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EFFECTS OF INTERRUPTION FLOW AT THE DIVERGE AREA

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ABSTRACT

Generally, congestion occurs mainly in a section where a traffic flow merge or diverge. This congestion decreases the mobility of the roads and causes the increase of the logistics cost, and ultimately it is the main cause of weakening the national competitiveness. Therefore, in this study, we analyzed the decrease effect of service traffic by interrupting once more diverge after diverge again.

We analyzed the traffic flow according to the number of interventions when 1,320 veh/h and 1,356 veh/h of traffic entering the main fleet are located in the junction of the Seoul Junction and the West Coast Highway. As a result of analysis, the most frequent headway interval value was 2.5 sec., which was longer than the connecting road (2.0 seconds), but the composition ratio was almost similar in the 8th observation time period when the intervention vehicle was 144 veh/h.

On the other hand, in the 6th observation period where the number of intercepting vehicles was 288 veh/h, the most frequent interval value was the same as the 8th observation time zone, but the composition ratio was reduced to 20%. In general, as the intervention traffic volume increases, the headway distance at the gore section increases, but the headway distance tends to decrease.

In the case of the traffic volume of 1,320 veh/h at the main line section and 288 veh/h in intercepting traffic (24 min. of 5 min. observation traffic), the capacity was reduced by 45.2% compared to the connecting road, the traffic volume of the fishermen was 1,356 veh/h when the traffic volume was 144 veh/h (5 min. observation traffic volume: 12 vehicles), the capacity decreased by 19.7% compared to the connection road.

Keywords: *Interruption, Diverge, Traffic flow, Headway*

I. INTRODUCTION

Recently, the traffic volume of roads has been decreasing due to congestion at all times. This shows that demand and supply do not coincide when we look at the overall road extension and the number of automobile registrations. As of 2003, the number of automobiles that started to soar since 1985 is approaching 150 vehicles per 1km, while actual roads cannot accommodate only 40 vehicles per 1km in South Korea. It can be seen that it can't be done. This phenomenon leads to a decrease in the capacity of the road, which decreases passenger communication capacity [1] and increases the cost of logistics, ultimately resulting in weakening national competitiveness [2] (Figure 1).

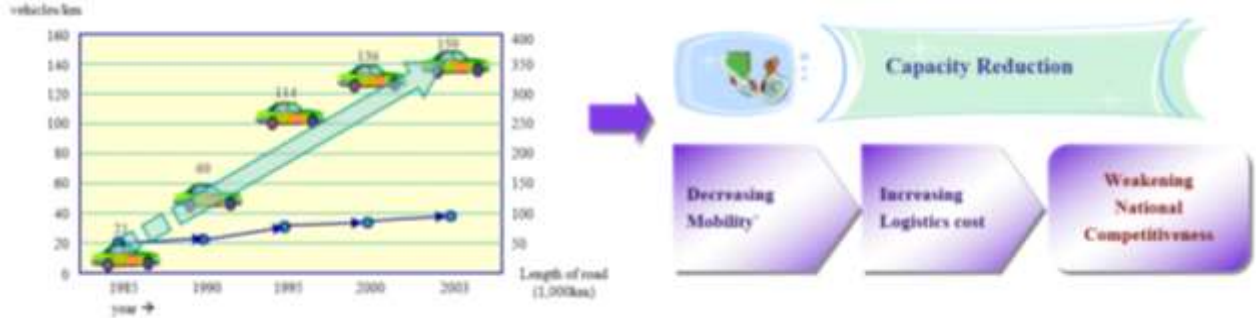

Fig. 1. Conceptual diagram of the problems caused by the number of cars per 1km of road extension

The reason for such congestion is fundamentally caused by the inconsistency of supply and demand including the geometry itself. However, in urban areas with high traffic demand, besides these factors, traffic accidents, falling cargo, wild animals, Congestion occurs due to unforeseen circumstances such as undesirable road use, compared to the less demanded districts. In recent years, various solutions have been proposed and applied mainly in the area where the capacity reduction occurs on the expressway. However, when the alternative to the link diverge section is relatively small and the cause analysis of the alternative reflects the driver's behavior not much.

In this study, we analyze the influence of the intervention of the fisherman in the traffic situation just before the capacity state in the urban highway diverge sectgion, which is in high demand, and discuss the countermeasures.

