Customer Satisfaction on Public Bus Network System on Malacca, Malaysia

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Abstract
Customer satisfaction is one of the main considerations when operating a successful city bus service. An increased number of private vehicles in the city causes traffic congestion resulted from low level of usage for public transportation. Unattractive public bus system might be the reason why the usage of public bus in Malacca is subdued. Four bus 4 routes in case study area with a total of 143 respondent participated in the survey. The results indicate that the performance of the bus network on those selected routes mostly at moderate level of service where frequency and timetable are the most significant factors that affect the passenger's satisfaction level. Findings of this study can help the bus operator and the state authority to retain the current ridership and the same time to attract new passengers to utilize the public bus service in Malacca
Keywords: Public Bus, Bus Network System, Customer Satisfaction, Trip Characteristic.

1. Introduction

The success of a public transport system can be seen through the number of passengers it can attract and retain in using the system. The performance of public transport is related to the factors describe its service which is the bus network system. As mentioned by Xiang & Loh, (2014) in the bus planning process, the highest level of sub-problem is related to bus network and frequency setting in which, have a long-term impact on bus network performance. An improvement made to the bus network will not only increase the attractiveness and ridership but also increase their revenue. It is cost-effective to bus operator and at the same time beneficial to the passengers as the waiting time could be reduced.

Malacca state government in pursuing to brand Malacca as a green technology city However, due to its popularity as a heritage town and tourist destination, Malacca is experiencing a significant traffic congestion (Sukri et al., 2017). The main contributor for this problem is at Ayer Keroh where the usage of land public transportation is low, but usage of private vehicles is high. In tackling this public transportation problem, Malacca state government has tried to implement free public bus project at certain road to encourage people using public bus. 290 000 commuters in the state will benefited from that complimentary service as mentioned by former Chief Minister Adly Zahari (The Star Online, 2018). Unfortunately, the rate of congestion in Malacca is still high even though the program was already implemented. Especially, especially during peak hour and holiday season. It shows that the project has failed to attract people to use the public bus.
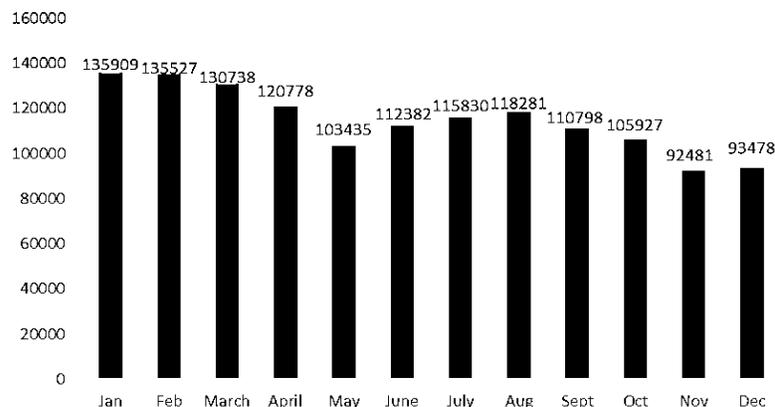

Fig. 1: Panorama Bus Ridership for 2019

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Figure 1 above shows, amount of ridership for 2019 still in decreasing trend even after implementation of the free bus. In addition, that, passengers had to wait almost three hours as the bus delayed in certain areas which raised dissatisfaction and complaint from passenger (Utusan Online, 2018). As a result, private transport usage has increased significantly and will continue to increase if public transport incapable to attract the travelers to use them. For the locals, Malaysian still views public bus as a very important form of transportation for them to commute. However, with poor performance, the demand to use public bus from people has decreased. Thus, to evaluate the current bus network system and identify improvement required crucial. This will benefit the economic, social, and physical structure of that city. There are three research objectives that has been achieved in this study, namely: (1) To identify travel characteristic of public bus passenger; (2) To evaluate public bus network system that can affect performance of the bus on each selected route and (3) To propose recommendation towards the performance of public bus network system.

