs or with vehicles complying with new emissions standards, their emissions can be reduced significantly. Due to limitations of sample size, the usefulness of opacity testing as a means to identify HEs could not be statistically tested.

What This Means

The results from this project demonstrate that a viable emissions reduction strategy could be to screen high emitter vehicles from the fleet and replace them or install emissions control technologies for maximizing the emissions reduction and air quality benefits. Larger vehicle fleets, especially those with older vehicles in the HGB area and other NA areas can provide many opportunities to apply these strategies for regional air quality improvement.

For More Information:
Research Engineer - Duncan Stewart, TxDOT, 512-416-4730
Project Director - Tim Wood, TxDOT, 512-416-2659
Research Supervisor - Josias Zietsman, TTI, 979-458-3476

Technical reports when published are available at:
http://library.ctr.utexas.edu/index.html

www.txdot.gov
keyword: research

Texas Department of Transportation
Research and Technology Implementation Office
P.O. Box 5080
Austin, Texas 78763-5080
512-416-4730