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STUDY SYSTEM PARKING AREA AGENCY ON ROAD-SHOPPING TOUR IN MAKASSAR

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ARTICLE INFO	ABSTRACT
	Today, the increased use of private vehicles for travel-shopping activity has caused its own problems of urban transport, such as the increasing use of part of the road as the vehicle parking area. As one of the initial steps in memecahkn the parking problems, this study aimed to analyze and evaluate the parking system that uses a portion of the road and its influence on the performance of traffic on a road which is the main area of activity-shopping tour in the city of Makassar. This study focuses on system-street parking on the road Jl. Somba Opu, which is the main street of tourist activity-shopping area in the city of Makassar. Surveys such as the characteristics of the road and parking system that is applied in these roads is done by using the method of recording plates parked vehicles. Angle of vehicle parking system also surveyed in this study. In addition, a survey conducted at the same time the volume of traffic census and survey kecapatan vehicles passing on the road Jl. Somba Opu. Analysis of the performance of the parking and traffic to the conditions existing parking angle system performed to evaluate the extent of the influence of the parking system on the performance of the road traffic on the roads Jl. Somba Opu. Furthermore, this study conducted an analysis model of the relationship volume and speed of traffic using a model approach based Greenshield linear models. On the other hand, performed the simulation and optimization for a variety of conditions kedaraan parking angle in order to determine the optimal balance between capacity and the amount of road space parking of vehicles that can be accommodated. By using a model of the relationship of traffic volume and speed, and the optimization results, the evaluation of the volume and the actual speed to the optimum condition to do. The results of the analysis and the evaluation shows that the parking system existing road has reduced road traffic performance significantly both the volume and speed of traffic. This performance decrease caused by the reduction in the dominant portion of the road to passing vehicles and irregularities angle parking of vehicles. Optimization results show that angle 45o parking is optimum parking angle. This optimum parking condition can speed vehicles passing though slightly reduce the volume of traffic. The results of this study are expected to be the basis of the studies in developing advanced modeling and simulation of the effect of parking on the performance of the road traffic in a comprehensive manner.

INTRODUCTION

In two decades, the problem of traffic in Indonesia in the form of delays, queues, congestion and perpakiran that degrade the performance of traffic flows is an issue that hit almost all cities - big cities in Indonesia, including the city of Makassar in South Sulawesi. This will have dire consequences on the development of the city if it is not taken seriously, efficiently and effectively. One issue problem that needs special attention is the fact that the road space is already very limited operating with much lower capacity than it should.

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This is because most of the road / street space is used for parking space, activities of economic sectors such as the existence of street vendors and others. The use of the road as a parking lot has a huge contribution to the reduction of road capacity and can lead to problems of traffic congestion and reduced accessibility. In the context of the problems mentioned above, little research has been conducted to evaluate the existing conditions at the same time recognize which solutions can be provided. One of the studies that have been done in this regard is the study of the effect of activities on-street parking on the road against the performance of roads in Jakarta - Jakarta (Tamin *et al*., 2000). The same was done for the park condition of the road in Makassar (Renta *et al*, 2012). Today, the increased use of private vehicles for travel-

shopping activity has caused its own problems of urban transport, such as the increasing use of part of the road as a parking area kendaraan. Sebagai examples are parking in most body Jalan Somba Opu which is one of the centers of economic activity in Makassar, At Jalan Somba Opu, public transport microbus kind cannot pass / pass. This causes people tend to use private vehicles and taxis as one means of transport to Jalan Somba Opu. Given this, coupled with the absence of a special parking area for vehicles prepared for parking then the potential on-street parking to be very high.

As one of the initial steps in memecahkn the parking problems, this study aimed to analyze and evaluate the parking system that uses a portion of the road and its influence on the performance of traffic on a road which is the main area of activity-shopping tour in the city of Makassar. This study specifically designed to evaluate the impact of various conditions of angle parking of vehicles on the performance of the traffic through model development effort and speed volume relationships using Greenshiled model approach, as well as the optimization of the capacity balance and the maximum number of vehicles parked on the corner of optimal conditions vehicle parking.

