Evaluating the Living Environment in Residential Areas at Taman Melati, Kuala Lumpur

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Abstract

This paper investigates the living environment in a residential area at Taman Melati in Kuala Lumpur, Malaysia. Traffic volume, NO_2 emissions, noise level and streetlight illuminance were variables selected to measure the living environment. A questionnaire was also used to evaluate residents' perceptions regarding their living environment. A high average traffic volume of about 7,800 vehicles per hour, especially along the arterial road (major road) was reported. Generally, a noise level in the range of 50-70 dB was measured in the residential area, and the average L_{Aeq} near the arterial road was about 76 dB. NO_2 concentration in the residential area varied widely, between 0.01 ppm and 0.04 ppm; the average NO_2 concentration was 0.018 ppm. The horizontal streetlight illuminance was measured under all streetlights and at every 5 m interval. The illuminance near the streetlights was high, but was low between them. Traffic noise proved to be a major limitation concerning a healthy living environment according to the residents of the study area. Even so, more than half the residents in the study area expressed satisfaction with the present living environment.

Keywords: traffic volume; noise; air pollution; living environment; streetlight

1. Introduction

A healthy living environment is vital to the positive lifestyle of a community. Environmental benefits such as freedom from noise, and from air and visual pollution, should ultimately encourage increased financial investment and thus develop the economic growth of the nation. However, growing physical development (new road infrastructure, housing areas) based on the Malaysia Plan 2000-2005, and increasing traffic volume (vehicle registration per population ratio in Kuala Lumpur was 1,830 vehicles to 1,000 persons), are leading to environmental degradation as a result of increasing traffic volume. This has a tremendous impact on the living environment, exposing residential neighborhoods in major cities in Malaysia to increased air pollution and noise levels.

Previous studies have found that noise (>75 dB) and air pollution levels (>0.02 ppm of NO_2) along major arterial roads running very close to residential areas in Kuala Lumpur were high because of the increased traffic volume (7,200 vehs/hr). This impacted the living environment of the residential areas affected (60% dissatisfied with noise level, 55% with air level) (Khoo, 2002, Sumiani *et al.* 2002 and Wan Nurul 2005). The main objectives of this paper are: 1) to measure levels of noise, air pollution (NO_2), streetlight illuminance and traffic volume, which are considered to affect the living environment of the study area and 2) to determine the perceptions of the residents toward the resulting living environment. Taman Melati is a major residential neighborhood located at the periphery of the central area of Kuala Lumpur, Malaysia, and was selected as the study area for this research. Measurement and analysis of these parameters at the selected study area is elaborated in the following sections. Perceptions of the residents concerning the living environment were noted by a questionnaire survey. Details of this questionnaire survey are also elaborated in this paper.

2. Research Approach

Background Of Study Area

Malaysia has an area of 329,758 sq. km. and is located between latitudes 1 and 7 degrees north and longitudes 100 and 119 degrees east, with Thailand to the north of Peninsular Malaysia and the Republic of Singapore to the south (Structure Plan of KL 2020). With its tropical climate, Malaysia has warm and humid weather throughout the year. Temperatures in the lowlands range from between 22 and 32 degrees centigrade, and in the highlands between 16 and 23 degrees centigrade. The mean annual rainfall is approximately 2,500 mm a year. The population of Malaysia was 23.3 million at the 2000 census, and includes three main ethnic groups: Malays (55%), Chinese (35%) and Indians (10%). Kuala Lumpur

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is the capital city of Malaysia and has a land area of 243 sq. km., with a population of 1.42 million (2000 census). Ethnic classification of the population of Kuala Lumpur (2000 census) indicates Malays (38%), Chinese (43%), Indians (10%) and others (9%). Kuala Lumpur is between 30 m and 200 m above mean sea level (Structure Plan of KL 2020).

Fig.1. Location Plan of the Study Area

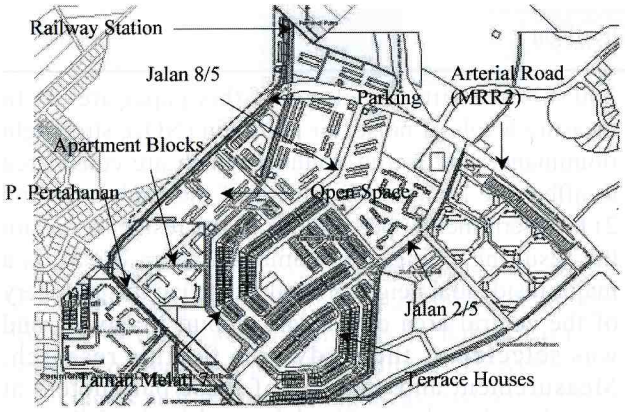

Fig.2. Site Plan of Taman Melati

Taman Melati, the study area, is located in the northeast of Kuala Lumpur (see Fig.1.). Taman Melati (as shown in Fig.2.) is a major residential neighborhood encompassing about 3,220 households in an area of about 0.75 sq. km., and is about 10 km from the CBD of Kuala Lumpur. It was selected as the study area because it encompasses diverse types of residential units including terrace houses, semi-detached houses, link houses and apartment-type houses. An arterial road running very close to the neighborhood, a railway station, which may have a detrimental effect on the living environment of the residents if not controlled properly and proximity to International Islamic University Malaysia were the reasons for selecting Taman Melati as the study area. The physical and environmental setting and its trend in Taman Melati is very similar to other residential areas in Kuala Lumpur.

