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TRAFFIC DENSITY DUE TO MOTORCYCLE NOISE DURING THE PANDEMIC COVID-19

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ABSTRACT

The density of motorized vehicles, especially motorcycles on the highway, is getting higher. However, in line with the 2020 Covid-19 pandemic, it has an impact on the decrease in the number of motorized vehicles on the highway. The density of motorcycles has a significant effect on noise, from all analysis calculations, the largest equation is obtained on the fourth day of the study, the second point (Sound Level Meter 2), with a contribution of 32.42%. Obtained the calculation below, y = 63.36 + 0.002x1. This equation means that if there is no decrease in motorcycle density, the noise level in SLM2 is 63.36 dBA. If there is a motorcycle density also has a significant effect on noise. The second largest equation was obtained on the third day of research at the third point (Sound Level Meter 3) with a contribution of 36.21% based on the equation calculation below, y = 60.24 + 0.001x1. The meaning of the above equation is that if there is an increase in the density of the motorcycle, the noise in the SLM3 is 60.24 dBA. The Covid-19 pandemic that has hit the world, Indonesia is also getting its effects, especially the very large Bogor district. The rapid spread of Covid-19 has changed the pattern of life for the people of Bogor, especially students who initially go to school every morning, now go to school and study online.

Keywords: traffic density; noise; motorcycles; sound level meter; Covid-19.

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INTRODUCTION

Land transportation, especially motocycles, is increasing rapidly from year to year in accordance with existing technological developments, currently transportation plays an important role in human life, roads are the means of transportation that play the most role in this, along with the increasing density of vehicles that pass as well as widening the road. Of course it produces new problems that may still be underestimated, the problem is noise (Syaiful, S, Mudjanarko, SW, 2019; Syaiful S, Akbar L, 2015; Syaiful S, 2015). So that the noise generated by these vehicles is considered normal for road users and local residents, but actually there are public facilities around the highway that are harmed by noise which will greatly disturb the school students such as students who need peace in the learning process (Syaiful S, Wahid N, 2020). Each motorized vehicle produces a variety of noise. This noise has a considerable impact on the tranquility of the area that is directly in contact with the highway. Therefore, setting the distance between the main school building and the road must be taken into account, for the sake of realizing the comfort of the school students (Syaiful S, Thamrin T, 2016; Karimah H, Akbardin J, 2019; Ganda SF, Moetriono H, Mudjanarko SW, 2019). The noise disturbance studied and observed is limited to noise source level disturbances which are not disturbances of air pollution levels or waste pollution. The sample studied can represent daily activities carried out at 06.00 - 18.00 WIB. The day that represents each educational activity for four days, namely Saturday, Sunday, Monday, Tuesday means the day that represents each activity.

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, 1997; Hobs, FD, 1995). The main characteristics of roads that affect the capacity of road traffic are influenced by several factors (Anonymous, 1997).

Vehicle density

Every activity passing from one place to another will be taken in a unit of time, the faster the path, the shorter the time taken. Likewise with motorized vehicles, the distance traveled in unit time by vehicles is called vehicle density.

Traffic density

Traffic density is the number of vehicles occupying a certain length of road segment or lane.

Traffic density is calculated by equations (1) and (2):

$$k = \frac{N}{L} \quad \text{.....(1)}$$

With :

k = density

N= volume

L = speed

$$k = \frac{\text{Volume}}{\text{speed}} \quad \text{.....(2)}$$

Vehicle density = number of vehicles/hour

Average space density = distance/hour (km/hour)

These limits the noise level for some areas or environments can be shown in table 1 below.

Table 1. Noise level limits

No	Health Designation/Environment	Noise level (dB_A)
1	Area Designation	
	a. Housing and settlement	55
	b. b. Trade and services	70
	c. c. Office and trade	65
	d. d. Green open space	50
	e. e. Industry	70
	f. f. Government and public facilities	60
	g. g. Recreation	70
2	Activity environment	
	a. Hospital or the like	55
	b. School or something	55
	c. Place of worship or the like	55

(Menteri Lingkungan Hidup, 1999)

Traffic Flow and Density

Traffic flow is the number of vehicles that cross the road at a time and distinguish between directions. The unit of traffic flow is the number of vehicles per unit time or smp per unit time. Density is the number of vehicles that cross the road in a long time regardless of direction. The density is measured in units of vehicles per hour.

Noise

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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 (Minister of Environment, 1996; Bangun LP, 2000; Nurul H, 2004).

Based on the nature and spectrum of sound, noise is divided into:

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

Data analysis

Observational data in this study is the observation data on the noise level on a straight road with the characteristics of the area.

The assumption taken is that the increase in the noise level (y) is a dependent variable and is influenced by several independent variables, namely:

x1 is the first independent variable/motorcycle density (SPM)

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

y = ao + a1.....an.xn

Where ao, a1, are coefficients determined based on research data.

RESEARCH METHODS

Working procedure

Research time

Field data collection was carried out for 4 days, namely:

a. Saturday 12 September 2020 at 06.00-18.00,
b. Sunday, September 13, 2020, 06.00-18.00,
c. Monday, September 14, 2020 at 06.00-18.00,
d. Tuesday, September 15, 2020 at 06.00-18.00.

