Proceedings of the Eastern Asia Society for Transportation Studies, Vol. 5, pp. 1815 - 1826, 2005

EVALUATING TRANSPORTATION IMPACT ON ENVIRONMENT IN A RESIDENTIAL AREA IN KUALA LUMPUR

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Abstract: This paper investigates impact of transportation on environmental elements such as noise and air pollution. Field surveys were administered to measure traffic volume, noise and air pollution level near a residential area at Taman Melati, Kuala Lumpur, Malaysia. Noise level meters were used to measure noise level at 74 selected points including one fixed point. Measurement on noise levels such as L_{Aeq}, $L_A$max, L_5, L_{10}, L_{50}, L_{90} and L_{95} was undertaken for about 12 hours at every 15 minutes time interval at fixed point and for 10 hours at movable points at the study area. NO_2 concentration (μg) was measured by using a simple polystyrol capsule. About 238 measurement points were selected fixing three capsules at each measurement point at streetlight poles and other relevant road furnitures at a distance of 1.5 m from the ground level. The capsules were left for about 24 hours. A 12-hour traffic volume count at selected traffic count stations was also conducted.

Key Words: traffic volume, air pollution, noise pollution, residential area, Kuala Lumpur

1. INTRODUCTION

It is highly imperative to live in a conducive environment to maintain a healthy and progressive lifestyle for the benefits of the nation. Human resource is a vital component to help boosts social and economic strength of a nation. People living at one place and working at another place is a very common phenomenon of a society. Protective living environment, free from noise, air and visual pollutions, at residential areas would necessitate healthy lifestyle which in turn makes complete and continued involvement at the workplace. Many factors are directly responsible for a better living environment in a residential area. Some factors may be visible

and others may not. To exemplify, factors such as noise and air pollution are not clearly visible but are subjected to wide detrimental effects on human lifestyle if they are not controlled thoroughly. Prolonged exposure to noise and air pollution may cause permanent physical damages to the people in particular and society in general. It is also equally important for the people living in a residential area to know the allowable noise and air pollution level that they are subjected to for them to prevent against any further damages for their well-being. Moreover, it will also help them to keep their interest to stay at the present residential area.

This paper investigates impact of transportation especially increase in traffic volume on environment in a residential area in Kuala Lumpur. The environmental elements include noise pollution and air pollutiona as they constitute detrimental effect to the living environment of the residents, if left unchecked. Field surveys were administered to measure traffic volume, noise and air pollution level near a residential area at Taman Melati, Kuala Lumpur, Malaysia. Noise level meters were used to measure noise level at 74 selected points including one fixed point. Measurement on noise level such as L_{Aeq}, $L_A$max, L_5, L_{10}, L_{50}, L_{90} and L_{95} was undertaken for about 12 hours at every 15 minutes time interval at fixed point and for 10 hours at movable points at the study area. NO_2 concentration (μg) was measured by using a simple polystyrol capsule. About 238 measurement points were selected fixing three capsules at each measurement point at streetlight poles and other relevant road furnitures at a distance of 1.5 m from the ground level. The capsules were left for about 24 hours. Finally, 12-hour traffic volume count at selected traffic count stations was conducted. Analysis and findings on each of the measured elements is reported in the following sections of the paper.

2. STUDY METHODOLOGY

2.1. Background of Study Area

It is considered important to describe Malaysia briefly before introducing the study area. Malaysia, an area of 329, 758 sq. km., is located between latitudes 1 and 7 degrees north and longitudes 100 and 119 degrees east with Thailand at the north of Peninsular Malaysia and Republic of Singapore at the south. Enjoying a tropical climate, Malaysia has warm and humid weather throughout the year. Temperatures in the lowlands range between 22 and 32 degrees centigrade while in the highland, it ranges between 16 and 23 degrees centigrade. Rainfall averages around 2500 mm a year. The population of Malaysia is 23.3 million (Government of Malaysia, 2000) which includes three main ethnic groups namely Malays, Chinese and Indians. Kuala Lumpur, the capital city of Malaysia, has a land area of 243 sq.km. with a population of 1.42 million (Government of Malaysia, 2000). The ethnic classification of Kuala Lumpur

population (Government of Malaysia, 2000) includes Malay (38%), Chinese (43%), Indians (10%) and others (9%). Kuala Lumpur is located between 30 m and 200 m above average mean sea level (Structure Plan of KL 2020).

