



# Level of Services (LOS) for Public Bus and Passenger's Aspiration in Kerian District, Malaysia

Syahriah Bachok, Mariana Mohamed Osman, Zakiah Ponrahono

Kulliyyah of Architecture and Environmental Design,  
International Islamic University Malaysia

syahriahbachok@gmail.com

## Abstract

Public transportation facilitates the mobility of activities and goods from all sustainable development key dimensions. Over the past decades, more trips of public transportation move people towards a more sustainable future, by reducing congestion on the roads and increasing the efficiency of the road system. The research aims at analysing the passenger's aspiration and perspective of sustainable public transport measure and evaluating Malaysian rural bus services, using the case study of Kerian District in the state of Perak. On-board intercept passenger survey and adoption of Geographical Information System (GIS) / Global Positioning System (GPS) were used to collect the primary data. The research suggested that whilst the services levels are less than those aspired by the passengers, there are many improvement areas to be prioritised in the near future.

**Keywords:** Sustainable transportation; sustainable transport indicator; transport planning; sustainable transportation dimension; passenger's aspiration.

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## 1.0 Introduction

Good cities need efficient public transportation. It facilitates community in accessing destination where many activities are carried out which contribute to individual and public wellbeing. It provides accessibility to people who cannot drive or could not afford to drive. However, there are many issues on growing volume and complexity of urban travel that have become a major concern to the transportation planners, service providers in urban areas and policy makers (Noraini Anor et al, 2011). This paper consists of literature reviews, data analysis and findings of public transport study in the District of Kerian, Perak Darul Ridzuan (Figures 1, 2 and 3).

### 1.1 Research Objectives

- i) To identify the existing of public transportation system and services provided in Kerian District.
- ii) To analyze the potential public transportation system and gap of demand and supply of public transportation in the study area

## 2.0 Literature Review

Public transportation is a gateway to sustainable accessibility system. Apart from that, an efficient public transportation service enhances personal economic opportunities, saves fuel, provides economic opportunities, saves money and reduces the environmental impacts. According to Rohana et. al (2012), a sustainable transport system is closely related to the relationship between satisfaction and the environment. However, there are a number of issues relating to public transportation services such as the limitation of facilities, the use of low quality of public transport facilities and interchanges, inconvenient fleet design, low passenger trips and long waiting time (Abd. Rahim and Nor Ghani, 2004). According to Suwardo, Madzlan Napiah, and Ibrahim Kamaruddin (2008), a large number of trips produced can increase the traffic, coupled with low growth of road length and inadequate facility of public transportation. Hence, the development of public transportation is crucial to solve traffic issues (Marwa A. Khalifa and Mohamed A. El Fayoumi 2012). Using public transportation can reduce the traffic volume and solve the traffic congestion. Public transport mode includes all multiple occupancy vehicles services designed to transport passengers on local and regional routes and their sub-systems. In order to provide effective services, some indicators to examine the effectiveness of bus service are applied (Suwardo, M. Napiah, and I. Kamaruddin, 2008). In practice, there are standards (Tables 1 through to 5) of Level of Service (LOS) for public bus operation (M. Napiah, A.F Amirah Suriati and Suwardo, 2010).

Table 1: 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 Madzlan Napiah, Amirah Suriati Ahmad Farid and Suwardo (2010)

**Table 2: Service Frequency LOS Thresholds**

LOS	Passengers/Seat	Frequency (buses/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 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: Transport Research Board of National Academics TCRP Report 100 (TCQSM 2003) as cited in Madzlan Napiah, Amirah Suriati Ahmad Farid and Suwardo (2010)

**Table 3: LOS Scheme for transit speed**

LOS	Transit speed as % of automobile speed	Description
A	>87.5	Transit trip can be considered as fast as automobile
B	75.0-87.4	Transit trip barely noticeably longer
C	62.5-74.9	Transit trip slightly longer
D	50.0-62.4	Transit trip longer
E	37.5-49.9	Transit trip at least twice as long
F	25-37.4	Transit trip at least

Source: Herman Orth, Robert Dorbritz and Ulrich Weidmann, 2011.

