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NATIONAL ROAD PERFORMANCE ANALYSIS BASED ON LAND USE UTILIZATION (A CASE STUDY OF THE NATIONAL ROAD IN PALU CITY)

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ABSTRACT

The level of traffic density in Palu city is increasing, especially on Jalan Diponegoro, Basuki Rahmat and Jalan Yos Sudarso which is a trade and service area, considering the status of these three roads is a national road. This study aims to determine the fluctuation of traffic volume and performance of Diponegoro, Basuki Rahmat and Yos Sudarso roads. The result of traffic volume fluctuation analysis on diponegoro road is 2181.75 smp/hour, with road capacity of 5179.97 smp/hour, degree of saturation (DJ) 0.42, travel speed (VT) of 46.00 km / hour with service level B. Volume fluctuation of Basuki Rahmat road is 1533.25 smp/hour, road capacity (C) is 5630.40 smp / hour, degree of saturation (DJ) is 0.27, travel speed (VT) is 51.75, service level B.And for yosSudarso road traffic volume of 2004.80 smp/hour, road capacity 2729.16 smp/hour, degree of saturation 0.73, travel speed (VT) 32.00 km / hour, with service level B. From the calculation of the degree of saturation (DJ) obtained DS value < 0.75 for all roads, which means that all national roads above can still serve vehicles passing through well.

KEYWORDS: *Capacity, Volume, Degree of Saturation, Speed, Level of Service*

Article History

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INTRODUCTION

Preliminary

Land use and transportation systems have a close integrity (linkage) in the formation of a space on a land. Along with the development of a region both economically and demographically, transportation activities are also increasing. If it is not anticipated that there will be problems in the field of transportation, especially congestion, so that it will increase land use conflicts that occur in areas of heavy traffic, dense buildings and dense activity (Rachman, AP., et al, 2020:69-82).

Palu city has areas that often experience congestion, especially in the area of education, religious areas and areas of trade and services.Jalan Diponegoro is a primary collector road located in the Lere Village area, trade and service activities on this road are able to generate large-scale population mobilization so that the volume of traffic on Jalan Diponegoro increases which certainly affects the level of road services. Jalan Basuki Rahmat is a primary arterial road located in the Birobuli Utara Village area, the problem that exists in the area along Jalan Basuki Rahmat is the lack of available parking space capacity compared to the number of visitor arrivals so that visitors who come will park their

vehicles on part of the road so that the speed of motorists who visit the road is reduced. Jalan yos Sudarso is a primary arterial road located in the Talise Village, Mantikulore District. The problem that often occurs on Jalan yos Sudarso is congestion due to long queues around gasstations.

Problems that began to be seen in the city of Palu is the level of traffic density that is increasing so that traffic jams appear, especially on Jalan Diponegoro, Jalan Basuki Rahmat and Jalan yos Sudarso which is a trade and service area. With the increase in land use every year the level of road services is decreasing and has an impact on the level of road user safety.

RESEARCH METHODS

Research Location

The location of the study was conducted on the National Road Corridor Jalan Diponegoro, Jalan Basuki Rahmat and Jalan Yos Sudarso which is one of the Centers *of the Central Business District* (CBD) in the city of Palu which is a trade and service area.

Based on the decree of the minister of PUPR number. 248 / KPTS/M/ 2015, the length of the segment in this segment is divided into 3 segments:

- Segment 1 = Jl. Diponegoro along 2.68 Km
- Segment 2 = Jl. Basuki Rahmat along 1.75 Km
- Segment 3 = Jl. Yos Sudarso 1.49 Km

