Jurnal
Teknologi

Full Paper

ASSESSMENT OF ROAD TRAFFIC NOISE IN SELECTED URBAN RESIDENTIAL AND CONSTRUCTION AREAS

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Article history
Received
13 September 2022
Received in revised form
13 April 2023
Accepted
30 April 2023
Published Online
25 June 2023

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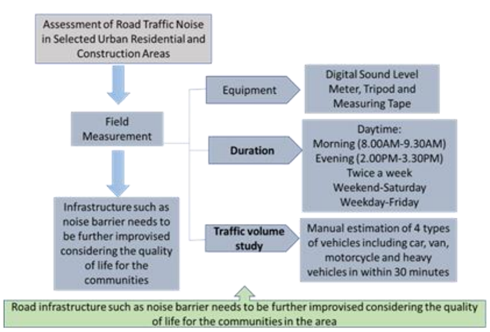
Graphical abstract



Abstract

The work presented in this paper includes a field investigation of road traffic noise between residential and construction areas in a selected urban area. The aim of this study was to assess the level of noise pollution from road traffic noise in Seri Kembangan, Selangor. Therefore, this study included measurements of traffic noise level, evaluation of the percentage traffic volume between residential and construction areas; and identification of the correlation between traffic volume and traffic noise level. An EXTECH 407764 sound level meter was used to take noise level measurements for 1 hour and 30 minutes in one-minute intervals at both study sites. The parameter collected in the noise level monitoring was average noise level (LAeq). The traffic volume study was conducted using manual counts for 30 minutes. Four types of vehicles were counted, namely cars, vans, motorcycles, and heavy vehicles. Based on statistical analysis, it can be concluded that both sites had high traffic noise levels which exceeded the maximum permissible limit of 60 dBA during daytime, according to Malaysian guidelines, due to several factors. The findings show that road infrastructure such as noise barriers need to be further implemented, especially in residential areas. Mitigation of noise pollution must be further carried out by contractors. Additionally, further investigations need to be conducted by the relevant authorities to reduce the level of noise which may affect the quality of life for the communities in the area.

Keywords: Road Traffic Noise, Urban Area, Traffic Volume, Noise Barrier, Noise Pollutions

Abstrak

Kerja-kerja yang dibentangkan di dalam kertas penyelidikan ini adalah merupakan kajian lapangan kebisingan lalu lintas jalan antara kawasan perumahan dan pembinaan di kawasan bandar terpilih. Kajian ini bertujuan untuk menilai tahap pencemaran bunyi daripada bunyi bising di jalan raya bagi kawasan bandar yang terletak di Seri Kembangan, Selangor. Oleh itu, kajian ini melibatkan pengukuran tahap hingar lalu lintas, penilaian peratusan isipadu trafik antara kawasan kediaman dan pembinaan; dan pengenalpastian korelasi antara isipadu lalu lintas dan tahap hingar lalu lintas. Meter aras bunyi EXTECH 407764 digunakan dalam pengukuran aras hingar. Pengukuran tahap hingar lalu lintas telah diambil selama 1 jam 30 minit di mana meter aras bunyi direkodkan pada selang satu minit di kedua-dua tapak kajian. Parameter yang dikumpul dalam pemantauan tahap hingar ialah tahap bunyi purata, bacaan LAeq selama 1 jam 30 minit. Manakala kajian isipadu trafik pula diukur melalui kiraan manual selama 30 minit yang terdiri daripada empat jenis kenderaan iaitu kereta, van, motosikal, dan kenderaan berat. Berdasarkan keputusan analisa statistik yang telah dibuat, boleh disimpulkan bahawa kedua-dua tapak mempunyai tahap hingar trafik yang tinggi yang melebihi had maksimum yang dibenarkan iaitu 60 dBA pada waktu siang mengikut Garis Panduan Malaysia disebabkan oleh beberapa faktor. Dapatan kajian menunjukkan infrastruktur jalan seperti penghalang bunyi perlu ditambah baik terutamanya bagi tapak kawasan perumahan. Manakala, tindakan pengurangan pencemaran bunyi bagi mengawal parasnya perlu dipertingkatkan lagi oleh kontraktor. Justeru, siasatan lanjut perlu dilakukan oleh pihak berkuasa bagi mengurangkan tahap bunyi bising yang boleh menjejaskan kualiti hidup masyarakat di kawasan tersebut.