II. REVIEW OF DOMESTIC AND OVERSEAS TECHNOLOGY TRENDS

In Korea, when queuing occurs in the diverging section to increase the capacity of the diverging section, the traffic police (for example, the ramp to enter the western part of the Seoul inner ring road) and the shoulder are temporarily used. This situation is similar in other countries as well. In this study, we investigated a method to temporarily use long shoulders except for interception.

In order to increase the capacity of the diverge section, there is a tendency to apply a method to temporarily use the shoulder at home and abroad. Of course, in Korea, it is already applied in the main road for diverge section of the metropolitan area. However, if there is a queue in the diverge section, enforcement is carried out to prevent barriers, but it is not a fundamental solution.

Germany, the Netherlands, and the UK are taking advantage of these alternatives [4, 5]. However, the difference between the domestic and foreign countries is that they use the shoulder temporarily only outside the country, whereas in Korea, the shoulder is temporarily used only during the time when the demand is concentrated, and after a certain period (when the driver becomes accustomed) It is used as a daily car.

In Korea, when using long shoulders temporarily, we use the standing type signs as shown in Fig.2

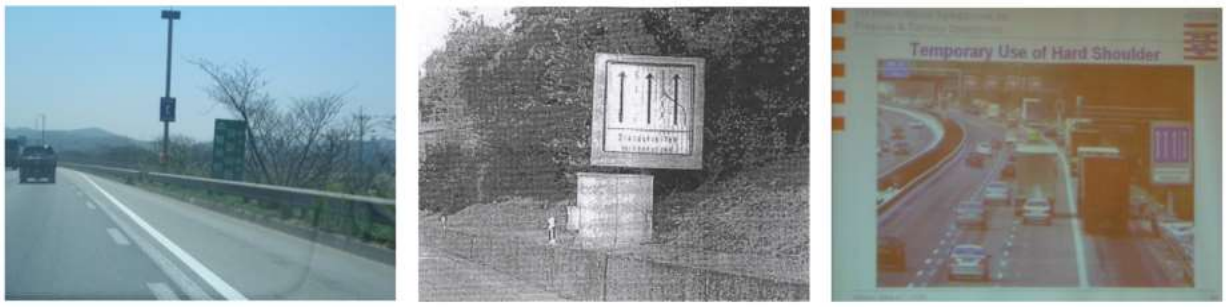

Figure 2. Temporary shoulder use sings (Left: Korea, middle: Netherlands) and practical examples (right: Germany)

In the case of Germany [3], the congestion was attributed to a demand increase of 57%, traffic accidents of 25% and road construction of 15%, and congestion due to soaring demand was dominant. It is utilizing the long shoulder temporarily for. After running the method to temporarily use long shoulders, the traffic accidents decreased by 30%, the travel time decreased by about 20%, the capacity of one car was temporarily increased to 25%, and the limit speed of the shoulder section The results of the short - term effect analysis suggest that most drivers accept it. Of course, in Korea, similar effectiveness analysis has been done to demonstrate the effectiveness of temporary use of long shoulders, but it has not been officially announced until now. As a result of the review, it can be seen that the technology for increasing the diverging capacity of domestic and foreign countries is mainly to use the shoulder temporarily.

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III. Field investigation and data analysis

Field Survey

In this study, it was selected as the site of the Cho-nam Junction, which goes from the Pangyo Bridge to the Seohaean Expressway. This point has a certain distance to the toll gate on the west coast highway from the entrance part of the Seoul suburban circulation highway, and it often affects the weekend such as weekends and holidays.

The demand is steady, and it is classified as the Seohaean Expressway from the Seoul Expressway to the Seomun Expressway. This section is legally permitted to intervene on the road marking.

Figure 3 shows the foreground (left) and observation points (right). The main effect scale was used as the main effect interval for the traffic flow effect by intervention, and the total distance was measured for 2 hours using the headway interval meter. The cargo interval survey was carried out at the gore (G) and the ramp (R), and the car intercepting the connecting road between the gorilla and the connecting road measured the time at which the interrupting occurred at the E point. The focus of the analysis is to analyze the change in the gauge spacing of the gore section according to the vehicle interposing per unit time (5 or 15 min.) versus the gauge interval distribution as the connection.

