

Factors Affecting Bus Ridership With Respect to Passenger Demography: A Case Study of Seberang Perai, Pulau Pinang, Malaysia

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Abstract: Efforts to induce greater use of public transport are plenty. However, understanding passenger preferable attributes selection can help focus on the viable approaches that can support the efforts. This study identified and evaluated various bus ridership variables that are important to bus passengers. A case study of 4 bus routes in Seberang Perai, Penang was made using 424 correspondents. It was found that the demography of passenger has a significant influence on the types of variables considered important for a good bus service. These variables include comfort, accessibility, bus fare reliability, suitable route network, etc. Local culture and captured passengers will have different impact on bus service requirements such that commonly known bus passenger behavior may not necessarily be true for such areas. This situation calls for service providers to consider issues such as road conditions, traffic congestion, pollution, etc. when deciding on service planning and implementation at selected localities.

Keywords: Bus ridership, Public transport, Passenger preference, Travel demand

1. INTRODUCTION

The Malaysian government is very keen to promote public transport, in particular the bus system as a travel mode throughout the country. The Land Public Transport Commission (SPAD), a specially created agency to manage and supervise all public transport modes in Malaysia, has various initiatives introduced to regulate bus services in major towns in the country. These include providing buses and monetary subsidies to ensure the provision of bus services are frequent and popular. At present, at least five major state capitals have been earmarked for their town bus system under the general name of “Rapid” bus service. The first two Rapid bus services are the Kuala Lumpur and Penang Rapid buses. Those state capitals are Ipoh, Melaka, Kuantan, Kucing and Johor Bahru.

The term services used in this study refer to “the set of bus vehicles which run along the fixed bus route” (Liu & Sinha, 2007) in which the services of the bus operating system is measured based on several indicators mentioned by few scholars. The efficiency of the bus services depend on the rules and regulation, route network design, fares and ticketing system, fleet size, scheduling, etc. Based on literature review, the criteria of an efficient bus service can be derived from the passenger or the operator perspective. From the point of view of the passenger, three elements considered to measure the efficiency of a service are ridership, reliability and satisfaction. Whilst from the operator’s point of view, quality, performances and efficacy are the important key determinants of the service efficiency.

Ridership which is influenced by internal and external factors determine the quality of the services (Rohani, Wijeyesekera, & Karim, 2013). The authors listed internal factors as the comfort level, travel time, distance, user-friendliness while the external factors refer to the operators' control over variables such as demand, supply, fuel price, congestion and policy. This paper brings forth the importance of understanding the perception of users, operators and authority on what is important to them in terms of bus service quality. This study examined the similarities and differences of the three parties' perspective on bus service quality, identify the criteria that define an efficient bus service and proposes a working guide to bus route design. Section 2 of the paper gives a description of the study location, section 3 discussed on data collection and analysis and section 4 listed the findings of the study. Section 5 ends the paper with the conclusions of the study.

2. STUDY LOCATION

In recent news updated by The Star Online, entitled Penang's future transport system published on 23rd September 2014, there is a planned to decrease the hectic caused by the road congestion by improvising the light rail transit (LRT) in parallel with the Penang Transport Master Plan Strategy. A review made by Almselati, Rahmat, and Jaafar (2011) had shown that public transportation in Malaysia is woeful in which required a few strategies and solutions to puzzle out the situation; 1) poor public transport system, and 2) increment of private transport ownership in which this situation also happening in Penang State. However, in solving the public transport problem, it is not required to remove the cars and motorcycle from the roads and substituting them with new mode of transport but it is about offering an affordable and convenient public transport such as buses. According to the statistics by the Road Transport Department, the number buses operating in Pulau Pinang, some 6000 plus, is ranked fifth in Malaysia which is considered low when compared to Kuala Lumpur and Johor Baru which has 20000 and 10000 buses each.

