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ANALYSIS OF TRAFFIC ROAD CAPACITY ON ROAD SECTION OF SEI LIAT – PANGKALPINANG CITY BOUNDARY

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Abstract - **The increasing number of vehicles in Bangka Belitung Province has caused several congestion points on several roads, one example in the Road Section of Sei Liat - Pangkalpinang City Boundary which is the main route connecting Pangkalpinang City with Sungailiat City. For the purpose of analyzing the existing capacity of the Sei Liat - Bts Road Section in Pangkal Pinang City, a traffic survey was conducted for seven days using CCTV as the data source. The average daily traffic volume value obtained on the Road Section of Sei Liat - Pangkalpinang City Boundarywas 11,156 vehicles/day or 902 pcu/hour. The value of Road Traffic Capacity obtained on the Road Section of Sei Liat - Pangkalpinang City Boundary was 2,977 pcu/hour with a degree of saturation of 0.3 which means that the Road Section of Sei Liat - Pangkalpinang City Boundary is included in the safe/unsaturated category and capable of serving vehicles that pass through this road every day.**

Keywords : **Traffic Volume, Road Traffic Capacity Analysis, and Saturation Degree**.

I. INTRODUCTION

Population growth in Bangka Belitung Province every year always increases. According to population census data conducted by the Central Statistics Agency in 2020, the population in Bangka Belitung Province reached 1,455,678 people, in 2010 the population in Bangka Belitung Province was 1,223,296 people. This shows that the increase in the population in Bangka Belitung Province is 18.9% (quite high). With this increase in population, the number of vehicles crossing the road will also increase, both passenger transport vehicles and goods transport vehicles.

This increase in the number of vehicles also causes traffic congestion, so research is needed regarding road capacity, whether the road segment is still able to accommodate the number of vehicles that pass through the road segment.

II. LITERATURE REVIEW

Roads are infrastructure built with the aim of connecting one area to another. The road serves as the path used by the vehicle to reach its destination.

A. Traffic Flow

Traffic flow is the number of motorized vehicles passing a point on the road per unit of time (Directorate General of Bina Marga, 1997). Performance analysis of the road section of the 1997 Indonesian Road Capacity Manual (IRCM) method can use traffic volume data in the form of Average Daily Traffic data or peak traffic flow data.

In its use, various types of vehicles must be converted into Passenger Car Units (PCU) by using Passenger Car Equivalents (PCE), which is a factor that shows different types of vehicles compared to light vehicles. The Passenger Car Equivalent (PCE) for each type of vehicle depends on the type of road and the total traffic flow which can be expressed in vehicles/hour. The value of PCE grouped based on the type of vehicle as follows.

1. Light vehicle (LV), is a 4-wheeled motor vehicle with an axle distance of 2.0 – 3.0 m (including passenger cars, microbuses, pick up, and small trucks according to the Bina Marga classification system).
2. Heavy vehicle (HV), is a motor vehicle with an axle distance of more than 3.5 m, usually with more than 4 wheels (including buses, 2 axles trucks, 3 axles trucks, and combination trucks according to the Bina Marga classification system).
3. Motorcycles (MC), are two- or three-wheeled motorized vehicles (including motorcycles and 3-wheeled vehicles according to the Bina Marga classification system).

Table 2. 1 Passenger Car Equivalence for Undivided Urban Roads

Road type: Undivided road	Two-way total traffic (vehicle/hour)	PCE	
		HV	MC
			Traffic lane width Wc (m)

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			≤ 6	> 6
Two undivided lanes (2/2 UD)	0	1,3	0,5	0,40
	≥ 1800	1,2	0,35	0,25
Four undivided lanes (4/2 UD)	0	1,3	0,40	
	≥ 3700	1,2	0,25	

B. **Road Traffic Capacity**

Road capacity is the maximum number of vehicles or people that can pass a road lane at certain times and conditions expressed in units of vehicles/hour or pcu/hour (Indonesian Road Capacity Manual 1997).