Research Place

The place and location of this research is in front of the Wiyata Mandala Middle School, namely the Salabenda-Parung Km highway. 4, Salabenda Bogor, West Java (16629) This is a national road.

Figure 1. Map of the research location and front of SMP Wiyata Mandala Salabenda (Source: Google Maps and Personal Documentation)

Materials and tools
Ingredients

The material used in this study is in the form of form data to retrieve motorcycle traffic data and noise data taken from the measurement results of the Sound Level Meter (SLM) noise instrument used.

Tool

The main and supporting equipment used in this study are as follows:

a. Sound Level Meter (SLM), as the main tool for calculating noise that occurs at a certain place and time. There are 3 (three) SLMs in use, which include:
   1. SLM 1, SLM Manual Krisbow brand, type KW06-291,
   2. SLM 2, SLM Manual brand Krisbow, type KW06-291, and
   3. SLM 3, SLM Outo brand Extech, type HD600.
   4. Roll Meter, as a tool for measuring the distance between the SLM point and the road and hospital wall building.
b. Digital camera, to document all processes in the ongoing research.
c. Tally or manual counting tool, as a tool to count the number of vehicles passing on the highway.
d. Laptop, as a tool in data collection and processing data obtained from the field during the research.
e. Stationery and note-taking officers in the field, to assist in recording everything obtained during data collection in the field.

Research methods

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

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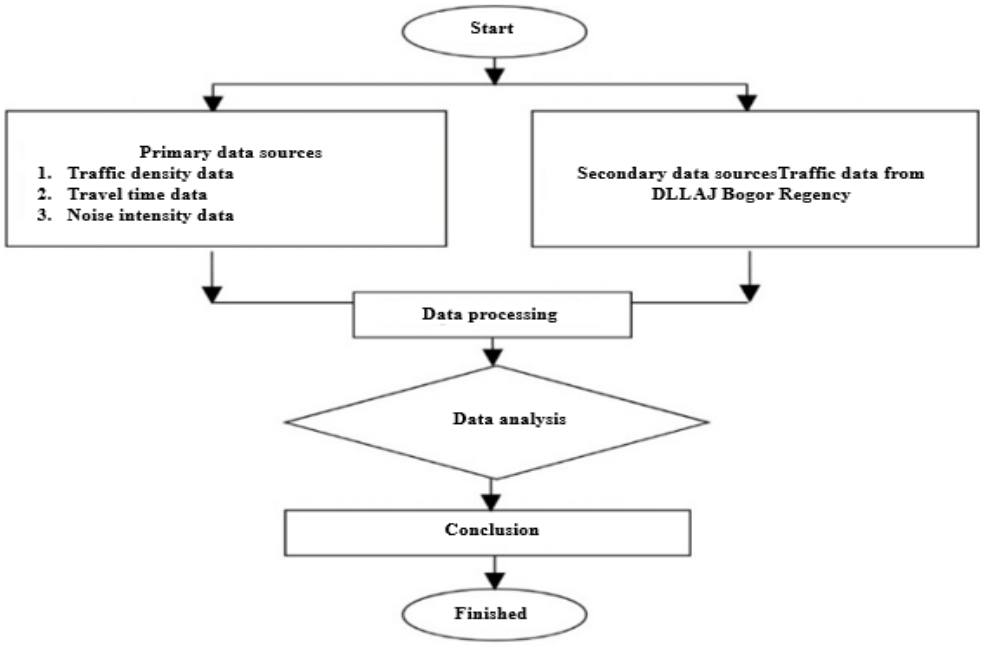

Figure 2. Research flow chart

RESULTS AND DISCUSSION

Traffic data results

The traffic result data that is calculated is data per 15 minutes for 12 hours a day. Data was taken from 6.00 to 18.00. This data was taken for 4 days, namely on Saturday 12 September 2020, Sunday 13 September 2020, Monday 14 September 2020, and Tuesday 15 September 2020.

This traffic data is obtained from the calculation of the Passenger Car Equivalence (EMP). The use of this calculation is intended to make it easy for traffic analysis to be carried out by passenger car unit factors (SMP) for each motor vehicle according to the Indonesian Road Capacity Manual (MKJI 1997), for urban roads as follows:

a. Heavy Vehicle (HV) = 1.30
b. Light Vehicle (LV) = 1.00
c. Motorcycle (SPM) = 0.40
d. Non-motorized vehicles = 1.00

In the implementation, the grouping is divided into two groups, namely motorcycles and light vehicles, where motorcycles (SPM) with a value of 0.40 and light vehicles (private cars, public transportation and freight transport) with an EMP of 1.00.

