STUDY OF HOSPITAL NOISE AT PARIT BUNTAR HOSPITAL, PARIT BUNTAR, PERAK.

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SCHOOL OF CIVIL ENGINEERING
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STUDY OF HOSPITAL NOISE AT PARIT BUNTAR HOSPITAL, PARIT BUNTAR, PERAK.

By

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I hereby declare that all corrections and comments made by the supervisor(s) and examiner have been taken into consideration and rectified accordingly.

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(Signature of Examiner)

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Date :

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ABSTRAK

Kajian ini memberi tumpuan kepada pengukuran bunyi dalam kawasan hospital di Hospital Parit Buntar. Objektif kajian ini adalah untuk mengukur tahap bunyi dalam dan luar bangunan hospital, untuk mengenalpasti sumber bunyi dalam dan luar bangunan dan untuk menghasilkan profil bunyi luar bangunan hospital. Kajian ini dijalankan selama dua hari yang mewakili hari cuti (Thaipusam) pada hari isnin untuk kawasan luar bangunan dan waktu bekerja pada hari selasa untuk kawasan dalam bangunan bagi mengukur persekitaran bunyi dengan mengunakan meter pengukur bunyi. Pengukuran aras bunyi diambil dalam setiap 3 minit dengan jarak waktu 1 saat. Pengukuran aras bunyi dipantau pada waktu pagi (0800-1030), tengah hari (1200-1430), petang (1600-1830) dan malam (230-2300). Senarai sumber bunyi direkodkan secara manual melalui pemerhatian bersama dengan waktu kejadian dan pistol kelajuan digunakan untuk mengukur tahap kelajuan lalu lintas daripada pelbagai jenis kenderaan di atas jalan raya. Paras bunyi minimum (Lmin), maksimum (Lmax), paras bunyi melebihi 10% (L10), 50% (L50) dan 90% (L90) diukur untuk membantu menilai tahap bunyi bising sedia ada di pelbagai lokasi yang diputuskan sebelumnya. Keputusan menunjukkan tahap kebisingan yang dipantau dari segi purata LAeq (mean) antara 53.9 dB(A) to 56.1 dB(A) bagi kawasan luar bangunan disebabkan oleh aliran lalulintas, bilangan kenderaaan yang mempengaruhi persekitaran dan penjana daripada Mydin manakala purata LAeq (mean) dalam bangunan antara 51.8 dB(A) to 61.9 dB(A) untuk Wad Angerik, Wad Dahlia, Wad Mawar and Wad Melor disebabkan oleh perbualan antara pekerja, bunyi telefon, batuk, kerusi, radio dan kipas siling yang menyumbang bunyi berlebihan ke persekitaran. Kira-kira 90% dan ke atas bacaan bunyi yang dicatat melebihi tahap yang dibenarkan oleh Jabatan Alamsekitar Malaysia dimana 50 dB(A) pada waktu siang dan 40 dB(A) pada waktu malam.

ABSTRACT

This study focuses on monitoring hospital noise in the study areas of Parit Buntar Hospital. The objectives of this study were to measure noise levels of indoor and outdoor of the hospital, to identify the source of indoor and outdoor noise and to produce the outdoor noise profile at the hospital. This study was conducted within two days representing holiday (Thaipusam Festival) which is Monday for outdoor areas and weekday which is Tuesday for indoor areas to measure the noise environment by using a sound level meter. The noise measurement was collected in every 3 minutes with interval 1 second. The noise levels measurement were monitored in the morning (0800-1030), afternoon (1200-1430), evening (1600-1830) and night (2030-2300). The list of noise sources was recorded manually from the observation together with time occurrence and speed gun for measuring traffic speed of various type of vehicle on roads. Minimum noise level (Lmin), maximum noise level (Lmax), noise level exceed 10% (L10), 50% (L50) and 90% (L90) were measured to assist in assessing the existing noise level at a various pre-determined location. Results showed that the monitored noise levels in term of average LAeq (mean) between 53.9 dB(A) to 56.1 dB(A) for outdoor due to traffic flow, the number of vehicles influenced the reading of the noise to the surrounding and generator from Mydin Mall while for indoor average LAeq (mean) between 51.8 dB(A) to 61.9 dB(A) for Ward Angerik, Ward Dahlia, Ward Mawar and Ward Melor due to staff conversation, phone ringing, cough, scrap chair, radio, audio and ceiling fan also contributed noise to the surrounding. About 90% and above the noise levels recorded were exceeded the Maximum Permissible Sound Level by Receiving Land Use for Planning and New Development by Department of Environmental (DOE) which is 50 dB(A) in the day time and 40 dB(A) in the night time.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
dB(A)	A-Weighted Sound Level in Decibel
DOE	Department of Environment
L_{10}	10^{th} Percentile Noise Level
L_{50}	50^{th} Percentile Noise Level
L_{90}	90^{th} Percentile Noise Level
L_{Aeq}	Equivalent Noise Level
L_{max}	Maximum Noise Level
L_{min}	Minimum Noise Level
SLM	Sound Level Meter
SPSS	Statistical Package for the Social Sciences
WHO	World Health Organization

CHAPTER 1 INTRODUCTION

1.1 Background

Noise pollution is unpleasant or excessive, which can interfere with human or animal life's activity or balance. However, unwanted sound can interrupt activity where quietness is desirable, distract concentration, decrease communication quality and contribute to individual stress. The human norm ear system has a limitation of sound capacity to perceive and receive sound. Research has focused on the fairly clear quality of life-effects associated with intrusive noise annoyance (Swift, 2010). Most of the countries facing the problem with environmental issue is noise pollution. Furthermore, noise is one of the insidious and unrecognized pollutants. According to (Choiniere, 2010), the example of unwanted sounds such as traffic sound, construction tools, aeroplanes, and leaf blowers harm human health and well-being. According to World Health Organization (WHO, 2004) for the technical meeting on sleep health, the excessive noise can cause hearing loss, disturbs sleep and triggers hormones that could affect the immune system, the metabolism and the cardiovascular system.

When a mother is exposed to environmental noise or excessive noise, it could also affect the unborn children. It has shown that pregnant women with excessive noise are at increased risk of premature birth and reduce the birth weight to the baby by American Academy of Pediatrics (Pediatrics, 1997).

