



Project Summary

Effect of Load Simulation on Auto Emissions and Model Performance

Peter Gabele and Richard Snow

A study was undertaken to examine the accuracy of an automobile emission rate model and the water brake dynamometer procedure used in the model's development. Using wheel torque-meters, actual road loads were recorded and later simulated with the vehicle on an electric dynamometer. Emissions results from tests using this load simulation were compared with results from tests using water brake simulation. Emission results were also compared to values predicted using the Environmental Protection Agency's Automobile Exhaust Emission Modal Analysis Model.

This Project Summary was developed by EPA's Environmental Sciences Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

Ambient air concentrations of CO within urban areas are often significantly higher than those predicted by dispersion models. Because CO is emitted predominantly by motor vehicles, models used to predict CO emission rates from groups or classes of motor vehicles could be contributing substantially to the shortfall and should be examined for inaccuracies. Two widely used models for estimating emissions are MOBILE2 and the Intersection Midblock Model (IMM). Both models employ the EPA Automobile Exhaust Emission Modal Model which is used to predict emissions for any given speed-time driving sequence. This

"Modal Model" has been criticized because it was developed using precatalyst cars which were tested on water brake dynamometers.

In this study, the Modal Model is evaluated by measuring emission rates from a late model vehicle and comparing these with values predicted using the model. The effect of water brake dynamometer load simulation versus actual road load simulation on regulated emissions is also examined.

Conclusions and Recommendations

Investigation of the effect of dynamometer load characteristics upon regulated emission rates and an evaluation of the EPA Modal analysis Model were completed. Based upon the study's findings the following is concluded:

1. The load applied by the water brake and the tire rolling resistance losses on the dynamometer was approximately equal to the actual road load measured in highway tests.
2. Regulated emission rates for the Celebrity are not significantly different when tested using the water brake simulation versus actual road load simulation on an electric dynamometer.
3. The EPA Exhaust Emissions Modal Model is an inaccurate predictor of regulated emissions from the Celebrity.

The conclusions suggest that water brake dynamometers adequately simulate actual road loads for emissions test

purposes. This should hold true for vehicles such as the Celebrity which have large inertia load components relative to aerodynamic load components. When the aerodynamic load component becomes a significant portion of the total road load, dynamometer absorbed power theoretically deviates with speed from the actual road load. The tendency for this occurrence, which makes simulation of road loads with water brake dynamometers more difficult, increases for extremely lightweight cars.

Because most data collected for use in MOBILE2 have been from vehicles roughly equal in size to or larger than the Celebrity, inaccuracies in load simulation have no significant effect on the accuracy of MOBILE2. However, should minicars (<2000 lb) ever occupy a significant percentage of the vehicle miles traveled (VMT), a re-evaluation of dynamometer load simulation will become necessary.

With regard to the Modal Model evaluation, results in tests on only one vehicle cannot in themselves disprove the model. This is true because the model was recommended for prediction of vehicle group emissions and not individual vehicle emissions. However, because high tech emission control systems have changed the relationship between vehicle speed and emissions since the model's development, the Modal Model should be updated.

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The complete report, entitled "Effect of Load Simulation on Auto Emissions and Model Performance," (Order No. PB 84-120 369; Cost: \$8.50, subject to change) will be available only from:

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