STUDY OF NOISE ON PASSENGER CAR SPEED

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ABSTRACT
Bogor Regency has an economic growth rate including the highest among cities and other districts around the Jakarta Capital Region. Regarding the condition of the vehicle population in Bogor Regency, the number of motorized vehicles in 2017 and 2018 experienced a growth of between 2% and 12%. In contrast to the growth rate of vehicles, the road growth rate is only 0.1% per year. Nurul Hidayah Mosque is located on Salabenda Rd, the object of the author's research to find out how much influence the sound of motorized vehicles has on worship activities around the Nurul Hidayah Mosque. In public transport car speed, motorcycle speed, and private car speed do not have a significant effect on the noise pollution produced. The noise level around the Nurul Hidayah Mosque, Salabenda Raya Rd, Bogor Regency which has been measured the smallest is 56.4 dB. This value exceeds the noise threshold of the Noise Level Standard Value for the Ministerial Decree, which is 55 dB. So that it requires attention and cooperation from the government and the community to overcome the noise in the worship area. The calculation and analysis obtained is on the equation with the largest R Square value on the fourth day of the study, the third point (Sound Level Meter 3), with a contribution of 22.67%. Like the equation on the side, \( y = 73.251 + 0.004x_1 - 0.311x_2 - 0.003x_3 \). The meaning of this equation is that if there is no decrease in the speed of motorbikes, private cars and public transport cars, the noise pollution level in SLM3 is 73.251 dB. If there is an increase in the speed of public transport cars by 0.004, the decrease of motorbikes by 0.311, and an increase in the speed of private cars by 0.003, the noise pollution level will decrease by 0.31 dB at SLM3.

Keyword: speed; passenger; noise; pollution; public transportation.

INTRODUCTION
Bogor Regency has a rate of economic growth including the highest among cities and other districts around the Jakarta Capital Region. Regarding the condition of the vehicle population in Bogor district, the number of motorized vehicles in 2017 and 2018 experienced a growth of between 2% and 12%. In contrast to the growth rate of vehicles, the road growth rate is only 0.1% per year. Fernanda, et al (2017) conducted a study of vehicle volume and speed on noise, concluding that the greater the volume of the vehicle, the lower the vehicle speed will result in a high noise level (Arlan.M, 2011; Bogor Regency Central Bureau of Statistics, 2020; Ikron.I.M, 2007; Ikron.I.M, 2007; Nababan.D, 2014). Likewise, if the vehicle volume is low, the vehicle speed will be higher, resulting in a lower noise level. This study is to determine the relationship between passenger car speed and the noise generated in the city of Bogor. Nurul Hidayah Mosque, located on Salabenda Rd, is the object of the author's research to find out how much influence the sound of motorized vehicles has on worship activities. The purpose of this research is to determine the relationship between passenger car speed and the noise it causes.

Salabenda T-junction trip is the busiest location at this time. Along with that, it is necessary to take action to implement the process of calculating traffic conditions in the field. This condition will greatly affect motor vehicle traffic activities that pass through the area where the noise investigation is carried out (Syaiful.S, 2020; Syaiful.S, 2021; Syaiful.S, Andana.R, 2021; Syaiful.S, Elvira.Y, 2017; Syaiful.S, Fadly.A, 2020; Syaiful.S, Hariyadi.D, 2019). The noise in question is the condition of the traffic being quiet, moderate and crowded. Calculations will be made based on field conditions. It also affects the asphalt road surface and the condition of the reinforced concrete surface (Akbardin.et.al, 202; Syaiful.S, 2017; Syaiful.S, 2020; Syaiful.S, 2020; Syaiful.S, Akbardin.J, 2020). The
condition of paved vehicle traffic is very stable. Surface conditions using reinforced concrete will affect the collision between the tires and the road surface (Syaiful.S, Hariyadi.D 2020; Syaiful.S, Mudjanarko.S.W, 2019; Syaiful.S, et.al, 2020; Syaiful.S, Sutarsa.S,2020). The road surface will be smooth and comfortable, there will be no noise. while the bumpy road surface and many potholes will affect the sound condition caused by the exhaust, rough engine and friction between the vehicle body and the uneven surface (Syaiful.S, Pratama.Y, 20219; Syaiful.S, Yuliantino.M, 2017; Syaiful.S, Wahid.N, 2020).

RESEARCH METHODS

The location for calculating vehicle speed and measuring the level of noise intensity was chosen in front of the Nurul Hidayah mosque, Jalan Salabenda Raya, Kemang sub-district, Bogor district. The time of the research was carried out for 3 months (July 2020 to September 2020). Data were collected for 4 days, without specifying certain days such as Saturdays and Sundays. The following is the location and research that will be carried out.