1.2 Problem Statement

Previous studies conducted by the World Health Organization (WHO, 1990) proof that the noise level at the hospital during day and night time getting increasing constantly since 1960 (Ryherd et al., 2008). According to WHO, the allowable noise level for hospital environment within 35-40 dB(A) and during evening or night, the range must be in 30-40 dB(A) (He et al., 2018). For internal space such as dwelling, the acceptable noise level are 35dB(A) and to avoid sleep disturbance during night time, the noise level should be equal or less than 30dB(A) in the bedroom (Moshi et al., 2010).

According to Department of Environmental Malaysia (DOE), the allowable noise levels for land use planning at the hospital during day time from 7.00 a.m. to 10.00 p.m. should be 50 dB(A) and 40 dB(A) in the night time from 10.00 p.m. until 7.00 a.m. (DOE, 2007)

Many researchers proof that the noise level in many hospital areas regardless of their area sizing, type of rooms, type of patients and also weekdays or weekends are always exceeding the recommended guideline from the WHO with average range of 60-70 dB(A) and can up to the maximum level which are 80-120 dB(A) (He et al., 2018). A study conducted by (Andrade et al., 2016), in the Governador Valadares Public Hospital, recorded the minimum and maximum levels in the maternity ward were 53 and 69. The value can reach up to 85 dB in female infirmary and emergency room.

Noise exposure with a long period can lead a negative impact such as hearing loss and speech interference, also may contribute to sleep disturbance and increase high blood pressure when continuous noise exposure happened (Isa et al., 2018). The excessive noise with continuous ringing in the ears will produce the symptom of tinnitus and Noise-Induce Hearing Loss (NIHL) also will damage the cochlea in the inner ears where the hair cell cannot regrow and no treatment (Zaiton et al., 2015).

From the previous study, noise ambience in the hospital was increasing and can lead to environmental problems. It will become noisier by time to time. As there is lack of study in noise pollution at the hospital in Malaysia specifically in indoor and outdoor, this study is conducted to fulfil the gap of the knowledge to see the noise level by comparing with standard guideline and identify the noise sources as well as to produce the hospital outdoor noise profile.

1.3 Objectives

The aim of this study is to assess noise levels at hospital in Parit Buntar, Perak. This study is carried out in order to achieve the following three main objectives:

a) To measure noise levels of indoor and outdoor of the hospital.

b) To identify the source of indoor and outdoor noise.

c) To produce the outdoor noise profile at the hospital.

1.4 Scope of Study

This research is conducted at Parit Buntar Hospital, Perak located coordinates of 5.130882, 100.483728. The measurement of the study was taken during the holiday and working hour. The main focus of this study is to collect the ambient noise level at the hospital and the results were compared with recommended for land use planning guideline at the hospital from DOE. This study also intended to identify the sources that contribute to noise pollution in the hospital. Noise measurement and identification of the source of noise were carried out indoor and outdoor of the hospital.

The sources of the noise were collected through manual observation during noise measurement and will be recorded into paper form. The noise measurement was measured in four different sessions, morning, afternoon, evening and night.

1.5 The Importance and Benefits of This Project

This study aims is to compare the noise levels in hospital at Parit Buntar, Perak with WHO and Department of Environment (DOE) guideline. Based on the Planning Guidelines for Environment Noise Limits and Control, the maximum permissible sound level (L_{Aeq}) by receiving land use for planning and new development at hospital area for day time is 50 dB(A), 40 dB(A) during night time. This study is being conducted to show the result of the noise level at the hospital. From the study result, it could be used to raise awareness among staffs about noise pollution. For engineers, it is very important especially during the design stage of hospital building for the future development and to help the hospital's top management to monitor which source of noise can be minimized or controlled to reduce the noise levels in the hospital.

1.6 Thesis Outline

Chapter 1: Introduction – Provides an overview on hospital noise pollution, the standards from WHO and DOE that allowable at hospital. The introduction describes includes the problem statement, objectives, scope of study, importance and benefits of the study to be carried out.

Chapter 2: Literature Review – Literature review from the previous study that related to study which explain the result and detail about the study on noise pollution, worldwide hospital noise pollution, noise source and effect to surrounding.

Chapter 3: Methodology – Clarifying all means taken in going before research. Thus this chapter provides information on the study area, equipment that were used to monitoring the data and method to analyse data.

Chapter 4: Results and Discussion – The results of the study are discussed in this chapter including indoor and outdoor analysis. Hospital outdoor noise profile was showed in this chapter.

Chapter 5: Conclusion and Recommendation – Concludes the research finding and recommendation for future study regarding noise at hospital.

CHAPTER 2 LITERATURE REVIEW

2.1 Hospital Noise Pollution

According to (Khademi et al., 2011), the quality of personnel's performance will be affected due to noise pollution and give serious effects to patients during the treatment process when the noise levels exceeded the standard guidelines. The usage of technology tools increases the noise environment in the hospital area. Noise also can be generated from many ways such as conversation among personnel, background noise by action and devices with acoustic alarm (Macedo et al., 2009). From the previous study found that the operation rooms was the noisiest place because the noise environment from the data collection was 64.2±2.1 dB (A) (Wang et al., 2017). Furthermore, the rate of Noise-Induced Hearing Loss (NIHL) will increase when exposed to high levels of noise at a long-term period. Noise-Induced Hearing Loss (NIHL) can cause deafness when keeping continuous exposure to the noisy environment. According to Macedo et al. (2009), physiological and psychological such as hypertension, headaches, hearing loss, muscle tone, the low concentration may occur when long-term exposure to noise level greater than 85 dB.

The main source of sleep disturbance in wardrooms come from non-structural elements (human activity) such as visitor, caregivers, and snoring roommates compare to structural source such as machine which less contribution in noise generation and the wardrooms noise levels result completely different from other researchers who do their investigation in Intensive Care Unit (ICU) to see the comparison between human source versus machine source where to produce the high noise environment (Park et al., 2014). From the finding, the maximum noise level, L_{max} is high in 3-bed or 4-bedrooms than 1-beds or 2-bedrooms.