Pulau Pinang consists of two parts which are Seberang Perai and Main Island. The Seberang Perai area has a total population of 820,000 people. Seberang Perai is divided into three main districts which are Seberang Perai Utara (SPU), Seberang Perai Tengah (SPT) and Seberang Perai Selatan (SPS) which in turn has 288692, 362820 and 166685 total population respectively. Figure 1 shows the location of the three districts with respect to the state of Pulau Pinang. The general mode of travel is by cars and motorcycles with only about 15% bus users. SPT and SPU districts have several major population centers such Butterworth, Bukit Mertajam, and Kepala Batas. It is fair to note that Butterworth was formerly the transport hub for mainland Pulau Pinang as it has a ferry service to Penang Island and is it also the terminus for rail service for Pulau Pinang state. Since the construction of the Penang Bridge, Butterworth standing as a transport hub has somewhat reduced. This however is expected to change with a new proposal to redevelop the Butterworth transport terminal into an integrated transport facility for the Northern region of Malaysia. The bus routes studied all terminates at Butterworth and hence are the main public transport link for the SPT/SPU area.

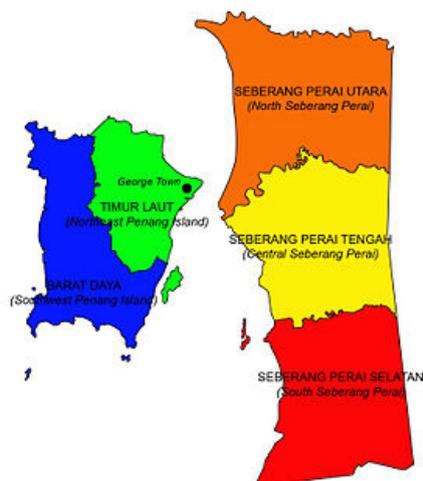


Figure 1. Districts in State of Pulau Pinang

3. DATA COLLECTION AND ANALYSIS

3.1 Data Collection

The population for this study is narrowed down to the Seberang Perai Tengah (SPT) district as SPT has the highest population and SPT consist of balanced range of age compared to other districts. Based on the table provided by Krejcie and Morgan (1970), for $N= 100\ 000$ and more, the sample, S is equal to ± 384 . For the purpose of this study, 450 respondents were selected for a questionnaire survey and direct observations were made on buses of the selected study routes. Moreover, the authority were also been surveyed in order to see the distinction between the user perception and the authority perception.

The available bus routes operating in the SPT area are numbered as 701, 702, 703 and 709. Figure 2 shows a typical route in the study. But, based on the map and land use data, there are many routes that could possibly be used as the target route. For the questionnaire study, the respondents were selected randomly from the passengers that ride on the buses on the study routes. In addition, the selected respondents should also be:

- Willing to take part in the survey
- Able to read
- Not openly biased to any influencing factors such as weather, emotions, etc.

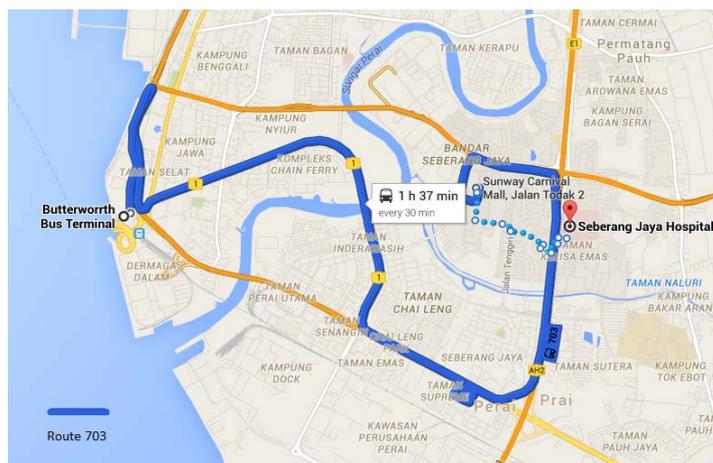


Figure 2. Typical bus route (703) in study area

For the data involving the respondents, the questionnaires were distributed at the main bus terminals i.e. the Butterworth Terminal and also the Bukit Mertajam (Summit) Terminal. A total of 100 respondents were selected from each study route (routes 701, 702, 703 and 709) and this required a month of data collection process. The questions posed were grouped into six main categories of reliability, accessibility, comfort, safety and security, information and route network. For the observation study, two sessions (morning; 0900- 1200, and afternoon 1500-1800) were conducted daily for a period of one week on all the study routes. Data that was in the observation study included the following:

- Travel time
- Travel distance
- Punctuality
- Scheduling & frequency
- Number of bus stops
- Delay
- Bus and driver condition
- Route criteria (distance, bus stop, walking distance, etc.)