Kata kunci: Kebisingan lalu lintas jalan, kawasan bandar, isipadu trafik, penghalang bunyi, pencemaran bunyi

1.0 INTRODUCTION

Sound is a complex phenomenon consisting of alternating compression and expansion of air which generates in all directions from a source. It can be described as a small change in local atmospheric pressure. Noise pollution is excessive sound that could have detrimental effects on human health. Today, environmental noise has become an issue. since it disturbs people doing their activities, especially in residential urban areas as most people are exposed to the health effect of traffic noise pollution. According to the Swedish Protection Agency and Statistics Sweden, the number of persons exposed to road traffic noise levels above outdoor guidelines (LAeq, 55dB and LAmax, 70 dBA) is approximately 2 million, or 25% of the population [1]. In China, road traffic noise complaints account for 35.3% of all noise complaints, while there are more than 30% of people exposed to noise levels greater than 55dB in the European Union [2]. There have been many studies across the globe searching for ways to develop models for noise prediction that could control noise levels. In 2009, the European Commission decided to develop CNOSSOS-EU (Common Noise Assessment Methods in Europe) for the noise mapping of road traffic, railway, aircraft, and industrial noise to develop a harmonized methodological framework for noise assessment [3].

Generally, noise pollution comes from industrial facilities. It also comes from sources such as highways, railways, airplane traffic, and construction projects [4]. According to the Department of Environmental Malaysia (DOE), in 2007, the most common measurement of traffic noise was the dBA level. Traffic noise can be measured using a Sound Level Meter with an A-weighting filter that simulates the subjective response of the human ear. The sound level meter used in this research was switched to its "F" (Fast) time weighting when ambient noise was measured. The maximum permissible sound level of urban residential for planning and new development is 60dBA for daytime and 50 dBA for night-time in Malaysia. Currently, several measures can be implemented to reduce traffic noise pollution such as improvements to vehicle construction, including low noise tires and brake blocks. Proper traffic management helps to reduce traffic volumes through intensification of public transport usage, such as by promoting cycling and walking on short distances.

In Malaysia, some residential areas are located near the highway, with a medium density of traffic flow. Over time, many sectors have been widely expanding. Sectors including transportation, industrial, and construction have led to higher levels of noise pollution. Noise from construction sites comes from construction activities like piling, hammering, and operations done by heavy machines, in addition to noise from massive traffic flows within an area [5]. Disregarding long-term exposure to traffic noise pollution has effects on the human health body such as hearing disability, performance loss, and interference with the social behavior of aggressiveness, protest, and helpfulness [6]. This has guided the World Health Organization (WHO) to set standards and limits of allowable noise levels to avoid the negative impact of noise pollution [7]. Seri Kembangan is a developing city located in Selangor, Malaysia. A Mass Rapid Transit (MRT) station in Seri Kembangan is scheduled to complete construction in 2022, which will help to reduce traffic congestion in the future. However, the high concentration of noise during the construction of Mass Rapid Transit (MRT) cannot be neglected. The same is true for residents of Seri Kembangan who live near major roads, as they are exposed to the noise pollution that accompanies the medium traffic flow. Therefore, noise level and traffic volume have been measured for both areas to make a comparison of traffic noise pollution between residential and construction areas in Seri Kembangan, Selangor. The purpose of this study is to evaluate the degree of noise pollution caused by vehicle traffic in Seri Kembangan, Selangor. This involves the measurement level of traffic noise, evaluation of the percentage of traffic volume, and establishing a correlation between traffic volume and noise level.

The primary scope of the study involved data collection for traffic noise levels, as well as traffic volume along with the road network for residential and construction areas. All data were recorded periodically in the morning and evening on a weekday (Friday) and weekend (Saturday) to monitor the noise level during peak and non-peak hours. Traffic flows, consisting of cars, heavy vehicles, vans, and motorcycles, were monitored through manual count in the morning and evening every 30 minutes. Then, the relationship between traffic density and noise level will be determined.

2.0 METHODOLOGY

This study was conducted in a selected urban area located in Seri Kembangan. Seri Kembangan, also known as Serdang New Village. It is a city located in Petaling District, Selangor. The city lies to the south of Kuala Lumpur at coordinates 3.021998, 101.705541. Seri Kembangan is a developing city with a population of 341,925. The city is expanding continuously with the development of transportation systems, including railway lines and road networks. In this research, construction and residential areas were chosen for data collection for traffic noise level.

The residential study area is located at Persiaran Pinggiran Putra 2 (Figure 1). It is near Putra Indah Apartments. The locations were chosen based on their medium traffic flow. Since the residential area is facing the road of Persiaran Pinggiran Putra 2, it was a strategic location for the data collection on traffic noise pollution. The study area for construction was located at Jalan Putra Permai, Pusat Bandar Putra Permai (Figure 2), nearby the MRT construction site and Giant Seri Kembangan. A high capacity of traffic flow and traffic congestion that occur during peak hours were selection factors for the this site. The locations of the study areas are shown in Figures 1 and 2.

