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Traffic Noise Impact in Perspective of City Ecology

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ABSTRACT

Noise traffic is the main problem in urban area which resulted by vehicle traffic transportation. The impact of traffic noise covers auditory and non-auditory effect human's life. In addition, high intensity of traffic noise has disturbed human social life ecologically. Feeling of annoyance resulted by high intensity of traffic noise will influence to the human behavior in driving of vehicles as indirect impact to human social life. In consequence, loss of life and material due to traffic accident is the part of human behavior. This study area is in Pekanbaru city where the relation between number of accident and growth of vehicle in each year indicating fluctuate condition. It can be concluded that the noise traffic impact associated with traffic accident ecologically.

KEY WORDS: *City, Traffic Noise, Ecology.*

1.0 INTRODUCTION

Road traffic noise is becoming the main problem in urban area due to its intensities may be adverse human comfort in their life. According to Mathias et al (2014) the traffic noise can cause auditory and non-auditory effect to human's health. The non-auditory effects of environmental noise on public health was studied and it was indicating to be annoyance, disturbs sleep and lead to bad performance such as fitness, hypertension, and impairs cognitive performance in schoolchildren.

Road traffic noise also effects to work performance of peoples as stated by Debasish et al (2012) in his study. This study examines the problems of reduction of individual's efficiency in his/her respective working places because of road traffic noise pollution. This study also proves that there is a relationship between annoyance and mental performance.

2.0 OBJECTIVE OF STUDY

This study investigates the ecological impact caused by high noise traffic intensity to the traffic accident as consequence of noise annoyance as psychological effect which leads to material losses due to the change of riding behavior. The impact of traffic noise covers many aspects but in this study will focus on material loss and its relevancy to the vehicle and population growth.

3.0 LITERATURE REVIEW

3.1 Noise Annoyance

Sato et al (1999) conducted the noise exposure measurement to quantify the noise level in different distances between houses and traffic line. The goal was to compare two principles for expressing noise exposure. The individual noise exposure was taken that refers to the distance of the respondent from the road and the floor level. The results described annoyance level in different distance where by limiting the number of vehicles would not have an effect on the extent of annoyance.

Dirk et al (2010) performed a study which concerning noise annoyance due to transportation noise that degraded environmental quality and noise sensitivity. The aim of this study was to verify that the noise sensitivity was associated with

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noise annoyance and reported that physical and mental health variables were not associated with noise exposure but with noise annoyance.

3.2 Effect of Traffic Noise to Socio Environment

Noise may cause negative impact to environment is unquestionable like Demian (2014) reported that sleep disturbance is caused by traffic noise significantly. Poor sleep causes social negative outcomes both in adults and children. In addition, Carla (2013) investigated that the road traffic noise exposure at home and children's behavior problems and sleeping problems of 872 10-year-old children from Munich-German. The result showed that the Road traffic noise exposure at home may be related to increased hyperactivity and more emotional symptoms in children.

4.0 MATERIAL AND METHODS

4.1 Area of Study

Pekanbaru city is capital city of Riau Province that lies in longitude 101014' - 101013' E and Latitude 0°25' - 0°45' N which is above sea level of 5to 50 m. Pekanbaru has high economic growth in the last year where consists of various company which operated in this region. Pekanbaru population is 1,038,118 inhabitants as of 2015 and number of vehicle is about 813718 vehicles as of 2015.

4.2 Noise Measurement

Noise measurement was conducted in the Jend. Sudirman street of Pekanbaru city which consists of 4 points of measurement. The noise was measured by using Analog Sound Level Meter (SLM) SL 4112. Measurement time referred to ISO R-2006 standard which divided into three part of time such as in the morning starting from 07.00 a.m - 09.00 a.m, day time 11.00 a.m – 01.00 p.m, and afternoon 03.00 p.m- 06.00 p.m. every measurement should represent for a certain time of hour reading as follow:

a. L1 was taken at 07.00 a.m (07.00 a.m - 08.00 a.m)
b. L2 was taken at 09.00 a.m (09.00 a.m - 10.00 a.m)
c. L3 was taken at 10.00 a.m (10.00 a.m - 11.00 a.m)
d. L4 was taken at 11.00 a.m (11.00 a.m - 01.00 p.m)
e. L5 was taken at 03.00 p.m (03.00 p.m - 04.00 p.m)
f. L6 was taken at 05.00 p.m (05.00 p.m - 06.00 p.m)

