

Modeling and Performance Evaluation of an Urban Corridor under Mixed Traffic Flow Condition

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Abstract : Indian traffic can be considered as mixed and heterogeneous due to the presence of various types of vehicles that operate with weak lane discipline. Consequently, vehicles can position themselves anywhere in the traffic stream depending on availability of gaps. The choice of lateral positioning is an important component in representing and characterizing mixed traffic. The field data provides evidence that the trajectory of vehicles in Indian urban roads have significantly varying longitudinal and lateral components. Further, the notion of headway which is widely used for homogeneous traffic simulation is not well defined in conditions lacking lane discipline. From field data it is clear that following is not strict as in homogeneous and lane disciplined conditions and neighbouring vehicles ahead of a given vehicle and those adjacent to it could also influence the subject vehicles choice of position, speed and acceleration. Given these empirical features, the suitability of using headway distributions to characterize mixed traffic in Indian cities is questionable, and needs to be modified appropriately. To address these issues, this paper attempts to analyze the time gap distribution between consecutive vehicles (in a time-sense) crossing a section of roadway. More specifically, to characterize the complex interactions noted above, the influence of composition, manoeuvre types, and lateral placement characteristics on time gap distribution is quantified in this paper. The developed model is used for evaluating various performance measures such as link speed, midblock delay and intersection delay which further helps to characterise the vehicular fuel consumption and emission on urban roads of India. Identifying and analyzing exact interactions between various classes of vehicles in the traffic stream is essential for increasing the accuracy and realism of microscopic traffic flow modelling. In this regard, this study aims to develop and analyze time gap distribution models and quantify it by lead lag pair, manoeuvre type and lateral position characteristics in heterogeneous non-lane based traffic. Once the modelling scheme is developed, this can be used for estimating the vehicle kilometres travelled for the entire traffic system which helps to determine the vehicular fuel consumption and emission. The approach to this objective involves: data collection, statistical modelling and parameter estimation, simulation using calibrated time-gap distribution and its validation, empirical analysis of simulation result and associated traffic flow parameters, and application to analyze illustrative traffic policies. In particular, video graphic methods are used for data extraction from urban mid-block sections in Chennai, where the data comprises of vehicle type, vehicle position (both longitudinal and lateral), speed and time gap. Statistical tests are carried out to compare the simulated data with the actual data and the model performance is evaluated. The effect of integration of above mentioned factors in vehicle generation is studied by comparing the performance measures like density, speed, flow, capacity, area occupancy etc under various traffic conditions and policies. The implications of the quantified distributions and simulation model for estimating the PCU (Passenger Car Units), capacity and level of service of the system are also discussed.

Keywords : lateral movement, mixed traffic condition, simulation modeling, vehicle following models

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