

**VEHICLE TRAFFIC VOLUME ANALYSIS DUE TO SOUND GENERATED IN FRONT OF THE RS. Hermina Bogor****Syaiful Syaiful, Muhammad Nanang Prayudyanto, Rulhendri Rulhendri, Puri Anita Lestari, Aqies Naili Nabila, Salma Leandra Damiana, Haldiana Haldiana**

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E-mail: [syaiful@ft.uika-bogor.ac.id](mailto:syaiful@ft.uika-bogor.ac.id)**ABSTRACT**

Motorcycles produce a variety of sounds. Sound is synonymous with noise. Noise is big enough to have an impact on the comfort of a place that is directly related to the highway. The distance between the hospital building and the road must be taken into account. This distance is important for the realization of patient comfort in the hospital/treatment room. The volume of motorcycles, light vehicles and heavy vehicles must be controlled, especially those passing through schools/places of worship/hospitals. Traffic flow/volume of motorcycles, light vehicles and heavy vehicles have a significant effect on noise. The calculation results obtained the largest equation on the fourth day of research at the third point (sound level meter<sup>2</sup>), with a contribution of 34.22% at  $y = 59.11 + 0.3x_1 - 0.1x_2 - 0.17x_3$ . This equation means that if there is no decrease in the volume of motorcycles, light vehicles and heavy vehicles, the noise level in SLM<sub>2</sub> is 59.11dB<sub>A</sub>. If there is an increase in the volume of motorcycles, light vehicles and heavy vehicles, the noise significantly affects. The results of the second equation from the calculation of the first day at the third point (sound level meter<sup>3</sup>) with a contribution of 19.30% based on the equation,  $y = 60.54 + 0.01x_1 - 0.01x_2 + 0.08x_3$ . This means that if there is an increase in the volume of the motorcycle, the noise on the SLM<sub>3</sub> is 60.54dB<sub>A</sub>. From the results obtained, there has been a decrease in the volume of motorcycles, light vehicles and heavy vehicles that pass through RS Hermina Bogor during the Covid-19 pandemic, because many hospital visitors/users do not travel or self-isolate at home. Decrease in the number of motorized vehicles that pass in front of the hospital. RS Hermina Bogor reached 45%.

**Keywords:** volume; motor vehicle; motorcycle; sound level meter; RS Hermina.

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**INTRODUCTION**

Increased mobility of people requires adequate, safe, comfortable and affordable transportation facilities and infrastructure for the community. The increase in per capita income makes people able to buy vehicles such as motorbikes and four-wheeled vehicles as a means of personal transportation. The increase in the regional economy has also led to an increase in the need for public transportation facilities such as buses and trucks (Abdel-Wahed TA, et.al, 2017; Ahmad KA, et.al, 2018). As a result, the number of traffic flows and the types of vehicles that use roads is increasing day by day, this causes problems in the transportation sector, one of which is the problem of noise pollution (noise) caused by traffic flows to the surrounding environment, one of which is the school area, hospital. Noise is unwanted sound, in general noise is closely related to disturbance. Noise is everywhere and distraction is one of the most common reactions to noise. Traffic noise is the dominant source of environmental noise in urban areas. Sources of noise associated with transportation are those from private cars, passenger cars, motorcycles, buses, trucks and heavy vehicles (Syaiful S, Mudjanarko SW, 2019; Syaiful S, et.al, 2022; Syaiful S, et.al, 2022; Syaiful S, Wahid N, 2020) Each vehicle produces noise, but the source and amount of noise varies greatly depending on the type of vehicle. Noise in urban areas with heavy traffic is not a new problem anymore, but an old problem that needs to be solved together (Aslan H, Kocaman H, 2018; Astarita V, et.al, 2018). Health services are not only influenced by internal factors, but also by external factors, namely the condition of the surrounding environment. Noise is a disturbance in the process of health services, at a prolonged intensity and at a certain level it can be harmful to health (Ganda CF et.al, 2019; Karimah H, Akbardin J, 2019).

In fact, the sound generated by motorized vehicles does not only come from the engine. The noise can be caused by friction between the tires and the road surface, non-standard exhaust, and the condition of the vehicle being unfit for operation. This fact was conveyed by Syaiful S, Pratama Y (2019). Roads that are not smooth will result in motorized vehicles slowing down. This will result in the collection of sound at a single point of noise, let alone traveling hand in hand with one another. Motorized vehicles will not be free to regulate their speed, resulting in a slowdown. This voice affects the conditions that have been prepared for a certain time (Syaiful S, Hariyadi D, 2019; Syaiful S, et.al, 2020; Syaiful S, 2020; Syaiful S, Fadly A, 2020).

Syaiful S, Andana R (2021) said that the vehicle functions properly if the engine and maintenance are carried out regularly. This will ensure a good engine and the sound it produces does not cause noise. Noise caused by the sound of this vehicle will be suppressed if it contains many factors, including good vehicle condition, well-maintained engine, distance between sound and noise sources, and the presence of tree obstructions. All of this will be suppressed if vehicle owners and people whose houses are near the highway always pay attention to the distance between bedrooms and the roadside. It is forbidden to use the shoulder of the road for business or residential activities. Intentionally or not, economic factors make people build semi-permanent buildings on the shoulders of roads, pedestrians and other public places, including intersections. This is very dangerous for the safety of the lives of its occupants as well as for motorized vehicles that have uncontrolled speeds (Syaiful S, et. Al, 2021; Syaiful S, et.al, 2021; Thamrin T, Syaiful S, 2016; Akbardin J, et al. al, 2020; Syaiful S et al, 2022; Syaiful S, Rusfana H, 2022).