**Table 4: 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: Noorfakhriah and Madzlan, 2001, p.6.

**Table 5: 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: Noorfakhriah and Madzlan, 2001, p.6.

### **3.0 Methodology**

Data was collected through a series of on-board survey. On-board survey is where the observation of bus route was conducted for name and distance of bus stop identification or stopping points. An enumerator rides the bus to record passengers' boarding or alighting at/or between stops and excludes him/herself as a passenger. This task continues between the two terminals (start and end points) during the bus operating hours, but it is not necessary that the enumerator rides the same bus. The bus speed is also recorded using the GPS applications that are synchronized with the tracking mobile satellites.

### **Limitations**

Despite the adaptable of methodology to different case study, there are some important limitations. The study has been limited by various logistics and human resources factors:

- i. Several equipment and GPS/GIS apparatus that have first been considered during pilot surveys could not be employed because of bus' conditions, peak hour crowds and enumerators capacity.
- ii. Several targeted operation time duration for data gathering could not be realized during comprehensive survey due to bus breakdowns, drivers' issues and changed/alterd timetable schedules, frequency and route de-fixing.
- iii. Bus conditions differ from one trip to another. Bus chassis, engines, comfort and convenience levels also differ from one passenger's route and trip experience to another.

### **4.0 Findings and Analysis**

Three primary bus service routes (Figures 1, 2 and 3) provided by the Red Omnibus Sdn. Bhd were recorded during the on-board survey. There are 5 possible points along route 3 to be proposed as bus stop locations. Along route 5, there are 7 points being identified as potential points for the bus stop locations. For route 8, there are 15 points of potential bus stop location being determined using the number of passengers accessing and egressing.

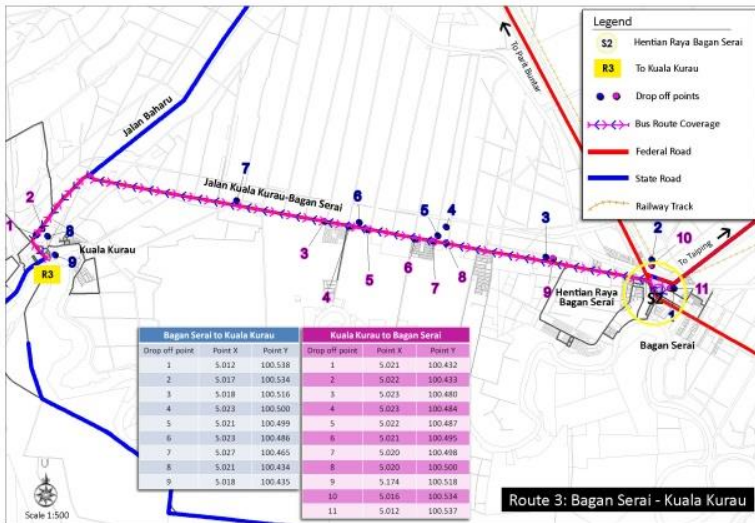


Figure 1: Route 3 Bagan Serai – Kuala Kurau Passengers Drop Points Map

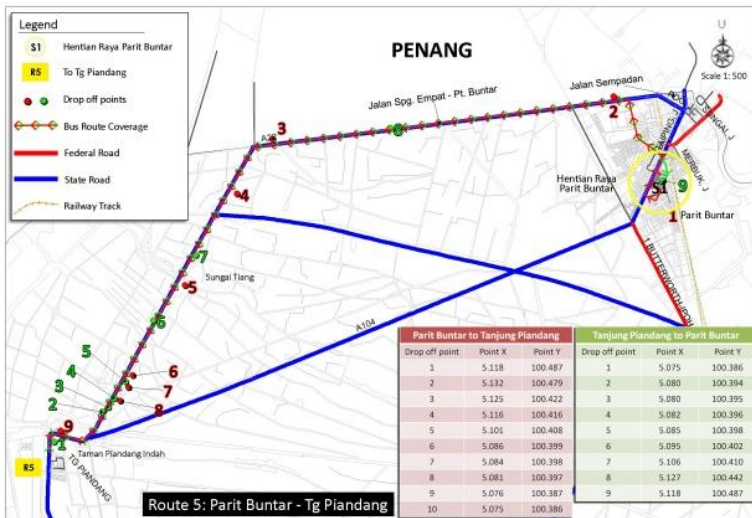


Figure 2: Route 5 Parit Buntar-Tanjung Piandang Passengers Drop Point Map.