The formula used in calculating Road Traffic Capacity is as follows:

C = Co x FCw x FCsp x FCsf x FCcs……. (2.1)

Where:

C = Capacity (pcu/hour)
Co = Base capacity for ideal conditions
FCw = Current path width adjustment factor
FCsp =Directional separator adjustment factor
FCsf = Side resistance adjustment factor
FCcs = City size adjustment factor

Table 2. 2 Base capacity on 2-lane 2-way undivided out-of-town roads (2/2 UD) (FC_O)

Road Type/ Alignment Type	Basic Capacity Total both directions pcu/hour
2/2 UD	
- Flat	3100
- Hill	3000
- Mountain	2900

Table 2. 3 Capacity adjustment factor for direction separator (FC_{SP})

Directions Separation SP % - %	FC_{SP}	
	Two Lane 2/2	Four Lane 4/2
50-50	1,00	1,00
55-45	0,97	0,985
60-40	0,94	0,97
65-35	0,91	0,955
70-30	0,88	0,94

Table 2.4 Capacity adjustment factor for side resistance (FCSF)

Road Type	Side Friction Class (SFC)	Kereb distance - barrier W_K (m)			
		≤ 0,5	1,0	1,5	≥ 2,0
Four divided lanes 4/2 D	Very low	0,95	0,97	0,99	1,01
	Low	0,94	0,96	0,98	1,00
	Medium	0,91	0,93	0,95	0,98
	High	0,86	0,89	0,92	0,95
	Very High	0,81	0,85	0,88	0,92
Four undivided lanes4/2 UD	Very Low	0,95	0,97	0,99	1,01
	Low	0,93	0,95	0,97	1,00
	Medium	0,90	0,92	0,95	0,97
	High	0,84	0,87	0,90	0,93
	Very High	0,77	0,81	0,85	0,90
Two undivided lanes 2/2 UD or One way road	Very Low	0,93	0,95	0,97	0,99
	Low	0,90	0,92	0,95	0,97
	Medium	0,86	0,88	0,91	0,94
	High	0,78	0,81	0,84	0,88
	Very High	0,68	0,72	0,77	0,82

Table 2. 5 Capacity adjustment factor for city size (FCCS) on urban roads

City size (population)	Adjustment factor for city size
< 0,1	0,86
0,1 – 0,5	0,90
0,5 – 1,0	0,94
1,0 – 3,0	1,00
> 3,0	1,04

C. **Degree of Saturation**

The degree of saturation (DS) is the ratio between the traffic volume and the traffic capacity of a road segment. The value of the degree of saturation indicates whether the road segment has problems in the capacity to serve vehicles that pass through it (Directorate General of Bina Marga, 1997).

The equation used to find the value of the degree of saturation is as follows:

DS = Q/C ……...……..(2.2)

Where:

DS = Degree of Saturation
Q = Traffic volume

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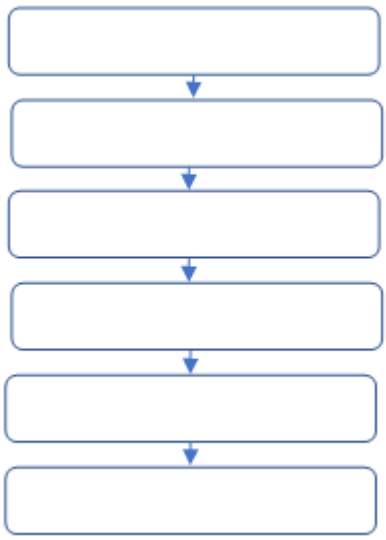
S = Road traffic capacity

III. RESEARCH METHODS

The research conducted in this activity located on Road Section of Sei Liat - Pangkalpinang City Boundary. Traffic data collection conducted using CCTV cameras installed for 24 hours, 7 days in a row.



IV. RESULTS AND DISCUSSION

Survey Result Data Collection

The data collected in this study is Daily Traffic data on Sei Liat – Bts Road Section Pangkal Pinang City. Data collection was conducted by installing CCTV for 7 consecutive days and counting the number of vehicles that pass on the road segment based on CCTV recorded.

The condition of the road on Road Section of Sei Liat - Pangkalpinang City Boundary has a segment length of 28.84 Km, with a road width of 7 m and a shoulder width of 1.5 m. This road section has a road type of 2/2 UD, a flat median type, and land use in the form of housing/gardens.

Road Traffic Capacity Analysis

Traffic data on Road Section of Sei Liat - Pangkalpinang City Boundary was taken on July 2 – July 9, 2021, then a manual calculation was conducted from the CCTV.