Taman Melati, the study area, is located at the northeast of Kuala Lumpur. Taman Melati, a small residential neighborhood, accommodates different categories of residential types such as terrace houses, semi-detached houses, link houses and apartment houses. It also accommodates railway station, large open spaces and alignment of an arterial road close to the study area. Taman Melati was selected as the study area for this research because it encompasses different types of residential areas such as terrace houses, semi-detached houses, link houses and apartment type houses. The alignment of an arterial road running very close to the neighborhood and the location of a railway station which may cause detrimental effect to the living environment of the residents, if not controlled properly, were the reasons for selecting Taman Melati as the study area. Additionally, the study area is also located at very close proximity to the University of one of the researchers.

2.2. Field Survey

A reconnaissance survey was conducted in the late August 2003 to choose study area and initial preparation on the collection of data. The main field survey on noise level, air pollution, traffic volume were conducted from 17th October to 25th October 2003. The details of the measurement on each of the elements are explained in the following subsections:

2.2.1. Measurement of Traffic Volume

A 12-hour, 7.15 a.m. to 7.15 p.m., traffic volume count at four selected traffic count stations were conducted including peak-hour. The traffic count stations include arterial road, collector road and local roads. The composition of traffic volume consists of four categories: category A include motorcars and taxis; category B buses, lorries, and trucks and trailer; category C vans and pickup trucks; category D motorcycles and scooters. Traffic volume was undertaken covering both directions at the selected roads.

2.2.2. Measurement of Noise Level

About 74 points that includes one fixed point and 73 movable points were selected to measure noise level. Fixed point was chosen to measure noise level at different period of the day and to ascertain disparity in noise level during the measurement period. The noise level at the fixed point was measured at every 15 minutes time interval for about 12 hours from 7.00 a.m. to 7.00

p.m. A noise level meter was stationed at a suitable location near the roadside of the arterial road at a distance of 1.2 m from the ground level. On the other hand, the noise level at the movable points was measured from 8.30 a.m. to 7.00 p.m. At every 15 minutes time interval, the noise level meter was moved to another selected point to measure noise level at that particular point and the process continued until the completion of all measurement points. The noise level meter at each of the movable points was located at the centre of 100 m x 100 m square mesh and at a distance of 1.2 m from ground level to measure noise level. The noise level values such as L_{Aeq}, L_{Amax}, L_5, L_{10}, L_{50}, L_{90} and L_{95} were measured both at the fixed and movable points.

2.2.3. Measurement of NO_2 Concentration

NO_2 concentration (μg) was measured by using a simple polystyrol capsule. About 238 measurement points were selected at the study area. Three capsules at each measurement point were fixed at the streetlight poles and other relevant road furnitures at a distance of 1.5 m from the ground level. The capsules were left for about 24 hours from 10 a.m. to 10 a.m. the following day. However, only 227 capsules were collected from the study area and thus accounting for 95% collection rate. Additionally, three permanent air-monitoring stations at Gombak, Petaling Jaya and Kuala Lumpur were also chosen to measure NO_2 level.

3. IMPACT OF TRANSPORT ON NOISE AND AIR POLLUTION

The findings on traffic volume, air and noise pollution levels are reported in the following subsections.

3.1. Traffic Volume

Average traffic volume (vehicles per hour) on each of the selected roads near Taman Melati is shown in figure 1. Traffic volume was observed to be very high along the main arterial road. Average traffic volume along the MRR2 (arterial road) was 7800 vehicles per hour, Persiaran Pertahanan (collector road) was 1300 vehicles per hour, Jalan 2/5 and Jalan 8/5 (local roads) were 500 vehicles per hour, and 400 vehicles per hour respectively.

Figure 2 shows hourly fluctuation trend of traffic volume on each of the selected road. Traffic volume was counted to be more than 12000 vehicles per hour during morning and evening peak hour along the major arterial road. Generally, traffic volume during peak hour was between 1.7 and 2.7 times than traffic volume during non-peak hour.

