Passenger’s Aspiration towards Sustainable Public Transportation System: Kerian District, Perak, Malaysia

Syahriah Bachok*, Mariana Mohamed Osman, Zakiah Ponrahono

Kulliyah of Architecture and Environmental Design, International Islamic University Malaysia

Abstract

Transportation implies the mobility of activities and goods from all sustainable development key dimensions. Over the past years, more trips of public transportation moves people towards a more sustainable future, by reduce congestion on the roads and increase the efficiency of the road system. The research aims at analysing the passenger’s aspiration and perspective of sustainable public transport measure and focuses on the evaluation Malaysia rural bus services. Methods of On-board passenger survey and adoption of Geographical Information System (GIS) / Global Positioning System (GPS) used to collect the primary data.

Keywords: Sustainable transportation; sustainable transport indicator; transport planning; sustainable transportation dimension

1. Introduction

Good cities need efficient public transportation. It facilitates community to have access for many activities that contribute to individual and public wellbeing. It provides accessibility to people who cannot drive or could not afford to drive. This paper consists of literature reviews, data analysis and findings of public transport study in the District of Kerian, Perak Darul Ridzuan (Figure 1, 2 and 3). The research aims at analyzing the need for basic transportation in a rural area of Perak Darul Ridzuan. The current issues on public transport are highlighted and analyzed to recommend the new system to improve public

* Corresponding author. Tel.: +0-000-000-0000 ; fax: +0-000-000-0000 .
E-mail address:.
transportation. Under the Perak Amanjaya Development Plan, public transport systems will be a focus in transportation planning. The moves towards increasing the accessibility and efficiency of public transport through improvements of the quality services and the integration of government-Non-Government Organizations responsibility in public transport development and planning are the two of the Key Result Areas (KRA).

2. Literature Review

Public transportation is a gateway to sustainable accessibility system. Apart from that, an efficient public transportation services enhance personal economic opportunities, save fuel, provide economic opportunities, save money and reduces the environmental impacts. According to Rohana et. al (2012), the move toward a sustainable transport system closely related to the relationship between satisfaction and 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, inconvenience of fleet, low passenger trips and long waiting time (J. Kenworthy, 2006, p.75, Christy and Adjo, 2005, Zegras,2005, Abd. Rahim and Nor Ghani, 2004, Litman, 2007, Banister (2000) cited in Nur Shazwani et. al,2012, Whitmarsh et. al,2007 and A.Hull, 2005). According to Suwardo, Madzlan Napiah, and Ibrahim Kamaruddin (2008) a large number of trips produced can increase the traffic together with the low growth of road length and the inadequate facility of public transportation. Hence, the alternative of using public transportation can reduce the traffic volume and solve the traffic congestion. Public transportation system includes all multiple occupancy vehicles services designed to transport people/customers on local and regional routes and their sub-systems. It is transportation provided either by van, bus, taxi, or rail or other conveyance, privately or publicly owned, providing their services to the public general or special service (Schwarcz, 2003). In order to provide appropriate bus service, some indicators to examine the effectiveness of the bus service applied (Suwardo, M. Napiah, and I. Kamaruddin, 2007, 2008(b) & 2009). In practice, there are standards (Table 1, 2, 3, 4 and 5) for Level of Service (LOS) of public bus operation (Suwardo, M. Napiah, and I. Kamaruddin, 2007 and 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, Amira 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 at 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.5
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. Research Objectives

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

4. Methodology

The data collected through a series of on-board survey. On-board survey is where the observation of bus route conducted for name and distance of bus stop identification or others point of stop. An enumerator ride the bus to record passengers’ boarding or alighting at/or between stops and exclude him/herself as passenger. Its continuous tasks between the two terminals (start and end points) during the bus operating hours, but not necessarily the enumerator ride the same bus. An enumerator assigned to read and record the GPS of passengers’ access and egress points. The bus speed also recorded using the GPS apps that synchronized with the satellite mobile. The survey conducted from 6 November 2012 to 10 November 2012 with the target of 100 convenience sampling unit of on-board passengers due to mobility and logistics reasons.

5. Limitations

Despite the adaptable of methodology to different case study, there are some important limitations. The findings from this study are subjected to the data collected according to the specific time. Survey was conducted during the offpeak of public transport services. Findings can be different if longer survey period is conducted, survey is conducted during peak hours, more allocation on funding to do on-board survey in multiple times and equip with more numbers of enumerators. However taking into consideration all the above issues, generalisation on current issues and proposals can be done to Kerian District and to an area with similar characteristic of Kerian.
6. Findings

Three primary bus service route (Figure 1, 2 and 3) provided by the Red Omnibus Sdn. Bhd is the case study. The data recorded during the on-board survey is in the GIS route map that attached with the attribute GPS data table on it (Figure 2, 3 and 4). There are 5 possible points along route 3 to be proposed as the bus stop location. Along route 5, there are 7 points identified as a potential point for the bus stop location. For route 8, there are 15 points of potential bus stop location determined using the number of passenger access and egress.

