

The Effect of On-Street Parking in the Kelapa Lima Beach Area on Traffic Performance on Timor Raya Street Kupang City

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Keywords: Capacity, Kupang, PKJI2014, Traffic, Urban Road.

Abstract: The increase in population and density of vehicles in urban areas results in a decrease in road performance which ultimately causes traffic congestion problems. An increase in the vehicle population along with a shortage of urban road space caused by roadside activities. One of them is the problem of parking on the road because there is no adequate parking space will result in a decrease in road capacity which has an impact on decreasing traffic performance on the road. The Kelapa Lima Beach area which is located on Timor Raya street is a new refreshing place for residents of Kupang City but does not have adequate parking facilities. Visitors park their vehicles on the road, causing the road capacity to decrease. This if allowed to continue will have a bad impact on all social aspects. The purpose of this study was to determine the effect of on-street parking on traffic performance on the Timor Raya segment. The analysis method uses the Indonesian Road Capacity Guidelines (PKJI 2014). The results show that on-street parking in the Kelapa Lima beach area has an effect of 79.84 percent on traffic performance on the Timor Raya Street.

1 INTRODUCTION

On rapid economic development and motorization, the number of motorized vehicles owned by residents in various cities has increased significantly. At the same time, the availability of transport infrastructure lags behind, causing an imbalance between transport demand and supply. This problem is especially noticeable in the vehicle parking system. In some areas of downtown Kupang, traffic is often heavy and parking spaces are very limited. Thus, most users rely on on-street parking facilities (Wadu, Tuati, and Sodianango 2020) (Wadu, Loden, and Bria 2019) (Wadu 2020).

On-street parking is often found in urban street environments, because it is easy and does not require a special parking space. Unfortunately, on-street parking spaces are also associated with reduced road capacity, which can result in reduced traffic performance and an impact on accidents when compared to roads of the same category without on-street parking (Edquist, Rudin-Brown, and Lenné 2012).

One of the new congestion points in Kupang City is the Kelapa Lima Beach area. The Kelapa Lima Beach area development project which will be used

as the location of a culinary center in Kupang City, East Nusa Tenggara, Indonesia Although the project has not been completed and has not been inaugurated, the Culinary Center area is already crowded with residents of Kupang on weekends. Many residents of Kupang City came to meet the location which is located in front of the Aston Kupang Hotel, on timor raya street. The unavailability of parking facilities in the area causes visitors to use the road as a parking area which then affects the capacity of the highway and causes a decrease in speed and traffic performance on Timor Raya street in the area. Thus, with increasing parking frequency and with increasing traffic volume, this has the potential to become a cause of congestion (Gore et al. 2021).

Several studies have been conducted on the existence of parking on the road band which affects the traffic performance parameters. On research (Et. al. 2021) using the 1997 Indonesian Road Capacity Manual (MKJI) and linear regression as the basis for calculating all data, the R value is more than 0.8 which means that on-street parking has a strong influence on vehicle travel time to pass H. Agus Salim street. On research (Honma and Meguro 2020) explains that in the downtown area of Yangon city, Myanmar, which often experiences heavy traffic, also shows that one of the reasons is the rampant illegal

parking of cars on the streets. On (Abu 2019) explains the average total segment delay of the total duration along the road segment due to roadside parking on the 3 road segments studied in Addis Ababa, Ethiopia was 7.29, 12.01 and 25.95 seconds per vehicle. On research (Nahry et al. 2019) on Jatinegara Barat street, Jakarta there is a fairly strong relationship between parking and vehicle delays moving to the parking location, and traffic volume also affects this relationship.

Seeing that the traffic conditions in the Kelapa Lima Beach area are increasingly congested, the purpose of this study is to find out how much influence parking vehicles have on the road to traffic performance has a high urgency.