Field Survey

A field survey was conducted on each of the chosen factors including noise level, NO_2 level, traffic volume and streetlight illuminance, and the questionnaire survey was carried out at the study area for about a week (from 17th to 25th October 2003). The set of factors was chosen because increasing traffic growth at variable speed is resulting in excessive noise and increased NO_2 level (among other pollutants). Interest in the safety of residents at night is also a consideration. Details of the field survey are explained in the following subsections:

Traffic Volume

A 12-hour, 7.15 a.m. to 7.15 p.m., traffic volume count (two directions) was conducted at four selected traffic count stations: the arterial road (1 station for each direction), a collector road (one station for each direction), and two local roads (one station each). Type of vehicles include motorcars and taxis (category A), buses, lorries, trucks and trailers (category B), vans and pickup trucks (category C) and motorcycles and scooters (category D). The traffic volume count was conducted on a weekday (Tuesday).

Noise Level

One fixed point and 73 movable points (total 74 measurement points) were selected for measurement of the noise level. At the fixed point, a noise level meter was stationed at a suitable location near the side of the arterial road at 1.2 m above ground level in order to measure differences in noise level at different times of the survey day. The noise level at the fixed point was measured every 15 minutes for about 12 hours (from 7.00 a.m. to 7.00 p.m.). At the movable points, the noise level was measured from 8.30 a.m. to 7.00 p.m. The noise level meter was moved every 15 minutes from one point to another to measure the noise level until all measurement points had been covered. The noise level meter at each of the movable points was located at the center of a 100 m x 100 m square grid and at 1.2 m above ground level. The noise levels, 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.

NO_2 Concentration

The NO_2 concentration (μg) was measured using a simple polystyrol capsule containing triethanolamine (20%), and a total of 238 measurement points were selected at the study area. Three capsules at each measurement point were fixed to the streetlight poles and other street furniture at a height of 1.5 m above ground level and left for about 24 hours (from 10 a.m. on Wednesday to 10 a.m. on Thursday). Only 227 capsules were collected from the study area, a 95% collection rate. The NO_2 value is measured by using Zaltsman reagent and a simple colorimeter. Additionally, five NO_2 measuring capsules were fixed at each of three air-monitoring stations at Gombak, Petaling Jaya and Kuala Lumpur for the purpose of converting the NO_2 amount (μg) into NO_2 concentration (ppm).

Streetlight Illuminance

A field survey of streetlight illuminance was also conducted at the study area for about 2 hours and 30 minutes (from 7.30 p.m. to 10 p.m.). This survey includes i) measuring horizontal plane illuminance directly below all streetlights (about 220 measurement points) in the study area; and ii) measuring horizontal plane illuminance at 5 m intervals (about 118 measurement points) along Jalan Taman Melati 7. In both cases, digital illuminance sensors were set at ground level to measure horizontal plane illuminance.

Questionnaire Survey

A questionnaire survey was administered to evaluate perceptions of the residents regarding their living environment at selected households in the study area. The questions included awareness concerning noise, air pollution, traffic volume and streetlight illuminance for safe, healthy and comfortable living conditions, the resident's expectation of the factors governing healthy living conditions and the resident's level of interest in the field surveys of air and noise pollution, traffic volume and streetlight illuminance. About 400 households were randomly selected from the total population of 3,222 households. Direct interviews were conducted at the 400 selected terrace and apartment units. A total of 265 samples were collected from the residents, a response rate of 66%.

3. Research Findings

The data for each of the selected variables were analysed and the findings are reported in the following subsections.

Traffic Volume

The average traffic volume was very high along the main arterial road. Average traffic volume along the MRR2 (arterial road) was 7,800 vehicles per hour, along Persiaran Pertahanan (collector road) 1,300 vehicles per hour, and along Jalan 2/5 and Jalan 8/5 (local roads) 500 and 400 vehicles per hour respectively. Fig.3. illustrates the hourly fluctuation of traffic volume on each of these roads. The high traffic volume is attributed to the high number of vehicles registered in Kuala Lumpur, about 2.75 million in 2003 (Wan Nurul, 2005). The average annual increase in vehicle registration in Kuala Lumpur between 1998 and 2003 was about 7% (Wan Nurul, 2005). The vehicle registration to population ratio in Kuala Lumpur was 1,830 vehicles to 1,000 persons (Wan Nurul, 2005). Generally, traffic volume during peak hours was 1.7~2.7 times greater than that of non-