![Fig. 1. Route 3 Bagan serai – Kuala Kurau passengers drop point map](image)
Fig. 2. Route 5 Parit Buntar-Tanjung Piandang passengers drop point map
Fig. 3. Route 8 Parit Buntar-Taiping passengers drop point 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               | Bagan Serai- Kuala Kurau        |           |           |               |               |                 |
|                 | Bagan Serai- Tanjung Piandang  |           |           |               |               |                 |
|                 | Parit Buntar- Kuala Kurau      | RM1.00    | RM5.20    | 13 km         | 98 km         | Every 45 min or 70 min |
|                 | Parit Buntar- Tanjung Piandang |           |           |               |               |                 |
|                 | Parit Buntar- Taiping          |           |           |               |               |                 |

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

Fig. 4. Overall Public Bus Passengers Satisfaction

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

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

| Public Bus Service Improvement | Respondent Anticipation | Analysis |
|--------------------------------|-------------------------|----------|
| Clean and comfortable bus with air conditional system | 70.6% | 29.4% | Greater % on age/generation gap between younger and elderly users showed that the future improvement on the bus conditions and services are needed. |
90% passengers from younger generation prefer to use electronic card for future ticketing system. This result show that younger generation more ready to use intelligent public transport system in future.

The result shows lower % of expectation on bus punctuality from older generation. This may due to reason of younger generation is using bus service to work compared to elder generation who are retiree and used it more for leisure purposes.

There is not much gap between younger and older users on frequency usage of the bus trip. This result show that, age is not a main factor towards frequency needs on bus trip.

Greater % from younger generation on anticipation to have well trained and efficient bus driver shows that elder generation just adapt with the current system.

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                                                                 |
|-------------------------------------------------------|-------------------------|--------------------------------------------------------------------------|
| Public bus service is efficient and sustainable when the highway is 6 lane | 83.3% 16.7%             | In general, there is greater gap between the younger and older users opinion on what defines the sustainable transport system. This results show that younger generation demands on the improvement of public transport service and can be as reference for the operators and |
| 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 | 94.4% 0.6%             |                                                          |
AES implemented
Public bus service is efficient and sustainable when the ITS implemented
Public bus service is efficient and sustainable there are bicycle lane and pedestrian walkway in the city circulation, school and neighbourhood zone

The summary of level of service for public bus in Kerian is in Table 9, 10, 11, 12 and 13.

Table 9. (LOS) Fixed-route Service Frequency

| 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

| 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

| 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)

| 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)

| BUS ID  | Passengers per seat | Comments                           | LOS |
|---------|---------------------|------------------------------------|-----|
| Route 3 |                    |                                    |     |
| Route 5 | 31-60               | Service available during the hour   | E   |
| Route 8 |                    |                                    |     |
7. Discussions and Conclusion

Overall findings show that the Kerian district needs a better public transportation particularly for the public bus service. 68% respondents prefer to use the public bus at least 3 days per week shows the demands of public transportation service is 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)                                                                 |
|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| There were gap in the age of users and this generation gap is               | Route to Selama has been discontinued                                         |
| significant in determining the future demand of bus service.                | LOS of Bus service is grade A/C/D/E                                             |
| Older respondents were more incline to have more frequent trips             | During the survey, there were three occasions where the buses failed to start.|
| rather than improvement of the physical condition of the buses              | These buses need proper and continuing maintenance and some may need to be    |
| (better exterior and interior of the buses and installation of air           | overhaul. Some of the buses have registration number started with AHQ and     |
| conditional system).                                                       | ACQ which showed that these buses were quite old.                            |
| Occupancy of bus service during off-peak was 80% from 44 sit and 16 standing | Bus layby was not clear and proper drop-off area was not designated by the     |
| offered. This clearly shows that there is high demand for public transport   | bus operators. Most of the drivers would stop their passengers anywhere on the |
| even though the survey was conducted during off-peak hour                   | roadside. This can be dangerous and can create accident to road users.        |
| Passengers declined to disclose their real income level. For those who are  | The overall road network in Kerian is good with dual lane and dual carriageway |
| willing to disclose their income, the range on average is between RM400 to  | The Bus stop is in minimal design with minimal shelter.                       |
| RM700. This showed that the users were considered from low income group      | There is not protection for the users during heavy rain.                      |
| because the national average for low income (poor) is RM500.                | Intercity public bus service is good                                           |
| Most of passengers were aware of the frequency of bus trip and the schedule | Based on site observation, there is delay on bus trip. Some of the buses     |
| and they usually did not refer to the bus schedule.                         | were delay more than 30 minutes and in one instances, the bus was delay for    |
| Most of the bus stops were with shelter and seating area.                   | more than 1 hour.                                                            |
|                                                                             | There is a door to door service by the buses along the route trip. This may   |
|                                                                             | be due to the takeoff and alight point were not designated by the bus         |
|                                                                             | operators.                                                                   |

Overall, the LOS of Kerian public transport services are in the 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   |
8. Conclusion

From the findings, adoption of international best practices in public transport in the operation of this service can improve the following:
- Improve the cost of local public transport
- Identify long-term of new rolling stock and infrastructure capital investment.
- Plan a comprehensive transportation network across the district and the state.
- Identify new technology in the public transport system

