NOISE POLLUTION NEAR TO THE CONSTRUCTION SITE IN AN URBAN AREA (A CASE STUDY IN SHAH ALAM)

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Suhaila Nasim[1], Janmaizatulriah Jani[2*]

[1] Chec Construction (M) Sdn Bhd, Kuala Lumpur, Malaysia

[2] School of Civil Engineering, College of Engineering, Universiti Teknologi MARA. 40450, Selangor, Malaysia

[*]Corresponding author: janmaizatulriah@uitm.edu.my

ABSTRACT

In the contemporary era of Malaysia's rapid modernisation, a multitude of construction and urbanisation projects are underway, particularly in urban areas. As Malaysia strives to achieve its modernisation goals and join the ranks of developed nations, it is imperative to prioritise and mitigate noise emissions stemming from these construction and urban development endeavors. Urban regions characterised by residential, commercial, educational zones, construction activities, and heavy traffic congestion often experience elevated noise levels. These multiple sources of noise have a detrimental impact on the health and well-being of the surrounding communities. The primary objectives of this study are to assess noise levels in areas near construction sites (specifically the Light Rail Transit (LRT) project), as well as away from construction sites, and to gauge the extent of noise disturbance experienced by the community. Additionally, the study seeks to measure the community's awareness of the effects of noise pollution. The chosen study areas encompassed the LRT-3 Shah Alam line construction site (coordinates: 3° 4'2.50 "N, 101°29'22.12 "E) and the non-construction site in Seksyen 9 (coordinates: 3°05'17.80" N, 101°31'24.42" E). Two methods were employed for data collection: first, the measurement of noise levels at the study areas using the Decibel X smartphone application, and second, the distribution of a questionnaire survey to the community residing near the construction site.

The questionnaire aimed to evaluate the impact of noise pollution and the community's acceptance of noise emissions from the construction site. The findings revealed that the Equivalent Continuous Sound Pressure Level (LAeq) at the LRT-3 Shah Alam line construction site exceeded the permissible equivalent noise level (65 dB (A), registering at 83.44 dB (A) during weekdays and 74.82 dB (A) during weekends. In contrast, at the non-construction site in Seksyen 9, the LAeq remained below the permissible limit, with values of 54.13 dB (A) during weekdays and 49.42 dB (A) during weekends. The questionnaire survey indicated that a majority of the community living near the LRT-3 construction site were significantly disturbed by the construction activities and the additional noise stemming from vehicular traffic, given the site's proximity to a university. Respondents reported suffering from various effects of noise pollution, including headaches, stress, insomnia, diminished focus, and increased stress levels. The community expressed a consensus that raising awareness about the impacts of noise pollution from construction and urbanisation areas is essential, and they called upon the government to play a pivotal role in regulating noise emissions.

Keywords: Community Awareness, Noise Level, Noise Pollution

1.0 INTRODUCTION

In the new era of development, the demand for modern vehicles, buildings, highways, and many more facilities has risen. Therefore, many development activities are being done worldwide including Malaysia. One of unexpected effect of development is pollutions. Noise is one of the types of pollution people have to deal when living in urban areas. The source of noise pollution in urbanise areas may come from vehicles and also from construction projects for new development areas. Noise emission from construction and urbanisation projects also trigger as one of the causes of noise pollution (Feng *et al*., 2020). The usage of bulldozers, trucks, piling machines, and other equipment in construction produces an elevated level of noise. As stated by the National Institute of Deafness and Other Communication Disorder, "long or repeated exposure to sound at or above 80 decibels can cause hearing loss" (Daniel, 2017). The human auditory system lies in the frequency range of 20Hz to 20 kHz (Gorai & Pal, 2006).