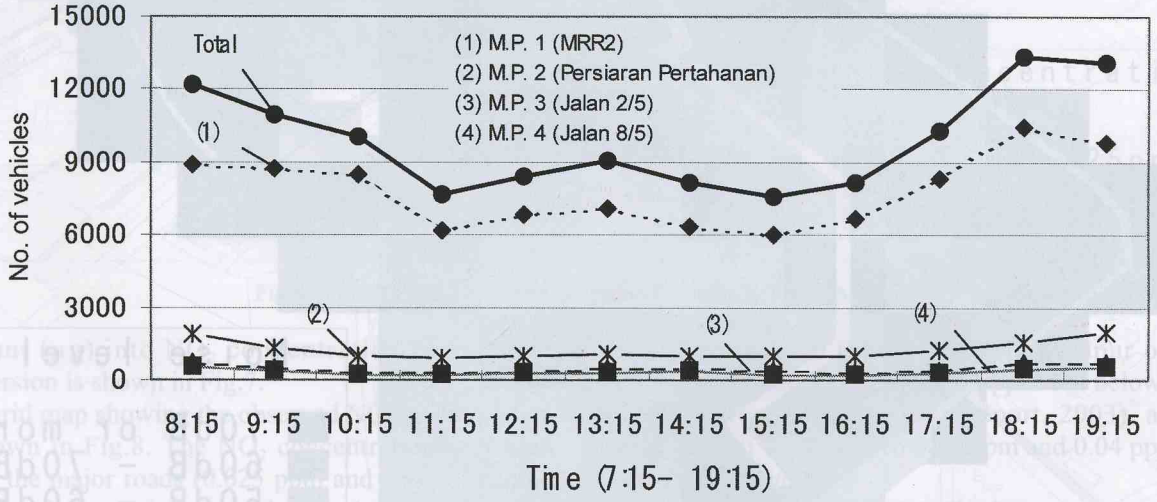

Fig.3. Hourly Fluctuation of Traffic Volume

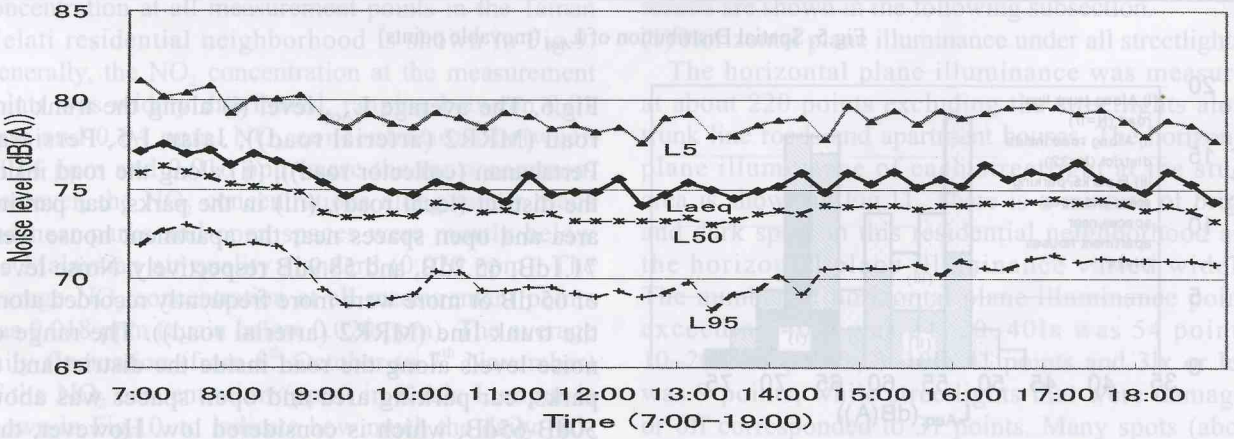

Fig.4. Fifteen-minute Fluctuation of Noise Level (Fixed Point)

peak hours. Along the arterial road MRR2, car traffic (category A) was observed to be about 70%, (compared to 60% of the total number of vehicles in Kuala Lumpur) followed by motorcycles (category D) 15%, lorries & buses (Category B) 10% and vans (Category C) 5%. Not surprisingly, an increasing number of commuters were using their cars as the main mode of transport for various trip purposes.

Noise Level

Regarding noise level, the analysis showed an interesting pattern in the study area. Fig.4. reveals that the noise level during the morning peak hour, 7.30 a.m.~8.30 a.m., was slightly higher than at the rest of the time including the afternoon and evening peak hour. Increased traffic volume at high speed (traveling above the legal speed limit of 80 kmph) to reach the workplace on time (work purpose) is the likely explanation. Analysis also showed that the maximum fluctuation of L_{Aeq} was only 3 dB, indicating a steady noise level during the observation period. The average L_{Aeq} near the major arterial road was calculated to be 75.6 dB (which exceeds the WHO recommended noise level).

Fig.5. shows the spatial distribution of L_{Aeq} at each of the measurement points (movable points). A few noise level readings near terrace houses exceeded 70 dB, mainly because of construction activities during the survey period. Nonetheless, the noise levels near parks, the parking area, and open spaces near the apartment houses were about 50-60 dB. The average L_{Aeq} distribution of all measurement points (movable points) in the residential neighborhood was 66.3 dB.

The frequency (in %) of L_{Aeq} at all measurement points in the residential neighborhood is shown in