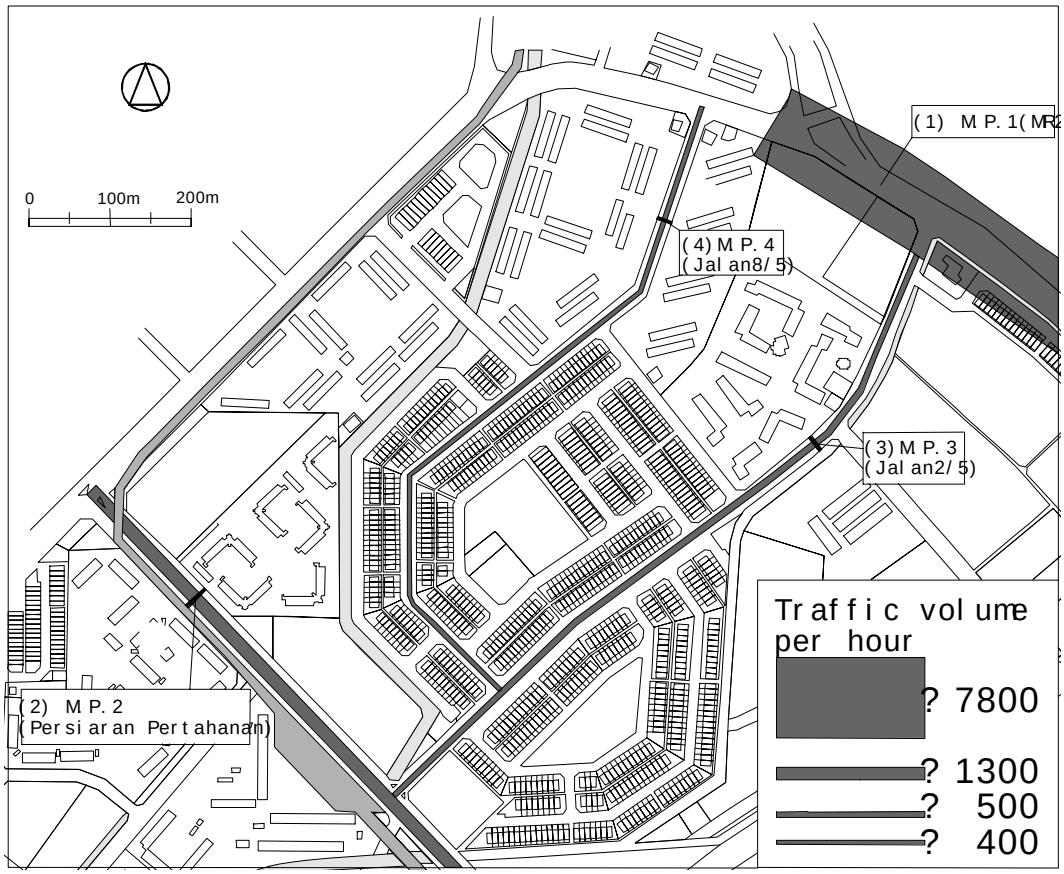

Figure 1. Average Traffic Volume Per Hour

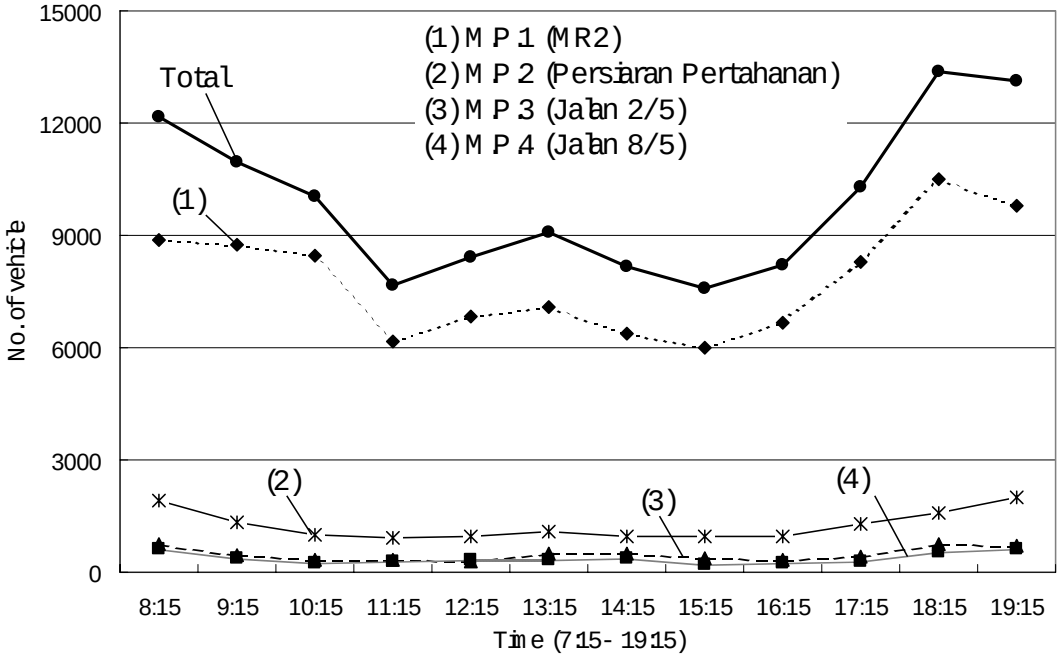

Figure 2. Hourly Fluctuation of Traffic Volume

The classified hourly fluctuation of traffic volume at each of the selected roads is given from figure 3 to figure 6. Generally, car traffic was observed to be higher than other mode of vehicles for each of the selected roads during the survey period. It is due to increased number of commuters using car as the main mode of transport for various trip purposes. Additionally, at present, the operationalization of public transport services in Kuala Lumpur is ranked at low level.

