A Simulation Model of Lane-Changing On a Multilane Highway

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ABRIDGMENT

•A DIGITAL simulation model of lane-changing on a multilane highway is described. The model covers 2-, 3-, and 4-lane sections of freeway, and provides for scanning of vehicle trajectories once every second.

Vehicles are input randomly into each lane, with desired speeds sampled from a normal distribution and headways from shifted exponential distribution. The parameters of these distributions are treated as exogenous input to the model, identified by lane. The motion of each vehicle is controlled by a set of simple car-following laws, including specification of maximum acceleration/deceleration rates, an "uncomfortable headway" distribution, and an exponential gap acceptance function. Again, the parameters of these distributions are treated as exogenous input.

Lane changes are generated whenever a vehicle is forced to travel at an "uncomfortable headway" and finds an "acceptable gap" available in an adjacent lane.

Output of the model includes lane-change counts, total and average lane-changing delay, average speeds, and the distribution of accepted gaps. The paper discusses the calibration and validation of the model based on Chicago area data, and describes the results of an extensive program of sensitivity testing. These latter tests suggest that the pattern of lane-changing is most strongly dependent on the desired speed distribution, and is not unduly sensitive to gap acceptance or acceleration/deceleration inputs. The model effectively replicates observed lane-changing behavior.

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