Syaiful S (2012 and Syaiful S (2015) said that the closer to the source of the sound, the higher the noise. The sound source generated by motorized vehicles on the highway is now starting to disturb the activities of residents. This needs to be addressed by implementing strict rules to control passing activities safe and orderly traffic without noise, so that it will create a sense of security and comfort in driving.

The population growth of the city is accompanied by the activities of citizens who are supported by motorized vehicles in their daily lives. Dependence on motorized vehicles is a living culture of the Indonesian people. So it is necessary to arrange for the placement of motorized vehicle engines to be adapted to road conditions in Indonesia. Uneven road conditions will affect the rotation of the wheels. The wheel of the vehicle turning abnormally will cause a noisy sound, thus disturbing the order of the people who hear it (Syaiful S, Irbah AF, 2021; Syaiful S, Saputra S, 2016; Syaiful S, 2015).

The purpose of the study was to obtain the effect of the volume of motorcycles, light vehicles and heavy vehicles due to the sound they make in front of RS Hermina Bogor. The limitation of the research refers to objects that pass in front of the hospital such as the number of motorized vehicles such as motorbikes, private vehicles and public transportation including freight transportation in front of Hermina Hospital, Bogor city. Noise disturbance comes from the sound of the vehicle, researched and observed noise level disturbances. The samples used were road users in front of RS Hermina Bogor, namely, hospital staff, hospital visitors and people who passed in front of RS Hermina Bogor. The sample studied can represent daily activities carried out at 06.00 - 18.00 WIB. Days that represent each hospital activity for four days, namely Monday, Wednesday, Thursday and Saturday were chosen to represent the day of activity and the day of the long week-end.

### **Definition of highway**

The highway is a land transportation infrastructure that plays a very important role in the transportation sector, especially for the continuity of the distribution of goods and services. The function of the road is to serve existing and developing traffic loads and flows, and can provide security and comfort to road users (Anonymous A, 1997). The main characteristics of roads that affect the capacity of road traffic are influenced by several factors.

**Traffic flow**

Traffic flow in general is a traffic condition that has an influence in terms of the volume and volume of traffic itself (Anonymous A, 1997).

**Free flow volume in real condition**

The volume of free current in real conditions is shown in equation (1).

$$FV = (FV_o + FV_w) \times FF_{sf} \times FF_{Vcs} \dots\dots\dots(1)$$

with:

- FV : actual free flow volume (LV), [km/hour];
- Fvo : basic free flow volume (LV), [km/hour];
- FVw : effective traffic road width adjustment [km/h];
- FFVcs : city size adjustment factor;
- FFVsf : side resistance adjustment factor.

**Capacity**

The capacity value is shown in equation (2).

$$C = CO \times F_{cw} \times FC_{sp} \times FC_{cs} \dots\dots\dots(2)$$

with:

- C : capacity (pcu/hour)
- CO : basic capacity for certain conditions (pcu/hour)
- Fcw : traffic lane width adjustment factor
- FCsp : direction separator adjustment factor
- FCsf : side resistance adjustment factor
- FCcs : city size adjustment factor

(Anonymous A, 1997).

**Road performance level**

The level of road performance is shown in equation (3).

$$DS = \frac{Q}{C} \dots\dots\dots(3).$$

with:

- DS : degree of saturation,
- Q : traffic flow capacity,
- C : capacity.

(Anonymous A, 1997).

**Passenger Car Equivalent**

The passenger car equivalent (EMP) for each type of vehicle depends on the type of road and the total traffic flow expressed in 1 hour. All SMP values for different vehicles are based on the EMP coefficient, to determine the equivalent of a passenger car, it is shown in Table 1, and the determination of the frequency of occurrence is shown in Table 2.

**Table 1.** Determining passenger car equivalence (EMP)

Road type = one-way street and divided road	Traffic flow per lane (vehicles/hour)	EMP	
		HV	MC
Two lanes one way (2/1)	0	1,3	0,40
Four divided lanes (4/2D)	>1050	1,2	0,25
Three lanes one way (3/1)	0	1,3	0,40
Six divided lanes (6/2 D)	>1100	1,2	0,25

(Anonymous A, 1997).

**Table 2.** Determination of incident frequency

Types of Adverse Events	Symbol	Weight Factor
Pedestrian	PED	0,5
Parking, vehicle stops	PCV	1,0
Vehicles in+out	EEV	0,7
Slow vehicle	SMV	0,4

(Anonymous A, 1997).

### Noise

Noise is an unwanted sound from a business or activity at a certain level and time that can cause disturbances to human health and environmental comfort (Anonymous A, 1996). Based on the nature and spectrum of sound, noise is divided into:

1. Continuous noise with a wide frequency spectrum, this noise is relatively constant within the limits of approximately 5 dB<sub>A</sub> for a period of 0.5 seconds consecutively.
2. Continuous noise with a narrow frequency spectrum, this noise is also relatively constant, but only has a certain frequency (at frequencies of 500, 1000, and 4000 Hz) such as saws, gas valves.
3. Intermittent noise, this noise does not occur continuously, but there is a period of relative calm, for example traffic noise, noise at the airport.
4. Impulsive noise. This type of noise has a change in sound pressure exceeding 40 dB<sub>A</sub> in very precise time and usually shocks the hearing, eg gunshots, explosions of firecrackers, cannons.
5. Repeated impulsive noise. This noise is the same as impulsive noise, only here it occurs repeatedly, for example a forging machine.

**Table 3.** Noise level limits

Health area/environment designation	Noise level (dB <sub>A</sub> )
1. Designation of area	
a. Housing and settlement	55
b. Warehousing and services	70
c. Office and trade	65
d. Green open space	50
e. Industry	70
f. Government and public facilities	60
g. Recreation	70
2. Environment of activities	
a. Hospital or the like	55
b. School or the like	55
c. Places of worship or the like	55

(Anonymous A, 1996).

