

VALUE ANALYSIS OF PASSENGER CAR EQUIVALENT MOTORCYCLE (CASE STUDY KARTINI ROAD BANDAR LAMPUNG)

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Abstract-Motorcycles in traffic mix on the 4 lane one-way road with no median dividers berpootensi an impact on the performance of the particular traffic volume of traffic, especially if the number of vehicles is very large motorcycle. This happens in the corridors of Bandar Lampung particularly traffic from the south or from the Gulf Betung. Studi done in the way of Kartini Bandar Lampung, ie after Kartini Mall and right in front lembga technocrat education. Survey conducted on Tuesday and Wednesday morning at peak hour, peak hour lunch, and afternoon peak hours by using a video camera. Results of analysis of the proportion of motorcycles acquired: On Tuesday, at 67.91% of the total volume of traffic, and Wednesdays at 69.73% of the total traffic volume, so that the average proportion was 68.82%, which shows that the growth of motorcycle high enough , the average value exceeds the normal composition according MKJI 1997 is 38%. Due to the growth of the motorcycle vehicle large enough for the volume of traffic, it is necessary to review the value of PCE for motorcycles as part of the traffic. Analysis is used to determine the value of PCE is to use the base capacity. The capacity of the base using multiple linear regression model. The results of the analysis obtained niali emp for motorcycles on the road Kartini is emp MC = 0.564, and emp HV = 1.347. Recommended for 4 lane road with no median one-way lane that has not been facilitated by special motor bike, then you should apply the separation column in order to reduce the level of accidents and provide security and comfort for pedestrians to cross the road.

Keywords: Vehicle motorcycle, composition, passenger car equivalent

INTRODUCTION

In the planning of road transport infrastructure in Indonesia based on the Indonesian Highway Capacity Manual (MKJI) 1997. Prices of existing provisions in MKJI drawn from the results of research in a particular area. So the price of this provision may not necessarily represent the characteristics of the existing traffic in the entire region of Indonesia. On the basis of these conditions would need to review the existing provisions are to be adapted to the conditions and characteristics traffic flow in each region in Indonesia. One of the provisions that are in effect the value MKJI are many different types of vehicles which is a comparison with the passenger cars as standard assessment. The determination as a measure of value called the passenger car unit (pcu). Units of passenger cars accounted for certain types of vehicles and equivalent against light vehicles (LV), referred to the equivalent value of passenger car equivalent (PCE). Passenger car equivalent (PCE) vehicle albeit from each type depends on the type of road and traffic flow total. Passenger car equivalent for each type of vehicle depends on the type of road and traffic flow total. Equivalent value can be obtained empirically for the types of vehicles such as light vehicle (LV) (including passenger cars, minivans, pickup trucks and jeeps), heavy vehicle (HV) (including trucks and buses), and motorcycles (MC).

Nowadays motorcycle users in Bandar Lampung increased year-over-year, more than 60% of vehicles passing on the highway is a motorcycle. This vehicle is widely used in addition to ease of movement on the highway, the price factor is the next thing that causes more people to use it. If the observed behavior of the bikers, they will always try to put himself in the forefront, and done everything possible to get ahead of the vehicle in front of him through the gaps between the vehicle is

running.

Based on the character and composition of motorcycle riders on the road four lanes in one direction, estimated emp motorcycle is not in accordance with the provisions of MKJI value in 1997, so in this study tried to determine the value of PCE for motorcycles on the street Kartini Bandar Lampung.

LITERATUREREVIEW

1. Characteristics of Traffic Flow

R. J. Salter, 1976 stated the vehicle flow analysis along roads affected by three significant parameters, namely speed, density and flow (volume) vehicle. Portrait of vehicle density measure service quality, demonstrated by the stream segment vehicle. Flow or volume of vehicles is a measure of the quantity of the flow of vehicles and demand on a road.

