CITY BUS CHARACTERISTIC-IPOH-TANJUNG RAMBUTAN

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CITY BUS CHARACTERISTICS:

IPOH – TANJUNG RAMBUTAN

by

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CERTIFICATION OF APPROVAL

City Bus Characteristics : Ipoh – Tanjung Rambutan

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CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

MOHD FIRDAUS ROSLI

ABSTRACT

This study evaluating public bus transportation operated along Ipoh – Tanjung Rambutan route. Service evaluated in term of frequency, time and route. Collecting data in identifying passengers and residents characteristics for demand level analysis. Data collected by survey and observation at study area. Survey form distributed randomly to passengers and residents. Characteristics extracted from survey organized into presentable form for demand analysis use. Bus service provided evaluated by Urban Bus Design. Actual data on site compared to results defined by Urban Bus Design. From the survey done, 51% are below 25 years old using public bus for transportation purpose. Most of them are students whose use public bus as mod of transportation from home to school and vice versa. Majority of passenger (61%) are with low income below RM500 per month. They are combination of students and factory workers. By survey of frequency on using bus per week, 39% of residents is not using bus at all and prefer to use own transportation like cars and motorcycle. Performance of bus operations is compare to Urban Bus Design method. As the results, number of buses provide for the service is not adequate for current amount of passengers ride per hour. Four buses provided but the service should provide seven buses to accommodate the passengers. These causes produce long waiting time for passenger with 26 minutes. Few numbers of bus stops within residential area make its more difficult for residents to use public bus. From survey, 67% have to walk more than 5 minutes to reach the nearest bus stops. Ipoh City Council (Majlis Bandaraya Ipoh) in their Ipoh Structure Plan (1998 – 2020) promising Ipoh local in improving city public transportation by building infrastructure of integration terminal center in Meru Jaya and South Chemor. Several recommendations has been made for improvement of public bus Ipoh – Tanjung Rambutan routes. Increasing number of bus stops and adding up one more bus for operations is some of the recommendations.

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CHAPTER 1

INTRODUCTION

1.1 Background Story

Bus is large road vehicle which mean to transport mass of passengers in one time. Historically famous with name Omnibus from a Latin words means "For all". First bus on the road is 1826 at France. It is been 182 years till now, thus bus is the oldest public transportation in the world. (Charles 1962)

Yet to the status of oldest public transportation of the world, bus still been used till today and improved with modern technology. America and Europe are heavily invested funds into improving infrastructures on public buses. Sadly, our nation Malaysia, think that buses is not practical anymore as public transportation. Implement new technology like Light Rail transit system consumes lot of Ringgit and effort. Yet, the result is not significant in improving performance of public transportation.

Ipoh – Tanjung Rambutan bus route has been chosen as study focus represent local public bus scene. Route Ipoh – Tanjung Rambutan is operated by Ipoh Omnibus Sdn Bhd and the only bus operator for inter city of Ipoh.

. According to Ipoh Structure Plan (1998 – 2020), Ipoh City Council (Majlis Bandaraya Ipoh) has been comes out with two main targets in improving public transportation services in Ipoh city.

- To create integrated, central, and efficient in public transportation system.
- To form a enforcement agency in handling public transportation system

Ipoh City Council shows their dedication in improving public transportation in Ipoh with their visions above. However, quality of public transportation in Ipoh still poor from the eyes of Ipoh's local people.

1.1.1 Tanjung Rambutan

Tanjung Rambutan is a main town in Kinta district, Perak, Malaysia. Located not far from Ipoh the state capital. The oldest mental hospital in Malaysia, Hospital Bahagia, is located here and Tanjung Rambutan famous by this trademark. Location of Tanjung Tambutan shown in Figure 1.1

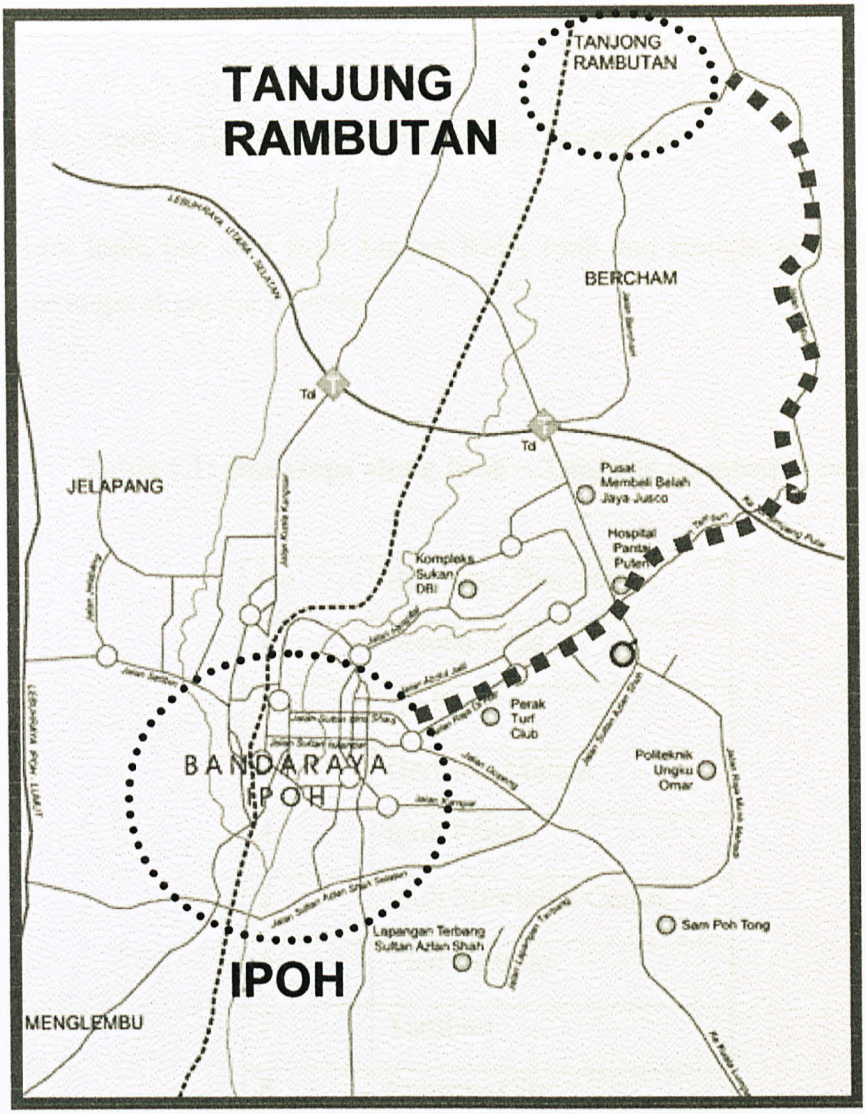

Figure 1.1: Map Location of Tanjung Rambutan

1.1.2 Why Ipoh – Tanjung Rambutan?

- **Ipoh** – Capital city of Perak. High volume of commuters expected to ride the bus.
- **Tanjung Rambutan** – End of route located in Hulu Kinta which consist lots of residential houses and small factory business park along the route from Ipoh to Tanjung Rambutan.

1.1.3 Ipoh - Tanjung Rambutan Bus Operation

From Ipoh, bus start from Medan Kidd, Ipoh and straight to Tanjung Rambutan with 12 bus stops along the journey.

Table 1.1: Bus stops along Ipoh – Tanjung Rambutan route

No	Bus stop/ Bus station
1	Medan Kidd
2	Jln Pasar
3	Gerbang Malam
4	Ipoh Parade
5	Ipoh Specialist Centre
6	Thai Temple
7	Tambun
8	Sunway City
9	Tmn. Perpaduan
10	Tmn. Perpaduan
11	Temple
12	Taman Indah
13	Taman Jaya
14	Tanjung Rambutan

Fare price is RM1.70 from Ipoh to Tanjung Rambutan and according to the bus driver, average passenger per day is 240 persons. Peak hour is during 6.00am to 7.00am and 5.00pm to 6.30pm.

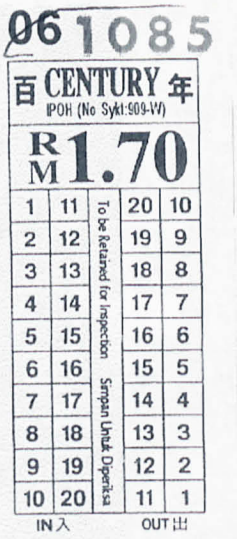

Figure 1.2: Bus ticket sample

Bus is using traditional ticketing system where ticket conductor on the bus is responsible for ticket sales. It is still practical to use ticket conductor in selling bus tickets where fast and efficient. But during peak hour, the system failed where ticket conductor can't move fast to entertain the entire passenger and one or two passenger maybe end up got free of charge ride.

Travel distance from Ipoh to Tanjung Rambutan is 12.5km and normal non congested traffic takes 45 minutes to complete travel.

Bus stops a long the roads were provided by authority (Dewan Bandaraya Ipoh). Good condition bus stop provide around the city center. As the journey travel leave the city the bus stops condition look old without proper maintenance and the worst is no bus stop provided in several stop point designated.