Noise pollution can cause direct or indirect results on physical health such as directly caused hearing impairment. For example, humans will experience abnormal loudness perception and tinnitus (Millar, 2020). The quality of sleep will also be affected when someone is exposed to noise pollution. They will have difficulty falling asleep or are inability to stay asleep. Each task in construction uses a different type of machinery. The sources of noise pollution are motorised vehicles, crowds, concerts, fireworks, etc. A construction project is also one of the

sources of noise pollution. Construction activities such as filling, cutting, site clearance and excavation produce a high level of noise because it is linked to the machinery used (Haron *et al*., 2012). Therefore, the noise production is different in accordance with equipment use. Since Malaysia is a developing country, there are a lot of construction projects in this country especially urban areas. Noise pollution level should be compared with the Guidelines for Environmental Noise Limits and Control (as shown in Table 1) to measure whether exceed permissible limit or not.

Table 1: Recommended Permissible Sound Level (LAeq) Receiving Land Use for Existing Built-up Areas (DOE, 2019)

Receiving Land Use Category	LAeq Day (7.00 am – 10.00 am)	LAeq Night (10.00 pm – 7.00 am)
Low Density Residential, Noise Sensitive Receptors, Institutional (School, Hospital, Worship)	60 dBA	55 dBA
Suburban and Urban Residential, Mixed Development	65 dBA	60 dBA
Commercial Business Zones	70 dBA	65 dBA
Industrial Zones	75 dBA	75 dBA

However, pollution must be controlled for the safety of human and ecosystem well-being. For this study, the project of Light Rail Transit 3 (Shah Alam – Klang) was chosen as study area because the project is located close to residential area, educational and commercial area. This study will measure whether noise emission from construction projects contributes a huge amount of noise to the environment or not. The objectives of this study are to evaluate the noise level for area near to the construction site and away from construction site and to measure awareness of the community on the effect of noise pollution.

2.0 METHODS

Essentially, two research methods were selected: 1. Utilising the Decibel X smartphone application to measure noise levels, and 2. Employing a questionnaire as a tool to gauge both the extent of noise disturbance experienced by the community and the community's awareness of the consequences of noise pollution.

2.1 Decibal X Application

The noise level in these two locations was measured by using Decibel X application on smartphone. This application was rated 3.9 stars by the users. It has day and night features where it is safe to use the application during nighttime or when the user wants to experience dark mode. The application is already calibrated, and the data collected will be save in the history. Decibel X offers frequency weighing filters such as A, B, C, ITU-R 468, and Z. Moreover, the application is also compliant with NIOSH and OSHA standards. The data collected for noise levels in both study areas, namely the LRT-3 construction site in Section 7 and the non-construction site in Section 9, Shah Alam were compared to the Guidelines for Environmental Noise Limits and Control. The selection of these study areas was based on their proximity to commercial, residential, and educational zones. The data sampling occurred during the months of March and April 2022, coinciding with ongoing piling works at LRT-3 construction site. Data collection for the LRT-3 project encompassed areas near both roadways and machinery zones. In contrast, data collection near the roadside was confined to Section 9, Shah Alam, Selangor.

It is crucial to acknowledge that this study may be subject to potential human error, primarily due to the need to measure the distance from the noise source to the collection point. For the evaluation of noise pollution levels and identifying contributing factors, three daily sessions were conducted on both weekdays and weekends in the selected study areas. Data samplings were consistently obtained from the same locations during each session. These sessions took place at specific times: from 7:30 a.m. to 8:30 a.m., coinciding with the morning rush as people commute to work and construction activities commence; from 11:30 a.m. to 12:00 p.m., during peak traffic hours; and from 4:00 p.m. to 4:30 p.m., as people return home from work. The Equivalent Continuous Sound Pressure Level (LAeq) in the study areas was calculated using the equation:

$$L_{Aeq} = 10log \sum_{(i=t)}^{(i=n)} (10)^{L_i/10} (t_i) \quad (1)$$

Where, n is the total number of samples take, L_i is the noise level in dB(A) of i^{th} sample and t_i is the fraction of total sample time.

