

Analysis of the Effect of Side Obstacles on Performance on the Z.A. Pagaralam Road Section

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ABSTRACT

Development in Bandar Lampung is increasing rapidly, causing an increase in transportation development. The development of transportation in the city of Bandar Lampung is currently still experiencing severe problems, so traffic hours often occur. The high level of congestion on the highway is caused by several things, including the unbalanced road capacity and vehicle volume and the presence of side obstacles, which add to congestion on the Z.A. Pagaralam road section. Apart from being a public road, Pagaralam is also located in one of the busiest economic centers in the city of Bandar Lampung. Along this stretch of road are campuses, schools, shops, pharmacies, shopping centers, and street vendors, and it is also a transfer point for passengers moving from one public transport to another, causing many side obstacles to occur on the road. To overcome this, it is necessary to analyze the influence of side obstacles on traffic performance. Data analysis was carried out using the PKJI 2014 method. The analysis of traffic volume obtained a value of 4747.75 cur/hour. The analysis results of the highest side obstacles were obtained on Tuesday at 12.00 – 14.00 segment 1 amounting to 838.90 incident weights.

Keywords: Traffic Volume, Side Obstacles, PKJI 2014.

Introduction

Bandar Lampung is the capital of Lampung Province, which has a population of 1,209,937 people, with a population growth rate from previous years of 0.37% (Central Statistics Agency for Bandar Lampung City, 2022). City development continues to increase along with the development of population numbers and activities, where the more population activity in a city, the faster the city will develop rapidly [1]. Thus, the community's need for transportation facilities is increasing along with the development of the community's economy. [2]–[7]. The development of transportation in the city of Bandar Lampung is currently still experiencing severe problems, so traffic hours often occur. The high level of traffic hours on highways is caused by several things, including unbalanced road capacity and vehicle volume and the presence of side obstacles, which add to congestion on these road sections [8]–[17].

Side obstacles impact traffic performance from activities next to the road segment, such as street vendors, pedestrians walking on the roadside, public or private vehicles stopping or parking in any place, vehicles entering and leaving the side of the road, and slow vehicles. Side obstacles greatly influence the level of service on a road section. A clear influence is a reduction in road capacity and performance so that side obstacles will indirectly affect vehicle speed. [18]–[25].

ZA Street. Apart from being a public road, Pagaralam is also located in one of the busiest economic centers in the city of Bandar Lampung. Along this stretch of road are campuses, schools, shops, pharmacies, shopping centers, and street vendors, and it is also a transfer point for passengers moving from one public transport to another, causing many side obstacles to occur on the road. Community or pedestrian activity on roads can also factor in congestion, for example, people crossing the road carelessly, getting on/off from public transport, which makes other vehicles stop, and so on. During rush hour on Jalan ZA, Pagaralam experiences traffic hours caused by the large number of vehicles piling up wanting to go to offices, campuses, schools, and other places of activity. Therefore, the ZA Pagaralam road section needs to conduct a review of the analysis of the influence of side obstacles on traffic flow, especially on vehicle performance. This research aims to determine how much side obstacles influence traffic flow performance on the ZA road section. Pagaralam.

Research Methods

The location of this research is Jalan, ZA. Pagaralam is 1.1 km long with a segment from Alfamart Jl. ZA. Pagaralam to Burger King Jl. ZA. Pagaralam. Traffic surveys were carried out at two survey points. This survey will use 8 survey officers, with 3 types of survey divisions, namely 4 people surveying vehicle volume, 2 surveying side obstacles, and 2 surveying speed. The research location can be seen in Figure 1. The implementation of this research activity can be seen in Figure 2.



