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Analysis of the Effect of Traffic Volume on Road Service Level Based on PM KM 14 Year 2024

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ABSTRACT

Wolter Monginsidi Street is one of the main activity hubs in Baubau City. It serves as a central shopping area, making it prone to traffic congestion due to the increasing traffic volume caused by human movement and transportation activities. This road stretches 600 meters and is lined on both sides with textile shops, clothing stores, and grocery shops. It also frequently accommodates vehicles coming from the direction of Pasar Karya Nugra, further escalating the traffic volume. The problem examined in this study is the impact of traffic volume on the service level of Wolter Monginsidi Street, assessed based on Regulation PM No. 14 of 2006. The study aims to determine the influence of traffic volume on the road's service level following the latest regulations outlined in PM No. 14 of 2006. Based on the analysis, the following conclusions were drawn: The traffic performance on Wolter Monginsidi Street is categorized as good since the road's capacity is sufficient to handle peak-hour traffic volumes. The service level of Wolter Monginsidi Street is classified under Service Level Category B.

Keywords: *Wolter Monginsidi Street, Baubau City, Traffic Volume, Density, PM KM No. 16 2006*

1. Introduction [Bookman Old Style 11pt bold]

One of the most important modes of transportation in all aspects of human endeavor is transportation. Relationships and interactions between people become easier with the existence of increasingly advanced modes of transportation, which also function as a tool to help humans move goods from one location to another. One of the pillars of industrial development, community development, and economic development is transportation. In an effort to encourage equitable development and its results, transportation also functions as a support system and catalyst for the progress of countries and regions (Warpani, 2002).

The demand for time and cost efficiency is very important in big cities, as it is closely related to the level of progress and development of society. Increased traffic flow is a consequence of the high population growth, the number of vehicles, and the development of new settlements both in the city center and suburbs. If not managed with effective traffic management, this can result in decreased time and cost efficiency due to congestion. When traffic volumes are high, such as during peak hours, roadways turn into transportation infrastructure that is unable to accommodate the flow of traffic. This is evident from the increasing congestion and delays that occur at intersections and road sections. Vehicle travel in urban areas is characterized by varying traffic patterns, both in terms of disturbance and speed. Road sections that are initially able to accommodate the number of vehicles will increasingly show their inability to meet the increasing demand as traffic volumes

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increase or their characteristics change (Malluluang et al., 2017). To prevent congestion and obstacles on the road, the rapid expansion of traffic must be matched by an increase in adequate transportation facilities. The emergence of unstable traffic flow and low public awareness in complying with traffic regulations are important issues that are prone to cause conflicts and traffic congestion due to the increasing level of vehicle ownership. Traffic flow on the road is also indirectly affected by the presence of industrial activities adjacent to the problematic road section. Therefore, it is imperative to assess the capacity and level of service of roads in the region to evaluate the current conditions and the management required in the future to build roads that are acceptable and enjoyable for all users. (Mukhlis, 2017).

Urban transportation systems cover a wide range of activities such as work, school, sports, shopping, and visiting people living on the land (houses, schools, shops, etc.). Land use is closely related to human activities. Land use consists of three interconnected components: people, activities, and location. The various activities carried out by humans show their dynamic nature as social beings. Humans need space to perform their functions. Land use in cities means the utilization of land for activities. In general, there are four categories of urban land use: housing, transportation networks, industrial and commercial activities, and public service facilities. (Hajia, 2023). According to (Direktorat Jenderal Bina Marga, 1997) Roads are a means of land transportation that includes all parts of the land area, including ancillary and additional buildings designed to facilitate traffic. In addition, roads function as access that connects various locations, while the purpose of infrastructure development is to improve economic efficiency and community welfare. The pace of the economy and the welfare of the community will be greatly influenced by areas that have good infrastructure development. Roads are one of the most important infrastructures in development. The problem of congestion in Indonesia has become an important concern. The current condition is the result of various factors, such as the rise of crowded centers that are the centers of government, trade, industry, tourism, and education as well as the increasing number of vehicles that are not proportional to the population (Rizky, Muhamad, Eko Supri Murtiono, 2021).

The main road in Baubau City is Jalan Wolter Monginsidi. This road is the central shopping area in Baubau City, and as a result of increased traffic volumes caused by the movement of people or modes of transportation, this road often experiences congestion. The traffic volume increases significantly as a result of the frequent vehicles passing from the direction of Pasar Karya Nugra, as well as the presence of textile shops, clothing stores, and grocery stores on the left and right sides of the 600-meter highway. One of the consequences of traffic management modifications is an increase in traffic volume. Therefore, this investigation will investigate the impact of traffic volume on the level of service of the road.