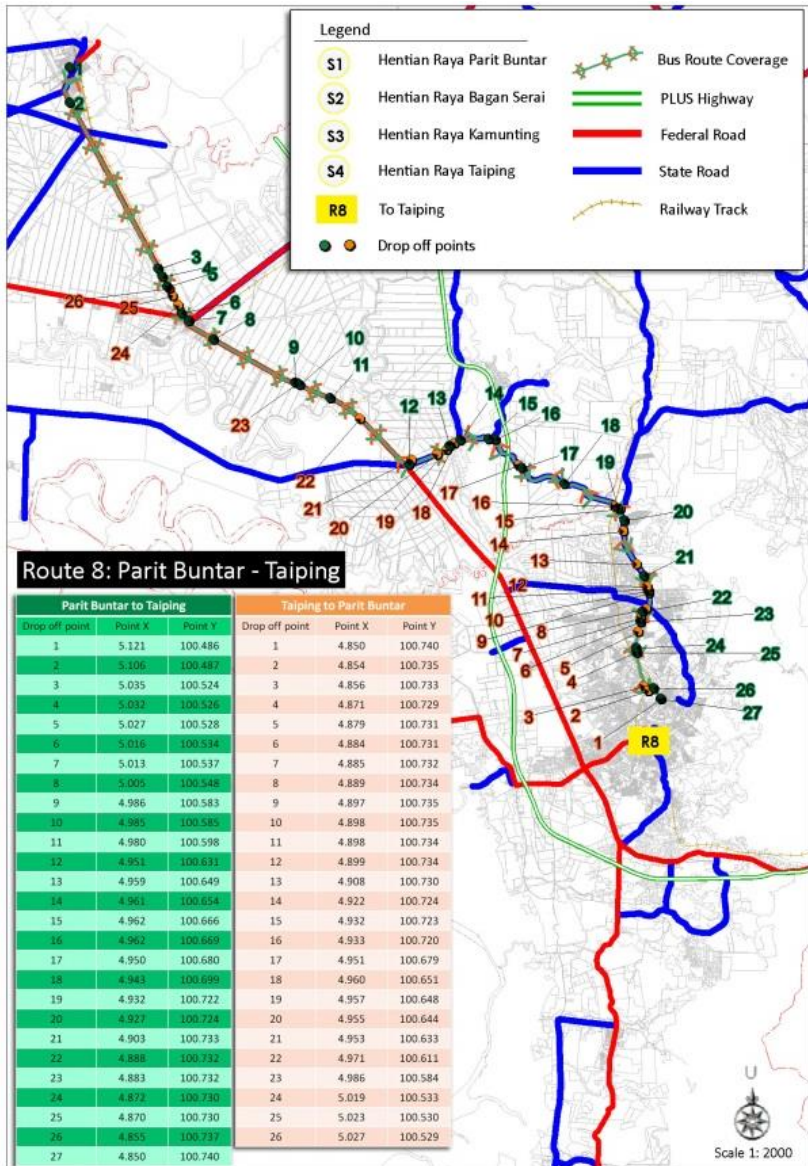


Figure 3: Route 8 Parit Buntar-Taiping Passengers Drop Points Map.

The route service, fare and frequency are summarized in Table 6.

Table 6: Kerian Intra-City Public Bus Service

No. Of Operator	Route	Min. Fare	Max. Fare	Min. Distance	Max. Distance	Frequency
1	<ul style="list-style-type: none"> <li>• Bagan Serai- Kuala Kurau</li> <li>• Bagan Serai- Tariung Pandang</li> <li>• Parit Buntar- Kuala Kurau</li> <li>• Parit Buntar- Tariung Pandang</li> <li>• Parit Buntar- Taiping</li> </ul>	RM1.00	RM5.20	13 km	98 km	Every 45 min or 70 min

Based on convenience sampling adopted during the on-board survey, 100 passengers gave their feedback on the structured questionnaire (which took 15-20 minutes to complete) with the assistance of enumerator assigned by the research team. From the data, it showed that 39% of respondents were satisfied with the current bus service followed by 37% who were fairly dissatisfied, 22% were neither satisfied nor dissatisfied and 2% were very dissatisfied (Figure 4). The same percentage (39%) of respondents dissatisfied and very dissatisfied with the service, and 22% of the respondents were indifferent (neither satisfied nor dissatisfied). This finding clearly showed an issue where only 39% of users were satisfied with the public transportation service in Kerian District.