Motor vehicle density processing results

The results of processing the density of motorized vehicles on data on Saturday, September 12, 2020 are as follows: Based on the density calculation guide from the Department of Highways, Ministry of Public Works of the Republic of Indonesia, data collection using density uses the following formula:

Density of motorcycles number of motorized vehicles and divided by the length of the survey

Motorcycle density (D) = Speed (U) x Volume (Q)

= vehicle/km

Example calculation:
Is known:
Speed/U = 29.61 km/hour

Volume/Q = 3,660 vehicles/hour
Density/D = 108,372.6 vehicles/km

Data Processing of Vehicle Density and Noise Caused by Motor Vehicles

The results of processing the density of motorized vehicles and noise using the SPSS version 22 program. When the data was selected in the field, the processing results showed that the recommended data were respectively for the density of motorcycles, private vehicles and public transportation.

Correlation Test

Correlation testing is used to find the relationship between two or more independent variables which are jointly associated with 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 as shown in table 2 below.

Table 2. Interpretation of the value of r

No	r	Interpretation of r Value
1	0	Uncorrelated
2	0,01 – 0,20	Very low
3	0,21 – 0,40	Low
4	0,41 – 0,60	Slightly low
5	0,61 – 0,80	High enough
6	0,81 – 0,99	Tall
7	1	Very high

Hypothesis

Ha = There is a significant effect between the density of motorcycles, the density of private vehicles and public transportation with noise.

Ho = There is no significant effect between the density of motorcycles, the density of private vehicles and the density of public transport with noise

= 5.00%

Data Statistical Analysis

Statistical analysis of data on Saturday 12 September 2020, a distance of 0.00m with SLM1.

Analysis and data processing using SPSS version 22 obtained noise level (y), motorcycle density (SPM/x1) based on 95% confidence level.
The results of the equation using the data above are presented in the form of the equation below.
Which represents a distance of 0.00m using SLM1, shown in the form of table 3 and figure 3 below:

Table 3. Statistical Analysis of Distance Data 0.00m

Noise due to motorcycle	Motorcycle traffic density
81.11	0.002
81.22	0.004
81.33	0.006
81.44	0.007

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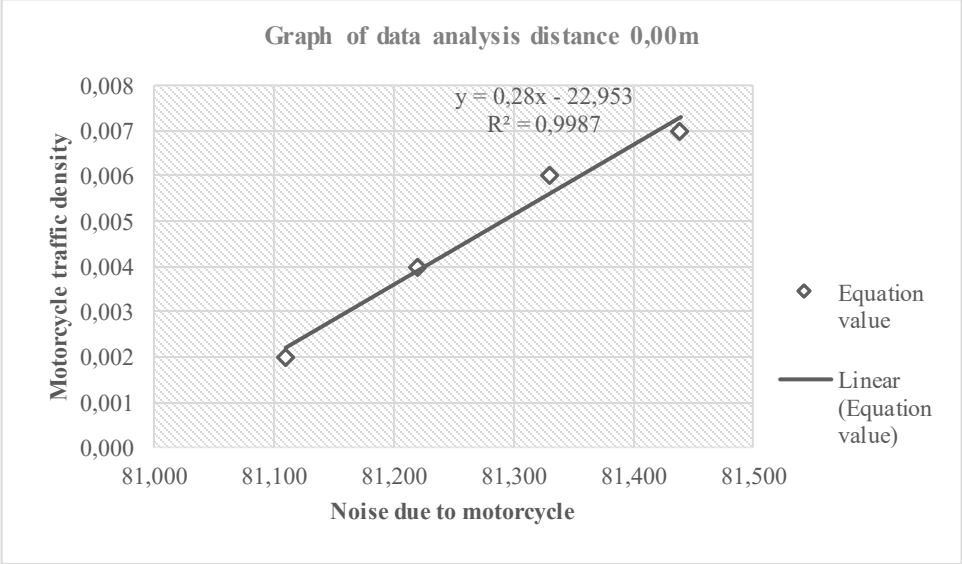

Figure 3. Data Analysis Graph

Statistical analysis of data on Saturday 12 September 2020, a distance of 3.44 m with SLM2. Shown in the form of table 4 and figure 4 below.

Table 4. Statistical Analysis of Distance Data 3,44m

Noise due to motorcycle	Motorcycle traffic density
67.76	0.002
67.80	0.003
67.84	0.004
67.88	0.005

