

Study of Traffic Noise Pollution at Penang Sentral Area, Butterworth, Penang

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Abstract: Noise pollution has become a major environment issue that happen at the urban area in the city. The noise pollution can affect the mental and physical health of the people nearby the resources of the sound. The lack of sleep, poor performance during working or studying and hearing impairment is one of the impacts because of constant noise pollution. The objectives of this research are to measure the traffic noise level at three difference area which are SMK Convent Butterworth, KTM Butterworth, and Surau Al- Hidayah Balai Pukat. The objective is to determine the traffic noise index and equivalent continuous noise pollution at three differences area which are SMK Convent Butterworth, KTM Butterworth, and Surau Al-Hidayah Balai Pukat and lastly to identify the awareness about the traffic noise pollution around the Penang Sentral community. The research area is Penang Sentral, Butterworth, Pulau Pinang. The hand-held sound level meter has been used to collect the data. The research will be conduct during peak hour for 5 days at three different stations around Penang Sentral area. The aim of this study is able to reduce the noise pollution and improve the health of the student and residents. The result from this study is there are noise pollution around the Penang Sentral area. The LAeq has exceed 70 dBA at the Surau Al Hidayah and KTM Butterworth. The TNI at the 3 location also has exceed 74 dBA. The people around the area also aware about the noise pollution in Penang Sentral area and they agree that noise pollution can cause health problem. The authorities play a big roles to overcome this problem. They have to plan the city planning before approve the building to be constructed. At the Penang Sentral area indeed has a noise pollution around the area.

Keywords: Traffic Noise Pollution, Penang Sentral,

1. Introduction

Transportation noise can cause sleep disturbance and from psychological and physiological stress reactions, it could impact health in respiratory system [4]. The effects of noise pollution pertain to cardiovascular health, lesser extent to respiratory and metabolic health [10]. Ubiquitous and noise environmental pollution, is a public-health issue. It leads to annoyance, decrease the environmental

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quality and also might affect health and human recognition. Any unwanted or harmful outdoor sound that is detrimental to the quality of human life can be classified as environmental noise [7]. The unction of linear, nodal infrastructure as well as cargo and human transport activities contribute to the production of unwanted noise that can reduce the quality of life and affect human health. Noise pollution has been causing many long-term and short-term health problems such as, metabolic syndrome [10] and sleep disorders [17]. The noise exposure is generally produced by the airports [5], common roads [9] and railway traffic [21]. There is particularly severe impact on children's cognitive ability because of noise pollution. Noise pollution causes severe damage to children's brains if expose for a long term and leads to mental retardation [15].

Noise pollution has been one of the largest urban environmental concerns and has a strong negative impact on people's life. The vibration of the object and the transmission in the form of waves in a certain medium such as solid, liquid, and gas can generate sound. Noise pollution arises when the sounding body makes random vibrations and the emitted sound adversely affects people and the surrounding environment. According to the sources, the noise can be divided into traffic noise of which substantially undermine people's mental, emotional, psychological and physical health [2]. According to [6], noise is the unwanted sound and it can cause discomfort to human and has intermittent or random sound oscillation. The measurement of noise level are depends on sound intensity and pressure. In modern society, reduced sleep duration and quality appear to be endemic. Many people thought cut bedtime period to minimum tolerability is to be efficient and harmless. It has been known for decade that sleep is release glucose regulation, a major modulator of hormonal and cardiovascular function. In conclusion, slow wave sleep (SWS), is associated with decreased heart rate, cerebral glucose utilization, blood pressure and sympathetic nervous activity [23].

In Malaysia, most of children are facing problems with traffic noise issue. This is because the increasing in number of vehicles in the road thus it will contribute to noise pollution. The excessive noise level at school areas might affect the class progress, focus of the student in class and communication interruption between teacher and student. Hearing issue will be a huge problem for children age 6-7 since they are still young and hard to cope with teaching process. Therefore, the study of traffic noise pollution is needed in order to find a way to reduce noise in specific area [19]. Road traffic noise pollution was known as a new treat to the people that lives in the cities. It has led to the cause of great annoyance to inhabitants of cities such as the sleep disturbance. Various of study was proven that traffic noise also causes the health problem such as physical and psychological, irritation, human performance and actions [13].

