



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

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**Abstract:** Noise pollution has become a major environment issue at the urban area. The noise pollution may affect 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 examples of the impacts because of constant noise pollution. The objectives of this research are: 1) to measure the traffic noise level at three difference area which are SMK Convent Butterworth, KTM Butterworth, and Surau Al- Hidayah Balai Pukat; 2) 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 3) 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 was conducted 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 locations 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 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 may affect sleep disturbance and from psychological and physiological stress reactions, it could impact health in cardiovascular health, respiratory system and metabolic health [1][2][3]. Ubiquitous and noise environmental pollution, is a public-health issue. It leads to annoyance, decrease the environmental 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 [4]. 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. The noise exposure is generally produced by the airports [5], common roads [6] and railway traffic [7]. 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 [8].

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 [9]. Noise is the unwanted sound and it can cause discomfort to human and has intermittent or random sound oscillation [10]. The measurement of noise level is depending 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 [11].

In Malaysia, most of children are facing problems with traffic noise issue. This is because the increasing in number of vehicles on the road 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 teachers and students. 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 the area [12]. 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].

## 1.1 Noise Pollution

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 [10]. 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 [14]. 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. 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 [15]. 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 [16].

In Malaysia most schools are located near the roadside [17]. 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) [18]. Environment of student's learning and environment of teacher's work which affected by noise pollution in surrounding school and studies should be highlighted as there have consequences to the students learning and performance at school [19][20][21]. The previous study of background noise found that the children which listening through noise and was harm student achievement and learning by studies around the world [22].

## 2. Methodology

### 2.1 Study Area

The research area, Penang Sentral was located at Butterworth, Penang was chosen as study area. 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 3km, there were a school, surau and KTM (Keretapi Tanah Melayu) (Fig. 1).

Behind Surau Al-Hidayah Balai Pukat had two terminal oil and gas which is from Shell and Petron terminal and commercial buildings. 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 and surrounded by parking lot and ferry terminal.



**Fig. 1 - Research area**

## 2.2. 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 (Fig. 2 and Fig 3).



**Fig. 2 - Sound Level Meter**



**Fig. 3 - Sound level meter on the tripod stand**

### 2.3 Method

The noise descriptors such as L10, L90 and Leq has been recorded. 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. The noise parameters in this study was equivalent continuous noise level (LAeq), noise level at 10% (L10), noise level at 90%(L90), traffic noise index(TNI).

**Table 3.1 - 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, Leq was calculated which expressed in dB(A) units. The formula to calculate the noise level is shown in equation (1).

$$LAeq\ 1hr = 10 \log [10^{(X1/10)} + 10^{(X2/10)} + \dots + 10^{(X3/10)} / n] \tag{1}$$

Where:

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

n = Number of observations

The equation (2) below show formula to calculate Traffic Noise Index (TNI).

$$TNI = L90 + 4(L10 - L90) - 30 \tag{2}$$

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

$$LNP = LAeq + (L10 - L90) \tag{3}$$

## 3. Results and Discussion

### 3.1 Results

From the Fig. 4 the LAeq 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 LAeq 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 LAeq at Surau Al Hidayah is 73.81 which is on Tuesday but KTM Butterworth has the highest LAeq, 76.53 on Thursday evening. From the value, noise pollution was occurred frequently at evening time. KTM Butterworth do not have many high LAeq data 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 55 dB which is exceed the value LAeq for SMK Convent Butterworth. All value for 5 days has exceed the limit 55 dB. The SMK Convent has a noise pollution that can disturb the concentration of students during study.