Model characteristics of traffic and parking

Relationship model volume and speed of traffic

Model relationships characteristic volume (V) and the speed (S) traffic on an urban road in general use Greenshield model approach. This model approach mengasusmsikan that the density (D) and the speed (S) traffic has a linear relationship, so that would be obtained model of the relationship between V and S-2 or order polynomial equation model parabola. Construction model of the relationship V and S (selanjutanya called the VS models) is described as the following paragraphs. Greens hield concluded that the relationship between the average speed (space mean speed) with a density of vehicles in a traffic flow is linear. This relationship can be seen in the following equation (Tamin 2000; Sitohang *et al*, 2001, Suteja 1999; Liputo and Ramli 2007; and Ali *et al*., 2006; Mathew and Rao, 2007; Aly *et al*, 2011, Renta *et al*, 2012):

$$S_s = S_f - \frac{S_f}{K_j}.k$$

…………………………..(1)

$$V = \frac{1}{K_j}S_s - .\frac{K_j}{S_f}.S_s^2$$

…………………….....(2)

The model estimates the capacity of roads

For urban road conditions in Indonesia, Indonesian Highway Capacity Manual (IHCM, 2007) has developed a model of road capacity estimates (C) as the equation (3).

$$C = C_o + FC_w + FC_{sp} + FC_{sf} + FC_{cs}$$

……………(3)

where Co is the basic capacity (smp / hour); FCW is the correction factor for the width of the road; FCSP is the correction factor for the division direction; FCSF is the correction factor for the side disruptions; FCCS is the correction factor for the width of the road.

The model estimates the number of vehicles parked on the road

The model estimates the number of vehicles parking (N) on a road section is a function of the width of the road and system usage or angle parking of vehicles is applied. Director General of Land Transportation, Department of Transportation (1998) has developed the model estimates the number of vehicles parked on a road length (L) as specified in Table 1.

Number of parking vehicles on urban roads

Systems / parking angle (degrees) Use of road width (meters) Number of parking vehicles

Sytems/ parking angle (degree)	The use of road width (meters)	Number of parking vehicles (unit vechile)
Paralel	2.59	N* = L* / 5.47
30º	3.42	N* = (L* – 0.85) / 5.18
45º	4.71	N* = (L* – 2.04) / 3.36
60º	5.25	N* = (L* – 2.01) / 2.99
90º	5.47	N* = L* / 2.59

N: the number of vehicles; L; the long side of the road

MATERIALS AND METHODS

Location studies

This research chose the study area on Jl segment. Somba Opu in Makassar. This road is the main road that connects almost all roads to and from the tourist area in the city of Makassar Losari as shown in Figure 1. Along this road there is a shop for shopping activities for both domestic and international travelers. Segment Jl. Somba Opu is a two-lane roads one way. With the building system functions as a tourist area-shopping, every day the majority of the road on Jl. Somba Opu used for parking activities for visitors or tourists in the area along the road.
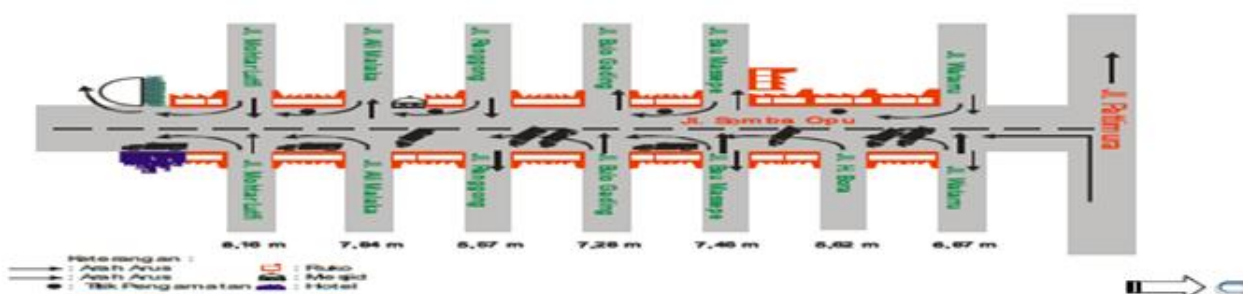

