

PARKING STUDY AT KLINIK KESIHATAN
BANDAR KUANTAN

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Bachelor of Engineering (Hons) in Civil
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PARKING STUDY AT KLINIK KESIHATAN BANDAR KUANTAN

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Report submitted in fulfilment of the requirements for the award of the degree of
Bachelor of Engineering (Hons) in Civil Engineering

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JUNE 2015

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Specially dedicated to

Special dedicated to my family that always love me, my supervisor, my friends that always be by my side and those people who had guided and inspired me throughout my journey of education

For all your love, care, support and believe in me

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ABSTRACT

Parking facility can be considered as part of planning requirement that can affect development scheme as a whole. Traffic conditions have tended to deteriorate and the searching time for parking space substantially increased. The increase of population, paralel with the increasing of road users lead to parking concerns, especially in Kuantan, Pahang. The study is to evaluate the car park at Klinik Kesihatan Bandar Kuantan, Pahang and to propose measure to improve the current situation based on parking demand. In case study, the methodology consists of three stage which is data collectin, data analysis and recommendation. Data analysis was done to obtain the actual rate of demands for parking space in these area compared to the availability of existing parking space. The results of the study was found that parking space here insufficient is to cater the for the user in the study area. Parking parameters methodology deals, in detail, with the data collection required for the evaluation process. The parking parameters of the condition of parking include parking durations, parking occupancy, Percentage of parking turnover, parking accumulation. A few recommendation will be suggested based on the results. The amount of data was collected and analyzed to show the parking situation. The most accurate method that used in this study is license plate survey method.

ABSTRAK

Kemudahan tempat letak kereta boleh dianggap sebagai sebahagian daripada keperluan perancangan yang boleh menjejaskan skim pembangunan secara keseluruhan. Keadaan trafik semakin merosot dan jangka masa untuk mencari tempat letak kereta yang kosong semakin meningkat. Peningkatan penduduk selari dengan peningkatan pengguna jalan raya yang membawa kepada kebimbangan permasalahan kekurangan tempat letak kereta di Kuantan, Pahang. Kajian ini adalah untuk mengkaji tempat letak kereta di Klinik Kesihatan Bandar Kuantan, Pahang dan untuk mengukur seta memperbaiki keadaan semasa berdasarkan permintaan tempat letak kereta. Dalam kajian kes, kaedah yang digunakan iaitu terdiri daripada tiga peringkat iaitu pengumpulan data, penganalisis data dan cadangan. Analisis data telah dilakukan untuk mendapatkan kadar sebenar permintaan untuk ruang letak kereta di kawasan ini berbanding dengan adanya tempat letak kereta yang sedia ada. Hasil kajian ini, didapati bahawa tempat letak kereta di sini adalah tidak mencukupi untuk memenuhi pengguna dalam kawasan kajian. Tempat letak kereta parameter metodologi tawaran secara terperinci, dengan pengumpulan data yang diperlukan untuk proses penilaian. Parameter meletak keadaan tempat letak kereta termasuk jangka masa letak kereta, peratusan pengguna tempat letak kereta, pengumpulan tempat letak kereta. Ada beberapa cadangan yang akan dicadangkan berdasarkan keputusan. Jumlah data yang telah dikumpul dan dianalisis untuk menunjukkan keadaan tempat letak kereta. Kaedah yang paling tepat yang digunakan dalam kajian ini adalah kaedah tinjauan plat lesen kenderaan.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND INFORMATION

Parking system is a part in the field of engineering. It is one of the duties of the Traffic Engineer. Parking is important to study, to find out whether it is sufficient or not. Parking is an area where cars or other vehicles may be left temporarily. It is a facility for drivers parking or storing vehicles to carry out their business. Density parking can be measured in a vehicle or vehicles per expand the length of the road.

Health facilities are divided into facilities for health services, primary, secondary and tertiary. A primary health service is the first patient contact with health services for cases other than emergencies.

Secondary treatment given only in hospital either has specialist or non-specialist. Only hospitals have specialists who will provide tertiary treatment. For emergency cases, patients may continue to the emergency department, hospital or clinic. Table 1.1 shows the list of hospitals and clinics in Kuantan and table 1.2 shows the categories and criteria for health facilities.

Table 1.1: LIST OF HOSPITAL AND CLINICS AT KUANTAN

A	GOVERNMENT
1.	HOSPITAL TENGKU AMPUAN AFZAN (HTAA)
2.	PUSAT KESIHATAN BUKIT SEKILAU
3.	PUSAT KESIHATAN INDERA MAHKOTA, KUANTAN
4.	PUSAT KESIHATAN BERSERAH, KUANTAN
5.	KLINIK KESIHATAN BANDAR KUANTAN
B	PRIVATE
1.	KUANTAN MEDICAL CENTRE
2.	KUANTAN SPECIALIST HOSPITAL
3.	HOSPITAL KCDC SDN BHD
4.	KLINIK YUSOF
5.	KUANTAN POLIKLINIK
6.	KLINIK KHIZAN
7.	POLIKLINIK SHUKRI & RAKAN-RAKAN
8.	KLINIK HAMDAN
9.	KLINIK AL-AMIN SDN. BHD.
10.	KLINIK SENTOSA
11.	POLIKLINIK AN-NISA'
12.	PUSAT RAWATAN KELUARGA MUIP SB

Table 1.2: Categories and Criteria for Health Facilities (Garis Panduan Perancangan Tempat Letak Kenderaan)

Category	Criteria
Health Clinics/ polyclinic	<p>Health clinics are designed based on the estimated arrival patients in a day.</p> <ul style="list-style-type: none"> - KK Type I: Arrival 800 - 1000 patients / day - KK Type II: Arrival 500-800 patients / day - KK Type III: Arrival 300-500 patients / day - KK Type IV: Arrival 150-300 patients / day - KK Type V: Arrival 50-150 patients / day - KK Type VI: Arrival <50 patients / day

I chose the car park in the town of Klinik Kesihatan Bandar Kuantan as my study area because Health Clinic is a medical centre set up by the government to help people in terms of physical and mental health. Health Clinic was established for those seeking health care and medicines with the lower price. They will be charged RM1.00 for the services. Whereas, government workers, they do not have to make payments for the services.

Many of those who are less fortunate will get treatment at this clinic. Besides that, there are also those who can afford to get treatment here because drugs in medication are available here under control. Each patient's treatment records will be kept and will be monitored by a doctor. Patients should come to the clinic twice a month to monitor their health. Examples of records that must be taken are blood pressure and diabetes tests.

Parking or waiting room must be provided and sufficient according to the requirements specified in order to give comfort to the people who visit this Health Clinic. The total of people in Kuantan is 224 016 peoples. Klinik 1 Malaysia UTC and Klinik 1 Malaysia Kempadang are the nearest clinic at Klinik Kesihatan Bandar Kuantan.

1.2 PROBLEM STATEMENT

Studies must be conducted to collect the required information about the capacity and use of existing parking facilities. In addition, information about the demand for parking is needed. The study aims to see the effect of inadequate parking space at Klinik Kesihatan Bandar Kuantan. The study will identify the cause to the problem and how to reduce it as there is an increase of population and car users in the Kuantan city (Izahar, M.A. 2011).

Among these problems is the occurrence of illegal parking, too many vehicles that hover to find a parking space so disturbing the comfortable public especially pedestrians in the Health clinic. Some standards are adopted for far too long, in which standards when it began use of private car ownership rate is low and the amount of space floor in urban areas is also small. This is definitely the standards applicable be not suitable for use in the current situation (Abdul Malek, A.A. 2011).

In addition, the problem is happening here is the lack of parking during peak hours. Peak time is the time in which patients who had an appointment with a doctor and often these problems occur in the morning. Most of them come in the afternoon to take medication.

The rules are carried out on a parking space is intended to ensure the effectiveness of the parking space and also to get the number of car parking spaces required. Provision of parking spaces depends on the economic and social factors. Most requests are usually the management cannot full fill the requests (Abdul Malek, A.A. 2011). The problems that hinder the smooth planning of parking spaces in a timely and effective are: -

- I. Increase the number of people in the future of the study area.
- II. The number and rate of individual travel.
- III. Daily trips rates that existed during the course of normal daily peak travel times.
- IV. Load the road leading to the study of the initial parcel.
- V. The relationship between the number of users during peak parking space with parking space overall.
- VI. The parking lot for the different categories of users of parking space.
- VII. Time to be considered for planning purposes.
- VIII. Increase the floor area of the study area is currently under construction.
- IX. Change the attractiveness of the area after development.

Above details should be taken seriously to get a more realistic assessment and more accurate decisions. With the right decisions, the demand of parking spaces in the future is minimized. Number of parking spaces required is directly proportional to the increase in population and expansion of the study area.

1.3 OBJECTIVES OF THE STUDIES

The objectives of the study are as follows:

- a. To access the demand and supply of parking space.
- b. To evaluate the parking parameters.
- c. To identify problems and recommend solutions to overcome the congestion and limited parking space in Health Clinic.

1.4 SCOPE OF STUDIES

The study is limited to scope and limitation, in order to receive a clear result from the analysis. The scope of the study will focus on:

- i. The parking problem for staffs and visitors in Klinik Kesihatan Bandar Kuantan. The parking space for car is 112 bays (40 bays for staff and 72 bays for visitor) and motorcycle is 40 bays. The issues are the congestion and traffic problems. The study tries to investigate and analyse a way to overcome the problem. The current management system for parking is not working successfully because of the congestion.
- ii. This study depends very much on survey method.
- iii. The survey method is during the opening hours only (weekdays: 7.00am to 9.00pm and weekend: Saturday from 7.00am to 12.00pm).

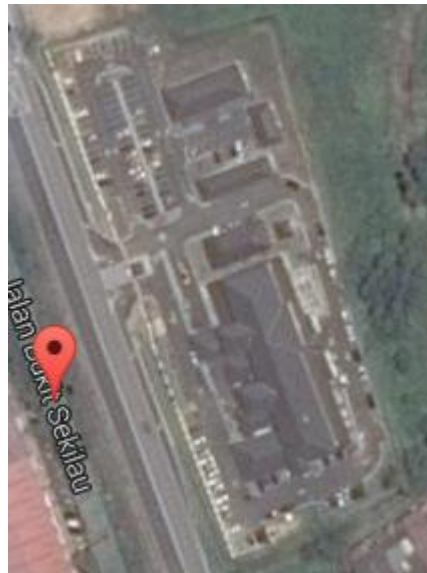


Figure 1.1: Map Klinik Kesihatan Bandar Kuantan (from google map)

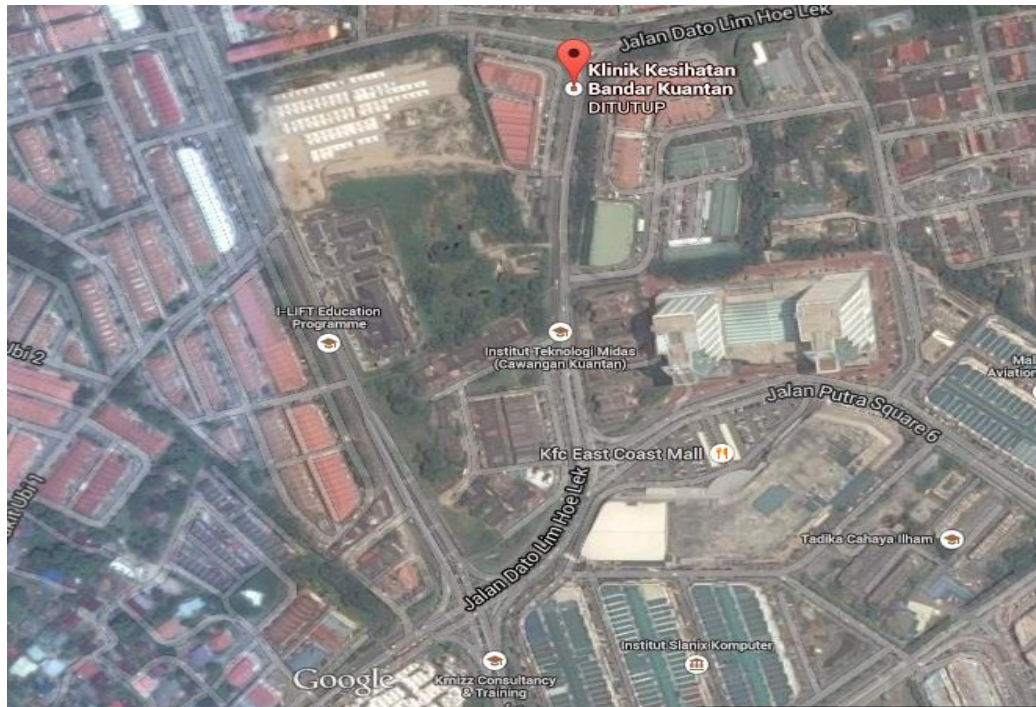


Figure 1.2: Location of Klinik Kesihatan Bandar Kuantan (from google map)



