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CAPACITY AND PERFORMANCE ANALYSIS OF SUTOMO ROAD AND MERDEKA ROAD PEMATANGSIANTAR CITY

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Abstract

Pematangsiantar City is one of the cities in North Sumatra Province that is currently developing. This city is experiencing rapid growth, so the need for efficient and reliable transportation facilities is increasing. There are two main roads in Pematangsiantar City, namely Sutomo Street and Merdeka Street, Sutomo Street and Merdeka Street are supported by trade and service activities on both sides of the road. Transportation readiness is one of the main supporters of the development of every city. Sutomo and Merdeka Street are roads located in the center of Pematangsiantar City which in terms of land function is a trade and service area. The problems on these roads are very dense and irregular economic activities, inadequate transportation and infrastructure, and the behavior of road users who park carelessly. The capacity and performance of Sutomo and Merdeka Streets, transportation activities on these roads are very hampered due to irregular parking and inadequate road capacity. The performance of Sutomo and Merdeka Streets is classified as very high so that the ability to accommodate traffic flow through both roads is low. To address these issues, it is necessary to conduct a study and build a parking building to reduce obstacles on both roads, and traffic engineering is needed so that passing vehicles do not pile up on both roads.

Keywords: ***Road Section Capacity, Road Section Performance, Pematangsiantar City***

I. INTRODUCTION

A. Background

Transportation is one of the important elements in the development of cities and urban areas. One part of transportation is the road network. The road network system is a section of road that is interconnected between activity centers or growth centers in a region. Traffic density in an area has a very close relationship to population growth in the area. Density caused by an increase in population will trigger congestion, and hinder economic and social movement. Traffic density can be seen from the capacity or volume of a road in accommodating the modes of transportation that pass through the area. Pematangsiantar City is one of the cities in North Sumatra Province which is currently experiencing rapid growth, so the need for efficient transportation facilities is increasing.

To create a better and more capable transportation system, we are faced with various challenges and opportunities as well as obstacles including dynamic environmental changes, such as regional autonomy, economic globalization, changes in the behavior of transportation service demand, political conditions, developments in science and the limitations of natural resources. The city center of Pematangsiantar has two main roads, namely Jalan Sutomo and Jalan Merdeka, Jalan Sutomo and Jalan Merdeka are supported by trade and service activities on the right and left sides of the road, so that both roads often experience congestion caused by high traffic flow. This condition illustrates the reduced performance of the road sections on Jalan Sutomo and Jalan Merdeka, as well as the limited capacity of the two roads. In anticipating these conditions, the performance and capacity of the Sutomo and Merdeka roads need to be studied so that good service and integration in the transportation sector can be achieved.

B. Research purposes

The purpose of this study is to describe the capacity and performance of the Sutomo and Merdeka roads in Pematangsiantar City.

II. LITERATURE REVIEW

a. Traffic Flow

Based on the Indonesian Road Capacity Manual (1997) it states that traffic flow (Q) is the number of motorized vehicles passing a point on a route per unit of time expressed in vehicles/hour (Qkend), pcu/hour (Qsmp) or average annual daily traffic (LHRT). The types of vehicles taken into account in traffic flow are:

i. Light Vehicles (LV)
ii. Heavy Vehicle (HV)
iii. Motorcycle (MC)
iv. Non-Motorized Vehicles (NVM)

b. Capacity Concept

Road capacity analysis aims to estimate the maximum amount of traffic that can be served by each road segment. This is because each road has limited capacity to accommodate traffic flow. If a traffic flow that is operated is close to or equal to the existing capacity, this will cause traffic flow obstruction and make road users uncomfortable and unsafe in driving. This capacity analysis can be used or applied to existing road facilities for the purpose of developing a road section. The blood equation for determining capacity according to the Indonesian Road Capacity Manual (MKJI 1997) is as follows

$C = Co$X FCw X FCSP X FCSF X FCCS

c. Side Obstacles

Side obstacles are the impact of activities on the side of the road that can disrupt the performance of the road section. The many activities on the side of the road often cause conflict and have a very large impact on the performance of the road section. Side obstacles that affect the performance and capacity of urban roads are:

i. Pedestrian
ii. Irregular parking
iii. Public transport and stopped vehicles
iv. Vehicles entering and leaving activities on the side of the road
v. Street vendor

d. Road Section Performance

Each road section has a measurable performance that provides an overview of the road conditions. The assessment of the performance of this road section is carried out based on data obtained from direct observations in the field. The performance of the road section is then assessed based on the Indonesian Road Capacity guidelines (PKJI 2014) and the Indonesian Road Capacity Manual (MKJI 1997).