Figure 1.3: Jalan Pasar Bus stop

Figure 1.4: Taman Java, Tanjung Rambutan bus stop

Table 1.2: Ipoh-Tanjung Rambutan bus stations distances

No	Bus stop/ Bus station	Distance ffrom each station (km)
1	Medan Kidd	0
2	Jln Pasar	2
3	Gerbang Malam	0.8
4	Ipoh Parade	0.6
5	Ipoh Specialist Centre	1
6	Thai Temple	2.4
7	Tambun	2.8
8	Sunway City	2
9	Tmn. Perpaduan	1.6
10	Tmn. Perpaduan	0.5
11	Temple	0.5
12	Taman Indah	1.4
13	Taman Jaya	1.5
14	Tanjung Rambutan	1.2

1.2 Problem Statement

There are several problems been facing by public bus passengers everyday. Bus frequency which is the bus reliability is always being a problem to them. Especially in the morning around 6.30am to 8.00 am and late afternoon at 5.00pm to 6.00pm. This is known as the peak hours for every working day.

Another problem is walking distance to nearest bus stop from home. Too few bus stops available make walking distance greater and resident choose another mod of transportation except bus.

1.3 Objectives and Scope of Study

Objective of this study is to acquire passenger's point of view towards to bus services provided. Identifying demand level of local resident towards bus service. This data is valuable for service evaluation and forecasting future demand.

Scope of study is as followings:

i. To evaluate the service provided in term of frequency, time and route.

ii. Identifying passengers and residents characteristics for demand level analysis.

iii. Recommendations for future improvement of bus service.

CHAPTER 2

LITERATURE REVIEW

2.1 Definition

Public bus is one of important element if public transportation. It connects people from different area to another area. Economic growth is dependable on good public transportation network. Without good planning on public transportation people, economy and also knowledge is not moving and stagnant. Consequently, development is not possible without good transportation.

Public transportations have been defined differently by different scholars. Creswell (1976) who defined public transportation is a type of transportation which carry passengers and for everybody. Well (1976) describes that public transportation is a way of effective transportation and able to carry number of people. Definition which most suit today scenario is public transportation comprises all transport systems that transport members of the general public, usually charging set fares.

For example, bustling cities in India, China, Mexico, and Thailand today are struggling to keep pace with the demand for more and better transportation as the number of people in these cities begins to swell with economic growth and development. With a rise in demand for transportation come congestion and other problems. Delays,

uncertainty, and stress levels are also beginning to take their toll on both individuals and society (Morris et al. 2005).

2.2 Service Quality

Passenger's satisfactions are important in public transportation. For instance, the better the quality of the ride, the more satisfied the passengers will be or the more frequently passengers have to change buses to get to their destinations, the less satisfied they will be with bus services. (Syed et al. 2007). The UK has already begun to look 10 years ahead to shape its transportation policy (Department of Environment, Transport and the Regions 2000). UK's Midlands operator Trent Buses conducted a thorough research with a view to improving services (Disney 1998) and identified customers' top requirements as: reliability or frequency of services, friendliness of services, clean bus interiors, comfort, value for money, clean bus exteriors, easy access, reasonable fares, and easy to understand and remember timetables.

When it comes to the evaluation of bus services, survey form or questionnaire is the reliable research method. Survey form must be design in compact and easy to read. According to Syed et al. (2007), the questionnaire was based on secondary research, as well as in depth interviews and extensive brainstorming. The questionnaire should be pretested on several randomly selected respondents. Minor adjustments must make to ensure conciseness, objectivity, and clarity. Demographic questions are also included inside the questionnaire. Syed et al. (2007) research are based on Dhaka City's transportation problems, the questionnaire was originally developed in English and translated and retranslated into local language Bangla. Panel of experts concurred on the content validity of the English and Bangla versions ensure the translation is clear and precise. In the survey form, student socioeconomic characteristics are requested. For

example, age, gender, number of family members, income, number of cars, and number of licensed driving members (Laura, E. and Gabriella, M. 2007).

Laura, E. and Gabriella, M. (2007) evaluate bus service quality by 16 service attributes. The 16 attributes are shown in Table 2.1 below.

Table 2.1: 16 Bus Service Attributes

Attribute	Description
Bus stop availability	Availability of bus stop near home
Route characteristics	Route characteristics (number of bus stops, distance between bus stops, etc.)
Frequency	Service frequency
Reliability	Reliability of buses that come on schedule
Bus stop furniture	Availability of shelter and benches at bus stops
Overcrowding	Bus overcrowding
Cleanliness	Cleanliness of interior, seats, and windows
Cost	Cost affordability
Information	Availability of schedule/maps at bus stops
Promotion	Availability of service information by phone, mail, Internet, etc.
Safety on board	Vehicle reliability and competence of drivers
Personal security	Safety against crimes on buses
Personnel	Helpfulness of personnel
Complaints	Administration of complaints
Environmental protection	Use of ecological vehicles
Bus stop maintenance	Physical condition of bus stops

On a scale from 1 to 10, users expressed a rate of importance and a rate of satisfaction on each attribute.

Bus operation evaluation is analysis by Urban Bus Design according to Rizal (2004). Initial data must collected by observation on the study area.

The data are as follow:

- Travel Distance, Lc (km)
- Travel time, t0 (minutes)
- Maximum capacity, Pmax Or Cb (passengers/hour)
- Bus capacity, Ca (passengers)
- Headway (minutes)
- Loading factor, α
- Time at terminal, tt (minutes)
- Commercial speed, Vc (km/hour)

The data followed by analysis with following formula

$$C_b = \frac{60C_t}{h_m} \quad (1)$$

C_b = Maximum capacity

C_t = Carry capacity

h_m = Minimum headway

$$C_t = C_a + \alpha C_s \quad (2)$$

C_a = Seated bus capacity

C_s = Maximum allowed standing in bus

$$T = 2(t_0 + t_t) \quad (3)$$

T = Cycle time

t_0 = Travel time

t_t = Time at terminal or waiting time

$$N_f = \frac{T}{h_m} \quad (4)$$

N_f = Number of buses

$$T' = N_f \times h_m \quad (5)$$

T' = New time cycle with number bus calculated

$$T_t = \frac{[T'-2(t_0)]}{2} \quad (6)$$

T_t = New time at terminal with T' calculated (waiting time)

2.3 Factors Affecting the Demand

There are several factors affecting demand for transit or usage for any public transportation. Murray (2001) mentions that availability of service near origin and destinations are major factors in any decision. Waiting time is the crucial factor influencing demand of user. Passengers value their waiting time the most, at a level two to three times that of in-vehicle-time (Mohring et al. 1987)

Service frequency of operations makes the user tend to use service. More frequency is available, more likely the ridership. Evans (2004) reported that ridership is expected to increase by 0.5 percent in response to each 1 percent of service increase. In residential area, accessibility of bus stop from home is giving an impact to the demand of use. People prefer to have to less walking to the bus stop. According to Hsiao et al. 1997 and Polzin et al. 2002, the more accessible the bus stops will lead to the higher the use.

Travel time element is should be consider in determining passenger demand. Travel with private vehicle is faster compare to public transportation. Domencich et al. (1968) found that passenger demand will decrease by 3.9 percent for a 10 percent increase in travel time.

2.4 Public Transportation in Malaysia

In Putrajaya, Nor and Ahmad (2006) stated that estimation results show that improvement in public transport alone is incapable of inducing sufficient modal shift to achieve the goal of a 70:30 split between public and private transport. However, current modal split is 15:85 between public and private transport. Factors contributing to the preference of using private transport in Putrajaya are because of high quality road network with plenty of road space, lots of parking spaces provided free of charge and poor public transport services.

Due to shortages of public funds and expanding societal needs, maintaining and improving the performance of public transportation systems are critical for future operations (Kittelson et al. 2003; Sulek and Lind 2000). In Malaysia, public bus transportation seems to be left behind with Government intention to alternative mod of public transportation like monorail, light rapid transit (LRT) and etc. Funding to new mod of transportation will takes at least 10 years to be effective in community. Available facilities like public bus services should be upgraded and improvement where waiting time for customer to receive significant impact of improvement is shortened.

In Klang Valley, neighborhood is saturated with building and structures where no more room for bus facilities improvement. Thus, Government approach in introducing new mod of public transportation to Malaysian is well thought-out. However, other city than Kuala Lumpur, people are still rely on bus as main public transportation. For example, capital city of Perak , Ipoh. As main public transportation mod in the city, bus city should be performing in excellent service. But, referring to Ipoh City Council (Majlis Bandaraya Ipoh) website at Complain section, people still complaining the poor service provided. Plus, an old infrastructure for bus operation is unacceptable. No proper bus stops provided and Integrated Transportation Terminal in Medan Kidd is unorganized and dirty.

Fortunately, Ipoh City Council has arranged to taken several steps in improving public transportation in Ipoh. According to Ipoh Structure Plan (1998 -2020), Ipoh City Council is planned to:

a. To build new Integrated Transportation Terminal at Meru Jaya

b. To build new Integrated Transportation Terminal providing bus, taxi and train (KTM) service at Chemor Selatan.

c. To form an organization agency to mange public transportation in Ipoh.

Hopefully by 2020, Ipoh city will have fine public transportation system which will benefit the people and country.

CHAPTER 3

METHODOLOGY

3.1 Information

Great understanding of theory and basic knowledge of methodology is crucial for this research. Comprehensive literature review must be done by lots of reading materials e.g text books, journals, magazine, articles and etc. From this, clear understanding of problem statement will lead to easier process of getting data.