2 REVIEW OF LITERATURE

2.1 Side Friction

Side friction are defined as activities that occur on the side of the road starting from lowering transportation activities that affect normal traffic lanes that pass through the road section (Forde and Daniel 2017). Roadside activities affect traffic flow operations and can cause delays, there are several references that try to measure the effect directly especially for developing countries where the effect tends to be high (Ryus et al. 2011).

When side friction are at their worst, road capacity is also reduced, resulting in traffic congestion problems. On research (Pal and Roy 2019) shows the road segment capacity decreased to 800 vehicles/hour from 1,950 vehicles/hour when the side friction rate increased from 50 incidents to 130 incidents. On research (Saw et al. 2019) capacity in the city of Warangal, India is estimated at 2909 vehicles/hour for road conditions with side friction. And the capacity in the absence of side resistance is 3173 vehicles/hour. There is an approximately 9% reduction in capacity due to side drag. On-street parking reduces road capacity (Chen et al. 2017). In general, side friction can be buses stopping at stops, pedestrians walking along the side of the train track and crossing randomly, parking on the street, exits and entries from the approach road, slow moving vehicles (P. Li and He 2016).

2.2 On Street Parking

On Street Parking is located on the side of the road with limited number of parking spaces, therefore it is suitable for short term temporary parking users and

should have a higher parking turnover rate to provide services to more users (J. Li, Wu, and Feng 2021). There are several indicators that will be used to correlate the effect between parking and traffic performance, including parking volume and parking accumulation (Wadu, Sulistio, and Wicaksono 2017).

$$\text{Accumulation} = Q_{\text{in}} - Q_{\text{out}} + Q_s$$

Where Q_{in} is the number of vehicles entering every hour, Q_{out} is the number of vehicles exiting every hour, and Q_s is the number of vehicles parked on the road before the observation.

$$\text{Volume} = Q_{\text{in}} + Q_s$$

Where Q_{in} is the number of vehicles entering every hour and Q_s is the number of vehicles that have been parked on the road before the observation. side

2.3 Urban Road Performance

Urban road performance which is commonly called Level of Service, LOS is a qualitative measure used to indicate traffic conditions in terms of speed, travel time, freedom to maneuver, comfort, convenience, traffic disturbance, safety etc. The more the ratio, the greater the congestion. v/c value of 1.0 indicates heavy traffic. LOS suitable for various scenarios are presented to deal with existing traffic problems (Gajjar and Mohandas 2016).

On (Yany, Farida, and Walujodjati 2016) e xplains traffic characteristics in terms of the V/C Ratio and the average travel speed of traffic due to parking on the road have a significant impact. When the parking volume is high, the V/C Ratio is high and the average travel time is low, causing congestion. While on research (Yany, Farida, and Walujodjati 2016) t he existing condition on Ir.H Juanda street with on-street parking apparently affects the performance of Ir.H. Juanda street. The capacity of roads without parking is 2,854 pcu/hour, while the capacity with parking is 1,215 pcu/hour. For V/C Ratio of 0.22. Average speed 33 km / h. The level of service for peak hours on Ir.H. Juanda street is C.

Based on the Indonesian Road Capacity Guidelines (PKJI 2014) traffic performance on urban roads can be determined through a comparison between the maximum hourly traffic flow and road capacity. (PKJI 2014).

3 RESEARCH METHODOLOGY

The research stages start from literature study, data collection, data analysis, to the results in the form of conclusions and recommendations for handling. It was started with a literature study which then identified problems that caused traffic jams on the Timor Raya road, especially in the Kelapa Lima Beach area of Kupang City. This stage is carried out to find out the real root problems that occur in the study area. At this stage, the concentration points of the study area and the scope of the problems to be discussed are also carried out. The analysis stage is a follow-up after data processing is completed. The purpose of this stage is to understand and analyze the processing results in depth. The analysis is carried out by taking into account the traffic performance on the section starting from the side friction and v/c ratio and then proceeding with the parking volume to find out how the effect of parking on traffic performance.

4 RESULTS AND DISCUSSION

4.1 Traffic Flow

Observation of traffic flow is carried out for one week starting from 07.00 to 24.00 as shown in Figure 1.

