



Fuel Consumption/Emissions Study Shows Environmental Benefits in Paving with Concrete

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The RMC Research & Education Foundation recently released a new report titled *Effect of Pavement Type on Fuel Consumption and Emissions in City Driving*. The study, conducted at the University of Texas at Arlington (UTA), focused on urban driving conditions on streets and local roads. UTA's Dr. Sia Ardekani was the lead researcher on the project and was assisted by Ms. Palinee Sumitsawan.

The study includes data collected from multiple runs of an instrumented passenger van driven on city streets on two pavement types: Portland cement concrete (PCC) vs. asphaltic concrete (AC); in two driving modes: constant speed vs. acceleration; and with two surface ambient conditions: dry vs. wet. Other factors that may influence fuel consumption were controlled or kept the same during data collection. Variables recorded for the study include date, time, ambient air temperature, atmospheric pressure, humidity, wind speed and direction, the temperature of the fuel flowing into and out of the tank, vehicle weight, tire pressure and auxiliary devices (e.g. A/C, radio, headlights, windows).

There were eight factor-level combinations: four each for PCC and AC - constant speed-dry, constant speed-wet, acceleration-dry and acceleration-wet. There were five replicates for each factorial combination resulting in 40 runs.

The chart above summarizes the results for fuel consumption and CO₂ emissions of two sets of factors measured: constant speed under dry and wet conditions for both PCC and AC. The data clearly show that the fuel consumption per unit distance is lower on PCC vs. AC under both dry and wet pavement conditions for a typical city-street speed of 30 mph. In fact, overall fuel consumption rates indicate **fuel consumption savings of 3 percent to 17 percent on PCC pavements**, depending on the driving mode, surface conditions, and crown and substructure materials and thicknesses. The percentage savings could also vary depending on the vehicle mix. Emissions factors are also significantly lower on PCC over AC.

Also developed for this project is the tool *Roadway Fuel Consumption and Emissions Calculator*. It was designed for use by State Departments of Transportation and local municipalities to help them quantify the total fuel consumption and project carbon footprint over the design life of the pavement.

Given the national stated goal of reducing dependence on oil and the world-wide interest in reducing emissions and promoting "green" initiatives, the timing of this study could not be better.

This study complements the many other sustainable development resources available from the RMC Research & Education Foundation's website at www.rmc-foundation.org. Both the study and calculator are available for download from the website and have been added to our *Research Supporting Sustainable Development* deliverables CD. For more information on this project, or other Foundation programs, please contact Julie Garbini or Jennifer LeFevre for more information.

PCC = Portland Cement Concrete AC = Asphaltic Concrete	Fuel Consumed (millions gals/yr)	Total CO ₂ (million metric tons/yr)
PCC, 30 MPH Constant Speed, Dry	3,598	12.7
AC, 30 MPH Constant Speed, Dry	3,775	13.32
PCC, 30 MPH Constant Speed, Wet	4,783	16.88
AC, 30 MPH Constant Speed, Wet	4,942	17.44
Note: These estimates are based on total vehicle miles of travel in the Dallas-Fort Worth region alone.		

The CO₂ Difference

The chart above indicates a difference in CO₂ emissions of 0.62 million tons per year in the Dallas-Fort Worth (DFW) Region alone. The average cost of CO₂ clean-up is approximately \$18 per metric ton. Therefore, the use of concrete could save approximately \$11 million per year in CO₂ clean up costs in the DFW area annually, and much higher savings nation-wide.