Table 1 Road Service Levels

Level of Service	Classification of Service Levels	VCR Value	Speed (km/h)
A	Free flow conditions at high speed, the driver can choose the speed that suits him. desired without any obstacles	0.00 – 0.2	At least 80
B	The flow is stable, but the operating speed is starting to be limited by traffic conditions. The driver has sufficient freedom to choose the speed.	0.21 – 0.44	At least 70
C	The flow is stable, but the speed and movement of vehicles are controlled, drivers are limited in choosing the speed.	0.45 – 0.74	At least 60
D	Current is approaching unstable, speed is still controlled	0.75 – 0.84	At least 50
E	Traffic volume is near/at capacity, flow is unstable, speeds are intermittent	0.85 – 1	At least 30
F	Forced or congested flow, low speed, volume below capacity. Long queues and major bottlenecks	> 1	< 30

Source: PKJI (2014)

III. METHOD

A. Research Location

The research location is the Sutomo and Merdeka roads in Pematangsiantar City.

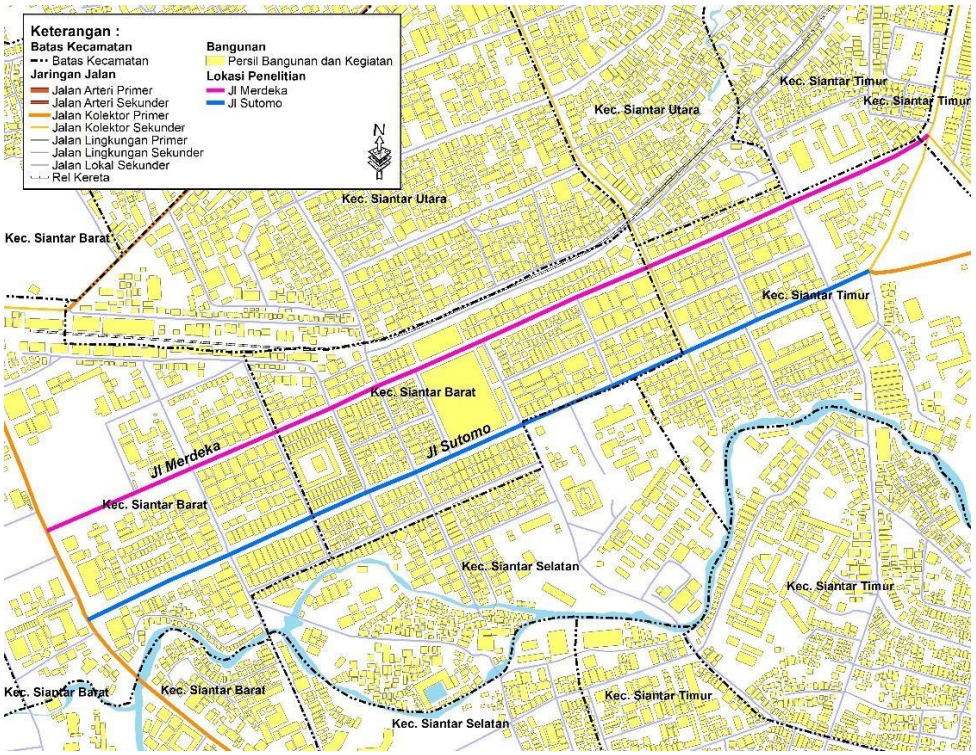

Figure 1 Research Location

Source: Processing of the Basic Map of the Pematangsiantar City RDTR, 2025

B. Research methods

This research method refers to the Indonesian Road Capacity Manual (MKJI 1997), which is related to the analysis of urban road sections. The research approach related to the analysis of road section performance on Jalan Sutomo and Jalan Merdeka uses a quantitative approach. According to Sugiyono (2019) quantitative data is data in the form of numbers and data that is converted into numbers (scoring). Quantitative approaches are used to explain and describe data according to the results of field surveys, which are then processed to obtain the average performance results of the road sections that occurred when the field survey was conducted. Field surveys were conducted during peak hours, namely in the morning at 07.00-08.000, at noon 12.00-13.00, and in the afternoon 16.00-17.00. Data collection was carried out using survey tools in the form of measuring instruments and stopwatches.