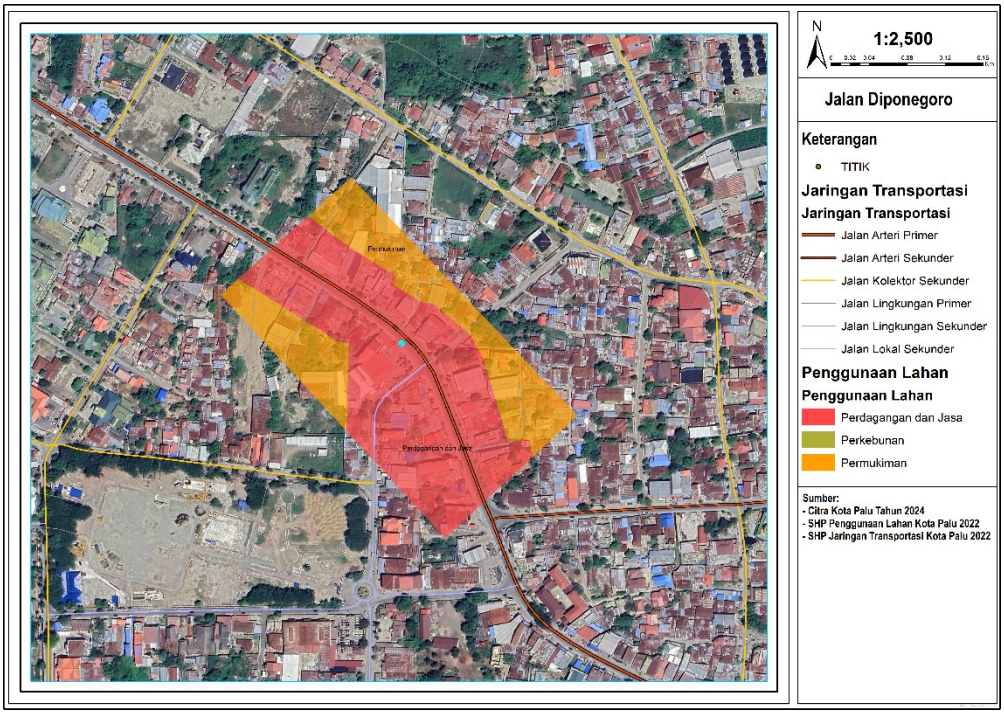

Figure 1: Map of Diponegoro Street Location

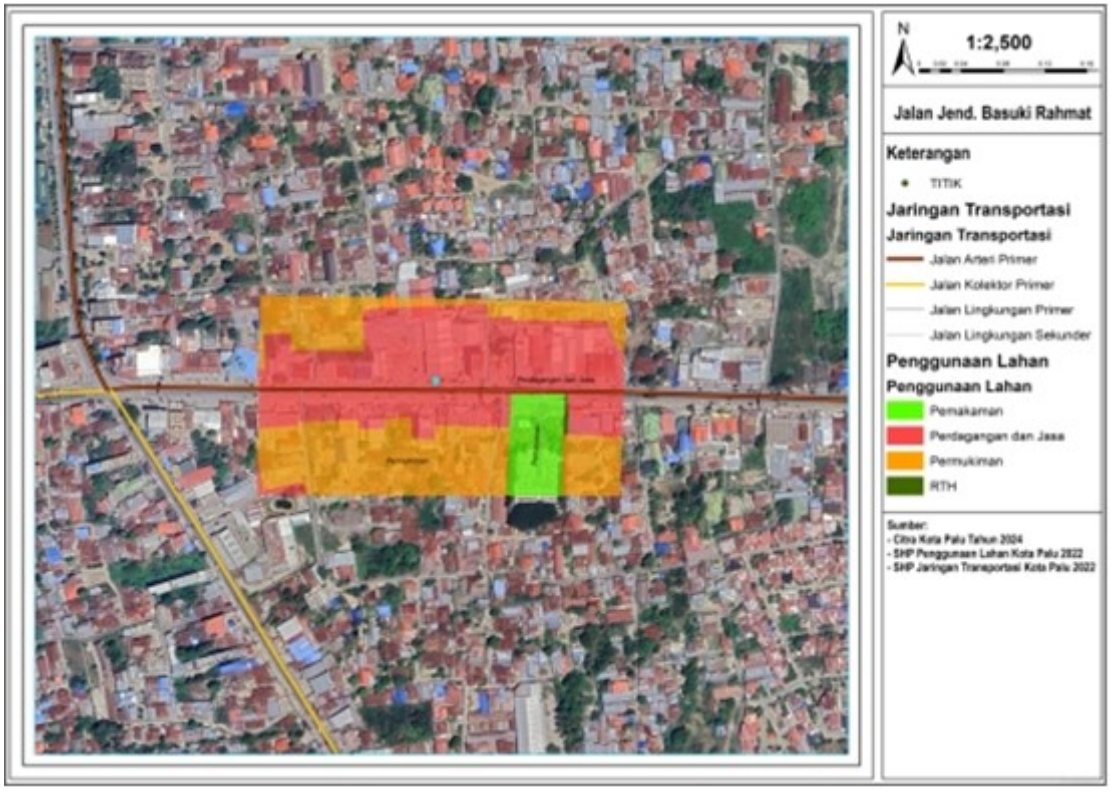

Figure 2: Map of Basuki Rahmat Street

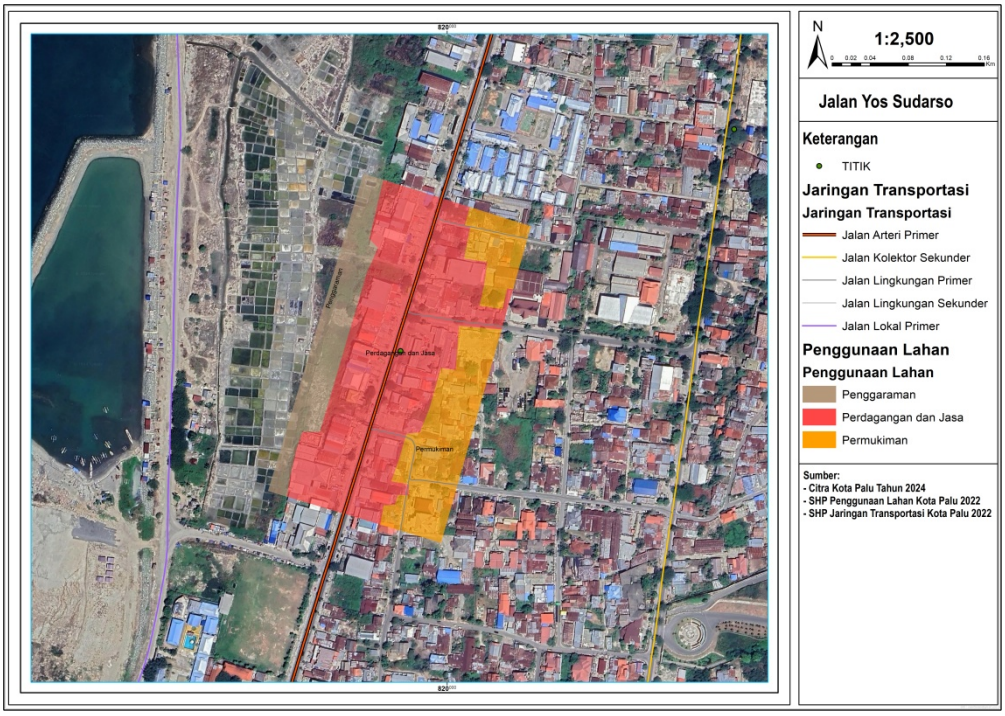

Figure 3: Location Map of Jalan Yos Sudarso

Data Collection Techniques

The Data needed in this study are primary data and secondary data. Primary Data obtained directly through field surveys, while secondary data obtained by collecting from Related Agencies and previous studies.

a. Data Collection Time

Survei *The Traffic Counting survey* was conducted for 3 working days (Tuesday) within 1 month, namely at the beginning of the month from the date (01-10), the middle of the month (11-20) and the end of the month (21-30) with a time span of 16 hours/day.

b. Equipment used

Here are the tools used to support survey activities:

- Survey Form
- *Clip Board*
- Stationery
- *Stopwatch*
- Meter
- *Counter*

RESULTS AND DISCUSSION

Traffic Analysis

a. Traffic Volume Data

Chart 1: Peak Hour Traffic Volume on Roads

Road	Hours Peak			Traffic Volume		
	Early	Middle	Late	Early	Middle	Late
Jl. Diponegoro	16.15 - 17.15	16.30 - 17.30	16.30 - 17.30	2181,75	2057,00	2003,90
Jl. Basuki Rrahmat	16.30 - 17.30	12.00 - 13.00	19.45 - 20.45	1533,25	1499,80	1443,55
Jl. Yos Sudarso	16.00 - 17.00	16.30 - 17.30	16.30 - 17.30	2004,80	1712,25	1696,85