Figure 1.3: Parking at Klinik Kesihatan Bandar Kuantan



Figure 1.4: Parking at Klinik Kesihatan Bandar Kuantan

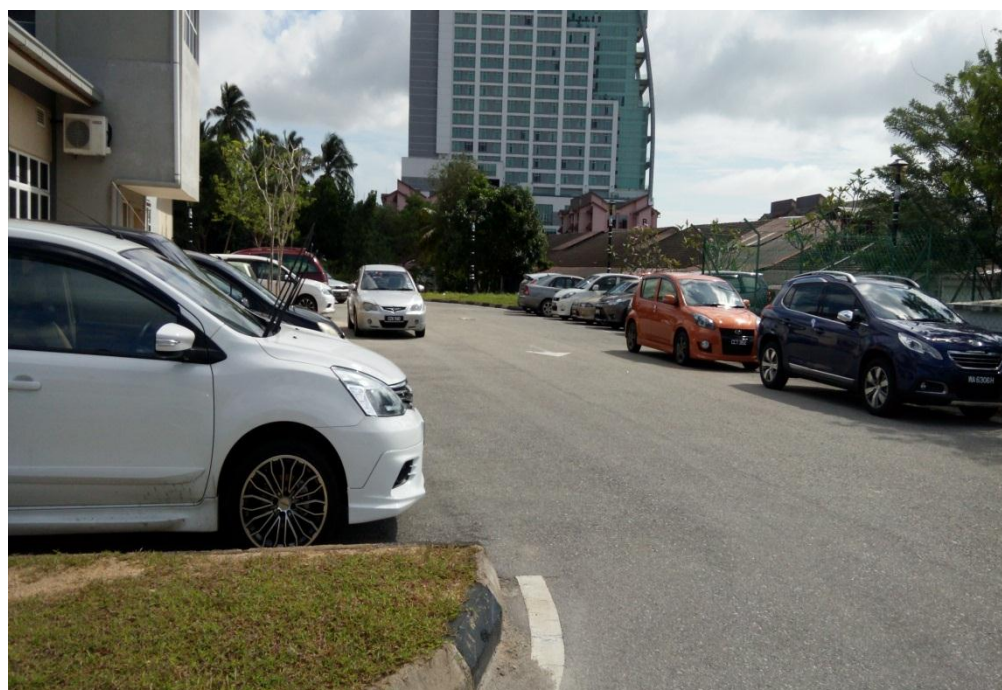


Figure 1.5: Parking at Klinik Kesihatan Bandar Kuantan



Figure 1.6: Parking at Klinik Kesihatan Bandar Kuantan



Figure 1.7: Parking at Klinik Kesihatan Bandar Kuantan



Figure 1.8: Parking at Klinik Kesihatan Bandar Kuantan

1.4.1 LIMITATION

The study has a number of limitations. There is limited amount of information available, particularly that relates to Malaysian experience in planning. There is not much information or published research and article on this topic. There might be some new and current information on the topic, which is kept by the private or government agencies. Unfortunately the information is treated as confidential and thus cannot be released to public. So, it is impracticable to obtain first-hand information. The study is carry out based on general survey, geographical remoteness of the study area, coupled with constraints of time and finance. So, this study has to be prepared within these limitations (Awang, M.N. 2003).

1.4.2 SIGNIFICANT OF STUDIES

There are some significant gains that can be achieved through the study. The important on this study are (Al-Khaisy, A. 2011):

- a. The results of the finding can be used to make guidelines and references for parking management at Klinik Kesihatan Bandar Kuantan, in terms of planning, organizing and controlling for future benefits.
- b. The study also can identify and improve the weakness on the management of parking, giving the alternative ways and recommendations.
- c. The study can be used as a guideline and reference to any interested individual or body, for the purpose of parking management in established urban area.

CHAPTER 2

LITERATURE REVIEW

2.1 OVERVIEW

This chapter is literature review of parking study at car park. Parking is one of the major problems that are created by the increasing road traffic. It is an impact of transport development. The availability of less space in urban areas has increased the demand for parking space especially in areas like central business district. This affects the mode choice also. This has a great economic impact (Ferilli, G. 2008).

Planning the development of an area requires a deep and thorough evaluation of the comfort of the area and ensures the environment is not affected by traffic jams on the roads. Each design is made should be able to handle the increase in population and development progress in the future. One of the progresses that can be seen is an increase in vehicles on the road and indirectly increased car park. This condition is caused by the addition of individual needs besides it is due to the progress and renewal of vehicle design (Ferilli, G. 2008).

Each area has its own unique characteristics and environmental. Therefore, a construction planning and facilities in the surrounding Jalan Bukit Sekilau should be implemented. Therefore, a careful evaluation should be done to meet the comfort of all road users. The need for parking is caused by socio-economic factors that are more advanced. This indirectly causes more people to use the car in any daily business. Therefore, planning is made shall take into account all aspects, especially in the comfort of the car park (Ferilli, G. 2008). Two important aspects in the design of the car park is

- a. Ease of vehicles includes such things as a good road network to facilitate vehicle is heading to a destination and also facilities for car parking.
- b. The issue of the environment is the process of vehicle maintenance such as noise, smoke and vehicle accident hazards.

Before making a plan for placement of parking in an area, building codes and zoning may be used as a guide. It is useful because in this code has been specified parking minimum and maximum. In conclusion, before making traffic planning important thing to note is the road system in the area able to accommodate the number of vehicles, parking available and there are problems in the area (Khisty C.J & Lall, B.K 2005).

2.2 PARKING PARAMETERS

The things that need to exist in analyses of parking parameters are:

- a. Rate of arrival and departure
- b. Average parking duration
- c. Parking accumulation
- d. Average occupancy
- e. Parking turn-over

2.2.1 RATE OF ARRIVAL AND DEPARTURE

The rate of arrival and departure involves determining the extent of parking usage, which includes counting of parked vehicles, at regular intervals over a period of time. The beat survey method was used where the data on parking demand was obtained by recording the registration plate number of the vehicle parked in each parking space for a period of with an interval period of 15 minutes to meet the research precision. The data on parking demand is important in understanding the parking behaviour where this method was used to study the patterns of arrival and departure and parking duration of the users. However, this method was applied to collect data pertaining only to vehicle arrival at the parking areas (Mathew, 2014).

2.2.2 AVERAGE PARKING DURATION

Parking duration is the length of time a vehicle parked at a space. When the parking duration is given in average, it indicates how frequent a parking space becomes available. Besides that, the average parking duration also helps to identify whether a parking facility is used as a short-term or long-term. Duration is calculated by dividing the total vehicle-minutes parked (time period of vehicles occupying parking spaces at the facility) by the total number of vehicles parked (Mathew, 2014).

2.2.3 PARKING ACCUMULATION

Parking accumulation refers from total number of arriving vehicles minus total number of departing vehicles, accumulated from the start of the observation. The time interval should be short for greater accuracy, maximum 15 minutes (Mathew, 2014).

Eq. (2.1)

Parking Accumulation

= Total number of arriving vehicle

– Total number of departing vehicle

2.2.4 AVERAGE OCCUPANCY

Parking occupancy is the percentage of occupied parking spaces during a specific period of time. It refers to the utilization rate of the parking facility, and is expressed in percentages (%). It relates parking demand with the existing parking supply. Furthermore, the parking occupancy also indicates the peak-hour demand. From the parking occupancy method, the data is analysed by calculating the number of available parking that actually used in the facility. The formula for parking occupancy is (Mathew, 2014).

Eq. (2.2)

$$\text{Parking Occupancy} = \frac{\text{Vehicles Accumulation}}{\text{Total number of Parking Spaces}} \times 100\%$$

2.2.5 PARKING TURN-OVER

Parking turnover is the number of vehicles utilizing the same stall over a given period of time. In short, it is known as the rate of usage of parking space. The parking turnover for individual parking spaces can be determined by counting the number of different cars using a particular parking space throughout the 14 hour study period. This is to determine the utilization rate of individual parking spaces. As for the average parking turnover for the parking lots, it is computed by dividing the total number of cars parked throughout the study period with the total number of parking spaces (Mathew, 2014).

Eq. (2.3)

$$\text{Average Parking Turnover} = \frac{\text{Total number of vehicles Parked}}{\text{Total number of Parking Spaces}}$$

2.3 PARKING PLACE

Placement car park is an important thing in planning the construction of an area. The traffic study process and the use of land and parking studies can provide guidelines for us to provide the required parking for either short term or long term.

Car parking provision is based on the height of the car and also the total number of cars on the road. Provision of adequate parking will prevent the occurrence of congestion in the parking lot and also can prevent motorists parking their car in a ban. Traffic congestion in the town of Kuantan is increasing as development progressed. Therefore, the necessary control measure to ensure the car park area is sufficient to accommodate the number of vehicles is increasing (Khisty C.J & Lall, B.K 2005).

Thus, the placement of parking must be made by looking at things that affect vehicle to an area of focus is to ensure that the facility is functioning and effective to the public, so it will be able to avoid traffic congestion and environmental pollution.

2.4 EFFECTS OF PARKING TO TRAFFIC

Parking areas to some extent affect the vehicles on the road. This can be seen in the placement of parking on the street "on-street parking" will reduce the load of vehicles on the road. In addition, the number, type of vehicle and the size of the room on the street side of the road or will affect the number of vehicles. Next placement parking area will impact on the travel and movement of vehicles (Khisty C.J & Lall, B.K 2005).

Without proper control, placement of parking in the street will be difficult for other cars entering and leaving the car park. This could be a danger to road users and pedestrians. Each of the focus area for the public should be in perfect control of the car park. In this way, it will provide comfort to the driver and can save time. Proper control can accommodate the number of cars a lot in a short time. Therefore, the main principle of parking policy is to provide adequate parking for cars heading to an area (Khisty C.J & Lall, B.K 2003).

2.5 TYPES OF PARKING

There are various types of car parks that can be obtained in the traffic system. Type of car parks can be classified into two types:

- a. Parking on street.
- b. Parking outside the road.

2.5.1 PARKING ON STREET

On street parking means the vehicles are parked on the sides of the street itself. This will be usually controlled by government agencies itself. Common types of on-street parking are as listed below. This classification is based on the angle in which the vehicles are parked with respect to the road alignment. As per IRC the standard dimensions of a car is taken as 5×2.5 meters (Mathew, 2014).