Figure 3. Field survey site (left) and survey spot (right)

Data Analysis

On-site surveys were conducted for 30 minutes from 11:30 am on May 24, 2006, and for 1 hour and 30 minutes from 11:40 am on the following day. As a result of the survey, the amount of traffic flowing from the Ilsan- The distribution of 1,104 ~ 1,584 veh/h, with about 80% of them entering the Mokpo city.

The number of barriers according to the traffic volume at the time of the survey is shown in Table 1, and is plotted in Fig.4.

Table 1. Field survey data

date	periods	Start		Finish		Ramp volume		Number of interrupting cars		Gore Volume	
		hour	Min.	hour	Min.	5min.	1 hour	5min	Saturate flow	5min	Saturate flow
May 24	1	11	32	11	36	137	1644	19	228	122	1,464
	2	11	37	11	41	123	1476	16	192	101	1,212
	3	11	42	11	46	103	1236	19	228	114	1,368
	4	11	47	11	51	139	1668	11	132	121	1,452
	5	11	52	11	56	126	1512	14	168	103	1,236

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	6	11	39	11	43	136	1632	24	288	110	1,320
	7	11	44	11	48	127	1524	14	168	114	1,368
	8	11	49	11	53	131	1572	12	144	113	1,356
May 25	9	11	54	11	58	130	1560	17	204	109	1,308
	10	11	59	12	3	127	1524	12	144	123	1,476
	11	12	4	12	8	142	1704	10	120	132	1,584
	12	12	34	12	38	116	1392	16	192	99	1,188
	13	12	39	12	43	134	1608	13	156	118	1,416
	14	12	44	12	48	81	972	11	132	102	1,224
May 25	15	12	55	12	59	125	1500	14	168	109	1,308
	16	13	0	13	4	89	1068	8	96	92	1,104
	17	13	5	13	9	77	924	7	84	99	1,188

In order to analyze the intervention effect of the diverge section, the interception number was analyzed for the cases where the traffic volume reaching the gore part is similar. 6 and 8 in Fig. 4, respectively. The traffic volume and the number of interrupts were 6 times (1320, 288 veh/h) and 8 (1356, 144 veh/h), respectively. The impact analysis by classifying interferences tracked the changes in the distance between the gates as the traffic volume reaching the gothic section was more or less interrupted at similar time intervals.