Fig.1. Map of the Road Network Study Area

Parking system uses parallel parking with angle parking erratic or as directed by the parking attendants on the road (varied use of 30o to 45o angle). With the utilization of the activity condition of the road like that, then the flow of traffic conditions on roads that pass often experience delays and queues, and also have enough traffic Speed low.

Method of collecting data

The data collected in this study includes data traffic characteristics (volume and speed) and parking characteristic data. Data collection is done for 7 days in a week according to the methods of Transportation (Ditlantas Transportation, 1999). The data collection method for each type of data, described as the following paragraphs. Vehicle speed data, aims to find the pace or speed of vehicles during peak hours. Surveyor consists of three persons, in which 2 people as the giver signs and one person as registrar information about the vehicle speed is observed. Data volume passing vehicles observed at 4 observation points. This data is intended to determine the total (amount) of vehicles passing through the road Jl. Somba Opu. The number of such vehicles are grouped into 4 categories namely heavy vehicles such as trucks, light vehicles such as passenger cars, motorcycles and non-motorized vehicles. Data parked vehicle aims to determine the number of vehicles parking. In observation of the surveyor noted the number plate of the vehicle, when the vehicle began to leave the vehicle when parking and parking locations. Before the data collection, carried out a preliminary survey which is conducted surveys of environmental conditions to determine the type of environment the way so it can be kind of environmental condition of the road.

Data analysis methods

Methods of data analysis performed in this study includes three stages of analysis activities. The first is to analyze the characteristics of the relationship model of traffic volume and speeds using Greenshield model approach as described in the previous section. The second is to optimize the balance between the actual capacity and the number of parking of vehicles that can be accommodated, in order to obtain optimum parking angle.

The optimization process is preceded by determining in advance the trend line between the two variables on a variety of angles parking conditions. The third is to evaluate the performance of the speed and volume of traffic using the VS models and optimization results.

RESULTS AND DISCUSSION

Traffic Characteristics

From the analysis and calculation of the volume of data traffic for four observation points during the 7 days of observation, the value of the maximum daily volume in the segment Jl. Somba Opu at 1452.83 smp / hour which occurred on Sunday, the lowest volume occurred on Thursday in the amount of 1384.56 smp / hour. Characteristics of a maximum average speed of traffic in rush hour to 7 days of observation 16:46 km / h occurred on Thursday. Capacity estimation results Jl. Somba Opu using equation (3) is approximately 2751.52 smp / hour. With an ideal capacity of this road, the obtained value of the maximum degree of saturation of 0528. The use of the road as a parking lot on the road Somba Opu cause a reduction in road width becomes 3.68 m, so that road capacity has decreased to 1587.72 smp / hour. With this condition the degree of saturation of actual values obtained Jl. Somba Opu increased to 0.89.