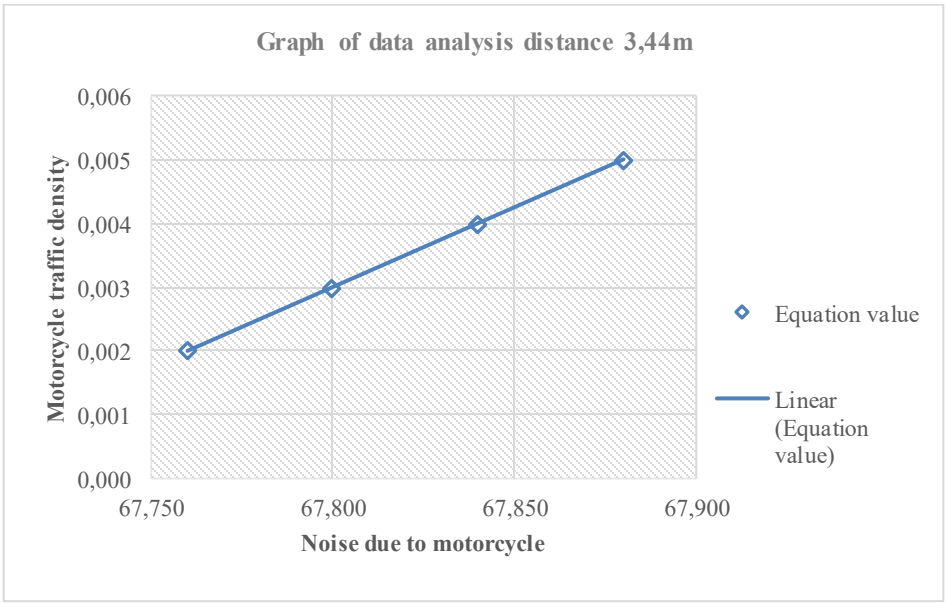

Figure 4. Data Analysis Graph

Statistical analysis of data on Saturday 12 September 2020, a distance of 15.25m with SLM3.

Shown in the form of table 5 and figure 5 below.

Table 5. Statistical Analysis of Distance Data 15,25m

Noise due to motorcycle	Motorcycle traffic density
67.41	0.003
67.51	0.004
67.61	0.005
67.71	0.006

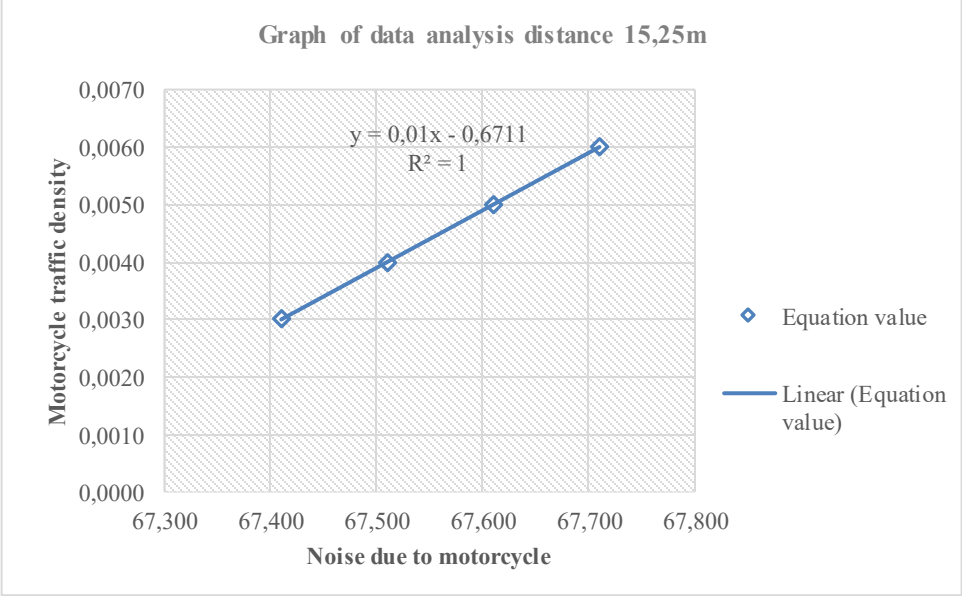

Figure 5. Data Analysis Graph

Statistical analysis of data on Sunday, September 13, 2020, a distance of 0.00 m with SLM1.

Shown in the form of table 6 and figure 6 below.

Table 6. Statistical Analysis of Distance Data 0,00m

Noise due to motorcycle	Motorcycle traffic density
77.73	0.002
77.80	0.003
77.87	0.004
77.90	0.005

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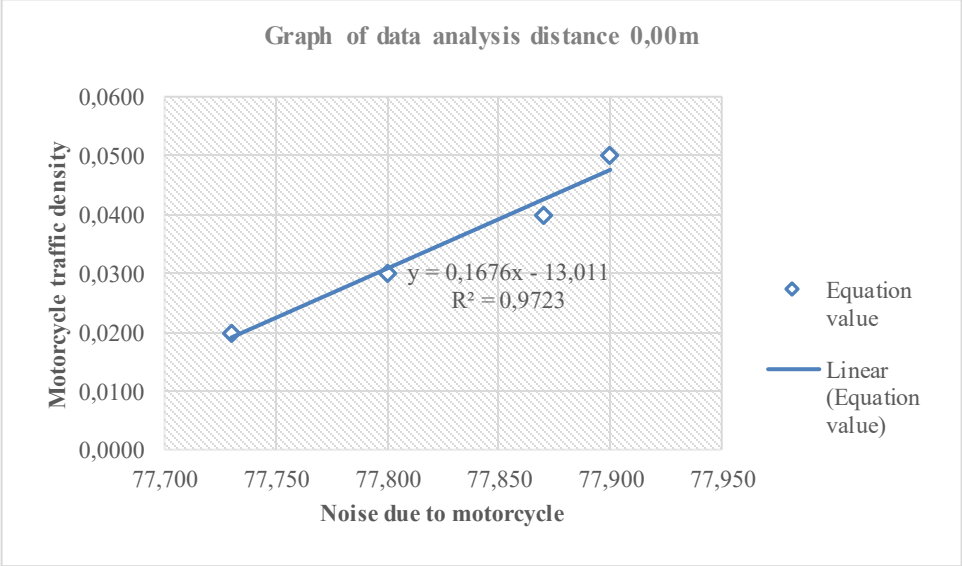

Figure 6. Data Analysis Graph

Statistical analysis of data on Sunday, September 13, 2020, a distance of 3.44 m with SLM2. Shown in the form of table 7 and figure 7 below.