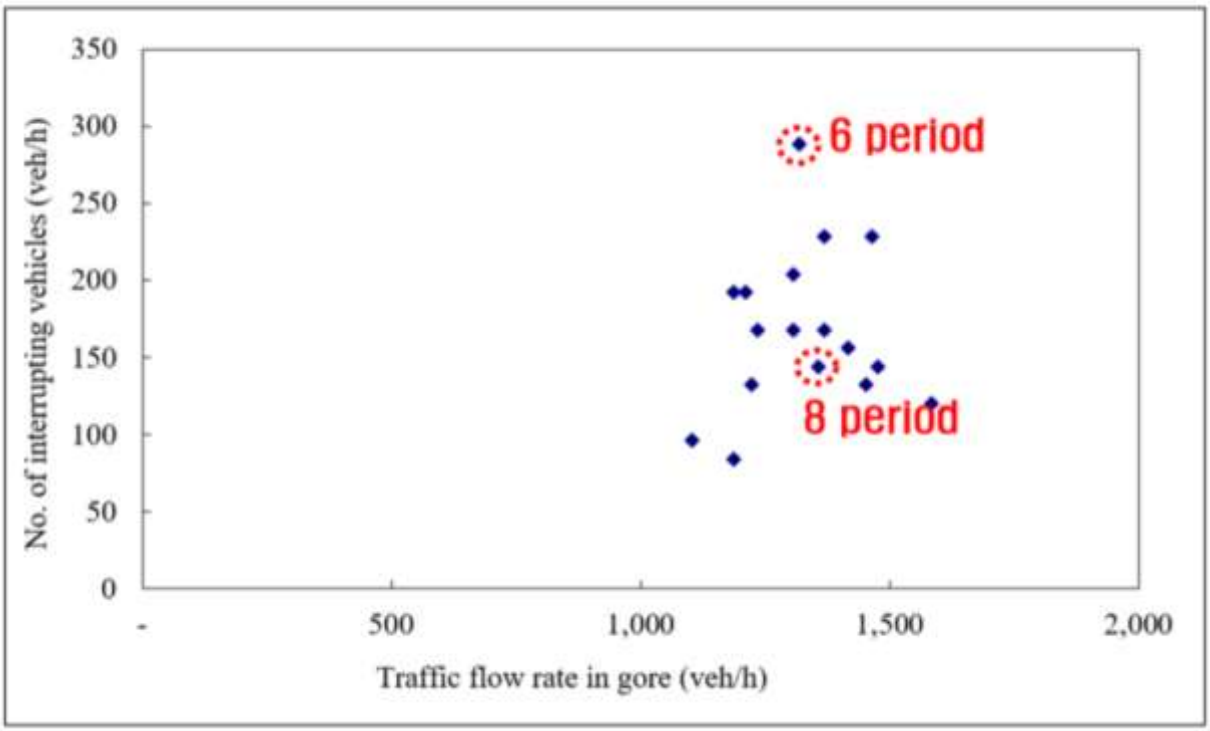

Figure 4. Traffic flow rate in gore to No. of Interrupting vehicles

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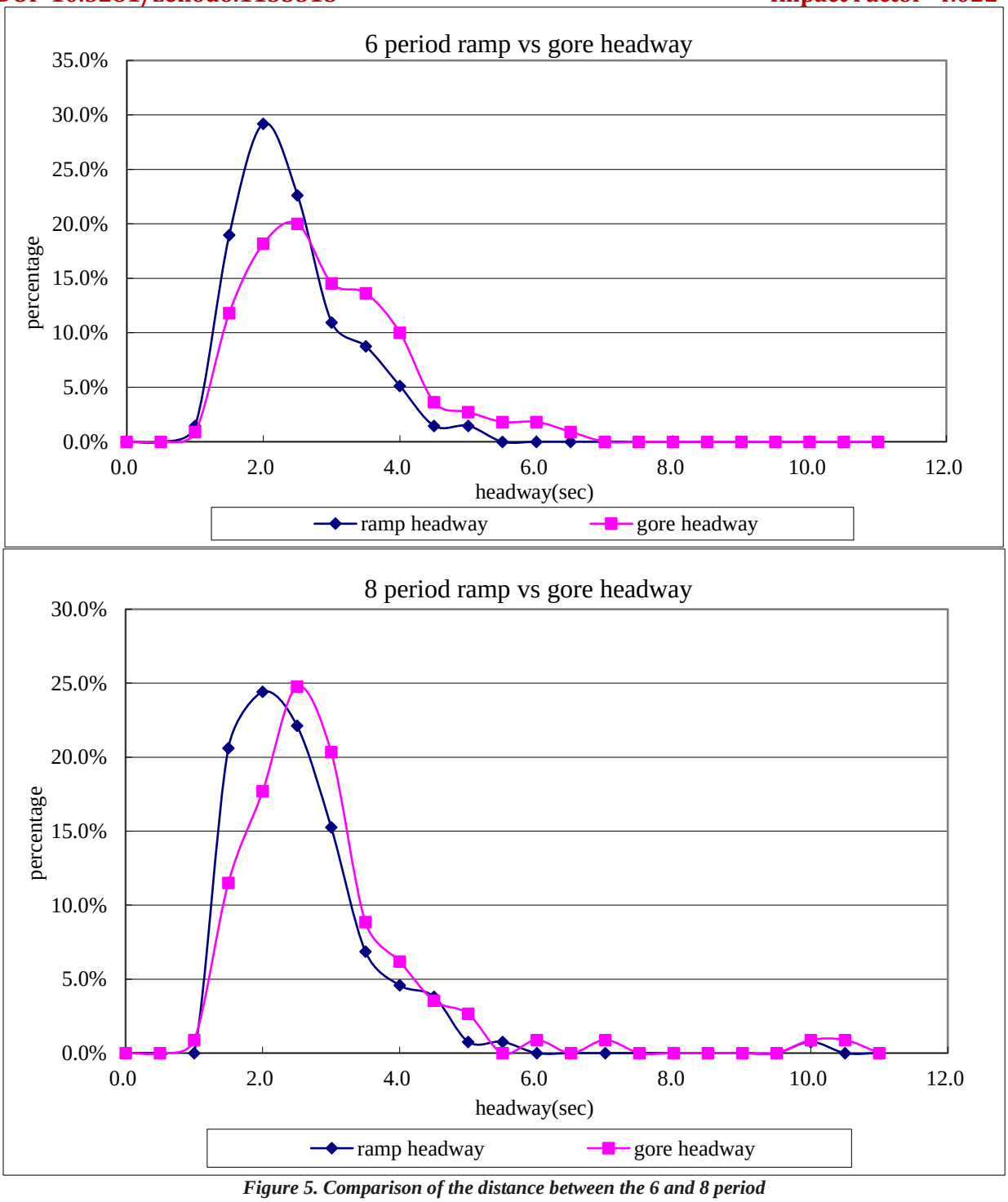

