A STUDY ON EVALUA[illegible]E OF URBAN BUS IN

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ABSTRACT

Public transportation such as urban bus is one of the utilities that are often used by people across Malaysia. Public transport must comply with several indicators such as bus utilization, passenger ridership, load factor, cycle times, time headways etc. Due to the rapid pace of development, high employment demand and meet the basic needs of the urban area, the performance of public transport should be addressed. Therefore, the objective of the study is to evaluate the operating performance of urban bus services and to identify the drawbacks and propose improvement. This study is conducted based on the observation of the performance of Rapid Kuantan which is the main of public transport in Kuantan. Data collection is achieved by observing at the bus terminal (bus stop) and onboard the buses by doing passenger counting. Result the observation showed, the average travel distance is higher because the value is higher than the World Bank Standard (230-260km) and its means good because the buses are highly utilized. On the other hand, for the headway, is still exceeds the World Bank Standard. Therefore the addition a number of bus can reduce the headway.For cycle times, routes for Hentian Bandar-Pekan and Hentian Bandar-Bukit Sagu is exceeds the World Bank Standard, which is (244minutes and 142minutes). In these cases, it would be better if bus operations to reduce the waiting time of passengers until the passengers on the bus are full. Lastly, the load factor for Hentian Bandar-Bukit Sagu is exceeds to 70% which is (85.8% and maximum number pax is 80%).This shows the area of the bus service is very encouraging.

ABSTRAK

Pengangkutan awam seperti bas bandar adalah salah satu kemudahan yang sering digunakan oleh hampir semua orang di Malaysia. Pengangkutan awam mesti mematuhi beberapa petunjuk seperti penggunaan bas, jumlah penumpang, faktor beban, masa kitaran, kekerapan masa dan lain-lain. Oleh kerana kadar pembangunan yang pesat, permintaan pekerjaan yang tinggi dan memenuhi keperluan asas kawasan bandar, prestasi pengangkutan awam hendaklah ditingkatkan. Oleh itu, objektif kajian ini adalah untuk menilai prestasi operasi perkhidmatan bas bandar dan untuk mengenal pasti kelemahan dan mencadangkan penambahbaikan. Kajian ini dijalankan berdasarkan pemerhatian prestasi Rapid Kuantan yang merupakan pengangkutan awam utama di Kuantan. Pengumpulan data dilaksanakan dengan memerhatikan penumpang di terminal bas (perhentian bas) dan di dalam bas. Keputusan pemerhatian menunjukkan, jarak purata perjalanan adalah lebih tinggi kerana nilai adalah lebih tinggi daripada World Bank Standard (230-260km) dan ia menunjukkan yang bas-bas digunakan dengan baik. Sebaliknya, kekerapan masih melebihi Worl Bank Standard. Oleh itu penambahan beberapa bas boleh mngurangkan masa kitaran kekerapan bas. Bagi laluan Hentian Bandar-Pekan dan Hentian Bandar-Bukit Sagu adalah melebihi World Bank Standard yang telah ditetapkan (244minit dan 142 minit).Dengan itu, adalah lebih baik jika bas yang beroperasi tidak menunggu sehingga penumpang penuh di hentian bas. Akhir sekali, factor beban bagi Hentian Bandar-Bukit Sagu adalah melebihi 70% iaitu (85.8% dan bilangan maksimum pax ialah 80%). Ini menunjukkan bidang perkhidmatan bas itu adalah amat menggalakkan.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Public transportation is essential services that must be provide by the government to its citizen. Yet, it still an issue faced by most of developing countries all over the world including Malaysia. As Malaysia begins to transform itself to become a developed country in 2020, it is a crucial to have comfortable, reliable and affordable world-class public transportation system to meet the target.

According to the Ministry of Transportation (2012), by having efficient transport network, several main transport issues faced by urban populations such as high traffic congestion during peak periods, unreliable service with cancellations and frequent delays and poor access to public transport services and network can be addressed. In fact, Malaysia had already invested in many public transportation planning and development program over the years.

However, the utilization rate is still poor and the use of private vehicles is continuously rising. This situation indicates that there are flaws within the previous and current approach. Public bus services should operate efficiently and effectively, from both demand and supply perspectives. Although the general terminologies of "efficiency" and "effectiveness" may seem to be closely related, these two measures are required to be considered separately in public transit system (Hatry 1980; Chu et al. 1992).

The aim of this study is to observe the performance of RapidKuantan busses as they travelled along two routes which have the higher passenger demand and the lower passenger demand. This will be undertaken through the analysis of the busses.