Method of research divided into several levels for easy organization of information. At the beginning, one work structure has been introduced in order to visualize the journey of research. This structure categorized into;

i. Written

ii. Interview

iii. Survey

iv. Observation

3.1.1 Written Information

It is facts and theories from the previous research which have been done before. This type of information sourced from books, journals, and research materials of individuals. Articles from internet aid research for fresh and updated information.

3.1.2 Interview Information

Interview method is heavily used in this research specially getting information from bus operator Omnibus Sdn Bhd and local authority Ipoh City Council (Majlis Bandaraya Ipoh).

3.1.3 Survey Information

Survey has been done to determine the level of passengers and surrounding residences satisfaction towards the quality of service provided by the bus operator. Random approach has been selected to obtain data in balance and well spread. From this, information generated is most accurate representing overall population.

3.1.4 Observation Information

Not all information can be obtained by survey method. For example, volume of passenger on specific time not suitable conducted by survey. Observation need raw data extracted from study area with average value of statistic taken as results.

Peak hour determined by counting total of user in specific time frame. (number/time). This counting must be done repetitive daily and weekly to obtain uniform data.

3.2 Data Collections

Data collections divided into two main source, Primer source and Secondary source.

a. Primer Source

Data collecting on site, where the data is obtained by survey and observation to study area.

b. Secondary Source

Secondary source is books, journal, articles and magazines and etc. Secondary source used for theory understanding and research concept.

3.3 Method of Research

Method has been used in the study is Survey Method which survey form distributed to bus passengers and surrounding residents. Passengers' characteristics data is extracted by this survey form. Moreover, service performance of bus operation can be indicating by this method. Bus operation schedule is compared with the data of bus operations from the survey form.

3.3.1 Survey

Survey is a way of data collection method. Purpose of survey is for evaluation and analysis. By survey, current level of demand can be determined and future demand is able to be forecasted. Survey sample is available at Appendix A and Appendix B.

Generally, there are a number of survey types which has been conducted on study area. For example, survey to passengers and residents. This approach is the most accurate to find original information.

Information collected by this survey are:

a. Initial start location

b. Journey destination

c. Purpose of journey

d. Reason of choosing certain type mod of transportation

e. Bus accommodation (seat or stand)

f. Bus stops (distance and number)

g. Bus schedule (frequency and reliability)

h. Ride fee

Survey form must be design to be filled easily by passengers and residents. Form must be simple, understandable and compact which can be filled fast. Avoid jargon and easy to read. Thus, for this research, survey form created in Bahasa Melayu as the majority of community is Malay.

3.3.2 Observation Data Collections

Observation is more practical to identify overall usage of public bus by passengers. Observation use to find out as below.

i. Number of passengers on specific time frame

ii. Identify peak hours on working days and weekend.

3.4 Data Processing

Data collected from survey and observations collected and processed. Processing is data organization in form of table and graph. Calculation is needed on part of the data as the final results. Finally, the results presented in diagram like bar chart, pi chart and etc.

3.6 Flow of Research (Step by Step)

Generally, step by step of method of research is as in **Figure 3.1**.

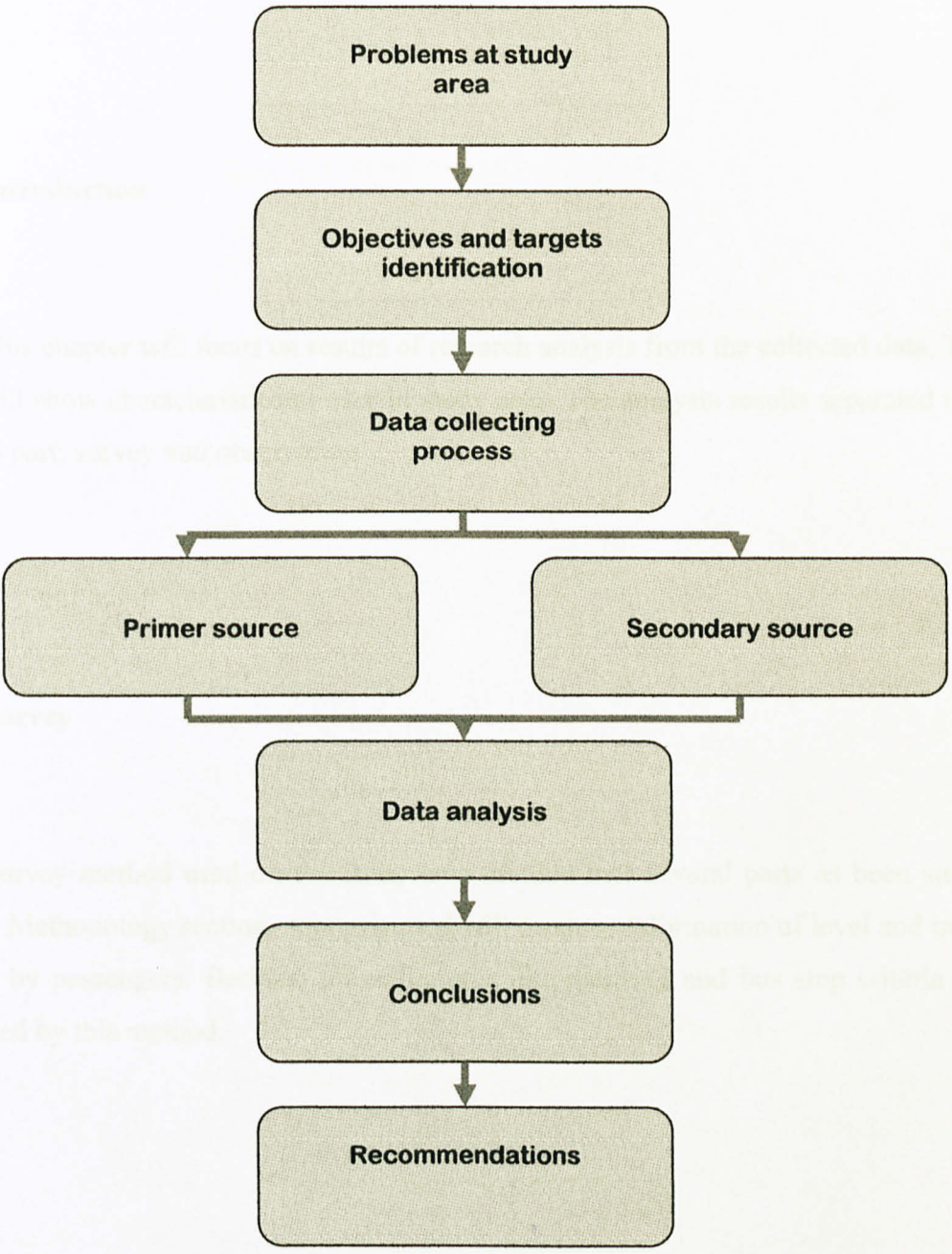

Figure 3.1: Research Methodology Flow Chart

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter will focus on results of research analysis from the collected data. The results will show characteristics of user in study area. The analysis results separated into two main part; survey and observation.

4.2 Survey

Survey method used on the study area divided into several parts as been stated before in Methodology section. Analysis used will produce information of level and trend of usage by passengers. Besides, infrastructures like pathway and bus stop criteria are determined by this method.

4.2.1 Age Analysis

Research is done via interviews and survey forms. Bus riders are consists of different level of age. Results of survey presented in the form of table (Table 4.1) below.

Table 4.1: Percentage of passenger by ages

Age (year)	Percentage (%)
<15	28
15-25	23
26-35	11
36-45	15
46-55	15
>55	8
Total	**100**

Data shown highest percentage of passenger age is comes from below 15 years old category which is 28%. Majority of the bus passenger is students which use public bus as two way transportation, home to school and school to home.

Second highest percentage is 15 to 25 years old category. Teenagers use public bus services mostly for leisure purposes. In other hand, teenagers are the group love to travel and moving a lot. Purpose of journey is visiting friends and leisure business. For 36 to 45 years old range average percentage is 15%. From the survey done, they are mostly housewives with no personal transportation for their daily activities. Above 55 year old scored lowest with 8% of the overall population.

