Evaluation of Side Friction in Ihcm for Highway 4 Lanes 2 Ways Divided

Evaluation of Side Friction in Ihcm for Highway 4 Lanes 2 Ways Divided

Najid[1*]
[1]Civil Engineering Department Tarumanagara University
Mobile : 0818156673

*najid@ft.untar.ac.id

Abstract. IHCM (Indonesia Highway Capacity Manual) was issued and came into force in 1997. After 20 years there has been a change in traffic from the number and composition, as well as the traffic regulation policy. As a result of this, the determination of IHCM's road capacity is often incorrect. Therefore it is necessary to evaluate IHCM. This study tries to evaluate IHCM through side friction factors, as one of the factors that determine the value of road capacity. Research is limited to evaluating the weight of each side friction factor and the effect of land use from the survey results using statistical analysis. From the analysis, it is found that the conditions for the use of shops, office and campus are in the category of high and low of side friction factor and the ranking of the relative weights of the side friction factors in IHCM is quite different.
Keywords : Capacity, Side Friction, Land Use.

1. Background

Transportation system is a road network system that physically connects an activity space with other activities space, which influences the development of a region (space of activity) and the development of a space of activity will require an increase in the transportation service system [1].

The development of activity space (activity) mainly occurs on the side of the road. Activities on the side of the road have an impact on traffic performance which can hamper traffic flow, which is then called side friction. Because it influences the flow of traffic it means it also affects the capacity of the road.

Side friction in the IHCM (Indonesian Highway Capacity Manual) are classified consisting of non-motorized vehicles (weight 0.4), pedestrians (0.5), left-right access roads (weight 0.7) and parked / stopped vehicles (weight 1, 0) [2]. The effect of side friction on capacity is the accumulation of the number of each occurrence of the side resistance factor multiplied by its weight.

In addition to IHCM, 1997 has been too long, the calculation of road capacity based on IHCM is often lower than the volume of traffic observed. Therefore IHCM needs to be evaluated. This research is expected to contribute to the research to revise IHCM in terms of the side effect factors on road capacity.

2. Identification of Problems

a. Relation of each side friction factor to land use condition.
b. The relationship of side friction factor and traffic volume.

3. Problem Formulation

From the identification of the above problems can be formulated:
a. What is the relationship between the conditions of land use and the magnitude of each factor in the side friction?
b. How does the traffic condition affected by the value of each side friction factor?
c. How is the difference in the side friction based on IHCM with the survey results?

4. Purpose and objectives

The purpose of this study:
a. Analyze the value of side friction in different land uses.

b. Arrange the correlation between land use with the value of the side friction factor.
c. Evaluate each side friction factor IHCM version

5. Scope of Problem

This research is limited by the following scope:
1. Highway configuration 4/2 D (two lanes two ways divided)
2. Study in the city of Jakarta and Bogor
3. Other factors and capacity calculation based on IHCM.

Geometric Data at Research Location:

- Kyai Tapa road, 15 m, with median dan width of sidewalk facility > 2.0 m
- Daan Mogot road, 14 m, with median dan width of sidewalk facility > 2.0 m
- Pajajaran road, 17 m, with median dan width of sidewalk facility > 2.0 m

6 Literature Review

6.1. Transportation Concept

The concept of transportation is based on the trip (origin) and destination (destination). In transportation, there are elements that are closely related to the concept of transportation itself [1]. These elements are as follows: Humans demand, goods demand, transportation mode, roads, terminals as land transportation infrastructure and transportation organization.

6.2. Side Friction Factors in IHCM

Side Friction are grouped in five classes, from very low to very high class as an accumulation of the four side side friction factors. Classification of side friction can be seen in Table 2.1 below:

Table 6.1 Classification of Side Fricton [2]

Side Friction Factor Level	Code	Amout of All Number of Side Friction per hour	Land Use Condition
Very Low	VL	<100	Residential area; almost no activity
Low	L	100-299	Residential area; in the form of public transportation and so on.
Medium	M	300-499	Commercial area; very high road side activity
High	H	500-899	Industrial area; several shops on the side of the road
Very High	VH	>900	Commercial area; market activity beside the road

Table 6.2: Side Friction Factors for Adjustment Higway Capacity [2]