2. Noise Pollution

According to [6], there were three types of noise pollution, and it can be classified as a chronic contamination, temporary contamination with physiological damage and temporary pollution without damage. For example, chronic contamination can cause hearing impairment due to constant exposure to high noise, secondly temporary contamination can cause damage in middle of the ear because of exposure to explosive noise and thirdly are temporary hearing impairment that normally causes by noise of the street and crowded area for some period [11]. Noise has been clearly identified as an important cause of physical and psychological stress throughout dozens of studies. Engine and contact of tyres on the ground produce large noise from vehicle and contribute to road traffic noise. Aircraft engine, frame, aircraft landing or taking off and also aircraft on the ground can cause noise pollution. Something that accompanied by vibration also can cause noise such as the rail noise that arises from the contact of the train wheels with the track, the locomotive engine or the wind resistance to the train [16]. The combinations of air pollutions and noise pollution acted as environmental stressor happened during morning rush hours and public transit. This combination also linked to psychological stress at home and workplace [18].

In Malaysia most schools are located near the roadside [8]. As a result, student can diminish their attention spans, social adaptability and even cause them to behave poorly because they are often exposed to levels of noise. Noise pollution are the second most threatening type of pollution in the

world declared by the World Health Organization (WHO) [3]. Noise pollution in schools Learning environment of students and work environment of teachers is affected because of noise in school and studies have highlighted the consequences to the students learning and performance at school [14][20][22]. In the study of background noise effect it found that the children are at disadvantage when listening through noise and can harm student achievement and learning by studies around the world [12].

3. Methodology

3.1 Study Area

The research area, Penang Sentral was located at Butterworth, Penang. It was developed as the main transportation hub for the State of Penang. A lot of construction is still in progress around the area as now it serves as the terminal for both public and intercity buses and is physically connected to the adjacent Butterworth railway station and Penang Free Terminal. Around the radius of 3 km, there were a school, surau and KTM (Keretapi Tanah Melayu) as in Figure 1.



Figure 1: Research area

Behind Surau Al-Hidayah Balai Pukat had two terminal oil and gas which is from Shell and Petron terminal and commercial buildings was located in front of Surau Al- Hidayah Balai Pukat. SMK Convent Butterworth is located at New Ferry Road. It was circled by Tabung Haji buildings, Penang International Dental college, Maybank and other commercial buildings. KTM Butterworth is located beside Penang Sentral. KTM Butterworth is surrounded by parking lot and ferry terminal.

3.2 Materials

Materials that have been used in this thesis is sound level meter and tripod stand to hold the sound level meter when set up at the side of the road at the chosen stations is in Figure 2.



Figure 2: Sound level meter on the tripod stand

3.3 Method

The noise descriptors such as L10, L90 and L_{eq} are recorded in Table 1. The noise measurement was carried out for 3 hours for 5 days for each station by using integrated equipment. The tripod for sound level meter has been set up at height 1.5 meter from the ground. The data have been calculated from the equation.

Table 1: Data collection time

	Surau Al Hidayah	SMK Convent	KTM Butterworth
Morning	0730-0830	0730-0830	0730-0830
Afternoon	1200-1300	1200-1300	1200-1300
Evening	1600-1700	1600-1700	1600-1700

For the method to calculate the sound level, L_{eq} was calculated which expressed in dB(A) units. The formula to calculate the noise level is shown in Equation 3.1.

$$LA_{eq} \text{ 1hr} = 10 \log [10^{(X1/10)} + 10^{(X2/10)} + \dots + 10^{(X3/10)} / n] \quad Eq.1$$

Where:

X1, X2 ... X3 = Represent the data observed

n = Number of observations

The Equation 3.2 below show formula to calculate Traffic Noise Index (TNI).