For easy reference, data presenting in bar chart .Please refer to Figure 4.1

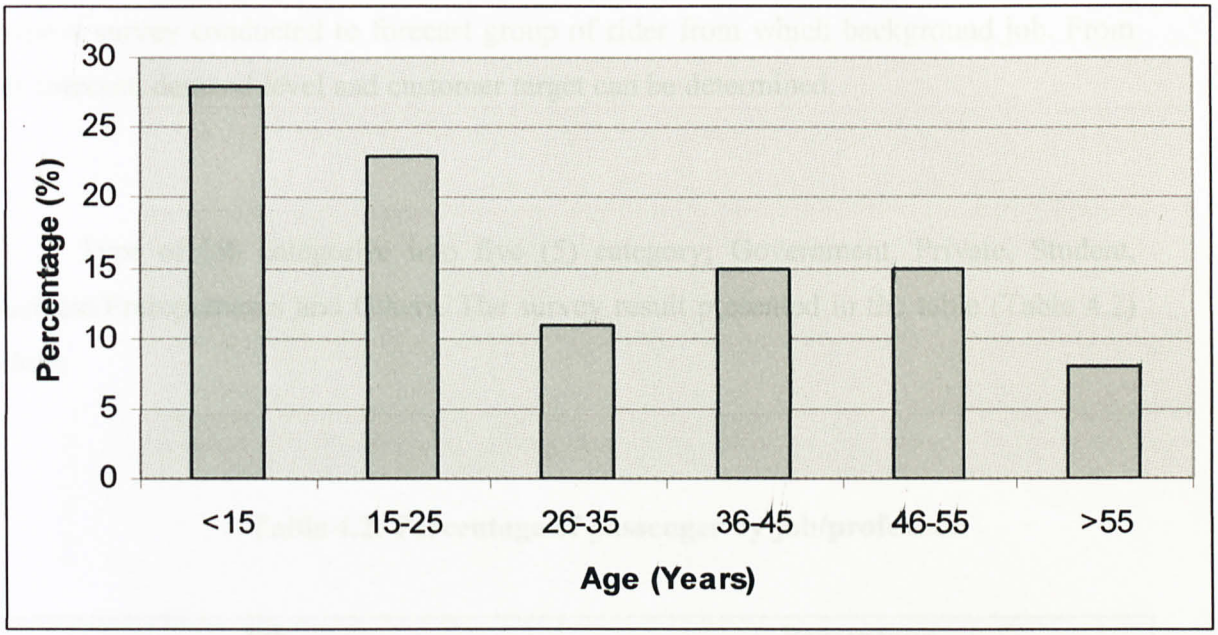

Figure 4.1: Percentage of passenger by ages

4.2.2 Job Analysis

Percentage of user branched into category of job/profession of bus riders. This job analysis survey conducted to forecast group of rider from which background job. From this forecast, demand level and customer target can be determined.

Type of job categorize into five (5) category; Government, Private, Student, Business/Entrepreneurs and Others. The survey result presented in the table (Table 4.2) below.

Table 4.2: Percentage of passenger by job/profession

Job	Percentage (%)
Government	5
Private	20
Student	37
Business	14
Others	24
Total	**100**

Refer to Table 4.2; Student group is the highest percentage with 37% of total. Thus, student group is the main target for public bus service market. Then data follow by Others by 24%. This group is mostly consists of housewives and pensioner.

Government group placed with lowest percentage with only 5%. These lowest percentages maybe less Government employees are situated inside survey area. Information of percentage of passenger by their job drawn into bar chart (Refer to Figure 4.2)

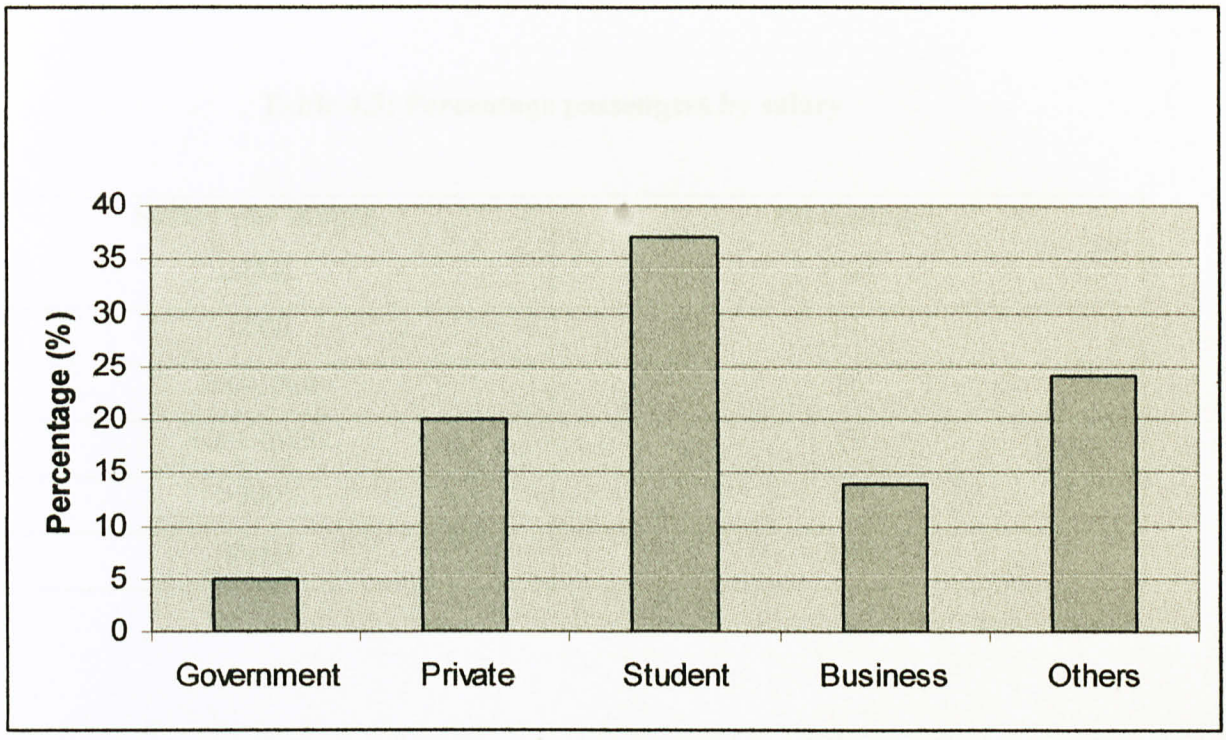

Figure 4.2: Percentage of passenger by job/profession

4.2.3 Salary Analysis

Passenger's characteristics categorize to amount of salary per month. Data collection arranged in the table (Table 4.3) below.

Table 4.3: Percentage passengers by salary

Salary per Month (RM)	Percentage (%)
<500	61
500-1000	16
1001-3000	17
>3001	5
Total	**100**

Data shown that group of salary less RM500 is the majority with 61%. The group is combination of students, housewives, pensioner and workers which most of them still rely on family members for personal financial. This data yield a conclusion of that low income group is contributed most to the usage of public bus.

More than RM3001 salary per month group as the lowest with 5%. This is because most of "more RM3001 salary" group own personal transportation like cars , motorcycle and etc. For them, taking bus is the last resort as taking bus is twice long the journey time and waiting time. This perception can be changed by improving the quality of service by bus operator.

Figure 4.3 show percentage of passengers by their salary presented in bar chart.

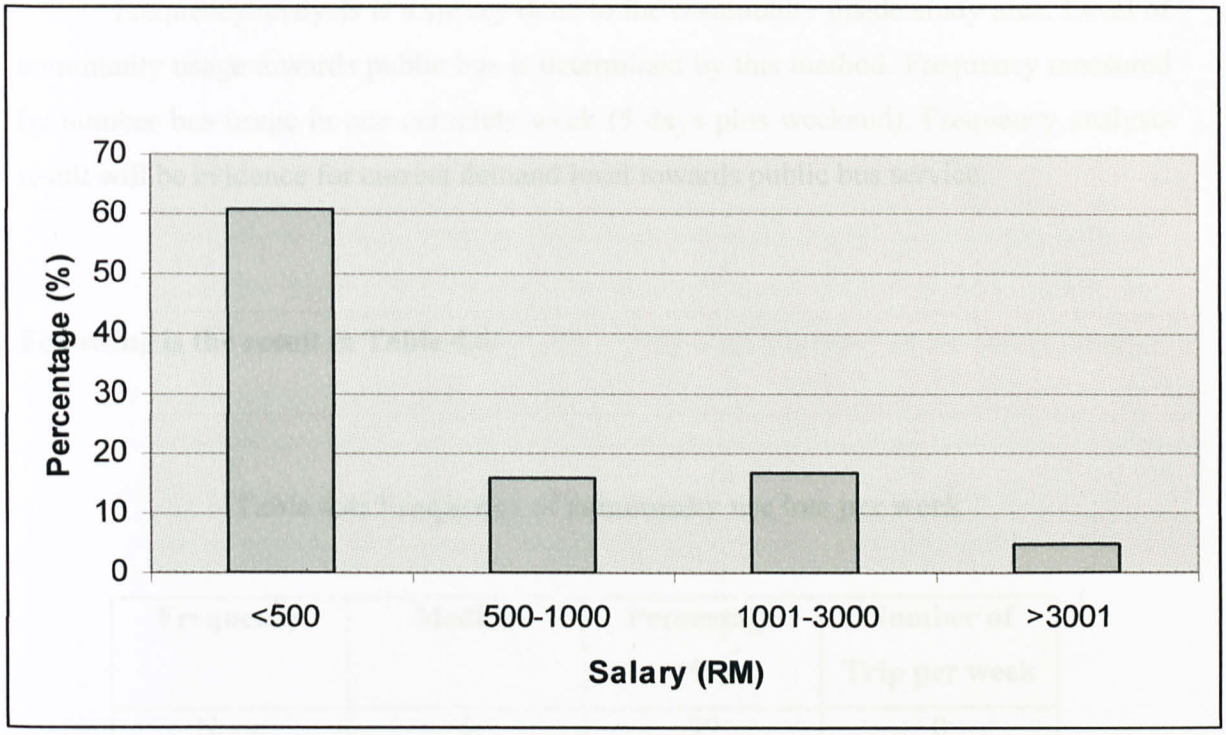

Figure 4.3: Percentage passengers by salary

4.2.4 Bus Usage Frequency Analysis

Frequency analysis is a survey done to the community inside study area. Level of community usage towards public bus is determined by this method. Frequency measured by number bus usage in one complete week (5 days plus weekend). Frequency analysis result will be evidence for current demand level towards public bus service.

Following is the result in Table 4.4.

