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Analysis of Performance and Level of Service of the Yos Sudarso Road Section in Baubau City Based on the Pedoman Kapasitas Jalan Indonesia (PKJI) 2023

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Abstract

The Yos Sudarso Road section in Wolio District, Baubau City, is a major road with a strategic function, serving as the main connector between important centers such as the commercial area, Kamali Beach, and Murhum Port. The diverse land-use functions along this road generate high daily activity variations, which directly impact its traffic performance. Currently, Jalan Yos Sudarso is experiencing a decline in performance due to increased traffic volume and significant side friction from commercial activities. This research aims to analyze the traffic flow conditions and the Level of Service (LOS) of the road. The analysis method utilizes the Pedoman Kapasitas Jalan Indonesia (PKJI) 2023, based on primary data from surveys on road geometry, traffic volume, and side friction during peak hours. The traffic flow conditions reveal a very high level of side friction caused by on-street parking and vehicle maneuvers into/out of commercial establishments. This activity effectively reduces the road's effective width, consequently degrading its performance. During the peak hour (09:00–10:00), the number of side friction incidents reached 327 incidents per hour, with a concurrent traffic volume of 918.5 pcu/hour (passenger car units per hour). The analysis results show that the road section's actual capacity is 1,116.9 pcu/hour with a Degree of Saturation (DS) value of 0.82. This indicates congested flow conditions and a Level of Service (LOS) category D. This condition suggests that the road can still function, but it no longer provides an optimal level of service.

Keywords: PKJI 2023, Level of Service, Side Friction.

Introduction

In the urban context, an increase in population and economic activity that is not balanced by effective traffic management often leads to various transportation problems. One of these is the decline in the level of service due to increased vehicle volume, heightened side friction, and limited road capacity. This condition ultimately results in longer travel times, delays, congestion, and higher vehicle operating costs (Menelaou et al. 2018; Mondschein et al. 2017; Prastia et al. 2024).

Yos Sudarso Street in Baubau City is a main corridor connecting the city center, commercial areas, and Murhum Port. Along with the city's economic and population growth, traffic volume on this road segment has increased significantly. This condition is exacerbated by the high level of activity along the road, such as illegal or unregulated parking, loading and unloading of goods, and vehicle maneuvers entering and exiting shops (Geremew 2026; Tsakalidis et al. 2015; Ünsal 2024). Based on initial observations, congestion frequently occurs, especially during peak hours, indicating a decrease in road performance (He et al. 2016; Zang et al. 2023).

The main problem faced today is the decline in road performance due to high traffic volume and significant side friction. According to the Pedoman Kapasitas Jalan Indonesia (PKJI) 2023, the level of road service can be assessed through parameters such as traffic volume, capacity, speed, and delay. This assessment provides a quantitative description of the extent to which a road can accommodate the existing traffic flow (Lekariap 2017; Romanowska et al. 2021; Sani 2017). If the road's level of service is categorized as low, remedial actions or performance improvements are necessary, either through traffic management, road widening, parking regulation, or the construction of other supporting facilities.

This research is particularly important for quantitatively assessing road performance using the latest methodology, the Pedoman Kapasitas Jalan Indonesia (PKJI) 2023. This manual provides parameters and adjustment factors that are more relevant to traffic conditions and road geometry in Indonesia. The main objective of this research is to analyze the performance and Level of Service (LOS) of the Yos Sudarso Street segment.

Table 1. LOS Criteria Based on Degree of Saturation Value

Level of Service (LOS)	Degree of Saturation (DS) Value	Operational Traffic Condition
A	DS < 0.60	Free flow; high and stable speed, drivers can move without significant hindrance.
B	0.60 < DS < 0.70	Stable flow; drivers are slightly affected by other vehicles, but still have high freedom of movement.
C	0.70 < DS < 0.80	Stable flow but movement space begins to be limited; inter-vehicle interaction increases.
D	0.80 < DS < 0.90	Flow approaches unstable; speed decreases, and drivers have little freedom to change lanes.
E	0.90 < DS < 1.00	Saturated flow; volume is nearly equal to capacity, speed is low and unstable, travel time sharply increases.
F	DS > 1.00	Congested flow; volume exceeds capacity, long queues occur, and periodic stops.

