Analysis of the Effect of Improvement in Traffic Smoothness on Additional Passing Lanes using ETC2.0 Probe Information

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1. Introduction

In Japan, the stage construction system has been widely adopted for efficient road maintenance, which temporarily uses two-way two-lane roads and changes them into four-lane roads according to increase in traffic volume. At present, two-way two-lane roads account for about 40% of expressways. On two-way two-lane roads, when the preceding car is traveling at a low speed, passing behaviors may be restricted and the state of following the preceding car may continue, which may impair smooth, safe, and comfortable driving.

The Government Order on Road Design Standards provides installation of an additional passing lane, if necessary, on a two-way two-lane road to provide a high service speed to road users. However, quantitative effect of such an additional passing lane has not been clarified.

Then, we analyzed the effect of improvement in traffic smoothness from installation of an additional passing lane according to traffic volume using ETC2.0 probe information.

2. Setting of analysis sections

In order to analyze the effect of improvement in traffic smoothness using traffic volume and speed data, we selected two sections where an additional passing lane was installed and annual average peak time traffic is different. Table provides the outline of the sections. For analysis, as shown in Fig. 1, a total of 9 sections were set by dividing each additional passing lane and the preceding and following lanes into three sections, respectively.

Table: Outline of the analysis sections

Section name	A	B
Lane extension (km)	1.3	1.1
Annual average peak time traffic (cars/h/lane)	414	840
Regulatory speed (km/h)	70	70
Maximum longitudinal slope (%)	0.8	0.7

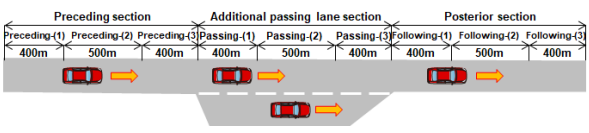

Fig. 1: Image for dividing the sections of additional passing lane, etc.

3. Analysis results

Fig. 2 shows average speed calculated according to traffic volume and 10th percentile speed for two sections A and B. Note that "10th percentile speed" means the low speed generated by one out of 10 cars. It was confirmed from the Figure that the average speed and 10th percentile speed increase in the additional passing lane section, and decrease thereafter. It was also confirmed with the 10th percentile speed that the effect of speed improvement increases as traffic is busy. On the other hand, the 10th percentile speed in the posterior section is much lower than the preceding section when traffic volume is 600 cars/h or more.

This would be because the bottleneck at the end of additional passing lane appeared and impedes traffic flow when traffic volume becomes large.

Consequently, the effect of improvement in traffic smoothness would be expected from installation of an additional passing lane when traffic volume is less than 600 cars / h.

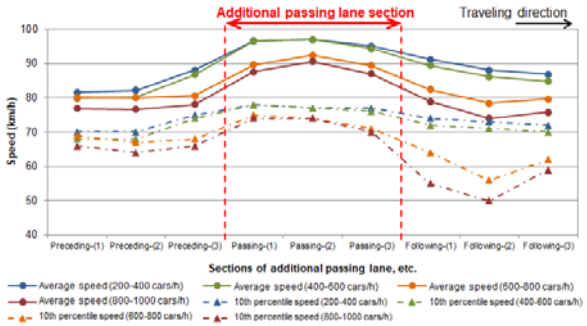

Fig. 2: Speed distribution according to divided sections

4. Conclusion

In this paper, we examined the effect of improvement in traffic smoothness by installation of an additional passing lane based on the relationship between traffic volume and speed. We also intend to continue the study on safe and smooth road planning and design methods.