Table 4.4: Frequency of community use bus per week

Frequency	Median	Percentage (%)	Number of Trip per week
None	0	39	0
<2	1.0	6	6
3 - 4	3.5	25	87.5
5 - 6	5.5	10	55
7 - 8	7.5	5	37.5
9 -10	9.5	7	66.5
11 - 12	11.5	7	80.5
13 - 14	13.5	1	13.5
Total		**100**	**346.5**

Average trip/week = 3.47

Average trip/day = 0.50

Refer to Table 4.4, residents of study area which use public bus mostly have 3 to 4 trip per week. Only 10% of the community uses the public bus 5 – 6 journey per week. 5 – 6 times per week are mostly employees who rely on bus to go to work.

In other hand, 39% of total population is not using bus at all. Owning personal transportation is the main factor for this reason. Moreover, current route of public bus not covering all residential area made the service unattractive to be used. Data of frequency usage drawn in bar chart (Figure 4.4)

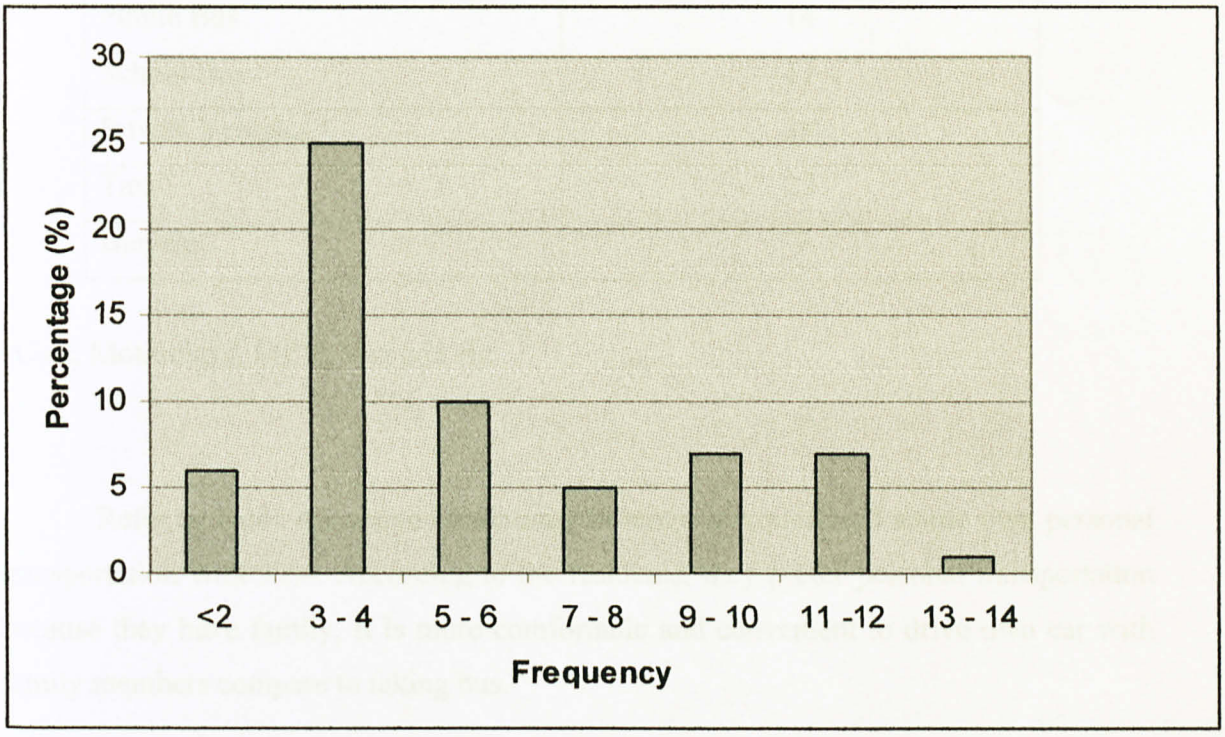

Figure 4.4: Frequency of community use bus per week

4.2.5 Mode of Transportation Analysis

Sample of random group has been selected with aid of survey form. The result obtained from the survey form as in Table 4.5 below.

Table 4.5: Percentage of community by mode of transportation.

Mode of Transportation	Percentage (%)
Public Bus	14
School Bus	17
Private Vehicles *	39
Taxi	23
Bicycle	7

*Cars, Motorcycle, MPV, Van and etc

Refer to Table 4.5 above community in study area preferred to use own personal transportation with 39%. According to the residents, they prefer personal transportation because they have family. It is more comfortable and convenient to drive own car with family members compare to taking bus.

Taxi is the second favorite with 23%. Taxi good frequency make it is more reliable. The quality of service, short travel time and comfortable ride with air-conditioning makes taxi got high demand from community even the price is slightly expensive.

Public bus only manages to acquire small percentage with 14%. Respond from the residents is public bus is not reliable with hours waiting time. Lack of bus stops is also another complaint received from the residents.

Data for the survey done presented in Figure 4.5 below.

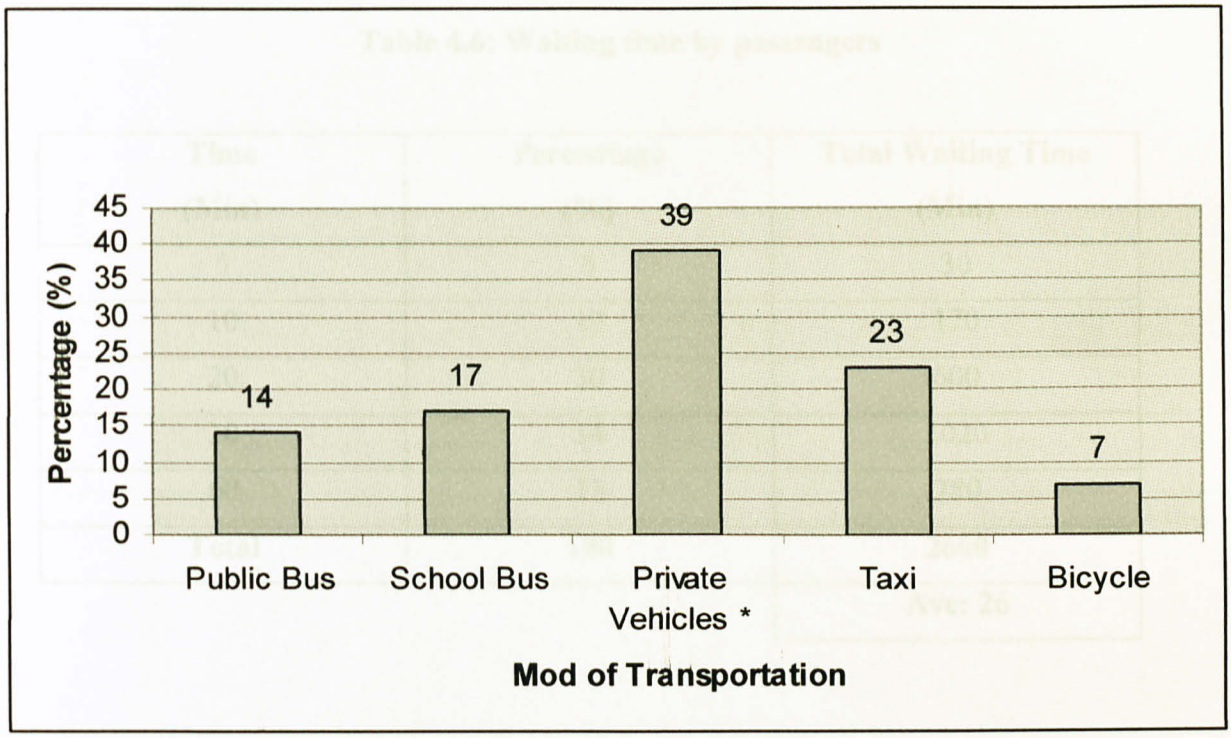

Figure 4.5: Percentage of community by mode of transportation.

4.2.6 Average Waiting Time

Waiting time from site must be known in order for comparison of actual value and theoretical value. Data extracted from survey form arranged in the Table 4.6 below

Table 4.6: Waiting time by passengers

Time (Min)	Percentage (%)	Total Waiting Time (Min)
5	6	30
10	17	170
20	30	600
30	34	1020
60	13	780
Total	**100**	**2600**
		Ave: 26

Majority experienced for 30 minutes of waiting time. 30 minutes is a very long waiting time. With 31% of passengers have to wait for 30 minutes, it is clearly show that consumer have to wait too long and at end will choose another mode of transportation.