### Data analysis

Observational data in this study is the observation data on the noise level on a straight road with regional characteristics. The assumption taken is that the increase in noise level ( $y$ ) is a dependent variable and is influenced by several independent variables, namely:

$x_1$  is the first independent variable/motorcycle volume (VMC)

$x_2$  is the second independent variable/light vehicle volume (VLV)

$x_3$  is the third independent variable/heavy vehicle volume (VHV)

Based on the data above, the linear regression model approach is obtained, namely:

$y = a_0 + a_1.x_1 + a_2.x_2 + a_3.x_3 + \dots\dots\dots a_n.x_n$ . Where  $a_0$ ,  $a_1$ ,  $a_2$  and  $a_3$  are coefficients determined based on research data.

### Research Place

The place and location of this research is in front of RS Hermina Bogor, Jl. Abdullah Bin Nuh Yasmin and including the National road.



Figure 1. Map of research location in front of Hermina Hospital, Bogor



Figure 2. Location in front of Hermina Hospital, Bogor

### Ingredients

The research material is in the form of data forms to take the number of motorbikes, the number of light vehicles and the number of heavy vehicles. The sound data form for motorized vehicles is taken from the measurement results of the Sound Level Meter (SLM) noise instrument used.

### Tools

The equipment used in this study as follows:

1. Sound Level Meter (SLM), as the main tool for calculating noise that occurs at a certain place and time. The SLM used has fruit, which include:
  - a. SLM 1, SLM Manual brand Krisbow, type KW06-291,
  - b. SLM 2, Krisbow SLM Manual, type KW06-291, and
  - c. SLM 3, SLM Outo brand Extech, type HD600.
2. Roll Meter, as a tool for measuring the distance between the SLM point and the road and school wall buildings.
3. Digital camera, to document all processes in the ongoing research.
4. Tally or manual counting tool, as a tool to count the number of vehicles passing on the highway.
5. Laptop, as a tool in data collection and processing data obtained from the field during the research.
6. Stationery along with member 1, member 2 and member 3 as data collectors in the field, assisting in recording, counting and conditioning the number of motorized vehicles obtained during data collection in the field.

## METHOD RESEARCH

The research method is presented in the form of a flow chart in Figure 3 below:

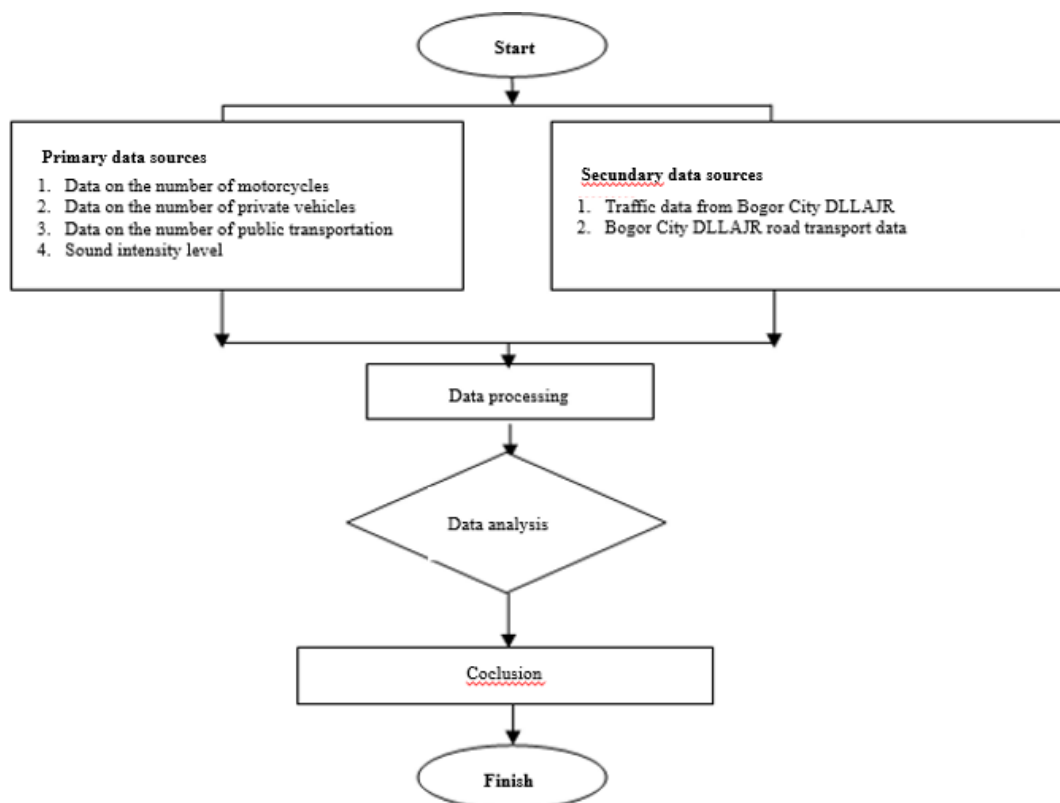


Figure 3. Research flow chart

## RESULTS AND DISCUSSION

### Traffic data results

This traffic data is obtained from the calculation of the Passenger Car Equivalence (EMP). The use of this calculation is intended to make traffic analysis easy to carry out the passenger car unit

factor (SMP) for each motor vehicle according to the Indonesian Road Capacity Manual (Anonymous A, 1997), for urban roads as follows:

1. Heavy Vehicle (HV) = 1.30
2. Light Vehicle (LV) = 1.00
3. Motorcycle (MC) = 0.40
4. Non-motorized vehicles = 1.00

In practice, the grouping is divided into two groups, namely motorcycles and light vehicles, where motorcycles (MC) have a value of 0.40 and light vehicles (private vehicles, public transport and freight transport) with an EMP of 1.00. Heavy vehicle with 1.30 EMP.