- A. Parallel parking is the vehicles are parked along the length of the road. Here there is no backward movement involved while parking or unparking the vehicle. Hence, it is the safest parking from the accident perspective. However, it consumes the maximum curb length and therefore only a minimum number of vehicles can be parked for a given kerb length. This method of parking produces least obstruction to the on-going traffic on the road since least road width is used. Parallel parking of cars is shown in figure 2.5.1(a). The length available to park N number of vehicles, $L = N/ 5.9$.
- B. 30° parking: In thirty degree parking, the vehicles are parked at 30° with respect to the road alignment. In this case, more vehicles can be parked compared to parallel parking

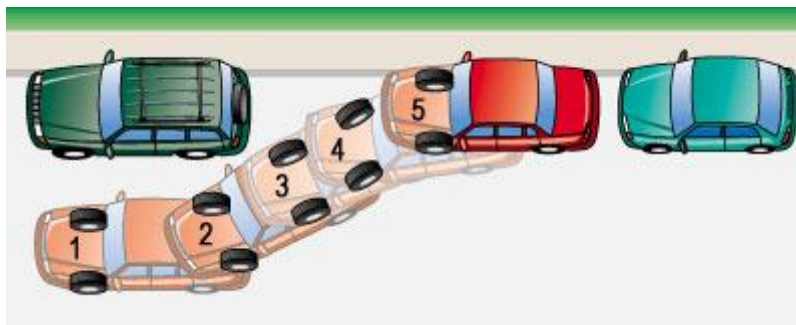


Figure 2.1: Illustration of parallel parking (Dr. Tom V. Mathew, 2014).

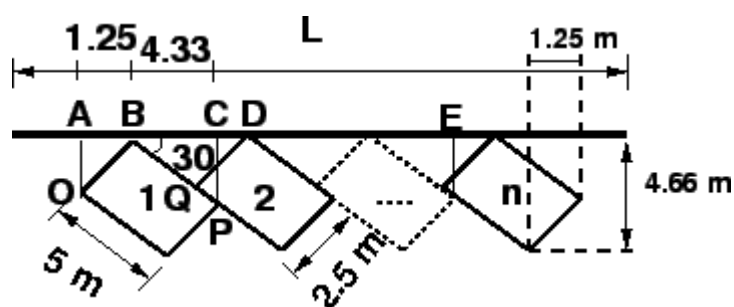


Figure 2.2: Illustration of 30° parking (Mathew, 2014).

- C. 45° parking as the angle of parking increases, more number of vehicles can be parked. Hence compared to parallel parking and thirty degree parking, more number of vehicles can be accommodated in this type of parking. From figure 2.5.1(c) length of parking space available for parking N number of vehicles in a given kerb is $L = 3.54 N + 1.77$.
- D. 60° parking is the vehicles are parked at 60° to the direction of road. More number of vehicles can be accommodated in this parking type. From the figure 2.5.1(d) length available for parking N vehicles $= 2.89N + 2.16$.
- E. Right angle parking is in right angle parking or 90° parking, the vehicles are parked perpendicular to the direction of the road. Although it consumes maximum width kerb length required is very little. In this type of parking, the vehicles need complex manoeuvring and this may cause

severe accidents. This arrangement causes obstruction to the road traffic particularly if the road width is less. However, it can accommodate maximum number of vehicles for a given kerb length. An example is shown in figure 2.5.1(e). Length available for parking N number of vehicles is $L = 2.5N$

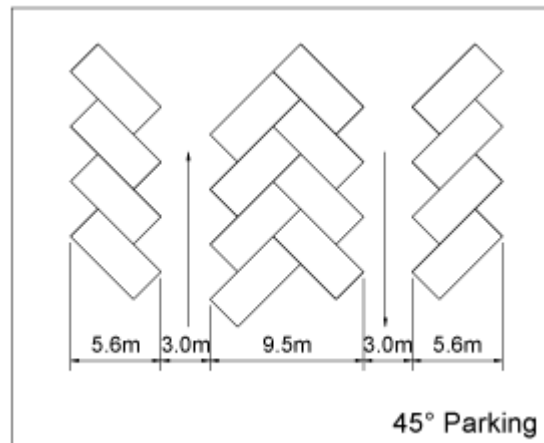


Figure 2.3: Illustration of 45° parking (Mathew, 2014).

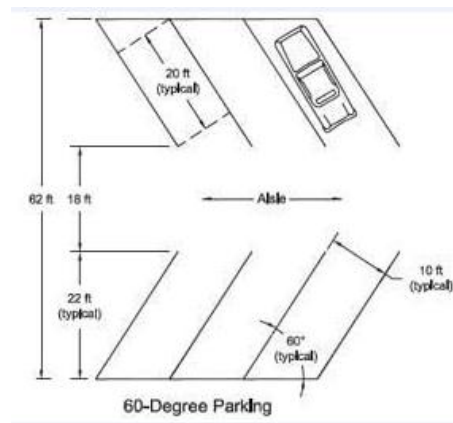


Figure 2.4: Illustration of 60° parking (Mathew, 2014).

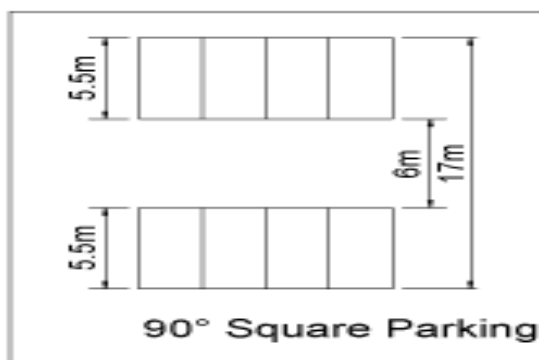


Figure 2.5: Illustration of 90° parking (Mathew, 2014).

2.5.2 PARKING OUTSIDE THE ROAD

Provision of off-street parking can focus minimizes driver to park the car on the road. In this way it can reduce traffic congestion on the roads. Placement must be appropriate and convenient for the public to carry on their business (Khisty C.J & Lall, B.K 2003).

To facilitate entry and exit of vehicles, lane entry and exit lanes should be well designed so that it can provide comfort to the users of the car park. Maintenance and management are usually run by local authorities or private companies.

In many urban centres, some areas are exclusively allotted for parking which will be at some distance away from the main stream of traffic. Such a parking is referred to as off-street parking. They may be operated by either public agencies or private firms. A typical layout of an off-street parking is shown in figure 2.2.2(a). (Mathew, 2014)

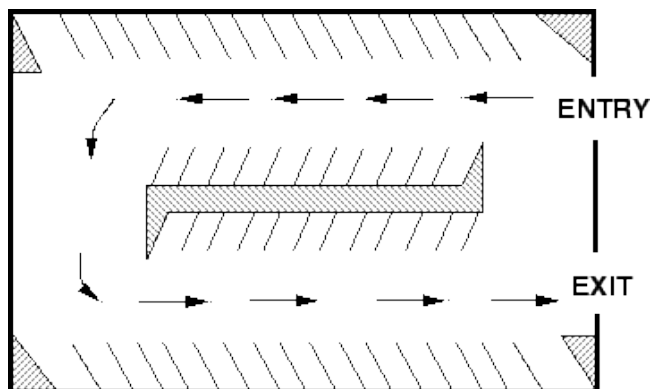


Figure 2.6: Illustration of off-street parking (Mathew, 2014).

2.5.2.1 OPEN PARKING

This type is the most famous among types of off-road parking. Open parking space is an area that been used as a parking space with a good design and layout. It is appropriate for suburbs because land values are lower than the central urban and manage using the payment system that requires attendant or ticket vending machine or using a car parking meter (Papacostas, 2005).

2.5.2.2 MULTI STOREY PARKING

This type is popular in urban areas. This type of parking can reduce the use of land. Usually this type of parking is available near the office, hotel and shopping centre. Owning a concentrated urban centres and are usually run by private companies who have the building. Payment will be charged to drivers who park their vehicles on the basis of duration of parking (Papacostas, 2005).

2.5.2.3 BASEMENT PARKING

Most parking is usually available at the bottom of the hotel buildings, shopping centres, under roads, public parks or community centres. Its construction is expensive and probably this type is the most expensive parking. Therefore, in most underground parking part of the initial cost will be offset because it represents costs that would otherwise be significant even though parking is not built (Papacostas, 2005).

Drivers who park in this area will normally be charged and remind them not to park too long. This method is a method of controlled parking to reduce congestion in the affected areas.

2.5.2.4 ROOF TOP PARKING

Rooftop car park provides parking at a reasonable cost. The main trip was to ram the Shopping is increased by the height of the building. In some cases it is possible to connect two or more to allow the ram in and out for the entire region (Hamsa, 2005).

2.5.2.5 PARKING SYSTEMS RAM

This type of parking is one of a kind car park outside the road. Parking management includes strategies that more efficient use of existing parking facilities which is to improve the quality of services provided. Parking management can reduce transport problems. It is normally located in the area shopping centres, markets and hotel buildings (Hamsa, 2005).

2.6 STANDARD PARKING REQUIREMENTS

Car parking provision in development planning carried out by the authorities must be based on certain standards in order of importance in certain areas. This means they must provide parking spaces to the driver can operate without control over them (Awang, M.N. 2003).

In residential areas and rural areas, the policy should be implemented so that drivers get parking facilities comfortable. This means that, proper planning should be made to harmonize the parking area and the number of cars at peak times. Therefore controlling the car park should be made by the authority which manages the areas involved (Hamsa, 2005).

Parking should be used by the public if there is demand for it. The policy is to allow people to park, especially in certain areas.

2.7 OBJECTIVES OF STANDARD PARKING

- a. To ensure that the car park provided adequate for the number of resignations car collector found in an area.
- b. To avoid road congestion due to an excessive number of cars by provide parking facility more regularly. It will be able to maintain the environmental conditions.

Standard car parks are different from one place to another. This is due to the different demands of the car park between the areas involved. In addition, these standards are based on the number of cars that are in the area. The area has the status and progress of different interests. The differences seen in the car park need demand for operational and non-operational (Awang, M.N. 2003).

2.8 EFFECTS OF PARKING

Parking has some ill-effects like congestion, accidents, pollution, obstruction to fire-fighting operations etc. (Mathew, 2014).

- I. Congestion: Parking takes considerable street space leading to the lowering of the road capacity. Hence, speed will be reduced journey time and delay will also subsequently increase. The operational cost of the vehicle increases leading to great economical loss to the community.
- II. Accidents: Careless manoeuvring of parking and un-parking leads to accidents which are referred to as parking accidents. Common type of parking accidents occur while driving out a car from the parking area, careless opening of the doors of parked cars, and while bringing in the vehicle to the parking lot for parking.
- III. Environmental pollution: They also cause pollution to the environment because stopping and starting of vehicles while parking and un-parking results in noise and fumes. They also affect the aesthetic beauty of the buildings because car parked at every available space creates a feeling that building rises from a plinth of cars.
- IV. Obstruction to fire fighting operations: Parked vehicles may obstruct the movement of fire fighting vehicles. Sometimes they block access to hydrants and access to buildings.

