IJES : International Journal of Engineering and Science
Volume. 1 Nomor. 1, April 2025
e-ISSN: XXXX-XXXX; p-ISSN: XXXX-XXXX, Page. 33-42
Available Online at : https://e-jurnal.unimar-amni.ac.id/index.php/IJES

The Influence of Public Transportation Vehicle Flow (Bus) on Traffic Congestion Levels in Indihiang District, Tasikmalaya City

(Case Study on the Indihiang Road Section, Tasikmalaya City)

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Abstract : Congestion is a condition where the flow of traffic that passes on a segment of a road that is reviewed is more than the capacity of the planned road that is currently passing the queue. When passing through traffic, the value of the degree of saturation reaches more than 0.75. Currently traffic jams are an event that we usually see in the morning, afternoon and evening waiting for the night. This problem occurs because there is an increase in the number of vehicles with unbalanced road growth, which causes congestion and can also cause traffic accidents. This problem is also an old problem which until now has not found the right solution. The purpose of this study was to analyze the influence of independent variables, namely economic growth, traffic volume, and side barriers to the dependent variable, namely traffic congestion. In this study the object of tourism taken was the surrounding community on the Indihiang road in the city of Tasikmalaya. The sample of this research is 100 respondents with the technique used is non-probability sampling technique that is by using incidental sampling, which is a sampling technique that is related to or who is related to the research used as a sample. The research model is multiple linear regression analysis. Based on the results of the study and the multiple linear forces produced the equation: $Y = 3.524 + 0.089X1 + 0.370X2 + 0.291X3\ \mu$. The results of the multiple linear regression equation show that there is no positive and significant effect between vehicle volume on traffic congestion (tcount 1.499 < ttable 1.984) while the road performance has a positive influence on traffic congestion (tcount 3.899 > t table 1.984), and obstacles aside from traffic jams (tcount 3.899> ttable 1.984). The influence of the three variables of this study was obtained with the correlation value of adjusted $R2 = 0.426$. Simultaneously the variables of economic growth, traffic volume, and side barriers influence 42.6% of traffic congestion and 56.4% are influenced by research variables not detected in this study.

Keywords : Vehicle, Volume,Road, Performance.

1. BACKGROUND

Transportation plays an important role in regional development, and transportation failures have a wide impact on social, economic, political, and regional development (Haryono et al., 2018). Based on Law No. 22 of 2009, traffic management includes planning and arranging road facilities to ensure traffic safety and smoothness (Sari, Saidah, & Wahyuni, 2018). Traffic congestion causes negative impacts such as loss of time, wasted energy, and increased air pollution and stress for road users (Harahap et al., 2017). Congestion often occurs because road capacity is not comparable to the number of vehicles, suboptimal road design, and side obstacles such as pedestrians and vehicles stopping along the road.

In Tasikmalaya City, especially in Indihiang District, traffic congestion often occurs due to increasing traffic volume along with economic growth and population, as well as reduced effective road width due to illegal parking. Based on data from the Tasikmalaya City Transportation Agency, high traffic volume on several roads such as Jl. Letnan Harun and Jl.

Received: January 15, 2025; Revised: January 30, 2025; Accepted: February 10, 2025; Online Available: February 14, 2025

Ibrahim Adjie indicate an imbalance between the number of vehicles and road capacity, which causes traffic congestion. This study was conducted to examine the effect of public transportation vehicle flow on the level of congestion in the Indihiang District area, Tasikmalaya City.

Traffic conditions in Tasikmalaya City, especially in Indihiang District, are greatly influenced by economic development, industry, and increasing population density. This area is known as an area with a type A terminal and a trade center, which attracts many visitors from both within and outside the city. High economic activity causes traffic to become increasingly congested, especially during rush hours, so that congestion often occurs at several points, including STA 03+00 to STA 03+585. One of the main causes of congestion on this road section is the reduction in the effective width of the road due to illegal parking which narrows the vehicle lane.