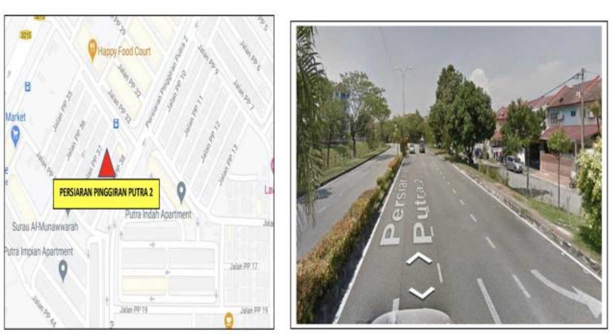


Figure 1 Residential Area

Figure 2 Construction Area

Figure 3 shows the location of both studied areas in Seri Kembangan, Selangor. The estimation of the distance between the areas is about 5 km. The study area for construction sites is nearby a Giant Hypermarket located on the main road that connected the Serdang Kembangan interchange of Damansara Puchong Expressway Besraya Expressway in the southwest to Seri in the northeast. Jalan Putra Permai, Seri Kembangan links with three major Expressway, Maju Expressway tolled expressways which are Damansara Puchong and Besraya Expressway. Persiaran Pinggiran Putra 2 is a local street within an urban neighborhood that offers direct access to the main roads, including surrounding residential areas.

Figure 3 Location of both study areas in Seri Kembangan, Selangor

Materials that were used in this study to conduct the sound level measurements included a sound level meter (SLM), tripod, and tape. For noise level measurements, EXTECH 407764 lab equipment was used to collect data in this study, according to the standard of IEC651 TYPE 2 & ANSIS1.4 TYPE 2 which provide dBA weighting for noise measurement. The most recent standard for noise measurement is IEC 61672. However, this standard has been superseded by IEC 60651. Originally this standard was called IEC 651.

The EXTECH 407764 sound level meter measures low frequency, medium frequency, and high frequency in decibels (dB). The louder the sound, the higher the decibel level. Table 1 shows the noise level in decibels. Measurements of noise levels in the frequency domain are typically expressed in decibels relative to a specified reference level, such as dB SPL (sound pressure level) or dB FS (full scale). In addition, specific frequency ranges can be measured and reported, including octave band measurements (e.g., 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, and 8 kHz) or third-octave band measurements (e.g., 31.5 Hz, 40 Hz, 50 Hz, 63 Hz, 80 Hz, 100 Hz, 125 Hz, and so on). These frequency-specific measurements are useful for identifying the frequency components of noise and can aid in the identification of specific sources of noise, as well as in the evaluation of the effectiveness of noise control measures.

Table 1 Noise level condition

Noise Condition	Noise Level (dB)	Frequency	Example of Noise Condition
Silent	0	-	No sound at all
Very quiet	10-30	Low	Threshold of hearing, desert, whisper, breathing
Quiet	30-50	Low	Library, quiet office
A little quiet	50-70	Medium	Piano practice, noise restaurant, busy street
Quiet noisy	70-110	Quite High	Highway traffic noise, subway, car horn, vacuum cleaner, alarm clock
Feel Painful (Loud Noise)	110-130	High	Machinery (industry & construction), disco, shotgun
Unbearable (Very loud noise)	130-150	Very High	Aircraft at takeoff, siren, jet

Note that at a noise level of 150 dB, the human chest begins to vibrate while noise level above 150dB, the human eardrum will burst. Figure 4 shows the component of EXTECH 407764 Sound Level Meter equipment.

A 1.5 m tall tripod was used to hold the sound level meter while monitoring the environmental noise for both studied areas. Measuring tape was used to measure the distance between the source of traffic noise and the sound level meter equipment. The distance should be 5 m away from the edge of the roadside.

Figure 4 EXCETH 407764 Sound Level Meter Equipment

Several previous research papers had a similar concept to this study. One was conducted by Nor N. A. (2019) [8], who conducted a noise monitoring and traffic composition study with similar tools, including a sound level meter, tripod, and measuring tape to collect noise data. Rosli, N. S. (2013) [9] also conducted a similar study to this research. Traffic volume and noise level were measured, and a correlation between both variables was made to identify the relationship between noise level and traffic volume. Yet another study by Yusoff, S. (2005) [10] used a similar field study to conduct noise monitoring and make a bar chart of sound level versus time of daytime during weekends and weekdays.

Sound level measurement was performed using a digital sound level meter (SLM) for 1 hour and 30 minutes during daytime on-site. A measurement of noise level was recorded periodically in the morning and evening. The justification of the duration is due to peak hours (8.00 a.m. -9. 30 a.m.) and non-peak hours (2.00 p.m. - 3.30 p.m.) to measure and compare the traffic noise level between medium and high traffic flow in both study areas. It was conducted twice a week, on weekdays (Friday) and weekends (Saturday).

