

Effects of Vehicles Lane Change Manoeuvre on Traffic Breakdown and Congestion in Highways

by

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ABSTRACT

Vehicular traffic congestion on highways and within urban areas is a major problem experienced worldwide in our roads network. It is one of the draw back on people quality of life causing delays, accidents and environmental pollutions. Thus a proper understanding of traffic congestion in our roads is necessary for effective traffic flow management and control. Traffic breakdown is the main cause of traffic congestion in our multi-lane roads due to highway bottlenecks such as lane-drops, on and off-ramps. In this study the three phase traffic flow theory of Kerner(2009) is outlined and the nature of traffic breakdown at highway bottlenecks explained. A multi-lane macroscopic traffic flow model of Aw-Rascle type is derived from kinetic traffic flow model of Klar and Wegener (1998), which expresses the lanechange term explicitly. For simulation of this traffic congestion, we consider a highway with three traffic lanes that has a bottleneck i.e an off-ramp. The model equations for each lane are solved numerically using Godunov scheme, whereby the Euler's method was used for the source term. The results of simulation near and within the bottleneck is presented in form of graphs and space-time plots. These results show that vehicle lane-change manoeuvres lead to heavy traffic breakdown and congestion on the inner lane compared to the other two lanes due to vehicles overlapping while squeezing to enter the bottleneck.

Keywords: Three phase traffic flow theory, Traffic breakdown, Traffic congestion, Highway bottlenecks, Vehicle lane-change manoeuvre, Over-acceleration,Speed adaptation.