Table 2.1: Specification of Parking (Garis Panduan Perancangan Tempat Letak Kereta. 2014)

Type of building	Car parking
Residential areas	Occupants: 1 Visitors: 1
Shop area	Employees: 1 Customer: 1 for every 25m ² shop area
Office	Occupants: 1 Visitors: 10% of parking spaces for employees
Bank	Employees: 1 to 4 for each of its officers and other employees
Industrial area	Employees: 1 Visitors: 10% of parking for employees.
Public libraries	Employees: 1 Visitors: 3 for each additional 500 members and 1 to 10 seats
Hospital	Employees: 1 to 1 unit every doctor and every other employee Patients and visitors: 1 for each 3 beds
Clinic	1 box car / 25m ² of floor space
School	Employees: 1 for every 2 employees Visitors: 4 for every 1000 pupils
Institutes of higher education	Employees: 1 for every 2 employees in charge Visitors: 5 for every 1000 students
Museums and art galleries centre	Employees: 1 for every 2 employees in charge Visitors: 1 for every 30m ² area
Cinemas	Employees: 1 for every 3 employees on duty Visitors: 1 for every 5 seats

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

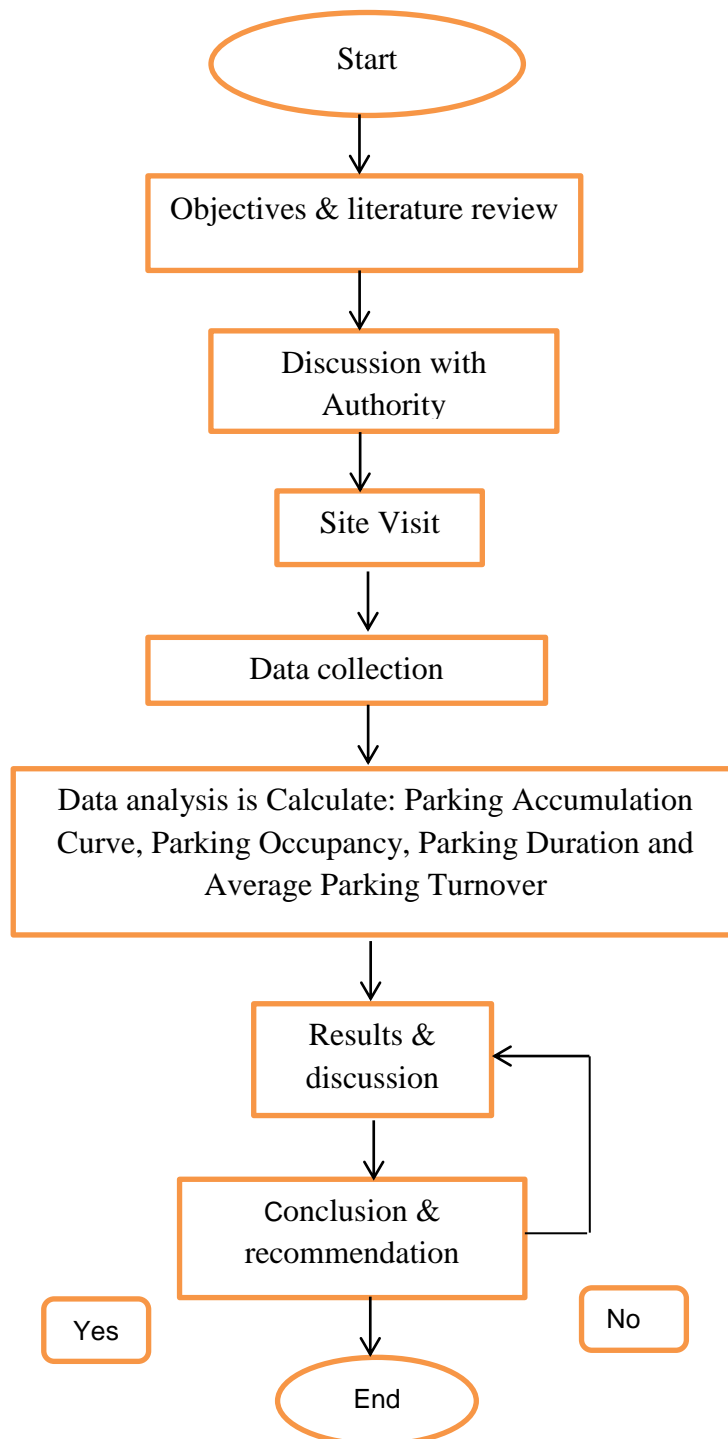
For the purpose of this study, parking study is to find out whether it is sufficient or not. Parking is a key element in providing planning and control traffic and provides a foundation in basic transport facility providing basic transport facilities in the area. Developments and progress in the area will result in a traffic system will also increase. Indirectly, it will cause parking requirements will also increase.

In a study of parking, we need to analyse the actual problem, the existing facilities are appropriate or not. In addition, we also need to study the impact of traffic and the impact on the environment should be considered in evaluating the placement of the car. The study of vehicle stops is also very important. Once the vehicle reaches the destination, respectively, the driver will be driving slowly to find a place to park.

In the Klinik Kesihatan Bandar Kuantan is selected as the study area. The number of residents in the area Kuantan is 224016 people. Therefore, I want to conduct a study of parking at Klinik Kesihatan to ensure that the number of car parking spaces sufficient to the population. This is because, a health clinic is provided for residents to concern about their health. Health is an important to us.

The process of completing this study involves a series of steps, which could be categorized into three basic approaches namely data collection, survey and analysis. This chapter will discuss in sequence regarding the detail methodology and procedures applied in achieving the objectives of this study.

Figure 3.1: Flow chart of methodology



3.2 INTEREST INVENTORY PARKING IN THE CONTEXT OF TRAFFIC PLANNING

Census car park is an important criterion in traffic planning. Of census parking can be known about the demands and needs of a parking area or otherwise. Intensity within parking is also available from this census. The concepts of time that should be taken into making judgments about parking demand. For example, demand for parking in the vicinity of Jalan Bukit Sekilau should be evaluated first. Selected times shall pass time at the venue.

Definition of parking demand will not be properly without having the concept of time. A trip that usually estimated at over 24 hours, with the request parking requirements should reflect the needs of peak hours in the day. In addition, attention is needed to request a parking vary according to seasonal patterns. With this concept of time will give the maximum rate for the peak season demand. This gives a fair idea about the description of the request parking for a land use.

Analysis of the survey, the parties concerned can provide control measures to overcome or reduce the issues and important factors on the characteristics of parking in an area. Only this is where all kinds of facilities required by the driver can be provided.

3.2.1 METHODS OF PARKING SURVEY

In conducting the parking survey, several methods can be used. It depends on the suitability of the selected area, the financial resources available, and the size of the survey, labour and equipment. Method of survey parking as follows:

1. Survey of arrival and departure
2. Assessment of parking demand.

3.2.2 SURVEY OF ARRIVAL AND DEPARTURE

In this survey, the occupancy count in the selected parking lot is taken at the beginning. Then the number of vehicles that enter the parking lot for a particular time interval is counted. The number of vehicles that leave the parking lot is also taken. The information should be recorded (vehicle registration number, type of vehicle, time of arrival, time of departure). The final occupancy in the parking lot is also taken. Here the labour required is very less. Only one person may be enough.

A mix of algebra for incoming and outgoing vehicles will provide the cumulative number of vehicles available in the area and the number of moving vehicles can be determined for the estimated amount of parking for the area.

A regulatory framework for parking demand can be generated using this calculation. Review detailed car park requires a long computation time in a week, and during this period there is a difference in the number of car placement area. The data obtained can be compared with the framework described by an average cumulative total.

Calculation carried out using this method usually requires employees' enumerator. Staff enumerators required to examine records and calculations to make a classification that will make a difference to the car park. Differences cars coming in and out of the area for a certain period will give the increase or decrease in the number of cars and thus provide contact use parking in the area.

The surveys will be carried out on weekdays, such as health clinics will be open on weekdays only. Surveys will be conducted on weekdays (3days) and Saturday for weekend. The time survey was the time a health clinic starts to open from 7.00am to 9.00pm for weekdays and weekend from 7.00am to 12.00pm.

3.2.3 EVALUATION OF PARKING DEMAND

In studies that have been discussed, all are associated with the vehicle in an area. Assessment is made to determine parking facilities should be provided in an area based on data obtained from studies conducted.

Request car park is different for each different area, especially when seen in time of need. For example, an office high demand on weekdays while in the shopping centre on holidays.

3.3 FEATURES AND CONTROLS PARKING

As far as this point, our country Malaysia has yet to have a census extensive car park. Therefore it is extremely difficult to assess its car park in the country, as has been done by developed countries such as Europe, Japan, and the United States.

What we need to note here is control features parking in our country are different from those in countries that described earlier, particularly in terms of the magnitude and extent of the form.

From here is not that we cannot directly take a census there as an example, but do not take the data and its self-control they have made as the basis and assumptions used in the preparation of our teeth car park. Sometimes the assumption that they have learned from the study and the survey, it is useful for us to use as a basis for the design of the car park and the characteristics of control in Malaysia.

Derived from census data can be known features and controls for the parking area. Features and parking control can be assessed through the following:

1. Measurement resignation car.
2. Addition of car placement.
3. Duration of car placement.

3.3.1 MEASUREMENT OF PARKING

The main items used to measure the placement of the car are:

- a. Car park numbers is the number of vehicles parked in an area at a particular time and can be divided into categories according to their destinations.
- b. Volume car park is the number of cars in the "parking load" the number of vehicles in a certain period, usually per day. The time taken by a vehicle parked in the minutes or hours is a car laying period.
- c. "Parking Turn Over" is the rate of use of the car park and it is obtained by dividing the volume of the placement of cars with parking for a specified period.
- d. Parking indicator is a measure for determining the use of the long road that is often taken as a percentage of the long edge of the road is theoretically 6meter occupied by parked cars.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 INTRODUCTION

The Parking facilities in Klinik Kesihatan Bandar Kuantan provided parking at several areas. The facility was provided to car parking and motorcycles parking. The parking area for staffs and patients are combined together. The parking space for car is 112 bays (40 bays for staff and 72 bays for visitor) and for motorcycle are 40 bays. The number of staff was determined by calculated the number of car that parked their car more than 7 hours and parked their car everyday (more than 1 day). This study aims to access the demand and supply of parking space, to evaluate the parking parameters and to identify problems and recommend solutions to overcome the congestion and limited parking space in Klinik Kesihatan Bandar Kuantan. Parking parameters methodology in detail, with the data collection required for the evaluation process. The parking parameters are:

- Parking durations
- Parking occupancy
- Percentage of parking turnover
- Parking accumulation

4.2 PARKING SPACE

The analysis is carried out by using arrival and departure survey. This is because by using this method, the data that obtained is the most accurate and realistic data comparing to others method. This method also fixed monitoring that can avoid chances of missing short term parkers.

Data was obtained at Klinik Kesihatan Bandar Kuantan, Pahang. The parking area at this clinic was combined together for staffs and patients. The collection of data was collected on weekdays (3 days) and weekend (Saturday only). The survey method is during the opening hours only (weekdays: 7.00am to 9.00pm and weekend: Saturday from 8.00am to 12.00pm).

The total parking for the car at Klinik Kesihatan Bandar Kuantan is 112 bays (40 bays for staff and 72 bays for visitor) and for motorcycle are 40 bays. Where, 3 bay for the OKU patients.

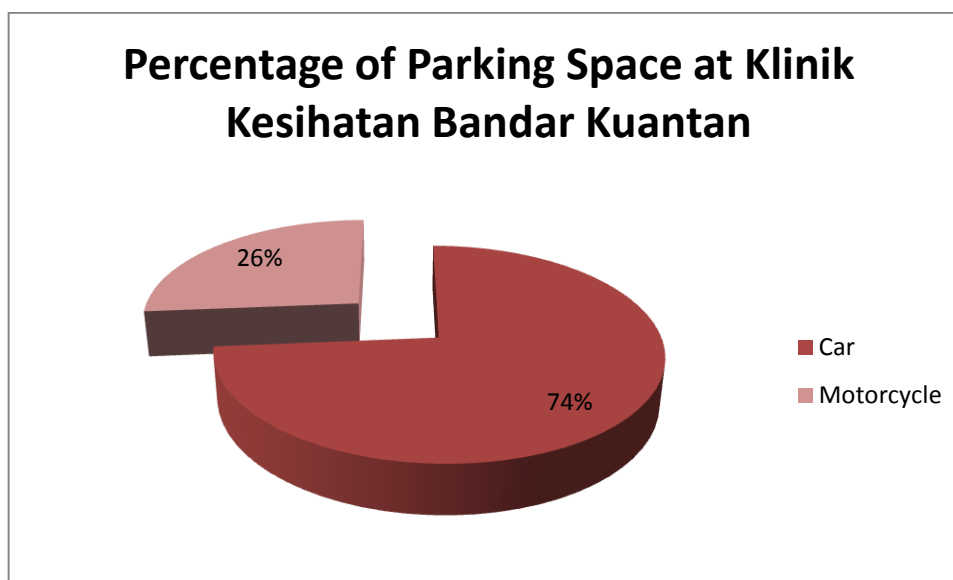


Figure 4.1: Percentage of parking

4.3 ANALYSIS OF PARKING ACCUMULATION

Parking accumulation is conducted to describe the number of vehicles parked in a KKBK in different time interval. First, the numbers of vehicles already in the parking area are counted. The counts were conducted at parking space in KKBK for one hour interval from the opening hours (weekdays: 7.00am to 9.00pm and weekend: Saturday from 7.00am to 12.00pm).