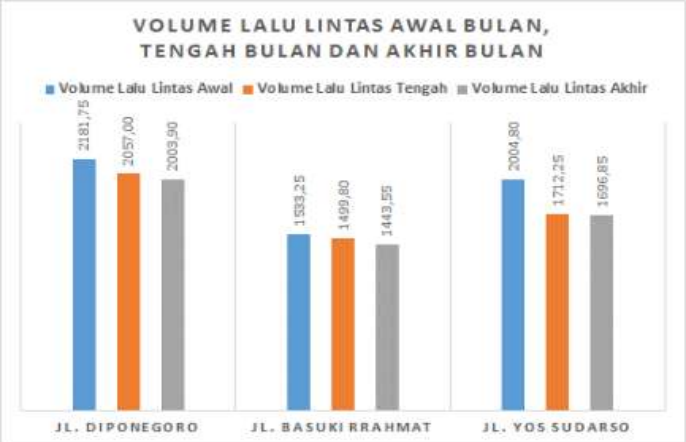

Figure 4

b. Side Obstacle Data

The data of side obstacles are pedestrian, vehicle stop/parking, vehicle exit/entry and slow/non-motorized vehicle along 200 m in front of each observation location. The side obstacle data can be seen in Table 4.3 below.

Chart 2: Data Barriers Side Jl. Diponegoro During Peak Hours

Observation	Peak Hour	Activity Side Street			
		Pedestrian	Vehicle Stop / Park	Vehicle In And Out	Vehicle Late
Early Month	16.15 - 17.15	20	167	1207	88
Middle of the Month	16.30 - 17.30	55	143	1005	12
End of Month	16.30 - 17.30	70	174	586	62

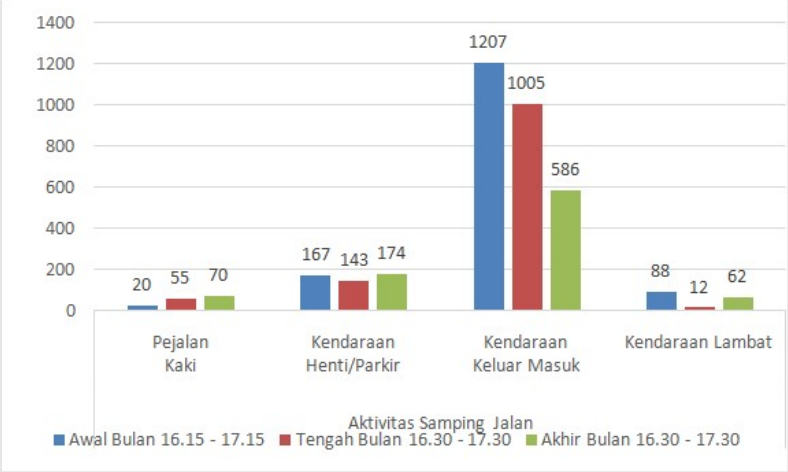

Figure 5: Graphic Barriers Side Jl. Diponegoro During Peak Hours.

Chart 3: Data Barriers Side Jl.Basuki Rahmat During Peak Hours

Observation	Peak Hour	Activity Side Street			
		Pedestrian	Vehicle Stop / Park	Vehicle In And Out	Vehicle Late
Early Month	16.30 - 17.30	197	246	499	3
Middle of the Month	12.00 - 13.00	98	186	286	63
End of Month	19.45 - 20.45	283	282	367	11

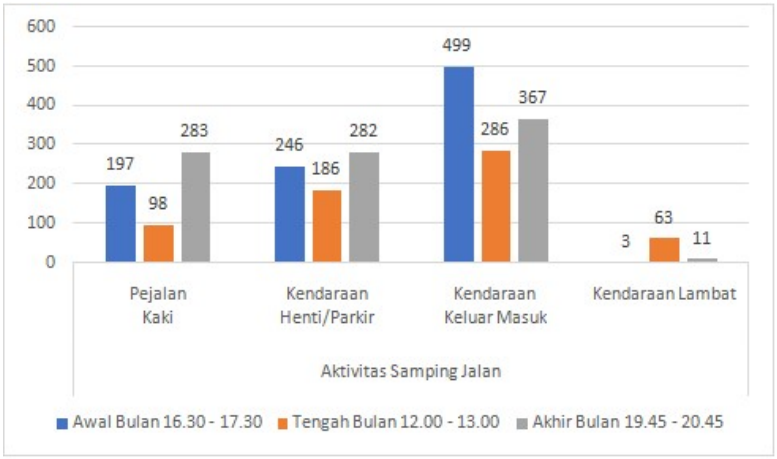

Figure 6: Graphic Barriers Side Jl. Basuki Rahmat During Peak Hours

Chart 4. Data Barriers Side Jl. Yos Sudarso During Peak Hours

Observation	Peak Hour	Activity Side Street			
		Pedestrian	Vehicle Stop / Park	Vehicle In and Out	Vehicle Late
Early Month	16.00 - 17.00	22	176	840	6
Middle of the Month	16.30 - 17.30	82	58	788	15
End of Month	16.30 - 17.30	28	99	355	9