Characteristics Vehicle Parking

Part of the road is used as a parking space is left on the road along Jalan Somba Opu. Wide road that is used as a parking lot for 3.83 m. The position of vehicles parked in parallel to intermingle between 45o position. There are also vehicles parked plated. Therefore, the necessary arrangements and establish optimum parking angle of the vehicle. The results of the survey and analysis of the data showed that the accumulation park parking peak occurred on Sunday in the amount of 75 to 56 vehicles to cars and motorcycles. The maximum duration of parking of vehicles for car and motorbike for 7 days is presented in Figure 2. Figure 2. The maximum parking duration Relationship Model Traffic Volume and Speed (Model VS) Result based odeling using the model approach Greenshield, acquired VS models as in Figure 3.
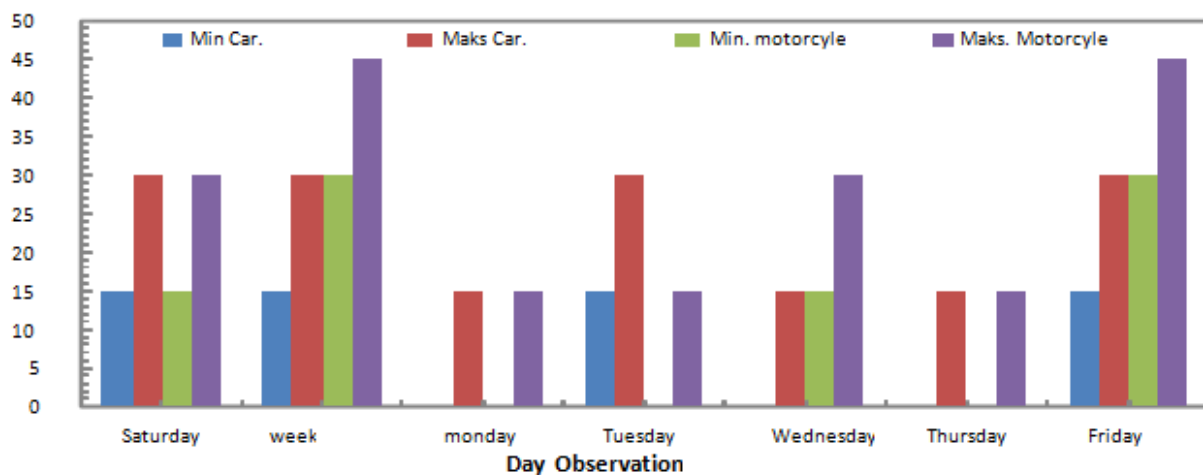

Fig.2. shows that the duration of a vehicle parked car during the 7 days of observation is 15 to 30 minutes, while the motor is at 15 to 45 minutes
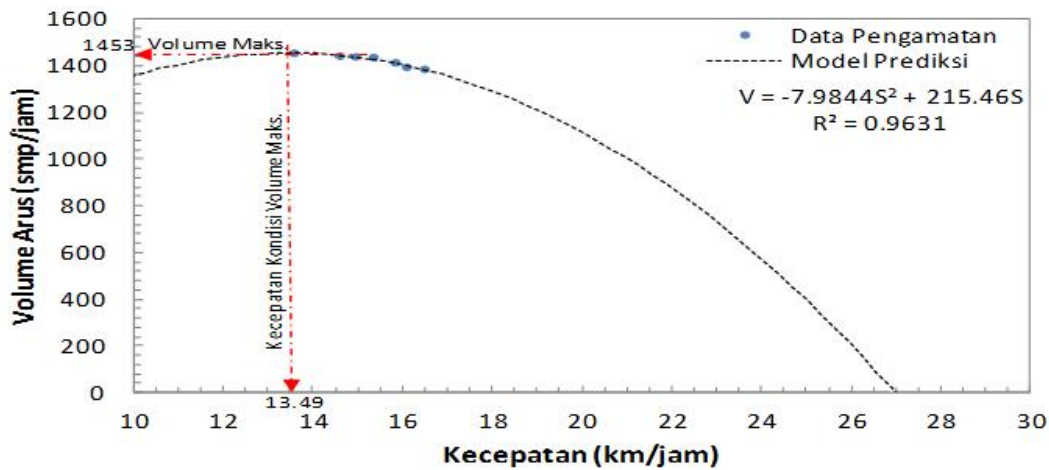
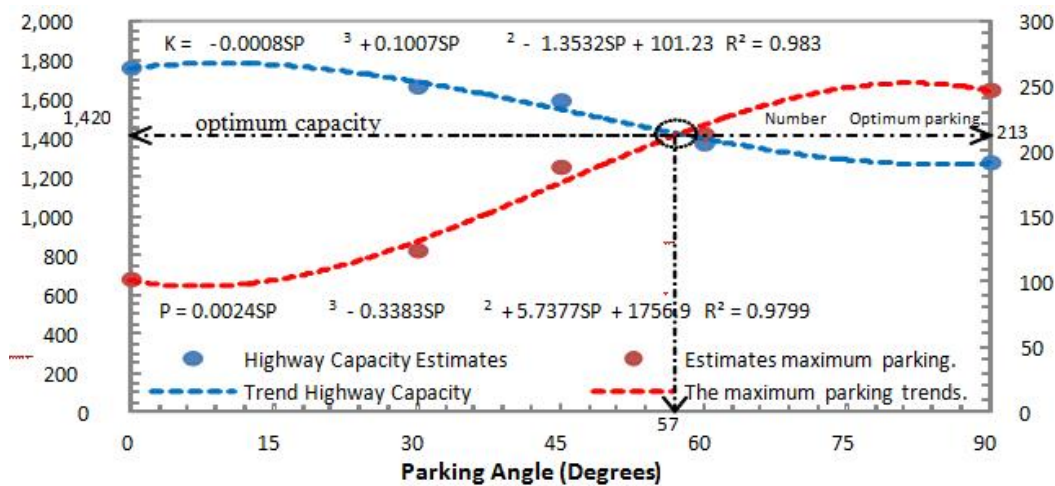**Fig.3. Relationship Model Traffic Volume by Speed**