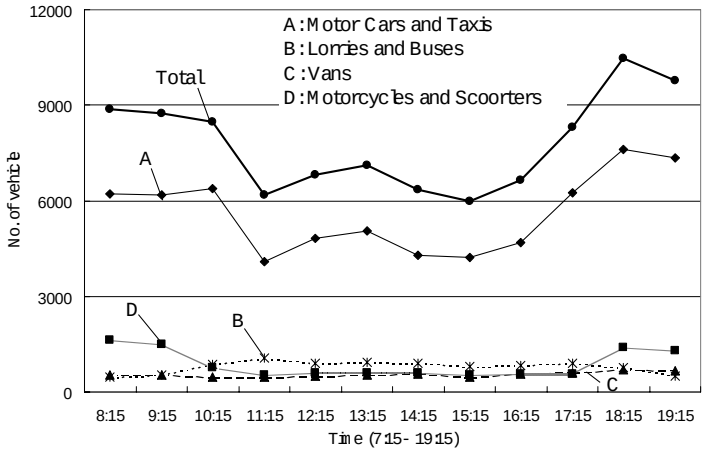

Figure 3. Hourly Fluctuation of Traffic Volume along MRR2

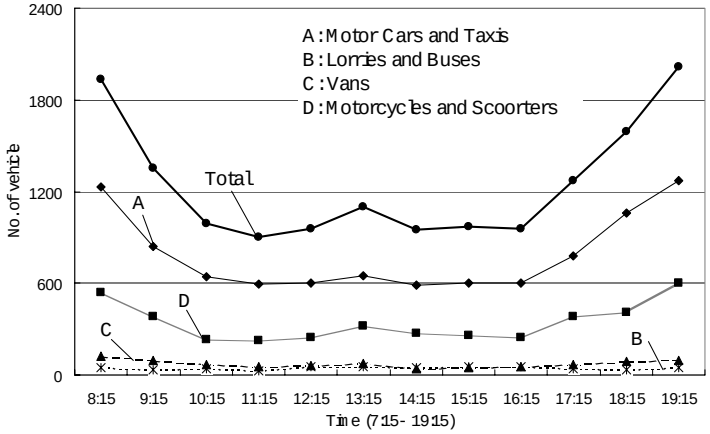

Figure 4. Hourly Fluctuation of Traffic Volume along Persiaran Pertahanan

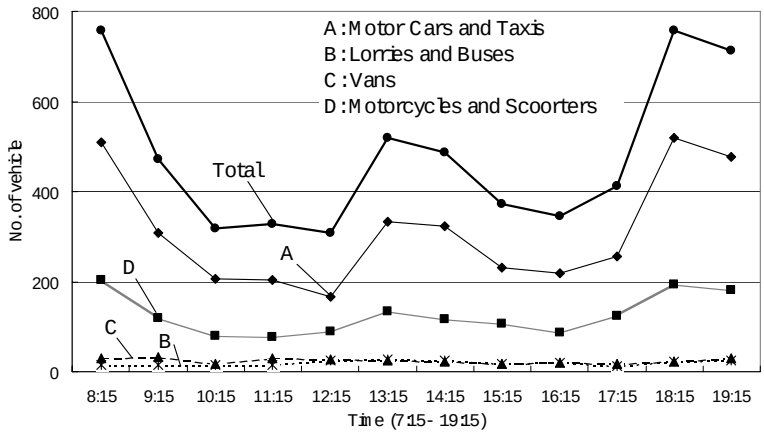

Figure 5. Hourly Fluctuation of Traffic Volume along Jalan 2/5

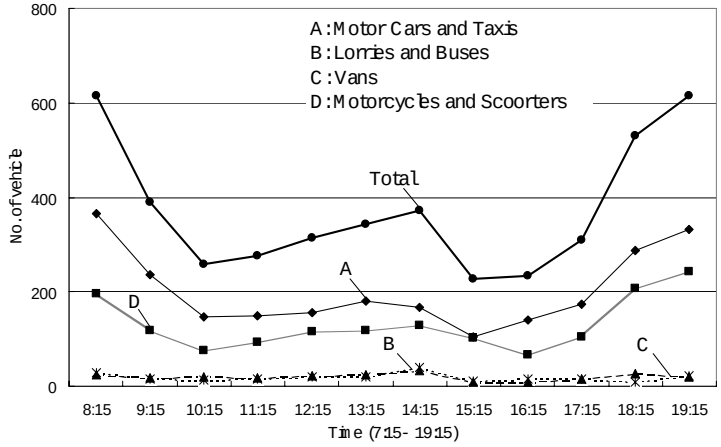

Figure 6. Hourly Fluctuation of Traffic Volume along Jalan 8/5

3.2. Noise Level

Each of the noise components such as L_5, L_{50}, L_{95} and L_{Aeq} had shown an interesting pattern of noise level in dB(A). The fluctuation of the noise level at the fixed point at every 15 minutes time interval is shown in figure 7. Generally, the noise level between 7.30 a.m and 8.30 a.m. was found to be higher than other time of the measuring day. Increased traffic volume during peak hour is the likely cause of this trend. The analysis also showed that the maximum fluctuation of L_{Aeq} was 3 dB indicating steady noise level during observation period. The average of L_{Aeq} near the major arterial road was calculated to be 75.6 dB.