2.2 Worldwide and Local Noise Level in Hospital

In South Korea at Dankook University Hospital, the noise level in hospital wardrooms show that the noise environment was higher than allowable level by WHO guideline as well as from domestic policies in South Korea which is the level was 63.6 dB (86.6dBA) (Park et al., 2014). This can be supported by Andrade et al. (2016) that show all the results obtained were above from the Associação Brasileira de Normas Técnicas (ABNT) and WHO guideline. From the investigation conducted in the maternity ward, the results show that the noise level varied between 53 dB up to 69 dB (Andrade et al., 2016). This can be considered as risk environment because the noise level was too high to patients and baby. For newborn, exposed to excessive noise level over 48 hours can be considered as a risk factor because can lead to deafness or sound trouble towards the baby (Uchôa NT et al., 2003). In placing more emphasis, the study in Intensive Care Unit (ICU) at China in MICU public government hospital revealed that the data collection for noise environment was beyond the standards guideline by WHO and the Emission Standard for Community Noise of China for hospital and ICU because the result for mean noise level during a week and a day were 66.64 dB(A) and 68.03 dB(A) (He et al., 2018).

Furthermore, in an observation-based study by Khedemi et al. (2011) in Iran, the study was conducted in Imam Reza Hospital. The quality of staff and patient's condition will give a serious effect when the background noise level beyond the standard. In this study, the average noise level in all unit was 60.24 dB. From the result, the noisiest place in Imam Reza Hospital was Nephrology Department and followed by the Emergency Department. After that, the average noise level in internal, surgical and cardiovascular emergency units above the standards, because levels obtained, were 62.9 dB, 62.4 dB and 62.2 dB. From the previous study, ICU noise level contributed to staff sleeping problem (Otenio MH et al., 2007). Noise in ICU can be produced from a varied source such as cardiac monitor, ventilation, infusion pump. Doctor's mistake may occur due to telephone ringing and falling instrument and may lead to patients dying because of lost concentration during the operation process.

In research in Greece, the results from this finding show that all the measurement was above the international guideline by World Health Organization (WHO) which is the result registered during the evening was 67.4 dB(A) and during the night was 62.7 dB(A) (Tsiou et al., 1998). When people are exposed to noise level greater than 90 dB(A) for 8 hours and above, this can be considered dangerous because it can give negative effects. The higher noise level will lead to increasing the usage of anaesthetic drugs because of sleep disturbance problems and the hospitalization duration will take longer (Park et al., 2014).

A study about hospital conducted in Kuala Lumpur revealed that noise level in term of equivalent continuous for 16 hours measurement in Kuala Lumpur Hospital ranged between 72.4 dB(A) and 80.3 dB(A) while measurement obtained in Tung Shin Hospital ranged between 76.8 dB(A) and 86.6 dB(A) (Elfaig et al., 2002). Another study about hospital in Malaysia which the hospital's names were confidential which located in Klang Valley area, Malaysia found that the noise levels of waiting area were worse than recommended by the WHO and it was found the noises are mainly generated by people in the waiting area (Nazli, 2013).

2.3 Noise Level Standards

DOE and WHO have published their guidelines for recommended noise level according to the type of building. According to Malaysia Department of Environment in Planning Guidelines for Environmental Noise Limits and Control (DOE, 2007), allowable noise exposure limit in hospital building is 50 dB(A) during day time and 40 dB(A) during night time. Table 2.1 represent the maximum permissible sound level (L_{Aeq}) by receiving land use for planning and new development (DOE, 2007). According to WHO, the critical issue in the hospital are communication interference, sleep disturbance and annoyance. The maximum noise level (L_{max}) of sound indoor during at night should not exceed 40 dB(A). Since the patients are less able to cope with stress, the noise level should less than 35 dB(A) in most rooms where patients are being placed or treated (WHO, 1999). Based on Table 2.2 in the Guideline for Community Noise for the specific environment in hospital ward room have identified the critical health effect may occur such as sleep disturbance and the recommended noise level (L_{Aeq}) 30 dB(A) during evening and night with time base of 8 hours.

2.3.1 Equivalent A-weighted Sound Level (L_{Aeq})

This is widely used as noise descriptor adopted in many developed countries. L_{Aeq} is a constant sound level which, under a given situation and time, contains the same sound energy as the actual time-varying A-weighted noise level. For DOE Guidelines, the day time L_{Aeq} is the equivalent A-weighted sound level for the day time of 7.00 am to 10.00 pm and the night time L_{Aeq} is the equivalent A-weighted sound level for the night time of the 10.00 pm to 7.00 am.

2.3.2 The n-Percent Exceeded Level, L_n

The normal percent and widely used value of n for Percent Exceeded Level were L_{10}, L_{50} and L_{90}. L_{10} was noise level exceeded for 10% of the time. For 10% of the time, the noise had a sound pressure level above the L_{10}. For the rest of the time, the sound pressure level below the L_{10} or exactly at L_{10}. L_{50} was noise reading which L_{50} is also known as the median of representing the noise level. L_{90} was noise level exceeded for 90% of the time. For 90% of the time, the noise has a sound pressure level above the L_{90}. L_{90} also represent the ambient or background noise level. Figure 2.1 shows the graph of sound pressure level against time illustrates L_{10}, L_{50} and L_{90}.

