

Peer Review

Review of: "Can Human Drivers and Connected Autonomous Vehicles Co-exist in Lane-Free Traffic? A Microscopic Simulation Perspective"

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I recommend rejecting this paper for the following main reason: The microscopic analysis and simulations of HDVs (human driving vehicles) are made using the wrong mathematical framework for real traffic. Indeed, as explained in detail in the book [A1], the SUMO model, as well as other microscopic traffic flow models, which are referred to and used for the theoretical analysis of traffic, are invalid for understanding real traffic. For this reason, the results of this paper are not interesting either for practice or for the further development of traffic theory.

Indeed, as was found in empirical results and the three-phase traffic theory that explained the empirical results [A1], a phase transition from free flow to synchronized flow (synchronized flow (S) is a phase of congested traffic) explains traffic breakdown and capacity in vehicular traffic. This transition was called an F->S transition. The F->S transition (traffic breakdown) exhibits the empirical nucleation nature. The SUMO model and other microscopic traffic flow models used in the paper cannot show and cannot explain empirical features of synchronized flow and the empirical nucleation nature of the F->S transition (traffic breakdown). For this reason, the basic mathematical framework developed and used for mixed vehicular traffic in this paper is totally wrong for the description of traffic breakdown and capacity.

To understand that and why the SUMO model cannot show and cannot explain empirical features of synchronized flow and the empirical nucleation nature of the F->S transition (traffic breakdown), the authors should read Chaps. 6–8 of the book [A1] and compare simulations of SUMO with empirical

results. Then the authors can understand that and why SUMO is a wrong modeling approach for simulations of features of real traffic.

In this book [A1], the authors can also find references to microscopic three-phase traffic flow models that, as proven in other books about three-phase traffic theory (see references to the books in the “Preface” of [A1]), can show and explain empirical features of synchronized flow and the empirical nucleation nature of the F->S transition (traffic breakdown). For a correct study of mixed traffic, the authors can use one of these three-phase models or create their own three-phase model that should be able to show and explain empirical features of synchronized flow and the empirical nucleation nature of the F->S transition (traffic breakdown).

Additional literature:

[A1] B.S. Kerner “Understanding real traffic: Paradigm shift in transportation science” (Springer, Cham 2021).

Declarations

Potential competing interests: No potential competing interests to declare.