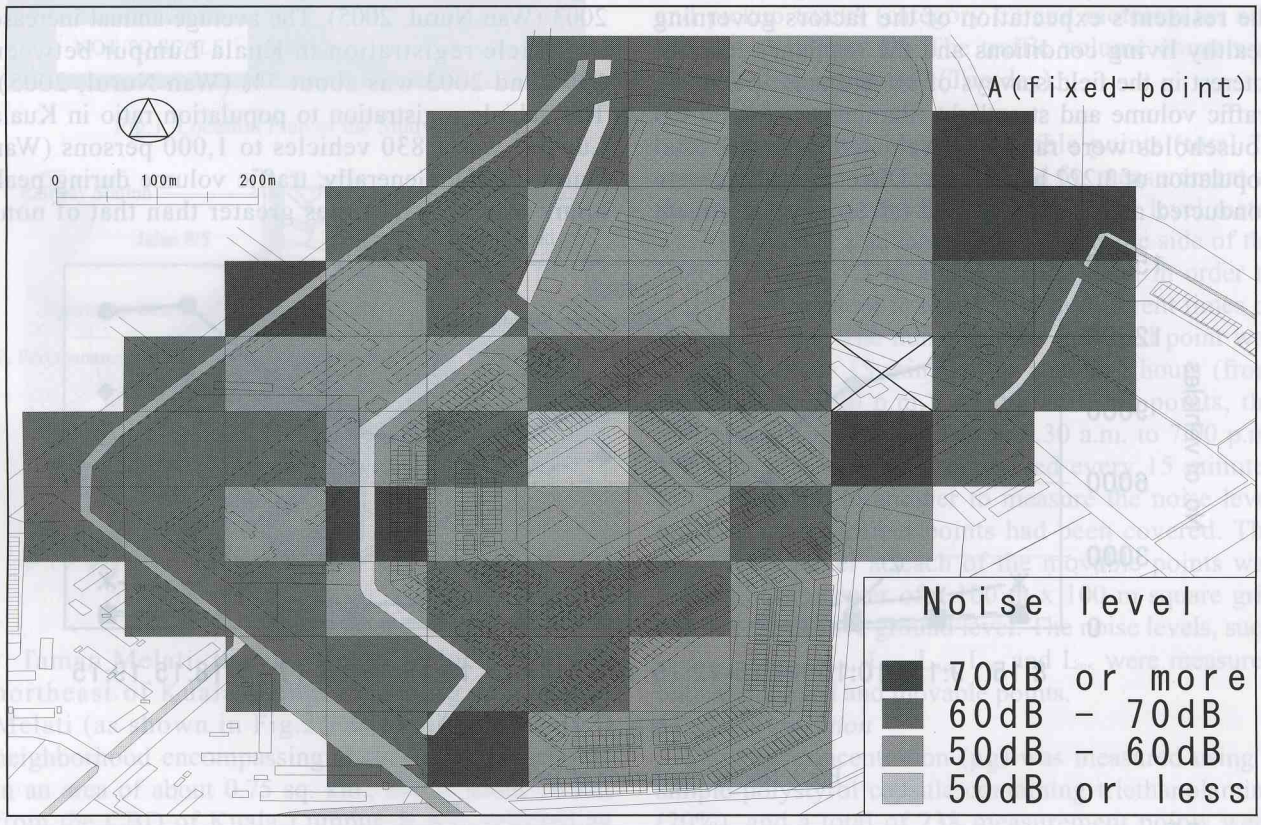

Fig.5. Spatial Distribution of L_{Aeq} (movable points)

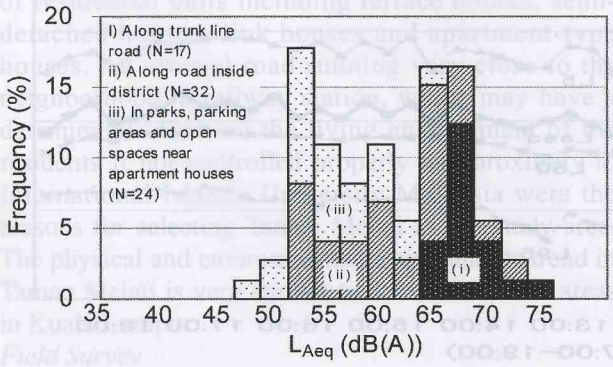

Fig.6. Frequency of L_{Aeq} in Taman Melati

Fig.6. The average L_{Aeq} level (i) along the trunk line road (MRR2 (arterial road)), Jalan 1/5, Persiaran Pertahanan (collector road)), (ii) along the road inside the district (local road), (iii) in the parks, car parking area and open spaces near the apartment house were 71.1dB, 65.2dB, and 58.9dB respectively. Noise levels of 65 dB or more were more frequently recorded along the trunk line (MRR2 (arterial road)). The range of noise levels along the road inside the district and at parks, car parking area and open spaces was about 50dB-65dB, which is considered low. However, this noise level variation was much greater than along the

trunk line road (MRR2 (arterial road)). Increasing traffic volume traveling at high speed along the arterial road is one of the major reasons for this trend.

NO_2 Concentration

A total of 238 measurement points were selected to measure NO_2, but only 227 measurement points were collected (the remaining capsules were found to be missing during the collection day). NO_2 measuring capsules were also fixed at each of the three air monitoring stations at Gombak, Petaling Jaya and Kuala Lumpur for the purpose of converting NO_2 amount (μg) into NO_2 concentration (ppm). The conversion is shown in Fig.7.

