

# Study of Information Content of Signal Passing Support to Improve Driver Behavior at Dilemma Zone

-Effect of Information Content Including Uncertainty on Whether a Driver can Passing a Signalized Intersection before Yellow Light -

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In this study, we investigated the information content of signal passing support to improve driver behavior, especially unsafe behaviors in the dilemma zone when approaching or entering a signalized intersection. This study consisted of a first experiment and a second experiment. The experiments were conducted by using a motion-based driving simulator. The driving simulator consisted of a main car body, a 6-DOF motion system and eight 150-inch screens installed around the car body converting 360-degree field of view. The information content of signal passing support were displayed to participants through a heads-up display.

In the first experiment, we requested participants to drive on a road with signalized intersection with the signal passing support of Traffic Signal Prediction Systems (TSPS) or without TSPS. From the viewpoint of driver and traffic safety, the signal passing support of TSPS (TSPS- $\alpha$ ) was set to display its information contents based on the conventional system design such that a car can reach the road beyond the intersection before the traffic light changes from green to yellow. We conducted two way of the experimental design: one factor was on TSPS (using TSPS- $\alpha$ , not using TSPS- $\alpha$ ) and another factor was on the time to change to the yellow light after passing at the position of optical beacon. As a result, especially in the scene facing near the dilemma zone, the TSPS- $\alpha$  could not always improve unsafe driving behavior, and it also resulted in a lower subjective score on the ease of determining whether to pass or stop and the usefulness for the TSPS- $\alpha$ . This suggests that there is a difference in the criteria for judging whether to pass through or stop at the intersection between human driver and the signal passing support of the TSPS- $\alpha$ . Therefore, we modified the system design of the criteria for passing through and stopping at and set up an additional information content which expressed that it was difficult to estimate and judge whether a driver could pass the intersection before the yellow light.

In the second experiment, we reflected the results of the first experiment into a TSPS (TSPS- $\beta$ ) and evaluated the effect of TSPS- $\beta$ , redesigned information content of signal passing support on driving behavior. Figure 1 shows the subjective ease of determining whether to pass or stop the intersection in the scene facing near the dilemma zone. Figure 2 shows the vehicle speed change before the yellow light. This suggest that the TSPS- $\beta$  tended to make the participants a small deceleration before the change to the yellow light and avoid the dilemma zone. Integrating the aboved-mentioned results, the TSPS- $\beta$  tended to make the participants determine whether to pass through or stop at the intersection more easily than the other conditions. Such modification of the system design also makes drivers feel that the system is more useful. In addition, the driver behavior expects to be improved by introducing by introducing and displaying the additional information content which expresses that it is difficult to estimate or judge whether to pass through or stop at the intersection.

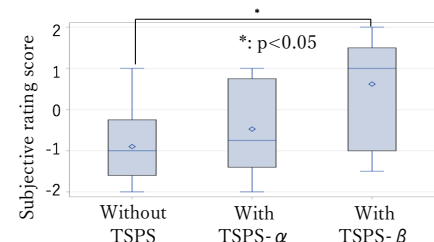


Fig.1 Subjective ease of determining whether to pass through or stop at the intersection

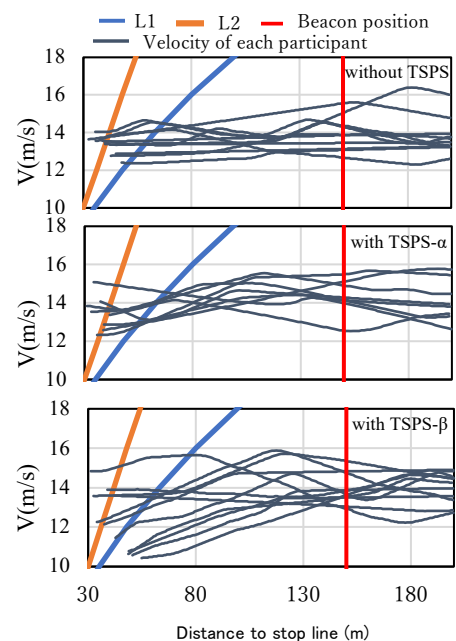


Fig.2 Relationship between vehicle speed and dilemma zone before the yellow light