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A STUDY ON NOISE LEVEL PRODUCED BY ROAD TRAFFIC IN PUTRAJAYA USING SOUNDPLAN ROAD TRAFFIC NOISE SOFTWARE

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Abstract — This paper is a study on noise level produced by traffic in Putrajaya. The main objective of the study is to employ SoundPLAN Road Traffic Noise Software and Norsonic 118 Sound Level Meter in determining, analyzing and assessing noise distribution levels in Putrajaya with the guidelines recommended by World Health Organization (WHO). Software Application and Field Observation are the methods used in this study. From the test results, there is no significant difference of using SoundPLAN software between manual handling by Sound Level Meter. This is supported by the results of the findings which show that t_{stat} is not exceeded than $t_{critical}$ by the T-test hypothesis study. There is a relationship between urban noises and traffic volume. The finding of the study also indicated that the distance from the traffic is the main factor to the increment of noise level at Putrajaya. From the analysis, a new noise contour map that covers some part of the districts has been produced. These noise maps have been particularized via software application that provide noise barrier to prevent noise level from disturbing human activities. Based on the study, it can be concluded that 30 % of the measurements from the study area were higher than 75 dB(A) which is exceeded than the limit that recommended by WHO which can effected hearing loss.

Keywords: Traffic Noise, Sound Level Meter, SoundPLAN.

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I. INTRODUCTION

Transportation noise tends to be a dominant noise source in urban as well as rural environment. Noise can be defined as unwanted sound or offensive sounds that unreasonably intrude into human daily activities. As far as one concern, noise is a serious problem. Noise disturbs sleep, disrupts activities, hinders work, impedes learning, and causes stress [1].

The majority of sounds detected by human hearing are within the range of 0 to 140 decibels (dB). The noise created by transportation normally resides in the range of 50 to 95 dB. The effects of transportation noise are routinely measured using an A-weighted decibel scale (designated dBA), which is useful for measuring the noise impact of a single occurrence but not the impact of continuous noise. The dBA measure has frequency response characteristic that correlate to human impressions of loudness. The higher levels of decibel scale could evoke psychological and pathological reactions of one individual [2].

Highway traffic noise is a major contributor to overall transportation noise. Rapid growths of development projects in Putrajaya contribute to rise of population thus increase the number of vehicles on the road. This situation in turn, causes a serious problem in noise pollution. The study was undertaken to monitor the existing noise levels generate from motor vehicles at Putrajaya road. By using the "SoundPLAN" model for traffic noise prediction, calculations were performed to predict the future noise levels from motor vehicles as a function of average speed, distance to the roadway, volume and composition of traffic as well as the recent noise levels.

II. OBJECTIVES

The main objectives for this study are stated as below:

1. To determine the existing noise levels generate from road traffic at Putrajaya Road.
2. To analyse the noise level produced by traffic with SoundPLAN Road Traffic Noise Software.
3. To compare the predicted noise distribution levels with the guidelines recommended by the World Health Organization (WHO).

III. LITERATURE REVIEW

Noise was a serious issue that should be considered in all stages of transportation system projects, from original design and construction to modifications. Transportation related noise affects millions of people and in many cases, requires local, state, and federal governments to provide noise abatement to help improve or restore their quality of life. The impact of noise on the quality of life can be substantial, especially with expanding transportation systems [3].

Highway noise is caused by the interaction between vehicle's tires with the pavement surface, aerodynamic sources and the vehicle's engine and exhaust system. The level of noise depends on three things which are the volume of the traffic, the speed of the traffic, and the number of trucks in the flow of the traffic. In most cases, traffic noise level is increased by heavier traffic volumes, higher speeds, and greater numbers of trucks.

IV. DATA COLLECTION AND FINDINGS

Measurements of noise levels at 14 locations in Putrajaya were undertaken simultaneously with traffic volume and speed. All measurements were performed using Norsonic 118 Sound Level Meter. The composition of vehicles are classified to class 1 for motorcycle, class 2 for individual cars, class 3 for van and small truck and class 4 for large trucks and buses. Table 1 shows the volume and average speed of vehicles at each station. Meanwhile Table 2 shows the comparison of noise levels value between Sound Level Meter (SLM) measurement and SoundPlan (SLPA) calculation.

