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Evaluation of Traffic Noise Level in Residential Areas Along Jalan Kluang - Case Study in Sri Gading, Batu Pahat, Johor

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Abstract: Noise, recognized as an adverse factor affecting human health and overall well-being, poses a significant public health concern. This study focuses on evaluating the traffic noise levels in residential areas along Jalan Kluang. Measurements were conducted in four selected residential areas, namely Taman Sri Saga, Taman Cempaka Putih, Kampung Kluang, and Taman Bahagia Baru, during morning (7.30 am - 9.30 am) and evening (4.00 pm - 6.00 pm) peak hours on weekdays. The results indicated that certain locations exceeded the noise limit that set by the Department of Environment (DOE). Kampung Kluang exhibited LAeq values of 71.10 dBA and 71.48 dBA during the morning and evening peak hours, respectively, surpassing the DOE noise limit. Taman Cempaka Putih also recorded noise levels, with LAeq values of 69.40 dBA and 66.46 dBA during the morning and evening peak hours, respectively. In contrast, Taman Sri Saga and Taman Bahagia Baru demonstrated LAeq values still below the DOE limit during both peak hours. Taman Sri Saga recorded LAeq values of 55.63 dBA and 57.78 dBA, while Taman Bahagia Baru recorded LAeq values of 57.58 dBA and 59.65 dBA during the morning and evening peak hours, respectively. Therefore, it is crucial to address the excessive noise levels in the affected residential areas to mitigate the detrimental effects and ensure a healthier living environment for the affected residents in those areas.

Keywords: Noise, traffic noise levels, L_{Aeq}, residential areas

1. Introduction

Noise can be defined as unpleasant sounds that are deemed harmful to both a person's well-being and their quality of life [1]. Noise can come from various sources. Road traffic significantly contributes to noise pollution in urban environments, with various types of vehicles, including trucks, buses, tractors, sport motor vehicles (SUV), motorcycles, and cars, playing a major role in generating traffic-related noise [2]. A recent survey in India had showed that nearly half of the respondents from Udaipur City response that land vehicles were the primary source of noise pollution [3]. Besides, in European countries, over 50.6 million people were exposed to road transportation noise levels exceeding 55 dB during the day, evening, and night (Lden) [4]. This proves that a significant number of individuals have been exposed to traffic-related noise pollution.

Noise has detrimental effects on health and lifestyle. Exposure to environmental noise, especially traffic noise, can lead to various negative impacts on the body, including cardiovascular disease, insomnia, cognitive decline in children, psychological issues, hearing system damage, obesity, and more [5] - [6]. A study in Muscat, Oman revealed that a significant portion of the population experienced annoyance at both their home and work environments due to elevated

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traffic noise during the night [4]. Then, from 2016 to 2017, about 39% or approximately 2,494,000 individuals in New York faced recurring sleep difficulties caused by traffic noise. Furthermore, exposure to intense noise can lead to temporary increases in blood pressure, heart rate, and vasoconstriction [7]. A study involving 225 interviews found that 25% of the participants experienced chronic health conditions such as hypertension, diabetes, depression, high cholesterol, and cardiovascular diseases due to exposure to traffic noise [8]. From this, it shows that exposure to traffic noise can have significant negative impacts on health and well-being.

Numerous studies have been carried out to assess the number of people exposed to traffic noise. A study conducted in Chancheng District, China identified that two of their study locations exceeded the nighttime traffic noise limit, with one recording a noise level of 49.9 dBA and the other ranging from 60 to 65 dBA [9]. In Malaysia, a study discovered that Desa Tun Razak in the Klang Valley Region experiences notable noise pollution mainly caused by weekday traffic. The study found that noise levels in this area reach 75.7 dBA during the day and 73.4 dBA at night, surpassing the noise standards set by both the Department of Environment (DOE) and the World Health Organization (WHO) [10]. Batu Pahat is an area experiencing urbanization and an expanding traffic network. Jalan Kluang serves as the main road connecting Batu Pahat, Ayer Hitam, and Kluang. Jalan Kluang had a total of 18,986 vehicles [11]. The significant vehicle volume on this road contributes to traffic noise, which affects nearby residential areas. A study conducted in Batu Pahat found that the average noise level on Jalan Kluang was 73.7 dBA on weekdays and 76.2 dBA on weekends [12]. These levels exceed the limits set by the Department of Environment (DOE), indicating areas in Batu Pahat exposed to excessive noise. Another recent study had been showed that certain residential areas along Jalan Kluang had exceeded the noise level set by DOE [13]. Therefore, the objective of this study was to determine the traffic noise level in the selected residential areas along Jalan Kluang, especially in the Sri Gading areas. Then, the collected A-weighted noise level, LAeq of residential areas are compared with the DOE standard. This investigation seeks to enhance our knowledge of the traffic noise produced by this road and offer valuable insights for future research and development purposes.