$$TNI = L90 + 4(L10 - L90) - 30 \quad Eq.2$$

The equation 3 below shows formula that has been used to calculate the Noise Pollution Level. From the equation LA_{eq} , the value for noise pollution level are calculated. To find the noise pollution level, L10 are minus with L90 and then plus the LA_{eq} .

$$LNP = LA_{eq} + (L10 - L90) \quad Eq.3$$

4. Results and Discussion

4.1 Results

From the figure 4.1 the LA_{eq} shows that Surau Al-Hidayah has more noise pollution between SMK Convent and KTM Butterworth because it has 5 time that over 70 db which is the limit for the LA_{eq} at mix development and commercial. The day that noise pollution has occur is on Monday, Tuesday, and Thursday which value 70.65, 72.04, 73.81, 71.2 and 71.04. The highest value for LA_{eq} at Surau Al Hidayah is 73.8, on Tuesday, while KTM Butterworth has the highest LA_{eq} , 76.53 on Thursday evening. From the value, we can see that noise pollution frequently occure at evening time. KTM Butterworth do not have many high LA_{eq} but it can potentially has noise pollution because the road are main road that are connected to the Penang Sentral, Surau Al-Hidayah and altenative road to the SMK Convent Butterworth. The limit for school is 55db which is exceed the value LA_{eq} for SMK Convent Butterworth. All value for 5 days has exceeding the limit 55db. The SMK Convent has a noise pollution that can disturb the concentration of students during study.