2. Methods

The location taken in this study is Jalan Wolter Monginsidi with a section length of 600 m. This research consists of primary data and secondary data.

Primary data obtained from this research are traffic volume, vehicle speed, road length, road width, and secondary data, namely the research location map. This research analyzes the following:

a. Peak volume

The highest volume that occurs at the observation location for 4 days, namely on Monday, Wednesday, Friday, and Sunday;

b. Free flow speed analysis

The speed that a driver would choose if driving a vehicle without being influenced by other vehicles on the road;

c. Road Section Capacity Analysis

The maximum traffic flow that can be maintained under certain conditions;

d. Degree Saturation Analysis

The ratio of traffic flow (smp/h) to capacity (smp/h) on a particular road section, where the degree of saturation is used as a parameter to determine the level of road service;

e. Average vehicle speed analysis

The average speed of all vehicles passing a point of the road during a certain period of time;

f. Road level of service analysis.

3. Findings and Discussions

3.1 Findings

The Geometric Conditions

The geometric conditions of road sections that we need to observe are road type, width of traffic lanes, kerbs, shoulders, medians, and road alignment. For more details can be seen in the description below:

a. Road Type

For the research location on Jalan Wolter Monginsidi, it is classified as an Urban Road with a type of two lanes one-way undivided (2/1 TT).

b. Width and Length of Traffic Lanes

Jalan Wolter Monginsidi has a road width of 6 m with a lane width of 3 m on each road. While the length of Jalan Wolter Monginsidi is 600 m.

c. Road Condition

From direct observation in the field, the road conditions are included in the industrial area with the category on the side of the road filled with shops that are shopping centers in Baubau City.

d. Road of Woltermonginsi does not use a road shoulder but uses a kereb which is a place for pedestrians and on this road also does not use a road median.

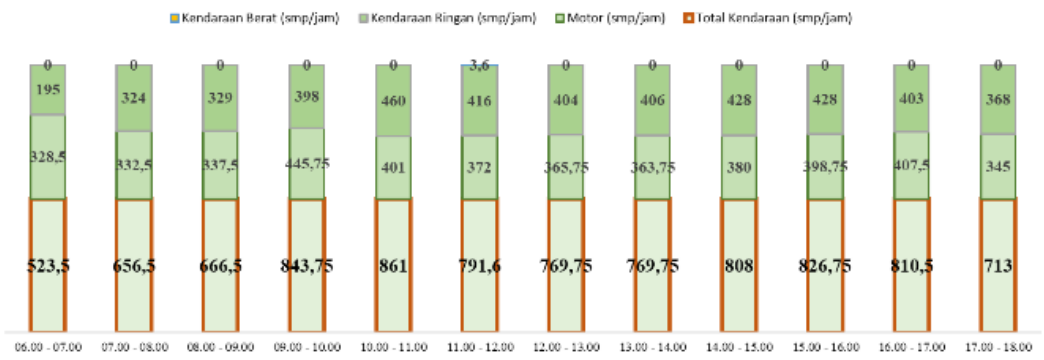


Figure 1. Based on the picture above, it is found that the largest volume of vehicles on Monday is at 10:00 - 11:00, namely 826.75

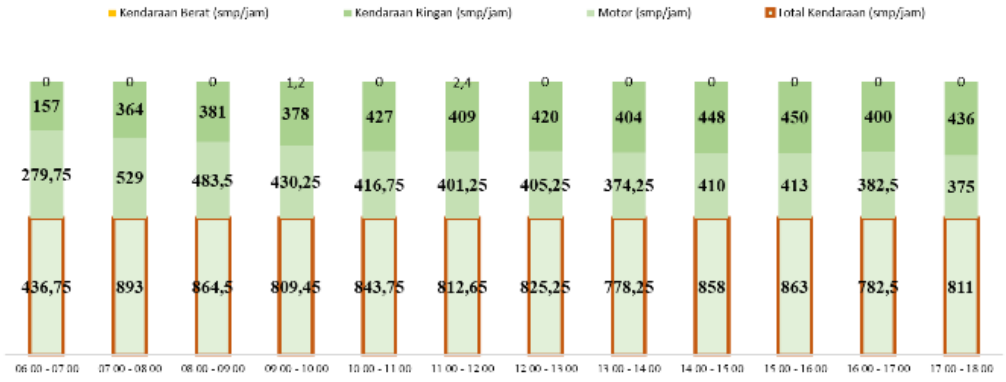


Figure 2. Based on the picture above, it is found that the largest vehicle volume on Wednesday is at 15.00 - 16.00 hours, namely 863 vehicles.