Traffic flow is a unique interaction between the driver, vehicle, and road. There is no same traffic flow even in similar circumstances, so that the flow at a particular road segment is always varied. Nevertheless required parameters can indicate the condition of roads or to be used for design. The parameter is the volume, speed, and density, level of service and degree of saturation. It is very important to be able to design and operate transportation systems with the efficiency and safety level of the best.

Khisty C. Jotin and Lall B. Kent stated that there is some variable or basic measure used to describe the flow of traffic. The three main variables are the velocity (v), volume (q) and density (k). Other variables used in the analysis of traffic is the headway (h), spacing (s) and occupancy (R).

2. Traffic volume (q)

Volume is the number of vehicles crossing a road at a particular time period in units of vehicles per unit time. Benefits of data (information) is the volume:
a. The relative importance of a route.
b. Fluktuasi in the flow.

- c. Traffic distribution in a road system.
- d. Tendency of road users.

Data volumes can be: Volume by direction of the current:

- a. Two directions.
- b. One direction.
- c. Straight flow.
- d. Either turn left turn flow and turn right.

Volume by type of vehicle, such as, among others:

- a. Passenger cars or light vehicles.
- b. Heavy vehicles (large trucks, buses).
- c. Motorcycles.

In general, vehicles on a road segment consists of various compositions vehicle, so the volume of traffic to be more practical if expressed in a standard vehicle types, namely passenger cars, so the technical term passenger car unit (pcu). To get the volume in smp, it would require the conversion factor from a wide range of vehicles to passenger cars, the passenger car equivalent factor or PCE (passenger car equivalent) Volume is based on the observation time traffic surveys, such as 5 minutes, 15 minutes, 1 hour

Rate of flow or volume flow rate is obtained from the observation that less than an hour, but then converted to a volume of 1 hour in a linear fashion.

Peak Hour Factor (PHF) is the ratio of the volume of a full hour with the peak of the flow rate on the hour, so that PHF can be calculated with the following formula:

$$PHF = \frac{\text{Volume 1 Hours}}{\text{Maximum Flow rate}} \quad \dots\dots (2-1)$$

Used in this study is the amount of current (flow) is more specific for each relation cut roads were reviewed with the speed and density at a certain time period.
caption:

$$k = \frac{n}{l}$$

k = density.

n = number of vehicles on the length

l = length of roads.

Density is difficult to measure directly (because it takes a certain point level that can observe the number of vehicles in a certain length of roads), so the magnitude of the two parameters determined from the volume and speed, which has the following relationship:
caption:

$$k = \frac{q}{v}$$

k = average density (Vehicles / km or smp / km).

q = volume of traffic (Vehicles / hour or pcu / hour).

v = average velocity space (km / h)

3. How to Find Value Equivalent Car Passenger (PCE)

Passenger Car Equivalent (PCE) is a conversion factor used to calculate the value menseragamkan vehicles, each vehicle in order to influence the overall traffic can be seen. The method can be used to estimate the value equivalence passenger cars, depending on the characteristics and traffic conditions. The ways or methods that can be used to find or estimate the passenger car equivalent (PCE) Capacity Base Method
Eko Supri Martiono in his research on the influence of motorcycles on the road junction with traffic light settings in Kendal, stating that the PCE can be used to calculate the capacity of the method of multiple linear regression is formulated following:

$$S = c_1lv + c_2hv + c_3mc + c_4um$$

Description:

S = saturation flow.

c = coefficient.

lv = passenger car / light vehicle.
hv = great car.
mc = motorcycle.
um = non-motorized vehicles.
Because $c_1 = \text{emp}$ for $lv = 1$ then:

$$c_1 lv = S - c_2 hv - c_3 mc - c_4 um$$

RESEARCH METHODOLOGY

The site chosen as a research site is an observer point RA Kartini street, after the supermarket segment Mall Kartini with $\pm 1,000$ meters long and 14 meters wide. Some reasons for selecting the Kartini as study sites, namely:

1. Streets RA Kartini is a 4 lane one-way with no median is the central corridor that connects the city of Bandar Lampung with vertices office and business activities, vehicle traffic has the greatest among the other city corridor at rush hour in the morning and afternoon.
2. Activities all the way from the left to the right road RA Kartni is trade, services, shopping, hospitality and educational institutions.
3. Selected 1 (one) point for the observer along the way kartini bear resemblance between the environment and roads kartini
4. Location survey is a trade and service area with a high density and busyness,

2. Traffic Volume

The volume of data traffic lslu take one (1) location on the street front kartini technocrat using a video camera in the morning peak hour (07.00 till 10.00 am), lunch (11:30 am till 13:30 pm), and afternoon (14:25 hours till 17:25) , which is Tuesday, March 19, 2012, and Wednesday, March 20, 2012. Data taken with a 5 minutes, according to the classification of types of vehicles Indonesian Highway Capacity Manual (MKJI) 1997, which is for vehicles Light Vehicle (LV) or light vehicles, Hevy Vehicle (HV) or severe vehicle, Motor

Cycle (MC) or bike motors, Unmotoryce (UM) or non-motorized vehicles are divided in group rickshaws and bicycles. Processing and calculation of the amount of traffic volume is done at home using a computer to see the results of camera footage. The calculation is performed for 5 minutes by using Hand Counter and recorded in a paper survey format for calculation of the volume of traffic.

Then the data is processed and how the calculation is as follows:

1. Number of vehicles of each split
2. Total vehicles per 5 menit is the number of all types of vehicles.
3. Result 1 hour per vehicle is multiplied by the total number of vehicle types that number five minute 12 for one hour
4. Proportion of the total vehicles produced motorcycles to total light vehicle (LV) and heavy vehicles (HV).

RESEARCH AND DATA ANALYSIS RESULTS

1. Data Segment streets

Streets Kartini Bandar Lampung runs north - south is a secondary collector roads that serve the transportation liaison function, gatherers and dividers with high trip characteristic with high average speeds and a limited number of driveways serving the public areas as well as urban Roads conditions consisted of 1-way to 4 lanes with no divider, which is to the north toward the center of trade. Details about Kartini roads are as follows. :

1. Lane 4 pieces and consists of 1 direction without a median
2. Width pavement 14 meters with middle lane lane 3.75 m, 3.25 m edge lane road with no shoulder.
3. Dividing a lane line markings straight dashed
4. Condition pavement either aspakl pavement layers.

. From the above data it can be seen the proportion of each type of vehicle in an average traffic per hour, as shown in Figure 1 and Figure 2.

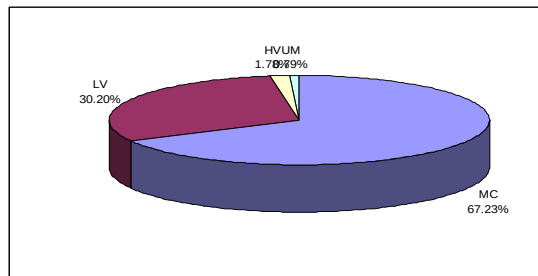


Figure 1 Proportion of Vehicle Type on Hourly Traffic streets Kartini Tuesday, March 19 2012

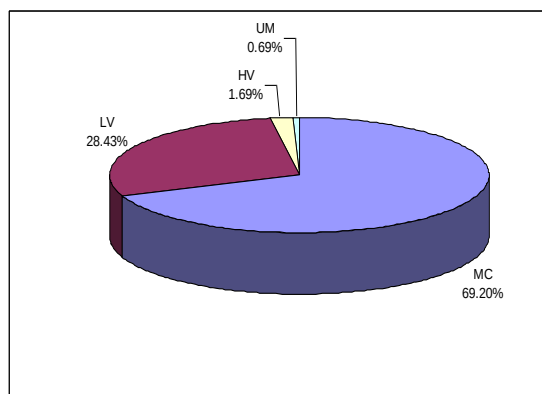


Figure 2. The proportion of the Vehicle Type
Hourly Traffic streets Kartini
Wednesday March 20,
2012

2. Vehicle Speed Data

Speed data retrieval is done with video camera same as the volume of data retrieval, the types of vehicles include Light Vehicle (LV) or light vehicle, Heavy Vehicle (HV) or heavy vehicles, and Motor cycle (MC) or motorcycle, as well as all the number 3 type of vehicle is taken and calculated travel time and can be calculated space mean speed (average speed space) well each type of vehicle as well as the average speed of traffic.