On this basis, we recommend that:
- Upgrade the public buses with new ticketing system, more ergonomic design of seating and stop button and air conditional system.
- Redesign the bus stop with standard design motif and equip with shelter, curb, public phone, lighting and a trip schedule information.
- Upgrade the ticket counter layout and enforce the display of the route and fares at the counter and information board.
- Allocate an electronic display monitor of the route and trip timetable at the bus station.
- Dedicate lanes for bus and taxi to upgrade the LOS of speed and frequency of public transportation system in Kerian.
- Provide route diversification to offer more comprehensive and excellent public transport system that cater all level of public transport user according to route:
  a) To city/centroid with 30minutes/interval
  b) Suburb to suburb/orbital with 1 hour/interval
  c) Special/disabled/center to suburb or suburb to center with 2 hour/interval/on demand
- Provide rolling stock diversification to upgrade the LOS in the public transport system
- Plan for the possibility to integrate the bus service and train service in Kerian with feeder bus route from bus stations to train stations

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

Acknowledgements

This study was undertaken with financial support from the Institut Darul Ridzuan (IDR).

References

Abd Rahim Md Nor & Nor Ghani Md Nor, 2004, Empowering Public Transport for Urban Environmental Management, Malaysian Journal of Environmental Management 7 (2006): 93 – 111
A.Hull, 2005, Integrated Transport Planning in the UK: From Concept to Reality, Journal of Transport Geography 13, Page 318-328.
Christy Mihyeon Jeon and Adjo Amekudzi, 2005, Addressing Sustainability in Transportation Systems: Definitions, Indicators and Metrics, Journal of Infrastructure Systems, Page 31-50.
Herman Orth, Robert Dorbritz and Ulrich Weidmann, 2011, Public Transport Capacity and Quality- Development of an LOS-Based Evaluation Scheme, 11th Swiss Transport Research Conference.
Institut Darul Ridzuan, Perak Amanjaya Development Plan.
Laporan Penemuan Rancangan Tempatan Kawasan Pentadbiran Majlis Bandaraya Kerian, 2020
J. Kenworthy, 2006, The Eco-City: Ten Key Transport and Planning Dimensions for Sustainable City Development, Environment & Urbanization Copyright © 2006 International Institute for Environment and Development (IIED), Vol 18(1): 67-85. DOI: 10.1177/095624706063947. Available at www.eau.sagepub.com

Lorraine Whitmarsh, Alex Haxeltine and Martin Wietschel, 2007, Sustainable Transport Visions: Expert and Non-expert Stakeholder Perspectives on Sustainable Transport, International Conference on Whole Life Urban Sustainability and its Assessment, M. Horner, C. Hardeastle, A. Price, J. Bebbington (Eds), Glasgow.

Madzlan Napiah, Amirah Suriati Ahmad Farid and Suwardo, 2010, Trip Productivity Evaluation Of Bus Service: Medan Kidd Bus Station, MUTRFC 2010.

Nur Shazwani Rosli, Sharifah Adibah Alyah Syed Adnan, Farah Diyanah Ismail and Abdul Azeez Kadar Hamssa, 2012, A Theoretical Review on Sustainable Transportation Strategies: The Role of Park and Ride Facility as a Generator of Public Transport Mode Shift, <www.europh.info/pdf/2012papers/DAY2/session3/S3/S3-3-P2.pdf>

Rohana Kamaruddin, ‘Ismah Osman and Che Anizaliana Che Pei, 2012, Customer Expectations and its Relationship Towards Public Transport in Klang Valley, Journal of asian Behavioural Studies, volume 2, number 5, april 2012

Suwardo, M. Napiah and I. Kamaruddin 2008 (a), Review on Motorization and Use of Public Transport in Perak Malaysia: Realities and Challenges, 2nd International Conference on Built Environment in Developing Countries (ICBEDC 2008).

Suwardo, Madzlan B. Napiah, and Ibrahim B. Kamaruddin, 2008(b), Punctuality and Expected Waiting Time of Stage Buses in Mixed Traffic, Jurnal Transportasi Vol.8 Edisi Khusus no.3 Oktober 2008: 213-226.

Suwardo, Madzlan B. Napiah, and Ibrahim B. Kamaruddin, 2009 (c), On-Time Performance and Service Regularity of Stage Buses in Mixed Traffic, International Journal of Business, Economics, Finance

Stacey Schwarcz, 2003, Public Transportation in Kuala Lumpur, Malaysia, MST. Available at http://web.mit.edu/mtransgroup/reports/reports%20pdf%203-25-04/Schwar%202002,%20Public%20Transport%20KL.pdf

Todd Alexander Litman, 2007, Urban Transportation Management, Chapter 9 Handbook on Urban Sustainability, N. Munier (editor), Springer. Page 353-387.

Zegras, C. 2005, Sustainable Urban Mobility: Exploring the Role of the Built Environment. Unpublished doctoral dissertation, Department of Urban Studies and Planning, Massachusetts Institute of Technology, September, available at: http://web.mit.edu/czegras/www/Final%20VersionV3.pdf