Table 7. Statistical Analysis of Distance Data 3,44m

Noise due to motorcycle	Motorcycle traffic density
68.33	0.004
68.43	0.005
68.53	0.006
68.63	0.007

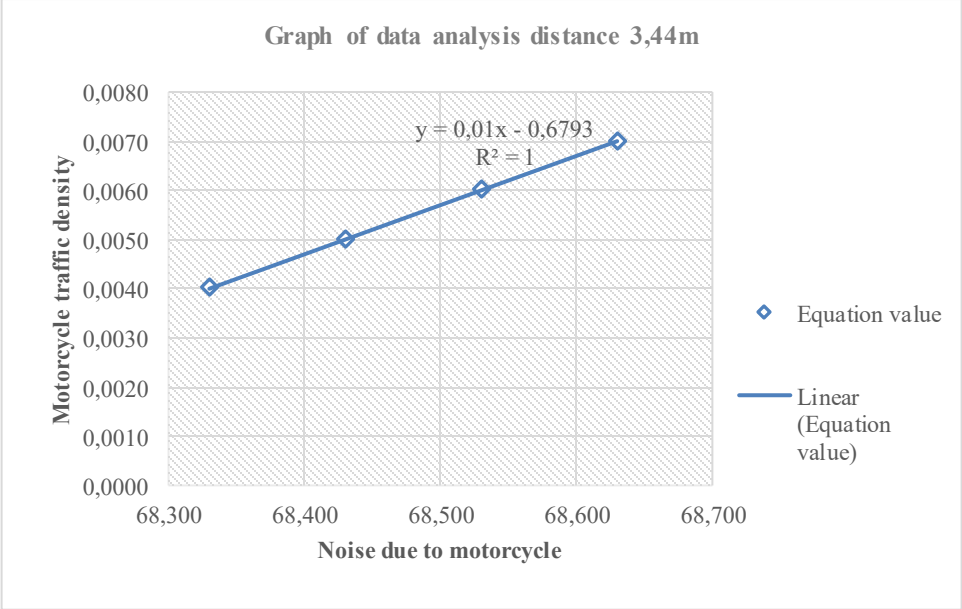

Figure 7. Data Analysis Graph

Statistical analysis of data on Sunday, September 13, 2020, a distance of 15.25 m with SLM3. Shown in the form of table 8 and figure 8 below.

Table 8. Statistical Analysis of Distance Data 15,25m

Noise due to motorcycle	Motorcycle traffic density
64.16	0.001
64.32	0.002
64.48	0.003
64.64	0.004

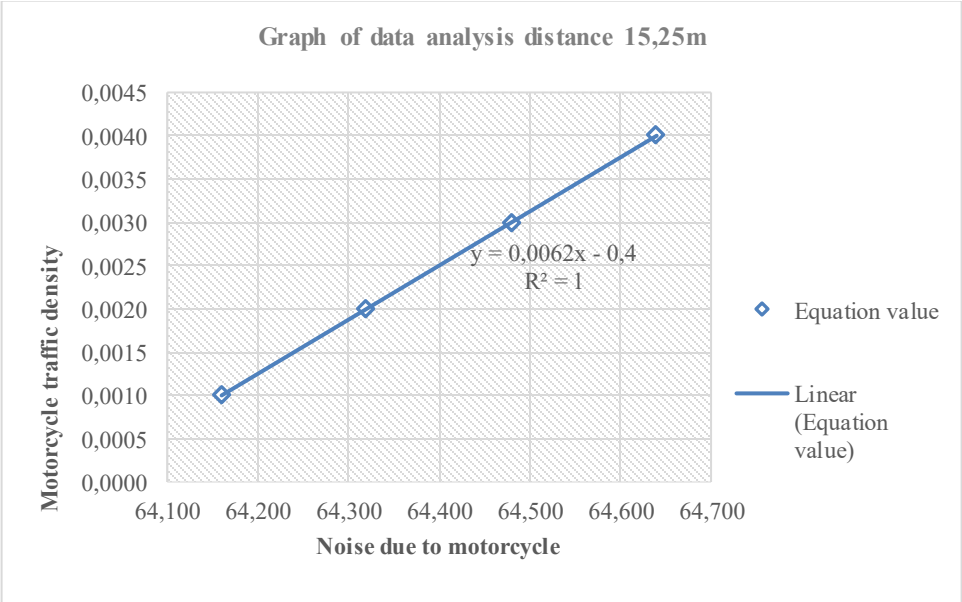

Figure 8. Data Analysis Graph

Statistical analysis of data Monday, September 14, 2020, a distance of 0.00 m with SLM1. Shown in the form of table 9 and figure 9 below.