![Picture 1. Research Locations (Source: Google Earth)]

Materials and Tools

The material in this research is in the form of data - The material used in this study is primary data related to existing conditions, such as road damage conditions carried out by direct survey to the location, road dimensions. Secondary data were obtained from related Dinas data. Meanwhile, the tools used are SLM, stopwatch, meter, office stationery, hand tally counter for calculating traffic data and computer software in the form of Microsoft Excel, Microsoft Word, Google Earth Pro and AutoCAD.

Research Flowchart

The following is a flowchart of the stages of the research which is outlined figure 2 below:
RESULTS AND DISCUSSION

Data analysis

Data analysis of the observation of the level of noise pollution on a straight road with the type of object of the mosque research. In this case it is assumed that the increase in the level of noise pollution \( Y \) is an independent variable. Dependent variables are placed in three measuring points, namely:

- SLM 1 on the sidewalk as a point of 0 meters,
- SLM 2 is located 3 meters from the sidewalk, and
- SLM 3 is located 24 meters from the sidewalk to the alley of the Nurul Hidayah mosque.

This dependent variable will be influenced by several independent variables, namely:

- \( X_1 \) is the first independent variable / speed of Public Transportation Car (MAU)
- \( X_2 \) is the second independent variable / motorcycle speed (SMR)
- \( X_3 \) is the third independent variable / private car speed (MPR)

Based on the data above, the linear regression model approach is obtained, namely: \( Y = a_0 + a_1.X_1 + a_2.X_2 + a_3.X_3 \). The respective coefficients \( a_0, a_1, a_2, \) and \( a_3 \) are coefficients determined based on research data.

Discussion on Statistical Analysis on Monday, July 6, 2020

Discussion on SLM1 analysis with a distance of 0.00 m from the edge of the highway.

Processing and discussion of data using the SPSS version 26.00 program obtained the level of noise pollution \( y \) and the speed of public transportation cars (MAU / \( x_1 \)), motorbike speed (SMR / \( x_2 \)), and private car speed (MPR / \( x_3 \)). Calculation and data processing based on a 95% confidence level. The results and discussion of equations that represent conditions in the field are shown as follows,


\[ y = 86.951 - 0.280x_1 + 0.060x_2 + 0.029x_3 \]

**Test criteria**

In the discussion of testing the summary model, it is obtained that the value of RSquare = 0.039, which means that \( x_1, x_2, \) and \( x_3 \) has a 3.94% effect on \( y \). Anova test results obtained by the value of F-count = 0.602 with the probability value (sig) = 0.617. From the data input, it is obtained the value of F-Table = is 2.816, obtained F-Count < F-Table, then \( H_a \) is rejected and \( H_0 \) accepted.

Discussion of the results of the coefficients test, motorbike speed, private car speed and public transport car speed have a constant value \((a) = 86,951, (b) = -0.280, (c) = 0.061, (d) = 0.029\), the value of t-count = 15.941, and the value (sig) = 0.000, from the data obtained the value of t-table = 2.015, then \( t \)-count > t-table, then \( H_a \) is accepted and \( H_0 \) is rejected.

**Discussion on SLM2 analysis at a distance of 3.00 m from the edge of the highway.**

Processing and discussion of data using the SPSS version 26.00 program obtained the level of noise pollution \((y)\) and the speed of public transportation cars \((\text{MAU} / x_1)\), motorbike speed \((\text{SMR} / x_2)\), and private car speed \((\text{MPR} / x_3)\). Calculation and data processing based on a 95% confidence level. The results and discussion of equations that represent conditions in the field are shown as follows,

\[ y = 71.522 - 0.326x_1 + 0.458x_2 - 0.381x_3 \]

**Test criteria**

In the discussion of testing the summary model, it was obtained that the value of RSquare = 0.138, which means that \( x_1, x_2, \) and \( x_3 \) has an 13.86% effect on \( y \). Anova test results obtained by the value of F-count = 2.361 with a probability value (sig) = 0.084. From the data input, the value of F-Table = 2.816, obtained F-Count < F-Table, then \( H_a \) is rejected and \( H_0 \) is accepted.

Discussion of coefficients test results, motorbike speed, private car speed and public transport car speed have a constant value \((a) = 71.522, (b) = -0.326, (c) = 0.458, (d) = -0.381\), the value of t-count = 11,717, and value (sig) = 0.000, from the data obtained the value of t-table = , then \( t \)-count > t-table, then \( H_a \) is accepted and \( H_0 \) is rejected.