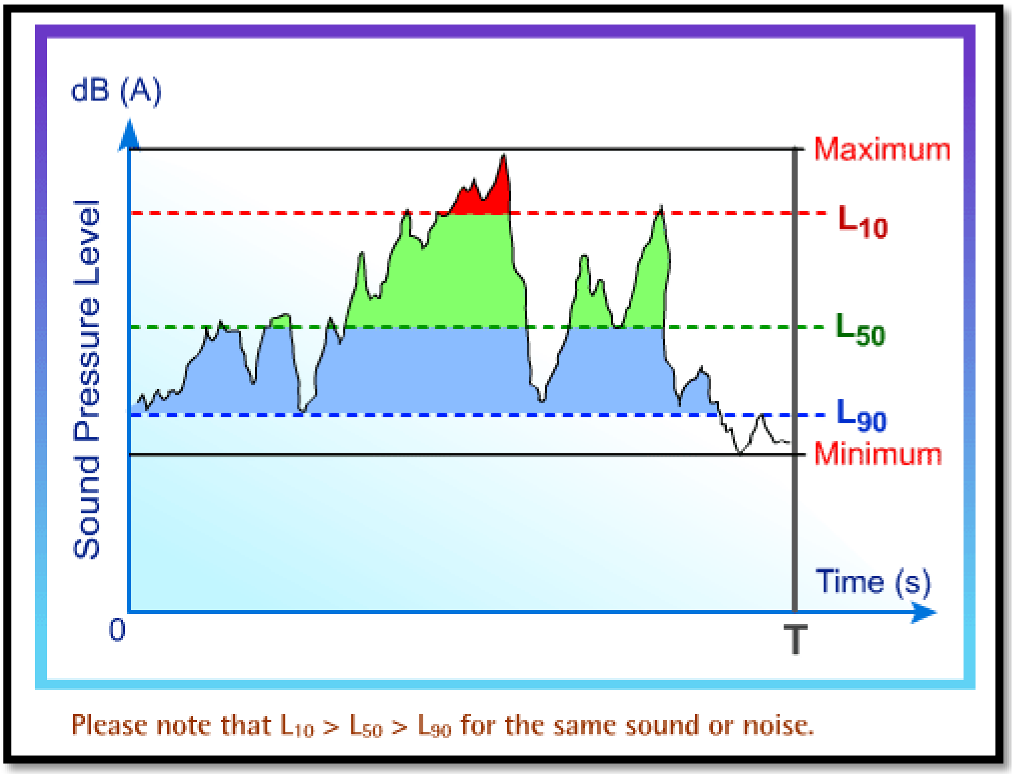

Figure 2.1: Sound Pressure Level against Time.

Table 2.1: Maximum Permissible Sound Level (L_{Aeq}) by Receiving Land Use for Planning and New Development (DOE, 2007).

Receiving Land Use Category	Day Time 7.00 am – 10.00 pm	Night Time 10.00 pm – 7.00 pm
Noise Sensitive Areas, Low Density Residential, Institutional (School, Hospital), Worship Areas	50 dB(A)	40 dB(A)
Suburban Residential (Medium Density) Areas, Public Spaces, Parks, Recreational Areas.	55 dB(A)	45 dB(A)

Urban Residential (High Density) Areas, Designated Mixed Development Areas (Residential - Commercial).	60 dB(A)	50 dB(A)
Commercial Business Zones	65 dB(A)	55 dB(A)
Designated Industrial Zones	70 dB(A)	60 dB(A)

Table 2.2: Guideline values for community noise in specific environments (WHO, 1999).

Specific Environment	**Critical Health Effect(s)**	**L_{Aeq} [dB(A)]**	**Time Base [hours]**	**L_{max} fast [dB]**
Outdoor living area	Serious annoyance, daytime and evening Moderate annoyance, daytime and evening	55 50	16 16	- -
Dwelling, indoors	Speech intelligibility & moderate annoyance, daytime & evening	35	16	
Inside bedrooms	Sleep disturbance, night-time	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60
School class rooms & pre-schools, indoors	Speech intelligibility, disturbance of information extraction, message communication	35	during class	-
Pre-school bedrooms, indoor	Sleep disturbance	30	sleeping-time	45
School, playground outdoor	Annoyance (external source)	55	During play	-
Hospital, ward rooms	Sleep disturbance, night-time Sleep disturbance, daytime and evenings	30 30	8 16	40 -

Hospitals, treatment rooms, indoors	Interference with rest and recovery	#1		
Industrial, commercial shopping and traffic areas, indoors and outdoors	Hearing impairment	70	24	110
Ceremonies, festivals and entertainment events	Hearing impairment (patrons:<5 times/year)	100	4	110
Public addresses, indoors and outdoors	Hearing impairment	85	1	110
Music and other sounds through headphones/ earphones	Hearing impairment (free-field value)	85 #4	1	110
Impulse sounds from toys, fireworks and firearms	Hearing impairment (adults) Hearing impairment (children)	- -	- -	140 #2 120 #2
Outdoors in parkland and conservations areas	Disruption of tranquillity	#3		

#1: As low as possible.

#2: Peak sound pressure (not LAF, max) measured 100 mm from the ear.

#3: Existing quiet outdoor areas should be preserved and the ratio of intruding noise to natural background sound should be kept low.

#4: Under headphones, adapted to free-field values.

2.4 Way to Improve Noise Level

The training about the noise level guidelines should be consider to healthcare professional when they change work site or first attempt in hospital. Next, the top management also can provide a class to all personnel including healthcare professional about the bad effect to occupational exposure to excessive noise (Andrade et al., 2016). Furthermore, controlling of electronic devices such as phone ringing, alarm, bells and avoid loud conversation among personnel close to patients may reduce the noise level in wardrooms (Macedo et al., 2009). Nowadays, some noise source such as suction tools, respiratory cannot be reduced as well (Tsiou et al., 1998). According to Tsiou et al. (1998), the meaning of awareness are apply oil if the door is squeaked, replace the new trolley if the wheelbase is broken, put in silent mode or low the phone ringing volume.

Next, a study that takes into consideration of vegetation around the hospital as a buffer zone to reduce the outdoor noise that enters hospital area and also for furthure new hospital development, should increase the mass and stiffness of the wall. It is because, the denser the wall material, the more it will reduce noise. Thus, concrete walls are better insulators than wood walls of equal thickness. Increase wall thickness is the best way to increase and improve sound insulation.

2.5 Summary of Literature Review

From the previous research, there is no guideline comparison between WHO and DOE for hospital area and there is no study conducted in four sessions that are morning, afternoon, evening and night time to make the comparison between each session. There are only have done by one shoot measurement or two or three-time phase only. Next, the study of indoor and outdoor in same hospital area measurement had not to be done yet.

CHAPTER 3 METHODOLOGY

3.1 Introduction

This chapter shows the outline of the study method used in this research. Then, it also describes the design method used to measure the sound levels and list out the noise sources. The instruments to collect noise levels and noise sources were also described and the procedure used in this study was included. All steps were used to achieve the objectives of this study. The study started after getting the approval to carry out the study from Director of Parit Buntar Hospital. The steps involve achieving all of the objectives of this study as shown in Figure 3.1 methodology flow chart.