2.2 Questionnaire Survey

A set of questionnaires was established to evaluate the awareness of community on the effect of noise pollution. Table 2 shows the summary of the questionnaire. The questionnaire consists of two sections which are A and B. The questionnaire was distributed to the community in the study area through both offline and online methods. Online distribution was primarily conducted through WhatsApp and social media.

Table 2: Summary of the Questionnaire for the Community

Section	Related Question
A	Section A consists of the respondent's background information which includes gender, age group and ethnicity.
B	Section B consists of the respondents' knowledge on the definition of noise pollution, its sources, whether the respondents are disturbed by the noise, and at what time usually they experience noise pollution. Therefore, the aim of this section is to create awareness of the sources of noise pollution. By conducting this survey, it strengthens the evidence of noise emission from construction projects can be harmful to humans and the environment. This section also consists of the respondent's perception towards the noise pollution issues particularly the noise emission produced from the construction site and urbanisation area.

2.3 Data Analysis Using SPSS

Statistical Package for the Social Sciences (SPSS 2019) version 26 was used for analysis of the questionnaires. Descriptive analysis was used to analyse the demographic of respondents in Section A, whereas reliability test or Cronbach's alpha was used to test the questions that contain Likert Scale in the questionnaire in Section B.

3.0 RESULTS

This section shows the analyses obtained from the recorded noise level and questionnaires survey. The noise reading from both study areas was compared to the Guideline for Environmental Noise Limit and Control and from questionnaires were analysed using SPPS software.

3.1 Noise Level

The noise level was measured during weekdays and weekend at LRT-3 construction site at Seksyen 7 and non-construction site at Seksyen 9 is located at Sekolah Menengah Kebangsaan Seksyen 9. Table 3 shows the comparison between L_{Aeq} at the study areas and permissible L_{Aeq} by Department of Environment.

Table 3: Comparison between L_{aeq} at the Study Areas and Permissible L_{aeq} by Department of Environment

Suburban and Urban Residential Mixed Development, L_{Aeq} 65 dB (A)	Seksyen 7		Seksyen 9	
	Weekday	Weekend	Weekday	Weekend
	83.44 dB (A)	74.82 dB (A)	54.13 dB (A)	49.42 dB (A)

The Department of Environment sets the allowable LAeq (Equivalent Continuous Sound Pressure Level) for suburban and urban residential mixed development at 65 dB (A). Any noise exceeding this permissible equivalent noise level is deemed detrimental to nearby communities, as it can harm the human auditory system, elevate blood pressure, and disrupt sleep patterns. The data in Table 3 shows that at the LRT-3 Shah Alam line construction site, the LAeq exceeds the acceptable equivalent noise level, reaching 83.44 dB (A) on weekdays and 74.82 dB (A). This clearly indicates that the primary contributors to noise pollution in the study area are heavy traffic (Mohd Isa *et al.*, 2018) and construction activities, as noted by Kantová in 2017. In contrast, the study conducted at the non-construction site in Section 9 recorded LAeq values below the permissible limit, measuring at 54.13 dB (A) during weekdays and 49.42 dB (A) during weekends. Therefore, the measurements indisputably highlight that construction activities are a significant source of noise pollution in the study area.

3.2 Sources of Noise Pollution and Awareness of the Community on the Effect of Noise Pollution

A total of 172 individuals, comprising local community members such as UiTM and UNISEL students, workers from commercial areas and residents living near the LRT-3 construction site, participated in the questionnaire survey. Based on SPSS analysis, the highest frequency of respondents responded to the questionnaire were female at 51.7% more than male respondents. Highest age of the respondents was between 20–30 years old (64%). The mode of race of respondents was Malay, 79.7% compared to China and India, which are 12.2% and 5.8% respectively. Section 7 is situated near to the educational, commercial as well as residential areas. Based on the questionnaires analysis as shown in Figure 1(a), 133 respondents have chosen noise pollution is coming from vehicles. Based on Figure 1(b), 55% of respondents agreed noise from LRT-3 construction is definitely disturbing the community. As been mentioned by Geetha & Ambika, (2015) noises from construction sites are from diesel power generators, cutting and wielding procedures, heavy machinery, material transit, and equipment condition. Based on the reliability test (Cronbach's alpha), the value of Cronbach's Alpha is 0.657, indicating that the survey data is acceptable and reliable.