. Table 1 Volume and speed of vehicle at selected station

Station No.	Name Of Road	Volume (pcu / 24 hour)	Average Speeds	
			Car (km/h)	Truck (km/h)
1-6	Persiaran Perdana	6 168	69.0	45.8
7-10	R8 B	4 968	70.0	43.6
11-12	Lebuh Bestari	5 586	67.0	46.4
13-14	P18C	4 776	60.0	41.3

Table 2 Average Noise Level (dBA) in Putrajaya

Station	SLM	SLPA
1	65.9	68.3
2	64.5	74.2
3	68.7	74.8
4	70.3	78.5
5	66.2	61.7
6	65.4	80.9
7	69.2	66.7
8	67.3	69.2
9	64.1	52.9
10	66.7	61.2
11	69.9	77.8
12	69.5	80.3
13	63.2	55.2
14	64.4	55.0

Table 2 shows the highest value of noise levels is at station 4. Station 4 is located at Persiaran Perdana where the government building located on northeast side of the station. Noise levels obtained at Persiaran Perdana Road were between 64.5 dBA to 70.3 dBA. The highest traffic noise level was recorded during the peak hour monitoring at 12.30 p.m to 2.30 pm, which was 73.2 dBA. The second station with highest value of noise level is located at Lebuh Bestari Road. Noise level obtained at Station 11 and Station 12 were between 69.5 dBA and 69. 9 dBA respectively. This station selected because of its proximity to the residential and commercial area.

V. SOFTWARE APPLICATION

SoundPLAN Software was the program employed to calculate the noise levels at selected measurement zones. The results calculate from SoundPLAN are shown in Figure 1. The stations with the low range decibel are identified as Station 9, Station 12 and Station 13. Sound pressure levels obtained at this station were 52.9 dBA, 55.2 dBA and 55.0 dBA respectively. These noise levels are considered low compared to the WHO and DOE guidelines (55 dBA in the daytime period for residential area).

The stations that exceed the limit of DOE and WHO guidelines are Station 4, Station 6, Station 11 and Station 12 which create high range decibel readings of 78.5 dBA, 80.9 dBA, 77.8 dBA and 80.3 dBA respectively.

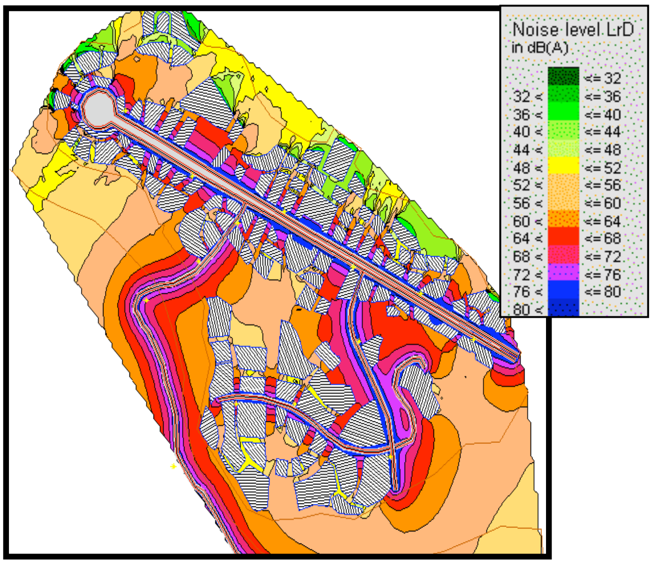

Figure 1 Level of noise at measurement stations.

VI. T-TEST SAMPLE

T-test sample is a statistical hypothesis to determine the differences between two series of data. This analysis was employed via Microsoft Excel. For this study, t-test statistical analysis is done to compare two sets of data between field observation and software application method which is shown in Table 2.

The critical or rejection region is the range of test values that indicates that there is a significant difference and the hypothesis should be rejected. In hypothesis testing there are one-tailed test, which consists of right-tailed or left-tailed. After derivation from the hypothesis testing, the results can be accepted due to no significant difference between Sound Level Meter and SoundPLAN software. T-test result for noise levels using SLM and SLPA in Putrajaya is shown in Table 3.

Table 3 T-test result for noise levels (dBA) in Putrajaya

Variable	SLM	SLPA
Mean	66.807	68.336
Variance	5.60148	96.6994
Observation	14	
Pooled Variance	51.1654	
Hypothesized Mean Difference	0	
df	26	
t-Stat	-0.5654	
P(T<=t) one tail	0.011501	
t Critical one tail	± 1.706	
P(T<=t) two tail	0.023002	
t Critical two tail	± 2.056	

VII. PREDICTION ON THE TRAFFIC NOISE LEVELS

Table 4 shows the prediction of traffic flow up to year 2020 by using current traffic data. The predicted traffic volume is based on 5 % increase in traffic growth rate starting from the current data of traffic flow in 2008. Then this value is been used to predict the noise level by using SoundPLAN software

Table 4 Predicted volume of vehicle in Putrajaya

ROAD / YEAR	NUMBER OF VEHICLE (pcu / 24 hr)			
	Jalan Persiaran Perdana	Jalan R8 B	Jalan Lebuh Bestari	Jalan P18C
2008	6 168	4 968	5 586	4 776
2010	6 800	5 477	6 159	5 266
2015	8 679	6 990	7 861	6 721
2020	11 077	8 921	10 033	8 578

Based on Table 5 the noise levels obtained from the traffic prediction is slightly higher due to the increasing of traffic volume. For the first 2-years estimation, traffic noise levels are not much different compared to the current existing values. The major noticeable changed when predicted noise level for 12 years analysis where the contours line was changed from 52 dBA to 56 dBA at selected zones. The noise level increase to 4 dBA from existing noise levels.