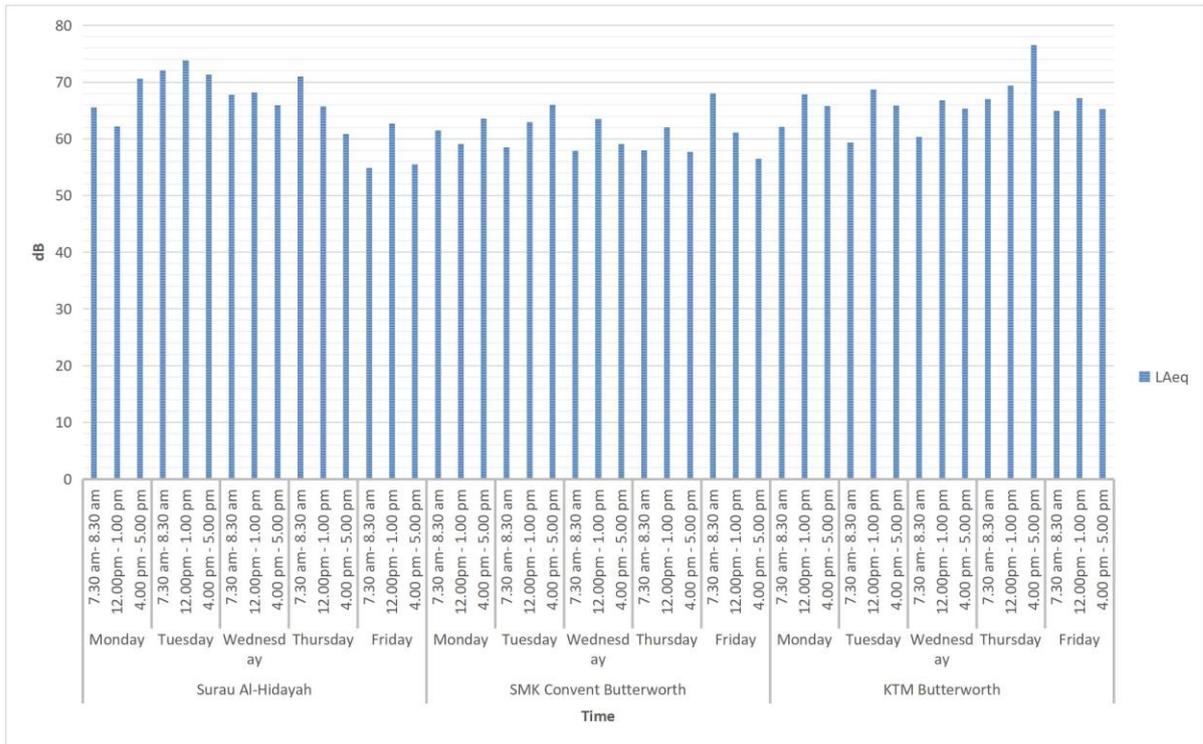


Fig. 4 - Comparison LAeq between 3 station

From the Fig. 5, 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 occurs, 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 show some data was exceeding 70 db. Hence, the value at Surau Al Hidayah also will be increasing at the future parallel to the increasing of lorries and busses activities. SMK Convent has only one data that over 70 dB but it also has potential for noise pollution. The average value for SMK Convent are around 60 dB.

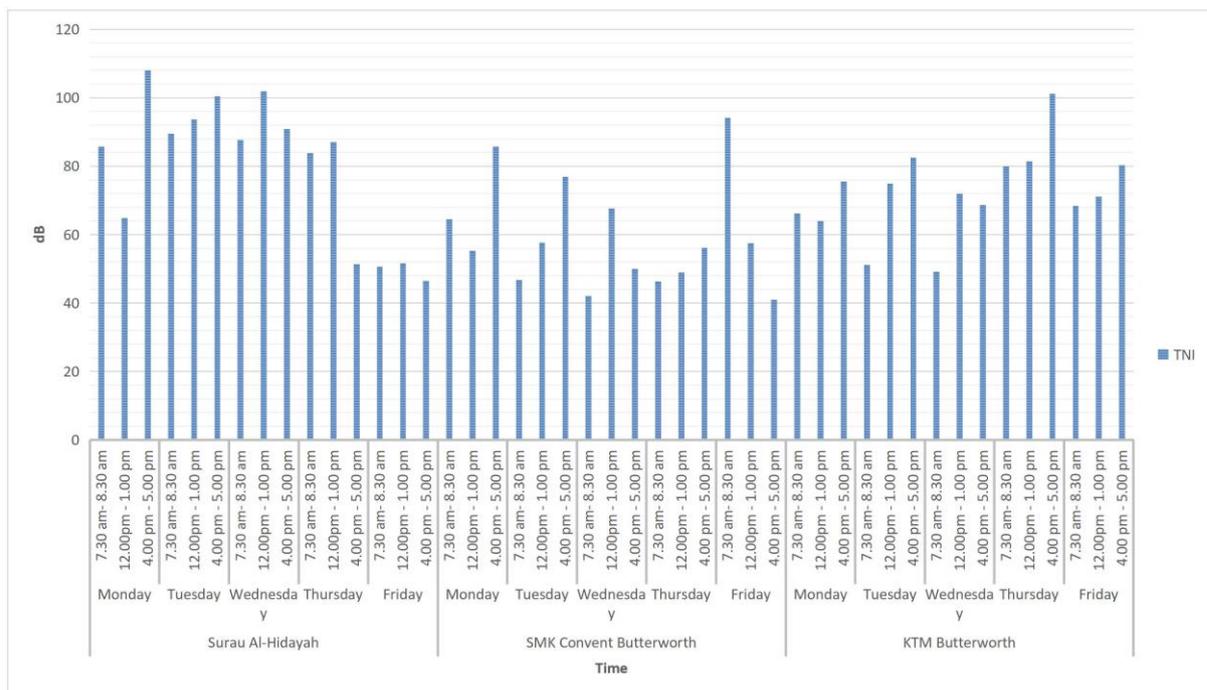


Fig. 5 - Comparison L10 between 3 station

For TNI, the Fig. 6 shows that Surau Al Hidayah has more data over 74 dB compared to KTM Butterworth and SMK Convent and it has the highest value between 3 stations which is 107.99. Only Monday afternoon, Thursday evening and Friday has the data that lower than 74 dB. There are 3 data 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 station. It has one of the highest value for TNI which is 101.13. There are many value that exceed 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 which indirectly disturb the prayer activities.