### Volume Processing Results on Monday, May 03, 2021

Based on the volume calculation guide from the Highways Department of the Ministry of Public Works of the Republic of Indonesia, data collection using volume uses the following formula:

Volume of motorcycles number of motorized vehicles/length of time survey

$$\text{Number of two-way motorcycles} = 298 + 144 = 442$$

$$\text{Time needed} = 06.00 - 06.15$$

$$= 15 \text{ minutes ( } 15/60) = (0.25) \text{ hours}$$

Example calculation:

Is known:

$$\text{Number of vehicles (n)} = 442 \text{ vehicles}$$

so

$$\text{Volume (Q=n/t) Q} = 442/0.25$$

$$= 1768.00 \text{ vehicles/hour}$$

### Results and discussion of noise caused by motorized vehicles

From the results of data processing using SPSS 22 and selecting the existing data. To show that the recommended data below are motorcycle volume data, light vehicle volume and heavy vehicle volume.

### Correlation Test

For correlation testing, look for the relationship between two or more independent variables which are jointly linked to the dependent variable, so that it is known the amount of the contribution of the independent variable which is the object of research on the dependent variable in table 6 below.

### Hypothesis

$H_a$  = There is a significant effect between the volume of motorcycles, the volume of light vehicles and the volume of heavy vehicles with noise

$H_o$  = There is no significant effect between the volume of motorcycles, the volume of light vehicles and the volume of heavy vehicles with noise

$\alpha$  = 5.00%

### Statistical data analysis Monday, May 03, 2021

### Discussion using a distance of 0.00m with an SLM1

The results of data processing using SPSS 22 obtained the noise level (y) with the volume of motorcycles (VMC/x1), the volume of light vehicles (VLV/x2) and the volume of heavy vehicles (VHV/x3) based on a 95% confidence level. The following is the result of the equation representing the condition of the distance of 0.00m using SLM1:  $y = 82.34 + 0.012x_1 - 0.10x_2 - 0.02x_3$ .

#### **Test Criteria**

The results of the summary model test obtained the value of RSquare = 0.049, which means that x1, x2, x3 have an effect of 4.90% on y.

The results of the ANOVA test obtained the F-Count = 0.557 with a probability value (sig) = 0.695. From the input data, we get the value of F-Table = 3.19 so F-Calculate < F-Table, then H<sub>a</sub> is rejected and H<sub>o</sub> is accepted.

The results of the coefficients test, the volume of motorcycles, the volume of light vehicles and the volume of heavy vehicles have a constant value of (a) = 82.34, (b) = 0.012, (c) = -0.10, (d) = -0.02, and the value of t-Count = 18,041 and value (sig) = 0.000, from the data obtained the value of t-Table = 2.014, then t-Count > t-Table, then H<sub>a</sub> is accepted and H<sub>o</sub> is rejected.

#### **Hypothesis decision**

The results of the statistical tests above can be drawn from the results of the hypothetical decisions regarding the effect of motorized vehicle volume on noise, that there is a significant effect or relationship between the volume of motorized vehicles on noise that occurs in SLM 1 on the first day.

#### **Discussion with a distance of 3.00m using SLM2**

Noise level (y) with motorcycle volume (VMC/x1), light vehicle volume (VLV/x2) and heavy vehicle volume (VHV/x3) based on 95% confidence level. The following is the result of the equation representing the condition of the 3.00m distance using SLM2:  $y = 66.17 + 0.03x_1 - 0.02x_2 - 0.08x_3$ .

#### **Test Criteria**

The results of the summary model test obtained the value of RSquare = 0.101, which means that x1, x2, x3 have an effect of 10.10% on y.

The results of the ANOVA test obtained the F-Count = 1.211 with the probability value (sig) = 0.320. From the input data, we get the value of F-Table = 3.19 so F-Calculate < F-Table, then H<sub>a</sub> is rejected and H<sub>o</sub> is accepted.

The results of the coefficients test, the volume of motorcycles, the volume of light vehicles and the volume of heavy vehicles have a constant value of (a) = 66.17, (b) = 0.03, (c) = 0.02, (d) = 0.08, and the value t-Count = 11.953 and value (sig) = 0.000, from the data obtained the value of t-Table = 2.014, then t-Count > t-Table, then H<sub>a</sub> is accepted and H<sub>o</sub> is rejected.

#### **Hypothesis decision**

The results of the statistical tests above can be drawn from the results of the hypothetical decisions regarding the effect of motor vehicle volume on noise, that there is a significant effect or relationship between motor vehicle volume and noise that occurs in SLM2 on the first day.

#### **Discussion with a distance of 12.00m using SLM3**

Noise level (y) with motorcycle volume (VMC/x1), light vehicle volume (VLV/x2) and heavy vehicle volume (VHV/x3) based on 95% confidence level. The following is the result of the equation that represents the condition of a distance of 12.00m using SLM3:  $y = 60.54 + 0.01x_1 - 0.01x_2 + 0.08x_3$ .



### Test Criteria

The results of testing the summary model obtained the value of RSquare = 0.193, which means that  $x_1$ ,  $x_2$ ,  $x_3$  have an effect of 19.30% on  $y$ .

The results of the ANOVA test obtained the F-Count = 2.577 with a probability value (sig) = 0.051. From the input data, we get the value of F-Table = 3.19 so F-Calculate < F-Table, then  $H_a$  is rejected and  $H_o$  is accepted.

The results of the coefficients test, the volume of motorcycles, the volume of light vehicles and the volume of heavy vehicles have a constant value of (a) = 60.54, (b) = 0.01, (c) = 0.01, (d) = 0.08 and the value of t-Calculate = 16,317 and value (sig) = 0.000, from the data obtained the value of t-Table = 2.014, then t-Count > t-Table, then  $H_a$  is accepted and  $H_o$  is rejected.

