

# The Effect of Traffic Volume on Noise (A Case Study of Residential and Shopping Area of Manggala District in Makassar City)

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**Abstract:** The pollution of the motorized vehicles due to the rapid growth of traffic volume raises public anxiety related to noise and health problems. To determine the extent of the effect of traffic volume on noise, noise measurements are carried out with Sound Level Meter and data collection on traffic volume with enumeration at a predetermined point. The maximum noise level in residential areas ranges from 53 dB, and in areas with mixed building functions (works and likes) around 65% the influence of noise on communication disturbances has been felt by the community. The noise level prediction model is directly proportional to the volume of traffic and is influenced by factors in the condition of road elevation and distance from occupancy to road.

**Keywords:** traffic, building functions, noise, health problems

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## I. Introduction

The capacity of road segments of major cities in Indonesia, including the city of Makassar, is not comparable to the growth in the number of vehicles, thus causing problems in various roads [1,2]. The imbalance between road capacity and traffic volume causes congestion and impacts on air pollution and noise. Pollution includes environmental problems that threaten big cities, especially motor vehicle emissions and the influence of health on health [3]. The results of previous studies [4] revealed that the noise level in the Makassar city area had reached 79-81 dB.

The increase in the number of motorized vehicles has caused an increase in noise on the road, causing inconvenience to road users and the surrounding community. The volume of heavy vehicles and light vehicles on a fairly dense highway is at risk of producing noise. One service center that feels the most noise disturbance in the vicinity is residential areas, social activities including schools, mosques, residential areas and hospitals on the left and right side of the road.

According to [5] the construction of residential and settlements in regional cities in general is often disputed in terms of the number of residential units built, and is indicated not to be proportional to the growth rate of number of reducers, including the quality of buildings using noise product building, road boundaries, lanes green for the protection and reduction of emission and noise pollution does not meet livable quality, aesthetic requirements and Green Open Space [6] fulfillment of facilities and infrastructure that are not yet adequate. Environmental conditions that are getting worse can cause air pollution and noise. Traffic noise has an impact on health and productivity problems; influence of performance and health conditions, concentration in work, temporary and permanent deafness. Anxiety is not feeling well, and for workers who have hearing aids that have certain limits and are very sensitive when facing continuous noise [7].

## II. Research Methods

This research is a field research, measuring noise levels based on traffic volume, carried out at the location of the main road environment that has different building functions and plant density in the road-owned room area and road monitoring room or in the road boundary area. The approach used is a field study for measuring or calculating traffic volume and noise, a qualitative descriptive visual survey for data collection on building functions and plant density that is thought to be a noise reduction.

### Time and Location of Research

The research was conducted in October, November, and December 2018 choosing the time of traffic density at 06.00 to 08.00 and 15.00 to 17.00. Research location on the Main Road of Bukit Baruga Residential on Highway Baruga is front IoSA and Dr.J.Leimena road/Antang raya. The location was chosen based on considerations, differences in building functions, road status, and traffic volume and tree plant density on the side or in the road space.

Analysis was carried out on vehicle volume and type, fence/building border, building density and function as well as road elevation. Measurement of road traffic noise uses a Sound Level Meter for 2 hours at each point of observation in the morning and evening.

### III. The Results

The location on the main road of Bukit Baruga Residential is a residential area with authority, equipped with social, educational/sports facilities. The conditions on the side of the road are packed with trees that function as in Figure 1. The average traffic volume is 12 vehicles per minute, the most on Saturdays, and the majority of motorized vehicles (65%) and noise levels range from 53 dB.



**Figure 1.** Bukit Baruga Residential Conditions

The location of Highway Baruga with the status of the road in Makassar City is located in front of the Institute of State Administration (IoSA) Baruga, along the road filled with commercial vehicles, shops/offices, workshops and offices (IoSA), and on the right side of the road there are trees with relatively lower density compared to residential areas (see in Figure 2). The average traffic volume is 43 vehicles per minute with the majority of motorcycle vehicles (72%), the noise level ranges from 63 dB.



