

Imtiyaz - Shabbir Moulvi

Thesis

Driver Behaviour Variability and its Effect on Vehicle Exhaust Emissions

Abstract

Certain modes of driving, i.e. excessive speeding and heavy acceleration, heavily contribute to total emissions of air pollutants and greenhouse gas emissions during a trip. Emission factor models, such as EPA's MOBILE, are unable to capture the full effect of such driving modes because they are primarily concerned with fleet-wide emissions based on average speeds. This study looked at alternative models which attempt to quantify variations in emissions due to the differences associated with individual driving patterns among a random group of drivers under conditions in which they drive to work/home everyday.

A sample size of 30 drivers in the age range of 20 – 50 years was chosen to drive on a route consisting of urban and rural roads. The experiment was conducted in a Carleton University vehicle installed with a data collection device manufactured by Netistix Technologies Corporation. This device captured, stored and transmitted the required data to a central computer station through Wi-Fi. This data was then downloaded from the Netistix website. The effect on emissions (i.e. CO₂, C), HC, NO_x) and fuel consumption values of differences in driving behaviour were estimated using the Comprehensive Modal Emissions Model (CHEM).

CHEM is a physical load based model which derives the emissions rates empirically from the fuel rate. It used second-by-second data as input and is able to predict second-by-second emissions and fuel consumption. On the other hand, the next generation of emission model for motor vehicles, Motor Vehicle Emission Simulator (MOVES) is a road load based model and uses Vehicle Specific Power (VSP) and speed operating mode bins to describe the activity of the motor vehicle fleet. By using emission factors associated with such bins by vehicle type, model year, etc. the emissions from the vehicle fleet can be estimated. The analysis of the Carleton vehicle data with different drivers is therefore aimed at characterizing each of the runs by these bins.

Keywords: Emissions, fuel consumption, driving behaviour/pattern, MOBILE, CHEM, MOVES, PERE, second-by-second, vehicle specification power (VSP).

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