Data presented in diagram for easy reference in Figure 4.6

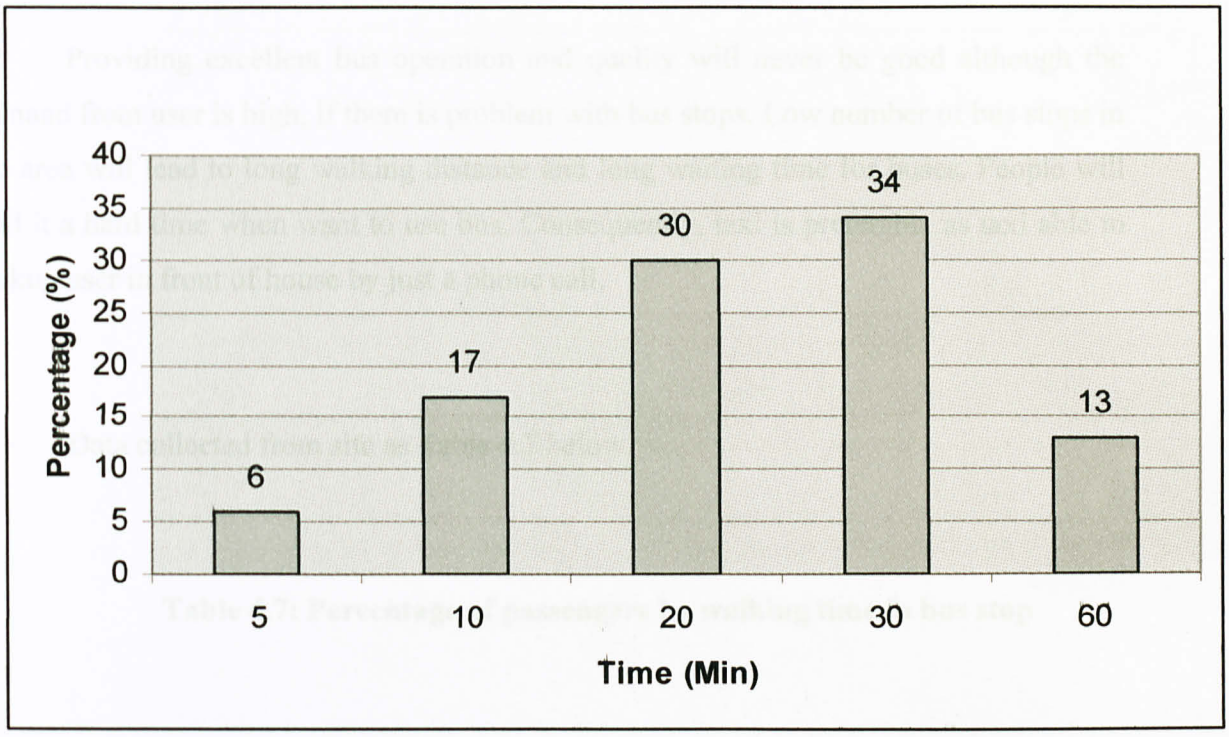

Figure 4.6: Waiting time by passengers

4.2.7 Walking Time to Bus Stop

Providing excellent bus operation and quality will never be good although the demand from user is high, if there is problem with bus stops. Low number of bus stops in the area will lead to long walking distance and long waiting time for buses. People will find it a hard time when want to use bus. Consequently, taxi is preferable as taxi able to pickup user in front of house by just a phone call.

Data collected from site as Table 4.7 below.

Table 4.7: Percentage of passengers by walking time to bus stop

Time (min)	Percentage (%)
< 3	5
3 – 5	28
> 5	67
Total	**100**

67% of passengers have to walk more than 5 minutes. From observation done, there are only two bus stops available in certain residential areas. Moreover, new residential area growing but no proper planning of bus route and bus stops to the new place makes the problems bigger.

Percentage of passengers by walking time to bus stops as shown in Figure 4.7 below.

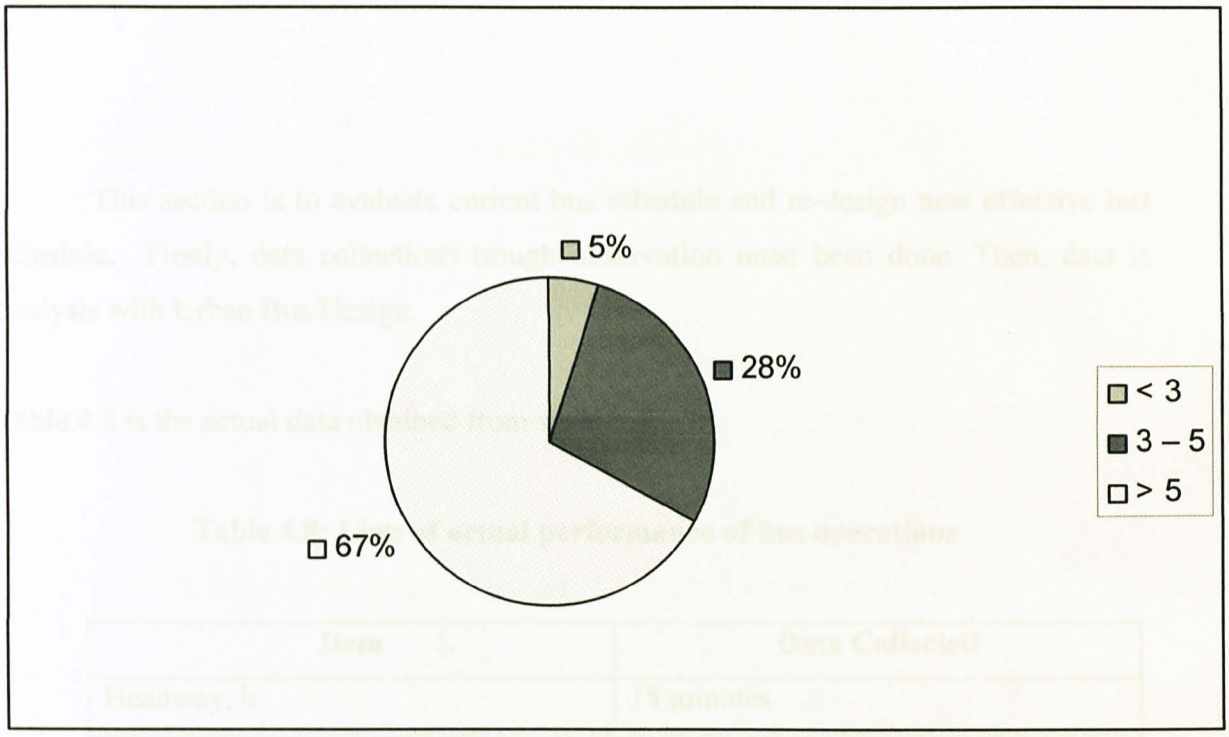

Figure 4.7: Percentage of passengers by walking time to bus stop

4.3 Bus Operation Evaluation

This section is to evaluate current bus schedule and re-design new effective bus schedule. Firstly, data collections trough observation must been done. Then, data is analysis with Urban Bus Design.

Table 4.8 is the actual data obtained from study area.

Table 4.8: Lists of actual performance of bus operations

Item	Data Collected
Headway, h	15 minutes
Time cycle, T	210 minutes
Waiting Time, T_t	26 minutes
Number of Bus, N_f	4 buses

Data collected for Urban Bus Design are as follow:

Travel Distance, L_c = 12.5 km

Travel time, t_0 = 45 minutes

Maximum capacity, P_{max} = 240 passengers per hour
Or C_b

Bus capacity, C_a = 54 passengers (including 10 standing)

For better comparison Table 4.10 showing actual data on site with desirable value by Urban Bus Design.

Table 4.10: Urban Bus Design value VS on site data

Item	Urban Bus Design	Actual On Site
Headway, h	13 minutes	15 minutes
Cycle Time, T	104 minutes	210 minutes
Waiting Time, T_t	7 minutes	26 minutes
Number of Bus, N_f	7 buses	4 buses

Refer to Table 4.11, it is clearly shown that current bus operation is not adequate for the current demand of 240 passengers per hour. With 4 buses provided, operation only can cater for 116 passengers per hour. Bus operator should providing 7 buses to supply present demand of passengers.

As the consequence, which lead to longer waiting time for bus rider. 26 minutes waiting time is intolerable which will create frustration and dissatisfaction among user. Passenger satisfaction towards service provided is important for bus operation future; passenger's decision on using the service again.

4.4 Recommendations to the Operation

4.4.1 Increase number of bus stops

Importance of bus stops is to ease user to have public bus service. Bus stops must be located strategically along the bus route. It must be well spread to ensure customers have nearest bus stops to their home. From the study done, 67% of passengers have to walk more than 5 minutes to the nearest bus stops.

From Ipoh to Tanjung Tambutan, only 12 bus stops provided for 17.5 km route. Only two bus stops available within residential area and the rest are near main road. From observation, only few numbers of bus stops inside residential area because the new residential area is does not have bus stops. In Kuala Lumpur, every new housing project should be equipped with bus stop area before approval of Developer Order (DO). Strictness of this matter can be refer to local newspaper The Star (Developer ignores DBKL order, Thursday April 24, 2008) where Kuala Lumpur City Hall (DBKL) issue stop work order for the construction and fine RM 100,000. The same regulation should be implemented by Ipoh City Council (MBI).

Cited from Duffy (2002), "People don't mind waiting for a bus if they know how long it's going to be. Even if they have to waste the time, at least they know it's going to be 15 minutes. Otherwise they're sitting there thinking the bus will be along in about two minutes, and when it doesn't show, and then they start getting frustrated." It is would be better if bus stop will be set with Real Time Display unit like available at train transit system. Mishalani et al. (2000) studied the value of information to passengers in terms of sing the waiting time more effectively. Passengers will wait for the bus with confident

that the bus will come. It doesn't matter how long its going to take but information sent to passenger is valuable to them.

4.4.2 Increase number of buses

From results of Urban Bus Design, bus provided currently is not sufficient. From this, it will lead to passengers have to wait long waiting time. 47% of total passengers have to wait more than 30 minutes for bus to arrive.

