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# TRAFFIC NOISE LEVEL ANALYSIS ON AHMAD YANI ROAD IN BANJARMASIN CITY

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**ABSTRACT**

*Along with the development of the times, the problems caused in the field of transportation are not only congestion problems but also environmental problems such as noise pollution. Noise is an excessive sound that comes from the activities of motorized vehicles both heavy vehicles (HV), light vehicles (LV) and Motorcycles (MC) that can cause the effect of human health problems and comfort of the surrounding environment.*

*This study aims to determine the noise level that occurs on the Ahmad Yani road section where the road section is the main road that crosses the center of Banjarmasin City and various other important places such as government offices, hospitals, shopping centers, traditional markets to tourist attractions. In this research, noise measurement was carried out using the primary data collection method by conducting surveys at 5 location points along Jalan Ahmad Yani KM 01-06 Banjarmasin which was carried out 1 day weekday and 1 day weekend for 12 hours from 06.00 to 18.00 using a Sound Level Meter tool.*

*The result of the noise level using the Sound Level Meter, the highest leq value was 87.34 dB(A) at 07.00-08.00. With this noise value, the results show that the Ahmad Yani Km 01-06 road section has exceeded the permissible noise standard according to Kep. MenLH No.48/MenLH/11/1996 concerning the standard noise level which ranges from 55-60 dB(A) for government and public facilities and other activity environments.*

**Keywords:** Noise, Sound Level Meter

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## 1. INTRODUCTION

Along with the development of a city and the rapid growth of population, has brought significant changes in various systems of activities of the population in urban areas so that the growth of transportation is also growing rapidly. With the increase in private motor vehicles to speed up daily activities rather than using public transportation, it can cause traffic congestion that causes delays to congestion in the city of Banjarmasin.

Another impact that is felt due to the flow of traffic on the road if further attention can also cause environmental pollution in the form of noise pollution or noise caused by motorized vehicles.

Noise on the highway is unavoidable, the cause can be the increasing number of roads, residential areas, places of worship, public places such as government and public facilities, activity centers for sports, recreation and shopping centers that are located on the edge of a busy highway so that the noise caused can interfere with hearing. The noise is not only caused by the sound of motor vehicles passing through the traffic flow but can also be caused by friction between the road and vehicle tires and vehicle horns [5].

Ahmad Yani Street in Banjarmasin is one of the main streets of Banjarmasin City in South Kalimantan with motorized traffic flow from morning to night. This road also connects important areas in Banjarmasin such as government offices, public services such as hospitals, entertainment and recreation centers, traditional markets and modern markets. As the main road, visually by looking at the large traffic flow on the road produces a high enough noise level that it is necessary to conduct research to find out exactly the noise generated by the traffic flow to find out whether the noise level that occurs is still tolerable or has exceeded the threshold.

## 2. REVIEW OF LITERATURE AND METHODOLOGY

In this study, Ahmad Yani Road will be selected at KM. 01 to KM. 06 Banjarmasin which is an arterial road in Banjarmasin. The survey will be conducted at 5 points along the Ahmad Yani road. Before determining the measurement point, a survey will be conducted first in order to get the appropriate measurement location and can represent most of the road.

Survey implementation for data collection will be carried out on 1 weekday and 1 weekend day for each point. Measurements are planned to be carried out from 06:00 to 18:00, i.e. for 12 hours to obtain the required data.

### 2.1. Noise

According to Kepmen LH, Noise is the unwanted sound of a business or activity in a certain level and time that can cause disturbances to human health and environmental comfort. [4] Noise Level Standard is the maximum level of noise that is allowed to be discharged into the environment from a business or activity so as not to cause disturbance to human health and environmental comfort. With the rapid growth of land, sea and air transportation, noise has become a very important environmental factor in cities, and it is not unrealistic to predict that even rural areas will be affected by noise in the future. [3]

According to the Minister of Health Regulation No. 718/Menkes/Per/XI/1987, noise is the occurrence of undesirable sound that disturbs and or can endanger health. [7] This noise is a collection of tones with various intensities that are not desired so that it disturbs people's peace, especially hearing.

Based on research, it is found that trees and bushes can reduce the noise that occurs around the neighborhood by 2 dB.[6]

Based on the source, noise can be classified into 3 (three) kinds of noise, namely [8]:

1) Impulsive noise, which is noise that does not come continuously, but piecemeal. For example: noise coming from the sound of a hammer being hit, noise coming from a piling machine.Kebisingan Kontinyu, yaitu kebisingan yang datang secara terus menerus dalam waktu yang cukup lama. Contohnya : kebisingan dari suara mesin yang dhidupkan.