Figure 1. Research Location

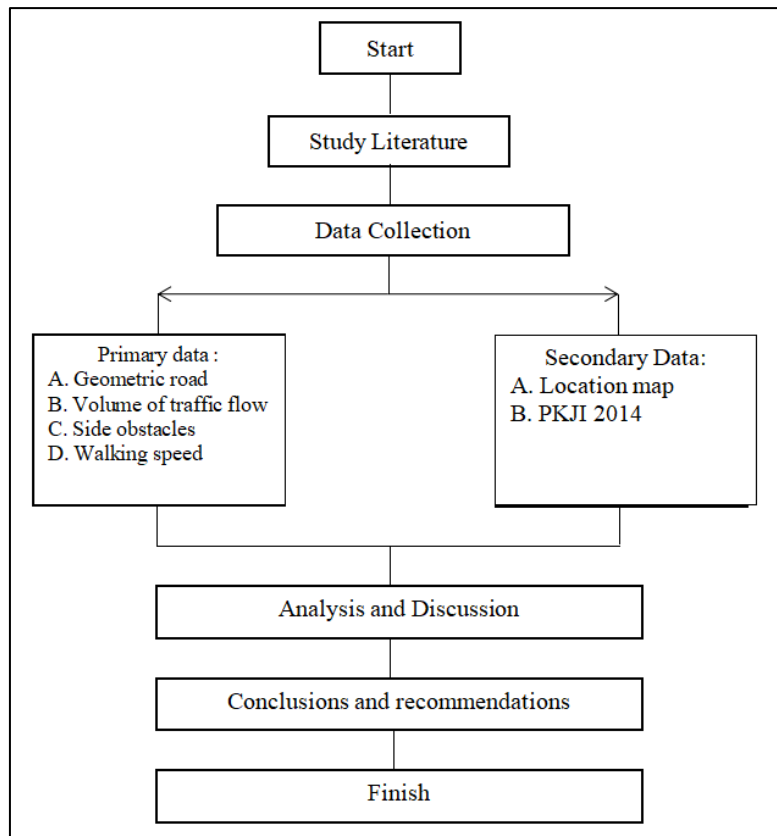


Figure 2. Research Flow Diagram

Results and Discussion

1. Geometric Research Location

The general condition of the ZA Pagaralam road section results can be seen in Table 1. Geometric Condition of the Road

Table 1. Road Geometric Conditions

Parameter	Segment 1	Segment 2
Road type	3 lanes 1 way (3/1 D)	3 lanes 1 way (3/1 D)
Regional Type	Urban area	Urban area
Path width	9 m	9 m
Lebar median	1 m	1 m
Carriage width	20 cm	20 cm
Sidewalk width	1,5 m	1,5 m
Long road	1,1 Km	1,1 Km

2. Traffic Volume Data

Traffic volume is the number of vehicles passing a point on a road section at a certain time (Kadarusman et al., 2023). Traffic volume data from this research was obtained from the field survey results by counting the number of vehicles passing the observation point every 15 minutes. This research was carried out for 3 days, on Monday, Tuesday, and Saturday (12, 13, and 17 December 2022), for data results from traffic recapitulation (cur/hour) can be seen in Table 3. The types of vehicles, according to PKJI 2014 surveyed, are Motorcycles (SM), Light Vehicles (KR), and Heavy Vehicles (KB), with equivalent factors of light vehicles (er) in Table 2.

Table 2. Light Vehicle Equivalentents According to PKJI 2014

Light Vehicle Equivalent		
SM	KR	KB
0,25	1	1,2

Source: PKJI (2014)

Table 3. Traffic Volume Recapitulation

Survey time	Monday, 12 December 2022		Tuesday, 13 December 2022		Saturday, 17 December 2022	
	Q total (skr/ hour)		Q total (skr/ hour)		Q total (skr/ hour)	
	Segmen 1	Segmen 2	Segmen 1	Segmen 2	Segmen 1	Segmen 2
07.00 – 0.9.00	4644,48	4645,00	4747,75	4299,13	3878,85	3022,30
11.00 – 13.00	4614,68	4401,15	4731,50	4056,50	3870,23	2812,40
16.00 – 18.00	4378,80	4040,50	4293,13	3688,25	3499,10	2569,85

In Table 2, the recapitulation of the traffic volume above, based on the results of research conducted on Monday, Tuesday, and Saturday, it was found that the highest traffic volume on Tuesday, December 13, 2022, was 4747.75 cur/hour.

3. Side Obstacle Data

Side obstacles are roadside activities that can affect traffic flow performance. In the side obstacle survey, the data that must be looked for can be seen in Table 4 and Table 5. This research was carried out for 3 days, on Monday, Tuesday, and Saturday (12, 13, and 17 December 2022), with data collection every 1 O'clock. The calculation of the results from the side obstacle survey is multiplied by weighting according to PKJI 2014 provisions. The results of the frequency weights in this study can be seen in Tables 6 to 11.