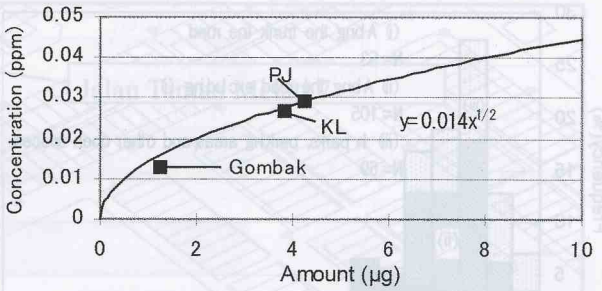

Fig.7. The Conversion Form of NO_2 in ppm

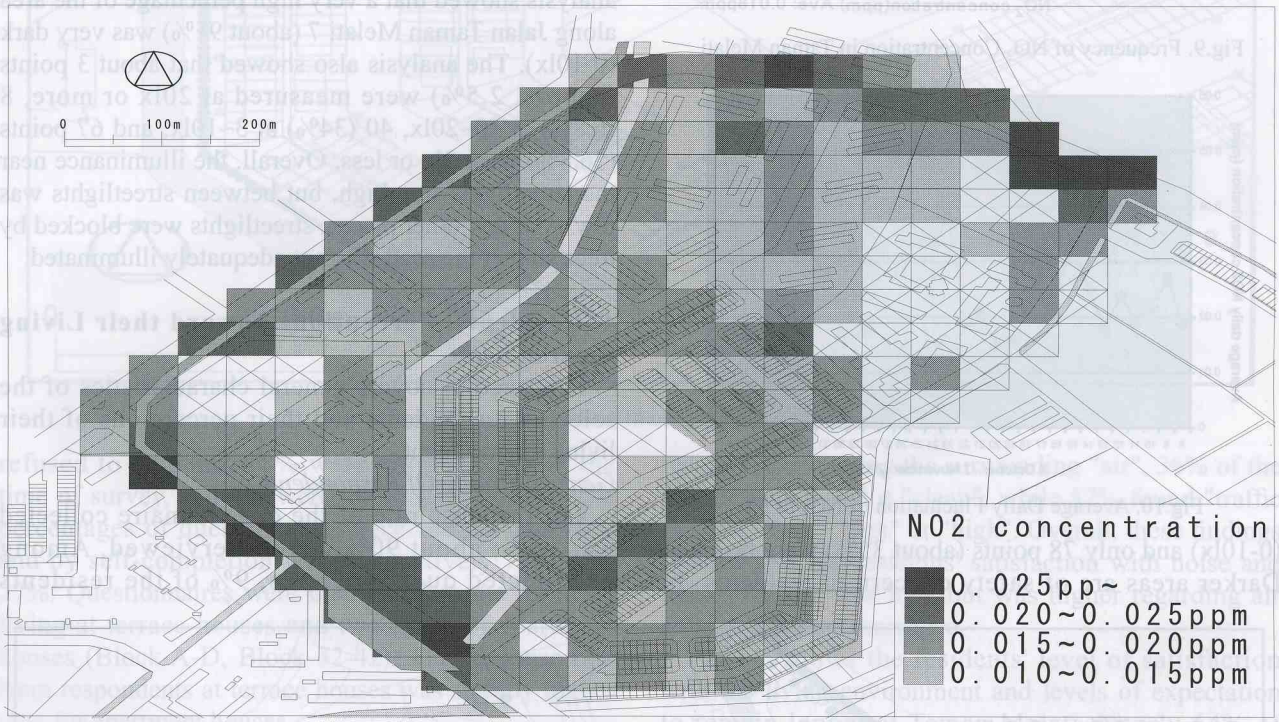

Fig.8. A Grid Map of NO_2 Concentration (in ppm) in Taman Melati

A grid map showing the observed NO_2 concentration is shown in Fig.8. The NO_2 concentration was high along the major roads (0.025 ppm and above) running at the periphery of the neighborhood, but low around the residential area. The frequency distribution of NO_2 concentration at all measurement points in the Taman Melati residential neighborhood is shown in Fig.9. Generally, the NO_2 concentration at the measurement points was widely distributed, ranging between 0.01 ppm and 0.04 ppm. NO_2 concentrations between 0.014 ppm and 0.016 ppm were the most common. However, the NO_2 concentrations along minor roads and near parks and open spaces were mostly below the Malaysian air quality standard (0.020 ppm). The average NO_2 concentration at all measurement points was 0.018 ppm (again below 0.020 ppm). The average daily fluctuation (from 8th October to 7th November) of the NO_2 concentration (ppm) in Kuala Lumpur is shown in Fig.10. to indicate how much the daily NO_2 concentration including measurement day varies. The NO_2 concentration (ppm) in Kuala Lumpur on the measurement day was above 0.03 ppm but below 0.04 ppm (Environmental Quality Report, 2003), and at Taman Melati was between 0.01 ppm and 0.04 ppm.

Streetlight Illuminance

The illuminance of streetlights was measured directly under all streetlights and at 5 m intervals. The results are shown in the following subsection.

(1) Horizontal plane illuminance under all streetlights

The horizontal plane illuminance was measured at about 220 points excluding the streetlights along trunk line roads and apartment houses. The horizontal plane illuminance of each streetlight at the study area is shown in Fig.11. There is a mixture of bright and dark spots in this residential neighborhood and the horizontal plane illuminance varied widely. The number of horizontal plane illuminance points exceeding 40lx was 24, 20~40lx was 54 points, 10~20lx 61 points, 3~10lx 41 points and 3lx or less was 9 points, while streetlights that were damaged or off corresponded to 31 points. Many spots (about 25%) near the residential neighborhood were very dark

