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ESTIMATION OF VEHICLE EMISSION ON MAINLINE FREEWAY UNDER ISOLATED AND INTEGRATED RAMP METERING STRATEGIES

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Abstract

On freeways with multiple on-ramps, it is a common practice to design a ramp metering strategy so as to regulate the entering rates from ramps and minimize the disruptions on the mainline. Most of the existing studies examine the performance of ramp metering on mobility and safety, rather than their impacts on the environment. This paper focuses on the estimates of vehicle emissions along mainline freeways under various ramp metering strategies. Vehicle speed and acceleration rates were measured during a field test along Interstate Freeway I-45 with five on-ramps in Houston, Texas, USA, while the instant vehicle emissions were estimated accordingly. The test was carried out in three scenarios: (1) no ramp metering, (2) isolated ramp metering, and (3) integrated ramp metering. Results show that, the isolated ramp metering strategy yields the highest emissions on freeway mainline among the scenarios. The mobility is significantly improved for the integrated ramp metering strategy, which also significantly contribute to the reduction in total emissions due to the reduced travel time and well-managed queue length on on-ramps. As a conclusion, the integrated ramp metering is with better mobility and environmental effects than the isolated and no metering strategies.

Keywords: air pollution, integrated control, isolated control, ramp metering

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