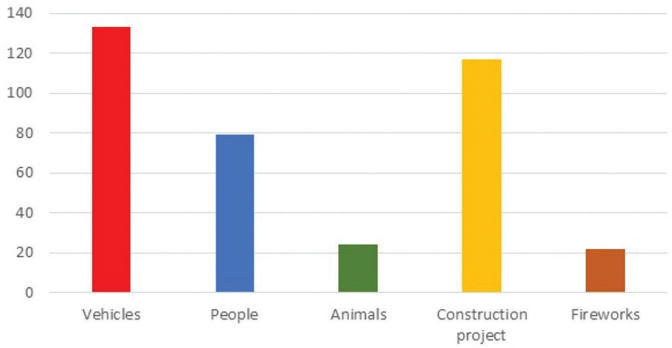

Figure 1(a): Major Sources of Noise Pollution in Seksyen 7, Shah Alam

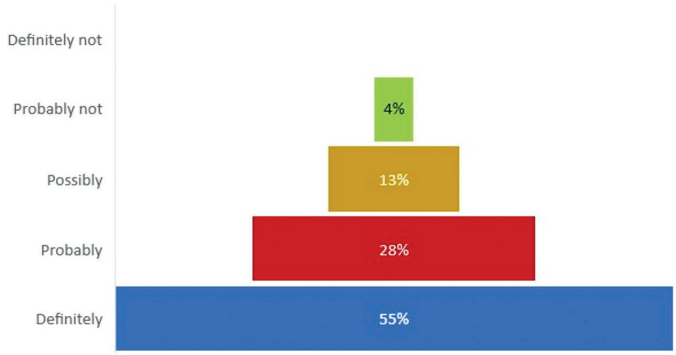

Figure 1(b): Noise Disturbance from LRT-3 Construction Site

Based on Figure 1(b), 55% of respondents agreed noise from LRT-3 construction is definitely disturbing the community. Section 7 is known as a commercial area as well as residential area where the shophouse is rented by most of the students from UiTM (Universiti Teknologi MARA) Shah Alam and other universities. 28% of respondents agreed that noise from LRT-3 construction is probably disturbing, while 13% agreed that noise is possibly disturbing the community. However, only 4% of the respondents agreed that noise from LRT-3 construction is probably not disturbing to the community because the respondents are not live nearby to the active construction site.

Table 4 shows 109 respondents out of 172 respondents were from age range 20-30 years old. 68 respondents from age range 20-30 years old agreed that noise pollution have caused headache and 74 respondents cannot focus on what they are doing due to

the loud noise. On the other hand, 4 respondents from age range 20-30 years old claimed there is no disturbance even when they are facing the noise pollution. 9 out of 109 respondents from this age range suffered from hypertension even they are still young. The risk of developing hypertension in younger adults is enhanced by the rising incidence of classis risk factors in the young such as obesity, diabetes mellitus and renal illness (Mammoser, 2017). For respondents at age range between 31-40 years old, 5 out of 34 respondents claimed that they suffered from insomnia due to the loud noise occurs near to their residential area. Most of the respondents agreed that they feel stressed and suffered from headache whenever noise pollution occur. For the age range 51-60 years old, 4 out of 5 respondents agreed that they suffered from hypertension. It shows that the older the age, the more they can resist with the noise pollution.