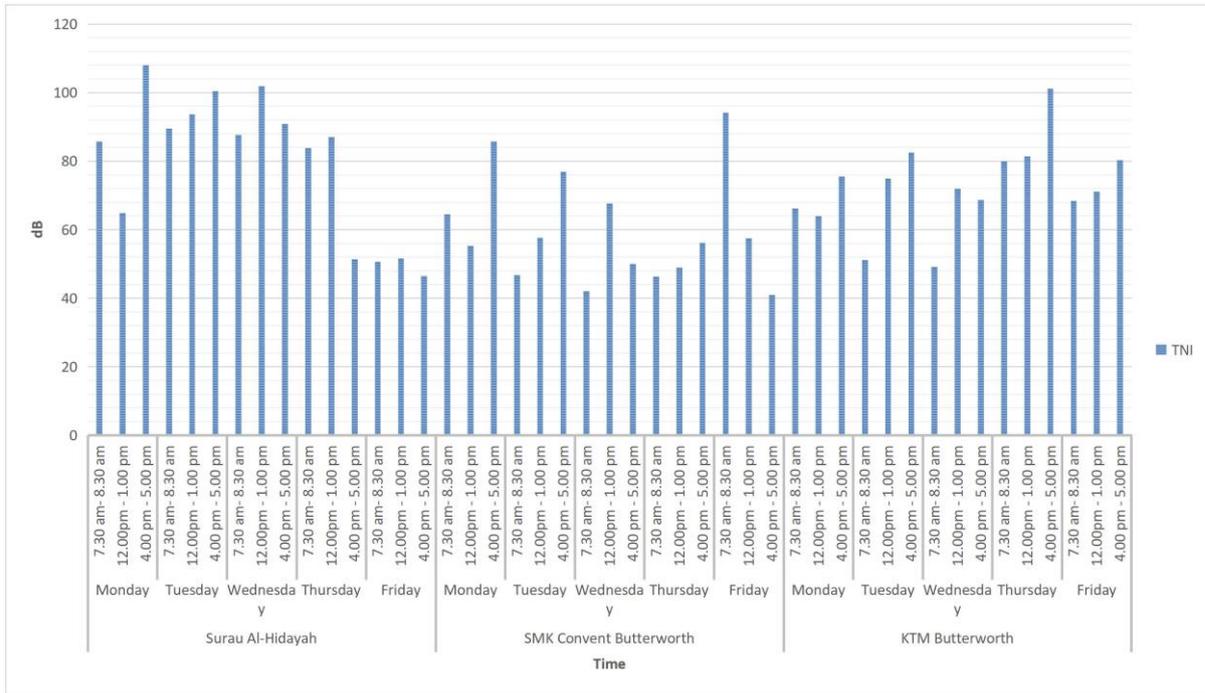


Fig. 6 - Comparison TNI between 3 station

### 3.2 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 know their awareness 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 while 6.7% does not aware about noise pollution. 62.5% respondent strongly agree and 35% agree that noise from traffic are disturbing their sleep while 2.5% respondent are moderately agreed. 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. Besides 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 agreeing and agree but another 3.3% respondent do not agree with this question. 50% respondent are strongly agreeing, 26.7% agree and 23.3% on moderate about contribution of Penang Sentral to the traffic noise pollution in their area. From the result for the questionnaire that have been distribute to the respondents, the residents were aware about the condition of their place and 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 government play a big role to overcome this problem in enforce the law regarding the noise pollution that come from vehicles. Many residents 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.

### 3.3 Discussions

The data from collected Fig 4, 5 and 6 with different time and places were observed and evaluated to analyse the noise pollution at the Penang Sentral area. The LAeq at the Surau Al Hidayah has exceed the limit for the noise pollution which is LAeq for the commercial and mixed development should not exceed 70 dB. On Monday, Tuesday and Thursday, LAeq has over 70 dB at that area. Besides that, the LAeq at SMK Convent also had exceed the limit but not as much as at the Surau Al Hidayah. The pump station at Surau Al Hidayah area cause the existence of a lot of

buses and lorry tankers. 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.

#### 4. Conclusion

In this study, field data has been collected and assessment were carried out at 3 difference locations to collect traffic noise impact data at Penang Sentral area. From this study Surau Al Hidayah has the most noise pollution around the Penang Sentral Area. The noise pollution are causes by the lorries from the pump station and bus from the terminal bus at the Penang Sentral. Surau A Hidayah has three 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, the highest activity of the lorries and buses was occurred at that area in the evening. At the KTM Butterworth there are only one 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 three areas. The LAeq can exceed to above 70 dB from the data that have been collected. From the survey that have been distributed, majority of the residents 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 government 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 the same issue occur in another area. From the survey, residents at the area have comfortable live even in noisy surrounding because the locations is strategic, easy to get the basic need and transportation in that area.

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