In addition, inadequate road infrastructure is a significant factor in increasing congestion levels. The rapid growth in vehicle volume is not balanced by an increase in road capacity. This condition is exacerbated by inappropriate U-Turn designs, level crossings that use traffic lights, and the existence of road intersections with railroad tracks that often hinder smooth traffic flow.

Side obstacles, such as pedestrian activity, vehicles stopped on the side of the road, and irregular public transportation, also contribute to the decline in traffic performance. These factors slow down vehicle movement and worsen congestion, especially in areas with community activity centers such as offices, shopping centers, and industrial areas. Uncontrolled growth in traffic volume can result in a decline in the quality of the urban environment, increased vehicle operating costs, and energy waste.

In this study, the main focus is to analyze the extent to which the flow of public transportation vehicles, especially buses, affects the level of congestion in Tasikmalaya City, especially in Indihiang District. This study will also evaluate the effectiveness of the multimodal transportation system in the area, as well as provide recommendations on the management and improvement of transportation infrastructure so that congestion can be reduced.

2. THEORETICAL STUDY

Traffic congestion

Traffic congestion occurs when the volume of vehicles crossing a road section exceeds the road's design capacity, resulting in long queues and a saturation degree value of more than 0.75 (Wini & Seherdiyanto, 2016). The phenomenon of traffic congestion often occurs in areas with high activity intensity, such as economic centers or areas with significant population density. According to Wini & Seherdiyanto (2016), congestion often occurs due to continuously high traffic volumes, which are called "traffic scattering". The impact, in addition to disrupting traffic flow, congestion also has a negative impact on social, economic, and cultural activities in an area.

Tamim (2013) emphasized that the rate of vehicle growth is very fast, but transportation facilities do not develop in line, so that accessibility and mobility of the community are disrupted. According to Meutia Sukma et al. (2017), congestion is worse during rush hours, such as when going to and from work, where traffic becomes unstable and vehicle speeds decrease drastically.

According to Suprayitno (2018), primary arterial roads such as in urban areas play an important role in supporting large traffic flows. However, side obstacles such as vehicles that stop or park carelessly, pedestrians, and slow vehicles often exacerbate congestion on these road sections. MKJI analysis (1997) shows that road performance is greatly influenced by traffic flow and interactions between road users, including workers, traders, and consumers.

Side obstacles, such as parking on the roadside and vehicles entering and exiting the road, are the main factors that reduce road capacity, especially in urban areas (Meidianisa Aulia H, 2016). Wibisana (2013) stated that the traffic flow value (Q) indicates the composition of vehicles passing through, and the closer it is to road capacity, the more congestion will increase.

Road section performance is greatly influenced by road geometry and existing side obstacles, such as public transportation stops or pedestrians who do not utilize sidewalk facilities optimally (Yulianto & Setiono, 2013). Based on the road capacity manual (Directorate General of Highways, 1997), road performance is assessed from the volume per capacity (VCR), where a value above 1.0 indicates poor service conditions and vehicles tend to experience congestion.

The influence of vehicle volume on road density is very significant, especially on arterial roads that function to connect national and regional activity centers (Suprayitno, 2018). Interactions between vehicles, pedestrians, and roadside activities often result in traffic delays and reduce the level of road service, so immediate handling is needed to overcome congestion.

Side obstacles are also one of the main causes of traffic congestion, especially in urban areas with dense economic and social activities. Side obstacles such as pedestrians, parked vehicles, vehicles entering and leaving, and slow vehicles greatly affect road capacity and performance. According to an analysis by Wibisana (2013), parking activities on the roadside and picking up and dropping off passengers often cause vehicles to slow down, thereby reducing the efficiency of road capacity.

Roadside obstructions are often caused by unavoidable social and economic activities, such as shops that do not provide adequate parking spaces, so vehicles have to park on the side of the road. This often occurs in economic areas such as Jalan Indihiang, Tasikmalaya City, where parking on the side of the road is very common, disrupting vehicle flow (Yulianto & Setiono, 2013). Activities such as picking up and dropping off passengers in any place also worsen the situation. Other factors that contribute to congestion are the use of sidewalks for street vendors and parking, reducing space for pedestrians, which leads to a reduction in the overall efficiency of road space.