2) Continuous Noise, which is noise that comes continuously for a long time. For example: noise from the sound of an engine being started.
3) Semi-continuous (intermittent) noise, i.e. noise that only flashes, then disappears and then comes again. For example: the sound of a passing car or airplane.There are three important elements that must be considered regarding transportation noise, namely:

1. Noise source
2. Noise receiver, which is a person or an activity that will be disturbed by this noise.
3. The path where the noise is transmitted from the source to the receiver.

Generally, noise caused by traffic is influenced by the number of vehicles (traffic volume) and the condition of the vehicle, the speed of the vehicle, the type of pavement, road geometrics, wind direction and speed.

Noise also has adverse effects that are defined as a change in the morphology and physiology of an organism that results in a decrease in functional capacity to cope with additional stress or an increase in the vulnerability of an organism to the effects of adverse environmental factors, including temporary effects as well as long-term disturbances to an organ or a person physically, psychologically or socially. Specific effects of noise include hearing loss, pregnancy loss, infant growth, communication loss, rest loss, sleep loss, mental impairment, performance, discomfort and various daily activities.
In addition to causing deafness, noise often also causes various disorders [10] such as:

a. Communication Disorder
   This is a situation where a person speaks in a noisy room, the person's voice will be difficult to catch/understand by the other person.
b. Sleep Interference
   The percentage of people who will wake up from sleep is 5% at a sound intensity level of 40 dB, and increases to 30% at 70 dB
c. Task Interference
d. Feeling of displeasure (*annoyance*)

## 2.2. Noise Quality Standard

Noise quality standard is the maximum level of noise quality standard that is allowed to be discharged into the environment from a business or activity so that it does not cause human health problems and environmental comfort.[1] Noise level is a measure of sound energy expressed in units of Decibel abbreviated as dB. Based on the Decree of the Minister of Environment Number KEP.48/MENLH/11/1996, dated November 25, 1996, the standard noise level for the Designation of Areas or Activity Environments can be seen in table 1. below:

**Table 1**. Noise Quality Standard

| No | Designation of Area/Environment Activities | Noise Level dB (A) |
|---|---|---|
| 1 | Housing and Settlement | 55 |
| 2 | Trade and Services | 70 |
| 3 | Office and Trade | 65 |
| 4 | Green Open Space | 50 |
| 5 | Industry | 70 |
| 6 | Airport | 75 |
| 7 | Government and Public Facility | 60 |
| 8 | Recreation | 70 |
| 9 | Hospital or Similar | 55 |
| 10 | School or Similar | 55 |
| 11 | Places of Worship or Similar | 55 |

## 2.3. Traffic Volume

Traffic volume is the number of vehicles passing a certain point or line on a road cross section. Traffic volume enumeration data is information needed for the planning, design, management and operation phases of the road [11]. The most annoying external noise is generated by vehicles, rail transportation, water transportation and air transportation including trucks, buses, racing cars, motorcycles. [2]

Traffic volume shows the number of vehicles passing one observation point in one unit of time (day, hour, minute) In connection with determining the number and width of lanes, the commonly used traffic volume units are average daily traffic, planning hour volume and capacity.[11]

The vehicles operating on the highway can be grouped into several categories [10]:

1. Heavy Vehicles (HV)
   Heavy vehicles are motorized vehicles with more than 4 wheels including buses, 2 axle trucks, 3 axle trucks, and combination trucks.
2. Light Vehicles (LV)
   Light vehicles are two-axle motorized vehicles with four wheels and 2.0-3.0 m axle spacing. These vehicles include passenger cars, microbuses, pick-ups, and small trucks.
3. Motorcycle (MC)
   Motorized vehicles with 2 or 3 wheels, including motorcycles and 3-wheeled vehicles.
4. Non-Motorized Vehicles (UM)
5. Vehicles with wheels driven by humans or animals, including bicycles, tricycles, horse-drawn carts and strollers.

## 2.4. Regression Analysis

Regression analysis is the study of functional relationships between variables expressed in the form of mathematical equations. The mathematical equation is called the regression equation. Regression analysis is distinguished by two types of variables, namely the independent variable called variable X and the independent variable called variable Y.

It can be stated that regression is as a function Y = f (X). Both variables are usually causal or have a causal relationship, that is, they affect each other. The form of regression depends on the function that supports it or depends on the equation.