The data were then tabulated and processed using the SPSS statistical package.

3.2 Data Analysis

In order to measure the consistency of the data, the reliability test is needed which refers to Cronbach's Alpha coefficient. According to Pallant (2007), the acceptable value for Cronbach's Alpha is 0.7 while the preferable value is 0.8. The number of respondents is one of the factors of the increment of the Cronbach's Alpha coefficient. Based on the construct shown in Table 1.0, all the coefficient of Cronbach's Alpha is significant. The value achieving 0.9 is probably considered as too good to be true as this value is achieving 1.0. However, some scholars argue that the Cronbach's Alpha value above 0.9 is excellent (Gandhi, 2012; Numally, 1978) .

Table 1 Reliability measures

	No of Items	Cronbach's Alpha coefficient
Cronbach's Alpha by construct		
1. Reliability	6	0.832
2. Accessibility	5	0.841
3. Comfort	4	0.807
4. Safety and security	4	0.832
5. Information	3	0.928
6. Route network	7	0.894

Most of the respondents were female with total of 70% out of the total respondents. Based on the demographic data from Seberang Perai Municipal Council (MPSP), the number of female citizens is only slightly lesser than male with value of 176,320 compared to 186,500. This bias percentage of female bus users is understandable as it was observed that most males would be using motorcycles rather than take the bus. A majority of the respondents, for both male and female, within the age of 41 to 50 years used the bus to go to work. The age group of 10 to 20 years old using the bus to go either to school, college or university is 18.3% and 39% for male and female respectively. For the purpose of leisure and shopping, the highest response came from female of 41 years old and above in which they were using buses for trips to supermarket, agro bazaar, etc. Clearly, most of the bus users in this study were females.

Unfortunately, bus users faced a few difficulties and problems when travelling using bus. One of the major problems is an unsuitable bus route. Some 13% of the respondents agreed that the existing bus route network had given a problem for them while travelling by bus because the routes were not suitable or too far from their destination. As shown in the pie chart in Figure 3, irrelevant bus stop location and bus fares are among the problems quoted by bus users. From the 424 respondents, some 12% are concerned about their personal security, 12% were facing problems with comfort and another 12% were dissatisfied with bus information. Less 1% claimed that they were struggling with a longer travel time and only 3% of the respondents confronted with longer waiting time for the buses.