The noise level was recorded for 1 hour and 30 minutes as the digital sound level meter will record an every-one minute of the noise level. The reason for the one-minute data interval is to collect details of noise level at the studied site without missing or disrupted by any noise variation while the field study was carried out.

For every 30 minutes within 1 hour and 30 minutes, the parameters collected in noise monitoring was average noise level (LAeq). Next, all data collected were investigated to determine the presence of medium and high traffic noise at both sites using descriptive analysis and an independent t-test to compare the mean traffic noise level between both selected study areas. The digital sound level was mounted on the 1.5m (5-ft) tripod and placed 5m (16-ft) from the pavement edge to prevent any obstacles or accidents that might occur when collecting data at the roadside as shown in Figure 5.

Figure 5 Location of Digital Sound Level Meter at 5m from the roadside

A traffic volume study, including traffic manual counts, was carried out to evaluate the traffic composition during daytime (morning & evening) in the residential and construction areas through a pie chart. The count took 30 minutes for 4 types of vehicle (cars, vans, motorcycles, and heavy vehicles). Then, the relationship between the number of vehicles and traffic noise level was determined.

Descriptive analysis was used to summarize the recorded data that had been collected in the form of statistical analysis through noise descriptors. The noise produced changed with time, since generating sound is not stable. Therefore, a noise descriptor is known as a different percentage of time during noise measurement. In this descriptive analysis, parameters that will be analyzed are average noise level or Noise Equivalent Continuous Sound Level LAeq, which is used as a standard descriptor to determine noise, especially along highways and residential and commercial areas. Moreover, LAeq is functional, applicable, and internationally accepted for traffic noise analyses [11]. The metric has been recognized as the descriptor of choice by many authorities in the world for traffic sources in environmental noise assessments.

An independent sample t-test was conducted in this study to test the statistical differences between the means of two groups based on the independent variables. Traffic volume data consisted of 4 types of vehicles, namely cars, vans, motorcycles, and heavy vehicles. Traffic volume studies are obtained through traffic manual counts. The data is taken for 30 minutes within the 1-minute interval. The pie chart is made to illustrate the percentage of vehicles for each studied area during the weekend and weekdays.

A correlation between traffic volume and noise level has been measured to determine the relationship between the two variables. Transportation development surrounding the city has increased the construction activities and traffic density, leading to increases in noise pollution in both construction and residential areas. Previous research has demonstrated that when there is a reduction in traffic volume, the noise will also reduce.

3.0 RESULTS AND DISCUSSION

The results of the average noise level, LAeq with traffic volume study were analyzed and discussed. The result of data collection on noise level monitoring between residential of Persiaran Pinggiran Putra 2 and construction areas at Jalan Putra Permai for weekdays was shown in Figure 6.

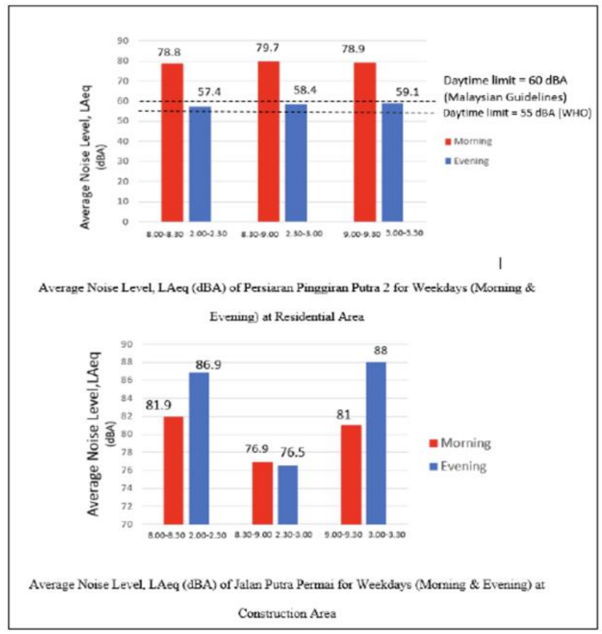


Figure 6 Average Noise Level , LAeq(dBA) at both residential and construction areas during weekdays