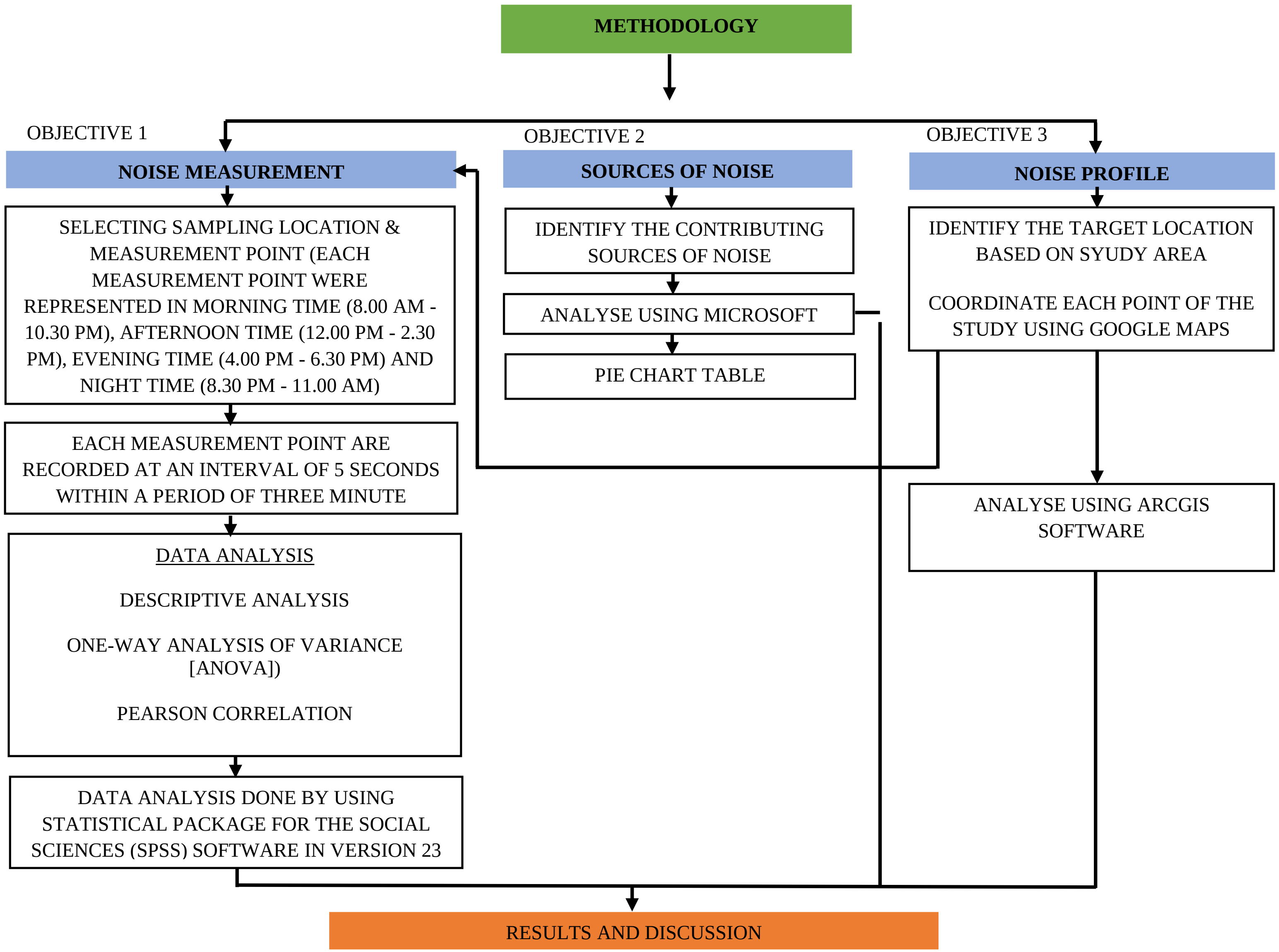

Figure 3.1: Research Flow Chart.

3.2 Study Area

This study is conducted at Parit Buntar Hospital area located in northern Perak, Malaysia. It is bordering near to Nibong Tebal, Pulau Pinang and Bandar Baharu, Kedah. The area for Parit Buntar Hospital is 60,720 square foot and for buildings, the area is 28,327 square foot, which near to Mydin Mall and KTM Station. There are 12 units in Parit Buntar Hospital, which are Administration Unit, Inpatient Unit, Emergency Unit, Diagnostic Imaging Unit, laboratory Training Unit, Outpatient Department Unit, Dinner Unit, Hemodialysis Unit, Physiotherapy Unit, Specialist Visit Unit, Pharmacy and Supplies Unit and Record Unit. The total number of beds in Parit Buntar Hospital are 120 beds that consist of four wards for men, women, pediatric and maternity. The population of Kerian District based on 2016 statistics are 180,341 and Kerian population are the ones who get treatment from Parit Buntar Hospital. Figure 3.2 shows the location study area while Figure 3.3 represent 249m and 280 distance from the study area to Kerian Mall Mydin and Keretapi Tanah Melayu Berhad (KTM) Parit Buntar station. Figure 3.4 is Parit Buntar Hospital close up the layout.