Table 5 Predicted noise levels (dBA) in Putrajaya

Station	Noise Level (dBA)			
	2008	2010	2015	2020
1	68.3	68.4	69.4	70.6
2	74.2	74.2	75.7	76.9
3	74.8	74.7	77.2	78.4
4	78.5	78.6	80.2	80.9
5	61.7	60.2	61.8	63.0
6	80.9	81.4	83.0	84.2
7	66.7	66.6	68.5	69.7
8	69.2	69.3	71.2	72.4
9	52.9	51.3	52.7	53.5
10	61.2	63.1	63.1	64.5
11	77.8	77.8	80.3	81.5
12	80.3	80.3	82.5	83.4
13	55.2	53.4	55.7	56.0
14	55.0	53.6	55.0	56.7

VIII. NOISE LEVELS WITH WALL BARRIER

From analysis, SoundPLAN software outputs have shown that the noise levels exceed the guidelines limit at selected point. Noise wall barrier is proposed to reduce noise level at this critical point. Figure 2 shows noise level when provides design of wall barrier with maximum 5 meter height. For this assessment, three locations were selected for this suggestion which is at Persiaran Perdana Road, R8B Road and P18C Road. It can be concluded that the protection wall can reduced noise level at the study area around 8 dBA to 12 dBA. As example, the noise level at Persiaran Perdana Road without wall barrier is 76 dBA. After noise wall barrier built at this location, the noise level reduces to the 64 dBA. This shows that the wall barrier reduces the noise level until 12 dBA.

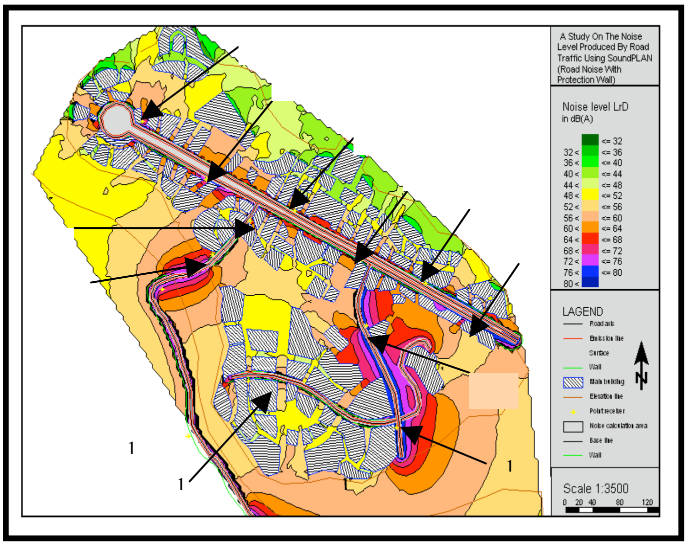

Figure 2 Noise level with noise barrier at 14 stations during daytime

IX. CONCLUSION AND RECOMMENDATION

The main findings of this study can be summarized as follows;

1. Results show that 30 % of the noise level measurements from the study area were higher than 75 dB(A) which is exceeded than the limit that recommended by WHO.
2. There are no significant difference between Sound Level Meter (SLM) and SoundPLAN (SLPA) software. This is supported by the results of the findings which show that t_{stat} not exceeded $t_{critical}$ by the hypothesis study.
3. The noise levels predicted from year 2010 to year 2020 based on 5% increase in traffic growth rate using year 2008 data vary according to the increase of traffic volume. Therefore, it can be seen clearly that the volume of traffic is a major contributed to the increment of noise level.
4. In order to overcome the problems associated with the volume of traffic, the wall barrier is the most efficient ways to reduced noise level around 8 dBA to 12 dBA.
5. SoundPLAN Road Traffic Noise Software is more comprehensive, quick and accurate in simulation, impressive in graphics and completely efficient modeling software. The software offers extra advantages in employing road traffic noise assessment with accuracy, convenience and less time consuming.

There are a few recommendations to control noise pollution. Noise barriers can reduce the sound level which enters a community from a busy highway by absorbing the sound, transmitting it, reflecting it back across the highway, or forcing it to take a longer path over and around the barrier. Trees and shrubs may be planted in front of building to provide some absorption for the sound. Future housing developments may locate non-critical areas such as corridors kitchens, bathrooms, elevators and service spaces in the noisy side and critical areas such as bedrooms and living spaces on the quiet side.

X. References

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