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Study of the driver's behavior of minimizing the risk when a driver encounters a situation of a high risk of collision during performing a lane change on a highway

Yuki Manabe [1)] **Toru Kojima** [1)] **Tsunetoshi Iwase** [1)]

1) National Agency for Automobile and Land Transport Technology Ntional Traffic safty and environment Laboratory
7-42-27 Jindaiji-Higashimachi, Chofu, Tokyo, 182-0012, Japan (E-mail: y-manabe@ntsel.go.jp)

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Amendment proposal to allow vehicles (passenger cars) which have Automated Lane keepng system (ALKS) to change lanes for the purpose of overtaking (Regular Lane Change, RLC) in the United Nations Convention Regulations (UN-R157) concerning automated driving devices used on highways, etc. (hereafter UN-R157/01 series) was adopted. Therefore, ALKS vehicles (passenger cars) that will be on the market in the future will be able to perform a lane change (LC) at the disision of the system. However, compared to lane keeping, there are more traffic participants who need to be aware of lane changing, so it is considered to be a behavior that is likely to fall into a dangerous situation. Therefore, when an ALKS vehicle performs a LC, it needs the ability to avoid possible hazardous events. UN-R157 mentions the collision avoidance capability of ALKS vehicles. If the collision avoidance ability is not quantitatively defined, the collision avoidance ability must be equal to or higher than that of a Competent and Careful human driver (C&C driver). Therefore, it is necessary to investigate the driving behavior of C&C drivers in order to discuss the collision avoidance ability of autonomous vehicles.

In this report, data on the driving behavior of 20 subjects were obtained using a driving simulator, and the driving behavior of general drivers who encountered dangerous events when performing LC was investigated.

An example of an experimental scenario is shown in Fig. 1 and Tab. 1. In the scenario shown in Fig. 1, the Ego vehicle running in lane 1 and the Subject vehicle running in lane 3 change lanes at the same time and make a danger of collision on lane 2. The percentage of driving behavior is shown in Fig. 2 and the timing of the subject's reaction is shown in Fig. 3. In this way, a quantitative evaluation of driving behavior when avoiding dangerous events was performed, and drivers who took better avoidance behavior were assumed to be C&C drivers. The characteristic driving behavior of C&C drivers was summarized.

Tab. 1 Experimental condition (LC4)

LC No.	4_1	4_2	4_3	4_4	4_5	4_6	4_7
Start of event	Start of Ego LCM*	Start of Ego LCP**	Start of Ego LCM	Start of Ego LCP	Start of Ego LCM	Start of Ego LCP	Start of Ego LCP
x_2 [m]	-20	-20	-4	-4	10	10	-4
Sub Winker	On	On	On	On	On	On	Off
V_{Ego} [km/h]	100	100	100	100	100	100	100
V_{Sub1} [km/h]	100	100	100	100	100	100	100
V_{Lead} [km/h]	80	80	80	80	80	80	80

* LCP: From start of the direction indecator lamps to end of the direction indecator lamps
**LCM: From the vehicle's front wheel closet to the lane marking to the vehicle's rear wheel closet to the lane marking

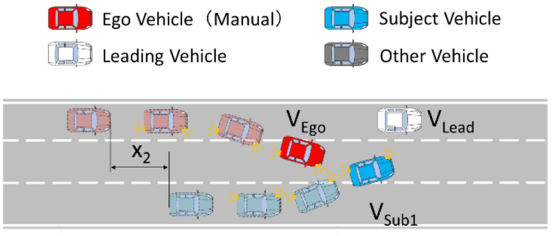

Fig. 1 Outline of the experimental scenario (LC4)

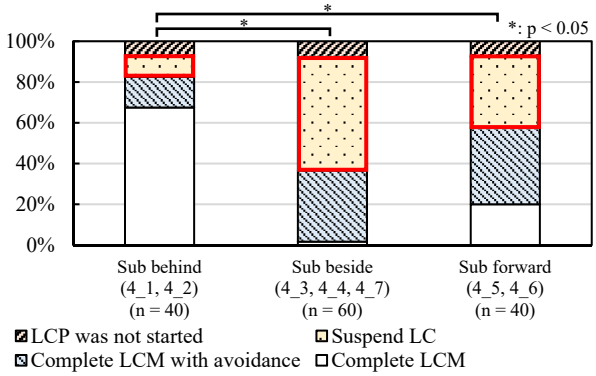

Fig. 2 Percentage of driving behavior (LC4)

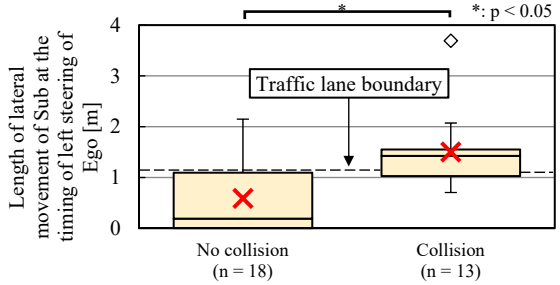

Fig. 3 Length of lateral movement of Sub at the timing of left steering of Ego (LC4)