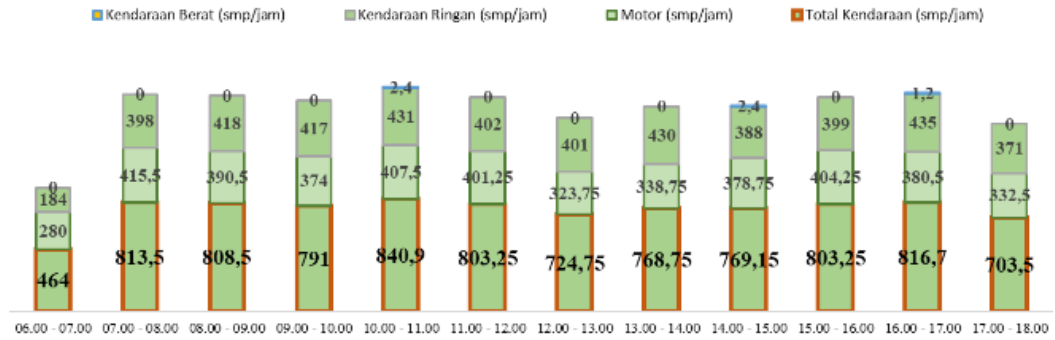


Figure 3. Based on the picture above, it is found that the largest vehicle volume on Friday is at 16.00 - 17.00 hours, namely 816.7

Free Flow Speed (FV)

Free flow speed (FV) is the speed of a vehicle at zero flow level, i.e. the speed of a vehicle that is not being used by other vehicles (Direktorat Jenderal Bina Marga, 1997). The equation for determining the free flow speed has the following general form:

$FV = (FV_o + FV_w) \times FFV_{sf} \times FFV_{cs}$

Description:

FV = Base flow speed (km/jam)

FV_o = Basic free flow speed of light vehicles (km/jam)

FV_w = Effective traffic lane width adjustment (km/jam)

FFV_{sf} = Adjustment factor for side obstacle conditions

FFV_{cs} = City size adjustment factor

After getting the values needed in the FV calculation. Next, the calculation is carried out to get the FV value.

$FV = (FV_o + FV_w) \times FFV_{sf} \times FFV_{cs}$

$FV = (55 + -4) \times 0,72 \times 0,95$

$FV = 34.14 \approx 35$ km/jam

Then it can be concluded that the free flow speed of light vehicles on Jalan Wolnginsidi is 35 km/hour.

Capacity

Based on (Kementrian Pekerjaan Umum, 2014) the formula for obtaining capacity is as follows:

$C = C_0 \times FC_{LJ} \times FC_{PA} \times FC_{HS} \times FC_{UK}$

Description:

C : Capacity (skr/jam)

FC_{LJ} : Base Capacity (skr/jam)

FC_{PA} : Capacity Adjustment Factor related to Lane Width

FC_{HS} : Capacity Adjustment Factor Related to Directional Separation

FC_{UK} : Capacity Adjustment Factor for City Size

After getting the values needed in the calculation of C. Next, the calculation is done to get the value of C.

$C = C_0 \times FC_W \times FC_{SP} \times FC_{SF} \times FC_{CS}$

$C = 3300 \times -4 \times 1 \times 0,72 \times 0,90$

$C = 1967,28 \approx 1968$ smp/jam

So it can be concluded that the capacity of the road section on Jalan Wolter Monginsidi that can be served is 1968 smp / hour compared to the largest peak hour volume of 893 smp / hour, it can be concluded that the road conditions are still capable of being used without the need to widen the road.

Degree of Saturation

The degree of saturation (Ds) is the ratio of traffic volume (V) to road capacity (C). The theoretical range of Ds is 0 to 1, which means that if the value is close to 1, the road condition is close to saturation. This is derived from the concentration of vehicles concentrated on the road during peak hours. The formula used in this calculation is provided by MKJI to determine the degree of saturation, namely:

DS = Q/C

Description:

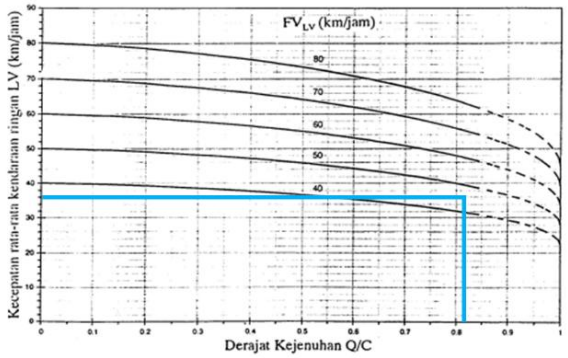
Q = Peak hour traffic volume

C = Road capacity

Based on the traffic volume analysis, the peak hour volume is 863 smp/hour with a capacity of 984 smp/hour. Then the degree of saturation is obtained:

