

Research Trends and Results

Development of a method to analyze congestion factors using probe data

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1. Introduction

In the “Effort to wisely use roads, mainly expressways” (July 2015), which is an interim report of the Arterial Highways Workshop, Road Subcommittee, the Panel on Infrastructure Development, the following efforts are outlined to realize smooth traffic: utilizing information and communication technology (ICT), establishing a method to analyze congestion factors, grasping bottleneck places and their causes, and implementing appropriate measures. In this article, we present an overview of a method to analyze congestion factors using probe data, which is under development at the NILIM.

2. Method to analyze congestion factors using probe data

As a method to analyze congestion factors, we are developing a method in which the direction of a speed decrease is identified using probe data, and congestion

factors are narrowed down by combining them with other data such as the volume of traffic. We conducted a congestion factor analysis at Intersection A in Ibaraki Prefecture. We confirmed that traffic congestion becomes serious in the northern direction, on straight roads, and in the morning, based on probe data and the volume of traffic classified by travel directions, and we analyzed the congestion factors. As a result, in this intersection, compared with the main road in the east-west direction, we found that when more time is assigned to green lights, the subsidiary road in the north-south direction has more traffic in the morning. Therefore, we can say that an inconsistency between the signal indication and traffic condition is one of the factors (Figure).

3. Concluding remark

In the future, we plan to compile a manual for data analysis, which will be used to establish an effective measure for traffic congestion.

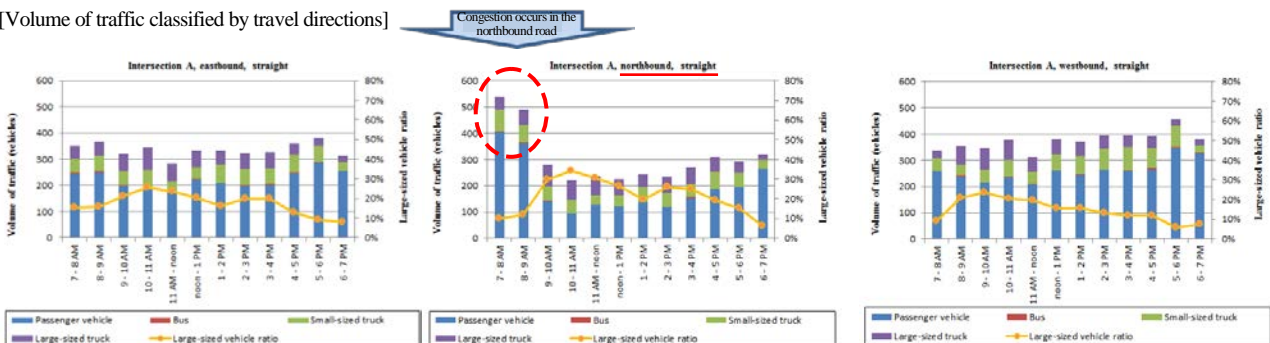
[Travel speed classified by travel directions] (Probe data)

Intersection A		Daytime								Holiday							
		Night		Morning		Afternoon		Evening		Night		Morning		Afternoon		Evening	
		Travel speed (km/h)	Ratio to Night (%)	Travel speed (km/h)	Ratio to Night (%)	Travel speed (km/h)	Ratio to Night (%)	Travel speed (km/h)	Ratio to Night (%)	Travel speed (km/h)	Ratio to Night (%)	Travel speed (km/h)	Ratio to Night (%)	Travel speed (km/h)	Ratio to Night (%)		
Southbound	Turn left	29.1	27.1	93%	24.8	85%	20.6	71%	29.4	28.2	96%	22.4	76%	21.9	74%		
	Straight	29.5	18.5	62%	21.2	72%	17.2	58%	27.7	23.7	86%	22.8	82%	21.6	78%		
	Turn right	20.8	26.3	127%	28.7	138%	21.3	103%	38.2	16.9	44%	24.2	63%	25.3	66%		
Westbound	Turn left	15.0	22.9	152%	22.9	152%	18.1	121%	18.9	36.0	191%	19.1	101%	19.0	101%		
	Straight	24.9	18.1	73%	19.7	79%	18.2	73%	20.0	15.4	77%	16.0	80%	13.7	69%		
	Turn right	18.0	13.9	77%	18.3	101%	10.9	60%	19.1	13.2	69%	16.4	86%	13.7	72%		
Northbound	Turn left	20.1	10.9	54%	10.8	54%	21.9	109%	17.9	22.9	128%	15.2	85%	10.2	57%		
	Straight	23.9	7.7	32%	16.0	67%	13.3	56%	15.4	19.9	130%	17.2	112%	15.1	98%		
	Turn right	14.4	12.1	84%	14.2	98%	12.3	85%	37.5	10.2	27%	16.1	43%	10.9	29%		
Eastbound	Turn left	29.7	24.5	82%	26.4	89%	19.7	66%	27.0	36.3	134%	25.3	94%	19.0	71%		
	Straight	27.3	22.7	83%	17.9	65%	17.3	63%	23.7	25.0	106%	17.0	72%	19.5	82%		
	Turn right	22.6	16.1	72%	16.0	71%	13.5	60%	19.8	33.7	170%	15.9	81%	14.6	74%		

*In Morning, Afternoon, and Evening
the left column represents travel speed (km/h)
the right column represents the ratio to the values of Night (%)

Travel speed
 :10 km/h and less
 :20 km/h and less
Ratio to the values of Night
 :50% and less
 :75% and less

[Volume of traffic classified by travel directions]



[Signal indication]

■ Recorded period of time: 7 - 8 AM ■ Cycle length: 110 seconds
 ■ Unit: second

1 φ	2 φ	3 φ	4 φ
Green: 26 Yellow: 3	Right green: 6 Yellow: 3 Red: 3	Green: 56 Yellow: 3	Right green: 6 Yellow: 3 Red: 2
<p>North-south direction (subsidiary road): <u>total 40 s</u></p>		<p>East-west direction (main road): <u>total 70 s</u></p>	

Focusing on straight in the morning

Focusing on length of green lights

[Supposed congestion factors and measures]

Factor	<ul style="list-style-type: none"> On the northbound subsidiary road, there is a lot of traffic in the morning and the length of the green lights is short. Thus, it is supposed that there are vehicles that cannot pass through the intersection within one cycle of the signal.
Measure	<ul style="list-style-type: none"> A reconsideration of signal indication in the morning will be effective, because the volume of traffic on the subsidiary road is larger than that on the main road in the morning.

Figure Trial result of analysis of congestion factors