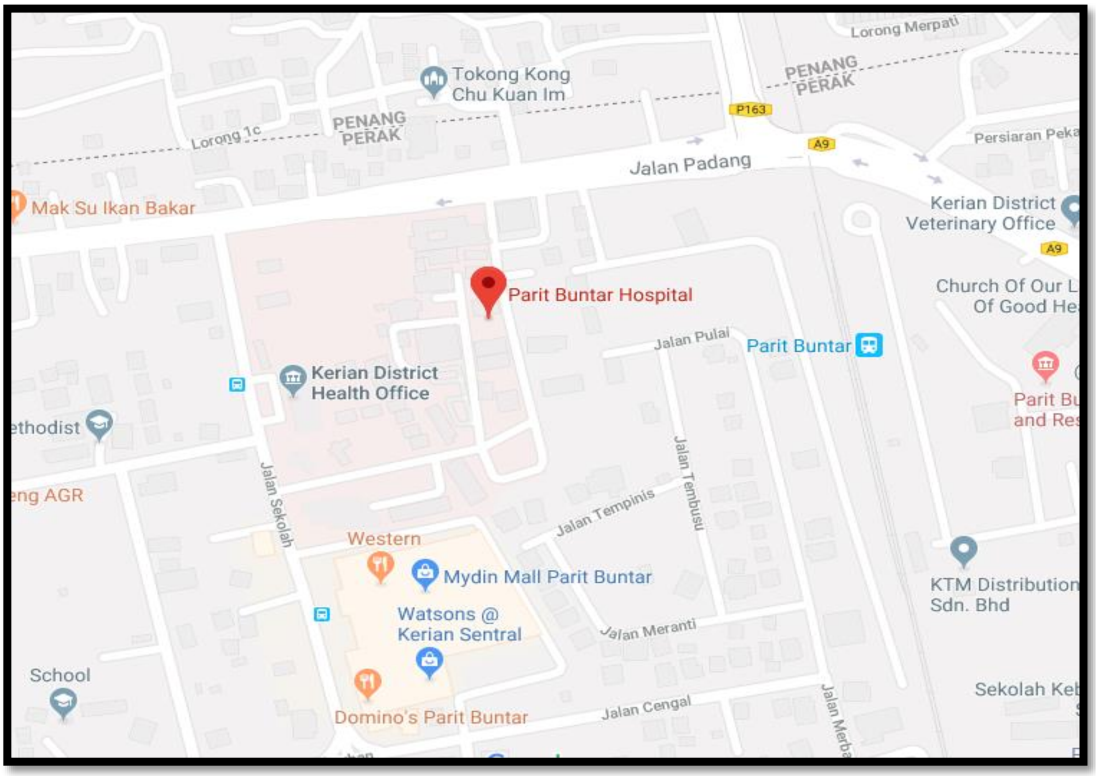

Figure 3.2: Location of Parit Buntar Hospital.

Figure 3.3: 249m and 280m distance from study area to Kerian Mall Mydin and KTM Parit Buntar Station.

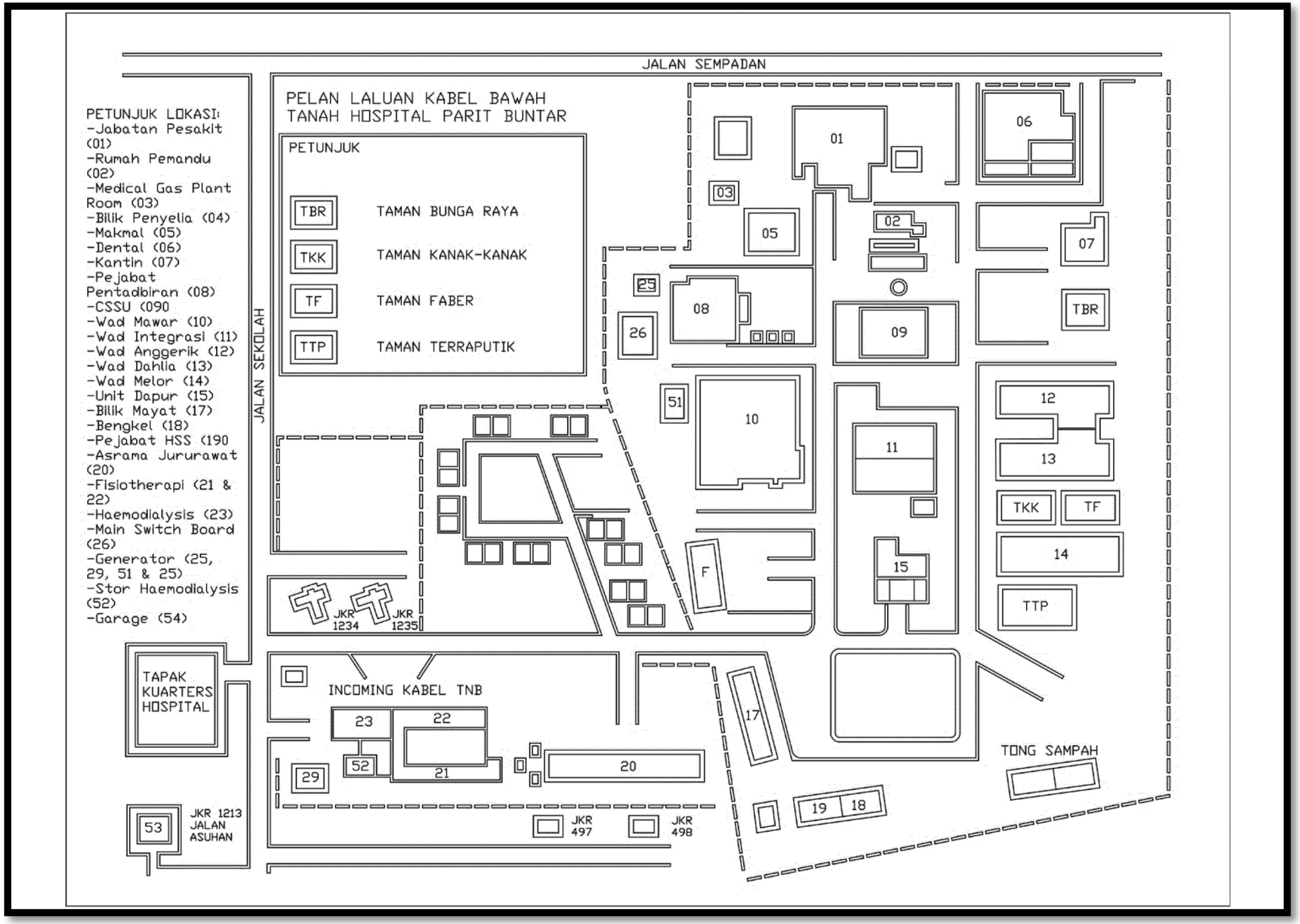

Figure 3.4: Parit Buntar Hospital close up layout.