**Discussion on SLM3 analysis at a distance of 24.00 m from the edge of the highway.**

Processing and discussion of data using the SPSS version 26.00 program obtained the level of noise pollution \((y)\) and the speed of public transportation cars \((\text{MAU} / x_1)\), motorbike speed \((\text{SMR} / x_2)\), and private car speed \((\text{MPR} / x_3)\). Calculation and data processing based on a 95% confidence level. The results and discussion of equations that represent conditions in the field are shown as follows,

\[ y = 65.200 - 0.080x_1 + 0.126x_2 - 0.164x_3 \]

**Test criteria**

In the discussion of testing the summary model, the value of RSquare = 0.089 is obtained, which means that \( x_1, x_2, \) and \( x_3 \) has an 8.88% effect on \( y \). Anova test results obtained by the value of F-count = 1.430 with a probability value (sig) = 0.247. From the data input, it is obtained the value of F-Table = 2.816, obtained F-Count < F-Table, then \( H_a \) is rejected and \( H_0 \) is accepted.

Discussion of coefficients test results, motorbike speed, private car speed and public transport car speed have a constant value \((a) = 65.200, (b) = 0.081, (c) = 0.127, (d) = -0.208\), the value of t-count = 22,133, and value (sig) = 0.000, from the data obtained the value of t-table = 2.015, then \( t \)-count > t-table, then \( H_a \) is accepted and \( H_0 \) is rejected.

**Discussion on Statistical Analysis on Wednesday, July 8, 2020**

**Discussion on SLM1 analysis with a distance of 0.00 m from the edge of the highway.**

Processing and discussion of data using the SPSS version 26.00 program obtained the level of noise pollution \((y)\) and the speed of public transportation cars \((\text{MAU} / x_1)\), motorbike speed \((\text{SMR} / x_2)\), and private car speed \((\text{MPR} / x_3)\). Calculation and data processing based on a 95% confidence level. The results and discussion of equations that represent conditions in the field are shown as follows,
Test criteria

In the discussion of testing the summary model, it is obtained that the value of RSquare = 0.044, which means that $x_1$, $x_2$, and $x_3$ have an 4.35% effect on $y$. Anova test results obtained by the value of F-count = 0.688 with a probability value (sig) = 0.576. From the data input, it is obtained the value of F-Table = 2.816, obtained F-Count < F-Table, then $H_a$ is rejected and $H_0$ is accepted.

Discussion of the results of the Coefficients test, motorbike speed, private car speed and public transport car speed have a constant value (a) = 86,951, (b) = 67,175, (c) = -0.141, (d) = 0.222, the value of t-count = 14,142, and the value (sig) = 0.000, from the data obtained the value of t-table = 2.015, then t-count > t-table, then $H_a$ is accepted and $H_0$ is rejected.

Discussion on SLM2 analysis at a distance of 3.00 m from the edge of the highway.

Processing and discussion of data using the SPSS version 26.00 program obtained the level of noise pollution ($y$) and the speed of public transportation cars (MAU / $x_1$), motorbike speed (SMR / $x_2$), and private car speed (MPR / $x_3$). Calculation and data processing based on a 95% confidence level. The results and discussion of equations that represent conditions in the field are shown as follows,

$$y = 79.217 - 0.155x_1 - 0.012x_2 + 0.342x_3$$

Test criteria

In the discussion of testing the summary model, it is obtained that the value of RSquare = 0.013 is obtained, which means that it has an effect of 1 on $y$. Anova test results obtained by the value of F-count = $x_1$, $x_2$, $x_3$ 34% 0.200 with a probability value (sig) = 0.896. From the data input, it is obtained the value of F-Table = , obtained F-Count < F-Table, then $H_a$ is rejected and $H_0$ is accepted.

Discussion of coefficients test results, motorbike speed, private car speed and public transport car speed have a constant value (a) = 67,175, (b) = -1.141, (c) = 0.014, (d) = 0.222, the value of t-count = 14,142, and the value (sig) = 0.000, from the data obtained the value of t-table = 2.015, then t-count > t-table, then $H_a$ is accepted and $H_0$ is rejected.

Discussion on SLM3 analysis at a distance of 24.00 m from the edge of the highway.