2. Literature Review

Transportation system is system can be said as set of things that working together as an interconnecting network or a part of a mechanism. It is also a system that able to move people and goods. (Boyce, 1984). To maintain a long service, a good transport system is a great factor as passengers will have a positive experience if the transport system has high performance level that can encourage users' loyalty (David Ackah, 2014)

According to Kepaptsoglou et al., (2015) crucial part of the planning process for operational of public transportation is network design, as it includes the determination of associated operational characteristics such as frequencies and design of route layouts. Feng et al., (2016) explained that bus transport network can be referred as a directed network which consist of routes, passenger flow and stations. Improving network performance can improve cost-effectiveness and attractiveness of public transport that may then increase passenger satisfaction which may lead to an increase in ridership (Xiang & Loh, 2014). Joewono et al., (2017) however explained that the movement between two substantial and meaningful activities can be defined as a trip where there may be more than one mode were used for traveling between the two activities. And the level of satisfaction can be influence by trip characteristic which is include frequency, trip purpose, cost, and distance of the trip (Ponrahono et al., 2016). It is important to know and understand passengers' trip characteristic as the decision to choose mode of transport can be influence by trip characteristic, personal characteristic, and environment attributes such as availability of transit service and land use activities (Kwan et al., 2018). For this study, the variable used in evaluation customers satisfaction are on the operational characteristics of public bus in Malacca which consist of route, frequency, timetables, scheduling (bus and drivers) and bus stops.

i.   *Route*
     Xiang & Loh, (2014) defined route as a sequentially ordered set of connected edges. Single link between two nodes can be referred as a route. Route networks need to be influence by the demand of passenger so that a convenient links between all points can be provide (Kilic & Gok, 2015).

ii. *Frequency*
     Hema & Angeline, (2014) stated that to satisfy the passenger demand frequency which is total number of public bus trips plays an important role during a fixed period as to provide convenience, comfort, and quicker time travel to the passenger for scheduling phases. Long waiting time will occur if the headways is more than 5-10 minutes and lead to dissatisfaction of the passenger (Nielsen & Lange, 2008).

iii. *Timetables*
     Each line run in the network have timetable that includes departure times. All the stops consist of a departure time from the initial terminal, an expected arrival time at the final depot and the expected departure times from each bus–stop on the route (Guihaire & Hao, 2017). Budiono, (2009) also stated that, important factors that may causing dissatisfaction of the passenger were accuracy of timetable punctuality and information.

iv. *Scheduling Buses*
     Determining the number of buses required for the considered period usually of one day long, to obtain a feasible sequence of line runs, is the purpose of scheduling buses as stated by (Guihaire & Hao, 2017).

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v.   *Scheduling Driver*
Scheduling driver aims at assigning driver to the bus service as each driver will ends up having a timetable for a given period of time in which scheduling phases usually based on one day period as stated by (Guihaire & Hao, 2017).

vi.   *Bus stops*
Sun et al., 2020 stated that the most important variable that can affect overall satisfaction is the conditions of stops (including the provision of shelter and seat). Waiting environment like bus stops should be equipped with shelters, security cameras, real time information, etc. and these amenities can enhance satisfaction of the passengers as it provides transit passenger a safe, an attractive and comfortable waiting environment. Perceived waiting time by the passenger can be shorten with shelters, real time information and other amenities as it reduces passenger frustration and anxiety, thus it may improve passenger's satisfaction (Brakewood et al., 2014).

3. Methodology

This research employed quantitative methodology. Data collection was done through observation and survey. Questionnaire was distributed to obtain more information from the respondents.

