SUSTAINABLE URBAN PUBLIC TRANSPORTATION SYSTEM IN MALAYSIA A COMPARISON OF BUS SERVICES IN KUANTAN AND PENANG

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ABSTRACT: Transportation refers to the mobility of activities and goods from all economic sectors. Transportation is the key towards sustaining goods, services and people mobility in economic activities. Public buses in Malaysia, in general, and Kuantan and Penang, in particular, have faced many challenges, including dwindling number of passengers. This research focuses on the passengers' perspective of the bus services from the aspects of frequency, travel time, as well as comfort and convenience. It aims at analysing passengers' aspiration and perspectives of sustainable urban public transport and focuses on the assessment of Malaysian urban bus services within selected areas in Kuantan and Penang. Satisfaction of the current patronage is assessed against several measurements. Buses function as feeders to these socioeconomic traffic generators on a daily basis, especially for commuters. Thus, comparison of sustenance of passengers is also made of both Kuantan and Penang users. The research found that some socio-demographic and trip characteristics indeed influenced the current satisfaction level of the passengers. Recommendations have been made to the bus operators to ensure future sustainability of urban stage bus services in Kuantan and Penang.
Keywords: transport planning, public transport, passenger's aspiration, on-board survey

INTRODUCTION

Inefficient public transportation relates to networking and accessibility issues that limit the choices of the users to access facilities and employment opportunities. Public transport is one of the optional modes to overcome many traffic issues including traffic congestion, reduce travel time and increase mobility level within the urban and rural activities (Kamba, Rahmat and Ismail, 2007). However, integration, co-ordination and monitoring of sustainable public transport planning as an efficient system is not being prioritised by the operators. This has contributed to the declining number of passengers using public transport as an alternative to private vehicles. There are also a number of issues such as limited facilities, use of low quality public transport facilities and interchanges, inconvenience of fleet, low passenger trips and long waiting time (Yaakub and Napiah, 2011b). In short, the current public transport system deals largely with issues and problems in operation, infrastructure and facilities provided (Kamaruddin, Osman, Anizaliana, and Pei, 2012).

LITERATURE

Public Bus Service and Bus Rapid Transit (BRT) System

An efficient public bus service will contribute towards rapid economic growth and healthy social development of a city. However, numerous researchers identified various issues relating to public bus services such as limitation of facilities, use of low quality public transport facilities and interchanges, inconvenience of fleet, low passenger trips and long waiting time which create adverse impacts on the economy, social and environment (Bachok, Ponrahono, Osman and Ibrahim, 2015; Chen, Yu, Zhang and Guo, 2009). This research aims to analyse public bus service performance in selected urban areas of Malaysia before generalising the issues existent in the system. Bus Rapid Transit (BRT) is one of the practical systems in the mass-rapid transit that allows urban travellers to use the bus at prescribed fare. It was developed in Brazil during the 1970s (Onatu, 2011) and it serves as a transit mode that is usually local in nature. Bus Rapid Transit System (BRT) is proven as a public transport system that provides consistent service and is able to overcome many issues of public bus system. It is a road-based system that replicates the railroad system, but purposely designed to provide high quality service which is affordable, fast, efficient and comfortable (Onatu, 2011). BRT system is profitable in terms of operation cost where the system can cater to a large number of passengers with higher

travelling speed. When higher travelling speed is achieved, it indirectly reduces the traffic emissions and delays in reaching the destination. The BRT system is also designed to capture the loss of boarding and alighting time during the bus fare collection with the intervention of smart ticketing system such as monthly electronic pass. Wright (n.d.) identified developed cities in Adelaide Australia, Brisbane Australia, Auckland New Zealand, Boston USA, Cleveland USA, Curitiba Brazil, Eugene USA, Cleveland USA, Los Angeles USA, Leeds UK, and Orlando USA as cities that have successfully implemented the BRT system. BRT system in general is an innovative public transportation system ideal in promoting cost-effective, higher passenger capacity and low infrastructure cost as well as time savings of boarding and alighting (Bührmann, Wefering and Rupprecht, 2011)**.** This is due to the capacity of the system to cater to higher mobility level per unit of resources allocated (Sakamoto, Dalkmann and Palmer, 2010). Wright (n.d.) believes that BRT system offers many benefits to economic, societal, environmental, urbanization process as well as geo-politic as the system employs a more sustainable public transportation approach. In the Malaysia context, BRT system is an innovative initiative included in the National Land Public Transport Masterplan. Among the program outlined in the public transportation system transformation plan, the BRT project will implement the five bus expressway transit service and a detailed BRT network feasibility study will be carried out soon (Aziz and Amin, 2012; PEMANDU, 2012).