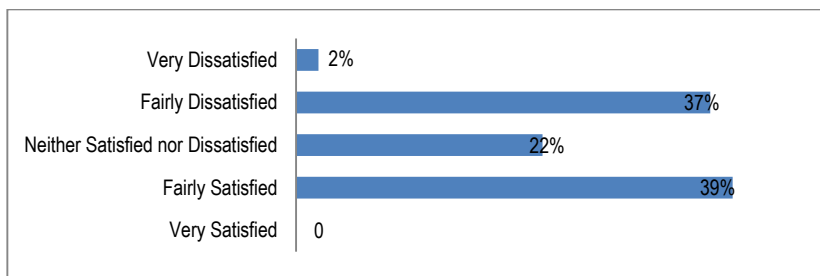


Figure 4: Overall Public Bus Passengers Satisfaction

The study on age gap between younger and older users showed that the younger generation was ready to use intelligent public transportation system compared to the older generation. The details analysis on age gaps are showed in the Tables 7 and 8.

Table 7: Generation Gap between young and elder citizen in anticipation of public bus improvement

Public Bus Service Improvement	Respondent Anticipation	Analysis
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	15 – 45 years old	Above 46 years old	
Clean and comfortable bus with air conditional system	70.6%	29.4%	High % on the generation gap of users showed the specified need for future improvements on the bus conditions are differing between younger and older generation
Bus ticket is electronic card	90%	10%	90% passengers from the younger generation prefer to use electronic card for future ticketing system. It showed that the younger generation was ready to use intelligent public transport system in the future compared to the older generation.
On time trip from O to D	71.4%	28.6%	The result shows lower % of the expectation on bus punctuality from the older generation. This may be due to that the younger generation used bus services to go workplace while the older generation used it more for leisure and other purposes.
Frequent bus trip	57%	43%	There is low gap between younger and older users' bus trips made and frequency of usage. This result showed that, age was not a main factor determining the frequency needs of bus trips.
Well trained and efficient bus driver	91%	9%	Higher % from the younger generation on anticipation to have well trained and efficient bus drivers showed that the older generation could tolerate with and adapt to the current system.
Bus condition is comfortable (with air conditional system), clean and safe	75%	25%	
Wifi and Television on the bus	82.4%	17.6%	
Bus is not taking standing passengers	80.4%	19.6%	

Table 8: Generation Gap between young and elder citizen in opinion of sustainable public transport

Sustainable Public Transport can be achieved through	Respondent Anticipation		Analysis
	15 – 45 years old	Above 46 years old	
Public bus service is efficient and sustainable when the highway is 6 lane	83.3%	16.7%	In general, there was a greater gap between the younger and older users opinion on what is defined as the sustainable transport system. The results showed that the younger generation demanded on the improvement of public transport service. It can be a reference for the operators and local authorities in planning for the future public transport service and system.
Public bus service is efficient and sustainable when the road is 2 lane of 2 ways	81.8%	18.2%	
Public bus service is efficient and sustainable when there is transportation hub for public transport integration	85.7%	14.3%	
Public bus service is efficient and sustainable when there is bus and taxi lane on the road	82.6%	17.4%	
Public bus service is efficient and sustainable when the AES implemented	94.4%	0.6%	
Public bus service is efficient and sustainable when the ITS implemented	84.2%	15.8%	
Public bus service is efficient and sustainable	71.4%	28.6%	



there are bicycle lane and pedestrian walkway in the city circulation, school and neighbourhood zone			
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**The summary of level of service for public bus in Kerian District is in Tables 9, 10, 11, 12 and 13.**

**Table 9: (LOS) Fixed-route Service Frequency for Kerian Public Bus Service**

BUS ID	Number of Buses	Average Headway	LOS
Route 3	1	<10	A
Route 5	1	<10	A
Route 8	1	15-20	C

**Table 10: (LOS) Fixed-route Hour of Service for Kerian Public Bus Service**

BUS ID	Scheduled first trip	Scheduled last trip	Hour of Service	LOS
Route 3	6.10 am	7.30 pm	12 hours	D
Route 5	6.10 am	7.30 pm	12 hours	D
Route 8	6.00 am	8.30 pm	14 hours	C