Table 9. Statistical Analysis of Distance Data 0,00m

Noise due to motorcycle	Motorcycle traffic density
76.03	0.003
76.06	0.006
76.12	0.012
76.18	0.018

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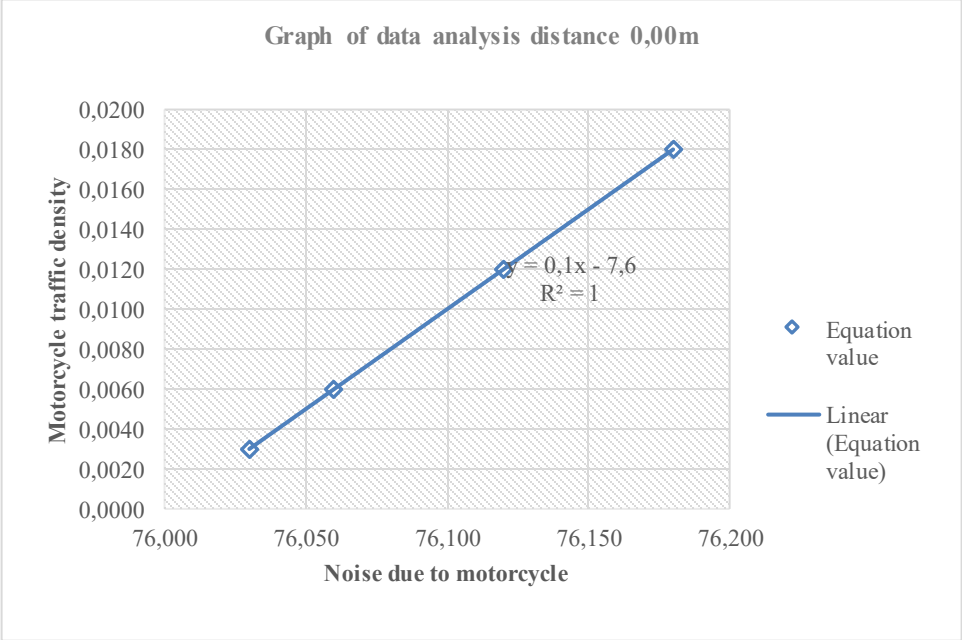

Figure 9. Data Analysis Graph

Statistical analysis of data Monday, September 14, 2020, a distance of 3.44m with SLM2. Shown in the form of table 10 and figure 10 below.

Table 10. Statistical Analysis of Distance Data 3,44m

Noise due to motorcycle	Motorcycle traffic density
67.55	0.001
67.65	0.002
67.75	0.003
67.85	0.004

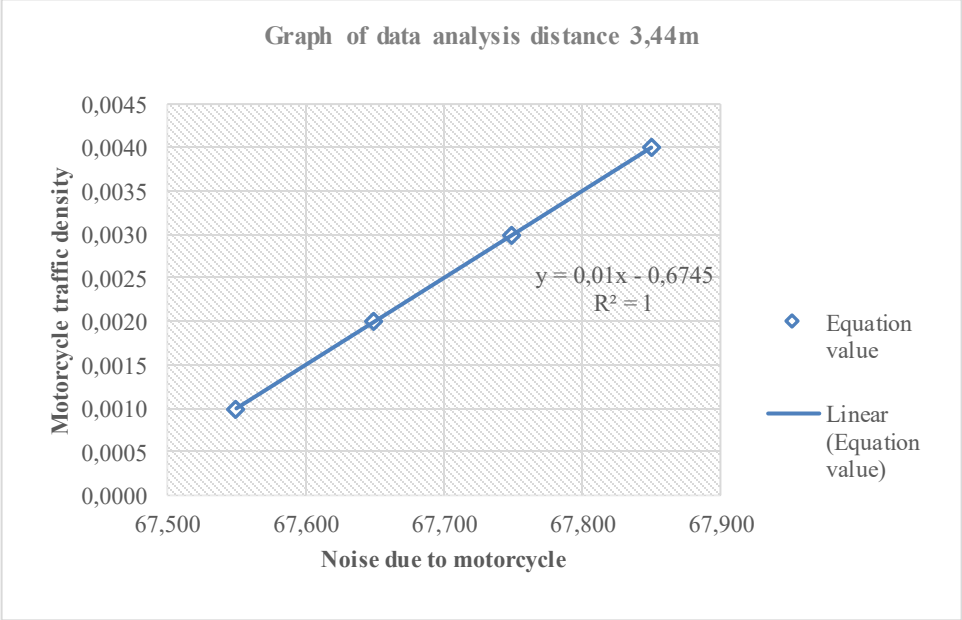

Figure 10. Data Analysis Graph

Statistical analysis of data Monday, September 14, 2020, a distance of 15.25 m with SLM2. Shown in the form of table 11 and figure 1 below.