Table 4. Frequency of Weight of Side Obstacle Events According to PKJI 2014

Types of Side Obstacle Events	Weighted Factors
Pedestrian (PED)	0,5
Vehicles enter and exit (EEV)	07
The vehicle parks and stops (PSV)	1
Slow vehicle (SMV)	0,4

Source: PKJI (2014)

Table 5. Side Obstacle Class

Side Obstacle Class	The weighted frequency value of events	Special conditions
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Very Low (VL)	<100	Residential and environmental roads are available, but there are no activities.
Low (L)	100 – 299	In residential areas, there is some public transportation.
High (H)	300 – 499	Industrial area, with several shops along the side of the road
Very High (VH)	>900	In commercial areas, there is market activity on the side of the road

Source: PKJI (2014)

Table 6. Frequency of Side Obstacle Weights, Monday 12 December 2022 Segment 1

Survey time	Monday, 12 December 2022			
	Segment 1			
	Pedestrian (PED)	Vehicle in/out(EEV)	Parking/stopping vehicles(PSV)	Slow vehicle (SMV)
07.00 - 09.00	24,50	651,60	121,00	13,60
12.00 - 14.00	30,00	616,20	90,00	11,20
16.00 – 18.00	29,00	646,40	115,00	14,80

Table 7. Frequency of Side Obstacle Weights, Monday 12 December 2022 Segment 2

Survey time	Monday, 12 December 2022			
	Segment 2			
	Pedestrian (PED)	Vehicle in/out(EEV)	Parking/stopping vehicles(PSV)	Slow vehicle (SMV)
07.00 - 09.00	21,50	596,20	118,00	13,60
12.00 - 14.00	30,00	595,60	107,00	10,00
16.00 – 18.00	22,00	656,50	98,00	15,60

Table 8. Frequency of Side Obstacle Weights, Monday 13 December 2022 Segment 1

Survey time	Tuesday, 13 December 2022			
	Segment 1			
	Pedestrian (PED)	Vehicle in/out(EEV)	Parking/stopping vehicles(PSV)	Slow vehicle (SMV)
07.00 - 09.00	32,50	610,40	101,00	14,80
12.00 - 14.00	24,50	678,40	126,00	10,00
16.00 – 18.00	24,50	446,60	116,00	15,60

Table 9. Frequency of Side Obstacle Weights, Monday 13 December 2022 Segment 2

Survey time	Tuesday, 13 December 2022			
	Segment 2			
	Pedestrian (PED)	Vehicle in/out(EEV)	Parking/stopping vehicles(PSV)	Slow vehicle (SMV)
07.00 - 09.00	22,50	411,80	101,00	13,60
12.00 - 14.00	25,00	453,80	95,00	10,80
16.00 – 18.00	24,50	538,20	113,00	12,40

Table 10. Frequency of Side Obstacle Weights, Monday 17 December 2022 Segment 1

Survey time	Saturday, 17 December 2022			
	Segment 1			
	Pedestrian (PED)	Vehicle in/out(EEV)	Parking/stopping vehicles(PSV)	Slow vehicle (SMV)
07.00 - 09.00	26,50	426,40	101,00	9,60
12.00 - 14.00	26,00	505,20	93,00	8,80
16.00 – 18.00	23,00	507,70	107,00	11,20

Table 11. Frequency of Side Obstacle Weights, Monday 17 December 2022 Segment 2

Survey time	Saturday, 17 December 2022			
	Segment 2			
	Pedestrian (PED)	Vehicle in/out(EEV)	Parking/stopping vehicles(PSV)	Slow vehicle (SMV)
07.00 - 09.00	19,50	411,80	266,60	8,00
12.00 - 14.00	25,00	453,80	93,00	10,40
16.00 - 18.00	27,50	538,20	90,00	12,00

After determining the analysis results in the table above, the highest side resistance results were obtained using the following equation:

$$SFC = PED + PSV + EEV + SMV \quad (1)$$

Information :

PED: pedestrian

PSV: vehicle parked/stopped

EEV: vehicles entering/entering from the side of the road

SMV: slow-moving vehicle

SFC: side resistance class

The results of the highest frequency weights can be seen in Table 12.