**Table 11: (LOS) Scheme for transit speed for Kerian Public Bus Service**

BUS ID	Average speed (km/h)	Maximum speed (km/h)	% of Speed	LOS
Route 3	46.1	73.6	62.64	D
Route 5	26.7	64.8	41.20	E
Route 8	35.6	77.8	46.14	E

**Table 12: Bus Passengers Loading (LOS) Thresholds (Off-peak) for Kerian Public Bus Service**

BUS ID	Passengers per seat	Comments	LOS
Route 3	0.00-0.50	No passenger need to sit next to another	A
Route 5	0.00-0.50	No passenger need to sit next to another	A
Route 8	0.76-1.00	All passengers can sit	C

**Table 13: Bus Service Frequency (LOS) Thresholds (Off-peak) for Kerian Public Bus Service**

BUS ID	Passengers per seat	Comments	LOS
Route 3			
Route 5	31-60	Service available during the hour	E
Route 8			

## 5.0 Discussions and Conclusion

Overall findings showed that Kerian District needed a better public transportation particularly for the public bus service. 68% respondents preferring to use the public bus at least 3 days per week showed the demand of public transportation service was still high. The summary of findings is in the Table 14 below:

**Table 14: Summary of Findings from demand and supply of public transport in Kerian**

Demand (DD)		Supply (SS)	
i.	Generation gap was significant in determining the future demand	i.	Route to Selama has been discontinued
ii.	Older respondents were more inclined to have more frequent trips rather than improvement of the physical condition of the buses.	ii.	LOS of Bus service was grade A/C/D/E
iii.	Occupancy of bus service during off-peak was 80% from 44 sit and 16 standing offered.	iii.	Buses failed to start. Some of the buses have registration numbers starting with AHQ and ACQ.
iv.	Passengers declined to disclose their real income level. For those who were willing to disclose their income, the range on average was between RM400 to RM700.	iv.	Bus layby was not clear and proper drop-off area was not designated
v.	Most of passengers were aware of the frequency of bus trip and the schedule	v.	The overall road network in Kerian District was good given the provision of dual lane and dual carriageway
vi.	Most of the bus stops were with shelters and seating areas.	vi.	The Bus stop was in minimal standard of design
		vii.	Intercity public bus service was good
		viii.	Delays were persistent on bus trips.
		ix.	Door to door services provided by the buses.
		x.	

Overall, the LOS of Kerian District public transport services are in Table 15 below:

**Table 15: Matrix of LOS for Public Transport Services in Kerian**

Criteria	Bus Service (Mark)		
	R3	R5	R8
Fixed-route Service Frequency LOS	A	A	C
Fixed-route Hour of Service LOS	D	D	C
LOS Scheme for transit speed	D	E	E
Passengers Loading LOS Thresholds (Off-peak)	A	A	C
Service Frequency LOS Thresholds (Off-peak)	E	E	E

## CONCLUSIONS

From the findings, adoption of international best practices in public transport in the operation of this service can improve the following;

- i. Improve the cost of local public transport
- ii. Identify long-term of new rolling stock and infrastructure capital investment.
- iii. Plan a comprehensive transportation network across the district and the state.
- iv. Identify new technology in the public transport system

On this basis, it is recommended that:

- i. Introduce a new ticketing system, more ergonomic design of seating and stop buttons, and air conditional system on buses.
- ii. Implement standard design motives and equip stopping points with shelters, curbs, public phones, lighting and a trip schedule information.

- iii. Upgrade the ticket counter layout and enforce the display of the route and fares at the counter and information board.
- iv. Allocate an electronic display monitor at stopping points.
- v. Dedicate lanes for buses and taxis to upgrade the LOS of speed and frequency
- vi. Provide route diversification: (To city/centroid with 30minutes/interval) or (Suburb to suburb/orbital with 1 hour/interval) or (Special/disabled/center to suburb or suburb to center with 2 hour/interval/on demand), a possible demand responsive service can also be provided.
- vii. Provide rolling stock diversification to upgrade the LOS in the public transport system
- viii. Plan for the possibility to integrate the bus service and train service in Kerian District with feeder bus routes from bus stations to train stations.

Public transportation improvements provided at an affordable cost and in effective ways can significantly contribute to the government's strong economic growth agenda and be beneficial to the Kerian District residents. Further details on short term and long term planning will accelerate the overall efficiency and effectiveness of public transportation system.

## Acknowledgement

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