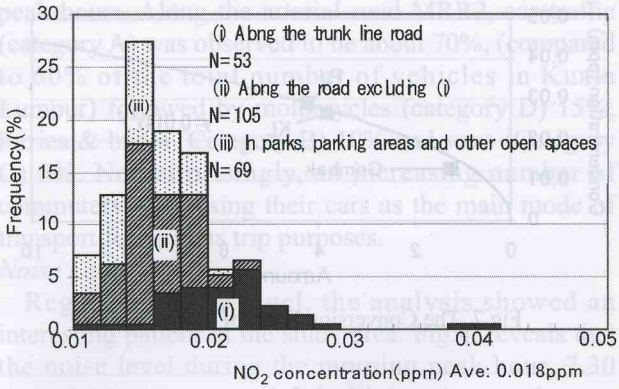

Fig.9. Frequency of NO_2 Concentration in Taman Melati

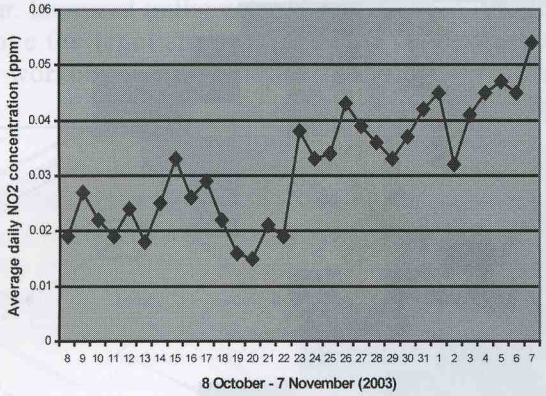

Fig.10. Average Daily Fluctuation of NO_2 in KL

(0-10lx) and only 78 points (about 35%) were brighter. Darker areas are of safety concern to residents. In Malaysia very few studies have been undertaken to measure the illuminance of streetlights in a residential neighborhood.

(2) Horizontal plane illuminance at 5 m intervals

The horizontal plane illuminance was measured at 5 m intervals along Jalan Taman Melati 7, a local road in the selected residential neighborhood. About 118 points were measured; the results of horizontal plane illuminance at 5 m intervals are shown in Fig.12. There were about 17 streetlights within the measurement range (590 m) along Jalan Taman Melati 7. The analysis showed that a very high percentage of the area along Jalan Taman Melati 7 (about 91%) was very dark (0-10lx). The analysis also showed that about 3 points (approx. 2.5%) were measured at 20lx or more, 8 (6.8%) at 10~20lx, 40 (34%) at 3~10lx, and 67 points (56.8%) were 3lx or less. Overall, the illuminance near the streetlights was high, but between streetlights was low. At a few other places, streetlights were blocked by trees so that the road was not adequately illuminated.

4. Residents' Perceptions Toward their Living Environment

This section covers general characteristics of the selected respondents and their perceptions of their living environment.

General Profile Of Respondents

The response rate of the questionnaire collected was 66%; about 90% were interviewed. Among uncollected questionnaires, 9% of the residents