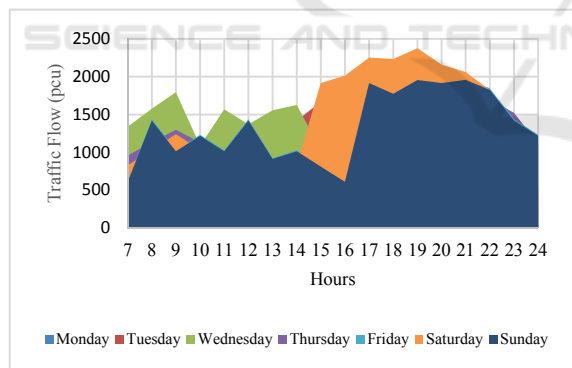


Figure 1: Traffic flow during one week observation.

Based on Figure 1, the peak traffic flow occurs on Saturday at 19.00 with a value of 2378 cur/hour. This condition occurs because Saturday is the weekend, which generally Kupang City residents relax and enjoy time with family. Meanwhile, the lowest traffic flow occurred on Monday at 24.00 with a value of 420 cur/hour. This happens because Monday is a working day where there are not many Kupang residents who do tourism or relax.

4.2 Side Friction

As traffic conditions peak on Saturdays, it is important to analyze roadside activity on Saturdays. This side activity is a side friction for traffic flow on the Timor Raya road.

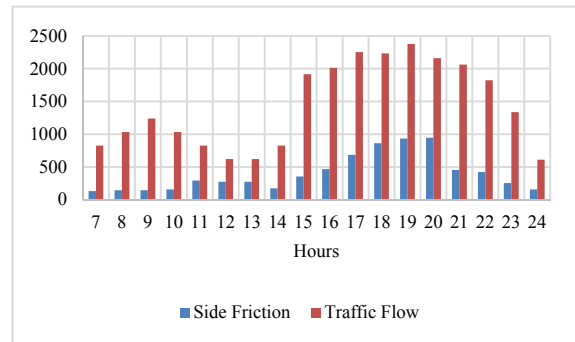


Figure 2: Side friction on Saturday.

Based on Figure 2, the highest side resistance is at 20.00 with 945 incident frequencies. Meanwhile, at 19.00 which is the peak hour of traffic flow, the side obstacle is at 934 the frequency of occurrence. This shows that with this high traffic flow, there are also high side friction, which means that the increase in traffic flow also increases the activities of residents on Kelapa Lima Beach.

4.3 Parking Accumulation

Road parking in the coconut five beach tourist area is recorded on Saturday and is shown in Figure 3.

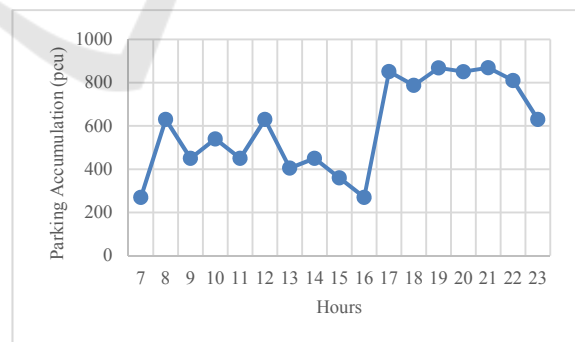


Figure 3: Parking accumulation on Saturday.

Based on Figure 3, parking accumulation starts to increase from 16.00 to 17.00 and starts constant at 17.00 to 22.00 with the highest accumulative occurring at 21.00 with a value of 869 vehicles. This also shows that high side friction and high traffic flow

have a relationship with increasing accumulative parking in the Kelapa Lima beach area.

4.4 Relationship Between Degree of Saturation and Side Friction Frequency

Higher side friction will affect the existing road capacity. With the degree of saturation as a parameter measuring how much capacity the road can meet the traffic needs on the Timor Raya road, a model of the relationship between side resistance and the degree of saturation is made in Figures 4 and 5.