Figure 5. Comparison of the distance between the 6 and 8 period

Figure 5 shows the change in the distance between the gauge sections and the gore sections according to the number of intervention vehicles at observation time intervals 6 and 8. In the case of the most frequent gap distance between the connection and the gore, the connection time is 2 seconds and the gore time is 2.5 seconds. 6, the composition

ratio of the most frequent headway interval value is decreased compared to the No. 8, and the composition ratio is increased as a whole until 4 seconds.

This situation is basically due to the fact that the traffic flow passing through Gore decreases the speed for branching and restores the normal traffic flow in the connecting road, so that the effect of the gap distance distribution is inevitable. However, due to the interruption, there is a considerable capacity reduction effect at the gore.

In this study, the approximate capacity reduction amount is calculated by using the most frequent headway interval value and composition ratio of the connecting road and the optimal headway interval and composition ratio of the gore section, assuming that the temperature of the gore section observed in the observed headway interval distribution is recovered to the mode- The results are shown in Table 2. As shown in Table 2, the capacity reduction rate was 238 veh/h in the 6th time interval with the interrupting capacity of 288 veh/h (24 vehicles with 5 minutes capacity), and the reduction ratio of traffic volume to traffic volume was 45.2% In the 8th time interval, it was interrupted by 144 veh/h (12 veh/h of 5 minute observation). Capacity decrease amounted to 82 veh/h, and the ratio of traffic volume to traffic volume ratio was 19.7%.

That is to say, if the intervention vehicle exceeds about 20% (= 288 / 1,320) of the traffic passing through the main road to the exit route, it can be considered that the capacity is reduced by 45%.

Table 2. Calculation result of capacity reduction by intervention

Periods	spot	Mode of headway (sec)	Percent (%)	Capacity(veh/h)*1)	Volume according to Percent of mode of headway (veh/h)*2)	Ramp/Gore volume	
						Reduction	% of reduction
6 period	Ramp	2.0	29.2	1,800	526	-	-
	Gore	2.5	20.0	1,440	288	∇ 238*3)	45.2%*4)
8 period	Ramp	2.0	24.4	1,800	440	-	-
	Gore	2.5	24.8	1,440	358	∇ 82*3)	19.7%*4)

*1) capacity=3,600sec/mode of headway, *2) capacity×%, *3) 526-288, 440-358, *4) 238/526, 82/440

IV. ALTERNATIVE PRESENTATION AND CONCLUSION

Presenting Alternatives

Operation and enforcement of barriers

In order to solve the problem of capacity decrease due to the interruption, it is necessary to set the interval as the interruption prohibition interval as shown in Fig. 6 and to crack the violation of the driver. Importantly, the road marking and the sign must be installed correctly so that the traffic flow can be classified in advance in the section A and the traffic section in the Mokpo area in the section A, and the section B should be set as a section for prohibiting the interception and performing the interception. This alternative cannot help the driver who has not got the turnaround opportunity in the rider or section A, so you should choose to go out in the other direction rather than overdo it.