2. Methodology

Four residential areas along Jalan Kluang were chosen to assess the traffic noise level generated in each area. Each residential area uses one point to measure the traffic noise levels. Table 1 provides details of the chosen residential areas and their respective sampling coordinates. Fig. 1 illustrates the specific locations of the residential areas selected for this study. These locations were chosen because they are close to Jalan Kluang, which makes them more vulnerable to traffic noise from the road.

In this study, a SLM-25 Sound Level Meter with data logging capability was utilized to measure the traffic noise level. The sound level meter was positioned at a height of 1.3 m above the ground and placed at more than 1.5 m from the nearest house in each selected study area. The distances between the buildings and the road to the data logger are illustrated in Fig. 2. The traffic noise level was measured using a data logger, which recorded the noise level every second for two hours during peak hours. This guarantees that the data logger consistently records the sound pressure level every second for two hours. The data collection process was repeated on three separate days to calculate the average sound pressure level.

Table 1 - Selected residential areas and sampling coordinates

Mark	Residential Area	Sampling Coordinates
S1	Taman Sri Saga	1.8636542144199124, 102.96740223106056
S2	Taman Cempaka Putih	1.866892233413986, 102.97306556370539
S3	Kampung Kluang	1.869921751376977, 102.98257071507724
S4	Taman Bahagia Baru	1.868593768126392, 102.99475080984817