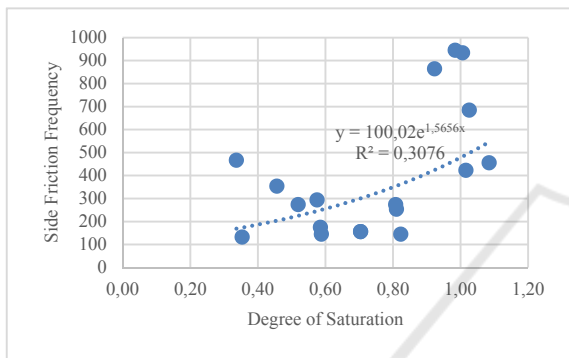


Figure 4: Relationship between degree of saturation and side friction frequency using exponential function.

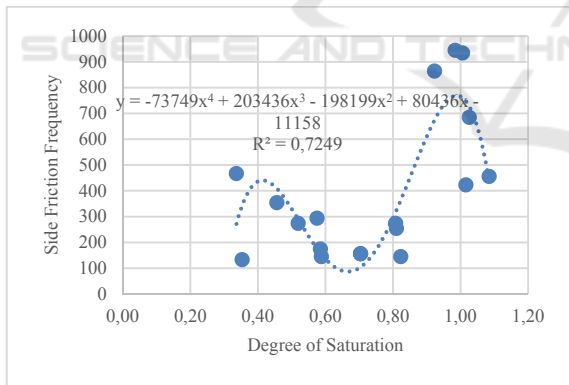


Figure 5: Relationship between degree of saturation and side friction frequency using polynomial of degree 4.

Figure 4 shows the relationship between the degree of saturation and side resistance with the equation $y=100.02e^{1.5656x}$ with $R^2 = 0.3904$ while in Figure 5 using the polynomial of degree 4 we get the equation $y = -73749x^4 + 203436x^3 - 198199x^2 + 80436x - 11158$ with $R^2 = 0.7249$ which is better than the exponential function.

4.5 Relationship Between Degree of Saturation and Parking Accumulation

The relationship between the degree of saturation (x) and parking accumulation (y) that occurs at the Kelapa Lima beach is shown in Figure 5.

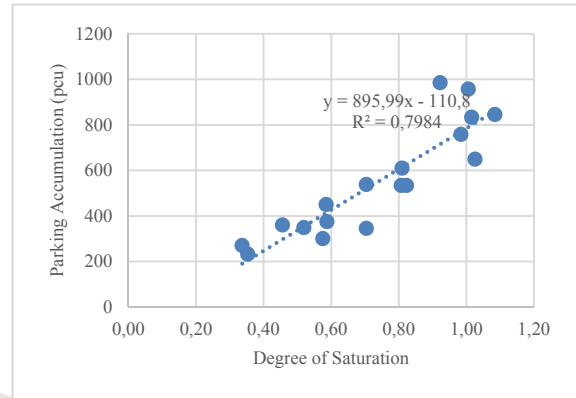


Figure 6: Relationship between degree of saturation and parking accumulation.

Based on Figure 5, the more parking on the road body will increase the degree of saturation of the road, which means that the higher the degree of saturation, the worse the road performance with the equation of the relationship between $y = 895.99x - 110.8$ with $R^2 = 0.7984$. This condition also explains that 79.84 percent of the degree of saturation can be affected by on-street parking. The rest, as much as 0.16 or 20.16 percent are influenced by unknown variables.

5 CONCLUSIONS

Based on the discussion of the effect of on-street parking in the Kelapa Lima beach area, it has an effect of 79.84 percent on traffic performance on the Timor Raya road. So that in the future the government must prepare parking facilities so that this will no longer continue, let alone cause bigger problems.

ACKNOWLEDGEMENTS

Thanks to Politeknik Negeri Kupang for providing financial and moral assistance during the researchers conducting this research.

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