Reply to "Comment on 'Cellular automata model simulating traffic interactions between on-ramp and main road' "

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We agree with the argument presented in the previous Comment in which the characteristics of a phase diagram are dictated by the prescribed asymmetric rules of on-ramp. We further point out that the existence of the four regions for $v_{max}>1$ is due to the rule in the case of $t_a=t_b$ and the rule that two cars can occupy the same site successively in one time step. We argue that the existence of the stable limit cycles in region IV is the property of the deterministic on-ramp system, and it is not the cause of the formation of region IV.

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Recently, the authors have studied the interactions between the traffic flows on main road and on-ramp using the Nagel-Schreckenberg model [1]. Two different types of phase diagram are reported: four distinct regions are observed in the cases of $v_{max}>1$, while only two regions are present in the case of $v_{max}=1$. In Ref. [2] Huang and Huang point out that the characteristics of the phase diagram are dictated by the prescribed asymmetric rules of on-ramp. We agree to this point. In this Reply, we investigate the cause for the different types of phase diagrams, which is not addressed in Ref. [2].

To this end, we assume that there also exist only two regions for $v_{max}>1$. Without loss of generality, we choose $v_{max}=2$. Considering the case $a_1=a_2=1$, our assumption requires that the cars on road B cannot enter the main road under the three situations presented in Fig. 1. For the situation in Fig. 1(c), this is the case. However, this is not the case for the situations in Figs. 1(a) and 1(b).

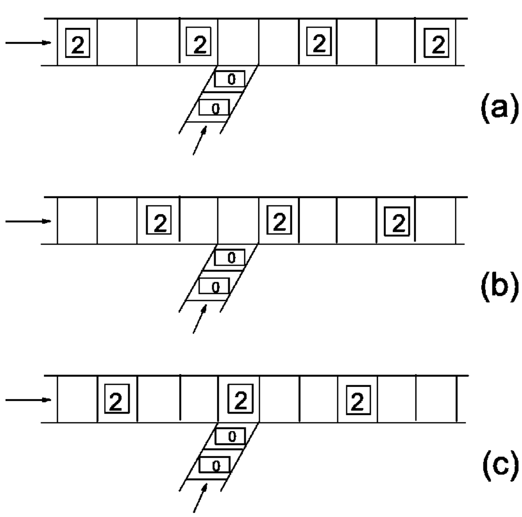

FIG. 1. The three assumed situations in the case of $v_{max}=2$. The square denotes the car and the one-digit integer shows its velocity.

The situation in Fig. 1(a) will evolve into that presented in Fig. 2(a) according to our rules. In one time step, two cars A_{lead} and B_{lead} occupy the site C_0 successively. The situation in Fig. 1(b) will evolve into that presented in Fig. 2(b), because $t_a=t_b$ in this case and the car B_{lead} has the priority (for its nearness to site C_0).

Therefore, we conclude that the existence of the four regions for $v_{max}>1$ is due to the rule in the case of $t_a=t_b$ and the rule that two cars can occupy the same site successively in one time step. If we change the rules into these, (i) the priority is endowed to the car A_{lead} when $t_a=t_b$, no matter what the distance from C_0; (ii) one site is allowed to be occupied by only one car in one time step, then the phase diagram becomes qualitatively the same for all v_{max}. It consists of only two regions I and II.

Note that we have confined ourselves to the deterministic case. We would like to point out that regions III and IV will appear in the phase diagram of $v_{max}=1$ if the randomization effect is considered [3].

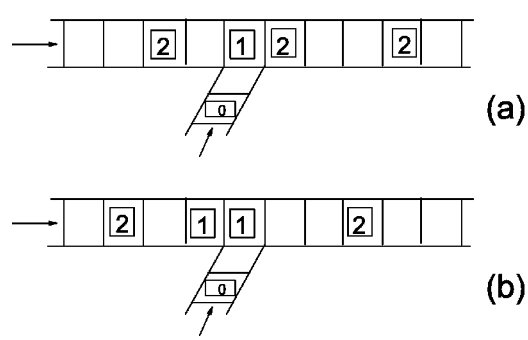

FIG. 2. The situations evolving from those in Figs. 1(a) and 1(b).

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Huang and Huang also pointed out that in the congested phase (region IV), the configurations evolve as stable limit cycles. We argue that this is the property of the deterministic on-ramp system, and it is not the cause of the formation of region IV. Our further simulations [3] show that when the randomization effect is considered, region IV still exists. Obviously, the configurations cannot evolve as stable limit cycles in this nondeterministic case.

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