Noise level monitoring was categorized into two sessions, which are morning and evening. The parameter of the average noise level, LAeq, was collected every 30 minutes within 1 hour and 30 minutes. The results show that LAeq during morning sessions at construction areas was higher compared to the residential area. The highest average noise level recorded in the morning was 81.9 dBA within the 8.00 a.m. to 8.30 a.m. time interval at the construction area of Jalan Putra Permai compared to the residential area at Persiaran Pinggiran Putra 2 as the highest average recorded was 79.7 dBA for 8.30 a.m. – 9.00 a.m. time interval. The monitoring result shows that the noise level values of both areas had exceeded the outdoor noise limit by the World Health Organization as well as Malaysia Guidelines. Based on observations made during the morning session, LAeq at Jalan Putra Permai near the construction area was slightly different from the average noise level at the residential area. This may be due to the number of lanes at Jalan Putra Permai nearby the construction area as compared to the residential areas, which contributes to high traffic density in that area. According to a previous study, the greater the number of vehicles creating the combination of the noises produced by engines, exhaust and tires leads to a higher noise level [12]. Therefore, LAeq increased at Jalan Putra Permai near the construction area compared to the residential area. In the evening session, LAeq in the residential area was lower compared to the construction area due to the non-peak hours since residents in Seri Kembangan were already going to the works during the morning session.

The results below show that the value of LAeq at Jalan Putra Permai near the construction area was 88 dBA higher than LAeq at the residential area which was 59.1dBA. This is because the construction works were actively being carried out during the evening session compared to the morning session due to the high traffic flow in the morning session. This leads to a high average noise level, LAeq at Jalan Putra Permai near the construction area. The result below clearly indicates that residents living in the residential area were exposed to high noise levels that exceed the maximum permissible limit during the morning session. People in residential areas may be exposed to the effects of noise pollution such as hearing impairment which eventually result in loneliness, depression, and reduced job performance due to the high road traffic noise exposure according to e.g. [4]. Meanwhile, Figure 7 shows the average noise level, LAeq at residential of Persiaran Pinggiran Putra 2 and construction areas at Jalan Putra Permai for the weekend during morning and evening sessions.

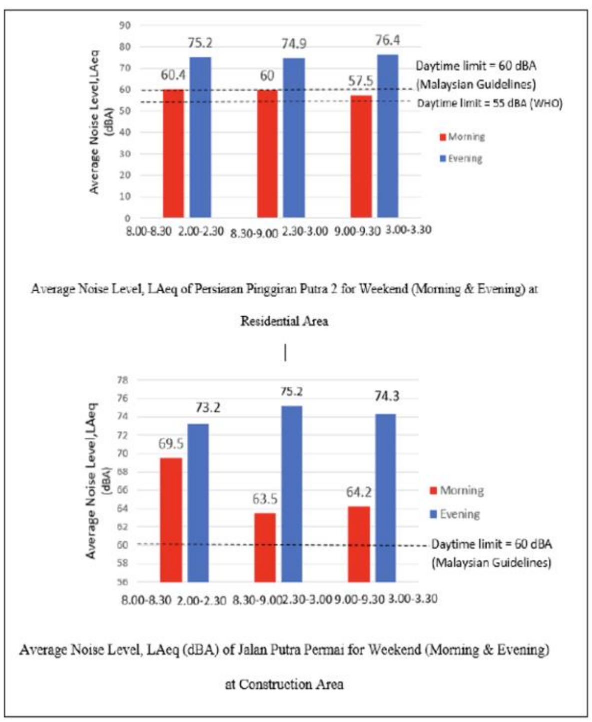


Figure 7 Average Noise Level , LAeq(dBA) at both residential and construction areas during weekend

Figure 7 shows that the average noise level, LAeq during the morning session in residential areas has a lower average noise level, LAeq compared to the construction area. This is because most people stay at home instead of going out in the morning during the weekend. The highest average noise level in ,the construction area during the morning session was 69.5 dBA, LAeq in the residential area reached only 60.4 dBA. Generally, LAeq was higher during the evening session compared to the morning session for both study sites. The average noise level of Persiaran Pinggiran Putra 2 at the residential area was 76.4 dBA, higher than at Jalan Putra Permai near the construction area which was 75.2 dBA. On the weekend, people in residential areas tend to go out to buy groceries at the nearby shops or malls, contributing to the high noise level in the evening.

The independent sample t-tests from the SPSS output are shown in mean boxplots of noise levels for construction areas and residential areas during weekdays and weekends in Seri Kembangan. Figure 8 below shows that the mean noise level near the construction area was 83.27, while the mean noise level in the residential area was 68.72 during weekdays.

