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Analysis of Noise Levels at Manggarai and Duri Train Stations

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Abstrak. This study aims to measure and analyze the noise level in two transportation areas with high activity, namely Manggarai Station and Duri Station, Jakarta. This location was chosen because of its function as a rail transit center that has a high passenger and train operating volume, which contributes to increased noise. The measurements were carried out on Friday to Sunday, with the duration of each session for 10 minutes, using four measuring tools, namely The Sound Level Meter, Noise Meter application, decibel sound application, and dB Sound Meter application, to ensure data accuracy. The results showed that the noise level at Manggarai Station ranged from 96.5 dB to 100.3 dB, while at Duri Station ranged from 95.8 dB to 99.7 dB. The highest noise fluctuation pattern was recorded on Friday at Manggarai Station, which made it the location with the highest noise levels during the study period. Based on the government-set noise threshold of 70 dB for transport areas, these two locations significantly exceeded the limit. The high level of noise is mainly caused by intensive train operations, such as the sound of locomotive engines, fans, cooling systems, and compressors, as well as the high volume of passenger activity. This study confirms that high noise levels in the station area have the potential to cause health impacts, such as stress, hearing loss, and fatigue for workers and passengers. Therefore, mitigation measures are needed such as improving noise suppression technology on locomotives, setting train operating schedules, and implementing quiet zone policies around stations to minimize the negative impact of noise on the surrounding community.

Keywords: noise pollution, train station, urban noise, environmental standards, public transportation.

I. Introduction

Noise pollution, which can be in the form of unwanted noise or sound, is an exposure that can contaminate the environment. Noise is treated differently from other pollutants such as chemical pollution and air pollution. Sound becomes pollution when it exceeds the threshold of

normal hearing, causing disturbances to humans and other living organisms [1]. The increasing transportation activities in urban areas generate significant noise with a fairly high frequency and duration. The World Health Organization (WHO) has established three levels of noise. It can be seen in the following table1.

Tabel 1. The three levels of noise established by the World Health Organization (WHO).

Noise Category	Noise Level Range (dB)
Safe	0–75
Danger Threshold	75–85
Danger	>85

One example of a transportation activity that generates significant noise is railway activity [3]. In Indonesia, noise regulations are governed by the Minister of Environment Regulation No. 48 of 1996, which sets the noise threshold for transportation areas at 70 dB. However, the implementation of this regulation often faces challenges, especially in public transportation areas with high activity [4].

More than 60% of railway stations in major cities in Indonesia experience noise levels that exceed this threshold, particularly during peak hours. Noise levels at railway stations during rush hours can reach up to 90 dB, well above the recommended threshold for human health [5]. Furthermore, repeated exposure to transportation noise has cumulative effects that can disrupt sleep quality, increase stress hormone levels, and even worsen chronic health conditions [6]. The sources of noise at railway stations include the rumble of the train's propulsion system or locomotives, noise from equipment (e.g., fans, engines, cooling systems, or compressors), and aerodynamic noise.

Analyzing noise levels at railway stations is not only crucial for evaluating compliance with environmental standards but also for understanding its social and health impacts. Noise is not just a technical issue but a social problem that affects the quality of life of the community. Manggarai and Duri stations are two vital transportation hubs in Jakarta. These stations serve as transit points for thousands of passengers daily. They connect various commuter rail routes in the Greater Jakarta area. For instance, Manggarai Station serves as a transit center for routes to Bogor, Bekasi, Jakarta

Kota, and Tanah Abang, while Duri Station services routes to Tangerang and surrounding areas [7].

The high activity levels at these stations have the potential to generate significant noise, which can impact the comfort and health of passengers and nearby residents. Research on noise in railway environments has been conducted at various locations. Based on previous studies, noise levels at Madiun and Yogyakarta stations were found to exceed the established thresholds [8]. In addition, the distribution of railway noise levels and the efforts of residents in coping with noise near railway tracks in Surabaya show that train noise significantly impacts the quality of life of the community [9].

However, there is limited research specifically analyzing noise levels at Manggarai and Duri stations. Therefore, this study aims to measure and analyze noise levels at these two stations, as well as evaluate their impact on the environment and public health. The results of this study are expected to provide useful information for the public and the government as a basis for improving the comfort of people in the vicinity of railway stations.

II. Method

This study uses a quantitative approach with a descriptive method. The research was conducted at two different station locations, namely Manggarai Utara Station and Duri Station, both of which are transit stations and are most frequently used by passengers for transit [10]. The study was conducted over four days, with two weekdays and the following two days being weekends. The research was conducted from December 13 to December 16, 2024. Data collection at Manggarai Station was carried out on one weekday and one weekend day, while data collection at Duri Station took place from December 14 to December 17, 2024.