The details of the collect data are included staff vehicles and patient vehicles because the parking area for staffs and patients are combined together. The survey was choosing during the operational hours of the management in KKBK. The numbers of vehicles enter and exits are recorded for the analysis. Accumulation data are summarized by time of survey period for the study area at KKBK. The parking accumulation (car) of parked vehicles for number of staff and patient on survey period was presented as below:

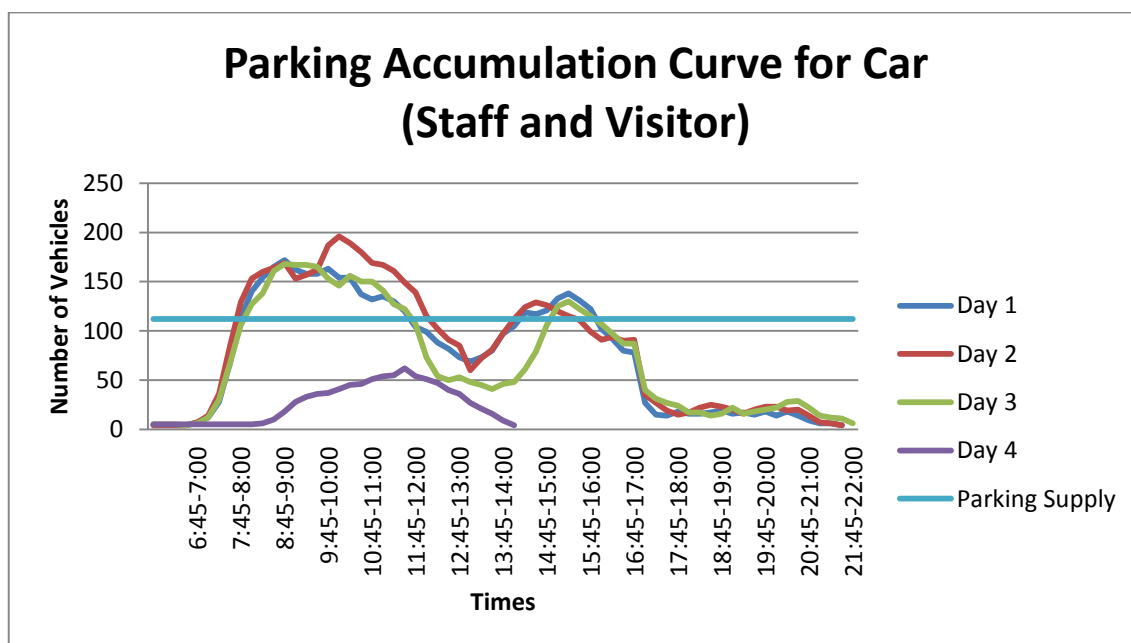


Figure 4.2: Parking Accumulation Curve for Car (Staff and Visitor)

Based on figure 4.2, the total number of arrival vehicles is 747 cars and the total number of departing vehicles is 743 cars. From the accumulation graph, the high demands occur at 8.45am with 172 cars for day 1. The total number of arrival vehicles is 788 cars and the total number of departing vehicles is 784 cars. From the accumulation graph, the high demands occur at 10am with 196 cars for day 2.

The total number of arrival vehicles is 758 cars and the total number of departing vehicles is 752 cars. From the accumulation graph, the high demands occur at 8.45am with 168 cars for day 3. The total number of arrival vehicles is 114 cars and the total number of departing vehicles is 112 cars. From the accumulation graph, the high demands occur at 11.30am with 62 cars for day 4. After that, the peak hour was identified based on the graph. Based on figure above, peak demand occurred at:

Table 4.1: Peak of demand for car (Staff and Visitor)

Day	No. of vehicles	Times
1	172	8.45am
2	196	10am
3	168	8.45am
4	62	11.30am

After 8am, the occupancy of vehicles become worse because of patients begins to enter the clinic to get the treatment. At this time, the rate of illegal parking will occur higher than before and because of this it will contribute to the traffic congestion

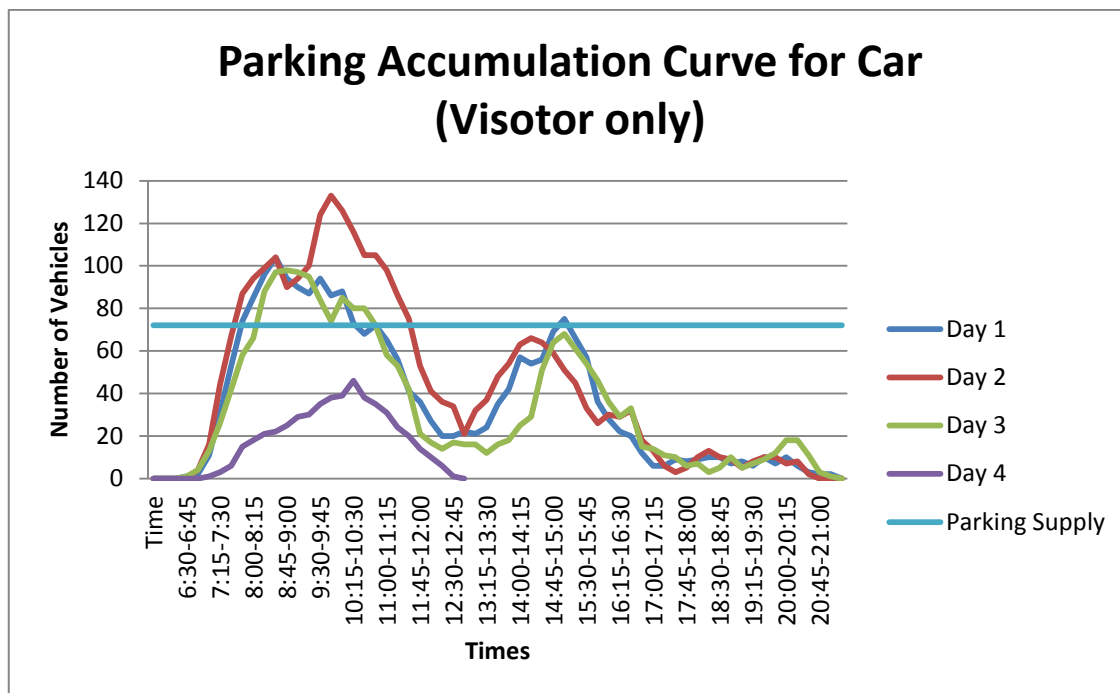


Figure 4.3: Parking Accumulation Curve for Car (Visitor only)

Based on figure 4.3, the total number of arrival vehicles is 617 cars and the total number of departing vehicles is 617 cars. From the accumulation graph, the high demands occur at 8.45am with 104 cars for day 1. The total number of arrival vehicles is 668 cars and the total number of departing vehicles is 668 cars. From the accumulation graph, the high demands occur at 10am with 133 cars for day 2.

The total number of arrival vehicles is 615 cars and the total number of departing vehicles is 615 cars. From the accumulation graph, the high demands occur at 9am with 98 cars for day 3. The total number of arrival vehicles is 101 cars and the total number of departing vehicles is 101 cars. From the accumulation graph, the high demands occur at 10.30am with 46 cars for day 4. After that, the peak hour was identified based on the graph. Based on figure above, peak demand occurred at:

Table 4.2: Peak of demand for car (Visitor only)

Day	No. of vehicles	Times
1	104	8.45am
2	133	10am
3	98	9am
4	46	10.30am

After 8am, the occupancy of vehicles become worse because of patients begins to enter the clinic to get the treatment. At this time, the rate of illegal parking will occur higher than before and because of this it will contribute to the traffic congestion. The parking space for car that required is 112 bays for visitor only. The parking required known from the calculation of average of maximum accumulation (car for visitor only) during the weekdays.

$$\begin{aligned} \text{Parking required} &= \frac{104+133+98}{3} \\ &= 111.67 = 112 \text{ bays} \end{aligned}$$

The parking accumulation (motorcycle) of parked vehicles for number of staff and patient on survey period was presented as below:

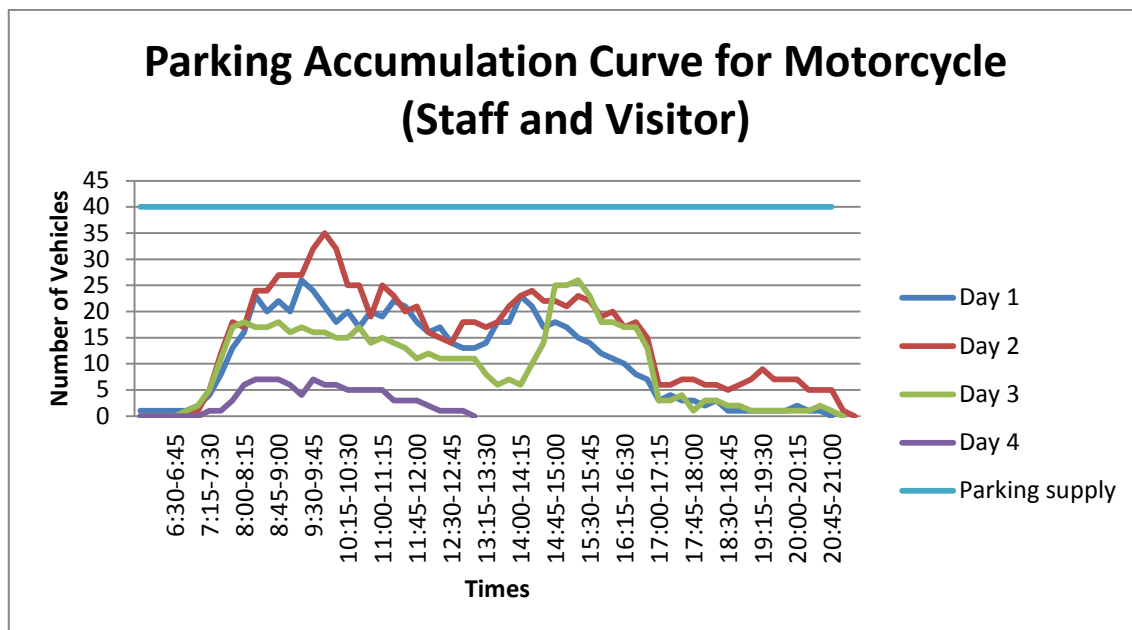


Figure 4.4: Parking Accumulation Curve for Motorcycle (Staff and Visitor)

Based on figure 4.4, the total number of arrival vehicles is 104 motorcycles and the total number of departing vehicles is 104 motorcycles. From the accumulation graph, the high demands occur at 9.15am with 26 motorcycles for day 1. The total number of arrival vehicles is 135 motorcycles and the total number of departing vehicles is 135 motorcycles. From the accumulation graph, the high demands occur at 9.45am with 35 motorcycles for day 2.

The total number of arrival vehicles is 111 motorcycles and the total number of departing vehicles is 111 motorcycles. From the accumulation graph, the high demands occur at 3.15pm with 26 motorcycles for day 3. The total number of arrival vehicles is 17 motorcycles and the total number of departing vehicles is 17 motorcycles. From the accumulation graph, the high demands occur at 8.15am with 7 motorcycles for day 4.

