Examination concerning structures for the use of 2+1 car lanes (Research period: FY 2016–2017)

Hiroki Onishi, Guest Research Engineer Daiya Morita, Guest Research Engineer
Yusuke Kono, Researcher Yoshihiro Tanaka, Senior Researcher Shinsuke Setoshita, Head
Road Division, Road Traffic Department

Keywords: 2+1 car lane, installation interval and lane length, density of following vehicles

1. Introduction

The interim report of the Land and Arterial Road Group, Road Division, Council for Social Infrastructure titled *Efforts To Use Roads Wisely Mainly on Highways* (July 2015) discussed the installation of effective passing lanes and three-lane roads as wise ways to reinforce the functions of temporary two-lane zones. In European countries in recent years, the so-called 2+1 car lane road, in which a passing lane is alternately installed in both directions, is being installed on two-lane roads with the expectation to improve service levels.

Therefore, the Road Division is now examining the installation of 2+1 car lanes in Japan.

2. Outline of analysis based on traffic flow simulation

On two-lane roads, passing behavior becomes limited when the car driving in front is slow, and cars behind the slow car are forced to follow the slow car. The road service level may be lowered in such cases.

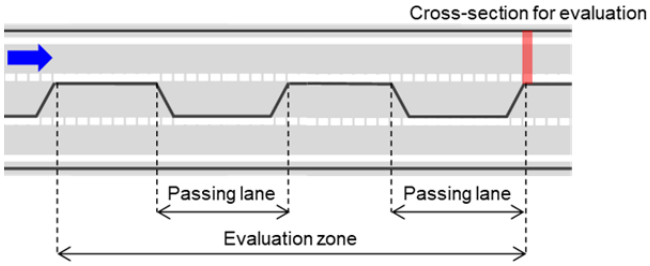

Figure 1. 2+1 lane road model

Table 1. Setup conditions for traffic flow simulation

Category	Setup conditions
Passing lane installation interval and length (km)	1.0, 1.5, 2.0, 2.5
Traffic volume (number of vehicles per hour)	300, 500, 700, 900, 1,000, 1,100, 1,200, 1,300, 1,400, 1,500
Expected speed distribution	Distribution from past studies[1)] is used.
Longitudinal gradient (%)	0

In this study, the density of following cars (number of vehicles where the time headway is within three seconds within a one-kilometer zone) is used as the index to assess the service level to simulate effective structures (installation interval and length of passing lanes) of 2+1 lane roads through traffic flow simulations.

As shown in figure 1, the traffic flow simulation used a road model of three lanes each way where the installation interval and length of passing lanes were equal. The conditions were set as shown in table 1.

3. Outcome of analysis

Table 2 shows the density of the following cars estimated by passing lane installation interval, length, and traffic volume. The gray section in the table indicates cases of installation interval and length with which the density of the following vehicles was at the minimum from the perspective of traffic volume. The analysis found that the density of following vehicles was at the minimum most often in cases of 1.5 km and 2.0 km. Based on the above, effective application of 2+1 lane roads that reduce the formation of the group of vehicles becomes possible when the installation interval and length of passing lanes are 1.5 km or 2.0 km.

4. Conclusion

This paper examined the effective structure of 2+1 lane roads using traffic flow simulations. The authors are going to continue examinations to enable the effective application of 2+1 lane roads.

Table 2. Estimated density of following vehicles

Traffic volume (number of vehicles per hour)	Passing lane installation interval and length (km)			
	1.0	1.5	2.0	2.5
300	1.0	1.1	1.2	1.3
500	2.8	2.7	2.8	3.1
700	5.3	4.8	4.8	5.1
900	8.2	7.4	7.4	7.8
1,000	10.1	9.3	8.9	8.9
1,100	12.6	11.0	11.0	11.1
1,200	14.8	13.1	13.1	12.9
1,300	17.9	15.4	14.4	14.8
1,400	18.5	17.3	17.2	18.5
1,500	23.1	20.2	19.8	20.0

[Reference]
1) *Traffic Engineering* Vol. 45 No. 1 pp. 58-67, 2010.