### Hypothesis decision

The results of the statistical tests above can be drawn from the results of the hypothesis decisions regarding the effect of motorized vehicle volume on noise, that there is a significant effect or relationship between the volume of motorized vehicles on noise that occurs in SLM3 on the first day.

#### Analysis of statistical data for Wednesday, May 05, 2021

##### Discussion using a distance of 0.00m with an SLM1

The results of data processing using SPSS 22 obtained the noise level ( $y$ ) with the volume of motorcycles (VMC/ $x_1$ ), the volume of light vehicles (VLV/ $x_2$ ) and the volume of heavy vehicles (VHV/ $x_3$ ) based on a 95% confidence level. The following is the result of the equation representing the condition of the distance of 0.00m using SLM1:  $y = 83.11 + 0.04x_1 + 0.09x_2 - 0.19x_3$ .

### Test Criteria

The results of the summary model test obtained the value of RSquare = 0.161, which means that  $x_1$ ,  $x_2$ ,  $x_3$  have an effect of 16.10% on  $Y$ .

The results of the ANOVA test obtained the F-Count = 2.065 with the probability value (sig) = 0.102. From the input data, we get the value of F-Table = 3.19 so F-Calculate < F-Table, then  $H_a$  is rejected and  $H_o$  is accepted.

The results of the coefficients test, the volume of motorcycles, the volume of light vehicles and the volume of heavy vehicles have a constant value of (a) = 83.11, (b) = 0.04, (c) = 0.09, (d) = -0.19 and the value t-Count = 16,335 and value (sig) = 0.000, from the data obtained the value of t-Table = 2.014, then t-Count > t-Table, then  $H_a$  is accepted and  $H_o$  is rejected.

### Hypothesis decision

The results of the statistical tests above can be drawn from the results of the hypothetical decisions regarding the effect of motorized vehicle volume on noise, that there is a significant effect or relationship between the volume of motorized vehicles on noise that occurs in SLM1 on the second day.

##### Discussion with a distance of 3.00m using SLM2

Noise level ( $y$ ) with motorcycle volume (VMC/ $x_1$ ), light vehicle volume (VLV/ $x_2$ ) and heavy vehicle volume (VHV/ $x_3$ ) based on 95% confidence level. The following is the result of the equation that represents the condition of a distance of 3.00m using SLM2 is:  $y = 64.81 - 0.01x_1 - 0.06x_2 - 0.07x_3$ .

### Test Criteria

The results of the summary model test obtained the value of RSquare = 0.043, which means that  $x_1$ ,  $x_2$ ,  $x_3$  have an effect of 4.30% on  $y$ .

The results of the ANOVA test obtained the F-Count = 0.488 with the probability value (sig) = 0.745. From the input data, we get the value of F-Table = 3.19 so F-Calculate < F-Table, then  $H_a$  is rejected and  $H_o$  is accepted.

The results of the coefficients test, the volume of motorcycles, the volume of light vehicles and the volume of heavy vehicles have a constant value of (a) = 64.81, (b) = 0.01, (c) = 0.06, (d) = -0.07 and t-Count = 12,991 and value (sig) = 0.000, from the data obtained the value of t-Table = 2.014, then t-Count > t-Table, then  $H_a$  is accepted and  $H_o$  is rejected.

### **Hypothesis decision**

The results of the statistical tests above can be drawn from the results of the hypothesis decision regarding the effect of motorized vehicle volume on noise, that there is a significant effect or relationship between the volume of motorized vehicles on noise that occurs in SLM2 on the second day.

### **Discussion with a distance of 12.00 m using SLM3**

Noise level (y) with motorcycle volume (VMC/x1), light vehicle volume (VLV/x2) based on 95% confidence level. The following is the result of the equation that represents the 12.00m distance condition using SLM3:  $y = 61.19 + 0.01x_1 + 0.02x_2$ .

### **Test Criteria**

The results of testing the summary model obtained the value of RSquare = 0.091, which means that  $x_1$ ,  $x_2$  has an effect of 9.10% on y.

The results of the ANOVA test obtained the F-Count = 1.082 with a probability value (sig) = 0.377. From the input data, we get the value of F-Table = 3.19 so F-Calculate > F-Table, then  $H_a$  is accepted and  $H_o$  is accepted.

The results of the coefficients test, the volume of motorcycles, the volume of light vehicles and the volume of heavy vehicles have a constant value of (a) = 61.19, (b) = 0.01, (c) = 0.02 and the value of t-Calculation = 26,163 and the value of (sig) = 0.000, from the data obtained the value of t-Table = 2.014, then t-Calculate > t-Table, then  $H_a$  is accepted and  $H_o$  is rejected.

### **Hypothesis decision**

The results of the statistical tests above can be drawn from the results of the hypothesis decisions regarding the effect of motorized vehicle volume on noise, that there is a significant effect or relationship between the volume of motorized vehicles on noise that occurs in SLM3 on the second day.

### **Statistical data analysis Thursday, May 06, 2021**

### **Discussion using a distance of 0.00m with an SLM1**

The results of data processing using SPSS 22 obtained the noise level (y) with the volume of motorcycles (VMC/x1), the volume of light vehicles (VLV/x2) and the volume of heavy vehicles (VHV/x3) based on a 95% confidence level. The following is the result of the equation representing the condition of the distance of 0.00m using SLM1:  $y = 74.37 + 0.06x_2 + 0.08x_3$ .

### **Test Criteria**

The results of the summary model test obtained the value of RSquare = 0.179, which means that  $x_2$ ,  $x_3$  have an effect of 17.90% on y.