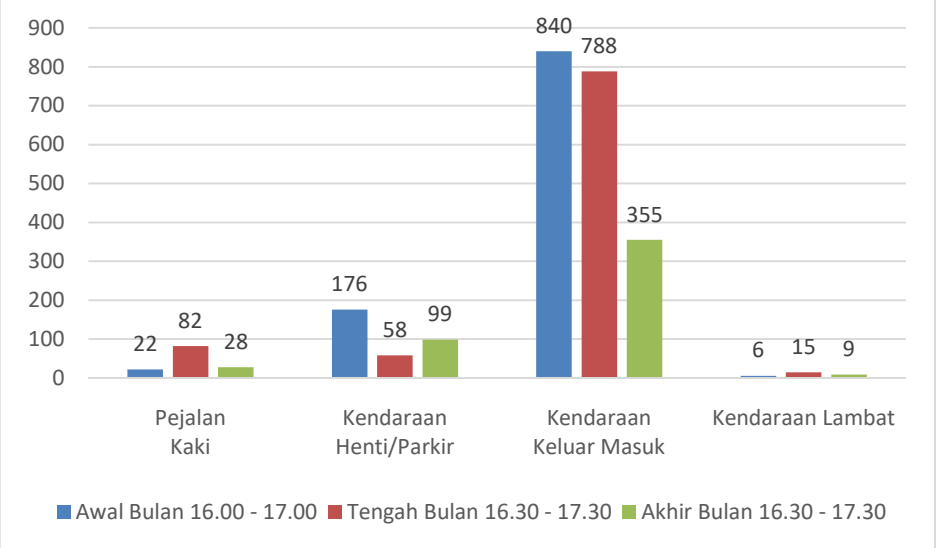

Figure 7: Graphic Barriers Side Jl. Yos Sudarso During Peak Hours

c. Vehicle Speed Data

Slovin formula is used(Husain Umar, 2002) as follows :

$$n = \frac{N}{1 + N(e)^2}$$

Description

n = number of samples SM

N = number of people SM

e = tolerance of the degree of looseness

Chart 5: Average Vehicle Speed During Peak Hours

Location	Survey Time	V Rata-Rata SM	V Rata-Rata MP	V Rata-Rata KS	V Rata-Rata BB	V Rata-Rata TB
Jl. Diponegoro	Beginning of Month	25.95	17.85	15.65	15.03	11.03
	Middle of Month	27.13	21.05	20.73	15.89	11.18
	End of Month	28.58	20.21	19.25	16.76	13.50
Jl. Basuki Rahmat	Beginning of Month	35.36	26.25	20.81	0.00	0.00
	Middle of Month	44.15	38.23	37.50	35.58	34.41
	End of Month	45.58	39.47	28.84	26.15	20.76
Jl. Yos Sudarso	Beginning of Month	30.83	22.28	22.17	19.92	19.43
	Middle of Month	40.45	34.62	33.00	24.00	22.72
	End of Month	40.07	35.13	32.10	23.14	23.08