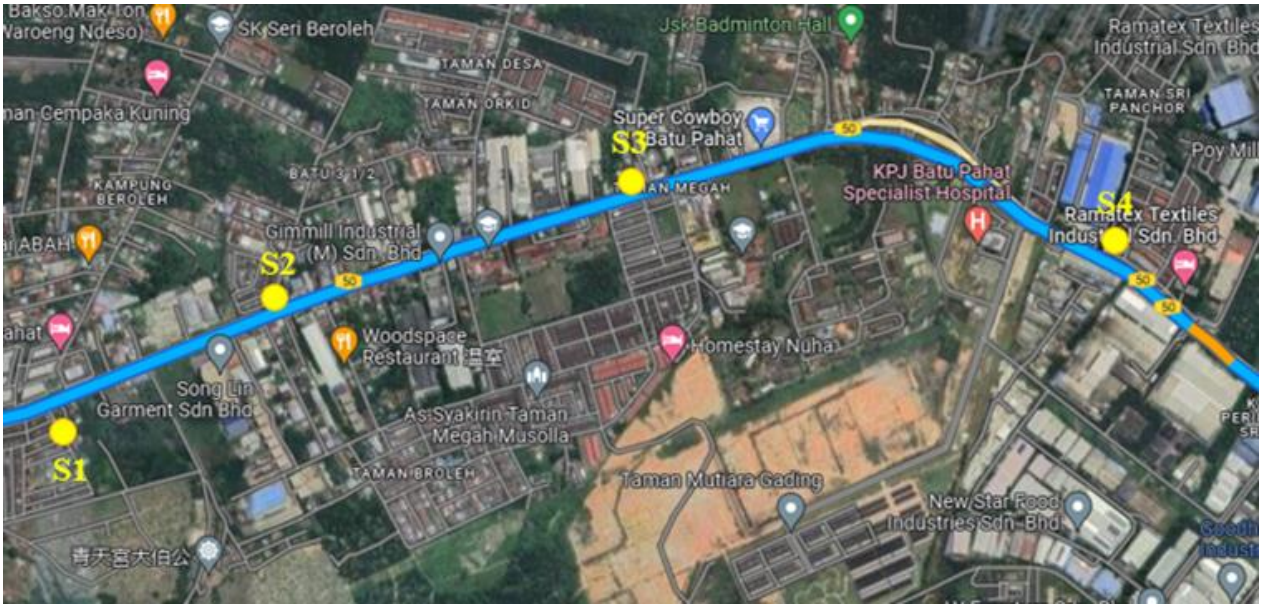

Fig. 1 - Measurement locations within the residential areas along Jalan Kluang

Simultaneously, vehicle classes were identified during the observation of traffic noise levels. Vehicle classes from both sides of the road were identified every 15 minutes, with a total duration of 2 hours for the traffic count. The measurement involved four categories of vehicles: motorcycles (Class 1), cars (Class 2), vans and medium trucks (Class 3), and heavy trucks and buses (Class 4). This classification ensured accurate identification of vehicle classes. The MultiCounter Application used to assist the collection of traffic volume on Jalan Kluang, Batu Pahat, Johor.

The measurement and analysis of traffic noise level are crucial in this study. In order to determine the traffic noise level in the study area, the A-weighted equivalent continuous noise level ($\mathbf{L_{Aeq}}$) was calculated using Eq. (1) [14].