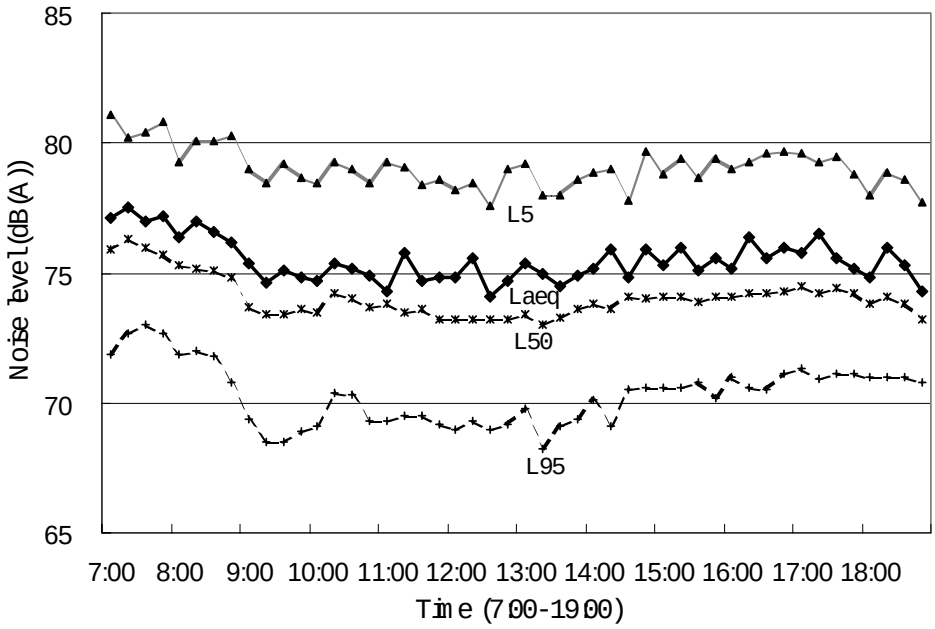

Figure. 7. The Fluctuation of the Noise Level at 15 minutes Time Interval (Fixed Point)

Figure 8 shows the spatial distribution of L_{Aeq} at each of the measurement points (movable

points). The noise levels at the selected study area were measured to be in the range 50-70 dB, which are considered comparatively higher. Few noise level readings near terrace houses were exceeded 70 dB because of construction activities during the survey period. The noise levels in the parks, parking area, and open spaces near the apartment houses were about 50-60 dB. However, there is only one point where the noise level was 50 dB or less. The average of L_{Aeq} of all measurement points at the study area was 66.3 dB. The measured noise levels were found to be within Malaysian standards except for values exceeding 70 dB or more.