The results of the ANOVA test obtained the F-Count = 2.338 with a probability value (sig) = 0.070. From the input data, we get the value of F-Table = 3.19 so F-Calculate < F-Table, then  $H_a$  is rejected and  $H_o$  is accepted.

The results of the coefficients test, the volume of motorcycles, the volume of light vehicles and the volume of heavy vehicles have a constant value of (a) = 74.37, (c) = 0.06, (d) = 0.08 and the value of t-Calculate = 19.073 and the value (sig) = 0.000, from the data obtained the value of t-Table = 2.014, then t-Calculate > t-Table, then  $H_a$  is accepted and  $H_o$  is rejected.

### Hypothesis decision

The results of the statistical tests above can be drawn from the results of the hypothesis decisions regarding the effect of motorized vehicle volume on noise, that there is a significant effect or relationship between the volume of motorized vehicles on noise that occurs in SLM1 on the third day.

#### Discussion with a distance of 3.00m using SLM2

Noise level (y) with motorcycle volume (VMC/x1) based on 95% confidence level. The following is the result of the equation that represents the condition of the 3.00m distance using SLM2:  $y = 67.542 - 0.02x1$ .

#### Test Criteria

The results of the summary model test obtained the value of RSquare = 0.261, which means that x1, x2 has an effect of 26.10% on y.

The results of the ANOVA test obtained the F-Count = 3.797 with a probability value (sig) = 0.010. From the input data, we get the value of F-Table = 3.19 so F-Calculate > F-Table, then  $H_a$  is accepted and  $H_o$  is accepted.

The results of the coefficients test, the volume of motorcycles has a constant value (a) = 67.42, (b) = -0.02 and a t-count = 17.574 and a value (sig) = 0.000, from the data obtained the t-table value = 2.014, then t-Calculate > t-Table, then  $H_a$  is accepted and  $H_o$  is rejected.

### Hypothesis decision

The results of the statistical tests above can be drawn from the results of the hypothesis decisions regarding the effect of motorized vehicle volume on noise, that there is a significant effect or relationship between the volume of motorized vehicles on noise that occurs in SLM2 on the third day.

#### Discussion with a distance of 12.00 m using SLM3

Noise level (y) with light vehicle volume (VLV/x2) and heavy vehicle volume (VHV/x3) based on 95% confidence level. The following is the result of the equation representing the condition of a distance of 12.00m using SLM3 is:  $y = 62.31 + 0.02x2 - 0.02x3$ .

#### Test Criteria

The results of the summary model test obtained the value of RSquare = 0.216, which means that x2, x3 have an effect of 21.60% on y.

The results of the ANOVA test obtained the F-Count = 2,958 with a probability value (sig) = 0.030. From the input data, we get the value of F-Table = 3.19 so F-Calculate > F-Table, then  $H_a$  is accepted and  $H_o$  is accepted.

The results of the coefficients test, the volume of light vehicles has a constant value of (a) = 62.31, (c) = 0.02, (d) = -0.02 and a t-count value = 33,818 and a value (sig) = 0.000, from the data in get the value of t-Table = 2.014, then t-Calculate > t-Table, then  $H_a$  is accepted and  $H_o$  is rejected.

### Hypothesis decision

The results of the statistical tests above can be drawn from the results of the hypothesis decisions regarding the effect of motor vehicle volume on noise, that there is a significant effect or relationship between motor vehicle volume and noise that occurs in SLM3 on the third day.

#### Analysis of statistical data for Saturday, May 08, 2021

#### Discussion using a distance of 0.00m with an SLM1

The results of data processing using SPSS 22 obtained the noise level (y) with the volume of motorcycles (VMC/x1), the volume of light vehicles (VLV/x2) and the volume of heavy vehicles (VHV/x3) based on a 95% confidence level. The following is the result of the equation

representing the condition of the distance of 0.00m using SLM1:  $y = 71.42 + 0.02x_1 + 0.06x_2 - 0.05x_3$ .

#### **Test Criteria**

The results of testing the summary model obtained a value of RSquare = 0.074, which means that  $x_1$ ,  $x_2$ ,  $x_3$  have an effect of 7.40% on  $y$ .

The results of the ANOVA test obtained the F-Count = 0.857 with the probability value (sig) = 0.498. From the input data, we get the value of F-Table = 3.19 so F-Calculate < F-Table, then  $H_a$  is rejected and  $H_o$  is accepted.

The results of the coefficients test, the volume of motorcycles, the volume of light vehicles and the volume of heavy vehicles have a constant value of (a) = 71.42, (b) = 0.02, (c) = 0.06, (d) = -0.05 and t-Count = 14,831 and value (sig) = 0.000, from the data obtained the value of t-Table = 2.014, then t-Count > t-Table, then  $H_a$  is accepted and  $H_o$  is rejected.

#### **Hypothesis decision**

The results of the statistical tests above can be drawn from the results of the hypothesis decisions regarding the effect of motorized vehicle volume on noise, that there is a significant effect or relationship between the volume of motorized vehicles on noise that occurs in SLM1 on the fourth day.

#### **Discussion with a distance of 3.00m using SLM2**

Noise level ( $y$ ) with motorcycle volume (VMC/ $x_1$ ), light vehicle volume (VLV/ $x_2$ ) and heavy vehicle volume (VHV/ $x_3$ ) based on 95% confidence level. The following is the result of the equation representing the condition of the 3.00m distance using SLM2:  $y = 64.35 + 0.1x_1 + 0.7x_2 - 0.2x_3$ .

#### **Test Criteria**

The results of the summary model test obtained a value of RSquare = 0.077, which means that  $x_1$ ,  $x_2$ ,  $x_3$  only have an effect of 7.70% on  $y$ .