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

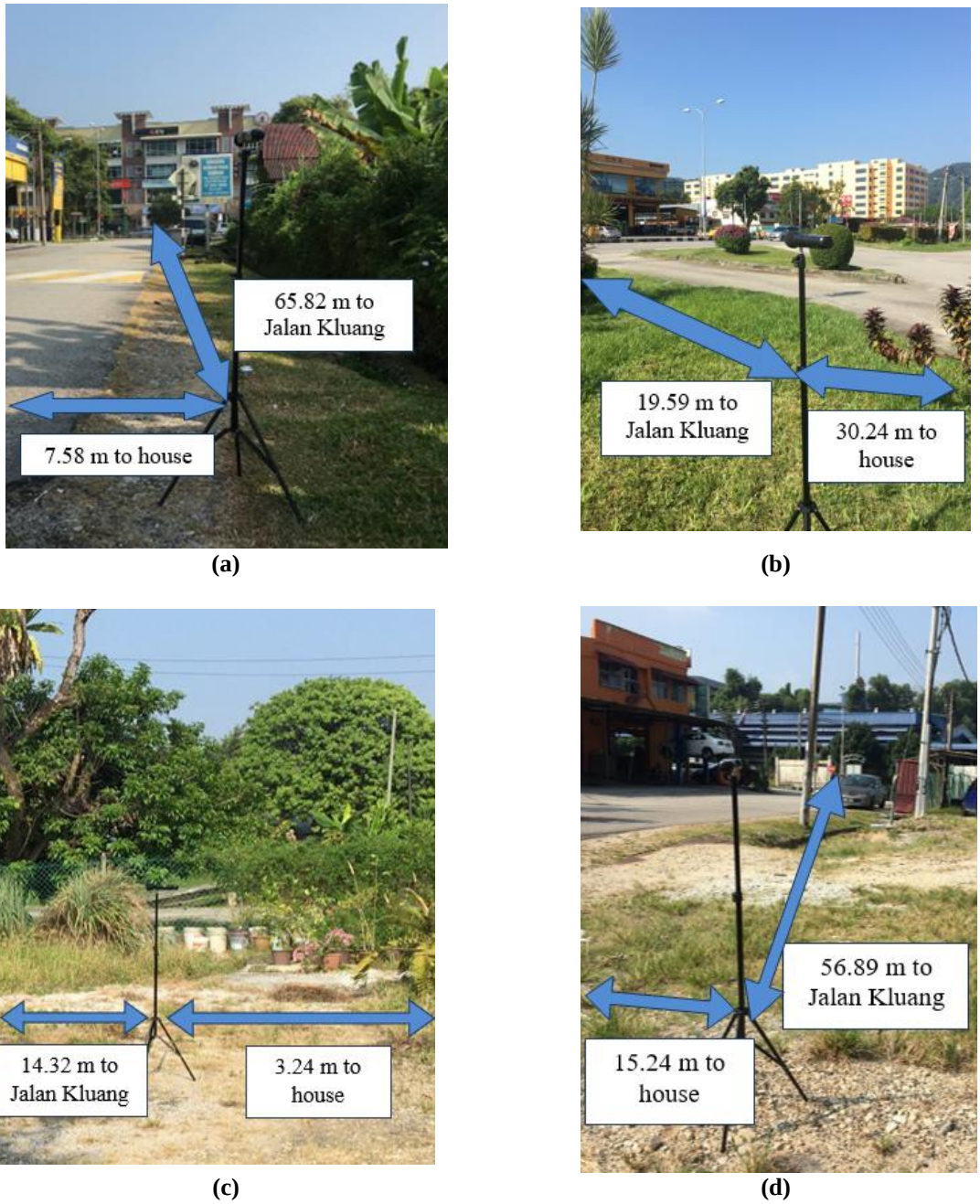

Fig. 2 - Measurement locations (a) Taman Sri Saga; (b) Taman Cempaka Putih; (c) Kampung Kluang; (d) Taman Bahagia Baru

3. Results and Discussions

The measurement of traffic noise level and traffic volume was conducted simultaneously on three different days in each of the chosen residential areas. These measurements were taken for two hours during both morning and evening peak hours. The MultiCounter application was utilized to gather the traffic volumes of the selected residential areas. In terms of assessing the traffic noise level, the A-weighted equivalent continuous noise level (L_{Aeq}) served as the primary parameter in this study. L_{Aeq} represents the average sound level present in an area over a specific time. A data logger was used to record the noise level every second for two hours during peak hours.

Table 2 - Results of traffic noise levels in four residential areas

Location	Time	L_{Aeq} (dBA)	L_{max} (dBA)	L_{min} (dBA)	L_{90} (dBA)	Traffic Volume	Noise Level by DOE (dBA)
Taman Sri Saga	am	55.63	84.11	39.43	47.80	6693	65
	pm	57.78	84.77	41.60	49.53	6614	
Taman Cempaka Putih	am	**69.40**	93.66	47.60	61.91	4565	
	pm	**66.46**	85.30	53.27	61.37	5503	
Kampung Kluang	am	**71.10**	91.84	59.63	65.80	7288	
	pm	**71.48**	90.29	60.95	66.15	7462	
Taman Bahagia Baru	am	57.58	79.10	44.85	51.14	6442	
	pm	59.65	86.56	46.96	53.50	6972	

Table 2 shows the traffic noise levels measured in different locations, namely Taman Sri Saga, Taman Cempaka Putih, Kampung Kluang, and Taman Bahagia Baru. The data includes measurements taken during both morning (am) and evening (pm) peak hours, along with various parameters such as L_{Aeq} (A-weighted equivalent continuous noise level), L_{max} (maximum noise level), L_{min} (minimum noise level), L_{90} (noise level exceeded for 90% of the time), traffic volume, and the noise level limit set by the Department of Environment (DOE).

According to the table, Taman Sri Saga had relatively lower noise levels, with L_{Aeq} values of 55.63 dBA in the morning and 57.78 dBA in the evening. Taman Cempaka Putih exhibited higher noise levels, with L_{Aeq} values of 69.40 dBA in the morning and 66.46 dBA in the evening. Kampung Kluang had the highest recorded noise levels, with L_{Aeq} values of 71.10 dBA in the morning and 71.48 dBA in the evening. Taman Bahagia Baru had moderate noise levels, with L_{Aeq} values of 57.58 dBA in the morning and 59.65 dBA in the evening. These results provide an overview of the noise levels in each location during peak hours.

Then, based on Table 2, some locations have exceeded the DOE noise level limit of 65 dBA, while others have stayed below it. Kampung Kluang had the highest recorded traffic noise levels, exceeding the DOE limit of 65 dBA. With L_{Aeq} values of 71.10 dBA in the morning and 71.48 dBA in the evening, significant noise pollution was observed in Kampung Kluang, which could negatively impact resident well-being. Similarly, Taman Cempaka Putih also surpassed the noise level limit, with L_{Aeq} values of 69.40 dBA in the morning and 66.46 dBA in the evening. In contrast, Taman Sri Saga and Taman Bahagia Baru exhibited relatively lower noise levels within the acceptable range, with Taman Sri Saga recording L_{Aeq} values of 55.63 dBA in the morning and 57.78 dBA in the evening, and Taman Bahagia Baru recording L_{Aeq} values of 57.58 dBA in the morning and 59.65 dBA in the evening. These findings emphasize the need to address noise pollution in Kampung Kluang and Taman Cempaka Putih, while highlighting the more favorable acoustic environment in Taman Sri Saga and Taman Bahagia Baru to ensure resident well-being and maintain a healthier soundscape. The results from the current study recorded higher noise levels compared to the previous study at different residential areas along Jalan Kluang [13].