3.1. Study Area

Study has focused on 4 routes covered by the main public bus operator call Panorama Melaka Ptd. Ltd. These routes located in Malacca central district shown in Figure 2 Malacca Central to Ujong Pasir, Figure 3 Malacca Central to Bukit Katil, Figure 4 Malacca Central to Batu Berendam, and Figure 5 Malacca Central to MITC which are part of central business district for Malacca. Furthermore, the rate of congestion at this district is the highest among the other districts. Zainu, (2020) stated that, according to World Bank Advisory Service, households in Malacca had 1.4 cars and 1.9 motorcycles, this statistic showed that the proportion of private vehicle ownership in Malacca is relatively high as compared to other states in Malaysia. The free public bus incentives that were given by the Malacca state government are also these 4 routes. There are also mix of land use activities in these 4 routes such as housing, commercial, industrial, etc. in which had made the transportation activity to be even more rapid.
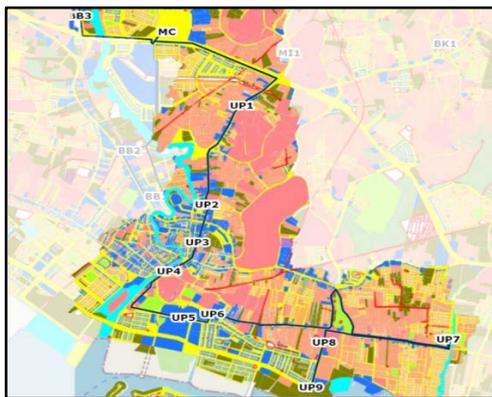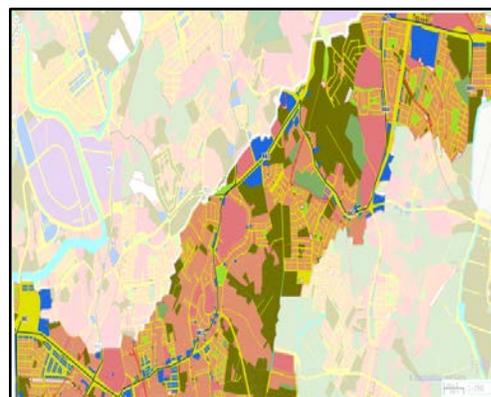

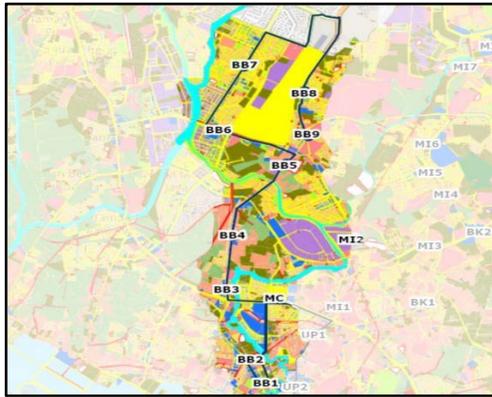Fig. 2: Route Ujong Pasir (UP)   Fig. 3: Route Bukit Katil (BK)
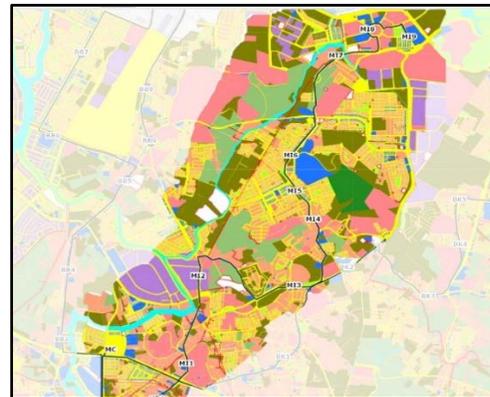
Fig. 4: Route Batu Berendam (BB)

Fig. 5: Route Malaysia International Trade Center (MITC)

3.2. Data Collection - A Selection of Respondents

The calculation of sample size at 95% of confident level is based on the equation below (Robert et al, 1999).

$$n = \frac{N}{1 + N \cdot (e)^2}$$

Where,
= Sample size
N = Population size
e = Margin Error

Based on the formula above, when the population is equal 836 passenger and the margin error is equal to 8%, the minimum number of respondents for this study is 132 respondents. The minimum distribution of the respondents according to each route are as follows.