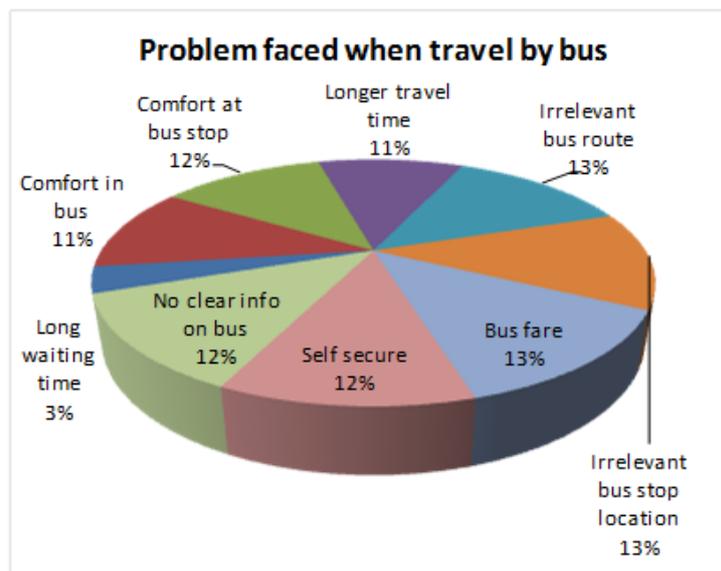


Figure 3. Problems in bus travel for passengers

The relationship between variables can also be determined through correlation analysis. It was found that reliability in scheduling is strongly correlated with punctuality and frequency with values of 0.653 and 0.638 respectively. There were other variables that showed a strong correlation such as reliable route with the travel distance. The respondents were given a Likert scale of 1 to 5 to evaluate each service criteria been studied. The mean of the values were then calculated and plotted into a graph. Sezhian et al (2011) used mean values to analyse the major selected criteria by managers and passengers. Figure 4 shows the mean values of the criteria for an efficient bus service as listed by the respondents. Out of the 23 items shown in Figure 4, a shortlist of 6 items with mean values 3.5 and above is given below:

- Comfort level of air conditioner and seat
- Disabled accessibility
- Reliable bus fare
- Easy to get bus ticket
- Easy to get on and get off the bus
- Bus driver is following the traffic rule and have good attitude

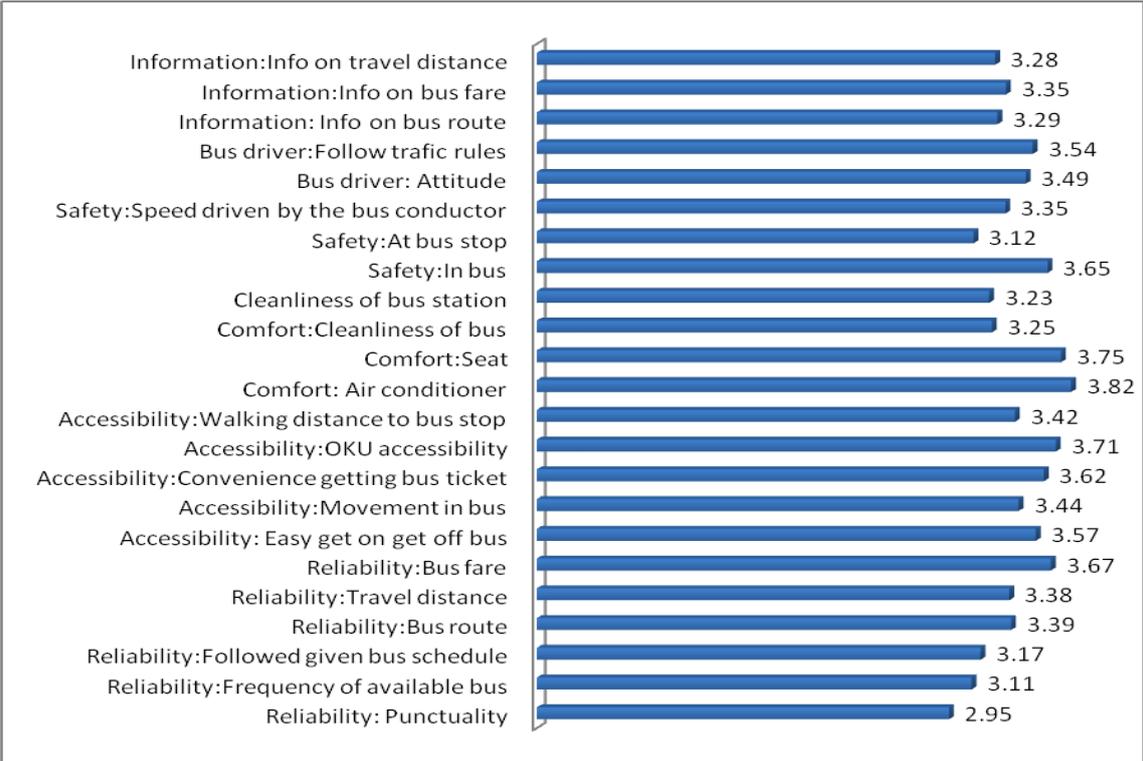


Figure 4. Criteria of an efficient bus service based on the mean value

The respondents also suggested that an efficient bus service should consist of a suitable bus route network which consists of a shorter travel distance, bus stop location not far from housing area and a service that fulfills the demand of users.