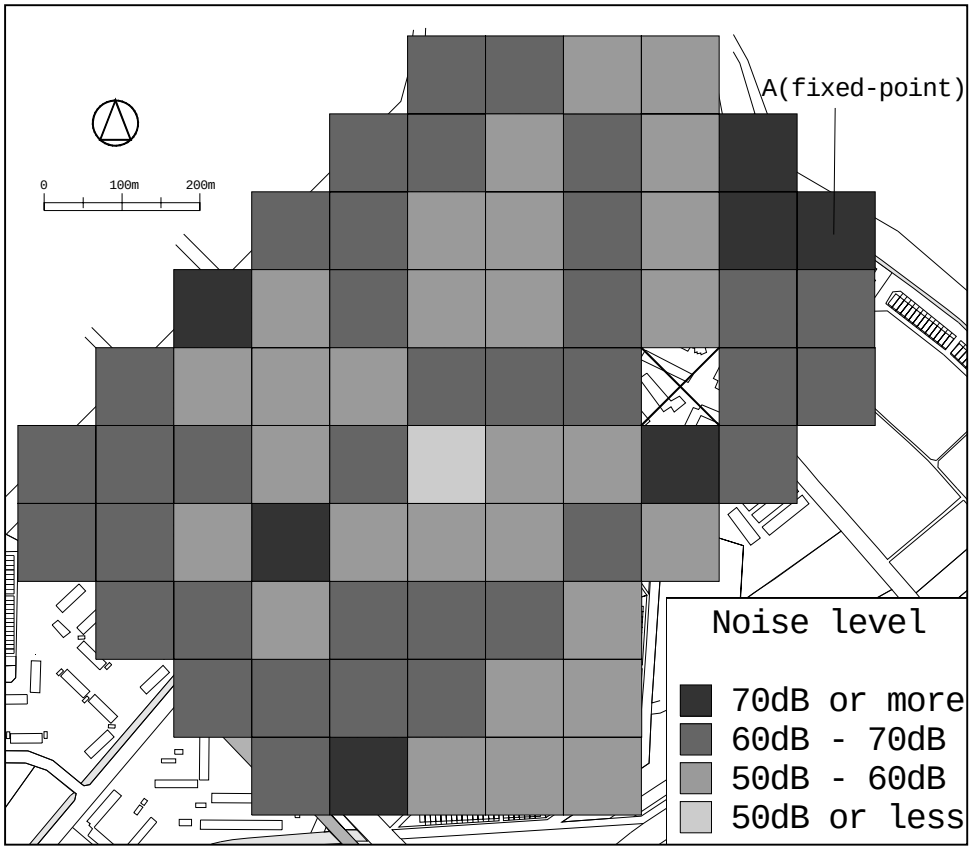

Figure 8. Spatial Distribution of L_{Aeq}

Figure 9 shows the frequency of L_{Aeq} at all measurement points in Taman Melati. The effect of traffic noise at each measurement point was analysed by dividing the study area into three types namely:(i) Along the trunk line road (MRR2 (arterial road)), Jalan 1/5, Persiaran Pertahanan (collector road)), (ii) Along the road inside district (local road), (iii) In the parks, car parking area and open spaces near the apartment house. The average L_{Aeq} of each type was 71.1dB, 65.2dB, and 58.9dB respectively. The noise levels along trunk line road were 65dB or more that is relatively higher. The range of the distribution of noise level values along trunk line road was determined to be small. The range of the distribution of noise levels along the road inside the district and at parks, car parking area and open spaces were about 50dB-65dB which are found to be low. However, it was found to be much wider than noise levels along trunk line road.

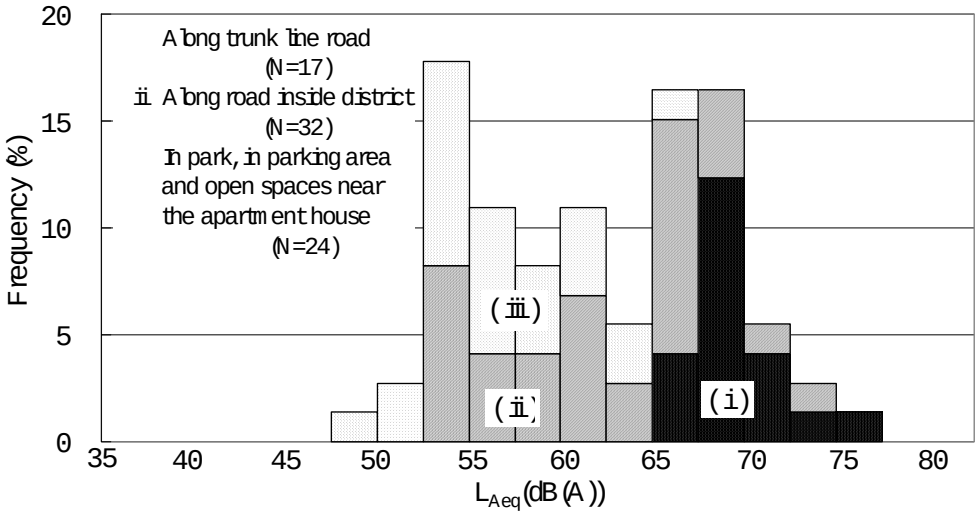

Figure 9. Frequency of L_{Aeq} in Taman Melati

3.3. NO_2 Concentration

The NO_2 measuring capsules are fixed at about 238 measurement points in Taman Melati but, however, the capsules were collected at only 227 measurement points (the remaining capsules were found missing during collection day). Meanwhile, about 5 NO_2 measuring capsules were fixed at each of the three air monitoring stations namely at Gombak, Petaling Jaya and Kuala Lumpur which is to convert NO_2 amount (µg) into NO_2 concentration (ppm). The conversion form is then determined from the data obtained from each of the three air monitoring stations. Thus, the amount of NO_2 (µg) being collected at each of the measuring point in Taman Melati is converted into NO_2 concentration (ppm). The conversion form is shown in the figure 10.