Table 11. Statistical Analysis of Distance Data 15,25m

Noise due to motorcycle	Motorcycle traffic density
60.24	0.001
60.40	0.002
60.56	0.003
60.72	0.004

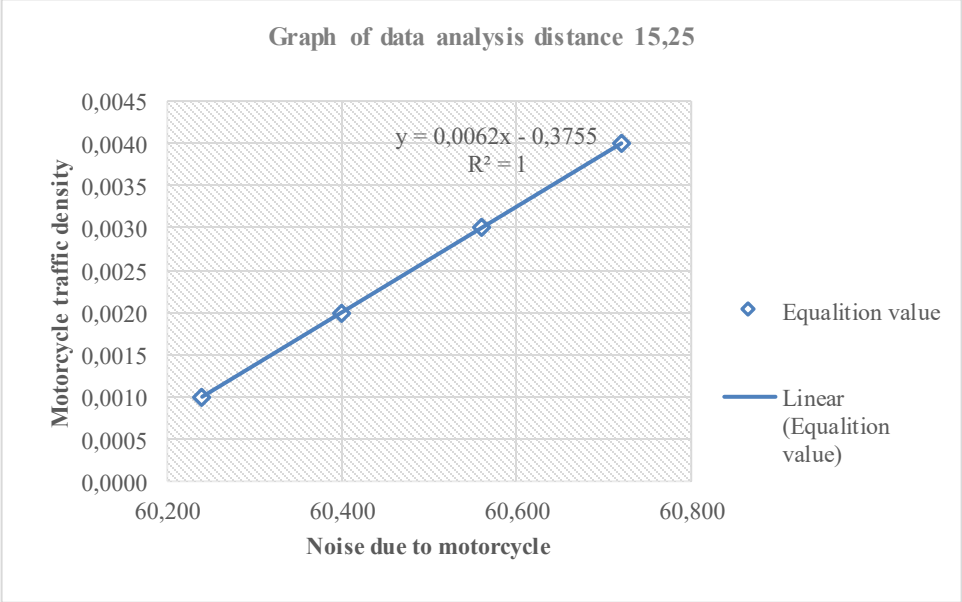

Figure 11. Data Analysis Graph

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Statistical analysis of data on Tuesday, September 15, 2020, a distance of 0.00m with SLM1. Shown in the form of table 12 and figure 12 below.

Table 12. Statistical Analysis of Distance Data 0,00m

Noise due to motorcycle	Motorcycle traffic density
75.64	0.003
75.74	0.006
75.84	0.012
75.94	0.018

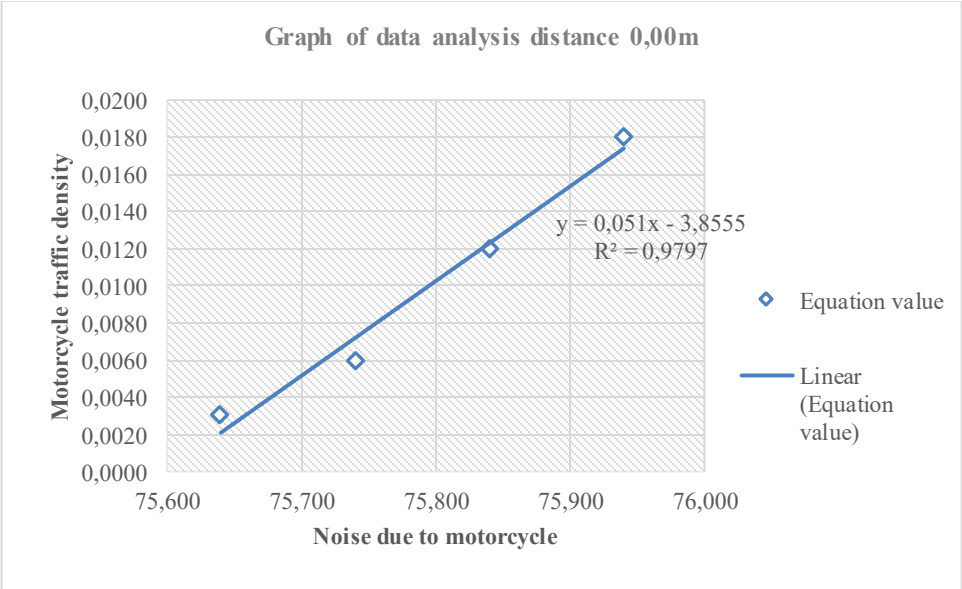

Figure 12. Data Analysis Graph

Statistical analysis of data on Tuesday, September 15, 2020, a distance of 3.44m with SLM2. Shown in the form of table 13 and figure 13 below.