The results of the ANOVA test obtained the F-Count = 0.900 with a probability value (sig) = 0.472. From the input data, we get the value of F-Table = 3.19 so F-Calculate < F-Table, then  $H_a$  is rejected and  $H_o$  is accepted.

The results of the coefficients test, the volume of motorcycles, the volume of light vehicles and the volume of heavy vehicles have a constant value of (a) = 64.35, (b) = 0.1, (c) = 0.7, (d) = -0.2, and the value of t-Count = 13,826 and value (sig) = 0.000, from the data obtained the value of t-Table = 2.014, then t-Count > t-Table, then  $H_a$  is accepted and  $H_o$  is rejected.

#### **Hypothesis decision**

The results of the statistical tests above can be drawn from the results of the hypothetical decisions regarding the effect of motorized vehicle volume on noise, that there is a significant effect or relationship between the volume of motorized vehicles on noise that occurs in SLM2 on the fourth day.

#### **Discussion with a distance of 12.00m using SLM3**

Noise level ( $y$ ) with motorcycle volume (VMC/ $x_1$ ), light vehicle volume (VLV/ $x_2$ ) based on 95% confidence level. The following is the result of the equation representing the condition of a distance of 12.00m using SLM3:  $y = 59.11 + 0.3x_1 - 0.1x_2 - 0.17x_3$ .

#### **Test Criteria**

The results of the summary model test obtained the value of RSquare = 0.363, which means that  $x_1$ ,  $x_2$  has an effect of 34.22% on  $y$ .

The results of the ANOVA test obtained the F-Count = 6.134 with a probability value (sig) = 0.001. From the input data, we get the value of F-Table = 3.19 so F-Calculate > F-Table, then  $H_a$  is accepted and  $H_o$  is accepted.

The results of the coefficients test, the volume of motorcycles, the volume of light vehicles and the volume of heavy vehicles have a constant value of (a) = 59.11, (b) = 0.3, (c) = -0.1, (d) = -0.17, and the value of t-Count = 23,202 and value (sig) = 0.000, from the data obtained the value of t-Table = 2.014, then t-Count > t-Table, then  $H_a$  is accepted and  $H_o$  is rejected.

### Hypothesis decision

The results of the statistical tests above can be drawn from the results of the hypothetical decisions regarding the effect of motor vehicle volume on noise, that there is a significant effect or relationship between the volume of motorized vehicles on noise that occurs in SLM3 on the fourth day.

### CONCLUSION

Motorcycle speed, private vehicle speed and public transport speed have a significant effect on noise, from all analysis calculations, the largest equation was obtained on the fourth day of the study, the third point (sound level meter3), with a contribution of 34.22%, as the equation  $y = 59.11 + 0.3x_1 - 0.1x_2 - 0.17x_3$ . That is, if there is no increase in the speed of motorcycles and a decrease in the speed of private transport cars and a decrease in the speed of public transport cars, the noise level at point 3 is 59.11dB<sub>A</sub>. If there is an increase in motorcycle speed of 0.3 km/hour and a decrease in the speed of private transportation cars by 0.1 km/hour and a decrease in the speed of public transportation cars by 0.17 km/hour, the noise level will decrease by 0.15 dB<sub>A</sub> on SLM3.

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### REFERENCES

- A Anonymous. 1996. Menteri Lingkungan Hidup. 1996. Baku Tingkat Kebisingan, Surat Keputusan Menteri Lingkungan Hidup Nomor: Kep-48/MENLH/1996/25 November 1996. Jakarta. (Indonesian).
- A Anonymous. 1997. Departemen Pekerjaan Umum Direktorat Jenderal Bina Marga, Pebruari 1997 Manual Kapasitas Jalan Indonesia (MKJI). Jakarta. (Indonesian).
- CF Ganda, H Moetrisono, SW Mudjanarko. 2019. Analisis Alternatif Pembiayaan Penyeberangan ASDP Ujung-Kamal Akibat Dibangunnya Jembatan Surabaya-Madura. ASTONJADRO: CEAESJ, 8(2), pp.103-109. (Indonesian). <http://ejournal.uika-bogor.ac.id/index.php/ASTONJADRO/article/view/2801/1681>
- H Aslan, H Kocaman. 2018. GIS Based Bus Stop Optimisation for Sakarya Public Transportation System, *Sakara University Journal of Science*, 22 (5), 1298-1308, 2018.
- H Karimah, J Akbardin. 2019. Kajian Tentang Model Bangkitan Pergerakan Permukiman Kawasan Ciswastra Kota Bandung, ASTONJADRO: CEAESJ, 8(2), pp.97-102. (Indonesian). <http://ejournal.uika-bogor.ac.id/index.php/ASTONJADRO/article/view/2799>
- J Akbardin, D Parikesit, B Riyanto, AT Mulyono, S Syaiful. 2020. MODELLING OF TRIPS ASSIGNMENT ANALYSIS FOR ROADS NETWORK SYSTEM BASED ON TRANSPORTATION NEEDS OF EXPORT COMMODITY. *ARPN Journal of Engineering and Applied Sciences* 15 (21), 2463-2470.
- KA Ahmad, S Afolabi, M Nda, HA Daura. 2018. Economic Benefit of Introducing a Bus Rapid Transit (BRT) in Kano State Nigeria. *IConCEES 2017. IOP Conf. Series: Earth and Environmental Science* 140 (2018) 012093.