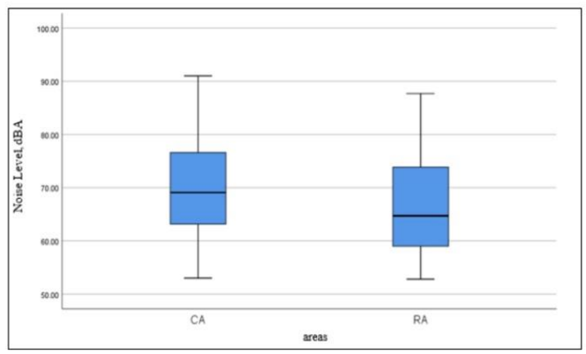


Figure 8 Mean box-plots of noise level for Construction Area (CA) and Residential Area (RA) during weekdays

Figure 9 shows the mean noise level near the construction area was 70.29 and the mean noise level in the residential area was 66.85. The value shows that the mean traffic noise level was higher near the construction area as compared to the residential area on weekdays and weekends. This is due to the high capacity of vehicles at Jalan Putra Permai, which is near the Mass Rapid Transit (MRT) construction area, as compared to Persiaran Pinggiran Putra 2 road in a residential area. The reason for the high capacity of vehicles at Jalan Putra Permai was due to the greater number of lanes compared to the Persiaran Pinggiran Putra 2 road, indirectly contribute to high traffic noise level.

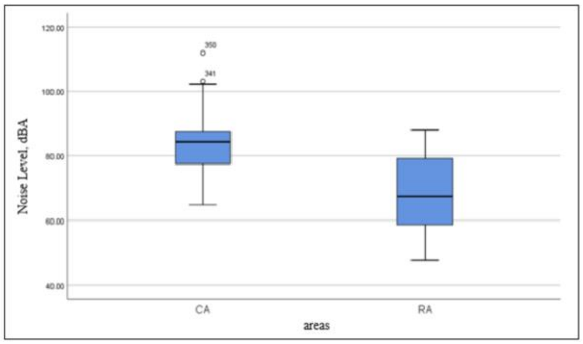


Figure 9 Mean box-plots of noise level for Construction Area (CA) and Residential Area (RA) during weekend

The traffic composition found in this study is shown in the Figures 10 and 11. The purpose of the vehicle volume study was to determine the traffic density at selected study sites. It was important as the study was related to the high noise level in both studied sites. From the results of analysis shown in Figures 10 and 11, it can be observed that the percentage of cars was slightly higher in construction areas compared to the residential area.

The pie charts also demonstrate that there is a higher percentage of heavy vehicles at Jalan Putra Permai near the MRT construction area compared to the residential area. Since the construction activities of Mass Rapid Transit (MRT) had been carried out near Jalan Putra Permai roads, therefore a lot of heavy vehicles including trucks, backhoe loaders, cement lorries, and bulldozers being used as well as passing by Jalan Putra Permai roads. These heavy vehicles contributed to a high noise level at Jalan Putra Permai due to the loud engine sound of the heavy vehicles These findings also are in line with the study conducted by [13], [14], and [15].

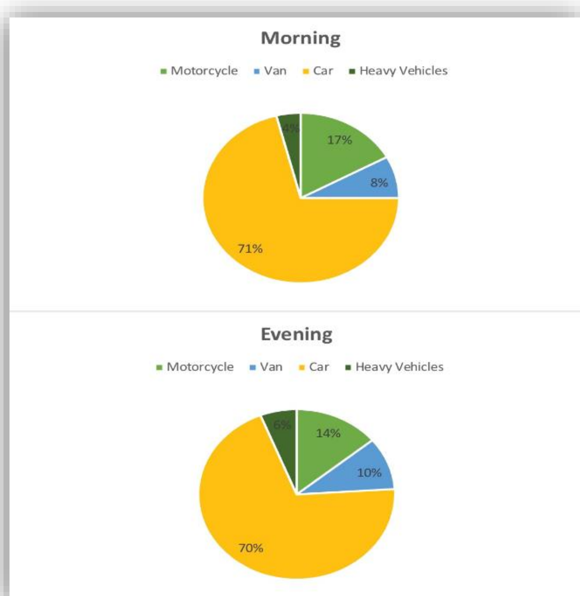


Figure 10 Percentage of different types of vehicles during weekdays in Residential Areas

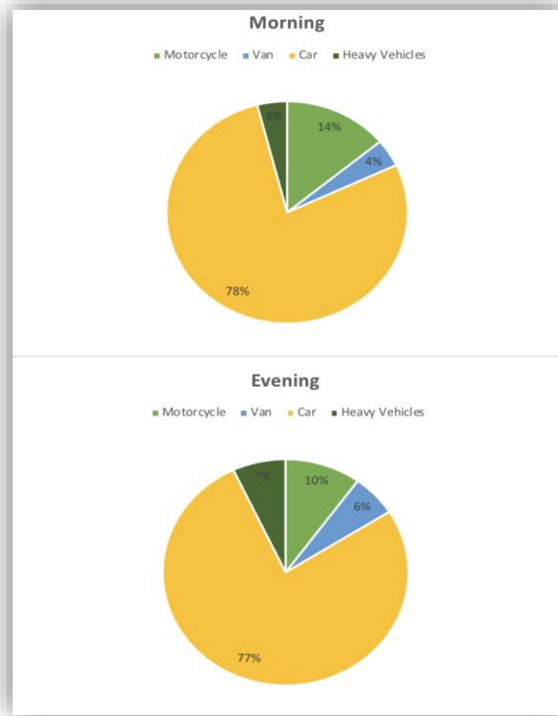


Figure 11 Percentage of different types of vehicles during weekdays in Construction Area

