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Vehicle Activity Characterization Approach to Quantify On-Road Mobile Source Emissions

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Abstract : Transportation agencies and researchers in the past have estimated emissions using one average speed and volume on a long stretch of roadway. Other methods provided better accuracy utilizing annual average estimates. Travel demand models provided an intermediate level of detail through average daily volumes. Currently, higher accuracy can be established utilizing microscopic analyses by splitting the network links into sub-links and utilizing second-by-second trajectories to calculate emissions. The need to accurately quantify transportation-related emissions from vehicles is essential. This paper presents an examination of four different approaches to capture the environmental impacts of vehicular operations on a 10-mile stretch of Interstate 4 (I-4), an urban limited access highway in Orlando, Florida. First, (at the most basic level), emissions were estimated for the entire 10-mile section 'by hand' using one average traffic volume and average speed. Then, three advanced levels of detail were studied using VISSIM/MOVES to analyze smaller links: average speeds and volumes (AVG), second-by-second link drive schedules (LDS), and second-by-second operating mode distributions (OPMODE). This paper analyzes how the various approaches affect predicted emissions of CO, NOx, PM2.5, PM10, and CO2. The results demonstrate that obtaining precise and comprehensive operating mode distributions on a second-by-second basis provides more accurate emission estimates. Specifically, emission rates are highly sensitive to stop-and-go traffic and the associated driving cycles of acceleration, deceleration, and idling. Using the AVG or LDS approach may overestimate or underestimate emissions, respectively, compared to an operating mode distribution approach.

Keywords : limited access highways, MOVES, operating mode distribution (OPMODE), transportation emissions, vehicle specific power (VSP)
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