The observation survey data was analyzed to identify the demand and supply from the bus service operator’s perspective. The survey recorded data on waiting time, travel time, number of passengers boarding and alighting at bus stops and also hotspots location. From the data it was found that the bus arrival is not dependent only on the frequency of the bus but was also influenced by the speed the bus was driven by the driver, traffic conditions on the road, weather, number of stop locations and capacity of passenger per returned trip. The weather condition did not affect bus usage as their mode of transport. In one case, even during a rain shower, the number of passengers on route 703 was 88. The most visited locations for this route were Megamall, Perai, Sunway Carnival, Hospital Seberang Jaya, Carefour and Tesco Extra Seberang Jaya – all major trip attractors. Table 2 gives a sample summary of the surveyed data for routes 701 and 703 in the study area.

Table 2. Surveyed data for route 701 and 703

Travel distance		Route 701	Route 703
		14 km	14 km
Survey Data			
1.	Travel Time – High Low	46 min 34 min	50 min 30 min
2.	No of stops - High Low	26 9	27 17
3.	No of Passenger - High Low	98 33	105 24
4.	Avg.Travel Speed -High Low	24.7 km/h 18.2 km/h	28 km/h 16.8 km/h
5.	Avg.Waiting- High Time Low	15 min 10 min	10 min 10 min

4. STUDY FINDINGS

Based on the data collected on the mentioned bus routes, a few relationships were identified. Figure 5 shows the relationship between total passenger and number of stops. Obviously, the more stops that can be made the number of passengers will increase. However, this generally resulted in a longer travel time for all the routes studied. Figure 6 shows a typical relationship between travel time and number of stops. Both these figures used data obtained from route 701.

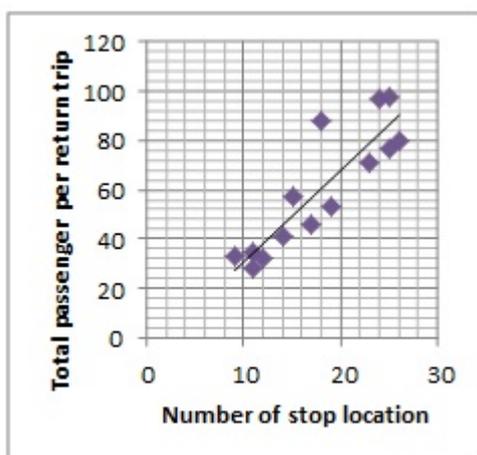


Figure 5. Total passenger VS No.of stops

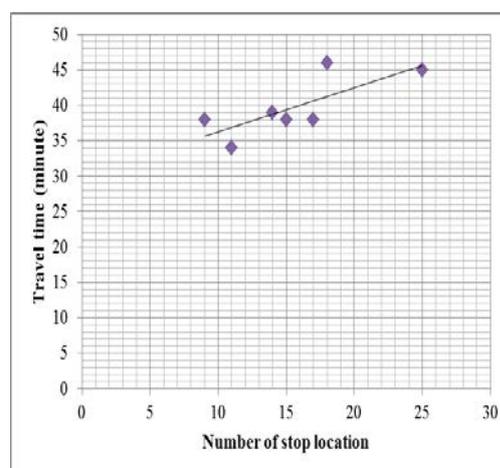


Figure 6. Travel Time VS No.of stops

Based on the survey done for the passenger and authority, different perception between these two perspectives is derived. Figure 7 below shows the relationship between passengers' perception and authorities' perception on various attributes of bus service operation and performance. Each attributes were analyzed using the mean value and presented in the graph as the X-Y coordinate. The higher mean values observed were related to air-conditioning (comfort) and reliable routing. Surprisingly, punctuality, frequency and easy access were the least in significance compared to other attributes. An explanation for this is that the users are captured patrons who have are 'forced' (due to their individual circumstances) to use buses and therefore would like to have comfort as a primary element of their travel. Since they are regular users, they have good understanding of the operational characteristics of the bus system such as punctuality and frequency and therefore were not of particular concern to them.