Fig.4. Optimization Angle Vehicle Parking

Figure 3 shows that the model of the characteristics relationship traffic volume and speed (model VS) on Jl. Somba Opu significantly following the model Greenshield. This is indicated by the value of the determinant coefficient (R2) is very high at 0.9631. The model equations obtained is V = -7,9844S2 + 215,46S.

Performance Roads Somba Opu

Based on the characteristics of the traffic conditions and the condition of the vehicles parked there, it can be said that the performance of segments Jl. Somba Opu was strongly influenced by the activities of vehicle parking for the purpose of travel-shopping activities, which has led to the decreased performance. This is indicated by a decrease in the capacity of 2751.52 smp / hour for effective road width of 7.5 m to 1452.83 smp / hour for effective road width of 3.68 m due to the use of part of the road to park, The number of vehicles parked on the road Somba Opu resulted in reduced road width, so that current can pass also becomes smaller. Conversely, if the vehicle is parked is reduced then the current can be served will increase, because the road to a current area will increase.

Furthermore, a decline in vehicle speed due to the use of the road as a parking lot caused by narrowing the width of the road so that vehicles through the streets Somba Opu focuses only on one lane.

Figure 3 shows that the higher the traffic flow through the streets Somba Opu, then the speed of the vehicle is also diminishing, due to the reduced width of the road is used as a parking lot. This condition is quite a range with behavioral performance delays and traffic queues are characterized by fairly low value of the speed of traffic. Overall, an increase in the degree of saturation of 0.528 (condition of service level B) becomes 0, 88 (conditions of service level D) due to the activity of vehicle parking. In this context, the position of the vehicle parking was also very influential on the performance of the traffic, where the effective width of the street there is little influence-street parking. Therefore, this study will further optimizing the angle parking of vehicles and further evaluate their impact on the performance of the traffic by using model results VS, so that roads can provide services and optimal performance.