1.2 PROBLEM STATEMENT

Due to the fact that public transportation is very important to the social and economic life of the citizens, a plan of massive improvement under Government Transformation (GTP) Program had been launched in November 2009 by the Prime Minister Dato' Seri Najib Tun Abdul Razak, however:

The problem faced by passengers in terms of the public transport implementation in the urban area still not solved due to the economy and environmental surrounding. Bus frequency rate also depends to the bus company, whether the bus schedule is available for travel from one destination to another has a frequency interval that takes a long time or otherwise.

Therefore, the problem faced by the passenger is that they have to wait from the time they arrived at the bus stop until the departure time of the next bus. Total bus travel in urban area also plays an important role especially during peak hours because of the high passenger volume, but insufficient number of busses impending congestion and likely some passengers could not board the bus. In the other hand, when they have the high frequency of bus services, they did not have a lot of passenger demand. So, the limited revenue wills occur and finally the demand for fare is increase.

1.3 OBJECTIVE OF STUDY

The objectives of this study are:

i. To evaluate the operating performance of urban bus services in Kuantan

ii. To identify the drawbacks and propose improvement

1.4 SCOPE OF STUDY

This study will be conduct in area of Kuantan, Pahang. The focus of this study is observation of the performance of the urban bus and observation of the operating characteristics including passenger counting in Kuantan, Pahang. In these research, the consideration is:

i. Doing observation of the service frequency.

ii. Doing passenger counting.

1.5 RESEARCH SIGNIFICANCE

The finding of this research is important for future planning purpose. Besides, it also will contribute to the body knowledge of public transportation literature. At the same time, it will serve as a source of reference to the future researchers who seek information regarding this topic.

The findings also will offer valuable information to public users as they will get cleared pictures and more understanding about the performance of intercity bus. Furthermore, this studies done to improve public transport system vulnerabilities urban buses.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Public transport is the main transportation around the world compare to others. While most people have other alternative to travel from one place to another, but the public transport is the most preferred choice as well as being readily available, especially in fast developing country.

Public transport is a shared passenger transport service which is available for use by the general public, as distinct from modes such as taxicab, carpooling or hired buses which are not shared by strangers without private arrangement. Public transport modes include buses, trolleybuses, trams and trains, rapid transit(metro/ subways/ undergrounds etc.) and ferries. Public transport between cities is dominated by airlines, coaches, and intercity rail. High-speed rail networks are being developed in many parts of the world.

2.2 HISTORY OF PUBLIC TRANSPORT IN KUANTAN

Kuantan is the largest town, progressive, beautiful, clean and organized development center. It's only become as the Pahang's state capital in 1995, which is having moved by the British Administration from the Kuala Lipis. It is about 277 kilometers from the Kuala Lumpur or its about 4 hour drive. Well over 400,000 people are live in Kuantan, which makes it the largest city in East Coast Malaysia. This is reflected in its public transportation, including Kuantan Airport (also known as Great Circle Airport) and also Kuantan Seaport.

The Rapid Kuantan bus system is quite new in Kuantan Pahang, but it is currently operating from two separate terminals (but both listed as Hentian Bandar on the bus routes and on buses headed for the terminals). As of April 2014, the Routes 100, 101, 102, 200, 300, 302, 303 and 600 start from Stadium while Routes 201, 301, 400, 401 and 500 start from behind the main market area. Route 200 goes to TelukCempedak and 201 to Taman Gelora. The 2 areas are about 300 meters apart with no clear sign posting as to which buses each area serves.

The company does not have a web site with the routes maps (the routes do not intersect) but it has a Facebook page only which it is very limited information and it was in Malay Language only. The route maps are also displayed on the monitors inside the buses but it's not long enough to make them out.

The new Kuantan Sentral Bus station is also quite a way of the city center. Traffic congestion is a problem that faces in Kuantan and the cities of Malaysia. Often, Multi-lane highways merge into the two-lane city traffic in the center of town. For the road conditions, they are decent, though, as the country's roads are pretty well maintained. The country of Malaysia has a rail system but it does not enter in Kuantan, Pahang.

2.2.1 Definition of Public Transportation

Public transportation is defined as transportation by a conveyance that provides continuing general or special transportation to the public (Tran & Kleiner, 2005). It excludes school buses, charter and sightseeing service and includes various modes such as buses, subways, rail, trolleys and ferry boats.