Of the implementation of survey data collected is data on vehicle travel times along the road cut 8.2 m, 11.4 m and 19.5 m. Determination of travel time do denghan computer and recorded in a paper survey format. Then the data is processed and the calculation is as follows:

1. Travel time for each type of vehicle add up and add up each time 5 minute.
2. Calculation speed is distance divided by travel time, with adjustment units of meters per second units to kilometers per hour. The data obtained is data speed per vehicle type and total of all types of vehicle speed within 5 minute.

Table 2. Speed Diskriptif Statistics
Average R.A Kartini. Road
Traffic

Table 1. Statistics Then Diskriptif Volume
Traffic (veh. / Hour) in streets
R.A.
Kartini

	N	Minimum	Maximum	Mean	Std. Deviation
Mornin	72	28.50	65.10	47.25	8.53
Day	48	3912.00	7272.00	5298.83	695.38
Afternoon	72	4716.00	8184.00	6089.50	730.46
on	72	5412.00	8976.50	6572.00	683.90

3. Similarity Analysis of Two Test Mean

This analysis was conducted to determine the similarity of the average volume of traffic from the two conditions, use determine whether the two averages in these conditions can be combined or not in the subsequent analysis. Determination analysis is performed using statistical test T-test for paired samples (Paired Sample T-Test) is conducting an analysis of the similarity hypothesis volume average as follows:

Hypothesis:

Ho = Both flat-ratra is identik
H1 = Second sample average is
not identical

Table 3. Recapitulation Test Results Similarity Average Traffic Volume streets Kartini

	TUES DAY MORN ING	TUESD AY	TUESD AY AFTER NOON	WEDNES DAY Day	WEDNESDA Y MORNING	WEDNES DAY AFTERNO ON	WEDNES DAY AFTERNO ON
TUESDAY				V			
TUESDAY MORNING	..	X	X		V	X	X
TUESDAY			X		V	V	V
TUESDAY AFTERNOO N					X	V	V
WEDNESDA Y MORNING						X	X
WEDNESDA Y AFTERNOO N							V
WEDNESDA Y AFTERNOO N							

Description:

V = Identical

X = Not Identical

Table 4. Recapitulation Test Results Similarity Average Traffic Volume streets Kartini

	TUESDAY MORNING	TUESDAY	TUESDAY AFTERNOON	WEDNESDAY	WEDNESDAY MORNING	WEDNESDAY AFTERNOON
TUESDAY				V		
TUESDAY MORNING	..	X	X		V	X
TUESDAY			X		V	V
TUESDAY AFTERNOON					X	V
WEDNESDAY MORNING						X
WEDNESDAY AFTERNOON						
WEDNESDAY AFTERNOON						

Description:

V = Identical

X = Not Identical

4. Analysis Determination of Passenger Car Equivalent (PCE)

Table 5. PCE Value Base Capacity at Streets. Kartini Bandar Lampung that meet the statistical

Time	Interval Volume Traffic Flow (vehicle)	PCE Basis Capacity				Sig.				R ²	Information
		L V	HV	MC	UM	LV	HV	MC	UM		
Tuesday Afternoon and Wednesday	6.162,8 – 6.725,3	1	1.34 7	0.623	0.56 4	-	0.05 0	0.00	0.00	0.70 8	Group5 from 9 class interval

CONCLUSION

It is obtained from the Passenger Car Equivalent Value Analysis Motorcycles on the road one-way four-lane road with no median in Bandar Lampung Kartini street summarized as follows:

1. Calculation results mean proportion motorcycle on Tuesday was 67.23% of total traffic volume and the proportion of motorcycle Wednesday 69.20% of the volume of traffic, so proporsi average motorcycle is 68.215% of the volume of traffic, motorcycle composition results greater than the normal value for the composition MKJI traffic in 1997 is equal to 38% for city size 0.5 - 1.0 million inhabitants.
2. The speed of vehicles on the roads R.A. Kartini morning at an average of 47.25 km / h, the time of day 46.6 km / h, and the afternoons 42.77 km / h, the speed is smaller in the afternoon than the morning and late afternoon because at the time the volume greater traffic and roads RA Kartini is a main way people moved north toward the city of Bandar Lampung for a place to stay after a hard day's work.
3. Analysis of the results obtained emp values for motorcycles on the road Kartini Bandar Lampung is: 0.564, and emp heavy vehicle (HV) = 1.347, this shows that the condition of roads Kartini had 4 lanes in one direction to the character of the motorcycle above restrictions contained in the emp motorcycle MKJI 0.40.
4. There difference in value to the value of the field PCE on MKJI because there are differences in the volume and composition of each type of vehicle.

REFERENCES

1., 1993, Government Regulation no. 43 Year 1993 on Infrastructure and Road Traffic, Assorted I, Semarang
2., 1997, Highway Capacity Manual (MKJI), Department of Public Works, Directorate General of Binamarga, Jakarta.
3., 1994, the Transportation Research Board National Research Council, Special Report 209 Third Edition, Washington. DC.
4. Box. P.C, Joseph C. Oppenlander, 1976, Manual of Traffic Engineering Studies, Institute of Transportation Engineering, Arlington, Virginia.
5. Dewanti, 1992, Crossing Behaviour and Gap Acceptance at an Intersection Insinalized in Bandung, Thesis S-2, ITB, Bandung bdwards J. D, 1992, Transportation Planning Handbook, Englewood Cliffs, New Jersey Garber, NJ, Hoel, LA, 2002, the Traffic and Highway Engineering, Third Edition, University of Virginia Gattis.
6. JL, Member, ASCE, and Low ST, 1999, Gap Acceptance At Atypical Stop-Controlled Intersections, Journal of Transportation Engineering / may / june.
7. Hobbs, FD, 1979, Traffic Planning and Engineering Second edition, Pergamon Press, Birmingham.
8. Hummer JE, 1994, Manual of Transportation Engineering Studies, Institute of Transportation Engineering, by Prentice-Hall, Inc., Englewood Cliffs, New Jersey.
9. Hewitt, RH, 1985, A Compatison Between Some Method of Measuring Critical Gap, Traffic Engineering and Control.

10. Khisty. CJ, Kent LB, 2005, the Transportation Engineering, An Introduction / Third Edition. Published by Pearson Education,
11. May, A.D, 1990, Traffic Flow Fundamentals. Pretice Hall. Englewood Cliffs, New Jersey
12. McShane, W.R, Roess. RP, 1990, Traffic Engineering, By Prentice Hall Inc., Englewood, New Jersey.
13. Morlok EK, 1985, Introduction to Engineering and Transport Planning, linguists by Johan K. Hainim, grants, Jakarta.
14. NAASRA, 1988, Guide to Traffic Engineering Practice, National Association of Australian State Road Authotities, Sydney.
15. Shelter. R. J, 1974, Highway Traffic Analysis And Design, University of Bradford.
16. Shelter. RJ, 1981, Traffic Engineering Worked Examples, University of Bradford, London
17. Sudjana, 1996, Statistical Methods, Tarsito, Bandung
18. Sukarno, et al, 2003, Determination of A Gap in Simpang Tiga With Signs Yield or Stop signs, Civil Engineering Journal Vol 4 No. 1
19. Taylor. MAP, Young, W, 1988, Traffic Analisis New Technology & New Solution, Hargreen Publishing Company, North Melbourne.