Figures 12 and 13 show the traffic composition in terms of type of vehicle during weekend morning and evening sessions in both studied areas. The vehicles at Jalan Putra Permai near MRT Construction area during morning session consisted of 78% cars, 14% motorcycles, 4% vans and 4% heavy vehicles. The vehicles in the residential area included 74% cars, 18% motorcycles, 5% vans and 3% heavy vehicles. In the evening session, the percentage of different types of vehicles for Jalan Putra Permai near the MRT construction area consisted of 77% cars, 10% motorcycles, 6% vans and 7% heavy vehicles. Meanwhile, the percentage of vehicles in the residential areas was 78% cars, 19% motorcycles, 2% vans and only 1% heavy vehicles. From the results below, the percentage of motorcycles during both sessions were higher at Persiaran Pinggiran Putra 2 residential area compared to the Jalan Putra Permai near the construction area. This is because most of the motorcycles are food delivery motorcycles, including *Foodpanda* and *Grabfood,* as well as service motorcycles for *Poslaju* and *JnT* passing by the residential areas to make deliveries to the residents. There were a few motorcycle riders that used horns, contributing to the noise pollution on Persiaran Pinggiran Putra 2 roads. This finding was supported by a previous study, in which misuses of the horn were found, as drivers in urban areas tend to use horn during high traffic flow [13].

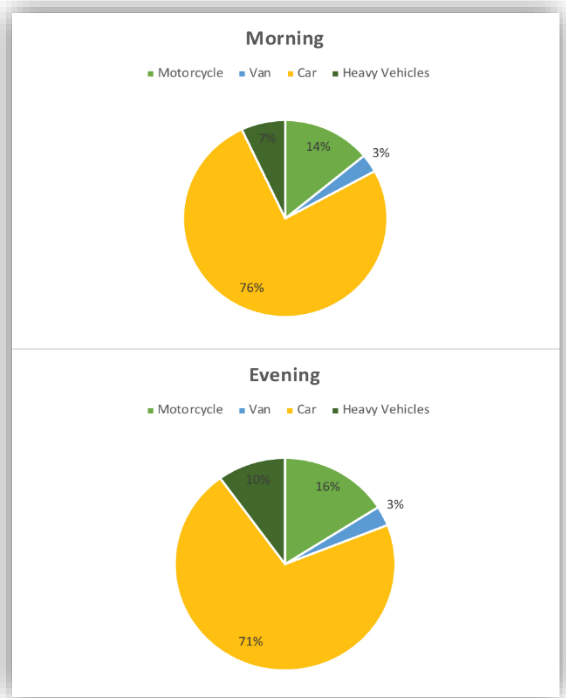


Figure 12 Percentage of different types of vehicles during the weekend in Construction Area

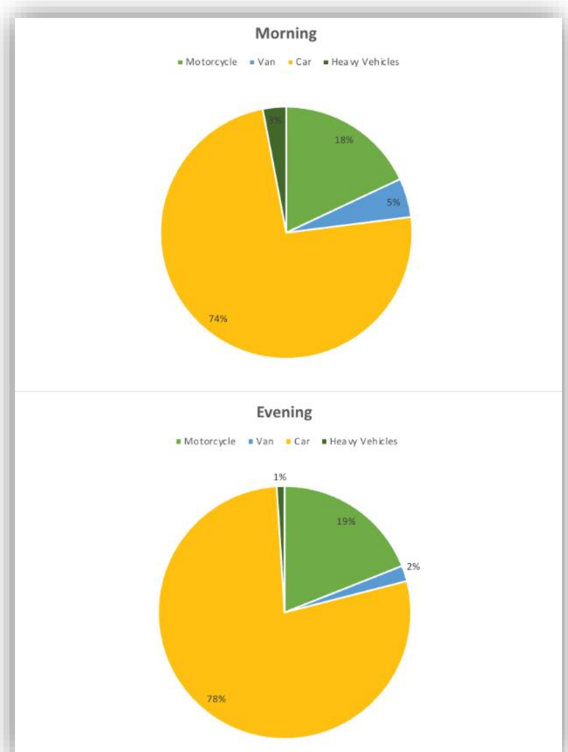


Figure 13 Percentage of different types of vehicles during the weekend in Residential Areas

Figure 14 shows the correlation between traffic volume and noise level in the construction area on a weekday in the morning daytime for 30 minutes duration. The construction area is selected due to the source of noise that is majorly contributed from that construction area. The graph shows that an increase in traffic volume will increase the level of noise, based on previous research findings [16], [17], and [18]. The highest traffic volume for the 1-minute interval was counted to be 65 vehicles at 9.24 a.m., with a high noise level of 89.7 dBA. However, the finding also shows that when there is an increase in traffic volume, the noise level will drop. The graph shows this situation at 9.15 a.m. minutes, the traffic volume was 64 vehicles, which was the second-highest of traffic volume, with a noise level of 70.9 dBA. This may be due to the low-speed movement of the vehicles with fewer intensity accelerations during that hour, which contributes to a low noise level [9] and [19].