Public Bus Services Quality Performance and Passenger's Satisfaction Assessment

A quality assessment of bus services can be imposed from the aspect of standard Level of Service (LOS) of public bus operation or passenger satisfaction level (Noor, Nasrudin and Foo, 2014). Level of service (LOS) is a tool to measure the quality of service provided according to specific attributes. In this study, the standards (Tables 2, 3 and 4) for Level of Service (LOS) developed by Transportation Research Board (2013) are referred in assessing the bus services provided in Kuantan and Penang.

Table 2: Fixed-route Hour of Service LOS

LOS	Hours of service	Remarks
A	19-24	Night 'owl' service provided
B	17-18	Late evening service provided
C	14-16	Early evening service provided
D	12-13	Daytime service provided
E	4-11	Peak hour service only or limited midday service
F	0-3	Very limited or no service

Source: Yaakub and Napiah (2011a)

Table 3: Fixed-route Service Frequency LOS

LOS	Average Headway (min)	Vehicle per hour	Remarks
A	<10	>6	Passengers do not need schedules
B	10-14	5-6	Frequent service, passengers consult schedules
C	15-20	3-4	Maximum desirable time to wait if bus/train missed
D	21-30	2	Service unattractive to choice riders
E	31-60	1	Service available during the hour
F	>60	<1	Service unattractive to all riders

Source: Yaakub and Napiah (2011a)

Table 4: Passengers Loading LOS Thresholds

LOS	Passengers /Seat	Remarks
A	0.00-0.50	No passenger need to sit next to another
B	0.51-0.75	Passengers can choose where to sit
C	0.76-1.00	All passengers can sit
D	1.01-1.25*	Comfortable standee load for urban transit
E	1.26-1.50*	Maximum schedule load for urban transit
F	>1.50*	Crush load

**approximate values for comparison*
Source: Transport Research Board of National Academics TCRP Report 100 (TCQSM 2003) as cited in M. Napiah et al. (2010)

Additionally, the passengers' satisfaction survey on bus services from the aspects of frequency, affordability, safety and security as well as comfort and convenience can help to assess the quality of services provided by the bus operators. It is a tool to measure the performance and quality of bus service that can be the benchmark or an indicator of the current performance of these buses (Suwardo, Napiah and Kamaruddin, 2009). In passengers' satisfaction survey, attributes such as waiting time, reliability, service information, comfort, travel time, convenience, safety, security, affordability and frequency of service are assessed (Nakanishi, 1997).

OBJECTIVES

The objectives of this research is to determine the Level of Services (LOS) of bus services in Kuantan and Penang and to analyse the bus passengers' preferences and aspirations toward bus services in these two cities.

METHODOLOGY

The methodologies adapted are secondary data collection, on board survey, interviews and site visits or observation methods in order to obtain bus services data and information related to the study.

On-board Transit Survey

On-board intercept face-to-face questionnaire survey method was used to capture the passengers' demographic and travel characteristics. On-board transit is the most accurate survey in getting reliable and detailed information (Yaakub and Napiah, 2011a). Standard questions about the respondent's background on age, ethnicity and gender were gathered from approachable respondents who are willing to give feedback during the on-board survey. Further questions were posed for the level of satisfaction with the bus services which aim to capture the passengers' preferences and expectations.