Processing and discussion of data using the SPSS version 26.00 program obtained the level of noise pollution ($y$) and the speed of public transportation cars (MAU / $x_1$), motorbike speed (SMR / $x_2$), and private car speed (MPR / $x_3$). Calculation and data processing based on a 95% confidence level. The results and discussion of equations that represent conditions in the field are shown as follows,

$$y = 67.175 - 0.141x_1 - 0.014x_2 - 0.222x_3$$

Test criteria

In the discussion of testing the summary model, it was obtained that the value of RSquare = 0.015, which means that $x_1$, $x_2$, and $x_3$ it has an effect of 0.48 % on $y$. Anova test results obtained by the value of F-count = 2.816 with a probability value (sig) = 0.881. From the data input, it is obtained the value of F-Table = 0.221, obtained F-Count < F-Table, then $H_a$ is rejected and $H_0$ is accepted.

Discussion of coefficients test results, motorbike speed, private car speed and public transport car speed have a constant value (a) = 64,411, (b) = -0.056, (c) = 0.021, (d) = -0.010, the value of t-count = 30,026, and the value (sig) = 0.000, from the data obtained the value of t-table = 2.015, then t-count > t- Table, then $H_a$ is accepted and $H_0$ is rejected.

Discussion on Statistical Analysis on Thursday, July 9, 2020

Discussion on SLM1 analysis with a distance of 0.00 m from the edge of the highway.

Processing and discussion of data using the SPSS version 26.00 program obtained the level of noise pollution ($y$) and the speed of public transportation cars (MAU / $x_1$), motorbike speed (SMR / $x_2$),
and private car speed (MPR / $x_3$). Calculation and data processing based on a 95% confidence level. The results and discussion of equations that represent conditions in the field are shown as follows, 

$$y = 87.975 - 0.629x_1 + 0.157x_2 + 0.278x_3$$

**Test criteria**

In the discussion of testing the summary model, it is obtained that the value of $R^2 = 0.162$, which means that it has an effect on $y$. Anova test results obtained by the value of $F$-count $= x_1$, $x_2$, $x_3$ 16.15% 2.826 with the probability value (sig) $= 0.159$. From the data input, the value of $F$-Table $= x_1$, obtained $F$-Count $> F$-Table, then $H_a$ is accepted and $H_0$ is rejected.

**Discussion on SLM2 analysis at a distance of 3.00 m from the edge of the highway.**

Processing and discussion of data using the SPSS version 26.00 program obtained the level of noise pollution ($y$) and the speed of public transportation cars (MAU / $x_1$), motorbike speed (SMR / $x_2$), and private car speed (MPR / $x_3$). Calculation and data processing based on a 95% confidence level. The results and discussion of equations that represent conditions in the field are shown as follows, 

$$y = 69.260 - 0.543x_1 + 0.177160x_2 + 0.377x_3$$

**Test criteria**

In the discussion of testing the summary model, it is obtained that the value of $R^2 = 0.162$, which means that $x_1$, $x_2$, and $x_3$ has an effect of 16 on $y$. Anova test results obtained by the value of $F$-count $= .18% 2.832 with a probability value (sig) $= 0.049$. From the data input, the value of $F$-Table $= 2.816$, obtained $F$-Count $> F$-Table, then $H_a$ is accepted and $H_0$ is rejected.

**Discussion on SLM3 analysis at a distance of 24.00 m from the edge of the highway.**

Processing and discussion of data using the SPSS version 26.00 program obtained the level of noise pollution ($y$) and the speed of public transportation cars (MAU / $x_1$), motorbike speed (SMR / $x_2$), and private car speed (MPR / $x_3$). Calculation and data processing based on a 95% confidence level. The results and discussion of equations that represent conditions in the field are shown as follows, 

$$y = 63.205 - 0.209 + 0.083x_2 + 0.158x_3$$

**Test criteria**

In the discussion of testing the summary model, it is obtained that the value of $R^2 = 0.083$, which means that $x_1$, $x_2$, and $x_3$ has an effect on $y$. Anova test results obtained by the value of $F$-count $= .829% 1.326 with a probability value (sig) $= 0.278$. From the data input, it is obtained the value of $F$-Table $= 2.816$, obtained $F$-Count $< F$-Table, then $H_a$ is rejected and $H_0$ is accepted.

Discussion of coefficients test results, motorbike speed, private car speed and public transport car speed have a constant value (a) = 63.205, (b) $= -0.209$, (c) = 0.083, (d) = 0.158, value of t-count $= 15.409$, and value (sig) $= 0.000$, from the data obtained the value of t-table $= 2.015$, then t-count $> t$-table, then $H_a$ accepted and $H_0$ was rejected.
Discussion on Statistical Analysis on Saturday, July 11, 2020

Discussion on SLM1 analysis with a distance of 0.00 m from the edge of the highway.