4.3 Collecting Sample and Data

In this study, the primary data were obtained by using *Cluster Random Sampling* to the urban dweller that subjected to the traffic noise along the main streets in Pekanbaru city. In number of sample were determined by the equation as below:

$$S = \frac{x^2.N.P.Q}{d^2(N-1)+x^2.P.Q} \quad (1)$$

Where:
s = Number of sample
N = Number of Population
x = Chi value with degree of freedom=1, error 10% (α=10%)
P = Accepted assumption value 0.5 (50%)
Q = Unaccepted assumption value 0.5 (50%)
d = percentage of different answer for each quistionare with assumption value 0.5 (50%)

based on the equation of (5), it is obtained the minimum number of sample as follow:

$$s = \frac{x^2.N.P.Q}{d^2(N-1)+x^2.P.Q}$$

$$s = \frac{2{,}706 \text{ x } 1.011.571 \text{ x } 0{,}5 \text{ x } 0{,}5}{(0{,}05)^2.(1.011.571-1) + (2{,}706)\text{x } (0{,}5)\text{x } (0{,}5)}$$

$$s = 271$$

5.0 RESULT AND DISCUSSION

5.1 Noise level

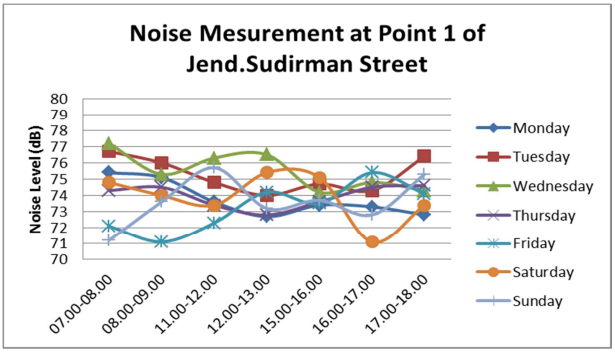

Figure 5.1: Noise Measurement at point 1 of Jend. Sudirman Street.

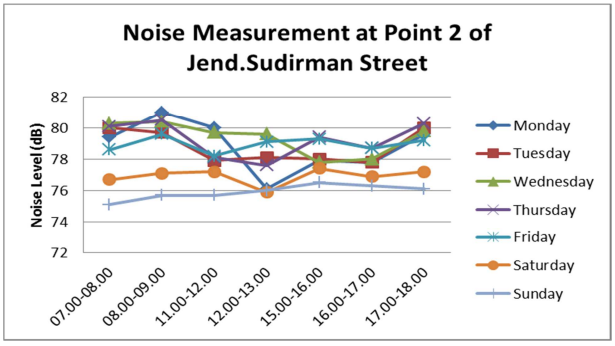

Figure 5.2: Noise Measurement at point 2 of Jend. Sudirman Street.

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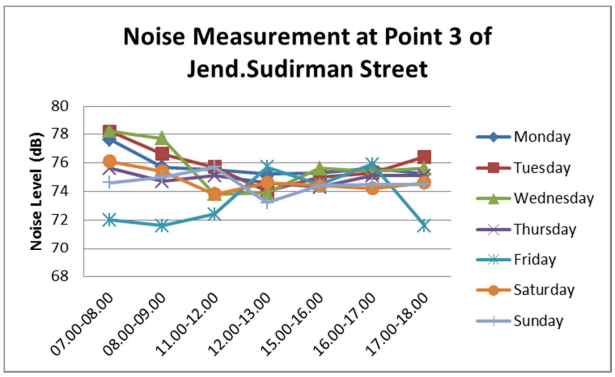

Figure 5.3: Noise Measurement at point 3 of Jend. Sudirman Street.

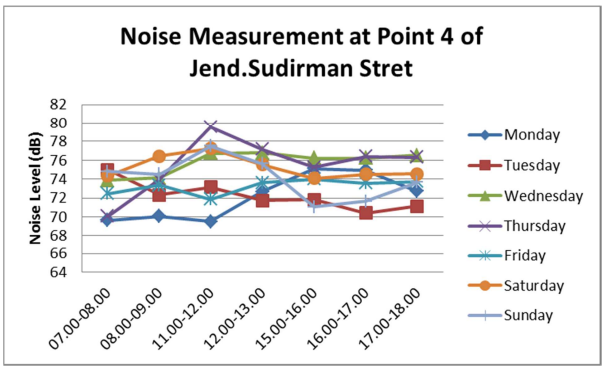

Figure 5.4: Noise Measurement at point 4 of Jend. Sudirman Street.

The noise measurement was conducted in Jend. Sudirman Street which divided into 4 spots measurement. Figure 5.1 - Figure 5.4

5.2 Noise Annoyance

At the number of 271 people as representative number of Pekanbaru population had been interviewed concerning the traffic noise exposed. The survey resulted 100% of people are being annoyed with the traffic noise exposed. The noise measurement ranges between 70 dB up to 80 dB. The sense of annoyance could effect to the quality of life because the comfort life of urban area becomes a human needs.

5.3 Population and Vehicle Growth

In figure 5.5 can be explained the comparison between the growth rate of population and the growth rate of vehicles in the city of Pekanbaru. The vehicle growth is faster than the population growth 2 times in the last ten years. This situation illustrates the improvement of living standards and the ability of people's purchasing power to the needs of transportation is very high. Meanwhile, spatial planning for settlements and roads that connecting an area with other areas becomes very important in order to minimize the noise problems in residential areas or congestion on the highway.