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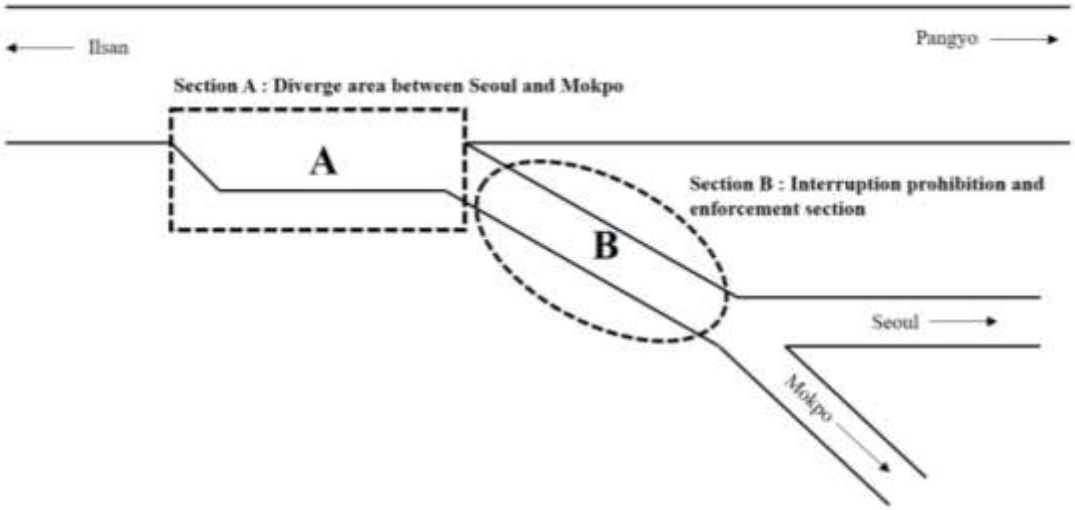

Figure 6. Interruption prohibited interval and intermittent interval setting concept

How to use the shoulder temporarily

Problem of capacity reduction on the road leading to the connection increases the amount of traffic that can pass through the lane, and there is a way to temporarily use the shoulder. This method is advantageous in terms of budget because it does not need unnecessary expansion of the road because it temporarily uses the shoulder. Of course, roads other than highways and highways such as urban highways will not be able to accommodate the length of the shoulders, which is a useful method to positively review on highways.

However, there is a difficulty in decision making because it is unclear when to use the shoulder. As a result, when the intervention is close to 20% at about 1,320 ~ 1,356 veh/h traffic volume, the capacity is reduced to about 45%. Although this level of traffic is not actual capacity, it is suggested to connect the connection capacity of 1,800 passenger cars to the capacity manual and the capacity to refer to the calculation of the number of passengers. However, 1,800 passenger cars/hour.

It is about 75%. If 20% of the traffic is interrupted, the transit demand will not reach the capacity but the capacity reduction will occur.

Therefore, the time to consider the temporary use of the shoulder to enter the highway main line is about 75% of the capacity. At present, the operation of working as a second lane is underway immediately after the investigation of this study, utilizing the long distance of the connecting road section. This is a way to operate like a second lane if traffic increases

Conclusion

In this study, the traffic flow according to the number of barriers was analyzed in the case of 1,320 veh/h and 1,356 veh/h, which are similar to the level of the entrance to the mainland. The results of the analysis are as follows.

As a result of analysis of traffic flow, in the observation time of the 8th intervention time of 144 veh/h, the most frequent interval value was 2.5 seconds, longer than the connection time (2.0 seconds), but the composition ratio was almost similar. On the other hand, in the 6th observation period where the number of intercepting vehicles was 288 cars / hour, the most frequent interval value was the same as the 8th observation time zone, but the composition ratio was reduced to 20%. In general, as the intervention traffic volume increases, the headway distance at the gore section increases, but the headway distance tends to decrease.

In the case of the traffic volume of 1,320 veh/h at the fishery section and the traffic volume of 288 veh/h (24 minutes of observation traffic at 5 minutes), the capacity decreased by 45.2% compared with the connection route, 1,356 veh/h when the traffic volume was 144 veh/h (5 minutes observation traffic volume: 12 vehicles), the capacity was reduced by 19.7% compared to the connection road.

In this study, it is desirable that the method of recovering the reduced capacity to the level of the downstream connection is to use the shoulder temporarily to handle the traffic demand rather than the intervention. However, if the problems caused by interruption continue to occur even after the temporary use of the shoulder blade, it is possible to review the measures to be taken.

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