Processing and discussion of data using the SPSS version 26.00 program obtained the level of noise pollution \( y \) and the speed of public transportation cars (MAU / \( x_1 \)), motorbike speed (SMR / \( x_2 \)), and private car speed (MPR / \( x_3 \)). Calculation and data processing based on a 95% confidence level. The results and discussion of equations that represent conditions in the field are shown as follows,

\[ y = 81.294 - 0.211x_1 - 0.040x_2 + 0.264x_3 \]

Test criteria

In the discussion of testing the summary model, it is obtained that the value of RSquare = 0.018, which means that \( x_1, x_2, \) and \( x_3 \) has an effect 1.77% on \( y \). Anova test results obtained by the value of F-count = 0.265 with a probability value (sig) = 0.850. From the data input, it is obtained the value of F-Table = 2.816, obtained F-Count < F-Table, then \( H_a \) is rejected and \( H_0 \) is accepted.

Discussion on SLM2 analysis at a distance of 3.00 m from the edge of the highway.

Processing and discussion of data using the SPSS version 26.00 program obtained the level of noise pollution \( y \) and the speed of public transportation cars (MAU / \( x_1 \)), motorbike speed (SMR / \( x_2 \)), and private car speed (MPR / \( x_3 \)). Calculation and data processing based on a 95% confidence level. The results and discussion of equations that represent conditions in the field are shown as follows,

\[ y = 74.392 - 0.320x_1 - 0.233x_2 + 0.456x_3 \]

Test criteria

In the discussion of testing the summary model, the value of RSquare = 0.074 was obtained, which means that \( x_1, x_2, \) and \( x_3 \) it has an effect 7.38% on \( y \). Anova test results obtained by the value of F-count = 1.169 with a probability value (sig) = 0.332. From the data input, it is obtained the value of F-Table = 2.816, obtained F-Count < F-Table, then \( H_a \) is rejected and \( H_0 \) is accepted.

Discussion on SLM3 analysis at a distance of 24.00 m from the edge of the highway.

Processing and discussion of data using the SPSS version 26.00 program obtained the level of noise pollution \( y \) and the speed of public transportation cars (MAU / \( x_1 \)), motorbike speed (SMR / \( x_2 \)), and private car speed (MPR / \( x_3 \)). Calculation and data processing based on a 95% confidence level. The results and discussion of equations that represent conditions in the field are shown as follows,

\[ y = 73.251 + 0.004x_1 - 0.311x_2 - 0.003x_3 \]

Test criteria

In the discussion of testing the summary model, it is obtained that the value of RSquare = 0.227, which means that \( x_1, x_2, \) and \( x_3 \) has an effect of 22.67 % on \( y \). Anova test results obtained by the value of F-count = 4.300 with a probability value (sig) = 0.964. From the data input, the value of F-Table = 2.816, obtained F-Count > F-Table, then \( H_a \) is accepted and \( H_0 \) is rejected.

Discussion of coefficients test results, motorbike speed, private car speed and public transport car speed have a constant value \( a = 73.251 \), \( b = 0.004 \), \( c = -0.311 \), \( d = -0.003 \), the value of t-count = 26.267, and the value (sig) = 0.000, from the data obtained the value of t-table = 2.015, then t-count > t-table, then \( H_a \) is accepted and \( H_0 \) is rejected.
CONCLUSION
From the results and discussion, it can be identified that the increase in the speed of motorbikes, private cars and public transport vehicles against the noise they cause, the following results are obtained, the noise level around Nurul Hidayah Mosque, Jalan Salabenda Raya, Bogor Regency which has been measured the smallest is 56.4 dB A. The value exceeds the noise threshold of the provisions Noise Level Standard Value, that is 55 dB A. So that it requires attention and cooperation from the government and the community to overcome the noise in the worship area. In public transport car speed, motorbike speed, and private car speed do not have a significant effect on the noise pollution produced. The calculation and analysis obtained is on the equation with the largest R Square value on the fourth day of the study, the third point (Sound Level Meter 3), with a contribution of 22.67%. Like the equation on the side, the meaning of this equation is that if there is no decrease in the speed of motorbikes, private cars and public transport cars, the noise pollution level in SLM3 is 73.251 dB A. If there is an increase in the speed of public transport cars by 0.004, a decrease in motorbikes by 0.311, and an increase in the speed of private cars by 0.003, the noise pollution level will decrease by 0.31 dB A at SLM3. 

\[ y = 73.251 + 0.004x_1 - 0.311x_2 - 0.003x_3 \]

REFERENCES


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