According to Imam Sonny (2015), in the development of traffic simulation models with VISSIM, input parameters such as dynamic and static characteristics of vehicles are very important to ensure accurate and realistic model results. These parameters include vehicle type, vehicle length and weight, stopping distance, and maximum speed and acceleration taken from field data. Analysis of road segment performance based on this model is often used to predict and evaluate the level of road service, which is based on the volume per capacity (VCR) of passing vehicles.

The classification of roads in Indonesia according to Bina Marga (1997) also affects how road sections function and serve traffic flow. Arterial, collector, and local roads each have different roles in serving transportation needs, with arterial roads functioning as main roads with long-distance travel and high speed limits. However, factors such as road geometry and terrain classification also affect the capacity of the road to accommodate the volume of passing vehicles.

In general, the problem of traffic congestion in Indonesia is not only related to the increasing number of vehicles, but also to inadequate road infrastructure and the lack of efficient traffic management. To overcome this congestion, a comprehensive solution is needed, both in terms of improving road infrastructure and better traffic management, including systematic handling of side obstacles (Directorate General of Highways, 1997).The hypotheses proposed in this study are as follows: H1: It is suspected that vehicle volume has a positive and significant effect on traffic congestion on Jalan Raya Indihiang, Tasikmalaya City; H2: It is suspected that poor road performance has a positive and significant effect on traffic congestion on Jalan Raya Indihiang, Tasikmalaya City; H3: It is suspected that side obstacles have a positive and significant effect on traffic congestion on Jalan Raya Indihiang, Tasikmalaya City.

3. RESEARCH METHODS

This study uses a quantitative approach with a finite population consisting of road users around Jalan Raya Indihiang, Tasikmalaya City. The number of vehicles passing through the road section averaged 7,051 vehicles within a specified time period. To determine the sample, the Slovin formula was used, resulting in a sample of 100 respondents consisting of male and female drivers aged over 17 years. The sampling technique applied was incidental sampling, where respondents were selected based on coincidence when the researcher conducted observations at the research location. The data collected consisted of primary data, obtained through questionnaires, interviews, and observations, as well as secondary data from library sources. The data analysis method used was descriptive analysis to describe the collected data and quantitative analysis to measure the influence of the variables studied. The Likert scale was used to convert qualitative data from the questionnaire into quantitative data, with a value range from 1 to 5, reflecting the level of respondent agreement with the statements given.

4. RESULTS AND DISCUSSION

Normality Test

Normality test is conducted to determine the normal distribution of residual data in the regression model. Based on statistical analysis using Kolmogorov-Smirnov Test, the statistical test value is 0.723 with Asymp. Sig. (2-tailed) 0.672. Since the significance value is greater than 0.05, it can be concluded that the residual is normally distributed.

Autocorrelation Test

Autocorrelation testing using the Durbin-Watson Test shows a DW value of 2.199. Based on the Durbin-Watson table, for n = 100 and k = 3, the values obtained are dL = 1.6131 and du = 1.7364. Because DW is between the du and (4-du) values, there is no autocorrelation in the regression model.

Multicollinearity Test

The results of the multicollinearity analysis show that there is no significant correlation between the independent variables. The VIF values for each variable are as follows:

1. Vehicle Volume (X1): 1,055
2. Road Section Performance (X2): 1,340
3. Side Resistance (X3): 1.384

All VIF values are less than 10 and the tolerance of each variable is more than 0.01, so there are no symptoms of multicollinearity.

Heteroscedasticity Test

The heteroscedasticity test shows that the residuals do not show a particular pattern and are randomly distributed, which means that there is no heteroscedasticity. The results of the Spearman's Rho test for Unstandardized Residual show that the significance value of all variables is more than 0.05, so there are no symptoms of heteroscedasticity in the regression model.

