

# Analysis of Noise Levels Due to Vehicle Traffic Sounds in the Environment Around Merauke City Arterial Roads Before and During the Pandemic

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**Abstract.** The purpose of this study was to determine the level of noise generated by motorized vehicles passing on arterial roads in Merauke City before the pandemic and during the pandemic. The method used in this research is the observation method. Measurement of vehicle traffic sound using Sound Level Meter. The equipment is placed 5 meters from the edge of the road, and 1.2 meters from the road surface. Measurements were carried out for 3 days for 7 hours. The measurement data is then processed to obtain the value of the noise level (Leq). The results of the analysis show that the noise level beside the arterial road before the pandemic (in 2019) was 72.21 dB and during the pandemic (in 2021) it was 68.54 dB. There was a decrease in the noise level as a result of a decrease in vehicle activity during the period of implementation of the community activity restriction (PPKM). Environmental conditions besides the arterial road are office and trade areas, so based on the noise level standard, the noise level value obtained has exceeded the quality standard, which is 65 dB.

**Keywords.** Noise level, Sound level meter, Arterial road.

## 1 Introduction

Economic growth is increasing in line with higher community activities. Infrastructure development and transportation accessibility can improve basic public services and the economy [1]. The movement of people to meet the needs of life increases the need for transportation services. Vehicles are tools that support the movement of people to be faster. From 2015 to 2019 the number of motorized vehicles in Indonesia experienced a fairly large increase, namely 6.13% per year. The highest increase occurred in the type of motorcycle vehicle. The increase reached 6.2% per year [2]. In 2020 the number of motorized vehicles reached 136 million units or an increase of 1.88% compared to the previous year [3]. Likewise with the growth in the number of vehicles in Merauke Regency. From 2015 to 2019 the increase reached 5.53%. In 2020 the number of vehicles in Merauke reached 75,468 units, an increase of 1.69% compared to the previous year [4]

The number of vehicles that are increasing every year has an impact on the environment around the road [5]. Each vehicle produces a sound that comes from the vehicle engine and vehicle horn. If the sound produced is beyond the comfort of human hearing, it is said to be noise or noise pollution[6]. Noise is sometimes not realized by the public[7]. Routines or feelings used to hearing high-intensity sounds are the cause. Whereas the

impact that will be felt is quite large, such as decreased concentration, decreased hearing health, irritability (emotional disturbances) and other physical health disorders [8]. Noise due to the flow of vehicular traffic mostly occurs around arterial roads that have commercial land uses. In a previous study [9] one of the roads in Merauke City with office and educational land use had a noise level due to traffic flow reaching 78.3 dB. The noise value that has exceeded the threshold is an indicator that traffic noise control is needed. One effort that can be done to reduce noise coming from vehicles is by using plant media such as wind plants [10].

In mid-2019, measurements of noise levels due to traffic flow on one of the arterial roads in Merauke City were carried out. The results show that the noise level generated by the vehicle has exceeded the allowable threshold. Then at the end of 2019 until now, Indonesia and the world experienced the Corona Virus Disease 2019 (Covid-19) pandemic. In Indonesia, from the beginning of 2020 to December 2021, restrictions on community activities (PPKM) were carried out to reduce community activities outside the home. The aim is to limit activities to suppress the spread of the virus, which is very easily transmitted through direct human contact. Restrictions on community activities outside the home directly have an impact on reducing traffic flow on the road. This reduction in traffic flow should

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be in line with the reduction in noise levels due to vehicle noise. Based on this, this research was conducted.

## 2 Research method

### 2.1 Type of research

This research is a quantitative research using the observation method. The resulting data is presented in the form of descriptive analysis. This study describes the situation in the field in the form of numbers.

### 2.2 Research location

The research location is in the surrounding area beside Jalan Raya Mandala, Merauke District, Merauke Regency, Papua Province, Indonesia. The measurement point is 5 meters from the edge of the road and 75 meters from the traffic light. The observation point is selected based on environmental conditions following the criteria for the distance of the observation point from the media that can reflect sound, the observation point is not obstructed. The measurement time is adjusted according to weather conditions. If it rains, the observations are stopped and repeated on another day. The location of the observation point can be seen in Figure 1.

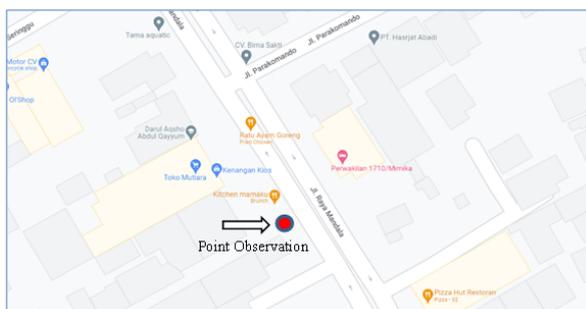


Fig. 1. Location of Observation Points.

