Texas A&M Transportation Institute

PROJECT SUMMARY

Texas Department of Transportation

0-6629: Texas Specific Drive Cycles and Idle Emissions Rates for Using with EPA's MOVES Model

Background

The U.S. Environmental Protection Agency's newest emissions model, Motor Vehicle Emission Simulator (MOVES), enables users to use local *drive schedules* (representative vehicle speed profiles) in order to perform an accurate analysis of emissions from vehicles. However, only the national average drive schedules are currently included in the default database of the model. The cold start and idling emissions and activity data of heavy-duty diesel vehicles (HDDVs) that are included in the MOVES model are based on a very limited number of data sources, even though they are important components of the total on-road mobile source emissions inventory.

This research provides local drive schedules for different regions of Texas for different vehicle classes and roadway types, as well as cold start and idling emissions rates for heavy-duty diesel trucks. The research also compares estimated emissions from MOVES for a sample of vehicles to real-world in-use emissions measurements.

What the Researchers Did

Researchers reviewed current literature on existing vehicle activity and HDDV emissions data collected in Texas, as well as available technologies and procedures for drive schedule data collection and analysis. Researchers then collected data in two phases.

In Phase 1, developing the local drive schedules, researchers acquired 83 light-duty, 50 medium-duty, and 112 heavy-duty vehicles for global positioning system (GPS) data collection. The medium- and heavy-duty vehicles were recruited from private and public fleets. This was supplemented by collection of 30 vehicle-days of data for medium-duty vehicles, and 650 miles of data for electric vehicles.

Researchers then tested the emissions of 15 heavy-duty vehicles in Phase 2—cold start and idling emissions of HDDVs. These vehicles were obtained through daily or weekly lease from truck leasing companies. The research team conducted idling emissions testing inside an environmental chamber at the Texas A&M Transportation Institute's Environmental and Emissions Research Facility, where temperature and relative humidity were controlled precisely. Test vehicles were tested under two different scenarios: normal idling and high idling. Also, each test was conducted under hot (100°F) and cold (30°F) test conditions. In addition to stabilized idling and cold start, the research team tested the vehicles at 5-minute and 15-minute

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soak times (the time period when the engine is off) to capture the changes in emissions as a function of soak time.

What They Found

A set of representative drive schedules was developed for each average speed bin. Instead of using speed and acceleration, the modified methodology for drive schedule development uses the operating mode bin distribution as the target parameter for developing the drive schedules.

The research team performed a simplistic comparison of emission rates obtained from the developed opMode distributions and drive schedules, to those from the MOVES default drive schedules. The results show that the largest differences between the MOVES default rates and those based on this study's results are for low and high speeds, i.e., speeds lower than 10 mph and higher than 40 mph.

Based on comparisons to the stabilized emissions, researchers observed the following trends:

- Cold-start emissions were higher than or similar to the stabilized emissions except those of formaldehyde for hot tests and carbon monoxide for cold tests.
- 5-minute soak emissions were similar to the stabilized emissions except those of particulate matter (PM) for hot tests and hydrocarbons (HC) for cold tests.
- 15-minute soak emissions were similar to the stabilized emissions except those of PM for hot tests and HC and PM for cold tests.
- 5-minute and 15-minute soak high emissions were higher than the stabilized emissions for all but those for nitrogen oxide (NO_x), which were similar to the stabilized emissions for hot tests.

What This Means

Different regions of Texas can use local drive schedules in their regional air quality analyses. The first step in this process is to obtain the approval of the consultative partners.

Cold-start emissions are usually higher than re-start emissions for intervening soak times of up to 59 minutes.

Trucks with California Air Resources Board clean idling stickers do not always meet the 30 g/h NO_x emissions threshold during idling under real-world conditions.

The idling emissions data indicate that the emissions control technologies that are currently used to reduce NO_x from diesel trucks are not as effective in idling conditions.

For More Information

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