**Figure 2.** Front conditions of IoSA (left) and Dr.J. Leimena road (right)

Antang Raya Road/Dr. J. Leimena road, the function of the building is classified as works and likes to have office activities, socio-economic results in very heavy vehicle traffic that triggers noise. The condition of the road side is less crowded with trees that do not reduce noise on the roadside (see in Figure 3), the volume of traffic in the morning and evening is 32 and 53 vehicles per minute respectively. Vehicles such as motorcycles range from 78 to 69% and the noise level ranges from 65 dB.

**Table 1.** Noise Prediction Model (dB) on the Main Road

No.	Noise Measurement Location	Bukit Baruga Residential		Non Residential		
		Flat	Elevation (1-2 meters)	Commercial (IoSA)	Settlement and Commercial (MIX)	Main Commercial Business, Offices (Secondary Data).
1.	Side of the road Y1	$Y1=0,2172(x)+26,2197$	$Y1=0,1866(x)+24,7858$	$Y1=0,0388(x)+31,8084$	$Y1=0,1889(x)+38,8534$	$y1=0.0003(x)+76,77$
2.	Road Side Area (distance 5 to 10 meters from (Y2))	$Y2=0,1977(x)+22,2528$	$y2=0,1559(x)+20,0725$	$Y2=0,0404(x)+30,7869$	$Y2=0,0487(x)+25,1399$	Ta.d
3.	Effect of distance ( $\Delta y$ ) on road boundaries and/or reducing plants (Y1-Y2)	$\Delta y=0,0195(x)+3,9669$	$\Delta y=0,0819(x)+4,7133$	$\Delta y=-0,0016(x)+1,0212$	$\Delta y=0,1402(x)+13,7135$	Relatively zero
		Effect of elevation $\Delta y_{ev1}=0,0206(x)+1,4339$ $\Delta y_{ev2}=0,0418(x)+2,1803$				

The model of the influence of traffic volume [8] and traffic characteristics for residential and non-residential has a correlation ( $R^2$ ) amount (0.70 to 0.85). Traffic noise is affected by distance and road boundary area. Noise at the roadside and road boundary area varies according to building functions (100% residential, commercial and residential and commercial mix) are in the range of 4 to 4 dB. While the influence of road level with settlement elevation has an effect of 1 dB to 2 dB as in Table 1.

**Table 2.** Sensitivity of Traffic Noise

No.	Location of Main Road	Level of sensitivity		Information
		Road side	Road Border	
1	Bukit Baruga Residential			The main residential street on Bukit Baruga is full (100%) of houses for residence/occupancy filled with various types of trees and blended
	Flat	0,2172	0,1977	
	Elevation	0,2378	0,1559	
2	Non Residential Highway Baruga	0,0388	0,0404	Highway Baruga the function of land on the edge of the shophouse and middle lower culinary
	Regional IoSA			
	Dr. J. Leimena	0,1889	0,0487	
	Business/office (secondary data) <sup>2)</sup>	0,003	Ta.d.	Dr. Leimena along the residential and commercial function roads, low RTH line density

**Source:** Analysis Results

- 1) Influenced directly by traffic volume density
- 2) Business area on the Perintis Kemerdekaan road, Urip Sumoharjo, Jalan Veteran, Bandung Road, Riburane Road, Jenderal Sudirman road, and A.P. Pettarani Road.

The level of noise sensitivity in residential as in Table 2 is higher than that of Highway Baruga outside the residential area, Dr.J. Leimena-Antang Raya Road and business/office area. Comparison of residential tensions that have elevation, ranges from 0.2177 to 0.2378 on flat roads and ranges from 0.1559 to 0.1977 with an elevation of 1 to 2 meters, in the road space (Rumija) in the area Road Border. Questionnaire results from the public that the highest noise disturbances occur on Dr. J. Leimena/Antang Raya Road, both IoSA and the level of low noise disturbance found in Bukit Baruga residential.