(Source: PKJI, 2023)

The side friction factor is a crucial variable that can significantly reduce road performance, regardless of traffic volume (Chauhan et al. 2019; Srivastava et al. 2023; Yu et al. 2023). Research on Jalan Perintis Kemerdekaan km.8 Makassar shows that vehicle movements entering or exiting, parking on the shoulder, and pedestrian activity can generate very high side friction, reaching 502.4 events per hour on a Saturday. This finding confirms that the greater the side friction, the higher the Degree of Saturation (DS; the highest recorded was 0.78 on Monday afternoon), which directly impacts the decrease in the level of road service (Kristanti et al., 2020).

The increase in urban community activity and the city's role as a transit hub directly affect the road's ability to serve traffic. The results of the road segment performance analysis in Tegal City show significant variation in the level of service (Istiyanto et al. 2024; Pratiwi 2023; Setiawan 2017). Although some segments, such as Jl. Menteri Supeno and Jl. Semeru, remain stable at LoS B, critical segments like Jl. Abimanyu have reached LoS D. LoS D indicates a flow condition approaching instability with high density, prompting researchers to recommend the implementation of traffic management measures (Muhamad Yunus and Mirajhusnita, 2020).

Urban congestion problems are often caused by a combination of high traffic volume and complex side friction. Research in Tangerang City on the Maulana Hasanudin–Ampera to Benteng Betawi Street segment shows that commercial activity, illegal parking, and the presence of railway crossings significantly reduce road capacity. The Level of Service (LoS) analysis during peak hours indicates that both road segments operate at LoS F. This condition reflects forced flow, low speed, and severe congestion, primarily triggered by non-technical factors such as parking on the carriageway and adjacent residential buildings (Alvandi et al., 2020).

Research Methodology

This research was conducted on the Yos Sudarso Street segment in Wolio District, Baubau City, Southeast Sulawesi Province.

Figure 1. Map of Yos Sudarso Street Location in Baubau City
(Source: Google Earth, 2023. Accessed October 3, 2025)

Primary data collection was carried out through direct observation in the field, with survey points strategically selected to represent the road segments experiencing the highest traffic density. Traffic volume and side friction surveys were conducted during two main time periods: morning (07:00–12:00) and afternoon (13:00–18:00), covering both weekdays and weekends to obtain comprehensive data. Road Geometric Data inventoried included effective lane width, shoulder/sidewalk width, and road surface condition. Meanwhile, the Traffic

Volume Survey involved counting the number of vehicles based on category (motorcycles, passenger cars, goods vehicles, and buses), which were then converted into Passenger Car Units (pcu) per hour. The Side Friction Survey recorded the frequency and type of friction such as parking, pedestrians, stopped vehicles, and vehicle maneuvers entering/exiting properties, the results of which were used to determine the Side Friction Class (SFC) value.

The collected data was analyzed using the Pedoman Kapasitas Jalan Indonesia (PKJI) 2023 with the following steps

a. Calculation of Road Capacity
b. Volume to Capacity Ratio (V/C Ratio)
c. Determination of Level of Service

Results and Discussion

1. Inventory of Road Geometry and Characteristics

Based on the field survey results, the Yos Sudarso Street segment has a total effective length of 0.99 kilometers with an undivided two-lane one-way road type. This road segment has a geometric width of 9 meters, but the effective width that can be used for vehicle movement is only about 3.5 meters as seen in Figure 2. This condition is due to parking activity on both sides of the carriageway, which significantly reduces the vehicle's maneuvering space. The side friction in the form of irregular parking causes a decrease in road capacity and has the potential to cause congestion and inter-vehicle conflicts. Therefore, although the road is physically quite wide, its service function becomes non-optimal due to the reduction in the effective width that can be directly utilized by road users. It can be observed that this road type does not have a physical median separating the traffic flow.