3.3 Noise Level Measurement

In this section, the detailing of noise planning and equipment is describe. Noise levels were collected at Parit Buntar Hospital area in Perak. The duration for this measurement of noise level on two days representing holiday (Thaipusam Festival) which is Monday (21/1/2019) for outdoor area and weekday which is Tuesday (22/1/2019) for indoor area to measure the noise environment by using Sound Level Meter (SLM) at various pre decided location. The Sound Level Meter manufactured by Cirrus Research plc with instrument type CR 1710 and series number G080259 in Figure 3.5. This Sound Level Meter was classified as the Class 1 Sound Level Meter that has the greatest level of accuracy and tolerance limit for Class 1 is at +/- 1.9 dB (A) at the frequency level of 1 kHz. The noise level measurements have four phases in this study. The first phase in the morning (0800 - 1030), second in afternoon (1200 – 1430), third in evening (1600 – 1830) and the last phase in night time (2030 – 2300) whereby patients need to sleep. The phase time representing the peak hour in a day. The result of L_{Aeq} will be compared to WHO (1999) and DOE guideline (DOE, 2007) after the measure at particular location. The height of the instrument will be set up at 1.5m using tripod as in Figure 3.6 from the ground and 1.0m away from any reflective surface as stated in The Planning Guidelines for Environmental Noise Limits and Control by Department of Environment..

Nineteen measurement points were selected as in Figure 3.7. The exact location coordinates were taken using Google Earth Pro as in Table 3.1. The noise measurement was collected in every 3 minutes with interval 1 second. The selection interval in 1 second provides the detail data information and representing the real noise environment at that particular point. In order to get the accurate data, the Sound Level Meter was calibrated (Appendix A) before and after the measurement using calibrator in Figure 3.8. The basic parts for the Sound Level Meter contain microphone, reading display in decibel, dB (A), amplifier and weighting network. To reduce noise reflected from researcher body, the microphone is faced to the noise source. Next, the sound level meter was setup early before the actual time investigation to ensure that all staffs and patients do the activity as usual.

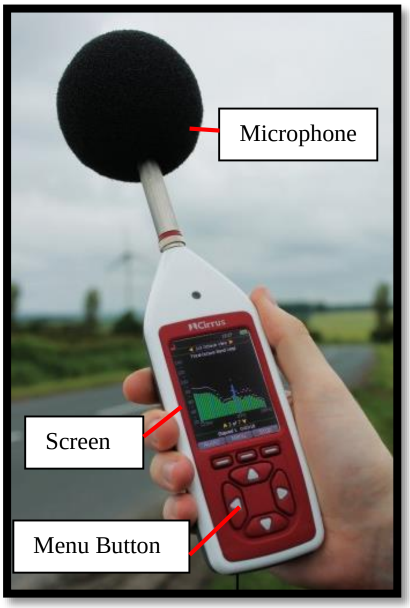

Figure 3.5: Sound Level Meter Cirrus CR1710.

Figure 3.6: Tripod.

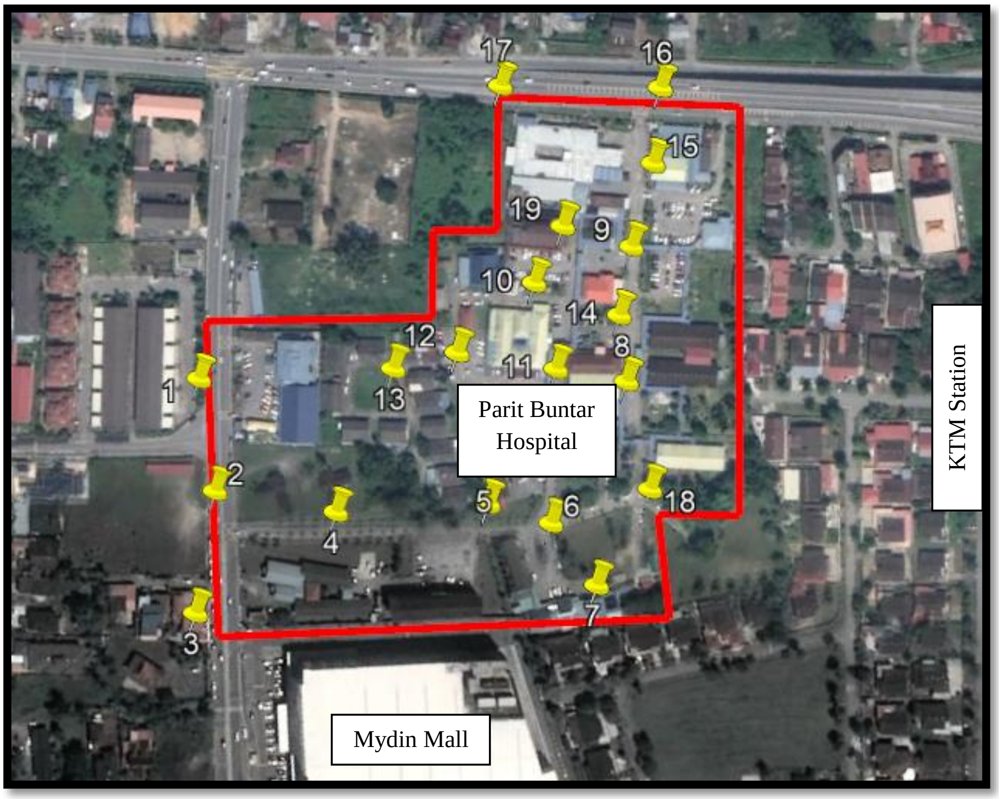

Figure 3.7: Map pinpoint the location of 19 noise measurement at Parot Buntar Hospital.

Figure 3.8: Calibrator.

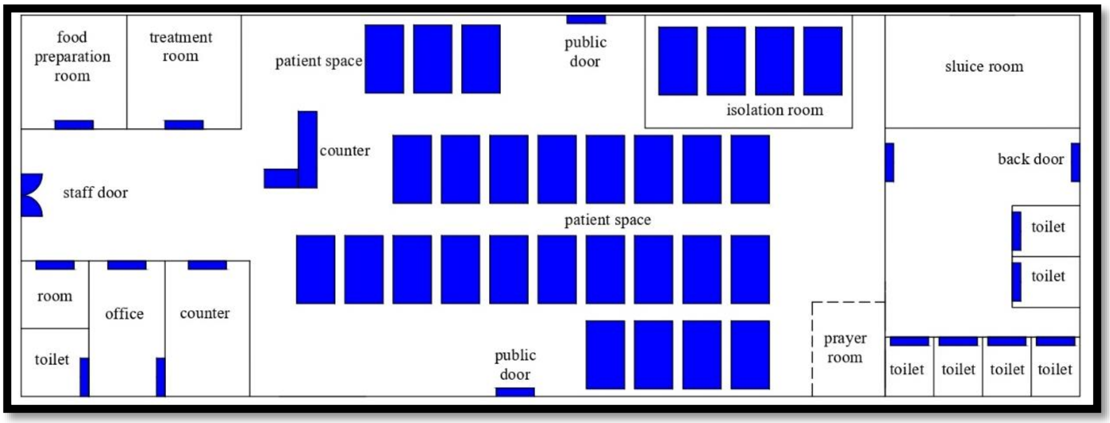

Figure 3.9: Ward Angerik.