Most public transport runs to a scheduled timetable with the most frequent services running to a headway. Share taxi offers on-demand services in many parts of the world and some services will wait until the vehicle is full before it starts. Para transit is sometimes used in areas of low-demand and for people who need a door-to-door service.

Public transport services can be profit driven by use of pay-by-the-distance fares or funded by government subsidies in which flat rate fares charged to each passenger. Services can be fully profitable through high ridership numbers and high farebox recovery ratios, or can be regulated and possibly subsidized from local or national tax revenue. Fully subsidized, zero-fare (free) services operate in some towns and cities.

2.2.2 Type of Public Transport

There is a multi-mode vehicle that is used to connect between one place to another place. Among the most commonly used for public transport is airplanes, bus and coach, train, commuter, intercity and high-speed rail, Rapid Transit, personal rapid transit, Cable-propelled transit, Ferry, motorcycle, Auto rickshaws, Pedi cabs, and Motorcycle rickshaws. The Figure 2.1 shows the bus RapidKuantan which is operated by Rapid Bus Sdn Bhd.

Figure 2.1: RapidKuantan - a third public bus network operated by Rapid Bus Sdn Bhd after RapidKL and RapidPenang

Source: (Syarikat Prasarana Bhd, 2013)

2.3 BUS OPERATING PERFORMANCE

According to the study on the Performance of Bus-Transit Operator, Lille said that the past experience of bus operations performance shows it is reliable. In most western countries, the demand for public bus transport has declined in recent decades because consumers are more likely in private transport such as cars and so on. (Lille, 2006)

The Argawal stated that, public bus transport provides essential mobility for people in urban areas around the world. Therefore, when the performance increases the city bus service, it can contribute in increasing the mobility of passengers and also in productivity enterprise. This is because the city's bus system operating efficiency contributed to the development of any society. (Agarwal, 2010). However, as a different of literature shows that the improvement in urban bus system is not an easy task. The difficulty in doing this is because those urban bus systems are affected by many overlapping factors.

ITTK carried out the performances of a public bus transport systems are influenced by several factor, such as the number of bus stops, increasing the number of buses, number of passengers, and changes along roadways. (IITK, 2008). Therefore, the many issues that causing inefficient of operation of bus services need to be identified and appropriate measures should be change to resolve it. In order to make an improvement on the bus operation, so the performance of the existing bus operation has to be studied well.

According to CIRT, in a variety of public sector performance measurement has become the focus. Unfortunately, too many are made to develop valid operational definition of performance, but it also exists in order to identify weaknesses and biases of some kind of measurement. (CIRT, 1992).

Moreover, according to research study by Hawas, other performance analysis study such as route design urban bus planning, such as bus and driver schedule which tried to combine bus and driver schedule are other examples in bus scheduling. Some also set standards such as the number of passengers in a given bus, the average kilometers per day. Others such as (Hawas et al.) evaluated urban bus performance using Data Envelopment Analysis based on some selected input (i.e. travel time per round trip, total number of stops, total number of operators, total number of buses) and output (i.e. daily ridership and vehicle-kilometer) variables. Other Key Performance Indicators is also studied by Randall et al. and used Financial, Customer, Learning and Growth, and Business Processes as KPI. (Eshetie Berhan, 2013)

As shown in several of the literatures, performance is a broad term and it depends on how the organization defines it. The methods may differ from one another depending upon their objective, the field they are applied to, the approach they employ, the basis of the metrics and the data that they have used. According to Iles, there are wide international variations in geographic, climatic, demographic, political, institutional, economic, environmental and cultural factors which influence the operation of a transport undertaking. However, for comparison purpose considering all the above factors would be very difficult to quantify and involve in the performance measurement. Therefore, the standard performance indictors from different authors are used for comparison purpose. (Iles, 2005).

According to Iles, urban buses on all day service will normally operate between 150 and 300 Km per vehicle per day. However, Armstrong-Wright and Thiriez stated that, for a reasonably run of urban bus service recommended that the average should be in the range of 210 to 260. (Armstrong-Wright, 1987)

In the research study of the M. Savsar said, the bus utilization of an urban bus transport can also be computed based on different approaches. It can be measured by the number of passengers transported in a given day per bus or the ratio of the number of passengers getting on the bus and passengers capacity of bus (M. Savsar, 2012). The numbers of passengers carried per vehicle per day (PPVPD) for a bus with capacity of 80 to 100 passengers is in between 1000 to 1200. Moreover, the vehicle utilization and the PLF are normally in between 65% to 75% and 80% to 90% respectively. (Eshetie Berhan, 2013)

2.3.1 Bus Utilization (km/bus/day)

Bus utilization compares the time spent in revenue-earning service to idle time. It expresses the number of buses in service as a percentage of the buses available for service

2.3.1.1 Beware of fixed costs

When a bus is idle, it's incurring fixed costs (depreciation, insurance, license fees, etc.), but not earning revenue to cover them. If it's operating empty between its depot and the route terminus, it's also incurring operating costs, which are not covered by revenue.