The authorities in Malaysia have the final say on the provision of bus services such as routes and schedules. Unfortunately, there has not been enough data collected to gauge bus user's preferences and hence a gap exists between what the users need and what is supplied and demand of bus services. The authorities need to better understand bus user's needs before imposing their planned routes and bus operations characteristics'.

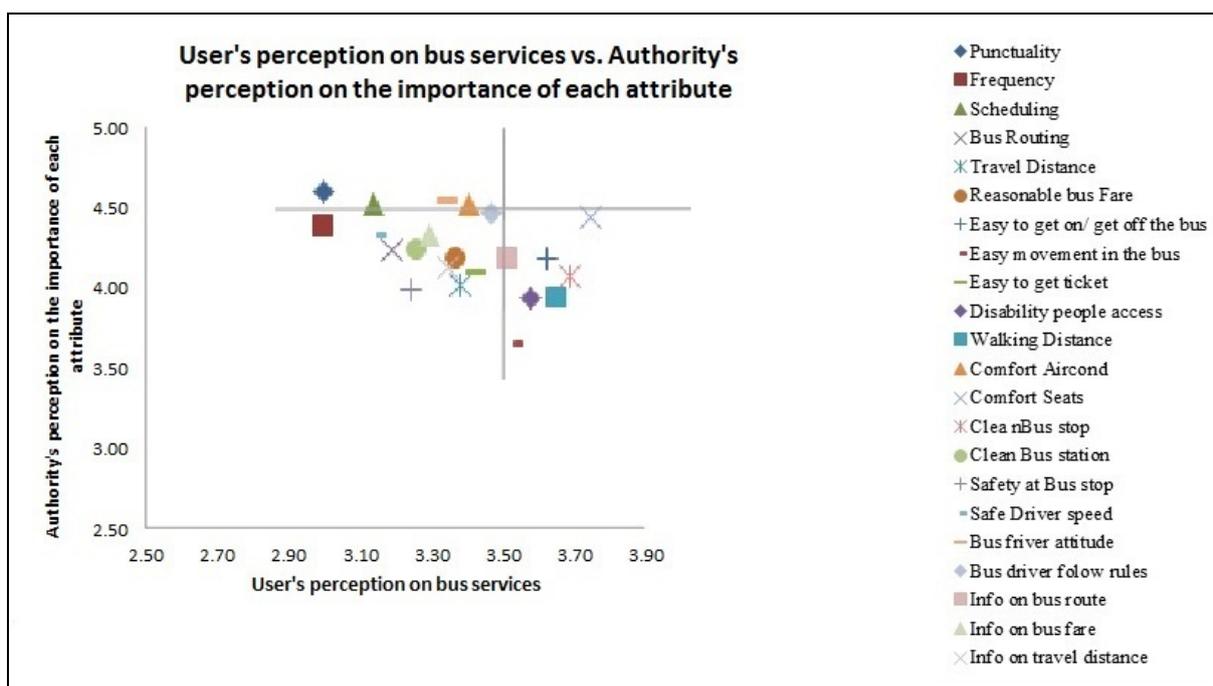


Figure 7. User's perception VS Authority's perception

5. CONCLUSION

Each bus route surveyed featured a few criteria that distinguished itself as an efficient or inefficient in terms of the service provided. Along with the data from questionnaire, the study included data from the field observations to find a connection between the criteria listed by the respondents and those found from fieldwork. From the users point of view the main criteria that describe a good bus service that should be focused on by service providers are comfort, routing, accessibility and fair bus fare structure. Considering the suggestions made by the respondents, an efficient bus service should primarily consist of a suitable and accessible bus route network that is comfortable to ride in. The bus route network should also

have a short travel distance and bus stops that are not far from housing areas. This study was limited to the SPT area and focused only on four bus routes, operated by only one service provider. The study had also concentrated only on existing bus riders and their perception of a good bus service. Further work is required to understand potential or new bus users' requirements as these may not be similar to those who are already using buses for their daily travel. As a general policy, authorities' regulating bus services should take into account the needs of users while ensuring a sustainable operation for the operators.

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