Sampling Unit

The sampling population consists of all bus service users in Kuantan and Penang. Target respondents are on-board passengers who are aged between 15 and 55 years old which is the common user of these services. A total of 330 survey questionnaires was distributed and collected using convenience sampling method during the on-board survey on 24 selected routes. See Table 5 for distributions of respondents according to urban-rural centre:

Table 5: Respondents Distribution

Town Centre	Terminal	No. of Routes	Frequency	Percentage (per cent)
Kuantan	Hentian Bandar	11	130	38.2
Penang	Seberang Prai	7	100	29.4
	George Town	6	100	29.4
	TOTAL	24	330	100

LIMITATION

All findings in this study are subject to the data collected based on the limitation of the research and permission given by the main bus service operators in Kuantan and Penang. The data were collected during off-peak hours of public bus services within a week. Findings can differ if longer survey period is conducted, or if the survey is conducted during the day trips with no public or school holidays, or if on-board surveys were conducted more than once on a single trip/route with more enumerators. Despite the adaptability of methodology upon different case studies, the study is limited by various logistic and human resource factors such as several targeted operation time duration for data collection could not be realized during the comprehensive survey due to bus breakdowns, drivers' behaviour issues and changed timetable schedules, frequency and route de-fixing

FINDINGS

An assessment on Level of Service (LOS) of fixed-route hour service for both bus services indicated that bus services in Penang correspond to LOS B to C, and bus services in Kuantan correspond to LOS B to E (see Table 6). Apart from that, the fixed-route service frequency LOS (see Table 7) of bus services in Penang correspond to LOS B to E, and bus services in Kuantan correspond to LOS D to E. These indicate that the services provided in Penang and Kuantan are considered acceptable and within desirable waiting time. Only certain routes categorized as "social obligation routes" upon which the bus service run during every 60 minutes interval. Additionally, the LOS of passenger threshold (see Table 8) calculated based on the number of passengers on-board during the survey, the bus services in Penang correspond to LOS C to F and bus services in Kuantan correspond to LOS A to F. Most of LOS F occurred during the peak hour trips and most of Penang bus route services face the issue of the crush load passengers situation on weekdays or weekend's trip.

Table 6: Summary of Fixed-Route Hour Service LOS between Bus Services in Kuantan and Penang

Case Studies	Indication		
	Fixed-route hour service LOS	Shortest service hour	Longest service hour
Penang	B to C	16 hours 30 mins	18 hours
Kuantan	B to E	11 hours 40 mins	17 hours 20 mins

Table 7: Summary of Fixed-route Service Frequency LOS between Bus Services in Kuantan and Penang

Case Studies	Indication		
	Fixed-route Service Frequency LOS	Highest LOS	Lowest LOS
Penang	B to E	Every 10-20 minutes	Every 25-40 minutes
Kuantan	D to E	Every 20-30 minutes	Every 60 minutes

Table 8: Summary of Passengers Threshold LOS between Bus Services in Kuantan and Penang

Case Studies	**Indication**	
	Weekday	**Weekend**
Penang	C to F	F
Kuantan	A to F	B to F

From the survey of 330 passengers, some 40 per cent of passengers surveyed were male in both Kuantan and Penang areas. Commonly, female passengers are higher because they were captive riders, most not owning a vehicle or having access to alternative modes of transport (Krizek & El-Geneidy, 2007) (see Table 9). Apparently, there are also higher number of respondents from 19-28 years old and 29-49 years old which indicate that the ridership of bus services in Kuantan and Penang is mostly from captive riders of college and university student and young working group who do not have access to private car or must use public transportation to travel (see Table 9). It can be concluded that the categories of respondents were mostly passengers on the commuting trip that use bus services as a mode to travel between repeated locations, particularly to reach workplaces and educational institutions. Additionally, the survey also found that in both Kuantan and Penang, bus services attracted more Malay (58.5 per cent) passengers compared to other ethnicities in the area. Some 11.2 per cent of the total respondents were tourists that used the bus services to reach tourism spot like Teluk Chempedak, Kuantan and around George Town, Batu Feringghi and Penang Hill in Penang. The study found that bus services in Penang and Kuantan attract more local and international tourists. This may be due to the characteristic of Kuantan and Penang cities. Based on the literature, the passengers' demographic profiles and readership profiles contribute to the ridership of the services and need to be factored in when designing an effective and efficient bus service.