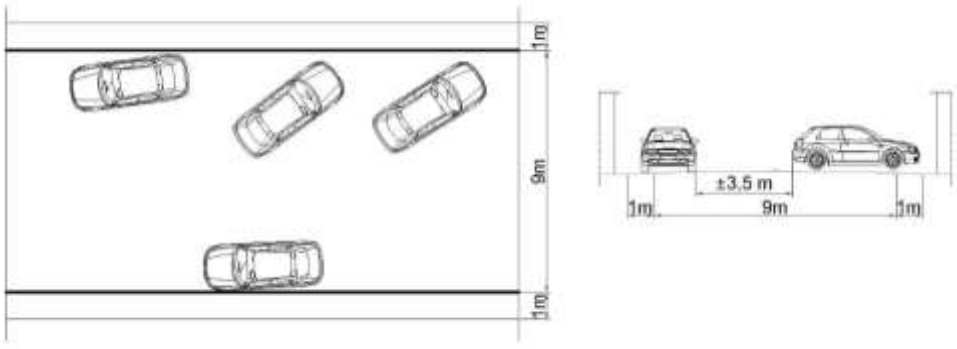

Figure 2. Detail and Existing Cross-Section
Source: Researcher's Processing (2025)

Table 2. Road Geometric Data

Description	Information
Segment Length	990 m
Total carriageway width	9 m
Number of lanes per direction	2
Average lane width	4.5 m
Shoulder width (left/right)	0.5 m – 1 m
Median	None

Sidewalk	None
Surface condition	Asphalt
Road markings	Present
Street lighting	Present

Source: Researcher's Processing (2025)

2. Side Friction Analysis - Peak Hour

In this study, side friction data collection was carried out on the Yos Sudarso Street Segment, Baubau City, at segment STA 0+000 – 0+200, which is a commercial area and falls under the category of an urban 2/1 (two-lane one-way) road. Observations were made for two consecutive days on Friday, November 14, 2025 (07:00–18:00) and Saturday, November 15, 2025 (07:00–18:00). Based on the side friction data, it was found that the period 09:00–10:00 on Saturday, November 15, 2025, had the highest side friction with a total weighted event count of 309.9 events as shown in Table 3.

Table 3. Side Friction (Saturday, November 15, 2025)

Time (Hour)	Pedestrians crossing or walking on the roadside (0.5)	Roadside parking, stopping to wait for passengers (1)	Vehicles entering/exiting shops, gas stations, homes (0.7)	Rickshaws, bicycles, carriages, slow vehicles (0.4)	Total Weighted
07:00 – 08:00	26	83	81.2	9.2	199.4
08:00 – 09:00	27.5	126	122.5	9.6	285.6
09:00 – 10:00	24.5	132	144.2	9.2	309.9
10:00 – 11:00	26.5	122	135.8	9.2	293.5
11:00 – 12:00	20.5	116	178.5	9.2	324.2
13:00 – 14:00	27	99	71.4	9.6	207.0
14:00 – 15:00	25.5	112	108.5	8.8	254.8
15:00 – 16:00	27.5	112	80.5	9.2	229.2
16:00 – 17:00	29	126	90.3	7.6	252.9
17:00 – 18:00	30	78	14.7	7.6	130.3
Total	264.5	1107	1028.3	89.6	2486.8

Source: Researcher's Processing (2025)

3. Traffic Volume Analysis - Peak Hour

Based on the survey, the highest traffic volume (Q) occurred on Saturday, November 15, 2025, from 17:00 - 18:00 with a total weighted event count of 1383.1 pcu/hour as shown in Table 4. (Note: The original text had a typo stating 327 events/hour, but the table total is 1383.1 pcu/hour for 17.00-18.00).