Increasing number of buses total of 7 based from Urban Bus Design is outrageous with cost of new bus and at the end maybe unprofitable to bus operator. Suggestion is to increase number of buses during peak hours which identified at 6.30 am to 8.00 am and 4.00 pm to 5.00 pm.Purchasing one new mini bus will help to reduce waiting time for passengers especially on peak hours.

4.4.3 User friendly bus operation

Only local people are familiar on how to use public bus service. No proper guidance on how the bus operated makes it difficult to attract new passengers and tourist. At Medan Kidd, schedule and bus numbering system provided is outdated and no information counter available. Bus operator should provide information of their service. Bus schedule and bus number should be posted on the bus, at the bus stops and anywhere relevant. As it carry name of public bus, it should well known by public.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Demand Level of Usage

Three main parties must be in good cooperation to achieve excellent public bus operations. There are user, operator and authorities. These three parties should have interaction with each other in solving problems occurs. At the end, everybody will get the benefits of it. Bus operator will have good profit, authority is thankful for doing their job and user will satisfied with the service provided.

Demand for public bus on certain area is related to the socioeconomic factors. Passenger's characteristics are the factors in determining the demand toward public bus usage. The characteristics divided into 3 main elements:

a. Passenger's background

b. Passenger's income

c. Passenger's satisfaction

5.1.1 Passenger's Background

Profession, purpose of journey and age are the example of what is passenger's background is. Youngsters are the most in community. From range of 15 to 25 years old, 26 to 35 years old, 36 to 45 years old and 46 to 55 years old, and 55 years old above, the numbers will reduce 15% for each age range. In this study, 15 to 25 years is the most using public bus and most of them are students. Public bus is the mod for them from home to school and school to home.

5.1.2 Passenger's Standard of Living

Having own personal transportation like cars and motorcycle is difficult for low income passengers. With monthly salary below RM1000 per month is definitely unaffordable to have vehicle. Therefore, these groups of passengers are really relying on bus. There are mostly students and factory employees. From this two main group only can generate great demand on public bus usage. School wills never end and salary of factory workers will never going to be increased rapidly.

5.1.3 Passenger's Satisfaction

Quality of service set big impact on usage of public bus. Passengers will evaluate service provided and this will lead to satisfaction or not. From the survey done, service provided is not satisfied by majority of the passengers. Reliability issue the problem, bus is always late and frequency is unpredictable. Passengers tend to us taxi which is more reliable and have comfortable ride.

5.2 Quality of Bus Operation

Service evaluation done shown data bus operation of Ipoh – Tanjung Rambutan Route is under performance. Availability of only 4 buses for operation is start of other problem. It creates the reduction of bus frequency which leads to poor bus reliability. Passengers have to wait more than average 26 minutes to receive the service. Bus comfortability is also the issue. Survey conducted receive majority of passengers unsatisfied with ride. The setbacks are dirty bus, no air conditioning, bumpy chair and trouble noise of bus engine. Moreover, passengers also receive bas service from bus driver and bus attendee.

5.2 Recommendations

Research should cover bigger sample in order to receive precise data presenting total population on the study area. Area of residential around Tanjung Rambutan is not covered all by this research. Limited resources of man power and time are the biggest challenge. For future improvement, similar research should be done by team of people. At least consist of 3 members, where man powers need most during survey and observation process.

Another big problem in Ipoh – Tanjung Tambutan route is the planning of the route itself. From the survey done, residents would like to have more coverage of buses inside their resident area. Better route will create accessibility of people to use the service. Bus route especially trough residential areas should be re-design and re-planning with proper method to satisfied user demand.

Cooperation from Omnibus Sdn Bhd in giving in formations such as Cost of operation per day will expand the research to cost effective of the operation analysis. Confidentiality and lack of cooperation from the company itself hold to research to be more comprehensive.

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APPENDICES

APPENDIX A: Survey Form (In Malay Languange)

BORANG SOAL SELIDIK

1) Bangsa

Melayu	☐	India	☐
Cina	☐	Lain-lain	☐

2) Umur

Kurang 15 Tahun	☐	36-45 Tahun	☐
15-25 Tahun	☐	46-55 Tahun	☐
26-35 Tahun	☐	> 55 Tahun	☐

3) Pekerjaan

Kerajaan	☐	Pelajar	☐	Jika lain-lain sila nyatakan
Swasta	☐	Sendiri	☐	_____

4) Pendapatan

< RM 500	☐	RM 1001-RM 3000	☐
RM 501-RM1000	☐	> RM 3001	☐

5) Bilangan ahli keluarga

1	☐	3	☐	Jika lebih sila nyatakan:
2	☐	4	☐	_____

6) Bilangan ahli keluarga anda yang bekerja

1	☐	3	☐	Jika lebih sila nyatakan: _____
2	☐	4	☐	Tiada ☐

7) Kekerapan menggunakan bas awam dalam seminggu

_____ (bilangan perjalanan/minggu)

8) Pengangkutan yang biasa di naiki semasa pergi/balik bekerja/sekolah/lain-lain pada hari biasa. Sila nyatakan.

_____

9) Di manakah tempat bekerja/sekolah.Sila nyatakan.

Tempat _____

10) Masa keluar bekerja/sekolah/lain-lain pada hari biasa.Sila nyatakan pukul berapa.

Pukul _____

11) Masa balik bekerja/sekolah/lain-lain pada hari biasa.Sila nyatakan pukul berapa.

Pukul _____

12) Masa keluar pada hari hujung minggu.Sila nyatakan pukul berapa.

Pukul _____

13) Purata masa menunggu bas.

< 5 minit	☐	10-20 minit	☐	Jika lebih sila nyatakan:
5-10 minit	☐	20-30 minit	☐	_____

14) Jarak masa dari rumah ke tempat menunggu bas.Sila nyatakan.

_____

CADANGAN

15) Perlukah bilangan bas ditambah?	Ya	☐	Tidak	☐
16) Adakah harga tambang berpatutan?	Ya	☐	Tidak	☐
17) Laluan bas lebih meluas lagi?	Ya	☐	Tidak	☐
18) Bas masuk lebih kerap lagi?	Ya	☐	Tidak	☐
19) Keselesaan ?	Ya	☐	Tidak	☐

APPENDIX B: Data from Survey Form

	Question 2	Question 3	Question 4	Question 7	Question 8	Question 9	Question 13	Question 14	Question 17	Question 18
1	<15years	Student	<RM500	10	Bus	Ipoh	10-20min	>5min	Yes	Yes
2	15-25years	Student	<RM500	10	Bus	Tambun	10-20min	>5min	Yes	Yes
3	<15years	Student	<RM500	12	School Bus	Ipoh	10-20min	>5min	Yes	Yes
4	<15years	Student	<RM500	4	Bycycle	Ipoh	20-30min	>5min	Yes	Yes
5	<15years	Student	<RM500	4	Bycycle	Ipoh	20-30min	5min	No	Yes
6	46-55years	Housewife	<RM500	4	Taxi	None	20-30min	5min	No	Yes
7	15-25years	Student	<RM500	12	Bus	Tambun	20-30min	5min	Yes	Yes
8	15-25years	Private	RM1000-RM3000	None	Private	Tambun	20-30min	>5min	Yes	Yes
9	15-25years	Student	<RM500	6	School Bus	Tambun	20-30min	5min	Yes	Yes
10	>55years	Housewife	<RM500	None	Private	None	20-30min	5min	Yes	Yes
11	15-25years	Goverment	RM1000-RM3000	None	Private	Tambun	20-30min	5min	Yes	Yes
12	46-55years	Goverment	RM1000-RM3000	None	Private	Tambun	20-30min	<5min	No	Yes
13	<15years	Student	<RM500	2	School Bus	Ipoh	20-30min	<5min	No	Yes
14	<15years	Student	<RM500	4	School Bus	Ipoh	20-30min	<5min	No	Yes
15	46-55years	Business	RM501-RM1000	None	Private	Ipoh	20-30min	<5min	Yes	Yes
16	<15years	Student	<RM500	4	School Bus	Ipoh	10-20min	5min	Yes	Yes
17	>55years	Pensioner	<RM500	8	Taxi	None	10-20min	<5min	No	Yes
18	36-45years	Business	RM1000-RM3000	None	Private	Tambun	20-30min	<5min	No	Yes
19	>55years	Housewife	<RM500	4	Taxi	None	5-10min	<5min	Yes	Yes
20	26-35years	Goverment	RM501-RM1000	None	Private	Ipoh	10-20min	2min	Yes	Yes
21	46-55years	Housewife	<RM500	None	Private	None	20-30min	<5min	Yes	Yes
22	46-55years	Pensioner	<RM500	None	Private	None	5-10min	2min	No	Yes
23	46-55years	Housewife	<RM500	4	Taxi	None	10-20min	2min	Yes	Yes
24	<15years	Student	<RM500	10	School Bus	Ipoh	10-20min	2min	No	Yes
25	46-55years	Housewife	<RM500	4	Taxi	None	10-20min	2min	No	Yes
26	<15years	Student	<RM500	4	School Bus	Ipoh	<5min	5min	Yes	Yes