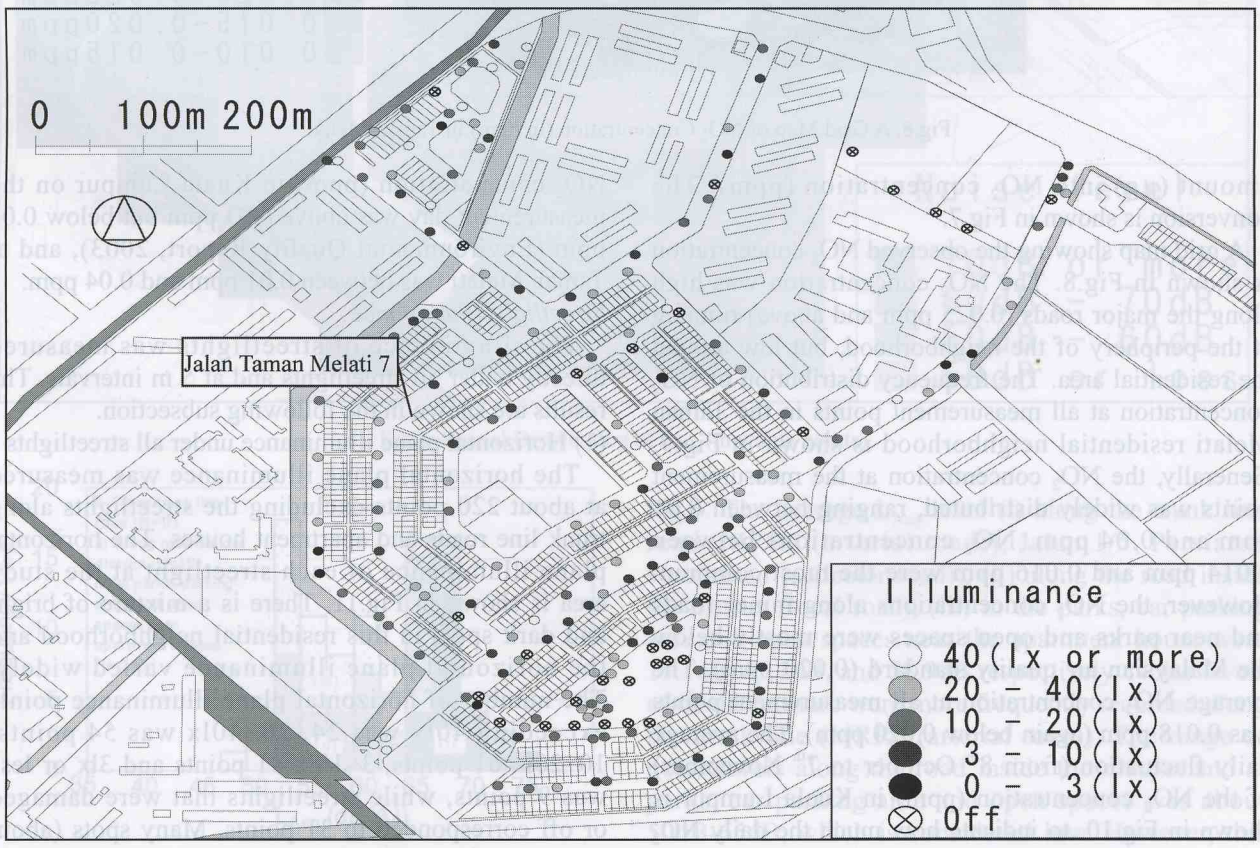

Fig.11. Horizontal Plane Illuminance of Streetlights

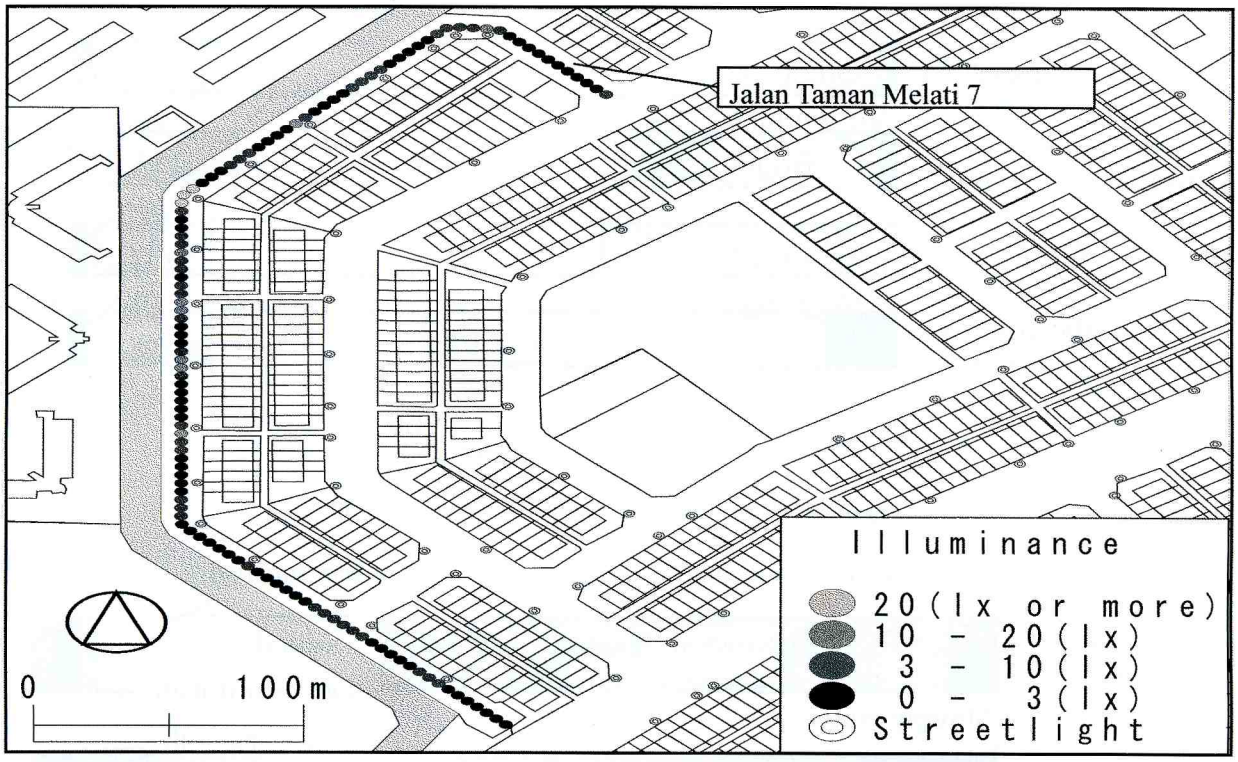

Fig.12 Horizontal Plane Illuminance at 5m Intervals

refused to respond, 18% were not available at the time of survey, and 7% were unoccupied houses. The percentages of questionnaires received by interview and by self-completion were respectively 73%, and 27%. Questionnaires were distributed to the residents living at terrace houses and two kinds of apartment houses (Block A-D, Block 32-42). The response rate from respondents at terrace houses was slightly higher than for apartment houses.

Female respondents (55%) were more common than their male counterparts (42%). The highest number of respondents were in the twenties age category (31%), and the average age of respondents was 33 years. Ethnic Malay respondents (84%) outnumbered any other ethnic group. The highest frequency (23%) was from households of 5 persons, and the average household size of the respondents was 5 persons. The average number of years that the respondents had lived at the present dwelling was about 8 years.

Perceptions Of The Living Environment

Residents' perceptions of their living environment are shown in Fig.13. About 25% of the respondents perceived a "very noisy" or "noisy" living environment. A very high percentage of residents (>80%) expressed "traffic noise" as the main noise source in a noisy living environment. One resident commented, "Most of the roads in Taman Melati are very noisy, especially at night because of increased traffic volume, especially motorcycles". Concerning streetlight illuminance at night, only 34% of the respondents stated it was "very bright" or "bright". "The area is too dark at night and sometimes feels unsafe" lamented one resident. Concerning the surrounding "air", 36% of the respondents found it "clean", while 57% found "traffic volume", "very high" or "high". Overall, these findings showed that the residents' satisfaction with noise and traffic volume was low, but was higher regarding air and streetlight illuminance.

Fig.14. shows the residents' level of satisfaction with the living environment and levels of expectation to remain longer at Taman Melati. Nearly 64% of the respondents said they were "strongly satisfied" or "satisfied" with the present living environment. The level of willingness among the residents to remain at Taman Melati is such that about 56% of respondents stated that they were "strongly willing" or "willing". It is clear that the overall satisfaction level of the residents with the living environment was high, although the satisfaction level regarding specific living environmental factors (noise and traffic volume) was low.

