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A macroscopic traffic model for highway work zones: Formulations and numerical results

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Abstract: This study presents a multilane model for analyzing the dynamic traffic properties of a highway segment under **a lane-closure operation** that often incurs complex interactions between mandatory lane-changing vehicles and traffic at unblocked lanes. The proposed traffic flow formulations employ the hyperbolic model used in the non-Newtonian fluid dynamics, and assume the lane-changing intensity between neighboring lanes as a function of their difference in density. The results of extensive simulation experiments indicate that the proposed model is capable of realistically replicating **the impacts of lane-changing maneuvers** from the blocked lanes on the overall traffic conditions, including the interrelations between the approaching flow density, the resulting congestion level, and the exiting flow rate from the lane-closure zone. Our extensive **experimental analyses** also confirm that traffic conditions will deteriorate dramatically and evolve to the state of traffic jam **if the density has exceeded its critical level** that varies with the type of lane-closure operations. This study also provides a convenient way for computing such a critical density under various lane-closure conditions, and offers a theoretical basis for understanding the formation as well as dissipation of traffic jam.