Angle Optimization Vehicle Parking

Optimization of vehicles parked corner didahulu by estimating the capacity of roads to various forms of angle parking. Capacity estimation is done by using equation (3) for any changes in the effective width of the road conditions due to variations in angle parking. The same was done to the maximum number of parking of vehicles that can be obtained for any variations in angle parking. Estimate the maximum
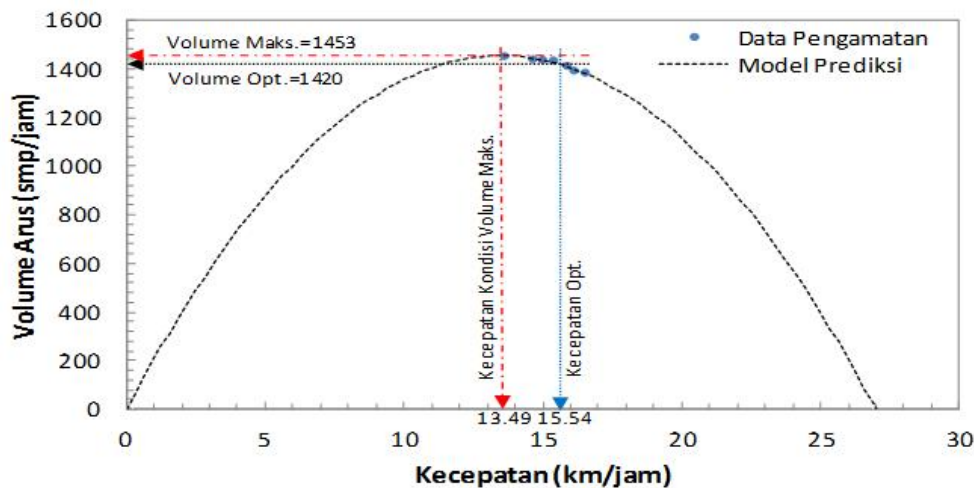
Fig.5. Optimization Angle Vehicle Parking

number of vehicles parked using the model given in Table 1. Based on the lines of the second tendency variable, the optimization of the parking angle conditions that can optimize the balance between the two variables (capacity and parking vehicles jmlah maximum) can be done and determined. By using the data results of the previous analysis, the obtained results of modeling tendency capacity and the amount of parking for various positions and angles parking optimal condition as shown in Figure 4. Figure 4 shows that the greater the angle of the parking lot, where diminishing the effective width of the road, then the road capacity will decrease, and vice versa maximum number of parking of vehicles is increasing.

Furthermore, Figure 4 shows that the point of balance for optimal conditions both variables occur on the condition of the parking angle of 57 ° (optimum conditions). The optimum conditions provide the capacity value of 1420 smp / hour and maximum number of vehicle parking for 213 vehicles. Furthermore, the optimum condition is evaluated the impact on traffic performance by using models VS.

Performance Evaluation of Traffic in Parking Optimum Angle Conditions

Evaluation is done by plotting the value of the optimum capacity due to optimum parking angle as an optimum volume value on the curve VS model predictions, so the value so be optimum speed traffic. This condition will be compared against the current value of the speed of the maximum volume conditions based models VS. Results plot both conditions presented in Figure 5. Figure 5 shows that the conditions optimum parking angle will give the speed of traffic at 15:54 km / h. While the value of the speed at maximum current condition is at 13:49 km / h. This indicates that the optimization of angle parking of vehicles can have a positive impact on the performance of the traffic as indicated by the increase in the value of speed of approximately 2 km / h. Although the increase in the value of this velocity is relatively small, but at least it can provide improved performance rate of traffic flow at road crossing Jl.Somba Opu which is the central region's largest shopping-tourism activities in the city of Makassar.

Conclusion

The impact of vehicle parking on a main road (Jl. Somba Opu) in tourist-shopping area in the city of Makassar on the performance of the traffic flow has been evaluated in this study. Through the development of a model of the relationship volume and speed of traffic (model VS), and the parking angle optimization that considers optimization of the capacity and the maximum number of parking vehicles on these roads, the impact of the parking activity has been able to be represented well. Results of the evaluation showed that an increase in the performance rate of traffic flow on the conditions of optimum parking angle compared to the actual conditions that occur. Although a positive impact in improving the performance of the traffic speed is not great, but it was enough to give an idea that the condition of the vehicle on the road the parking system can still be made improvements in order to obtain optimal results, both in terms of traffic performance, as well as from side parking capacity. In the end, the results of this study are expected to be the basis for developing the modeling and simulation of the effect of parking on the road traffic performance comprehensively in further studies in the future.

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