### 2.5. Correlation

Correlation is a measure of the relationship between two or more variables expressed by the degree of closeness or level of relationship between variables. Measuring the degree of relationship with the correlation method is the correlation coefficient r. In this case, it is explicitly stated that in correlation analysis it does not matter whether one variable depends on the other or vice versa. So the correlation method can be used to measure the degree of relationship between an independent variable and another independent variable or between two variables.

### 2.6. Multiple Linear Regression Analysis

Multiple linear regression analysis referred to in [9] is a statistical method that can be used to study the nature of the problem being investigated. Multiple linear regression equations have more than one independent variable, the general form is as follows:

$$Y= A + B1X1+B2X2+\ldots\ldots\ldots\ldots\ldots+BNXN \quad (1)$$

Description:

| | |
|---|---|
| Y | = Non-Free Variables |
| X1, X2, XN | = Independent Variables |
| A, B1, B2, BN | = Constants and regression coefficients |

The analysis method uses multiple linear regression analysis, with traffic noise level (Y) as the independent variable and independent variables including light vehicle volume (X1), heavy vehicle volume (X2), motorcycle volume (X3), light vehicle speed (X4), heavy vehicle speed (X5), motorcycle speed (X6).

## 3. RESULTS AND DISCUSSION

### 3.1. Testing Result

This chapter will explain the stages of research implementation, starting from an overview, research data to data analysis using regression analysis in Microsoft Excel.

The data obtained from the field both the results of traffic enumeration and the results of noise measurements are directly recapitulated. Data collection was carried out for one day. Data was taken in the time range of 06.00 to 18.00 WITA. The types of vehicles that are the object of the survey are motorcycles (MC), light vehicles (LV) and heavy vehicles (HV) with measurement intervals per ten minutes of traffic counting data. The road section under review is Jalan A. Yani KM 1 in Banjarmasin City. When traffic data and noise data were collected simultaneously, the weather conditions were sunny and cloudy throughout the day.

### 3.2. Traffic Volume Data

From the results of the traffic survey conducted during one day of observation with normal road conditions, the composition of each vehicle is obtained, namely motorcycles (MC), light vehicles (LV), and heavy vehicles (HV) with an observation interval of ten minutes.

The data will later be multiplied by the EMP factor of each vehicle and the results will be in the form of smp/hour. The example of traffic volume calculation (Special flow of motor vehicles at 06.00-07.00).

1.Traffic data calculation of each vehicle per 1 (one) hour

It is known that the volume of motorcycles (MC), light vehicles (LV) and heavy vehicles (HV) at 06.00-07.00 hours on the A. Yani KM 1 road section at the research location is as follows:

MC volume = MC volume in the direction of leaving the city + MC volume in the direction of entering the city

= 1320 + 822

= 2142

LV volume = LV volume in the direction out of town + LV volume in the direction of entering the city

= 623 + 336

= 959

HV volume = Outbound HV volume + Inbound HV volume

= 2 + 0

= 2

2. Calculation of total vehicle traffic data per 1 hour multiplied by the EMP of each vehicle:

MC volume = 2158 x EMP MC

= 2142 x 0,2

= 428.4 smp/hour

LV volume = 959 x EMP LV

= 959 x 1,2

= 1150.8 smp/hour

HV volume = 2 x EMP HV

= 2 x 1,2

= 2.4 smp/hour

3. Calculation of total vehicle traffic data per 1 hour

Volume = total volume per hour

= 428,4 + 1150,8 + 2,4

= 1581,6

### 3.3. Noise Data

Noise data collection using a sound level meter (SLM) noise level measurement tool was carried out simultaneously during the traffic survey. The noise graph (dB) at the observation hour is shown in the following graph.

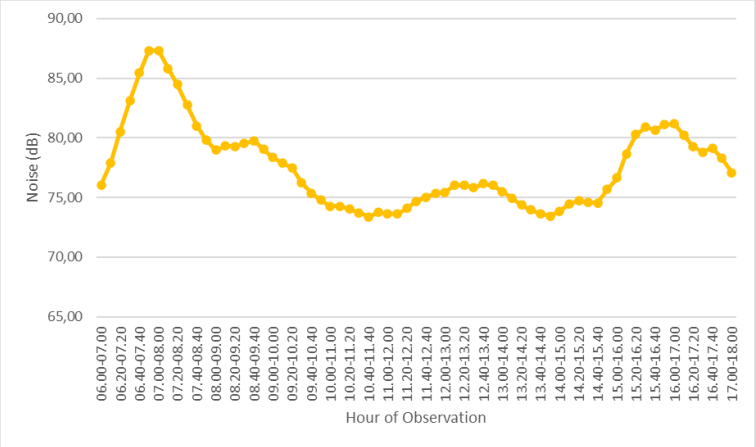


**Fig.1** Noise Graph (dB)

From the graph above, it can be seen that the lowest, average, and highest noise levels at certain hours are as follows:

**Table 2**. Noise Quality Standard

| Value | Hour of Observation | Noise(dB) |
|---|---|---|
| Highest | 07.00-08.00 | 87,34 |
| Lowest | 10.40-11.40 | 73,37 |
| Rata-Rata | | 80,355 |

## 3.4. Analysis of Traffic Relationship (SMP/hour) with Noise (dB)

To describe the relationship between traffic (smp/hr) and noise (dB) the data was analyzed with linear regression in Microsoft Excel to get the value of the regression equation graph. The graphical equations used to describe the relationship between traffic (smp/hr) and noise (dB) are exponential, linear, logarithmic, polynomial and power graphical equations. As an example, the following is a graph of the relationship between traffic and noise with the exponential equation.

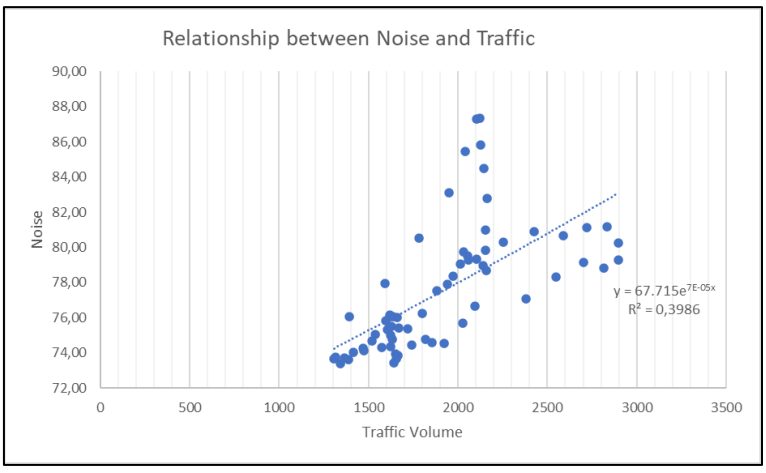


**Fig.2** Relationship between Noise and Traffic

Figure 2 shows the distribution data of the relationship between noise and traffic with the exponential equation. The results of each equation are presented in the following table:

**Table 3**. Result Table of Equation

| No | Form of Equation | $R^2$ | $R$ | Relationship Description |
|---|---|---|---|---|
| 1 | *Exponential, y = 67,715e$^{7E-05x}$* | 0,3986 | 0,6313 | Medium |
| 2 | *Linear, y = 0,0055x + 67,088* | 0,406 | 0,6371 | Medium |
| 3 | *Logarithmic, y = 11,445ln(x) - 8,6455* | 0,4475 | 0,6689 | Medium |
| 4 | *Polynomial, y = -6E-06x$^2$ + 0,031x + 41,866* | 0,5214 | 0,7220 | Strong |
| 5 | *Power, y = 25,578x$^{0,1471}$* | 0,4423 | 0,6650 | Medium |

From Table 3 it can be concluded that the best equation is the polynomial equation with R^2=0.5214 and R=0.7220. So Traffic (smp/h) affects the noise (dB) by 52.14%.

**Table 4**. Values Based on Correlation Coefficient

| $R^2 Value$ | The absolute value of the correlation coefficient (r) | Interpretation |
|---|---|---|
| <0.04 | 0.00-0.199 | Slight correlation; almost negligible relationship |
| 0.04 | 0.20-0.399 | Low correlation; relationship is sure but small |
| 0.16 | 0.40-0.699 | Moderate correlation; substantial relationship |
| 0.49 | 0.70-0.899 | Strong correlation; marked relationship |
| 0.81 | 0.90-1.000 | Very strong correlation; very reliable relationship |

The value based on the correlation coefficient listed in the table can be concluded that the relationship between noise and traffic has a strong correlation and has a real relationship.

Based on the Minister of Health Regulation No. 718/Menkes/Per/XI/1987, the observation result has the highest noise value of 87.34 dB which means it is in zone D which is intended for industrial environments, factories, train stations, bus terminals, and similar.

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