The equipment used included a Sound Level Meter and three different applications: a noise meter, decibel sound measurement, and sound meter decibel apps. Measurements were taken in open spaces to avoid sound reflection. The measurements were conducted during peak hours, in the afternoon, when many people are returning from work, between 16:00 and 17:50 WIB, and data collection was done three times. The noise data was analyzed using a computer and the daily average noise levels for each station were calculated. The results were then compared with the noise standards set by the WHO and the government.

III. Result and Discussion

The average noise level on weekdays at Manggarai Station was recorded at 100.2 dB, while at Duri Station, the average noise level on weekdays was 96.1 dB. Based on these averages, it was noted that the highest average noise level was at Manggarai Station. This is because, according to interviews with security personnel stationed at the platforms, platforms 11 and 12 experience the highest levels of activity. These platforms have frequent train traffic, leading to relatively high noise levels in the area.

Table 1. Table of train noise measurement data in the Manggarai station area 13 December 2024 and 15 December 2024

Day and date	**Time**	**Sound level meter**	**Application**			**Average**	**Daily average total**	**Total station average**
			Noise meter	Decibel Sound	Sound meter dB			
Friday,13 December 2024	16:30	103 dB	99dB	102 dB	98 dB	100,5 dB	102,8 dB	
	17:00	101,9 dB	110dB	95 dB	97 dB	100,9 dB		
	17:30	110,6 dB	100dB	94dB	99 dB	100,7 dB		98,6 dB
Sunday,15 December 2024	16:45	103,9 dB	93 dB	100 dB	90 dB	96,7 dB	96,5 dB	
	17:25	114,3 dB	96 dB	92 dB	89,6 dB	97,9 dB		
	17:40	96,9 dB	90 dB	103 dB	89,7 dB	94,9 dB		

Table 2. Table for measuring train noise in the Duri station area 14 December 2024 and 16 December 2024.

Day and date	Time	Sound level meter	Application			Average	Daily average total	Total station average
			Noise meter	Decibel Sound	Sound meter dB			
Saturday,14 December 2024	16:45 - 16:55	101,7 dB	93dB	100dB	94dB	97,1 dB	100,2 dB	98,2 dB
	17:25 – 17:35	95,5 dB	102dB	111dB	97dB	101, 3 dB		
	17:40 – 17:50	96,6dB	103dB	115dB	95dB	102,4dB		
Monday,16 December 2024	16:45 - 16:55	111,0dB	94 dB	103 dB	89dB	99,25 dB	96,1 dB	
	17:25 – 17:35	93,2dB	91 dB	94 dB	86 dB	91 dB		
	17:40 – 17:50	98,2dB	95 dB	110 dB	89,7 dB	98,2dB		

Based on the data obtained, the average noise level on weekends at Manggarai Station was recorded at 96.5 dB, while at Duri Station, it was higher at 100.2 dB. These calculations indicate that Duri Station experienced higher noise levels than Manggarai Station. Weather conditions, particularly rain during the measurement period, may have contributed to the increase in noise levels at Duri Station. When it rains, many passengers seek shelter in the station area, resulting in increased crowding and more human activity, thus raising the noise levels. Additionally, the sound of falling rain and the potential noise from vehicles or other modes of transportation operating in adverse weather conditions could further exacerbate the noise levels in the surrounding station environment.

Figure 1. Data collection atmosphere at Manggarai Station

Figure 2. Data collection atmosphere at Duri Station

From the measurements taken, the total average noise level on weekdays at Manggarai Station was 98.6 dB, while the noise level at Duri Station was 98.4 dB. Based on the data, it can be concluded that Manggarai Station has a higher noise level than Duri Station. The high measurement results are due to the physical and operational characteristics of both stations. Manggarai Station has a larger

building and train operations that involve elevated tracks above the station, leading to higher noise levels.

The average noise level at both Manggarai and Duri Stations was 98.5 dB. When compared to the noise standards set by the World Health Organization (WHO), this level exceeds the recommended threshold. The maximum recommended noise limit for public transportation is 70 dB. The high noise levels can negatively affect passenger health.

The results obtained are consistent with previous studies at Madiun and Yogyakarta Stations [8]. The noise levels at both stations exceeded the safe limits established. Therefore, it is recommended to take mitigation steps such as improving noise-reducing technology on locomotives, regulating train operation schedules, and implementing quiet zones around the stations to minimize the negative impact of noise on the surrounding community.

IV. Conclusion

Based on the measurements conducted, the total average noise level at Manggarai Station was 98.6 dB, and at Duri Station, it was 98.4 dB. From this research, it can be concluded that the noise levels recorded exceed the established noise quality standard limits. The main factors contributing to the noise are the high volume of train operations, intensive braking, announcements through loudspeakers, and passenger activity on the platforms. Additionally, external conditions, such as traffic congestion around the station, also contribute to the increase in noise levels.

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