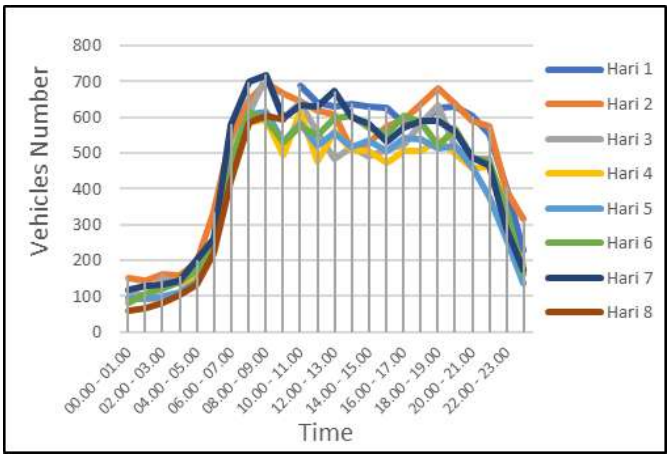


Figure 3. 2 Traffic Graph on Road Section of Sei Liat - Pangkalpinang City Boundary (Normal)

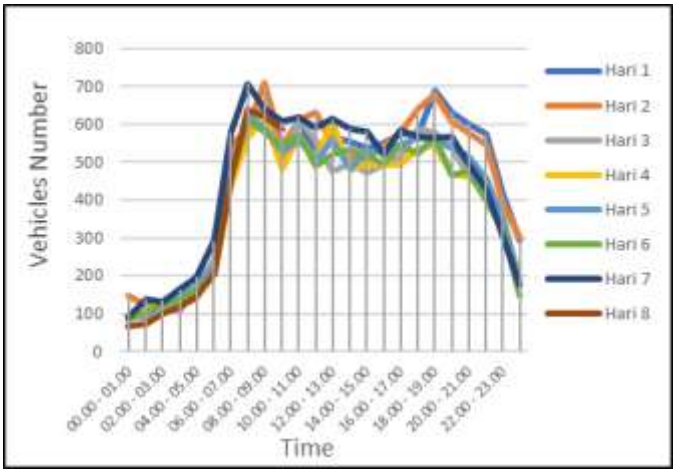


Figure 3. 3 Traffic Graph on Road Section of Sei Liat - Pangkalpinang City Boundary (Opposite)

From Figure 3.2 and Figure 3.3 it is found that the traffic volume that passes on the Road Section of Sei Liat - Pangkalpinang City Boundary has a peak time of 08.00 – 09.00, this applies equally both from normal and opposite directions.

Road Section of Sei Liat - Pangkalpinang City Boundary has an Average Daily Traffic value of 11,156 vehicles/day. However, in analyzing the traffic capacity of a road section, it is necessary to calculate the Passenger Car Equivalence (PCE) to convert different types of vehicles. Calculation of the PCE value from the Road Section of Sei Liat - Pangkalpinang City Boundary is as follows:

MC = (6.239+0) x 0,5
= 3.120 pcu/day
LV = (3.385+146+845) x 1
= 4.376 pcu/day
HV = (541) x 1,3
= 704 pcu/day

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Thus, the value of the Traffic Volume that passes through the Road Section of Sei Liat - Pangkalpinang City Boundary is as follows:

$Q = (MC + LV + HV) \times 0{,}11$
$= (3.120 + 4.376 + 704) \times 0{,}11$
$= 8.200 \times 0{,}11$
$= 902$ pcu/hour

Furthermore, to get the value of Road Traffic Capacity, conducted with the following calculations:

$C = C_o \times FC_w \times FC_{sp} \times FC_{sf} \times FC_{cs}$
$= 3.100 \times 1 \times 0{,}99 \times 0{,}97 \times 1$
$= 2.977$ pcu/hour

Then the degree of saturation analysis was conducted to show the road's ability to serve vehicles that pass through it.

The value of the degree of saturation was calculated with the following calculation:

$DS = Q/C$
$= 902 / 2.977$
$= 0{,}3$

From the value above, the value of the degree of traffic saturation (DS) obtained on the Road Section of Sei Liat - Pangkalpinang City Boundary was 0.3, which means that the traffic on the road is still in the safe or unsaturated category because the DS value < 0.8.

V. CONCLUSION

From the results of traffic analysis on Road Section of Sei Liat - Pangkalpinang City Boundary can be seen that the peak traffic density was 08.00 – 09.00 and 18.00 – 19.00. After analyzing the Road Traffic Capacity, the road capacity value was 2.888 pcu/hour with a saturation degree value of 0.3 which indicated that the Road Section of Sei Liat - Pangkalpinang City Boundary is included in the safe/unsaturated category and capable of serving vehicles that pass through this road every day.

VI. SUGGESTION

From this research, suggestions that can be given are as follows:

1. The results of the analysis of road traffic capacity on Road Section of Sei Liat - Pangkalpinang City Boundary are still in safe/unsaturated condition. However, with the development of the region and population growth that continues to occur, it is feared that in the next few years this road will become saturated and there will be more severe congestion. It is hoped that further research is needed in the next few years to prevent congestion that will occur.
2. Apart from the Road Section of Sei Liat - Pangkalpinang City Boundary, the analysis needed on other roads that have high traffic flow and population.

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