### 2.3 Measurement method

The data of this research are the volume of vehicular traffic and the noise level generated by the sound coming from light vehicles, heavy vehicles and motorcycles. Data collection was carried out for 3 days for 7 hours. Measurements were carried out for 10 minutes to represent each hour. Determination of the measurement time for 10 minutes based on the results of the preliminary survey. The measurement of the volume of vehicle traffic is carried out at the same time as the measurement of the noise level. Volume measurement is done using traffic counters and camcorders. Traffic counter to measure the volume of traffic that passes close to the noise level measurement point. Other traffic counters and Handycam are used to calculate the volume of traffic passing in the lane next to the median or furthest side from the noise measurement point. Noise level measurements are carried out at a distance of 5 meters from the edge of the road and 1.2 meters from

the road surface or adjusted to the height of the ground using a sound level meter.

### 2.4 Analysis method

The volume of vehicle traffic was analyzed using equation 1. [11]

$$\text{Volume, } Q \text{ (smp/hour)} = V_{Mc} \cdot \text{Emp } M_c + V_{Lv} \cdot \text{Emp } H_v \quad (1)$$

Analysis of noise data from measurements in the field is calculated using equations 2 and equation 3. [12]

$$L_{Aeq} = L_{50} + 0,43 (L_1 + L_{50}) \quad (2)$$

$$L_{Aeq,day} = 10 \log_{10} \left[ \left( \frac{1}{t_n} \right) \cdot \left( 10^{\frac{L_{eq}^1}{10}} \right) + \dots + \left( 10^{\frac{L_{eq}^n}{10}} \right) \right] \quad (3)$$

## 3 Result and discussion

A comparison of the results of vehicle traffic volume measurements carried out in mid-2019 (before the pandemic) and at the end of 2021 (during the pandemic) is shown in table 1, table 2 and table 3.

Table 1. Traffic volume on the first day of observation.

Time	First day	
	Traffic volume before the pandemic (2019), smp/hour	Traffic volume during the pandemic (2021), smp/hour
08.00 - 08.10	213,9	155,8
09.40 - 09.50	197,8	187,5
10.10 - 10.20	202,4	190,1
11.50 - 12.00	210,9	181,2
12.00 - 12.10	203,0	230,7
13.50 - 14.00	217,5	169,2
14.10 - 14.20	162,3	168,0

Table 2. Traffic volume on the second day of observation.

Time	Second day	
	Traffic volume before the pandemic (2019), smp/hour	Traffic volume during the pandemic (2021), smp/hour
08.00 - 08.10	158,0	155,4
09.40 - 09.50	203,9	190,4
10.10 - 10.20	222,8	236,0
11.50 - 12.00	209,1	212,7
12.00 - 12.10	208,6	229,4
13.50 - 14.00	199,1	194,8
14.10 - 14.20	143,0	177,7

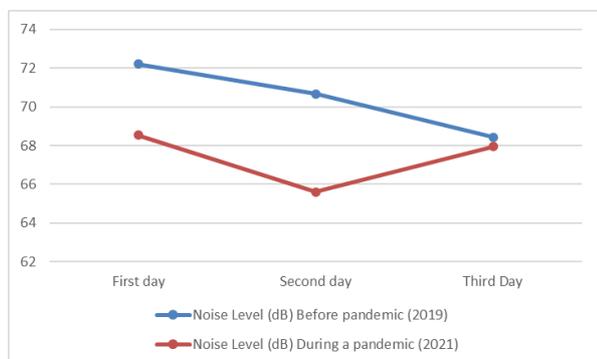
**Table 3.** Traffic volume on the third day of observation

Time	Third day	
	Traffic volume before the pandemic (2019), smp/hour	Traffic volume during the pandemic (2021), smp/hour
08.00 - 08.10	214,0	171,1
09.40 - 09.50	212,7	162,1
10.10 - 10.20	212,0	202,0
11.50 - 12.00	198,5	189,2
12.00 - 12.10	189,8	216,7
13.50 - 14.00	197,8	170,6
14.10 - 14.20	132,4	171,1

In the three tables, the results of measuring the volume of vehicle traffic show that there is a decrease in the volume of vehicle traffic. The decrease was not too significant because measurements were made during the pandemic, there had been a decrease in the number of cases of patients infected with Covid 19 in which the level of community activity restrictions (PPKM) had been lowered. The highest noise level from vehicle traffic before the pandemic was 72.21 dB and the lowest was 68.43 dB. The highest level of noise from vehicle traffic during the pandemic was 68.54 dB and the lowest was 67.94 dB. More clearly the value of noise levels before and during the pandemic can be seen in table 4 and figure 5.

**Table 4.** Noise level due to traffic noise.

Time	Noise Level (dB)	
	Before the pandemic (2019)	During the Pandemic (2021)
First day	72,21	68,54
Second day	70,67	65,61
Third day	68,43	67,94



**Fig. 2.** Noise Level before pandemic (2019) and during the pandemic (2021).

## 4 Conclusion

The volume of vehicular traffic on the Merauke City arterial road before the pandemic and during the

pandemic experienced a decrease in the volume of passing vehicles. The level of noise generated by the sound of vehicles passing on the road has decreased. The highest noise level before the pandemic of 72.21 dB decreased to 68.54 dB during the pandemic. Despite the decrease, the value of 68.54 dB has exceeded the threshold required by the Decree of the Minister of the Environment No. 48 of 1996, which is 65 dB for office and trade areas.

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