Table 9: Bus Service Ridership Profile in Kuantan and Penang

Variables	**Penang**		**Kuantan**		**TOTAL**	
Gender	**Frequency**	**%**	**Frequency**	**%**	**Frequency**	**%**
Male	78	39	54	41.5	132	40
Female	122	61	76	58.5	198	60
TOTAL	200	100	130	100	330	100
Age Group						
13-18 years old	23	12.5	13	10	38	11.5
19-28 years old	39	19.5	92	70.8	131	39.7
29-49 years old	102	51	24	18.5	126	38.2
Above 50 years old	34	17	1	0.8	35	10.6
TOTAL	200	100	130	100	330	100
Ethnicity						
Malay	95	47.5	98	75.4	193	58.5
Chinese	23	11.5	15	11.5	38	11.5
Indian	47	23.5	15	11.5	62	18.8
Tourist	35	17.5	2	1.5	37	11.2
TOTAL	200	100	130	100	330	100

In Table 10, the analysis shows that respondent from Kuantan and Penang found that the bus condition was good (73.6 per cent) and only 15.5 per cent of the respondent gave negative feedbacks on the condition of buses. Table 11 shows that the respondents (55.8 per cent) were dissatisfied with the overall services in both areas. This dissatisfaction showed that the quality of bus services in both localities were low. When probed in detail, the study found (see Table 12) that 55.5 per cent of the respondents from both areas were dissatisfied with the punctuality and frequency of the current bus services. Another 30.3 per cent of respondents have issues related to reliability and safety of the buses while the remaining respondents also stated issues on poor comfort level and cleanliness of these buses. A high number of respondents in both areas want the service to be improved in term of punctuality (on-time service) and frequency.

Table 10: Satisfaction towards Bus Condition among Bus Service Passengers in Kuantan and Penang

Bus Condition	**Penang**		**Kuantan**		**TOTAL**	
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
Good	146	73	97	74	243	73.6
Average	20	10	16	12.3	51	10.9
Not Good	34	17	17	13.1	36	15.5
TOTAL	200	100	130	100	330	100

Table 11: Satisfaction Level among Bus Service Passengers in Kuantan and Penang

Satisfaction Towards Bus Service	**Penang**		**Kuantan**		**TOTAL**	
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
Satisfied	34	17	18	13.8	52	15.8
Between Satisfied and Dissatisfied	70	35	24	18.5	94	28.4
Dissatisfied	96	48	88	67.7	184	55.8
TOTAL	200	100	130	100	330	100

Table 12: A Comparison of Passengers' Aspiration and Future Intents of Sustainable Urban Public Transportation in Malaysia among the Kuantan and Penang Bus Rider

Aspiration And Future Intents	**Penang**		**Kuantan**		**TOTAL**	
	Frequency	**(%)**	**Frequency**	**(%)**	**Frequency**	**(%)**
Punctuality and Frequency	100	50	83	63.8	183	55.5
Comfort and Cleanliness	20	10	27	20.8	47	14.2
Reliability and Safety	80	40	20	15.4	100	30.3
TOTAL	200	100	130	100	330	100

CONCLUSION

Bus service quality assessment through a standard Level of Services (LOS) indicates that the bus services provided in Penang and Kuantan are good overall. However, the passengers' satisfaction survey indicates that aspects of frequency, punctuality, safety and security as well as comfort and convenience need improvements. From the transformation of public bus services in Penang and Kuantan, it shows a rapid change in the overall level of service of public transportation system in the town. Modern and advanced technology, and well-executed operation plans have been deployed by the bus service providers to increase the efficiency and effectiveness of the bus service performance.

The initiative and improvement programmes for buses in George Town, Seberang Prai and Kuantan have benefitted the locals in their daily commute, especially for city residents in terms of higher mobility, greener transportation system and more reliable public transport system. The promotion of sustainable public transportation system in urban areas requires tremendous political will and public acceptance. As the demand on public bus service is high, the current public bus services should be improved in aspects such frequency and more routes to residential area to achieve a high level of sustainable bus service system.

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