Table 1: Panorama Ridership for 2019

Route	Daily Ridership	Weight percentages	Number of respondents
UP	580	580/836×100 = 69.3%	69.3/100×132 = 91.4 ≈ 91
BB	137	137/836×100 = 16.5%	16.5/100×132 = 21.7 ≈ 22
BK	68	68/836×100 = 8.1%	8.1/100×132 = 10.6 ≈ 11
MITC	51	51/836×100 = 6.1%	6.1/100×132 = 8.1 ≈ 8
Total	836	100	132

3.3. Data Analysis

In order to evaluate the bus network system of Panorama bus, scoring method were used to measure the passengers' satisfaction in order to know the performance of the bus network by scoring each question in the questionnaire. The formulations for scoring value and percentage in this study are shown as in (i) and (ii).

(i) *Score Value = (Total counted mark for each criteria)*
                        (Total full mark)

Score Value = ($\sum(p \times m)$)
                    (n×y)

When ,   *p ; number of respondent*
           m ; score mark
           n ; Total number of respondent
           y ; 4, highest value of score

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(ii)   *Scoring Percentage = (Total counted score) ×100%*
            (Total full mark score)

4. Result and Discussion

The analysis is structured based on demographic profile and the main data analysed to evaluate the passengers satisfaction on Panorama's bus network system performance. The final survey involved a total of 143 respondents in which 91 respondents (63.6%) comes from route Ujong Pasir, 22 respondents (15.4%) comes from route Batu Berendam, and 15 respondents (10.5%) comes from both Bukit Katil and MITC routes.

4.1. Demographic Profiles

In those 4 routes shown in Table 2, respondents who are 40 years old and below were the majority respondents in this study. This might be because they are the one who actively commuting to take care of their errands and work. According to employment status in the table shows that majority of the respondent employment status are employed which represent 60% and above for all these 4 routes.

Transportation cost is also one of the reasons why the people of Malacca chose public transportation as their main mode of transport. Table 2 indicates that all the respondent came from B40. (below 40% national income) income group earning less than RM4300 per month. More than 60% of the respondents in this study regularly used bus service as their mode of transport in Malacca city.

Table 2: Respondents Demographic Profiles

Criteria/Bus Route	UP	BB	BK	MITC
	Percentage (%)			
Gender				
Male	44	50	40	40
Female	56	50	60	60
Age				
<18-30	27.5	27.3	33.3	33.3
31-40	29.7	36.4	26.7	46.7
41-50	26.4	18.2	13.3	6.7
>51	16.5	18.2	26.7	13.3
Nationality				
Malaysian	92.3	95.5	100	80
Non-Malaysian	7.7	4.5	-	20
Employment Status				
Student	13.2	9.1	6.7	6.7
Unemployed	19.8	9.7	20	33.3
Employed	62.6	81.8	66.7	60
Pensioner	4.4	-	6.7	-
Monthly Income				
None	33	18.2	26.7	33.3
<RM1500	28.6	22.7	26.7	40
RM1501-RM3000	36.3	50	46.7	26.7
>RM3001	2.2	9.1	-	-
Mode of Transport				
E-Hailing	11	4.5	26.7	6.7
Taxi Services	-	-	-	-
Bus	84.6	68.2	60	60
Private Vehicle	4.4	27.3	13.3	33.3

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4.2. Data Analysis

According to the table 3, the performance of bus network system of Bukit Katil and Ujong Pasir routes were moderate with 57% and 59% respectively whereas MITC and Batu Berendam have achieved good performance with 64% and 68%. Percentage of scoring for Bukit Katil route was the lowest among the other route in this study. This indicated that there are several criteria of service offred that respondents were not quite satisfied with. Besides that, for Ujong Pasir route, frequency and timetable variables obtained the lowest score for this route's performance. Although MITC and Batu Berendam have achieved good performance for bus network system, the percentage is only at minimum of good performance level.