IV. RESULTS AND DISCUSSION

A. Problem identification

As an infrastructure, the road network plays an important role in the spatial structure of a region. This spatial arrangement will support the distribution process of people and goods to improve the function of the region and provide added value to the region. Based on its status, Pematangsiantar City has three classes of roads, namely national roads which are the responsibility of the central government; provincial roads which are the responsibility of the provincial government; and city/district roads which are the responsibility of the city/district government. Each road condition has a measurable performance that provides an overview of the road condition. Identification of transportation problems on the Sutomo and Merdeka roads can be seen in the following table:

Table 2 Transportation Problem Matrix on Jalan Sutomo and Jalan Merdeka

The problem	Indicator	Alternative Solutions
1. Economic, business and government activities are concentrated in the city center (Jalan Sutomo and Jalan Merdeka)	1. The concentration of movement is towards the city center in the morning and towards the outskirts of the city in the afternoon. 2. Traffic congestion in the city center is getting higher 3. Traffic performance in the city center is declining 4. Through traffic on national highways is hampered 5. Parking demand increases while parking space is limited	1. Development of new activity centers 2. Development of an integrated transportation network system to facilitate the mobility of people and goods.
2. Movement patterns/characteristics and intensity	1. External-external movements tend to be high 2. Internal-internal movements tend towards the city center (CBD) 3. External-external movements are disturbed by local activities	1. Priority for continuous movement 2. Arrangement of movement in the city center 3. Control of access to main roads 4. Side obstacle control on main road sections
3. Transportation infrastructure and supporting infrastructure	1. Facilities for boarding/alighting public transport passengers are very minimal 2. Pedestrian facilities are used for other functions (street vendors/vehicle parking) 3. Disabled facilities are not yet available 4. Utilization of Rumija/Rumaja is not in accordance with the provisions 5. The availability of road equipment facilities is still low (signs, markings, APILL) 6. Road nodes/terminals do not function as they should	1. Construction of bus stop and sidewalk/crossing facilities 2. Revitalization of bus stop and sidewalk functions 3. Provision of facilities for the disabled (persons with disabilities) 4. Provision of road equipment facilities
4. Traffic Management and Engineering	1. Management of road and intersection control is not yet optimal in utilizing road capacity. 2. Irregular parking 3. Utilization of the road body for purposes other than traffic purposes	1. Implementation of traffic management and engineering strategies and techniques on sections and intersections 2. Implementation of Parking Management and Control 3. Supervision of road network utilization
5. Road User Behavior	1. Violating traffic signs, markings, APILL 2. pick up/drop off passengers anywhere 3. Not wearing a helmet and turning on lights during the day 4. Motorcyclists go against traffic flow 5. Irregular parking	1. Intensifying socialization of orderly traffic on the road 2. Law enforcement of traffic violations both persuasively and preventively

Source: Analysis, 2025

B. Road Section Capacity

Road section capacitySutomo and Merdeka Street are one-way roads, the length of Sutomo Street is 1,565.60 m and the length of Merdeka Street is 1,772.30 m. Both roads have Very High (VH) side obstacles, which means that both roads have very high side obstacles. This is caused by various causes, one of which is irregular parking and inadequate road supporting facilities.

Table 3 Capacity of Sutomo Street and Merdeka Street

Sutomo Street	Road Lane Type	One Way
	Road Length (m)	1,565.58
	Road Width (m)	10.5
	Shoulder Width (Left, Right)	0.5
	Side Obstacles	VH
Independence Street	Road Lane Type	One Way
	Road Length (m)	1,772.30
	Road Width (m)	9
	Shoulder Width (Left, Right)	0.5
	Side Obstacles	VH