- S Syaiful, H Siregar, E Rustiadi, ES Hariyadi, MN Prayudyanto, R Rulhendri. 2022. Noise from the traffic volume of motorcycle during the Covid-19 pandemic: A case study of Wiyata Mandala Junior High School Bogor. *Sustinere: Journal of Environment and Sustainability* 6 (1), 44-54.
- S Syaiful, H Rusfana. 2022. RIGID PAVEMENT PLANNING IN TRAFFIC: CASE STUDY IN CIHERANG ROAD AND PEMUDA ROAD, BOGOR REGENCY, INDONESIA. *Journal of Applied Engineering Science*, 1-13.
- S Syaiful, SW Mudjanarko. 2019, Noise of Motor Vehicles at from of Baiturrahman Great Mosque Semarang City, *The Spirit of Society Journal*, 2 (2) March 2019. <https://jurnal.narotama.ac.id/index.php/scj/article/view/902>
- S Syaiful, H Siregar, E Rustiadi, ES Hariyadi. 2022. Performance of Three Arms Signalized Intersection at Salabenda in Bogor Regency, *ASTONJADRO: CEAESJ*, 11(1),pp.13-29.
- S Syaiful, H Siregar, E Rustiadi, ES Hariyadi, FAD Ardila, CFR Akbar. 2021. Traffic Density Due to Motorcycle Noise During the Pandemic Covid-19, *ASTONJADRO: CEAESJ*, 11(1),pp.151-166.
- S Syaiful, N Wahid. 2020. A Study of The Density of Motor Vehicles In Front of Bunda Hospital Margonda Depok Against Noise Pollution, *The Spirit of Society Journal*, 3 (2) March 2020. <https://jurnal.narotama.ac.id/index.php/scj/article/view/1094>
- S Syaiful, Y Pratama. 2019. Sustainable Studies about General Public Transport Performance in the City Of Bogor, *ARPN Journal of Engineering and Applied Sciences* 14 (18), 3241-3247.
- S Syaiful, D Hariyadi. 2019. Case Study on Sustainable T-Jungtion Cibinong City Mall (CCM) in Bogor Indonesia, *ARPN Journal of Engineering and Applied Sciences* 14 (17), 2960-2971.
- S Syaiful, H Prayoga, J Akbardin. 2020. Sustainable about the Need of Parking Systems at the Mall RDS Bogor, *ARPN Journal of Engineering and Applied Sciences* 15 (22), 2620-2626.
- S Syaiful. 2020. Analysis of Motorized Vehicle Sound Pollution in front of Mall Yogya Plaza Bogor. *INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH* 9 (8), 400-405.
- S Syaiful, A Fadly. 2020. Analysis of the Effectiveness of Bus Services Outside of Campus IPB Dramaga Bogor. *ASTONJADRO: CEAESJ* 9 (2), 173-186.
- S Syaiful, R Andana. 2021. Passenger Car Speed Assessment Relationship to the Noise Caused, *ASTONJADRO: CEAESJ* 10 (1), 41-49.
- S Syaiful, H Siregar, E Rustiadi, ES Hariyadi. 2021. Analysis of Motorcycle Traffic Speed Which Creates Noise in front of Wiyata Mandala Junior High School During The Covid-19 Pandemic. *ASTONJADRO: CEAESJ* 10 (2), 225-236.
- S Syaiful, H Siregar, E Rustiadi, ES Hariyadi. 2021. Traffic Improvement Strategy in Transportation System Using AHP Method. *ARPN Journal of Engineering and Applied Sciences* 16 (22), 2431-2439.
- S Syaiful, 2015. TINGKAT RESISTENSI POLUSI SUARA DI DEPAN RSIA SENTOSA BOGOR. *ASTONJADRO: CEAESJ* 4 (2), 57-61. (Indonesian).
- S Syaiful, AF Irbah. 2021. STUDY OF NOISE ON PASSENGER CAR SPEED. *ASTONJADRO: CEAESJ* 10 (2), 195-203.
- S Syaiful, S Saputra. 2016. STUDI KASUS POLUSI SUARA YANG DITIMBULKAN VOLUME KENDARAAN BERMOTOR (Kajian Di depan Rumah Sakit Bunda Margonda Kota Depok). *ASTONJADRO: CEAESJ* 5 (1), 27-35. (Indonesian).

- S Syaiful. 2012. STUDI KASUS TENTANG TINGKAT KEBISINGAN YANG DITIMBULKAN KENDARAAN BERMOTOR DI BOGOR (Kajian di Depan Rumah Sakit Azra Jalan Pajajaran Kota Bogor). ASTONJADRO: CEAESJ 1 (1), 73-80. (Indonesian).
- S Syaiful. 2015. ROAD MAP KEBISINGAN YANG DITIMBULKAN KENDARAAN BERMOTOR DI KOTA BOGOR (Kajian Seksi III untuk Kasus di Depan SDN Cibuluh 1 No. 222 Kota Bogor). Prosiding KoNTekS 9 Konferensi Nasional Teknik Sipil 9 1 (1), 951-954. (Indonesian).
- TA Abdel-Wahed, IH Hashim. 2017. Effect of Speed Hump Characteristics on Pavement Condition. Journal of Traffic and Transportation Engineering (English Edition) 2017; 4 (1) pp 103-110.
- T Thamrin, S Syaiful. 2016. ANALISIS KEBISINGAN YANG DITIMBULKAN KEPADATAN KENDARAAN BERMOTOR (Studi kasus Depan Masjid Assalafiyah, Jl. Raya Sukabumi KM 22 Cigombong, Kabupaten Bogor). ASTONJADRO: CEAESJ 5 (2), 46-57. (Indonesian).
- V Astarita, DC Festa, VP Giofre. 2018. Mobile Systems Applied to Traffic Management and Safety: a state of the art, Italy. The First International Workshop on Mobile Systems applied to Traffic Management and Society, Smart Vehicles and Smart Roads (MOBITrafic 2018) Arcavacata Cosenza, Italy. <http://creativecommons.org/licenses/by-nc-nd/3.0/> (diakses 19 Agustus 2021).