Q1 bus coverage for Bukit Katil route only scores 0.45 value which indicate passenger are not quite satisfied with the bus coverage. This might be due to the development route planning for this route had delayed in its planned progress. Thus, it is crucial for the bus operators to do regular route revision to ensure the bus service can meet the passenger demand and attractive enough to attract people to switch from private vehicle to public transport.

Based on Q6, Ujong Pasir and Bukit Katil has the number of frequency of bus service scored 0.52 and 0.45 respectively. These indicate that passenger demand to increase the frequency of the bus. Having high level of frequency not just might improve passenger's satisfaction but it can also help to attract more people to switch from private vehicle to public transport.

As for Q9, Ujong Pasir and Bukit Katil routes show moderate score value, it indicates the departure of the bus from the terminal is not as expected. From the observation, there are more than 10 buses that were unused at the terminal. The operator has assigned number of buses that will operate in each route but in the event of a bus breakdown, no other bus will replace the damaged bus. This leads to inaccuracy of the departure time of the bus. Shortage of the buses should not happen as this bus operator is the only bus provider that operates public bus transportation service and this company are owned by the state government of Malacca.

Criteria Q14 on the bus stop variable shows low level of service value for all routes. This mean, there are no appropriate information on the bus stop. As Panorama is the only bus operator that served public bus transportation in Malacca Tengah and owned by state government of Malacca it is not impossible for the bus operator to provide its own a decent and informative bus stop for their passengers.

Table 3: Score Value for Each Route

	Qs	UP		BB		BK		MITC	
		M	S	M	S	M	S	M	S
R	Q1	289	0.79	74	0.84	27	0.45	47	0.78
	Q2	280	0.77	69	0.78	48	0.8	43	0.72
	Q3	253	0.70	70	0.80	42	0.7	35	0.58
	Q4	228	0.63	53	0.60	29	0.48	38	0.63
	Q5	144	0.40	62	0.70	43	0.72	31	0.52
F	Q6	188	0.52	56	0.64	27	0.45	37	0.62
	Q7	177	0.49	53	0.60	28	0.47	39	0.65
	Q8	143	0.40	46	0.52	26	0.43	34	0.57
T	Q9	200	0.55	69	0.78	33	0.55	43	0.72
	Q10	203	0.56	47	0.53	36	0.6	37	0.62
	Q11	178	0.49	53	0.60	32	0.53	39	0.65
	Q12	227	0.62	69	0.78	32	0.53	38	0.63
BS	Q13	272	0.75	73	0.83	40	0.67	43	0.72
	Q14	94	0.26	23	0.26	19	0.32	19	0.32
	Q15	267	0.74	62	0.70	46	0.77	39	0.65
	Q16	273	0.75	71	0.81	27	0.45	43	0.72
	Q17	229	0.63	67	0.76	44	0.73	42	0.7
Total		3645	10.05	1017	11.53	579	9.65	644	10.75
Score %		59%		68%		57%		64%	

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UP = Ujong Pasir, BB = Batu Berendam, BK = Bukit Katil, MITC = Malacca International Trade Centre.
BS = Bus Stop, T = Timetable, F = Frequency, R = Route,
M= Mark, S = Score

Conclusion

It was found that the bus network system for public bus on the selected routes is on moderate and minimum good level of service. Frequency and timetable are the variable that most affect the bus network system performance. As the performance of the bus network is on moderate and minimum good level, there is a room for improvement that public bus operators should take in order to offer a better bus service to their passengers as they are the only bus operator in Malacca city.

Acknowledgement

References

[1] Boyce, D. (1984). Transportation Systems. In *Encyclopedia of Life Support Systems (EOLSS): Vol. I.*

[2] Budiono, O. A. (2009). Customer satisfaction in public bus transport: A study of travelers' perception in Indonesia. *Service Science Program*, 56.