#### IV. Discussion

The ideal side of the road is an area that functions for safety [9] and the comfort of road users, land for the development of roads, buffer zones, green lanes, places for construction of service facilities, and protection against natural form [10]. The condition on the side of the Bukit Baruga residential road is filled with shady trees and shrubs such as the Ketapang Kencana tree, and bushes (green grasses), and hedgerows (shrubs). Ketapang trees are slender in shape, have stretched and terraced twigs, making them suitable for yard plants and noise reduction. Ketapang Kencana is able to grow with a height of 10 to 20 m with stems standing tall and neat. This tree also has slender twigs that grow straight. Green lane as one form of urban forest has a function as a medium that has the ability to reduce air pollutants including carbon dioxide (CO<sub>2</sub>) which floats in the air and produces oxygen (O<sub>2</sub>) (Iwan, 2009).

Conditions on the edge of the IoSA road, which are filled with economic activities on the left side which are crowded by people and on the right side there are productive mango trees, *glondongan* trees, there are king palm trees, *tanjung* trees which are noise reducing plants can reduce noise. Dr. J. Leimena there is no noisy reducing plants unless they are located on the home page. There are no noisy reducing plants on the roadside, only in the yard of the house, the mango tree. Community attention to the importance of Green Open Space (GOS) does not play an active role in maintaining the existence of plants [6]. Crop management systems that are still low have an impact on the poor maintenance of plant vegetation

The maximum noise at the research location shows that in the Bukit Baruga residential area it ranges from 53 dB, on the IoSA 63 dB and on the road Dr. J. Leimena- Antang Raya road is around 65 dB, the noise level, and the number of vehicles is directly proportional. The noise level is strongly influenced by the elevation of the road, and the distance between the road and the trees.

Road geometry and altitude are relatively influential on the noise level that is directly received by residents in the house. Uneven road elevation from the noise source can be reflected and indirectly entered into the house influenced by the geometric road.

Based on the sample of public health problems, it can be explained that the noise level in Bukit Baruga residential is relatively very low, on the highway location in Baruga in front of the low IoSA and on the road of Dr. J. Leimena/Antang Raya is very high, especially influencing the noise disturbance in the residence.

**Table 3.** Perception of Complaints in the Three Location Research Objects

No.	Indicators	Bukit Baruga Residential	IoSA	Dr. J. Leimena/ Antang Raya Road
1	Noise level	low	Sometimes	very high
2	Communication disorders	low	Sometimes	enough
3	Physiological disorders	low	low	low
4	Psychological disorders	low	Sometimes	Sometimes

The effect of noise on public health for physiological disorders such as dizziness, nausea, insomnia, shortness of breath, rapid fatigue, muscle tension, and abdominal pain have not yet been seen as influences, almost by the community in the three study sample locations. While the disruption to the psychological factors of discomfort, emotional influence, and anger and the influence of noise on productivity is still low, not influential especially the residents who live in Bukit Baruga residential, while those who live on Baruga Road in front of the IoSA and on the road of Dr. J. Leimena/Antang Raya Road feels disturbed with a low level of disturbance within tolerant limits.

#### V. Conclusions And Recommendations

The traffic volume ratio in the three research locations, namely in the Bukit Baruga Residential Area is a commercial and residential mix, and the majority of the commercial is 1: 4: 6. The majority of motorized vehicles range from 58% to 77%. Cars between 22% to 41% and other vehicles (trucks, bentor, public transportation, bicycles) range from 0% to 1%.

The noise level is directly proportional to the volume of traffic and is influenced by the factors of road elevation and distance (road/road boundaries). Higher noise sensitivity in residential areas than commercial areas.

The noise level is still relatively normal, the physiological and psychological disorders of the community in the residential area are classified as low, the area outside the residential that functions works, business and social noise has affected the physiological and psychological disturbances even though within the limits of tolerance.

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