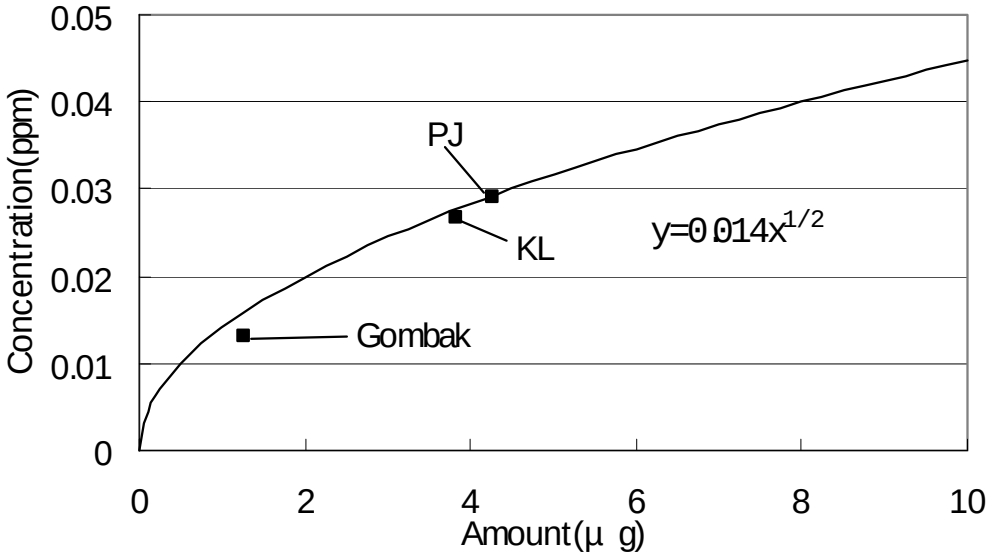

Figure 10. The conversion Type of this Field Survey

A mesh map showing the result of the field survey on NO_2 concentration at Taman Melati is shown in Figure 11.

Figure 11. A Mesh Map of NO_2 Concentration in Taman Melati

Specifically, the result of NO_2 concentration was high along the trunk line roads surrounding Taman Melati, but low in the residential area. The frequency of NO_2 concentration at all measurement points in Taman Melati is shown in Figure 12. The measurement points include: (i) Along the trunk line road, (ii) Along the road excluding (i), (iii) In the park, car parking area and other open spaces. The results showed NO_2 concentration at the measurement points was widely distributed ranging between 0.01ppm and 0.04ppm. The frequency of NO_2 concentration between 0.014ppm and 0.016ppm was recorded to be the highest. However, most of the results of NO_2 concentration for the category (ii) and (iii) were observed to be below Malaysian air quality standard of NO_2 (0.020ppm). The average NO_2 concentration at all measurement points was 0.018ppm.

The average daily fluctuation of NO_2 concentration (ppm) in Kuala Lumpur is shown in figure 13. NO_2 measuring capsules were fixed at KL station on 22nd October 2003 and collected on 23rd October 2003. The following chart represents how NO_2 concentration varies between 8th

October and 7th November including measurement days and it was found that the NO_2 concentration (ppm) on the measurement day was above 0.03 ppm and below 0.04 ppm.