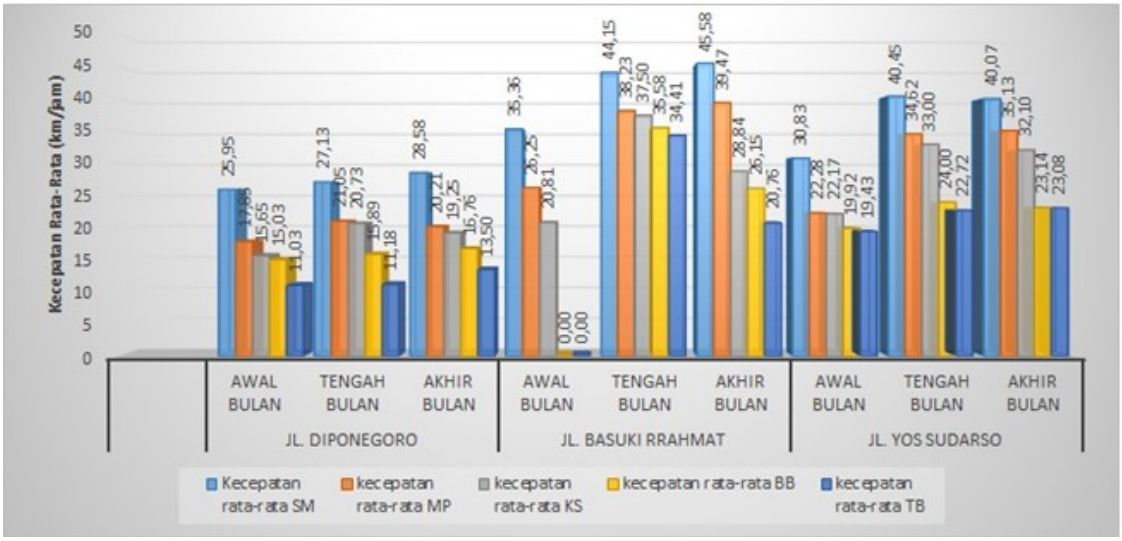

Figure 8: Chart of Average Speed

Road Performance Analysis

Performance analysis of Diponegoro street, Basuki Rahmat Street and Yos Sudarso Street using the Indonesian road capacity guidelines (PKJI 2023) on urban roads which are National Road status.

a. Road Capacity (C)

NIlai pada capacity can be calculated based on the Indonesian road capacity guidelines (PKJI 2023).

$$C = C0\ xFCLJxFCPAxFCHSxFCUK$$

$$C = 6800\ x\ 0{,}92\ x\ 1{,}00\ x\ 0{,}92\ x\ 0{,}90$$

$$C = 5179.97 \text{ smp/hour}$$

Chart 6: Calculation of Road Capacity on Roads

Location	C0 (smp/jam)	FCLJ	FCPA	FCHS	FCUK	C (smp/jam)
Jl. Diponegoro	6800	0.92	1.00	0.92	0.90	5179.97
Jl. Basuki Rahmat	6800	1.00	1.00	0.92	0.90	5630.40
Jl. Yos Sudarso	2800	1.14	1.00	0.95	0.90	2729.16

b. Degree of Saturation (DJ)

Chart 7: Saturation Degree Value (DJ)

Location	Survey Time	Peak Hour	Volume (Smp/Hour)	Capacity (Smp/Hour)	Degree of Saturation (DJ)
Jl. Diponegoro	Early Months	16.15 - 17.15	2181,75	5179,97	0,42
	Middle of the Month	16.30 - 17.30	2057,00	5179,97	0,40
	End of Month	16.30 - 17.30	2003,90	5179,97	0,39
Jl. Basuki Rahmat	Awal Bulan	16.30 - 17.30	1533,25	5630,40	0,27
	Middle of the Month	12.00 - 13.00	1499,80	5630,40	0,27
	End of Month	19.45 - 20.45	1443,55	5630,40	0,26
Jl. Yos Sudarso	Early Month	16.00 - 17.00	2004,80	2729,16	0,73
	Middle of the Month	16.30 - 17.30	1712,25	2729,16	0,63
	End of Month	16.30 - 17.30	1696,85	2729,16	0,62

c. Free Current Speed (VB)

Tabel 8: Free Flow Velocity Value for MP Under Field Conditions

Location	VBD (Km/Jam)	VBL	FVBHS	FVBUK	VB (Km/Jam)
Jl. Diponegoro	61-4	-4	0.92	0.93	48.77
Jl. Basuki Rahmat	61	0	0.93	0.93	52.76
Jl. Yos Sudarso	44	3	0.95	0.93	41.52

d. Travel Speed (VT) and Travel Time (WT)

Chart 9: Rated Travel Speed (VT) and Travel Time (WT)

Location	Survey Time	Volume (smp/HR)	Degree of	Maturity Travel Speed (km/hr)	Segment Length (km)	Travel Time (HR)
Jl. Diponegoro	Beginning of Month	2181.75	0.42	46.00	0.2	0.0043
	Middle of Month	2057.00	0.40	47.50	0.2	0.0042
	End of Month	2003.90	0.39	47.90	0.2	0.0042
Jl. Basuki Rahmat	Early Month	1533.25	0.27	51.75	0.2	0.0039
	Middle of Month	1499.80	0.27	51.75	0.2	0.0039
	End of Month	1443.55	0.26	51.90	0.2	0.0039
Jl. Yos Sudarso	Beginning of Month	2004.80	0.73	32.00	0.2	0.0063
	Middle of Month	1712.25	0.63	33.75	0.2	0.0059
	End of Month	1696.85	0.62	34,00	0,2	0.0059

e. Service Level of Roads

Chart 10: Road Service Level

Location	Time Survey	Degree of Saturation (DJ)	Service Level
Jl. Diponegoro	Beginning of the Month	0.42	B
	Middle of the Month	0.40	B
	End of the Month	0.39	B
Jl. Basuki Rahmat	Beginning of the Month	0.27	B
	Middle of the Month	0.27	B
	End of the Month	0.26	B
Jl. Yos Sudarso	Beginning of Month	0.73	C
	Middle of the Month	0.63	C
	End of the Month	0.62	C