5. Conclusions

This paper addresses the living environment of a residential area in Taman Melati, Kuala Lumpur. Some of the important findings include: The average traffic volume (about 7,800 vehicles per hour) along the arterial road, running at close proximity to the study area (within 200 m) was observed to be high. Car traffic (private vehicles) was higher (about 70%) than other modes of transport. As a result, noise generated from traffic along the arterial road was measured as 70 dB or more causing disturbances to the residents living near the arterial road. More than 80% of the residents

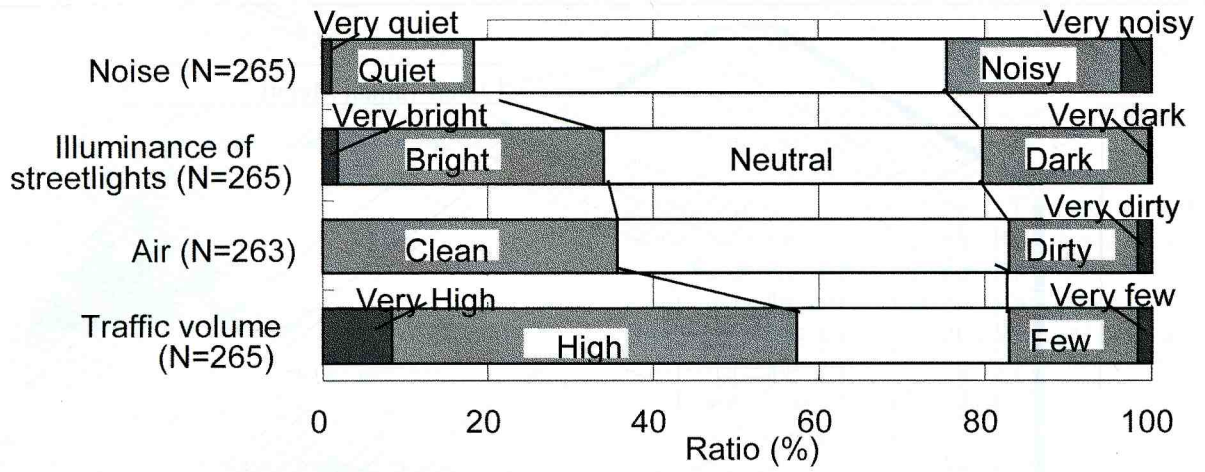

Fig.13. Residents' Perceptions Toward Living Environment

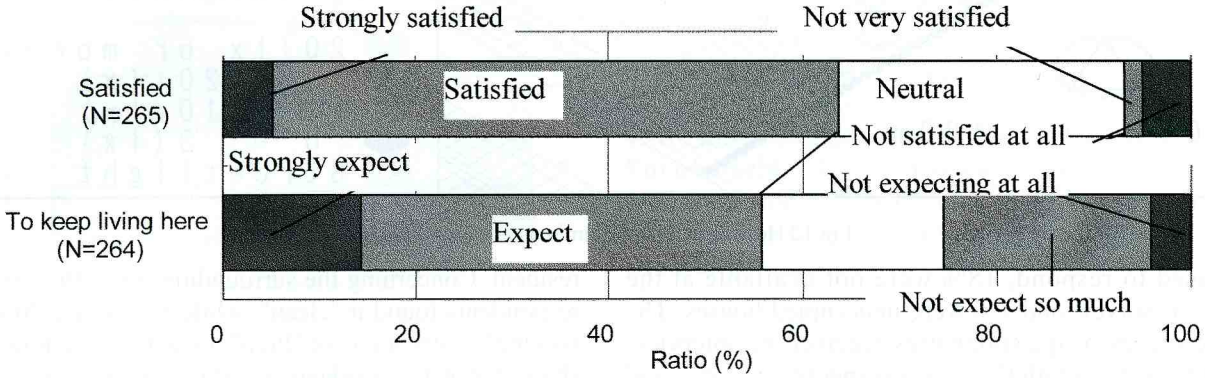

Fig.14. Level of Satisfaction and Expectation to Stay Further at Taman Melati

had expressed "traffic noise" as the main noise source in the present living environmental setting. This also applies in other neighborhoods in Kuala Lumpur because of increasing traffic volume. However, the noise levels near parks, parking areas, and open spaces near the apartment houses were lower (about 50-60 dB). NO_2 concentration was also high along the arterial road (0.025 ppm or more) but low along local roads (minor roads) and at parks and open spaces (0.020 ppm or less). Streetlight illuminance at night is essential for residents' safety and security. About 90% of the streetlights along Jalan Taman Melati 7 (local road) had illuminance of 10lx or less (dark spots) as against 25% for the whole study area.

Increased traffic volume, especially by private cars, and the associated noise and air pollution level along the arterial road running close to the residential area has produced degradation in the living environment of the residents of the study area. Existing public transportation use in Kuala Lumpur is at a very low level (only about 15% of total travel). Greater use of public transportation (buses and trains) in the future is expected, which will eventually decrease traffic volume by private vehicles and thus contribute to a decrease in air and noise pollution levels along arterial roads running close to the residential areas. Despite being focused on one residential neighborhood at a district level only, this paper provides a platform upon which to gauge existing environmental conditions, and the satisfaction level of the residents of Taman Melati. However, further studies at other residential neighborhoods in Kuala Lumpur are planned to further enhance understanding of the living environment and the related satisfaction level of the community.

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