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Model for Calculating Traffic Mass and Deceleration Delays Based on Traffic Field Theory

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Abstract : This study identifies two typical bottlenecks that occur when a vehicle cannot change lanes: car following and car stopping. The ideas of traffic field and traffic mass are presented in this work. When there are other vehicles in front of the target vehicle within a particular distance, a force is created that affects the target vehicle's driving speed. The characteristics of the driver and the vehicle collectively determine the traffic mass; the driving speed of the vehicle and external variables have no bearing on this. From a physical level, this study examines the vehicle's bottleneck when following a car, identifies the outside factors that have an impact on how it drives, takes into account that the vehicle will transform kinetic energy into potential energy during deceleration, and builds a calculation model for traffic mass. The energy-time conversion coefficient is created from an economic standpoint utilizing the social average wage level and the average cost of motor fuel. Vissim simulation program measures the vehicle's deceleration distance and delays under the Wiedemann car-following model. The difference between the measured value of deceleration delay acquired by simulation and the theoretical value calculated by the model is compared using the conversion calculation model of traffic mass and deceleration delay. The experimental data demonstrate that the model is reliable since the error rate between the theoretical calculation value of the deceleration delay obtained by the model and the measured value of simulation results is less than 10%. The article's conclusion is that the traffic field has an impact on moving cars on the road and that physical and socioeconomic factors should be taken into account while studying vehicle-following behavior. The deceleration delay value of a vehicle's driving and traffic mass have a socioeconomic relationship that can be utilized to calculate the energy-time conversion coefficient when dealing with the bottleneck of cars stopping and starting.

Keywords : traffic field, social economics, traffic mass, bottleneck, deceleration delay
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