Table 12. Highest frequency weight of Side Obstacles

Hari/Tanggal	Survey time	Number of incidents	
		Segment 1	Segment 2
Monday, 12 December	07.00 - 09.00	810,70	749,30
	12.00 - 14.00	747,40	742,60
	16.00 - 18.00	805,20	792,10
Tuesday, 13 December	07.00 - 09.00	758,70	548,90
	12.00 - 14.00	838,90	584,60
	16.00 - 18.00	502,70	688,10
Saturday, 17 December	07.00 - 09.00	563,50	705,90
	12.00 - 14.00	633,00	582,20
	16.00 - 18.00	648,90	667,70

Based on the research results, the highest total side resistance was obtained on Tuesday at 12.00 - 14.00 segment 1, amounting to 838.90 incident weights.

4. Free Flow Speed Data

Factors that impact free flow speed are essential to free flow speed, speed due to road width, free speed due to side obstacles, and adjustments to city size. In this free flow speed analysis, following the rules in the Indonesian Road Capacity Guidebook (PKJI 2014), the free flow speed of light vehicles (VB) can only be used to measure traffic performance. Data from free flow speed can be seen in the following equation, and the results of calculations from this research can be seen in Table 13.

$$V_B = (V_{BD} + V_{BL}) \times FV_{BHS} \times FV_{BUK} \quad (2)$$

Information :

VB: Free flow speed for KR in field conditions (Km/hour)

VBD: Basic free flow speed

KR VBL: Speed adjustment due to road width

FVBHS: Free speed adjustment factor due to side obstacles on the road have shoulders or roads equipped with carriages or sidewalks with carriage distances to the nearest barrier.

FVBUK: Speed adjustment factor for city size

Table 13. Free Flow Speed Calculation Results

Road type	Speed adjustment factor				Free flow speed (V _B)
	Basic free flow (V _{BD})	The width of the road (V _{BL})	Side obstacles (FV _{BHS})	City size (FV _{BUK})	
6/2D	57	-4	0,96	1,00	50,88 km/hour

5. Road Capacity Data

Capacity (C) is the maximum traffic flow through a road segment that can be maintained per hour under certain conditions. The factors that influence capacity must be determined to determine capacity value. This can be seen in the following equation, and the results obtained can be seen in Table 14.

$$C = C_0 \times FCLJ \times FCPA \times FCHS \times FCUK \tag{3}$$

Information:

C: Capacity (current/hour)

C0: Basic capacity (cur/hour)

FCLJ: Capacity adjustment factor related to lane width or traffic lane

FCPA: Capacity adjustment factor related to direction separation

FCHS: Side drag adjustment factor

FCUK: City size adjustment factor

Table 14. Results of Road Section Capacity Calculations

Road Type	Base speed C ₀ (skr/hour)	Adjustment factor				Capacity C (skr/hour)
		Lane width (F _{CLJ})	Directional divider (F _{CPA})	Side obstacles (F _{CHS})	City size (F _{CUK})	
6/2D	1560	0,92	1,00	0,96	1,00	1377,8

Source: Research Data Management (2022).

6. Degree of Saturation

The degree of saturation (DS) is the ratio to capacity used as the main factor in determining the level of performance of intersections and road segments. Data on the degree of saturation can be seen in the equation formula as follows, and the results can be seen in Table 15.

$$DJ = \frac{Q}{c}$$

Information:

DJ: Degree of saturation

Q: Vehicle volume (cur/hour)

C: Road capacity (cur/hour)

Table 15. Calculation Results of Degree of Saturation

Q (skr/hour)	C (skr/hour)	Degree of saturation (DJ)
474,75	1377,8	3,45

Source: Research Data Management (2022).

Conclusion

Based on the results of the discussions that have been carried out, it can be concluded that the analysis carried out on Monday, Tuesday, and Saturday showed that the highest traffic volume on Tuesday, 13 December 2022, was 4747.75 cur/hour. The analysis results of the highest side obstacles were obtained on Tuesday at 12.00 – 14.00 segment 1 amounting to 838.90 incident weights. Criteria for side obstacles on Jalan ZA. The Pagaralam is considered very high (ST). Based on the analysis according to the Indonesian Road Capacity guidebook (PKJI 2014), the results of calculating the capacity of road sections were 1377.8 (curr/hour), and the calculation results of the degree of saturation were obtained with a value of 3.45.

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