CONCLUSION

a. Traffic volume fluctuations occur due to the utilization of land use as a trade and service area in each location. The Volume of traffic increases at the beginning of the month with different peak hours. Most likely this is triggered by the large number of people buying their various needs at the beginning of the month.

- Volume most traffic on Jalan Diponegoro at the beginning of the month amounted to 2181.75 smp / hour with peak hours of 16.15-17.15.
- The largest traffic Volume on Jalan Basuki Rahmat at the beginning of the month amounted to 1533.25 smp/hour with peak hours of 16.30-17.30.
- The largest Volume of traffic on Jalan yos Sudarso at the beginning of the month amounted to 2004.80 smp / hour with peak hours of 16.00-17.00.

b. Traffic performance can be determined based on the degree of saturation (DJ) or travel speed (VT) in certain road conditions. Where the lower the value of the degree of saturation (DJ) or the higher the travel speed (VT) indicates the better traffic performance.

- Diponegoro street at the beginning of the month has a road capacity of 5179.97 smp/hour, the degree of saturation (DJ) of 0.42 with a vehicle volume of 2181.75 smp/hour, and travel speed (VT) of 46.00 km / hour with a segment length of 0.2 km. Jalan Diponegoro has a service level of road section B, this is due to the capacity of the road is still adequate to accommodate the volume of vehicles obtained during peak hours. Travel speed (VT) of vehicles obtained on Jalan Diponegoro is slower than Jalan Basuki Rahmat, one of the causes is the class of side obstacles that occur on Jalan Diponegoro is very high while on Jalan Basuki Rahmat is categorized as high.
- Jalan Basuki Rahmat at the beginning of the month has a road capacity of 5630.40 smp/hour, the degree of saturation value (DJ) of 0.27 with a vehicle volume of 1533.25 smp/hour, and travel speed (VT) of 51.75 km / hour with a segment length of 0.2 km. Jalan Basuki Rahmat has the same level of service as Jalan Diponegoro. This is also due to the capacity of the road that is still adequate to accommodate the volume of vehicles obtained during peak hours. Vehicle travel speed (VT) obtained on Jalan Basuki Rahmat is faster than Jalan Diponegoro because it has different side obstacle class criteria.
- Jalan yos Sudarso at the beginning of the month has a road capacity of 2729.16 smp/hour, the degree of saturation value (DJ) of 0.73 with a vehicle volume of 2004.80 smp/hour, and travel speed (VT) of 32.00 km / hour with a segment length of 0.2 km. Jalan yos Sudarso has a service level of Road C, in contrast to Jalan Diponegoro and Jalan Basuki Rahmat which has a service level of road B, this is because the capacity of the road on Jalan Yos Sudarso can hardly accommodate the volume of vehicles obtained during peak hours so that the travel speed (VT) of the vehicle is slower than the travel speed (VT) at Jalan Diponegoro and Jalan Basuki Rahmat.

ADVICE

- As a result of the utilization of land use that dominates as a trade and service area at the research site obtained vehicle speed < 60 km / h, although the level of Service Road Sections B and C. So it is necessary to conduct a study for traffic handling at locations that affect the performance of National Roads and based on the regulation of the Minister of Transportation No. 111 of 2015 on roads that one of the technical requirements of National Roads for urban areas has a maximum speed limit of 60 km/hour.
- Yosudarso road section with the value of the degree of saturation (DJ) which mendakati 0.75 need to get treatment as soon as possible to improve the effectiveness of existing traffic management in this area, such as the time of heavy vehicle mobility outside peak hours and the application of one-way road near Pertamina intersection in Jalan Yosudarso, because this is very influential speed of vehicles during peak hours.
- Provision of parking prohibition signs on the road at each research site, as well as the provision of parking spaces so that vehicles do not park *on the street*, melaikan *off the street* either in open areas or special parking spaces that have been prepared so as to reduce side barriers on National Roads.

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