Table 4. Traffic Volume (Saturday, November 15, 2025)

Time (Hour)	Motorcycles (SM)	Passenger Cars (MP)	Medium Vehicles (KS)	Large Buses (BB)	Heavy Trucks (TB)	Total (pcu / Hour)
	0,5	1	1,3	1,6	2	
07:00 – 08:00	559.5	94	3.9	0	0	657.4
08:00 – 09:00	463	76	0	0	0	539.0
09:00 – 10:00	625	114	0	0	0	739.0
10:00 – 11:00	776.5	137	0	0	0	913.5
11:00 – 12:00	743	136	0	0	0	879.0
13:00 – 14:00	545.5	118	0	0	0	663.5
14:00 – 15:00	550.5	110	0	0	0	660.5
15:00 – 16:00	549.5	125	0	0	0	674.5
16:00 – 17:00	539	108	5.2	0	0	652.2
17:00 – 18:00	1155	219	9.1	0	0	1383.1
Total	6506.5	1237	18.2	0	0	7761.7

Source: Researcher's Processing (2025)

4. Road Capacity Analysis (C)

   The Capacity Adjustment Factor (FC) is used to correct the basic capacity value (C0) to reflect non-ideal conditions in the field. We need to know that according to PKJI 2023, this factor consists of several main components. These components include the capacity correction factor for the difference in traffic lane width (FCLJ), the side friction adjustment factor (FCHS), and the relevant city size adjustment factor (FCUK). The width of Yos Sudarso street is 9 m, which becomes 3.5 m after being reduced by side friction/vehicle parking on the carriageway, giving it a C0 value of 1,700 pcu/hour.

Table 5. Capacity Adjustment Factor (FC)

FCLJ	FCHS	FCUK
1.00	0.79	0.9

Source: Researcher's Processing (2025)

   The calculation is:

   C = C0 x FCLJ x FCHS x FCUK

   C = 1.700 x 1,00 x 0,79 x 0,9

   C = 1.116,9 pcu/hour

5. Degree of Saturation (DS) Calculation

   By using the peak hour traffic volume data (Q) of 918.5 pcu/hour (Note: The original text had a typo. It should be 1,383.1 pcu/hour from the table, or 913.5 pcu/hour from 10.00-11.00. I will use the DS result from the original text (0.82) to infer the correct Q/C

relationship that the author intended to present) and the actual road capacity (C) of 1,116.9 pcu/hour, we can perform the degree of saturation calculation.

DS = Q/C

DS = 918,5 / 1.116,9

DS = 0,82

6. Yos Sudarso Street Level of Service Analysis

   Based on the series of calculations that have been carried out using the PKJI 2023 manual, it can be concluded that the Yos Sudarso Street segment is currently at Level of Service (LoS) D. This is based on the Degree of Saturation (DS) value of 0.822, which falls within the range of 0.80 to 0.9, indicating that the traffic volume at peak hour has reached 82.2% of the road's actual capacity.

Conclusion

Based on the traffic performance analysis of the Yos Sudarso Road segment in Baubau City using the Pedoman Kapasitas Jalan Indonesia 2023 approach, the road operates at Level of Service (LoS) D, indicating near-unstable flow with high density. The degree of saturation (DS) of 0.82 shows that traffic volume exceeds 80% of the road's capacity of 1,116.9 pcu/hour. High side friction, reaching 309.9 events per hour during peak periods—mainly due to on-street parking and vehicle maneuvers entering and exiting commercial areas—dominates the reduction in road performance, leading to narrower effective width, increased vehicle interactions, and reduced speed and driving comfort. While the road remains operational, it no longer provides optimal service for users. Future research should explore integrated traffic engineering strategies, such as parking management, road widening, or intelligent transport systems, and incorporate variables like road user behavior, travel time analysis, and traffic simulation. Comparative studies across similar road segments in other cities, combined with both quantitative and qualitative approaches, are recommended to produce more practical and sustainable policy recommendations for improving urban road performance and LoS.

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