Poor utilization will result in low profitability, and may also result in inadequate service capacity unless there is an excessive number of a vehicle. However, a balance must be found between utilization and load factors. There is no point in operating buses on journeys where there is insufficient demand to cover the direct costs of the journey. (World Bank Group, 2006).

2.3.2 Ridership (Pass/bus/day)

Ridership is the number of persons who ride a particular system of public transportation over a given period of time.

2.3.3 Load Factor (Pax / seat)

This indicator, calculated by dividing passenger kilometers by seat kilometers, shows the average load on a bus route throughout the day. The higher the load factor, the more profitable the operation, provided that fares are set high enough: if they are too low there can be significant loss even on very full buses. The theoretical maximum of 100% is never achieved in urban services; buses are rarely full for an entire journey, and usually there are directional imbalances in demand at different times, resulting in buses operating with heavier loads in one direction than in the other.

The load factor will depend on the nature of the route but in practice should normally be about 30% to 40% for large buses and for very busy midribs routes up to 65%. Certain types of electronic ticket machines, as well as smart cards, may provide data to enable load factors to be calculated. (World Bank Group, 2006).

The easiest way to measure passenger-kilometers is to conduct a sample boarding and alighting survey and to multiply the occupancy between any two stops by the stop distance. For urban services with fairly regular stop spacing it is usually adequate to divide the route length by the number of stops to calculate the average stop distance. Seat-kilometers are simple to measure being the kilometers operated by all the buses on a route times the average capacity of the buses on the route. (World Bank Group, 2006).

Passenger load factor and reliability that represent comfort and convenience of the service level of a bus route vary significantly, so they may be appropriate for evaluating service level of bus operation. The reliability can be evaluated by the data collected, while the estimation of the passenger load factor requires the data on passenger loading and unloading at each stop.

2.3.4 Cycle Time

Cycle time is the time for one vehicle to make a complete cycle of the route. It is twice the route length (L) divided by the average speed (S) plus layover times at each end of the route. Vehicle requirements can be calculated as a function of cycle time and headways.

2.3.5 Headway

According to the Anderson, the headway is a measurement of the distance or time between vehicles in a transit system. The precise definition varies depending on the application, but it is most commonly measured as the distance from the tip of one vehicle to the tip of the next one behind it, expressed as the time it will take for the trailing vehicle to cover that distance. A "shorter" headway signifies a more frequent service. Freight trains might have headways measured in parts of an hour, metro systems operate with headways on the order of 1 to 5 minutes, and vehicles on a freeway can have as little as 2 seconds headway between them.

Headway is a key input in calculating the overall route capacity of any transit system. A system that requires large headways has more empty space than passenger capacity, which lowers the total number of passengers or cargo quantity being transported for a given length of line (railroad or highway, for instance). In this case, the capacity has to be improved through the use of larger vehicles. On the other end of the scale, a system with short headways, like cars on a freeway, can offer very large capacities even though the vehicles carry few passengers. (Anderson, Transit Systems Theory, 1978)

The term is most often applied to rail transport, where the number of tracks is limited and signaling capabilities require long headways between trains. Newer signaling systems and moving block controls have dramatically reduced headways in modern systems compared to the same lines only a few years ago. In principle, automated personal rapid transit systems and automobile platoons could reduce headways to as little as fractions of a second. (Anderson, Transit Systems Theory, 1978).

2.3.6 Average (km/bus/day)

The indicator for average (km/bus/day) is the sub-criteria indicate the average of kilometers operating per bus per day during a statistic period. It is define by ratio between Average kilometers/day to total fleets available in the depot.

2.3.7 Time Management

According to the paper of Dr. R. Dilli Babu, they said that the qualitative of indicator performance measure how effectively manage the time in the terminal, in terms of schedules, trips, shifts, services from the customer point of view (Dr. R. Dilli Babu, 2010)

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

Methodology is a method for the investigation or research which is acts as a procedure to achieve the objective of the research. This is important for the study research because from the methodology, it can avoid any delay or wastage and focus on the objective that has been set. Based on the methodology, the flow of this research can be planned. This chapter discusses on how the research process during the observation. The data collection for the analysis is doing by the direct field for service frequency surveys and passenger surveys.