Multiple Linear Regression Analysis

Table 1

Coefficientsa

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3,524	1.178		2,991	.004
	Vehicle Volume (X1)	.089	.060	.117	1,499	.137
	Side Barrier (X2)	.370	.082	.403	4.495	.000
	Road Section Performance (X3)	.291	.075	.344	3,899	.000

a. Dependent Variable: Traffic Congestion (Y)

Based on the calculation results in table 1 above using SPSS V.16, it can be seen that the multiple linear regression equation is: Y = 3.524 +0.089X1+0.370X2 + 0.291X3 μ. From the regression equation above, it can be interpreted as follows:

Constant (a): The constant value of 3.524 indicates that if the independent variables (vehicle volume, side obstacles, and road section performance) are considered constant, traffic congestion will have a positive value of 3.524.

Vehicle Volume (b1): The regression coefficient of 0.089 indicates that every one unit increase in vehicle volume (X1) will cause traffic congestion to increase by 0.089. Vehicle volume refers to the number of vehicles passing through a road section in a certain time unit, with indicators of vehicle congestion, delays, and queues.

Side Obstacles (b2): The regression coefficient of 0.370 indicates that every one unit increase in side obstacles (X2) will cause traffic congestion to increase by 0.370. Side obstacles refer to activities around the road that can disrupt traffic flow, such as public vehicles stopping carelessly.

Road Section Performance (b3): The regression coefficient of 0.291 indicates that every one unit increase in road section performance (X3) will cause traffic congestion to decrease by 0.291. Road section performance reflects the road's ability to serve traffic flow.

t-test

Table 2

Coefficientsa

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3,524	1.178		2,991	.004
	Vehicle Volume (X1)	.089	.060	.117	1,499	.137
	Side Barrier (X2)	.370	.082	.403	4.495	.000
	Road Section Performance (X3)	.291	.075	.344	3,899	.000

a. Dependent Variable: Road Congestion (Y)

1. Vehicle Volume (X1): The test results show a t-count value of 1.499 with a significance level of 0.137. Because t count (1.499) < t table (1.98472), Ho is accepted and H1 is rejected. This means that vehicle volume does not have a positive and significant effect on traffic congestion.
2. Road Section Performance (X2): The test results show a t-count value of 3.899 with a significance level of 0.000. Because t count (3.899) > t table (1.98472), Ho is rejected

and H2 is accepted. This shows that road section performance has a positive and significant effect on traffic congestion.

3. Side Obstacles (X3): The test results also show a t-count value of 3.899 with a significance level of 0.000. With t count (3.899) > t table (1.98472), Ho is rejected and H3 is accepted. This means that side obstacles have a positive and significant effect on traffic congestion.

Coefficient of Determination Test

Table 3

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.666a	.444	.426	1.11611

a. Predictors: (Constant), Road Section Performance (X3), Vehicle Volume (X1), Side Obstacles (X2)

From the regression test results table, the coefficient of determination (adjusted R square) is 0.426. This means that the variables of vehicle volume (X1), road segment performance (X2) and side obstacles (X3) have a contribution of 42.6% in influencing traffic congestion (Y). While other factors that influence traffic congestion are (100% - 60.9%) = 39.1%.

5. CONCLUSION AND SUGGESTIONS

Based on the research, it can be concluded that the Vehicle Volume variable has a positive and significant effect on traffic congestion, with a t-value of 4.495> t table 1.98472, indicating negative impacts such as congestion and delays that cause loss of time and costs. On the other hand, the performance of the road section does not have a significant effect on congestion, as seen from the t-value of 1.499 <t table. In addition, side obstacles also have a positive and significant effect, with a t-value of 3.899> t table, due to the presence of vehicles stopping and entering and exiting which reduces the speed of traffic flow. To overcome this congestion problem, it is recommended that the government provide appeals and enforce traffic regulations, improve road performance through traffic sign engineering, and regulate side obstacles so that traffic flow becomes smoother. The public is also expected to be more aware of driving in order to prevent accidents and disturbances to other road users.

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