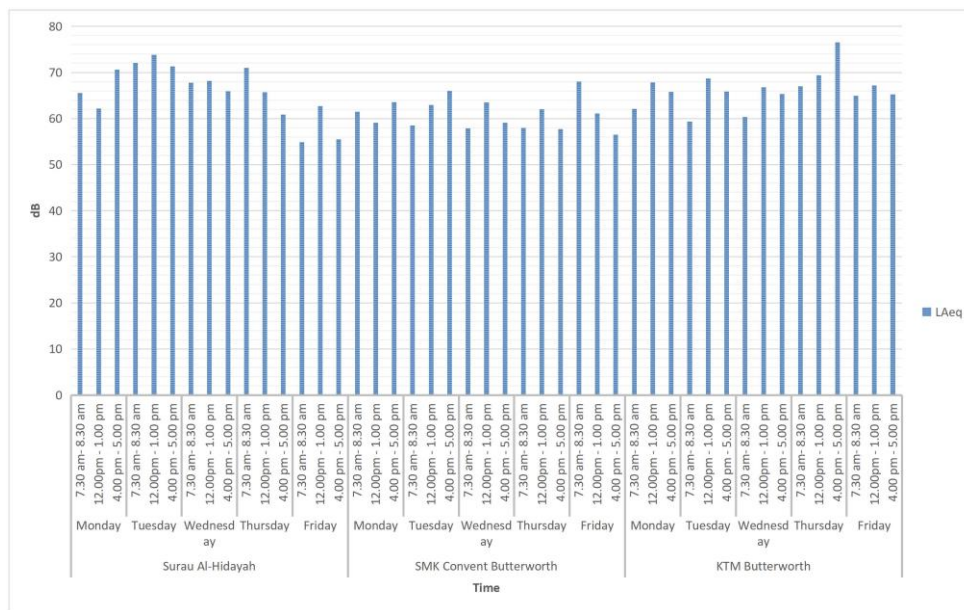


Figure 2: Comparison LA_{eq} between 3 stations

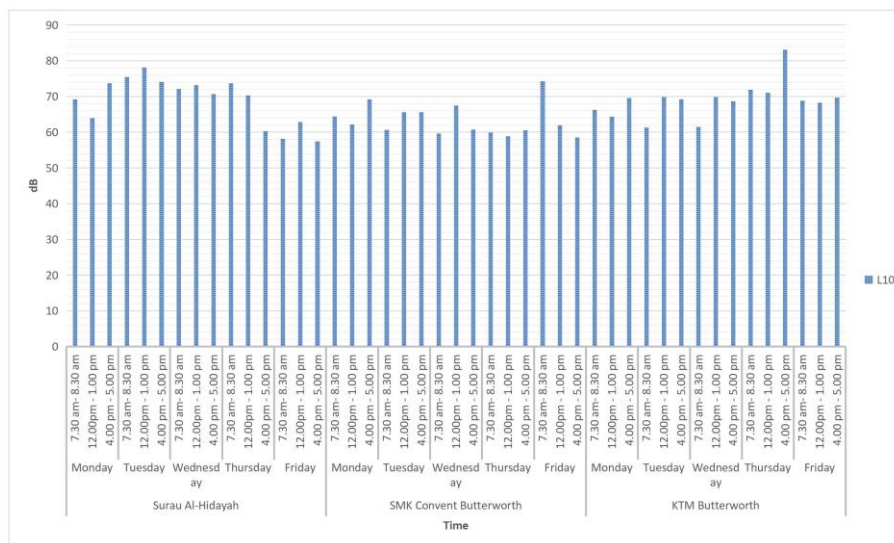


Figure 3: Comparison L10 between 3 stations

From the Figure 3, the L10 limit is 80 dB which is only KTM Butterworth has exceeded the limit that on Thursday evening. The KTM Butterworth has noise pollution in that area. The graph shows that the average value is around 70 db so when the increasing of vehicles occurred, the noise value at the KTM Butterworth will also increase in the future. This situation also will happen at the Surau Al Hidayah because the value for L10 also has many value that over 70 db. When many lorries and busses activity occur, the value at Surau Al Hidayah also will be increasing at the future. SMK Convent has only one value that over 70 db but it also has potential for noise pollution. The average value for SMK Convent are around 60 db.

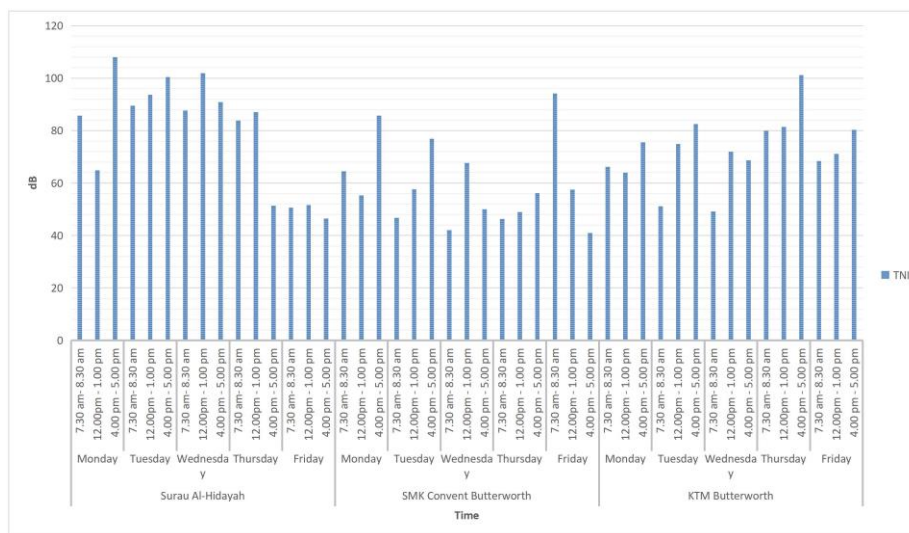


Figure 4: Comparison TNI between 3 station

For TNI, the Figure 4 shows that Surau Al Hidayah has more value that over 74dB and it has the highest value between 3 station which is 107.99. Only Monday afternoon, Thursday evening and Friday has the value that lower than 74dB. There are 3 value that exceed 100 db which is 107.99, 100.42, and 101.82. Surau Al Hidayah have the worst noise pollution between the 3 station which is on Monday, Tuesday Wednesday and Thursday. KTM Butterworth is the second worst station between 3 stations. It has one of the highest values for TNI which is 101.13. There are many values that exceeded the limit value for TNI for KTM Butterworth. Lastly, SMK Convent only has 3 value that exceed TNI limit which is 85.72, 76.82, and 94.16. For the summary the Surau Al Hidayah has the worst noise pollution level between 3 station. This can disturb the prayer of the resident at that area.