3.2 LOCATION OF THE STUDY

This research was conducted at area of Kuantan, Pahang. Based on the location indicated by studies to be carried out is referring to the two types of roads that are in high passenger demand and the low passenger demand. By referring the way of RapidKuantan routes, the route with the highest passenger demand around the Kuantan is at the route between 'Hentian Bandar-Pekan' which is route 400, and the route with the lowest passenger demand is between the routes 'Hentian Bandar-Bukit Sagu' route 301.

3.3 ROUTES CHARACTERISTICS OF THE STUDY AREA

Bus routes of RapidKuantan at Figure 3.1 show the map for 'Hentian Bandar-Pekan' with the highest passenger demand currently operates with an average route length of 53 km, most of include the central business, villages, housing estate, commercial areas of the city and also industrial areas. It's taking about 1 hour to get to the terminal Pekan.

Bus routes of RapidKuantan at Figure 3.2 show the map for between 'Hentian Bandar-Bukit Sagu' with the lowest passenger demand currently operate with an average route length of 42 km. It is by the number of areas such as commercial areas of the city, industrial areas and through the village of Felda. It's taking about 50minutes to get to the Bukit Sagu. Table 3.1, showing the number of routes location for Rapid Kuantan at route 301 for Hentian Bandar-Bukit Goh-Bukit Kuantan-Bukit Sagu, while the number of routes location for Rapid Kuantan at route 400, Hentian Bandar-Pekan.

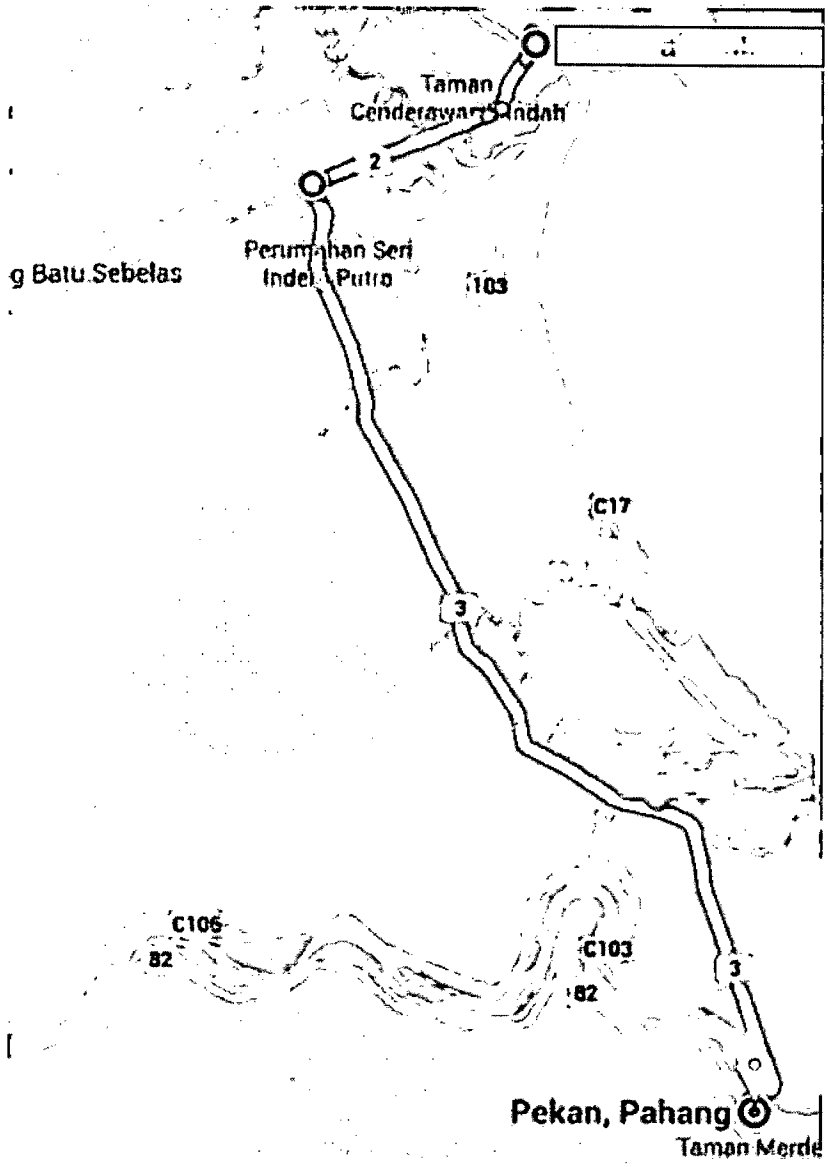

Figure 3.1: Map show the location of bus RapidKuantan routes 400 which is travels between the 'Hentian Bandar and Pekan' with the high of passenger demand.