The traffic volume at each location plays a significant role in the recorded noise levels. Referring to the same table, Kampung Kluang had the highest traffic volume with 7,288 vehicles during the morning and 7,462 vehicles during the evening peak hours. Followed by Taman Sri Saga, Taman Bahagia Baru, and Taman Cempaka Putih, the traffic volumes recorded in the morning and evening peak hours are 6,693 and 6,614 vehicles, 6,442 and 6,972 vehicles, and 4,565 and 5,503 vehicles respectively. These numbers indicate varying levels of vehicular activity in each location. Kampung Kluang stands out with the highest traffic volume, indicating a significant presence of vehicles during both the morning and evening hours. This high traffic volume may contribute to the elevated noise levels observed in Kampung Kluang. Taman Cempaka Putih demonstrates a relatively lower traffic volume compared to Kampung Kluang but still exhibits high noise levels. This suggests that factors other than traffic volume may contribute to the higher noise levels in Taman Cempaka Putih. Factors such as being near to Jalan Kluang cause this residential area to have a relatively high L_{Aeq} reading. In contrast, Taman Sri Saga and Taman Bahagia Baru demonstrate relatively

moderate traffic volumes compared to the other two locations. Despite having high traffic volumes compared to Taman Cempaka Putih, Taman Sri Saga and Taman Bahagia Baru recorded L_{Aeq} levels below the noise limit. This can be explained by their locations being further away from Jalan Kluang, resulting in lower L_{Aeq} readings. However, comparing between these two locations, Taman Bahagia Baru has recorded a higher level of L_{Aeq} compared to Taman Sri Saga because Taman Bahagia Baru has recorded a higher volume of traffic. Consequently, the increase in vehicle quantity contributes to greater noise production, ultimately resulting in higher L_{Aeq} readings.

In conclusion, the table provides an overview of the noise levels in different locations during peak hours, indicating variations in noise pollution. It highlights locations that exceed the DOE noise level limit, potentially posing risks to residents' health and well-being. The traffic volumes observed in the locations with the highest and lowest L_{Aeq} values further contribute to the understanding of noise levels, with higher traffic volumes often associated with higher noise levels.

4. Conclusion

This study aimed to evaluate the traffic noise levels in four residential areas situated along Jalan Kluang, Batu Pahat. The assessment was conducted on three different days, considering both morning and evening peak hours. The L_{Aeq} values were recorded for a duration of two hours during the peak hours and were later compared to the noise level standards set by the Department of the Environment (DOE). In addition to L_{Aeq}, parameters such as L_{max}, L_{min}, and L90 were also measured to provide a thorough analysis of the research findings.

The findings reveal that some residential areas have exceeded the noise level limit set by the DOE. For instance, Kampung Kluang recorded L_{Aeq} values of 71.10 dBA and 71.48 dBA during the morning and evening peak hours respectively, surpassing the permissible limit of 65 dBA. Similarly, Taman Cempaka Putih had noise levels of 69.40 dBA and 66.46 dBA during the respective peak hours, exceeding the DOE limit as well. In contrast, Taman Sri Saga and Taman Bahagia Baru demonstrated lower noise levels below 65 dBA. Taman Sri Saga recorded L_{Aeq} values of 55.3 dBA and 57.78 dBA, while Taman Bahagia Baru had levels of 57.58 dBA and 59.65 dBA during the respective peak hours.

Among the assessed locations, Kampung Kluang and Taman Cempaka Putih have been identified as having a poor quality of acoustical environment. These areas recorded noise levels that exceeded the permissible limit set by the DOE, indicating a significant issue of noise pollution. On the other hand, Taman Sri Saga and Taman Bahagia Baru demonstrated relatively lower noise levels, suggesting a better acoustical environment. Residents in these areas may experience a quieter and more peaceful living environment. It is important to address the excessive noise levels in Kampung Kluang and Taman Cempaka Putih to improve the acoustical environment and ensure the well-being of residents.