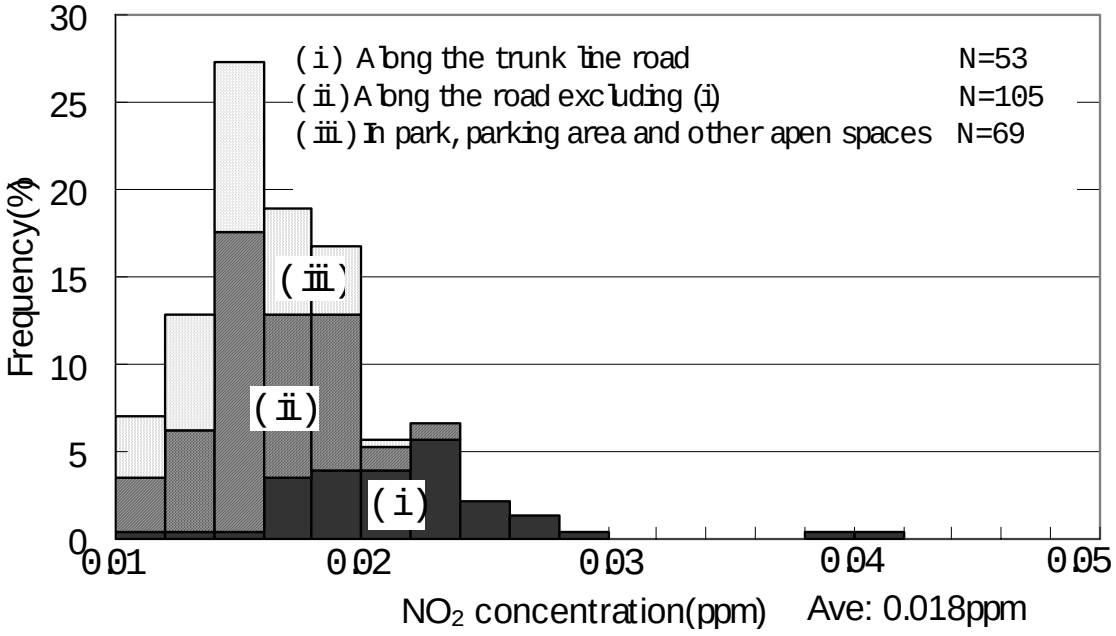

Figure 12. Frequency of NO_2 Concentration in Taman Melati

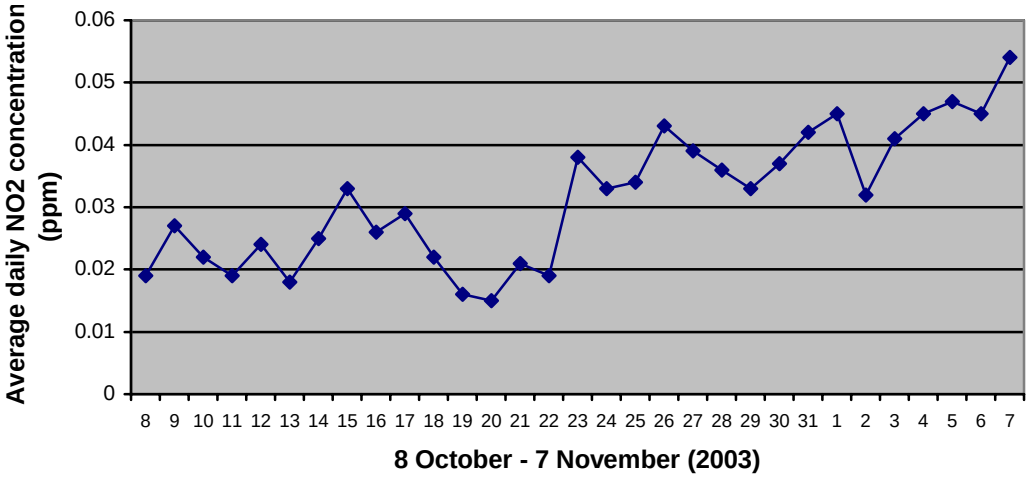

Figure 13. Average Daily Fluctuation of NO_2 Concentration

4. CONCLUSIONS

Healthy and harmonious living environment in a residential area are basic yardstick for well-being of a community. It will encourage effective involvement of the working population to further develop economy of the nation. It also reduces public healthcare expenditures significantly which normally found to take bigger proportion of the national budget. Moreover, it enhances the visual quality of the area. The findings of this study are expected to inculcate general awareness of the residents of the study area on the existing conditions of each of the selected environmental factors.

Traffic volume was observed to be very high along the main arterial road. Average traffic volume along the MRR2 (arterial road) was 7800 vehicles per hour, Persiaran Pertahanan (collector road) was 1300 vehicles per hour, Jalan 2/5 and Jalan 8/5 (local roads) were 500 vehicles per hour, and 400 vehicles per hour respectively. Generally, car traffic was observed to be higher than other mode of vehicles for each of the selected roads during the survey period. It is due to increased number of commuters using car as the main mode of transport for various trip purposes and poor services of public transport. The noise levels along trunk line road were 65dB or more which is relatively higher than other selected roads. Specifically, the result of NO_2 concentration was high along the trunk line roads surrounding Taman Melati, but low in the residential area. The results showed NO_2 concentration at the measurement points was widely distributed ranging between 0.01ppm and 0.04ppm. The frequency of NO_2 concentration, 0.014ppm -0.016ppm was recorded to be the highest. However, most of the results of NO_2 concentration along collector and local roads and at parks, open spaces were observed to be below Malaysian air quality standard of NO_2 (0.020ppm). The average NO_2 concentration at all measurement points was 0.018ppm.

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