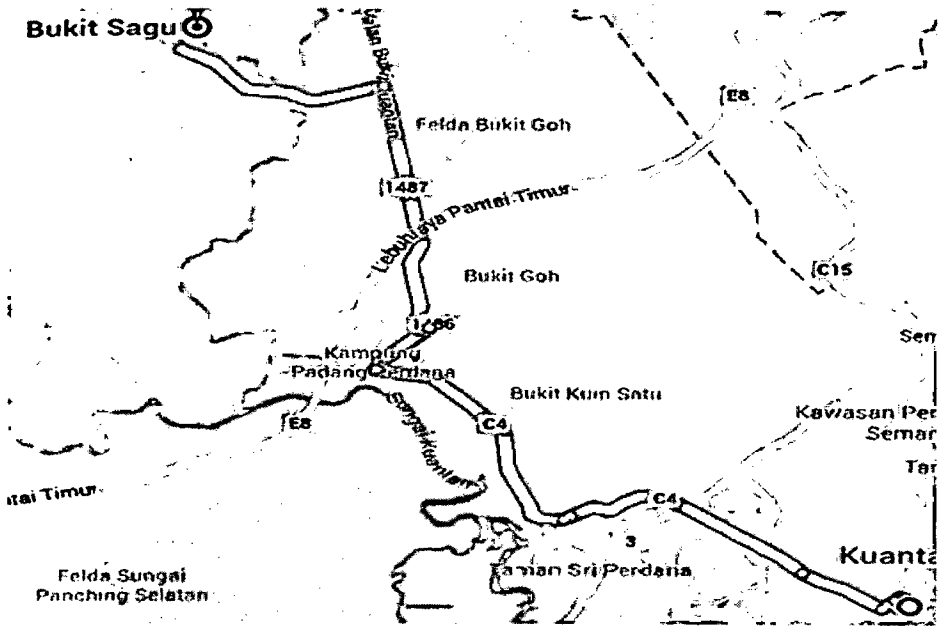

Figure 3.2: Map showing the location of bus RapidKuantan routes 301 travels between the 'Hentian Bandar and Bukit Sagu' routes with a low passenger demand.

Table 3.1: Number of Routes Location for Rapid Kuantan

100 - Hentian Bandar - Gambang Resort
101 - Hentian Bandar - Inderapura - Inderasempurna
102 - Hentian Bandar - SgIsap - PermatangBadak
200 - Hentian Bandar - TelukCempedak
300 - Hentian Bandar - Taman Impian
301 - Hentian Bandar - Bukit Goh - Bukit Kuantan - Bukit Sagu
302 - Hentian Bandar - InderaMahkota 1
400 - Hentian Bandar - Pekan
401 - Hentian Bandar - Kg Ubai
500 - Hentian Bandar - SgLembing
601 - Hentian Bandar - Polisas

Source: (Syarikat Prasarana Bhd, 2013)

3.4 DATA COLLECTION

Extensive surveys were carried out on all two routes. For the services frequency surveys, the observation were doing on the terminal. The purpose of this observation is doing to record the number of bus and also to record the times when it passed the observation point. Based on this observation, the data will be collect by record the number of the registration of bus, the number of bus routes, total number of buses operated on each routes, arrival and depart times, and destination of the route that has been assigned as shown in Figure 3.3 .

The destination of routes is used to simply to determine whether a trip is originating or terminating from the survey location since origin and terminating trips are not used in the analysis. This data will be collect for a minimum of 2 or 3 days and maximum about 10 days representing weekdays and weekend. The form to record the data is at the Appendix A.

For the passenger counting, the observer were onboard the buses for counting the numbers of passengers boarding/alighting at each bus stop that were counted manually, but to record the number of passenger, no need to record himself as the passenger. This task is done by repeating at each of bus stop (at the start and end points) as long the buses are still in operating. This process is shown in Figure 3.4. The form to record the data is at Appendix B, C, D and E.