Based on the analysis parking accumulation for motorcycle, there is no parking problem occur at Klinik Kesihatan Bandar Kuantan. After that, the peak hour was identified based on the graph. Based on figure above, peak demand occurred at:

Table 4.3: Peak of demand for motorcycle (Staff and Visitor)

Day	No. of vehicles	Times
1	26	9.15am
2	35	9.45am
3	26	3.15pm
4	7	8.15am

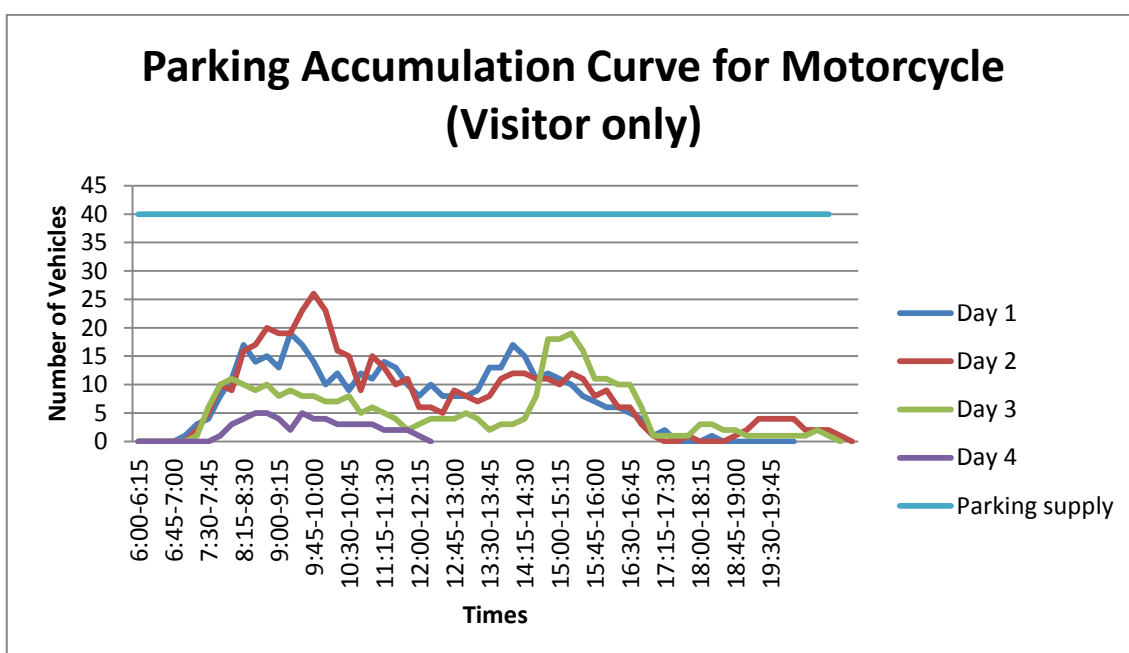


Figure 4.5: Parking Accumulation Curve for Motorcycle (Visitor only)

Based on figure 4.5, the total number of arrival vehicles is 92 motorcycles and the total number of departing vehicles is 92 motorcycles. From the accumulation graph, the high demands occur at 9.15am with 19 motorcycles for day 1. The total number of arrival vehicles is 119 motorcycles and the total number of departing vehicles is 119 motorcycles. From the accumulation graph, the high demands occur at 9.45am with 26 motorcycles for day 2.

The total number of arrival vehicles is 96 motorcycles and the total number of departing vehicles is 96 motorcycles. From the accumulation graph, the high demands occur at 3.15pm with 19 motorcycles for day 3. The total number of arrival vehicles is 14 motorcycles and the total number of departing vehicles is 14 motorcycles. From the accumulation graph, the high demands occur at 8.30am with 5 motorcycles for day 4.

Based on the analysis parking accumulation for motorcycle, there is no parking problem occur at Klinik Kesihatan Bandar Kuantan. After that, the peak hour was identified based on the graph. Based on figure above, peak demand occurred at:

Table 4.4: Peak of demand for motorcycle (Visitor only)

Day	No. of vehicles	Times
1	19	9.15am
2	26	9.45am
3	19	3.15pm
4	5	8.30am

4.4 ANALYSIS OF PARKING OCCUPANCY

Parking occupancy is the percentage of occupied parking spaces during a specific period of time. It refers to the utilization rate of the parking facility, and is expressed in percentages (%).The formula for parking occupancy is (Dr. Tom V. Mathew, IIT Bombay)

Eq. (2.3)

$$Parking\ Occupancy = \frac{Vehicles\ Accumulation}{Total\ number\ of\ Parking\ Spaces} \times 100\%$$

Additional parking occupancy surveys were undertaken by using licence plate method of survey and the results are presented as below:

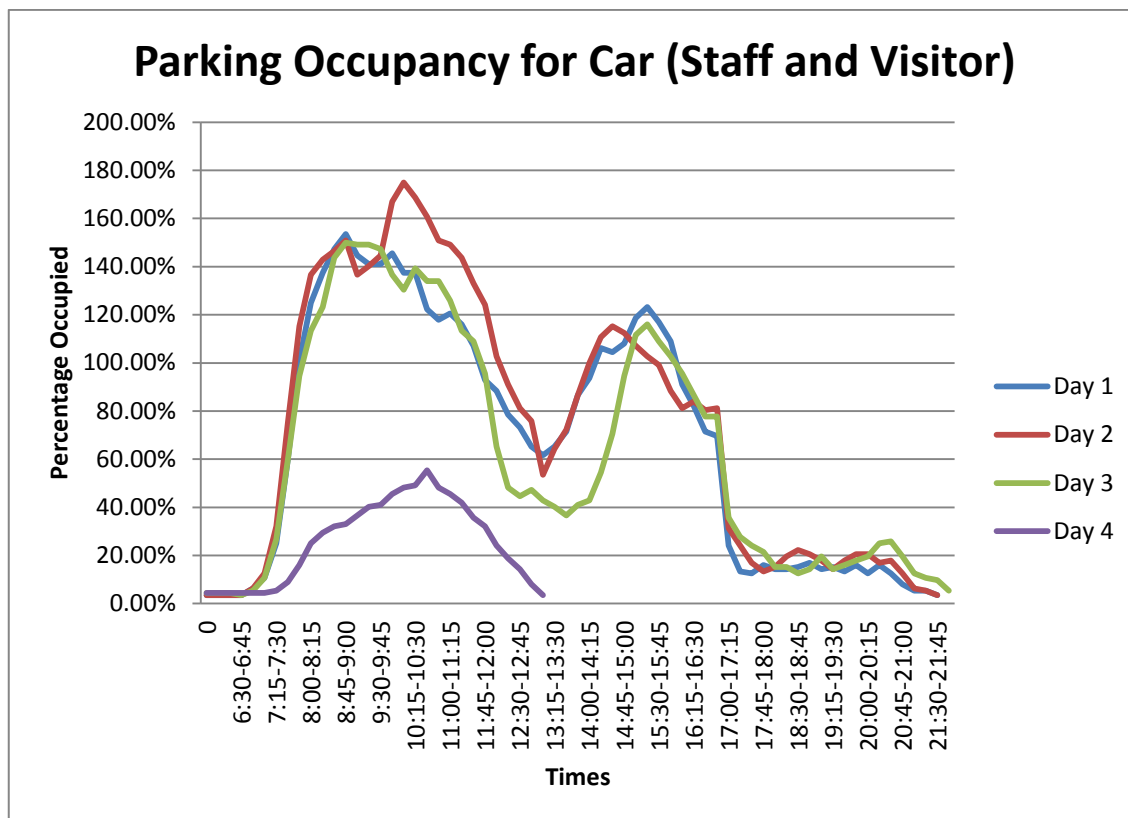


Figure 4.6: Parking occupancy for Car (Staff and Visitor)

Based on figure 4.6, the parking spaces for car at study area are fully occupied where the total of occupancy rate are exceed 100%. The time that fully occupied the parking occupancy is from 7.30am to 11.45am and from 2.15pm to 4pm for day 1. The time that fully occupied the parking occupancy is from 7.45am to 11.15am and from 2pm to 3.30pm for day 2. The time that fully occupied the parking occupancy is from 8am to 11.45am and from 3pm to 4pm for day 3. The parking spaces for car at study area are not fully occupied where the total of occupancy rate are not exceed 100% for day 4 (weekend).

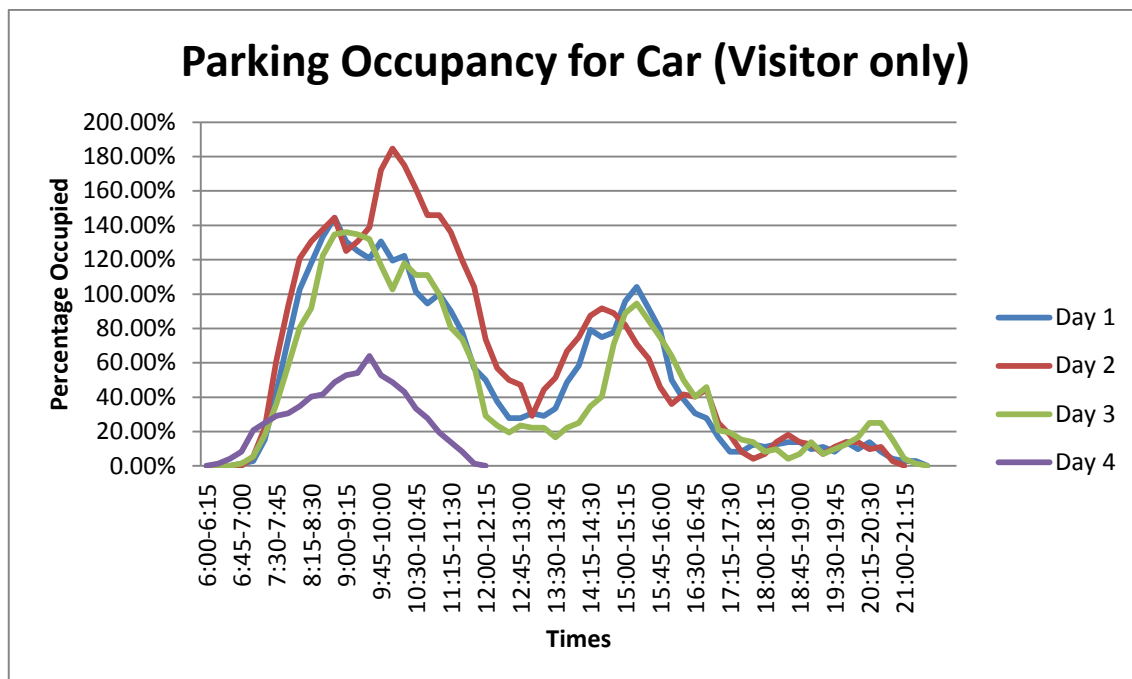


Figure 4.7: Parking occupancy for Car (Visitor only)

Based on figure 4.7, the parking spaces for car at study area are fully occupied where the total of occupancy rate are exceed 100%. The time that fully occupied the parking occupancy is from 8am to 10.45am and at 3.15pm for day 1. The time that fully occupied the parking occupancy is from 8am to 12am for day 2. The time that fully occupied the parking occupancy is from 8.30am to 11am for day 3. The parking spaces for car at study area are not fully occupied where the total of occupancy rate are not exceed 100% for day 4.