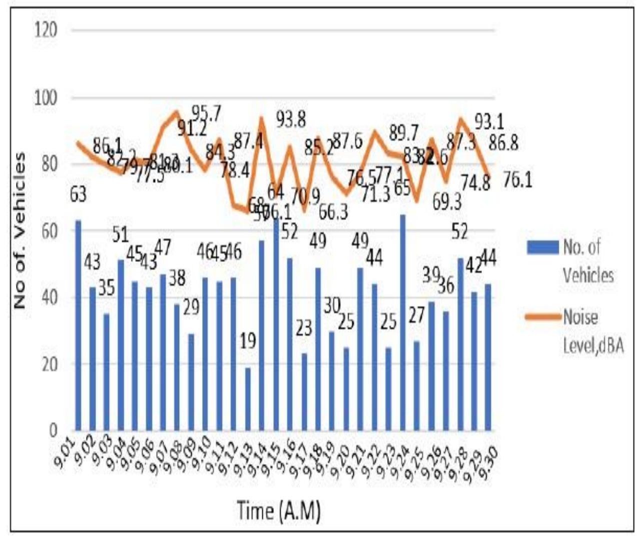


Figure 14 Relationship between noise level and traffic volume at construction area during weekday in morning daytime

For the past 10 years, construction projects have been the second-largest source contributing to environmental noise pollution in Malaysia. This can be seen through four different construction projects analysis in Malaysia which are Petronas refinery extension projects, MG-3, Jana Manjung power station in Perak, roller compacted concrete plant in Semenyih, and co-generation plant in Melaka. Noise pollution monitoring carried out on 16-17th April 2003 showed that the noise level varied between 45.2 dBA and 76.2 dBA during daytime and 42.8 dBA-56 dBA during nighttime [20]. These findings have created awareness of noise control strategies at site construction to avoid the impact of high noise levels [21] & [22]. Acoustic measurements can be conducted in various settings to evaluate noise pollution levels and identify potential mitigation measures. Highways can be measured for noise pollution caused by road traffic and compared to noise levels in nearby residential areas. Train stations can be evaluated for noise pollution caused by passing trains, and mitigation measures can be identified. Industrial areas may have high noise pollution levels due to heavy machinery and equipment, and acoustic measurements can be conducted to assess the extent of the noise. Hospitals can also be assessed for noise pollution in different areas, and potential mitigation measures can be identified to improve the patient experience. Similarly, schools can be evaluated for noise pollution, and potential measures can be identified to create a better learning environment [23] & [24].

4.0 CONCLUSION

This study shows that both study sites experienced high noise levels which exceeded the maximum permissible limit of 60dBA, according to Malaysian guidelines, except for weekdays in residential areas during the evening (non-peak hours) and for the weekend during the morning in residential areas. Independent t analysis has shown that the mean noise levels were higher in the construction area compared to the residential area due to the high traffic density. The results obtained from the volume of the vehicle study show of cars (76%, 71%, and 70 % during weekdays, and 78%, 77%, and 74% during weekends) were much higher compared to other vehicles at both studies sites. Therefore, it can be concluded that there was increased population growth at Seri Kembangan using cars, which has indirectly contributed to the noise emission on the roads. Lastly, the correlation between vehicle volume and traffic noise indicates a relationship between those two variables, as an increase in vehicle volume leads to higher noise production. However, further investigation is necessary to measure the traffic noise levels in other residential and construction areas in Seri Kembangan, Selangor. In order to minimize noise pollution, various methods can be employed, depending on the location, source, and objectives of the noise reduction project. Common techniques include constructing noise barriers, utilizing sound-absorbing materials, isolating vibrations, modifying the noise source, or enclosing it. The reduction of noise should be based on a comprehensive assessment of the acoustic environment, taking into account the specific requirements of the project. It is crucial to consider potential unintended consequences, such as decreased worker productivity or the creation of new sources of noise.

Conflicts of Interest

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

Acknowledgement

This research has been fully supported by the School of Civil Engineering, College of Engineering, Universiti Teknologi MARA. The approved funds have made this important research viable and effective.

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