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Evaluating Real World Driving Behavior: The Characterization of Eco-Driving Strategies and Their Role in Reducing Tailpipe Emissions and Fuel Consumption

ABSTRACT

Greenhouse gas (GhG) emissions, specifically CO2, are of rising concern due to their deleterious effects upon the environment and human health. Transport sector reliance upon fossil fuel energy – CO2 being the primary byproduct of combustion - generates approximately one fourth of total U.S. GhG emissions (Barkenbus, 2010). Despite significant improvements in U.S. vehicle fleet CAFE standards and the introduction of fuel-efficient hybrid vehicles to the passenger vehicle market, fuel consumption continues to rise, underscoring the need to address driver behaviors which are wasteful. Studies conducted recently have shown the impact of fuel advisory interfaces and driver training programs upon simulated and real world trip fuel consumption, with individual driver improvements of up to 15% (Beusen, 2009, Boriboonsomin et al, 2010). Little research has been conducted, however, which investigates the impact of road infrastructure and driver constraints upon the relative efficiency of vehicular operations within a spatial context. To better understand the relationship between driving behavior and fuel consumption and emissions, this investigation proposes to assess the efficacy of specific eco-driving strategies within constrained driving conditions through a naturalistic study of second by second on-board real world data within an urban downtown context.

In this study, vehicle parameters including speed, acceleration, and fuel consumption are measured along a specified route traveled by two vehicles through Chittenden County, Vermont. Though many studies seek to normalize driver behaviors by removing data collected under constrained driving conditions, i.e. the sudden occurrence of a red light or a crossing pedestrian, the observed frequency of these incidents, and the significant variation in vehicular trajectory which results, is of interest in assessing corrective eco-driving responses across discrete road links. Additional comparison is made between the two vehicles, one hybrid and one conventional 2010 Toyota Camry, to assess the relative benefits of eco-driving between the two vehicle platforms. The outcome of this spatial analysis, conducted across 40 discretized road segments of varying grade, signalization and block length within downtown Burlington, Vermont, shall characterize specific modal behaviors, i.e. acceleration and deceleration, in both constrained and unconstrained conditions. The impact of specific eco-driving strategies upon fuel consumption, i.g. engine coasting and observance of minimum vehicle headways, shall be quantified within this relative spatial context.

REFERENCES

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