[3] David Ackah, (2014). The Role of Transportation in Achieving Customer Satisfaction in a Private Distribution Company, Munich, GRIN Verlag, https://www.grin.com/document/284724

[4] Feng, S., Hu, B., Nie, C., & Shen, X. (2016). Empirical study on a directed and weighted bus transport network in China. *Physica A*, *441*, 85–92. https://doi.org/10.1016/j.physa.2015.08.030

[5] Guihaire, V., & Hao, J. (2017). *Transit network design and scheduling : A global review Transit Network Design And Scheduling : a Global Review*. *December*. https://doi.org/10.1016/j.tra.2008.03.011

[6] Hema, D. D., & Angeline, R. (2014). *Frequency of Buses Determination Model and Bus Schedule in Chennai Metro Transport for ITS Based System*. *4*(11), 118–124. https://doi.org/10.1097/NEN.0b013e31816a0dc8

[7] Joewono, T. B., Santoso, D. S., Adinegoro, L., & Kharisma, A. H. (2017). Characteristics of of Travel, Trave, Activities, Activities, and and Action Space of Young Workers Riding Motorcycles in Developing City Workers Riding Motorcycles in Developing City. *Transportation Research Procedia*, *25*, 5023–5039. https://doi.org/10.1016/j.trpro.2017.05.202

[8] Kepaptsoglou, K., Asce, M., Karlaftis, M., Ph, D., & Asce, M. (2015). *Transit Route Network Design Problem : Review Transit Route Network Design Problem : Review*. *8*(September). https://doi.org/10.1061/(ASCE)0733-947X(2009)135

[9] Kilic, F., & Gok, M. (2015). A benchmark proposal for route-planning of urban bus service. In *Proceedings - 4th Eastern European Regional Conference on the Engineering of Computer-Based Systems, ECBS-EERC 2015* (Issue August). https://doi.org/10.1109/ECBS-EERC.2015.30

[10] Kwan, S. C., Sutan, R., & Hashim, J. H. (2018). Trip characteristics as the determinants of intention to shift to rail transport among private motor vehicle users in Kuala Lumpur, Malaysia. *Sustainable Cities and Society*, *36*(October 2017), 319–326. https://doi.org/10.1016/j.scs.2017.10.030

[11] Nielsen, G., & Lange, T. (2008). Network Design For Public Transport Success – Theory And Examples. *Transport*, 30. http://www.ppt.asn.au/pubdocs/thredbo10-themeE-Nielsen-Lange.pdf

[12] Ponrahono, Z., Bachok, S., Ibrahim, M., & Osman, M. M. (2016). Assessing Passengers' Satisfaction Level on Bus Services in Selected Urban and Rural Centres of Peninsular Malaysia. *Procedia - Social and Behavioral Sciences*, *222*(June), 837–844. https://doi.org/10.1016/j.sbspro.2016.05.183

[13] Sukri, F. H., Chew, B. C., Hamid, S. R., & Loo, H. S. (2017). *Building a sustainable land public transportation at Ayer Keroh , Malacca : Perspective view from hang tuah jaya municipal council (HTJMC) Building a Sustainable Land Public Transportation at Ayer Keroh , Malacca : Perspective view from Hang Tuah*. *020053*. https://doi.org/10.1063/1.4976917

[14] Sun, S., Fang, D., & Cao, J. (2020). Exploring the asymmetric influences of stop attributes on rider satisfaction with bus stops. *Travel Behaviour and Society*, *19*(October 2019), 162–169. https://doi.org/10.1016/j.tbs.2020.01.004

[15] Utusan Online, I. F. (2018, May 22). Kekurangan bas diatasi segera. *Utusan Online*.

[16] Xiang, Z., & Loh, K. (2014). *Factors Influencing Bus Network Design*. 1–79.

[17] Zainu, Z. A. (2020). *4 Kaedah Rangka Sistem Pengangkutan Bersepadu di Melaka*. Melaka Kini. https://melakakini.my/4-kaedah-rangka-sistem-pengangkutan-bersepadu-di-melaka/

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