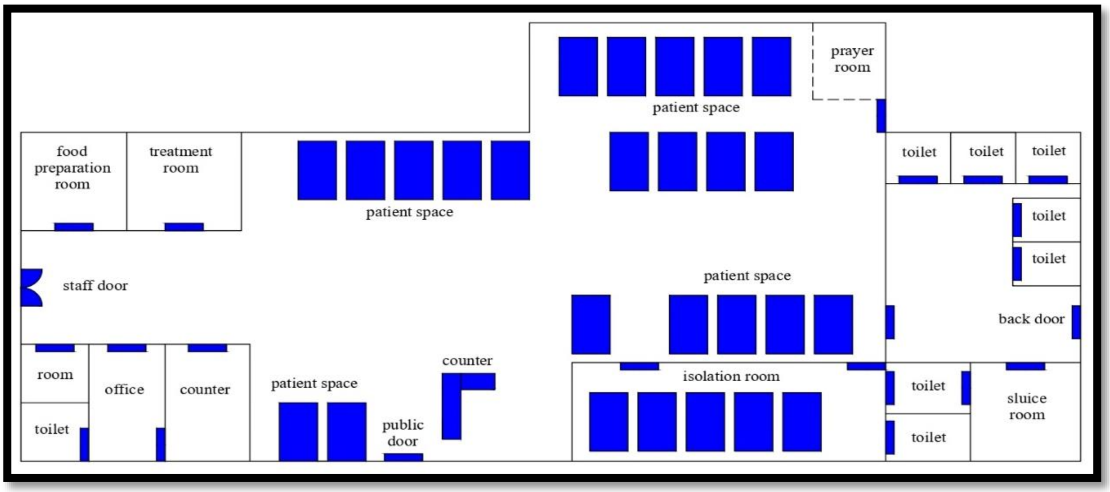

Figure 3.10: Ward Dahlia.

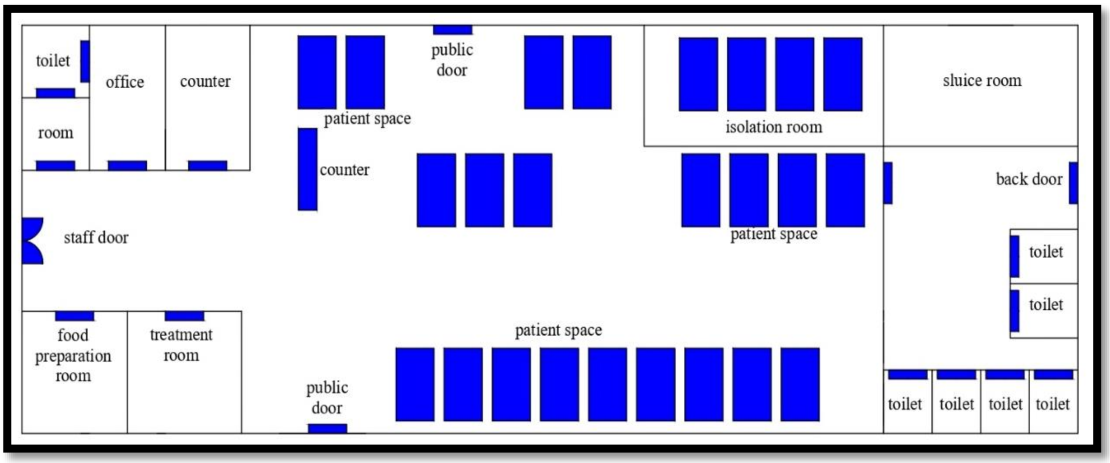

Figure 3.11: Ward Melor.

Table 3.1: GPS coordinate and point descriptors of each point.

No.	Latitude	Longitude	Descriptor of the point	No.	Latitude	Longitude	Description of the point
1	5.12992	100.48171	Near to main road (Jalan Sekolah)	11	5.13032	100.48341	Near to parking
2	5.12940	100.48190	Near to main road (Jalan Sekolah)	12	5.13030	100.48292	11.56m from residential area
3	5.12880	100.48193	56.54m from Kerian Mall Mydin	13	5.13016	100.48263	55.41m from Christian grave
4	5.12942	100.48250	Near to main gate road	14	5.13064	100.48366	20.0m from ward angerik
5	5.12961	100.48322	59.0m from Mydin's generator	15	5.13140	100.48367	18.79m from outpatient department
6	5.12958	100.48354	60.0m from Mydin's generator	16	5.13177	100.48363	Near to flyover (Jalan Padang)
7	5.12933	100.48382	Beside workshop and HSS office	17	5.13162	100.48286	Near to flyover (Jalan Padang)
8	5.13033	100.48376	15.30m from ward dahlia	18	5.12984	100.48398	23.14m from ward melor
9	5.13098	100.48365	8.0m from CSSU	19	5.13101	100.48330	Beside laboratory
10	5.13071	100.48322	5.50m beside ward mawar				

3.4 Noise Source

In this section, the method for collecting noise sources was described. During the noise measurement survey, it is very important to identify and record the main source of noise that contributing the unwanted sound to the environment. The list of noise sources was recorded manually from the observation as shown in Figure 3.9 together with time occurrence. Speed gun was used for measuring traffic speed of various type of vehicle on roads shown in Figure 3.10. One person has measured the noise using sound level meter as shown in Figure 3.11 while another person observed the noise sources.

Figure 3.12: Manual count of traffic speed and noise sources.