Highway Type	Side Friction Factor Level	Adjustment Factors for Side Barriers and Kerb - Barrier Distance (FCsf)			
		Distance Kerb-Barrier			
		≤ 0,5	1,0	1,5	≥2,0
4/2 D	VL	0,95	0,97	0,99	1,01
	L	0,94	0,96	0,98	1,00
	M	0,91	0,93	0,95	0,98
	H	0,86	0,89	0,92	0,95
	VH	0,81	0,85	0,88	0,92

7. Methodology

This research use survey data based on road observation and statistical analysis approach. Research process that explain data collection and data analysis, describe at figure 7.1 below:

Survey Form Design

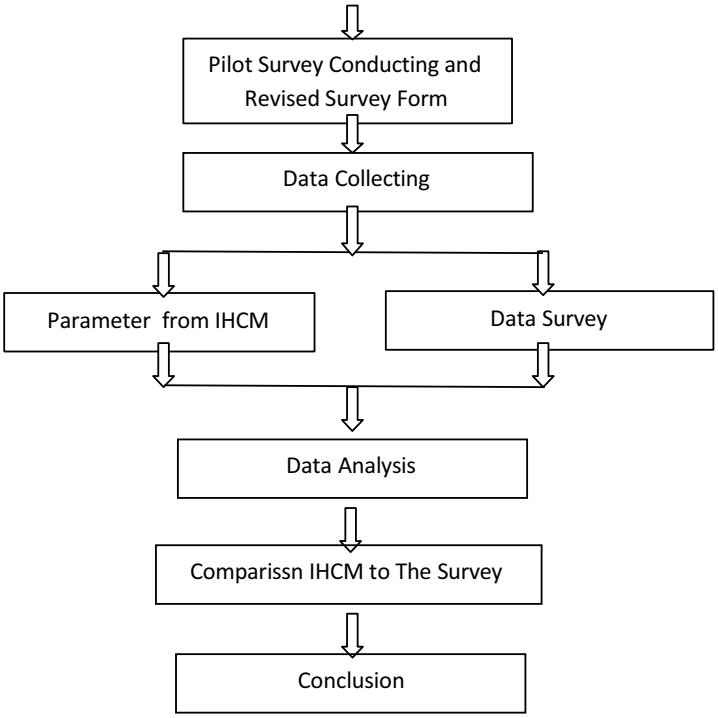

Figure 7.1. Research Flowchart

8. Data Collection

Data Collection method by survey on two roads in Jakarta and one road in Bogor, in Jakarta there are South Meruya road and Sacna Sunter road and in Bogor there is Kebon Pedes road. Traffic Volume analysis based on IHCM for PCU (passenger car unit motor cycle and heavy vehicle).

8.1. Traffic Volume Survey

Survey method with field observations carried out on the side of the road, the surveyor takes data on traffic volume.. Time for morning data collection (06.00-08.00), daytime (11.00-13.00) and afternoon (17.00-19.00). Traffic volume data at Kyai Tapa Jakarta, Daan Mogot Jakarta and Pajajaran Bogor describe on Table 8.1, below:

Table 8.1. Accumulation Traffic Volume Survey on Kyai Tapa Jakarta, Daan Mogot Jakarta and Pajajaran Bogor

Survey Time	Q (traffic volume) (pcu/hour) Kyai Tapa	Q (traffic volume) (pcu/hour)	Q (traffic volume) (pcu/hour)
06.00-07.00	3349		
06.15-07.15	3470	3599	2514
06.30-07.30	3508	3814	2508
06.45-07.45	3584	3693	2400

07.00-08.00	3595	3653	2382
11.00-12.00	2760	3346	2267
11.15-12.15	2700	2725	1876
11.30-12.30	2832	2728	1946
11.45-12.45	3006	2659	1946
12.00-13.00	3244	2687	2024
17.00-18.00	3951	2825	2099
17.15-18.15	3989	3112	1851
17.30-18.30	3969	3034	1854
17.45-18.45	4048	2945	1554
18.00-19.00	3946	2769	1472
		2734	1596

Side Friction Condition at three roads that survey conducted describe at table 8.2, 8.3, 8.4 below:

Table 8.2. Side Friction Data at Kyai Tapa Jakarta

Time Slice	Side Friction Factor				Total Weighted Side Friction Factor
	Non Morised Vehicle	Pedestrian	Access	Parking Vehicle	
06.00-07.00	12	26	658	24	502.4
06.15.07.15	19	32	749	27	574.9
06.30-07.30	22	37	828	32	638.9
06.45-07.45	25	39	864	35	669.3
07.00-08.00	28	41	860	35	668.7
11.00-12.00	35	49	810	37	642.5
11.15-12.15	42	53	734	36	593.1
11.30-12.30	49	51	666	38	549.3
11.45-.12.45	60	56	600	40	512
12.00-13.00	59	55	581	40	497.8
17.00-18.00	59	57	565	43	490.6
17.15.18.15	57	65	585	44	508.8
17.30-18.30	55	65	645	41	547
17.45-18.45	50	62	722	48	604.4
18.00-19.00	49	55	774	56	644.9

Table 8.3. Side Friction Data at Daan Mogot Road Jakarta

Time Slice	Side Friction Factor				Total Weighted Side Friction Factor
	Non Morised Vehicle	Pedestrian	Access	Parking Vehicle	
06.00-07.00	23	20	168	14	150.8
06.15.07.15	28	22	192	14	170.6
06.30-07.30	28	25	202	19	184.1
06.45-07.45	25	23	206	22	187.7
07.00-08.00	26	25	208	27	195.5
11.00-12.00	32	29	189	29	188.6
11.15-12.15	38	30	185	33	192.7

11.30-12.30	41	32	175	38	192.9
11.45-.12.45	41	32	162	40	185.8
12.00-13.00	36	29	181	44	199.6
17.00-18.00	35	31	169	42	189.8
17.15.18.15	37	33	160	38	181.3
17.30-18.30	38	35	163	36	182.8
17.45-18.45	36	33	164	36	181.7
18.00-19.00	32	28	180	42	194.8

Table 8.4.. Side Friction Data at Pajajaran Road Bogor

Time Slice	Side Friction Factor				Total Weighted Side Friction Factor
	Non Morised Vehicle	Pedestrian	Access	Parking Vehicle	
06.00-07.00	15	23	196	22	176.7
06.15.07.15	14	25	161	24	154.8
06.30-07.30	14	27	153	25	151.2
06.45-07.45	16	27	160	22	153.9
07.00-08.00	16	24	172	23	161.8
11.00-12.00	20	28	176	26	171.2
11.15-12.15	23	29	162	30	167.1
11.30-12.30	27	31	134	34	154.1
11.45-.12.45	30	39	121	39	155.2
12.00-13.00	31	40	123	40	158.5
17.00-18.00	30	41	141	45	176.2
17.15.18.15	27	46	155	46	188.3
17.30-18.30	26	43	163	48	194
17.45-18.45	23	36	157	43	180.1
18.00-19.00	22	32	142	37	161.2

9. Data Analysis

Data analysis describe about relationship between traffic volume and side friction at every road show on table 9.1 and Percentage Differencies between Survey and MKJI show on table 9.2 below:

Table 9.1 Relationship of Traffic Volume with Side Friction

Side Friction Factor	**IHCM**	**Pearson Correlation (R)**		
		Kyai Tapa, Jkt	Daan Mogot,Jkt	Pajajaran Bogor
Non Motorized Vehicle	**0,4**	0.2	0.1	0.1
Pedestrian	**0,5**	0.3	0.9	0.5
Left-Right Acces	**0,7**	0.7	0.4	0.2
Parked/ Stopped Vehicle	**1**	1	0.9	0.5

Table 9.2. Percentage Differencies between Survey and MKJI

Road	Description	Total Number Side Friction	Level Classification	FCsf	**Amount Differencies** H Level	**Amount Differencies** L Level
Kyai Tapa	Campus, Hospital	500 – 700	H	0,95	0.4	---
Daan Mogot	Shop, Office	150 - 200	L	1	---	1.1
Pajajaran Bogor	Restauant, Shop	150 - 200	L	1	---	1.3

From table 9.2. we can see the differencies between survey result and IHCM at Daan Mogot road and Pajajaran road look significantly compare with Kyai Tapa road.

10. Conclusion

a. Weight Sequence in IHCM for side friction more close with data analysis at Kyai Tapa road.
b. The value of weight side friction in IHCM and data analysis is quite difference in three location.
c. In land use Campus give more side friction condition compare with other land use

11. References

[1] Tamin, O Z, (2000). *Planning and transportation modeling,* Publisher ITB, Bandung.

[2] IHCM (1997), Indonesia *Highway Capacity Manual,* Directorate General of Highways, Ministry of Public Works Indonesia.