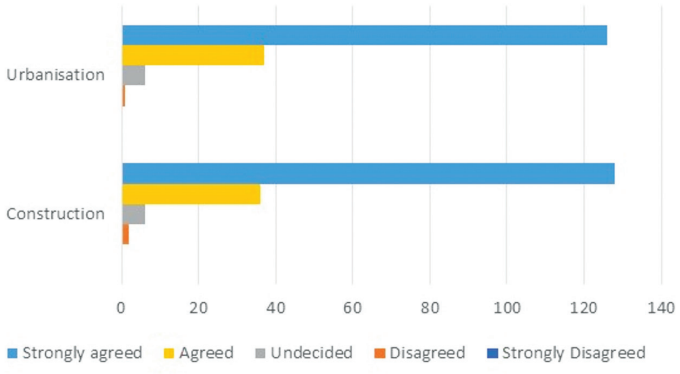

Figure 2: Respondent's Awareness on the Impact of Noise Pollution in Construction Sites and Urbanisation Area

As shown in Figure 2, most of the respondents strongly agreed that Malaysia government should improve the awareness among community on the impact of noise pollution from construction and urbanisation area to their life. The construction site located near to the commercial, residential and educational areas should have a noise control plan such as installation of a noise barrier in order to preserve the health condition of the community, especially in the urban area.

4.0 CONCLUSIONS

The results of this study clearly demonstrate that the LAeq (Equivalent Continuous Sound Pressure Level) exceeds permissible Environmental Noise Limits and Control standards at the construction site area compared to non-construction sites, both on weekends and weekdays. The primary sources contributing to noise pollution in the study area are heavy traffic and construction activities. The findings from the questionnaire survey also indicate that a majority of respondents attribute the main source of noise to vehicles and construction activities. It can be inferred that the community has experienced various adverse effects of noise pollution, including headaches, stress, insomnia, and hypertension. Additionally, the community expressed agreement that the Malaysian construction industry should take measures to reduce noise emissions stemming from their construction and urbanisation activities. Reducing noise emissions is expected to enhance the quality of life for the community. Furthermore, the government is encouraged to enforce legal actions against construction projects that fail to implement noise control measures, such as noise barriers at their construction sites.

Table 4: The Age of Respondent Vs the Effect of Noise Pollution

			Age and effect Crosstabulation The effect of noise pollution						Total
			No Disturbance	Headache	Stress	Insomnia	Hypertension	Cannot focus	
Age (years old)	20-30	Count	4	68	65	21	9	74	109
	31-40	Count	2	26	29	5	9	14	34
	41-50	Count	1	20	19	5	9	10	23
	51-60	Count	0	4	3	2	4	2	5
	61 and above	Count	0	0	0	1	1	1	1
Total		Count	7	118	116	34	32	101	172
Percentages and totals are based on respondents									
a. Dichotomy group tabulated at value 1.									

5.0 ACKNOWLEDGEMENTS

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PROFILES

SUHAILA BINTI NASIM, a dedicated 25-year-old civil engineer, achieved academic excellence by graduating with honors in Civil Engineering from UiTM Shah Alam in September 2022. She has demonstrated her commitment and expertise during her employment at CHEC Construction (M) Sdn Bhd, where she has been actively engaged for over a year. Suhaila's profound interest lies in conducting research related to Water Resources and Environmental Systems, with a current emphasis on exploring greenhouse gas emissions and air temperature dynamics in the context of global warming. Her unwavering dedication is driven by a strong belief in fostering a sustainable future.
Email address: suhailansim@gmail.com

TS DR JANMAIZATULRIAH JANI, a distinguished senior lecturer hailing from the School of Civil Engineering, College of Engineering, Universiti Teknologi MARA. She has been contributing to the field of education since December 1999. Her academic journey includes a master's thesis focused on rainfall modelling and a doctoral thesis centered on GIS-based groundwater modelling. Her research pursuits encompass a diverse range of interests, including flood and erosion modelling, the utilisation of GIS in groundwater and hydrological modelling, as well as investigations into environmental assessment and monitoring.
Email address: janmaizatulriah@uitm.edu.my