4.2 Questionnaire

From the research at the Penang Sentral area, questionnaire has been distributed around the area to get their opinion about the noise pollution around Penang Sentral area and to ask if they are aware about noise pollution around their area. From the result, 76.7% strongly agree and 16.7% agree respondent aware about traffic noise pollution around their area and another 6.7%.62.5% respondent strongly agree and 35% agree that noise from traffic are disturbing their sleep.2.5% respondent are moderately agree. For the traffic can cause phycological illness such as stress, hypertension and loss focus, 40% respondent strongly agree and 40% agree while 20% are moderate. Beside that, 59.1% and 18.2% respondent strongly agree and agree that government has enforce the traffic law strictly again the modification of vehicles but 9.1% respondent disagree with the question. 43.3% and 30% respondent are strongly agree and agree but another 3.3% respondent do not agree with this question. The respondent are asked about contribution of Penang Sentral to the traffic noise pollution in their area, 50% respondent are strongly agree, 26.7% agree and 23.3% on moderate. From the result for the questionnaire that have been distribute to the respondents, we can conclude that the resident is aware

about the condition of their place and the also aware what is noise pollution and effect of the noise pollution to their daily activities such as sleep, prayer and study and also effect of noise pollution to their health. They also agree that noise pollution is mainly come from heavy vehicles and goverment play a big role to overcome this problem in enforce the law regarding the noise pollution that come from vehicles. Many resident agree that they are comfortable live in this area because it is near to get basic need and easy to get transportation such as bus and taxi to move around the town.

4.3 Discussions

From the data that have been colleted with different time and places were observed and evaluated to analyse the noise pollution at the Penang Sentral area. The noise parameter for the equivalent continuous noise level (LAeq), noise level at 10% (L10), noise level at 90% (L90), traffic noise index (TNI) and noise pollution level. From the Table show the result for the noise pollution at the Penang Sentral area. For the commercial and mixed development the LAeq day must be not exceed 70 dBa . The LAeq at the Surau Al Hidayah has exceed the limit for the noise pollution. On Monday, Tuesday and Thursday LAeq has over 70 dbA at that area. Beside that, the LAeq at SMK Convent also had exceed the limit but not as much as at the Surau Al Hidayah. Surau Al Hidayah has alot of bus and lorry tanker because around the area there are pump station and exit for the bus and lorry to the highway. The LAeq at KTM Butterworth has only one over limit data. For TNI Surau Al Hidayah has the highest TNI between 3 station which is 107.99. For the noise pollution level (LNP), Surau Al Hidayah also has the highest noise level which is 92.09.

5. Conclusion

In this study, field data has been collected and assessment were carried out at 3 difference location to collect traffic noise impact data at Penang Sentral area. From this study we can conclude that at Surau Al Hidayah has the most noise pollution around the Penang Sentral Area. The noise pollution are causes by the lorry from the pump station and bus from the terminal bus at the Penang Sentral. Surau A Hidayah has 3 TNI over 100 which is 107.99 in the Monday evening, 100.42 in the Tuesday evening and 101.82 in the Wednesday evening. From this data we can conclude that in evening has the highest activity of the lorry and bus at that area. At the KTM Butterworth there are only 1 TNI data over 100 which is on Thursday evening. KTM Butterworth road is one of the alternative road that has been used by the lorry and bus to the Penang Sentral and Surau Al Hidayah. KTM Butterworth and Surau Al Hidayah has high LAeq between the 3 area. The LAeq can exceed to above 70 dbA from the data that have been collected. From the survey that have been distributed, majority of the peoples at Penang Sentral area aware about the noise pollution around the area. They are also aware about effects of noise pollution to their health such as disturbing of sleep. From this data, the goverment play a main role to overcome this problem. They must take action and city planning must be plan before approval to build the building around the city to avoid this problem to happen again in another area. From the survey, resident is used to the noise pollution and they feel comfortable live in that area because of it is easy to get the basic need and transportation in that area.

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