Source: Field Survey, 2024

C. Traffic Volume

Table 4 Traffic Volume on Jalan Sutomo and Jalan Merdeka

No.	Road Section Name	Time Interval	Traffic Volume (vehicles/hour)				Traffic Vol. (smp/hour)	Traffic Volume (vehicles/hour)
			MC	LV	HV	UM		
1	Sutomo Street	07.00 - 08.00	1729	1113	8	5	1991.9	2855
		12.00 - 13.00	1653	1497	2		2326.1	3152
		16.00 - 17.00	2451	2013	7	2	3249.2	4473
2	Independence Street	07.00 - 08.00	2334	1356	6		2530.8	3696
		12.00 - 13.00	1925	1286	1	2	2251.4	3214
		16.00 - 17.00	2576	1609	7		2906.1	4192

Source: Field Survey, 2024

Based on the table above, it can be seen that high traffic volume on Jalan Sutomo and Jalan Merdeka occurs in the afternoon, where on Jalan Sutomo it reaches 4,473 vehicles/hour while on Jalan Merdeka it reaches 4,192 vehicles/hour.

D. Road Section Performance

Table 5 Performance of Sutomo Street and Merdeka Street Sections

No.	Road Section Name		Correction Factor				Total CapacityC(smp/hour)	Level of service
			FCw	FCsp	FCsf	FCcs		
1	Sutomo Street	3300	1	1	0.73	0.9	2168.1	E
2	Independence Street	3300	0.92	1	0.73	0.9	1994.7	F

Source: Analysis, 2025

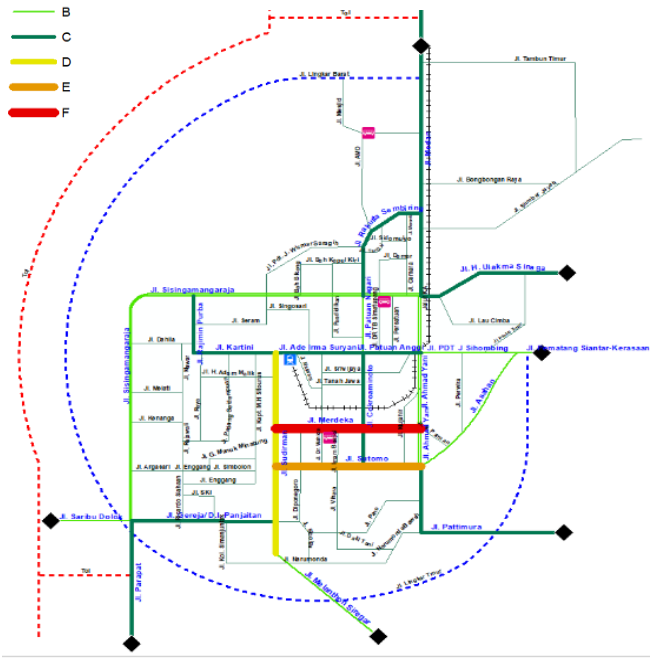

Figure 2 Illustration of the Performance of the Sutomo and Merdeka Road Sections

Source: Analysis, 2025

Based on the table above, it shows that Sutomo Street is classified as a service level E, which means that the traffic volume is approaching/is at an unstable flow capacity, while Merdeka Street is classified as a service level F, which means that the flow is congested, the speed is low, and the volume is below capacity. Thus, the performance of Sutomo Street and Merdeka Street is classified as low in terms of accommodating the traffic flow that passes through both roads.

V. CLOSING

A. Conclusion

Based on the analysis and discussion in this study, the following conclusions can be drawn:

a. The Sutomo and Merdeka roads are considered to be very busy and congested roads.
b. The problem on both roads is that trade and service activities cause high traffic volumes.
c. Inadequate transportation infrastructure such as parking locations and the behavior of road users who park haphazardly.
d. The performance of the Sutomo and Merdeka roads is caused by side obstacles, including irregular parking lots and irregular street vendors.

B. Suggestion

Based on the conclusions above, several suggestions can be put forward for handling traffic flow obstacles on Jalan Sutomo and Jalan Merdeka. Some of these suggestions are:

i. To support trade and service activities on Jalan Sutomo and Jalan Merdeka, a study and construction of a parking building is needed, so that side obstacles that occur on both roads are reduced.
ii. Traffic engineering is needed in the area around Jalan Sutomo and Jalan Merdeka or planning alternative roads in the area, so that passing vehicles do not pile up on the two roads.

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