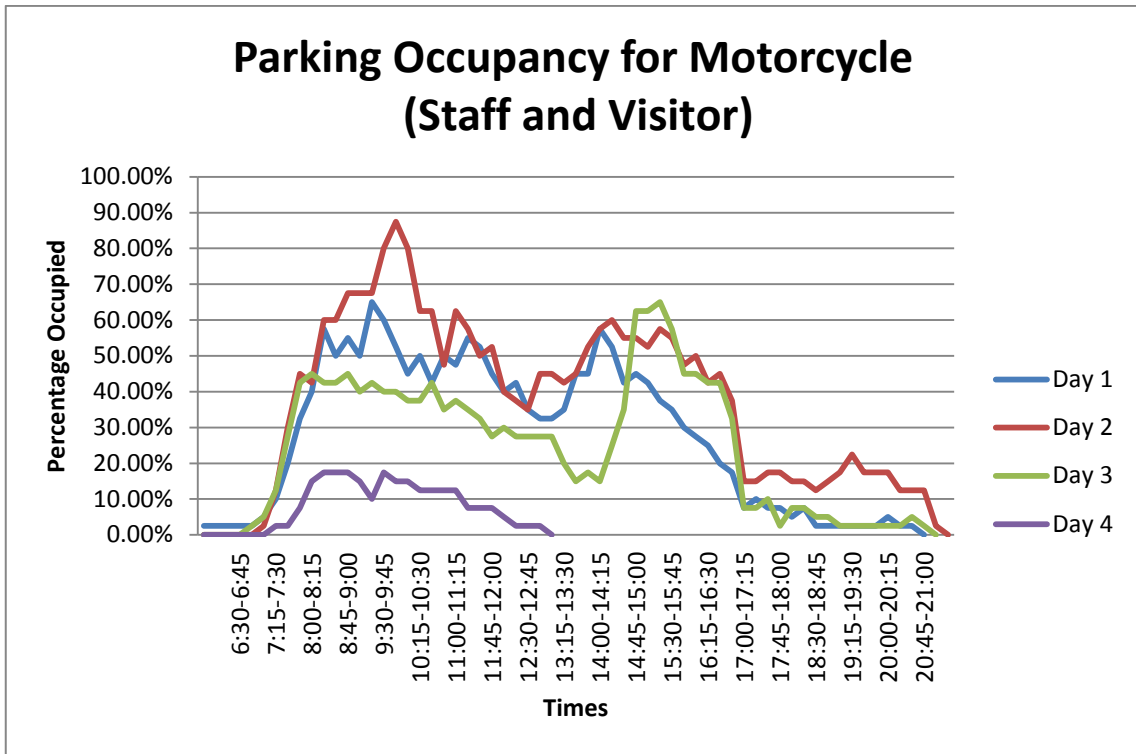


Figure 4.8: Parking occupancy for Motorcycle (Staff and Visitor)

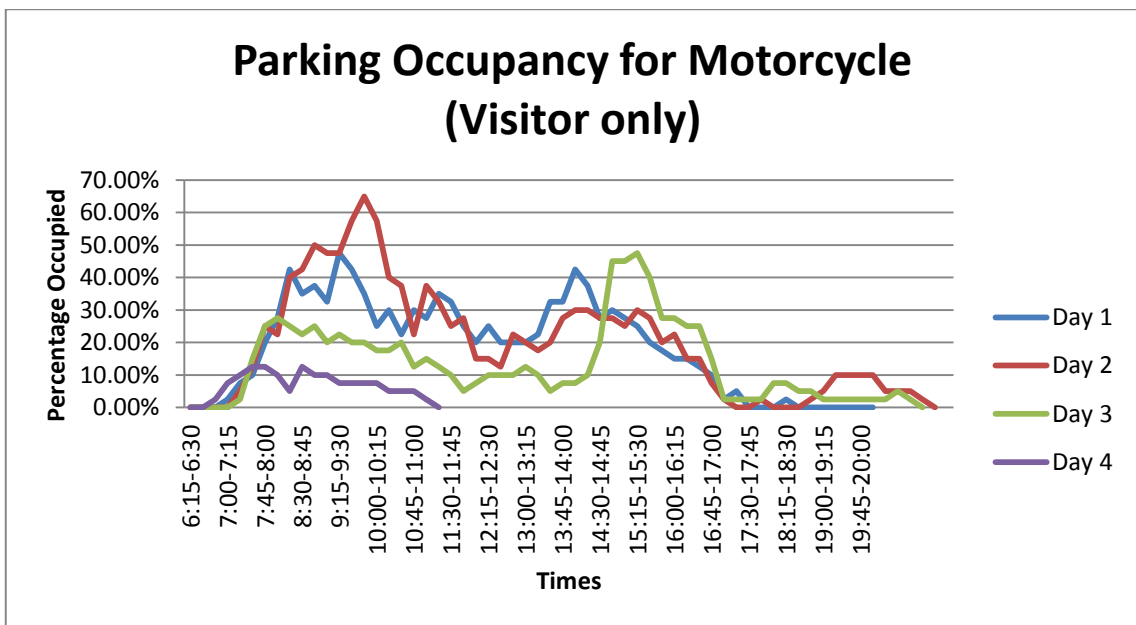


Figure 4.9: Parking occupancy for Motorcycle (Visitor only)

Based on figure 4.8 and figure 4.9, the parking spaces for motorcycle at study area are not fully occupied where the total of occupancy rate are not exceed 100%.

Based on the graph above, the parking spaces only for car at study area are fully occupied where the total of occupancy rate are exceed 100% at weekdays. This situation shows that the demands of parking spaces are higher than parking supply provided. This situation will cause traffic congestion and delays in working hours.

4.5 ANALYSIS OF PARKING DURATIONS

It is the period for which each vehicle is parked at the parking area inside the Health Clinic. The mean parking duration is the amount of time that all vehicles are parked in the parking area during survey duration. Data arrangement and sorting such that entering data of each vehicle and its existing data are on the same line by using sort command. Then the parking duration for each vehicle is automatically computed by subtracting entering time from exiting time in a format in separate columns.

Results of this step are represented in table. The first is for the number of parked vehicles for each time range. After that, the analysis of the average parking duration for the visitor is defined by determined the outlier for the data. Then, the average parking duration, maximum parking duration and minimum parking duration is determined by deleted the outlier data. When analysing normally distributed data, standard deviation can be used in conjunction with the mean in order to calculate data intervals.

Table 4.5: Parking Duration for car and motorcycle (for staff and visitor)

Parking Duration (minutes)	Day 1		Day 2		Day 3		Day 4	
	Car	Motorcycle	Car	Motorcycle	Car	Motorcycle	Car	Motorcycle
Minimum	6	5	7	7	7	7	6	9
Maximum	1166	531	1166	698	1034	589	876	298
Average	35	48	35	35	22	33	71	59
Standard deviation	19.11	29.60	19.77	18.40	10.18	19.53	37.34	37.19
Sample size	487	74	508	90	346	73	96	14

Based on the Table 4.5 above, the minimum parking duration for car is from 6 to 7 minutes on weekdays and weekend. Then, the maximum parking duration is from 1034 to 1166 minutes on weekdays and 876 minutes on weekend. The average parking duration on weekdays is 22 minutes to 35 minutes and on weekend is 71 minutes. The maximum parking duration shows the parking duration for the staff.

Next, the minimum parking duration for motorcycle is from 5 to 9 minutes on weekdays and weekend. Then, the maximum parking duration is from 531 to 698 minutes on weekdays and 298 minutes on weekend. The average parking duration on weekdays is 33 minutes to 48 minutes and on weekend is 59 minutes. The maximum parking duration shows the parking duration for the staff.

Data of average parking duration for the staff and visitor is defined by removing the outlier from the data. There are standard deviation and sample size for the data of parking duration after removing the outliers.

Table 4.6: Parking Duration for car and motorcycle (for visitor only)

Parking Duration (minutes)	Day 1		Day 2		Day 3		Day 4	
	Car	Motorcycle	Car	Motorcycle	Car	Motorcycle	Car	Motorcycle
Minimum	6	5	7	7	7	7	6	9
Maximum	321	301	313	216	277	191	167	132
Average	35	48	35	35	22	33	71	59
Standard deviation	18.69	29.60	19.24	18.40	10.20	19.53	37.34	37.19
Sample size	463	74	492	90	339	73	96	14

Based on the Table 4.6 above, the minimum parking duration for car is from 6 to 7 minutes on weekdays and weekend. Then, the maximum parking duration is from 277 to 321 minutes on weekdays and 167 minutes on weekend. The average parking duration on weekdays is from 22 minutes to 35 minutes and on weekend is 71 minutes.

Next, the minimum parking duration for motorcycle is from 5 to 9 minutes on weekdays and weekend. Then, the maximum parking duration is from 191 to 301 minutes on weekdays and 132 minutes on weekend. The average parking duration on weekdays is 33 minutes to 48 minutes and on weekend is 59 minutes. Data of average parking duration for the visitor is defined by removing the outlier from the data. There are standard deviation and sample size for the data of parking duration after removing the outliers.

4.6 ANALYSIS OF AVERAGE PARKING TURN-OVER

Parking turnover is the number of vehicles utilizing the same stall over a given period of time (Papacostas, 2005). In summary, the parking turnover can be determined by counting the number of different cars through the survey period. This is because to determine the utilization rate of parking space (Hamsa, 2005). The average parking turnover is determined by dividing the total number of vehicles parked with the total number of parking bays.

Table 4.7: Average parking turnover for car (Staff and Visitor)

Day	Total number of car parked	Average parking turn over
1	747	6.67
2	788	7.04
3	758	6.77
4	114	1.02

Table 4.8: Average parking turnover for motorcycle (Staff and Visitor)

Day	Total number of motorcycle parked	Average parking turn over
1	104	2.6
2	135	3.38
3	111	2.78
4	17	0.43

Results of average parking turnover for car and motorcycle for staff and visitor are tabulated in Table 4.7 and Table 4.8. These finding represent the total daily parkers observed using these facilities for 4 days.

The results show that, during weekdays the average parking turnover for cars and are high and for motorcycles are low. Low average parking turnover was considered during weekend for cars and motorcycles. This is because the opening hours on weekend (Saturday) is from 8.00am until 12.00pm. There is a low visitor during that day. Most of car parked for a short term parking during the weekdays.

Table 4.9: Average parking turnover for car (Visitor only)

Day	Total number of car parked	Average parking turn over
1	617	8.57
2	668	9.28
3	615	8.54
4	101	1.40

Table 4.10: Average parking turnover for motorcycle (Visitor only)

Day	Total number of motorcycle parked	Average parking turn over
1	92	2.3
2	119	2.98
3	96	2.40
4	14	0.35

Results of average parking turnover for car and motorcycle for visitor are tabulated in Table 4.9 and Table 4.10. These finding represent the total daily parkers observed using these facilities for 4 days.

The results show that, during weekdays the average parking turnover for cars and are high and for motorcycles are low. Low average parking turnover was considered during weekend for cars and motorcycles. This is because the opening hours on weekend (Saturday) is from 8.00am until 12.00pm. There is a low visitor during that day. Most of car parked for a short term parking during the weekdays.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

The results of the study were summarized to ensure the objectives and requirements were achieved successfully. The results obtained through the observation and analysis that had been carried out was really important to assist in constructing and recommendation. This chapter will show how far the study has been achieved to fulfil the objectives.

However, the conclusion for this study will come out with the recommendation. This is because these two phases are related to each other that will suggest due to the problem observed. The recommendations, the parking space at the study area can be set to solve to overcome the parking space problem because this problem will lead to traffic congestion in this area study.

There are four major indicators explaining the parking utilization of the area or site focus which is parking occupancy, parking accumulation, parking turn over, and also average duration of occupancy. According to KROHN (1992) said that about 85% to 95% instead of 100% of the available parking capacity is used in the analysis. This is because levels of utilizations are higher than 95% are hard to attain due to efficiency losses in turn over, and circulation. When the utilization of the capacity is exceeds 95% it becomes very difficult to find an empty parking space.

5.2 CONCLUSION

Based on the study that have been conducted at Klinik Kesihatan Bandar Kuantan, the conclusion that can be conclude is the parking demand is higher than the parking space for car that had been provide at Klinik Kesihatan Bandar Kuantan on weekdays only. At peak hour, the parking users used to wait for the parking space. It will take a long time to wait and to get the parking because patients take a long time to see the doctor to get the treatment. This situation will lead to the traffic congestion. This is because the users start to park illegal.

Then, the parking spaces for car at study area are fully occupied where the total of occupancy rate are exceed 100% at morning and evening during weekdays. This situation shows that the demands of parking spaces are higher than parking supply provided. This situation will cause traffic congestion and delays in working hours.

After that, the minimum parking duration for car is 6 minutes on weekdays and weekend. Then, the maximum parking duration is 1166 minutes on weekdays and 876 minutes on weekend. The average parking duration on weekdays is 698 minutes to 531 minutes and on weekend is 876 minutes. The maximum parking duration shows the parking duration for the staff.

The minimum parking duration (visitor only) for car is from 6 to 7 minutes on weekdays and weekend. Then, the maximum parking duration is from 277 to 321 minutes on weekdays and 167 minutes on weekend. The average parking duration on weekdays is from 22 minutes to 35 minutes and on weekend is 71 minute

Based on the study that have been conducted at Klinik Kesihatan Bandar Kuantan, the conclusion that can be conclude, during weekdays the average parking turnover for cars and motorcycles are high. Low average parking turnover was considered during weekend for cars and motorcycles.