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References

[1] Maite S., María J. G. T., Pablo F. & María T. Z. (2022) Noise Disturbance and Well-Being in the North of Spain, *International Journal of Environmental Research and Public Health, 19(24)*, 16457, https://doi.org/10.3390/ijerph192416457

[2] Muralikrishna, I. V., & Manickam, V. (2017). Chapter Fifteen - Noise Pollution and Its Control. *Environmental Management, Science and Engineering for Industry* (pp. 399–429). Elsevier. https://doi.org/10.1016/B978-0-12-811989-1.00015-4

[3] Samdani, P., & Singhvi, B. S. (2021, August 24). An Assessment of Noise Pollution at Some Critical Locations of Udaipur City by the Use of Sound Level Metre [Virtual conference session]. *Proceedings of International Conference on Communication and Computational Technologi*. https://doi.org/10.1007/978-981-16-3246-4_38

[4] European Environment Agency. (2020). Environmental noise in Europe - 2020. In European Environment Agency (Issue 22/2019). https://op.europa.eu/en/publication-detail/-/publication/ed51a8c9-6d7e-11ea-b735-01aa75ed71a1/language-en

[5] Gupta, A., Gupta, A., Jain, K., & Gupta, S. (2018). Noise Pollution and Impact on Children Health. *Indian Journal of Pediatrics*, *85*(4), 300–306, https://doi.org/10.1007/s12098-017-2579-7

[6] Singh, D., Kumari, N., & Sharma, P. (2018). A Review of Adverse Effects of Road Traffic Noise on Human Health. Fluctuation and Noise Letters, 17(1), 1–12. https://doi.org/10.1142/S021947751830001X

[7] Amoatey, P., Omidvarbona, H., Baawain, M. S., Al-Mayahi, A., Al-Mamun, A., & Al-Harthy, I. (2020). Exposure assessment to road traffic noise levels and health effects in an arid urban area. *Environmental Science and Pollution Research*, 27(28), 35051–35064, https://doi.org/10.1007/s11356-020-09785-y

[8] Ihemeje, J., & Onyelowe, K. C. (2021). State-of-the-art review on the assessment and modelling of traffic noise intensity on roadside dwellers: The Port Harcourt, Nigeria case. *Cleaner Engineering and Technology*, 5, 100328. https://doi.org/10.1016/j.clet.2021.100328

[9] Yang, W., He, J., He, C., & Cai, M. (2020). Evaluation of urban traffic noise pollution based on noise maps. *Transportation Research Part D: Transport and Environment*, 87(August), 102516, https://doi.org/10.1016/j.trd.2020.102516

[10] Halim, H., Abdullah, R., Nor, M. J. M., Aziz, H. A., & Rahman, N. A. (2017, August 8 - 9). Assessment of road traffic noise indices in urban residential areas of Klang Valley, Malaysia. *Proceedings of the International Conference of Global Network for Innovative Technology and AWAM International Conference in Civil Engineering (IGNITE-AICCE'17). AIP Conference Proceedings*, 1892(1), 1–8. https://doi.org/10.1063/1.5005682

[11] Transport Statistics Malaysia. (2021). *Statistik Pengangkutan Malaysia 2021*. *https://www.mot.gov.my/my/Statistik%20Tahunan%20Pengangkutan/Statistik%20Pengangkutan%20Malaysia%202021.pdf*

[12] Rosehan, N. S., & Abas, A. (2019). Pencemaran Bunyi Bising Trafik di Bandar Batu Pahat Johor. *Akademika*, 89(2), 97–109, http://journalarticle.ukm.my/15018/1/27336-106514-1-PB.pdf

[13] Segaran, V. C., Tong, Y. G, Abas, N. H., Daniel, B. D., Nagapan, S., Kelundapyan, R. (2020, August 26-27). Traffic Noise Assessment among Residential Environment in Batu Pahat, Johore, Malaysia. *Proceeding of The 2nd Global Congress on Construction, Material and Structural Engineering. IOP Conference Series: Materials Science and Engineering, 713, 012049. https://iopscience.iop.org/article/10.1088/1757-899X/713/1/012049/pdf*

[14] Davies, M. L., & Cornwell, D. A. (2008). *Introduction to Environmental Engineering*. McGraw-Hill.