FTA

FEDERAL TRANSIT ADMINISTRATION

REPORT SUMMARY

Transit Vehicle Emissions Program

Final Report

Background

The selection of transit vehicle fuel and powertrain technology is critical to the mission of providing safe, efficient, reliable, environmentally-conscious, and cost-effective public transportation. Each technology offers advantages and disadvantages. West Virginia University (WVU) conducted a research program to provide resources to assist transit agency managers to evaluate low-emissions, fuel-efficient options in vehicle procurement and planning activities.

Objectives

The program had three major objectives:

- Task 1: Provide technical assistance to the Federal Transit Administration (FTA) and Pennsylvania Transportation Institute (PTI) to establish an emissions testing program for all new model transit vehicles.
- Task 2: Evaluate the efficiency and emissions benefits of alternative fuel and advanced technology transit vehicles.
- Task 3: Develop online tools and resources to assist transit agency managers in determining the most appropriate and advantageous bus propulsion technologies considering emissions, fuel type, fuel economy, and life cycle cost.

Findings and Conclusions

A standardized emissions testing component of the Altoona Bus Testing Program was established that will provide standardized tailpipe emissions test results for all new transit buses, and three online tools were developed that can assist transit agencies to evaluate alternative fuel and propulsion system options when making vehicle procurement decisions.

In Task 1, WVU evaluated potential test methodologies and recommended that emissions testing be performed using a chassis dynamometer and 40 CFR Part 1065 dilution tunnel and emissions sampling system, following as closely as possible the test procedures mandated by the U.S. Environment Agency for heavy-duty engine emissions testing. WVU also provided technical assistance to select and define emissions sampling system specifications, and the WVU Transportable Emissions Laboratory conducted a side-by-side comparison study to validate the test procedures and results of the PTI laboratory. The new emissions laboratory is operational at PTI. The audit of the dynamometer and emissions equipment did not reveal any problems or deficiencies in the equipment, with the exception of the particulate matter filter conditioning and weighing facilities. It was recommended that PTI invest in an environmentally-controlled clean room and upgrade its microbalance. The emissions testing revealed the challenges associated with measuring emissions from modern transit buses equipped with active diesel particulate filters (DPF) and selective catalytic reduction

(SCR). These active after-treatment systems introduce test-to-test variability as a result of thermal management and active regeneration events. Although this variability cannot be completely eliminated through testing procedures, it can be mitigated through very consistent vehicle warm-up practices, consistent soak times between subsequent tests, and rigorous test procedures.

In Task 2, WVU used its Transportable Vehicle Emissions Laboratory to measure the fuel consumption and exhaust emissions from a variety of transit buses, including buses powered by conventional petroleum diesel fuel, compressed natural gas, Fischer-Tropsch synthetic diesel fuel, biodiesel fuel blends, and buses equipped with diesel-hybrid electric powertrains. The intent was to provide data to feed into an online transit bus emissions database and the transit fleet emissions inventory developed under Task 3 of this project.

Task 3 developed tools to estimate the emissions profile of existing transit fleets and evaluate how integration of fuel and propulsion technologies into the fleet will alter the emissions footprint. WVU also developed a set of tools for evaluating the pollutant emissions and fuel economy of transit bus fleets, including a searchable database of transit vehicle emissions test data and a transit fleet emissions inventory model. In addition, WVU, Battelle, and the Transit Resource Center developed a transit vehicle life cycle cost model (under contract to the Transit Cooperative Research Program Project C-15). The tools can be accessed on a publicly-available web site called Integrated Bus Information System (IBIS), which is accessible at http://ibis.wvu.edu.

Benefits

As a result of this research program, conducted in conjunction with a program funded at the Pennsylvania Transportation Institute, a standardized emissions testing component of the Altoona Bus Testing Program was established. The program will provide standardized tailpipe emissions test results for all new transit buses that can be used by transit agencies for vehicle procurement and strategic environmental planning. This research also developed three online tools that can assist transit agencies to evaluate alternative fuel and propulsion system options when making vehicle procurement decisions. Future research will update the life cycle cost model and continue to add new bus technologies to the transit fleet emissions inventory model.

Project Information

FTA Report No. 0048

This research was conducted by Drs. Scott Wayne, Nigel Clark, and Donald Lyons of the West Virginia University Department of Mechanical and Aerospace Engineering. For more information, contact FTA Project Manager Lisa Colbert at (202) 366-9261, lisa.colbert@dot.gov. All research reports can be found at **www.fta.dot.gov/research**.