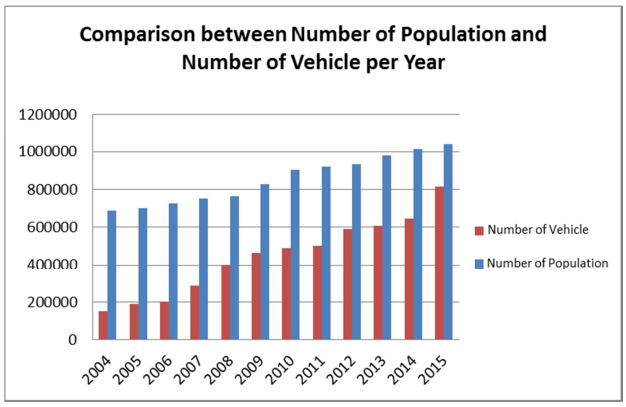

Figure 5.5: Comparison between population and vehicle growth in Pekanbaru.

5.4 Material Losses

Since the vehicle growth is higher than the population growth so it can cause problems for the environment and the urban population that impact on the quality of life of the community.

Road traffic accidents are not only caused by the increased traffic volume, decreased the quality of roads or transportation planning that do not meet the geometric standards, but also it could derive from psychological effects of urban communities which tend to not have driving ethics.

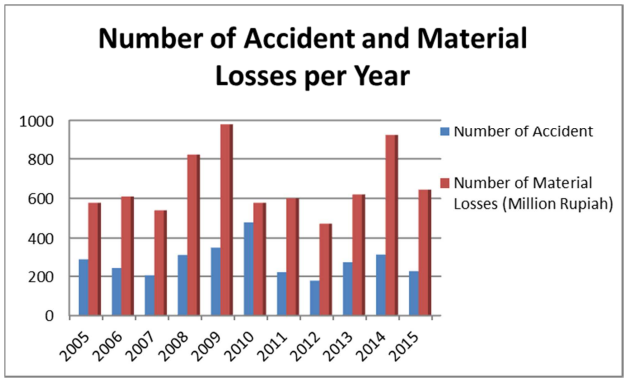

Figure 5.6: Number of accident and material losses in Pekanbaru city.

6.0 CONCLUSION

Vehicle traffic noise can degrade the environment quality of life. Noise annoyances are not only associated with health impairment, but it can lead to poor quality of life which accumulated psychologically and changing the human behavior. Number of accident and loss of material reflects the wobble condition mentally in urban area. Therefore, urban spatial planning is the main factor to improve the social quality.

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REFERENCE

1. Mathias Basner, Wolfgang Babisch, AdrianDavis, Mark Brink, Charlotte Clark, Sabine Janssen, and Stephen Stansfeld (2014). *Auditory and non-auditory effects of noise on health*. http://dx.doi.org/10.1016/S0140-6736(13)61613-X. available in sciencedirect.
2. Debasish Pal and Debasish Bhattacharya (2012). *Effect of Road Traffic Noise Pollution on Human Work Efficiency in Government Offices, Private Organizations, and Commercial Business Centres in Agartala City Using Fuzzy Expert System: A Case Study*. http:// dx.doi.org/ 10.1155/ 2012/828593
3. Halperin D (2014). *Environmental noise and sleep disturbances: A threat to health.* Sciencedirect-sleepscience 7 209-212. Department of Psychiatry, Barzilai Medical Center, Haistadrut Street 2, Ashkelon 78278, Israel.
4. Murphy E and A King Eoin (2014). *Environmental Noise Pollution.* ELSEVIER, First Edition.
5. T. Sato, T. Yano, M. Bjoè Rkman and R. Rylander (1999). Road Traffic Noise Annoyance In Relation To Average Noise Level, Number Of Events And Maximum Noise Level Journal of Sound and Vibration - 223(5), 775±784
6. Carla M.T.Tiesler, Matthias Birk, Elisabeth Thiering, Gabriele Kohlbock, Sibylle Koletzko, Carl-Peter Bauer, Dietrich Berdel, Andreavon Berg, Wolfgang Babisch, Joachim Heinrich (2013). *Exposure to road traffic noise and children's behavioural problems and sleep disturbance: Results from the GINIplus and LISAplus studies.* Environmental Research 123 (2013) 1–8. ELSEVIER.
7. Dirk Schreckenberg, Barbara Griefahn1 and Markus Meis (2010). *The associations between noise sensitivity, reported physical and mental health, perceived environmental quality, and noise annoyance.* Noise & Health, Volume 12:46,7-16.
8. Bugliarello G, Alexandre A, Barnes Jhon and Wasktein Charles (1978). *The Impact of Noise Pollution*. ISBN 0-08-018166-X.
9. Wang K Lawrence, Pereira C Norman, Hung Yung-Tse (2005). *Advanced Air and Noise Pollution Control.* Humana Press Inc. 999 Riverview Drive, Suite 208, Totowa, New Jersey 07512. e-ISBN 1-59259-779-3.

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