DS = 863/984 = 0,88

Analysis of Light Vehicle Speed Based on Degree Saturation Value



Gambar D-2:2 Kecepatan sebagai fungsi dari DS untuk jalan banyak-lajur dan satu-arah

Figure 4. Graph of Relationship Between Light Vehicle Speed and Degree of Saturation

Based on the graph in Figure 5, it can be obtained that the speed of light vehicles at peak hours is 38 km / h, which means that the speed of vehicles that can be passed at peak hours is 38 km / h. If the speed of the vehicle exceeds the speed at peak hours, it will result in the risk of accidents.

Road Level of Service Analysis

The level of service analysis uses the Minister of Transportation Regulation No. KM 14 of 2006 concerning Traffic Management and Engineering on Roads. Based on the regulation of the minister of transportation in the appendix which can be seen in table 1.

Table 1. Relationship between Level of Service and Average Speed

Service Level	*Characteristics of Related Operations*
A	- Relatively free flow with occasional stops - Average travel speed ≥ 40 km/h
B	- Stable flow with little delay - Average travel speed ≥ 30 km/h
C	- Stable flow with acceptable delays - Average travel speed ≥ 25 km/h
D	- Approaching unstable flow with delays that are still within tolerance - Average travel speed ≥ 15 km/h
E	- Unstable flow - Average travel speed ≥ 15 km/h
F	- Restrained flow - Traffic jams - Traffic in these conditions is backed up

Based on the analysis of light vehicle speed, the average vehicle speed value is 38 km / hour. Based on table 1, it is obtained that the level of road service on the Wolter Monginsidi road section can be categorized that Wolter Monginsidi Road is in the category of road service level B.

3.2 Discussions

The geometric condition of the road segment we need to observe includes the type of road, width of traffic lanes, curbs, shoulders, medians, and road alignment. The research location on Jalan Wolter Monginsidi is classified as an urban road with a type of two-lane one-way undivided (2/1 TT). Urban roads, such as this, are commonly found in high-density areas and play a critical role in the transportation network by facilitating the movement of vehicles and pedestrians. This classification is essential for planning and management purposes, as urban roads often face unique challenges, including congestion, safety concerns, and mixed traffic conditions. Road of Wolter Monginsidi has a road width of 6 meters, with each lane having a width of 3 meters. The total length of Jalan Wolter Monginsidi is 600 meters. The dimensions of the road are critical for determining its capacity and the level of service it can provide. The width of traffic lanes directly influences driver behavior and vehicle speed, which are crucial factors in road performance analysis. Based on direct field observations, the road condition is within an industrial area with shops lining the sides, serving as a shopping center in Baubau City. Jalan Wolter Monginsidi does not use shoulders but employs curbs for pedestrian use, and it also lacks a median. The absence of shoulders and medians can increase the vulnerability of the road to congestion and safety issues. The industrial and commercial nature of the area contributes to significant vehicular and pedestrian activity, necessitating careful planning and managemen. The analysis of Road Wolter Monginsidi, classified as a two-lane, one-way urban road, reveals a width of 6 meters and a total length of 600 meters, serving an industrial area without medians or shoulders but with curbs. Traffic volume surveys identified peak volumes of 861, 863, and 816.7 PCU/hour on Monday, Wednesday, and Friday, respectively, with the highest on Wednesday. The calculated free-flow speed for light vehicles is approximately 35 km/h, influenced by lane width adjustments, high side friction (0.72), and urban size factors (0.93). The road's

capacity is 1968 PCU/hour, comfortably accommodating peak traffic volumes. The degree of saturation (Ds) is 0.44, reflecting moderate traffic conditions. Light vehicles maintain an average speed of 38 km/h during peak hours, aligning with service level C, characterized by stable flow and tolerable delays. Overall, Jalan Wolter Monginsidi supports efficient traffic management in Baubau City and does not require immediate capacity expansion. Future improvements in side friction management and urban infrastructure planning could further enhance performance.

4. Conclusion

Based on the analysis and discussion in Chapter IV, the following conclusions can be drawnThe existing traffic performance on Jalan Wolter Monginsidi is categorized as good because the existing road capacity on Jalan Wolter Monginsidi is still able to accommodate the volume of traffic at peak hours, namely the level of road service on the Wolter Monginsidi road section is categorized as category B road service level. The suggestions given by the author in this study are that it is necessary to prohibit illegal parking that takes up the road body so that road capacity can be maximized and further research needs to be carried out related to side obstacles on the Wolter Monginsidi road section.

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