Table 13. Statistical Analysis of Distance Data 3,44m

Noise due to motorcycle	Motorcycle traffic density
63.24	0.001
63.48	0.002
63.72	0.003
63.96	0.004

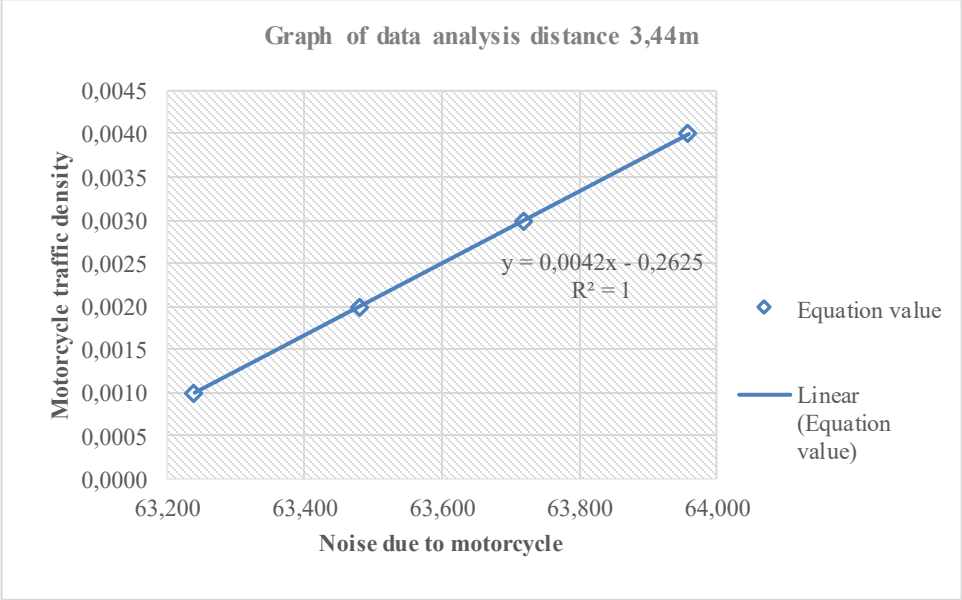

Figure 13. Data Analysis Graph

Statistical analysis of data Tuesday 15 September 2020, 15.25 m distance with SLM3
Shown in the form of table 14 and figure 14 below.

Table 14. Statistical Analysis of Distance Data 15,25m

Noise due to motorcycle	Motorcycle traffic density
70.69	0.002
70.79	0.004
70.89	0.006
70.99	0.008

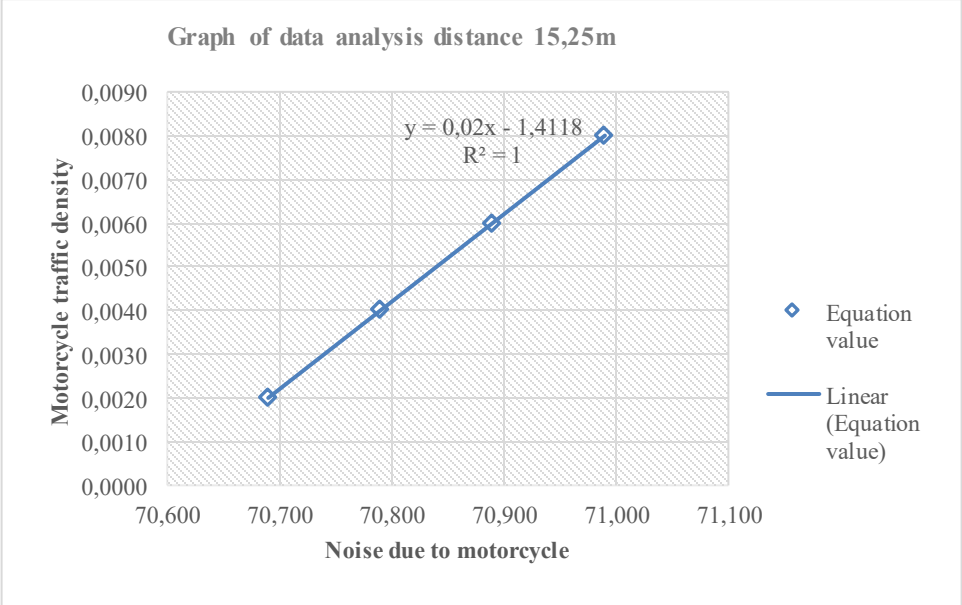

Figure 14. Data Analysis Graph

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CONCLUSION

Based on the results and discussion, the following results are obtained, the density of motorbikes, the density of private vehicles and public transportation has a significant influence on noise, from all the analysis calculations, the largest equation is obtained on the fourth day of the study, the second point (Sound Level Meter 2), with a contribution of 32.42%. Obtained the calculation below, y = 63.36 + 0.002x1. This equation means that if there is no decrease in motorcycle density, the noise level in SLM2 is 63.36 dB_A. Motorcycle density will have a significant effect on noise and the third largest equation was found on the second day of research at the point (Sound Level Meter 3) with a contribution of 23.20% based on the equation calculation below, y = 60.24 + 0.001x1. The purpose of this equation is if there is an increase in the density of the motorcycle, the noise in the SLM3 will reach 60.24 dB_A. This means that the low density of motorcycles during the Covid-19 pandemic will reduce the noise generated by these motorized vehicles.

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