	Question 2	Question 3	Question 4	Question 7	Question 8	Question 9	Question 13	Question 14	Question 17	Question 18
27	36-45years	Business	RM1000-RM3000	None	Private	Ipoh	5-10min	5min	Yes	Yes
28	15-25years	Student	<RM500	8	School Bus	Ipoh	20-30min	5min	Yes	Yes
29	<15years	Student	<RM500	4	School Bus	Ipoh	5-10min	10min	Yes	Yes
30	36-45years	Housewife	<RM500	4	Taxi	None	5-10min	5min	Yes	Yes
31	36-45years	Private	RM501-RM1000	None	Private	Ipoh	10-20min	10min	Yes	Yes
32	<15years	Student	<RM500	6	Bycycle	Ipoh	10-20min	5min	Yes	Yes
33	15-25years	Student	<RM500	8	School Bus	Ipoh	5-10min	5min	Yes	Yes
34	36-45years	Goverment	RM501-RM1000	None	Private	Tambun	<5min	5min	No	Yes
35	26-35years	Goverment	RM1000-RM3000	None	Private	Tambun	>1jam	5min	Yes	Yes
36	<15years	Student	<RM500	12	Bus	Ipoh	<5min	<5min	Yes	Yes
37	36-45years	Private	RM501-RM1000	None	Taxi	Ipoh	>1jam	5min	Yes	Yes
38	36-45years	Housewife	<RM500	6	Taxi	None	10-20min	5min	Yes	Yes
39	15-25years	Private	RM501-RM1000	None	Private	Ipoh	1jam	>5min	Yes	Yes
40	26-35years	Private	RM501-RM1000	10	Bus	Tambun	10-20min	<5min	Yes	Yes
41	<15years	Student	<RM500	4	School Bus	Ipoh	20-30min	<5min	Yes	Yes
42	<15years	Student	<RM500	4	School Bus	Ipoh	10-20min	<5min	No	Yes
43	26-35years	Private	RM501-RM1000	None	Private	luar daerah	20-30min	<5min	No	Yes
44	36-45years	Business	RM1000-RM3000	None	Private	luar daerah	20-30min	<5min	Yes	Yes
45	>55years	Pensioner	<RM500	None	Private	None	20-30min	5min	Yes	Yes
46	15-25years	Student	<RM500	None	Private	Ipoh	10-20min	<5min	Yes	Yes
47	46-55years	Housewife	<RM500	4	Bus	None	5-10min	5min	Yes	Yes
48	<15years	Student	<RM500	2	School Bus	Ipoh	>1jam	5min	Yes	Yes
49	15-25years	Private	RM501-RM1000	4	Taxi	Ipoh	>1jam	<5min	Yes	Yes
50	15-25years	Private	RM501-RM1000	10	Bus	Ipoh	10-20min	5min	No	Yes
51	26-35years	Private	RM1000-RM3000	None	Private	Tambun	20-30min	<5min	No	Yes
52	36-45years	Private	RM501-RM1000	None	Private	Ipoh	10-20min	<5min	No	Yes

	Question 2	Question 3	Question 4	Question 7	Question 8	Question 9	Question 13	Question 14	Question 17	Question 18
53	26-35years	Private	RM1000-RM3000	None	Private	Ipoh	10-20min	<5min	No	Yes
54	46-55years	Business	RM1000-RM3000	None	Private	Tambun	20-30min	<5min	Yes	Yes
55	15-25years	Private	RM501-RM1000	6	Taxi	Ipoh	>1jam	5min	Yes	Yes
56	15-25years	Private	<RM500	12	Bus	Ipoh	>1jam	5min	Yes	Yes
57	15-25years	Private	RM501-RM1000	None	Private	Tambun	20-30min	<5min	Yes	Yes
58	<15years	Student	<RM500	6	Private	Ipoh	20-30min	5min	Yes	Yes
59	36-45years	Business	RM501-RM1000	None	Private	Ipoh	20-30min	5min	Yes	Yes
60	46-55years	Housewife	<RM500	6	Taxi	None	20-30min	5min	Yes	Yes
61	>55years	Housewife	<RM500	4	Taxi	None	5-10min	5min	Yes	Yes
62	<15years	Student	<RM500	2	School Bus	Ipoh	10-20min	<5min	No	Yes
63	<15years	Student	<RM500	4	Bycycle	Ipoh	<5min	<5min	No	Yes
64	<15years	Student	<RM500	10	Bus	Ipoh	>1jam	5min	Yes	Yes
65	<15years	Student	<RM500	4	Private	Ipoh	5-10min	5min	Yes	Yes
66	26-35years	Housewife	<RM500	4	Taxi	None	<5min	5min	No	Yes
67	15-25years	Private	RM501-RM1000	12	Bus	Tambun	5-10min	5min	No	Yes
68	15-25years	Private	RM501-RM1000	6	Taxi	Tambun	<5min	5min	Yes	Yes
69	36-45years	Business	RM501-RM1000	None	Private	Ipoh	20-30min	5min	Yes	Yes
70	46-55years	Private	RM1000-RM3000	None	Private	Tambun	20-30min	<5min	Yes	Yes
71	46-55years	Housewife	<RM500	6	Taxi	None	10-20min	5min	Yes	Yes
72	<15years	Student	<RM500	2	Private	Ipoh	10-20min	5min	Yes	Yes
73	26-35years	Business	RM1000-RM3000	None	Private	Ipoh	10-20min	5min	Yes	Yes
74	>55years	Pensioner	<RM500	None	Taxi	None	10-20min	10min	Yes	Yes
75	<15years	Student	<RM500	4	Taxi	Ipoh	10-20min	10min	Yes	Yes
76	46-55years	Business	RM1000-RM3000	None	Private	Ipoh	20-30min	10min	Yes	Yes
77	26-35years	Private	RM1000-RM3000	None	Private	Ipoh	10-20min	5min	Yes	Yes
78	>55years	Housewife	<RM500	6	Bus	None	10-20min	10min	Yes	Yes

	Question 2	Question 3	Question 4	Question 7	Question 8	Question 9	Question 13	Question 14	Question 17	Question 18
79	46-55years	Business	RM501-RM1000	None	Private	Ipoh	5-10min	12min	Yes	Yes
80	15-25years	Private	RM501-RM1000	12	Bus	Tambun	5-10min	5min	Yes	Yes
81	15-25years	Business	RM501-RM1000	14	Taxi	Tambun	5-10min	<5min	Yes	Yes
82	36-45years	Business	RM501-RM1000	None	Private	Ipoh	10-20min	<5min	No	Yes
83	15-25years	Student	<RM500	8	School Bus	Ipoh	10-20min	5min	Yes	Yes
84	15-25years	Student	<RM500	4	School Bus	Ipoh	5-10min	>5min	Yes	Yes
85	>55years	Housewife	<RM500	6	Bus	None	10-20min	>5min	No	Yes
86	<15years	Student	<RM500	10	Bus	Ipoh	5-10min	5min	Yes	Yes
87	<15years	Student	<RM500	8	School Bus	Ipoh	5-10min	5min	Yes	Yes
88	36-45years	Housewife	<RM500	4	Taxi	None	>1jam	>5min	Yes	Yes
89	36-45years	Housewife	<RM500	2	Taxi	None	5-10min	>5min	No	Yes
90	15-25years	Private	RM501-RM1000	None	Private	Ipoh	<5min	<5min	No	Yes
91	15-25years	Student	<RM500	4	School Bus	Ipoh	>1jam	5min	Yes	Yes
92	26-35years	Private	RM1000-RM3000	None	Private	Tambun	5-10min	5min	Yes	Yes
93	36-45years	Business	RM1000-RM3000	None	Private	Tambun	<5min	5min	No	Yes
94	<15years	Student	<RM500	4	Private	Ipoh	20-30min	>5min	Yes	Yes
95	15-25years	Private	<RM500	12	Bus	Ipoh	>1jam	>5min	Yes	Yes
96	46-55years	Business	RM1000-RM3000	None	Private	Tambun	>1jam	>5min	Yes	Yes
97	<15years	Student	<RM500	4	Bycycle	Ipoh	20-30min	>5min	Yes	Yes
98	26-35years	Business	<RM500	None	Private	Tambun	20-30min	>5min	Yes	Yes
99	<15years	Student	<RM500	2	Bycycle	Ipoh	1jam	>5min	Yes	Yes
100	<15years	Student	<RM500	4	Bycycle	Ipoh	20-30min	>5min	Yes	Yes

$$C_b = \frac{60C_t}{h_m} \quad \textbf{(1)}$$

C_b = Maximum capacity

C_t = Carry capacity

h_m = Minimum headway

$$C_t = C_a + \alpha C_s \quad \textbf{(2)}$$

C_a = Seated bus capacity

C_s = Maximum allowed standing in bus

$$C_t = C_a + \alpha C_s$$
$$= 44 + (0.54)(10)$$
$$= 49.4 \text{ passengers per hour}$$

$$h_m = \frac{60C_t}{C_b}$$
$$= \frac{60(49.4)}{240}$$
$$= 12.35 \text{ minutes}$$
$$\approx 13 \text{ minutes}$$

T = $2(t_0 + t_t)$ **(3)**

= 2 (45 + 6)

= 102 minutes

Or 1 hour 42 minutes

N_f = Number of buses

N_f = $\frac{T}{h_m}$ **(4)**

= $\frac{102}{13}$

= 8 buses

T' = New cycle time with number bus calculated

T' = $N_f \times h_m$ **(5)**

= 8×13

= 104 minutes

T_t = New time at terminal with T' calculated (waiting time)

T_t = $\frac{[T' - 2(t_0)]}{2}$ **(6)**

= $\frac{[104 - 2(45)]}{2}$

= 7 minutes