In Klinik Kesihatan Bandar Kuantan, there are entrance and exit gate for the visitors. Based on my research, they like to use the entrance gate to exit from the Klinik Kesihatan Bandar Kuantan. This will lead to traffic congestion if they collide with other visitor which is to enter the KKBK. This problems need to solve to prevent an accident happened in this study area. Besides that, the lane entry and exit lanes at Klinik Kesihatan Bandar Kuantan are not well designed especially when to drop patients. The facilitate entry and exit of vehicles, lane entry and exit lanes should be well designed so that it can provide comfort to the users of the car park.

In this case study, the parking space need to be added since the demand increase. Some of users will to park their car at park illegally without respect the others. The parking spaces that fulfil the users need to be provided at the strategic spot. However, the management must have a proper planning so that it will not tend to another problem. The parking space for car that required is 112 bays for visitor only. The parking required known from the calculation of average of maximum accumulation (car for visitor only) during the weekdays.

$$\begin{aligned} \text{Parking required} &= \frac{104+133+98}{3} \\ &= 111.67 = 112 \text{ bays} \end{aligned}$$

5.3 RECOMMENDATION

The parking space problem needs to be resolving immediately to prevent the traffic congestion at Klinik Kesihatan Bandar Kuantan. This situation will contribute problems to public such as noise pollution and will lead to accidents. There are some recommendations to improve this problem:

- i. Based on the analysis, the reasonable number should be provided in Klinik Kesihatan Bandar Kuantan is 112 bays for visitor. The parking should be added more in the parking space is 40 bays and the parking lots for staff and visitor should be separated.
- ii. Location for parking lots must be in strategic areas where drivers can park their car easily and not far from the Klinik Kesihatan Bandar Kuantan. There was an acre land behind and besides the Klinik Kesihatan Bandar Kuantan area. This area is more effective as parking spaces to reduce the parking problem at study area.
- iii. The most efficient in decreasing parking problem is by building double storey parking. This type of parking can reduce the use of land.
- iv. Place the signboard "no entry" on entrance gate. So that, they will not use entrance gate to exit from the Klinik Kesihatan Bandar Kuantan.
- v. The lane entry and exit lanes at KKBK are not well designed especially when to drop patients. Based on my research, the best designed is at Klinik Kesihatan Greentown, Ipoh.
- vi. Encourage staff for car-pooling. However, by sharing the same car, the transportation and parking problem can be reduces.
- vii. Traffic light for pedestrian should be providing at the main road in order to prevent accident from happen.

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APPENDIX C

DATA ARRIVAL AND DEPARTURE OF VEHICLES (DAY 1)

		TOTAL PARKING (CAR)=112			
Day 1: 14/1/2015		TOTAL PARKING (MOTORCYCLE)=40			
Registration Number	Type of Vehicle	Time Arrival	Time Departure	Hour	Minutes
CCW2609	KKBK		9:44		
CDB260	KKBK		8:52		
CDD2482	KKBK		8:42		
WHC1210	KKBK				
CDM1858		6:46	21:03	14:17	857
JDV64	MOTOR		18:38		
CDL5832		6:48	8:22	1:34	94
CBG5221		6:59	9:46	2:47	167
W792E		7:05	16:38	9:33	573
WEL9212		7:07	16:33	9:26	566
CBF2012	MOTOR	7:09	7:44	0:35	35
WLB1767		7:01	9:44	2:43	163
CDD9215		7:01	12:56	5:55	355
WXA562		7:13	12:46	5:33	333
CDN7494		7:16	9:51	2:35	155
JPD9591		7:18	10:35	3:17	197
CCN3633		7:18	7:58	0:40	40
CCM3075	MOTOR	7:21	9:04	1:43	103
JPQ24		7:21	13:00	5:39	339
CCC3954		7:21	17:03	9:42	582
CAJ6912	MOTOR	7:23	9:05	1:42	102
BJG4381		7:23	8:00	0:37	37
CAX8748		7:24	17:05	9:41	581
WSM4389		7:24	17:18	9:54	594
WJP695		7:25	7:38	0:13	13
CBY7283		7:25	11:04	3:39	219
CCJ9969		7:28	9:06	1:38	98
WPD5507		7:28	16:32	9:04	544
CDD9613		7:29	8:43	1:14	74
CBF8347		7:29	8:06	0:37	37
TAB4221		7:29	8:01	0:32	32
BBK9502		7:29	7:53	0:24	24

APPENDIX D

DATA OF PARKING ACCUMULATION FOR CAR (DAY 1)

Time	Arrival	Cumulative	Departing	Cumulative	Accumulation	Parking Supply
	4	4	0	0	4	112
6:00-6:15	0	4	0	0	4	112
6:15-6:30	0	4	0	0	4	112
6:30-6:45	0	4	0	0	4	112
6:45-7:00	3	7	0	0	7	112
7:00-7:15	5	12	0	0	12	112
7:15-7:30	16	28	0	0	28	112
7:30-7:45	41	69	2	2	67	112
7:45-8:00	50	119	4	6	113	112
8:00-8:15	41	160	14	20	140	112
8:15-8:30	28	188	14	34	154	112
8:30-8:45	22	210	11	45	165	112
8:45-9:00	24	234	17	62	172	112
9:00-9:15	14	248	24	86	162	112
9:15-9:30	19	267	23	109	158	112
9:30-9:45	23	290	23	132	158	112
9:45-10:00	23	313	18	150	163	112
10:00-10:15	16	329	25	175	154	112
10:15-10:30	21	350	21	196	154	112
10:30-10:45	14	364	31	227	137	112
10:45-11:00	16	380	21	248	132	112
11:00-11:15	25	405	22	270	135	112
11:15-11:30	15	420	20	290	130	112
11:30-11:45	8	428	18	308	120	112
11:45-12:00	8	436	24	332	104	112
12:00-12:15	9	445	14	346	99	112
12:15-12:30	6	451	17	363	88	112
12:30-12:45	7	458	13	376	82	112
12:45-13:00	7	465	16	392	73	112
13:00-13:15	10	475	14	406	69	112
13:15-13:30	9	484	5	411	73	112
13:30-13:45	12	496	5	416	80	112
13:45-14:00	24	520	7	423	97	112
14:00-14:15	18	538	10	433	105	112

14:15-14:30	26	564	12	445	119	112
14:30-14:45	14	578	16	461	117	112
14:45-15:00	20	598	16	477	121	112
15:00-15:15	27	625	15	492	133	112
15:15-15:30	20	645	15	507	138	112
15:30-15:45	12	657	19	526	131	112
15:45-16:00	12	669	21	547	122	112
16:00-16:15	12	681	32	579	102	112
16:15-16:30	6	687	16	595	92	112
16:30-16:45	5	692	17	612	80	112
16:45-17:00	6	698	8	620	78	112
17:00-17:15	2	700	53	673	27	112
17:15-17:30	2	702	14	687	15	112
17:30-17:45	1	703	2	689	14	112
17:45-18:00	4	707	0	689	18	112
18:00-18:15	2	709	4	693	16	112
18:15-18:30	4	713	4	697	16	112
18:30-18:45	3	716	2	699	17	112
18:45-19:00	6	722	4	703	19	112
19:00-19:15	2	724	5	708	16	112
19:15-19:30	3	727	2	710	17	112
19:30-19:45	1	728	3	713	15	112
19:45-20:00	7	735	4	717	18	112
20:00-20:15	2	737	6	723	14	112
20:15-20:30	7	744	3	726	18	112
20:30-20:45	1	745	5	731	14	112
20:45-21:00	2	747	7	738	9	112
21:00-21:15	0	747	3	741	6	112
21:15-21:30	0	747	1	741	6	112
21:30-21:45	0	747	2	743	4	112

APPENDIX E

DATA OF PARKING OCCUPANCY FOR CAR

Time	Day 1	Day 2	Day 3	Day 4
	3.57%	3.57%	4.46%	4.46%
6:00-6:15	3.57%	3.57%	4.46%	4.46%
6:15-6:30	3.57%	3.57%	4.46%	4.46%
6:30-6:45	3.57%	3.57%	3.57%	4.46%
6:45-7:00	6.25%	6.25%	5.36%	4.46%
7:00-7:15	10.71%	12.50%	10.71%	4.46%
7:15-7:30	25.00%	32.14%	26.79%	5.36%
7:30-7:45	59.82%	75.00%	59.82%	8.93%
7:45-8:00	100.89%	115.18%	94.64%	16.07%
8:00-8:15	125.00%	136.61%	113.39%	25.00%
8:15-8:30	137.50%	142.86%	123.21%	29.46%
8:30-8:45	147.32%	146.43%	143.75%	32.14%
8:45-9:00	153.57%	150.89%	150.00%	33.04%
9:00-9:15	144.64%	136.61%	149.11%	36.61%
9:15-9:30	141.07%	140.18%	149.11%	40.18%
9:30-9:45	141.07%	144.64%	147.32%	41.07%
9:45-10:00	145.54%	166.96%	136.61%	45.54%
10:00-10:15	137.50%	175.00%	130.36%	48.21%
10:15-10:30	137.50%	168.75%	139.29%	49.11%
10:30-10:45	122.32%	160.71%	133.93%	55.36%
10:45-11:00	117.86%	150.89%	133.93%	48.21%
11:00-11:15	120.54%	149.11%	125.89%	45.54%
11:15-11:30	116.07%	143.75%	113.39%	41.96%
11:30-11:45	107.14%	133.04%	108.93%	35.71%
11:45-12:00	92.86%	124.11%	95.54%	32.14%
12:00-12:15	88.39%	102.68%	65.18%	24.11%
12:15-12:30	78.57%	91.07%	48.21%	18.75%
12:30-12:45	73.21%	81.25%	44.64%	14.29%
12:45-13:00	65.18%	75.89%	47.32%	8.04%
13:00-13:15	61.61%	53.57%	42.86%	3.57%
13:15-13:30	65.18%	64.29%	40.18%	
13:30-13:45	71.43%	72.32%	36.61%	
13:45-14:00	86.61%	86.61%	41.07%	
14:00-14:15	93.75%	100.00%	42.86%	
14:15-14:30	106.25%	110.71%	54.46%	
14:30-14:45	104.46%	115.18%	70.54%	
14:45-15:00	108.04%	112.50%	94.64%	

15:00-15:15	118.75%	107.14%	111.61%	
15:15-15:30	123.21%	102.68%	116.07%	
15:30-15:45	116.96%	99.11%	108.93%	
15:45-16:00	108.93%	88.39%	102.68%	
16:00-16:15	91.07%	81.25%	95.54%	
16:15-16:30	82.14%	83.93%	86.61%	
16:30-16:45	71.43%	80.36%	77.68%	
16:45-17:00	69.64%	81.25%	77.68%	
17:00-17:15	24.11%	31.25%	35.71%	
17:15-17:30	13.39%	24.11%	27.68%	
17:30-17:45	12.50%	16.96%	24.11%	
17:45-18:00	16.07%	13.39%	21.43%	
18:00-18:15	14.29%	15.18%	15.18%	
18:15-18:30	14.29%	19.64%	15.18%	
18:30-18:45	15.18%	22.32%	12.50%	
18:45-19:00	16.96%	20.54%	14.29%	
19:00-19:15	14.29%	17.86%	19.64%	
19:15-19:30	15.18%	14.29%	14.29%	
19:30-19:45	13.39%	17.86%	16.07%	
19:45-20:00	16.07%	20.54%	17.86%	
20:00-20:15	12.50%	20.54%	19.64%	
20:15-20:30	16.07%	16.96%	25.00%	
20:30-20:45	12.50%	17.86%	25.89%	
20:45-21:00	8.04%	12.50%	19.64%	
21:00-21:15	5.36%	6.25%	12.50%	
21:15-21:30	5.36%	5.36%	10.71%	
21:30-21:45	3.57%	3.57%	9.82%	
21:45-22:00			5.36%	

