Evaluating the quality of services for bus performance in Alor Setars

S Norhisham¹ ², M F A Bakar¹, A Syamsir¹, N Zaini¹, N L Baharin³, N S M Shkuri⁴ and N M Saad⁵

¹College of Engineering, Universiti Tenaga Nasional, 43000 Kajang, Selangor, Malaysia.
²Institute of Energy Infrastructures (IEI), Universiti Tenaga Nasional, 43000 Kajang, Selangor, Malaysia.
³College of Business Management & Accounting, Universiti Tenaga Nasional, 43000 Kajang, Selangor, Malaysia.
⁴College of Energy Economics & Social Sciences, Universiti Tenaga Nasional, 43000 Kajang, Selangor, Malaysia.
⁵College of Computing & Informatics, Universiti Tenaga Nasional, 43000 Kajang, Selangor, Malaysia.

Corresponding author’s email: shuhairy@uniten.edu.my

Abstract. Traffic congestion is one of the issues raised as the development and urbanization moving forward. Bus services still considered as an public transport option to move from one location to another. Since 1957, bus services have been a primary selection not just a big cities like Kuala Lumpur and Georgetown as well as small town in like Alor Setar, Kota Bahru and others. As the demand increase year by year, the quality of service is expected to be improved as well. Recently, public transport in small cities in Malaysia also faced a huge competition with E-hailing services such as Grab and MyCar. Therefore, these paper is to determine the service quality of bus performance in Alor Setar, Kedah. These studies were conducted in April 2019. Service quality data have been taken at Terminal Shahab Perdana, Alor Setar. Transit Capacity and Quality of Service Manual (TCRPM) has been stated as a specific guidelines and key indicators to determine the quality service of bus performance in designated area. There were four specific areas would be focused in these studies such as service frequency, hours of service, factors of passenger load, on time performance. Based on the results, it shows that only passenger load factor has classified as A quality of service in these studies. The hours of services and on time performance were classified as Class D while the service frequency was classified as Class F. The overall quality of service in Alor Setar, Kedah is classified as Class D which consider as moderate as there is a lot of issues should be addressed. Some improvement on these three attributes should be made to increase the quality of service. Authorities also could use the outcome of these studies to determine and identifies the significant improvements for bus service on these areas.
1. Introduction
Nowadays, Malaysia is one of the fastest growing regions in Southeast Asia. Malaysia has long aspired to join the ranks of developed countries like Singapore, Japan, and others. Traffic congestion is one of the issues raised as development and urbanisation moves forward. Public transport, especially bus services, are still considered the option to travel from one place to another. Independent bus services have been the main choice of transport not just for big cities like Kuala Lumpur and Georgetown but small towns like Alor Setar, Kota Bahru and others. The government should not only focus on rectifying bus services in big cities but small towns should be focused as well [1,2]. The government has a huge commitment to provide more convenient bus services throughout Malaysia [1]. In 2012, statistics showed that approximately 1.5 million trips are made in Klang Valley daily of which 30% are represented by public transport usage daily [3,4]. Hence, it is important to evaluate the quality of public transport services in these countries [5]. Growing populations, especially in urban areas causes increasing of daily movement on the road using both private vehicles and public transportations [6]. As the demand increases, demand for quality of service is expected to be increased as well [6]. The government has started the initiative to rectify quality of bus service outside Kuala Lumpur by taking over on specific areas through selected operators.

Globalisation and technology provide a lot of benefits to people. Therefore, bus operators engage with the latest technology to improve the quality of bus performance by using intelligent transportation systems to solve traffic congestion problems [7], development of expert system to analyse quality of bus services and integrated systems to identify real time information of departure and arrival of buses [8]. There are a few issues raised by passengers and users such as service quality, punctuality, and driver behavior etc. [4]. Trustworthiness between drivers and users also could be other issues which leads to negative perceptions among themselves [9]. Recently, the government has initiated several improvements to provide quality service of public transport such as management systems, monitoring, and controlling by Agensi Pengangkutan Awam Darat (APAD) [9]. Normally, passengers and users always expect a short waiting time of bus arrivals. Unfortunately, it could not be done by operators, as short times require frequency of service and the operations would increase as well [10]. As a service provider, it is necessary to identify and acknowledge customer perceptions and their demands [11,12]. The overall performance is a significant aspect that should be addressed by operators and authorities. The quality of service for specific areas could be summarised based on overall performances [13].

Alor Setar is the capital state of Kedah Darul Aman, Malaysia. Alor Setar is located in the northern area of the peninsular of Malaysia and it is under the administration of Alor Setar City Council [14]. There is no specific operator that currently operates a bus service in Alor Setar at Terminal Shahab Perdana, Mergong. The quality of bus services should be measured by operators regularly [15,16]. Passengers have always addressed the same issues for the past 10 years such as lack of schedule information, punctuality of drivers, and no supervision of management operators [17,18]. The government should also improve terminal facilities especially in small towns like Alor Setar and Kota Bahru as well as improving the safety in terminals [19,20]. Bus services must provide good quality services as there is a lot of competition with e-hailing services such as MyCar and Grab recently. These e-hailing services provide a lot of advantages as the service provided is for a specific customer only and customers could simply choose specific pickup and drop-off points upon request [21]. There was a report stated that the quality of services can be considered as passenger perception as the quality of service should include the quality of transit service [22]. Passengers and users in Klang valley always face daily problems such as poor time management of bus services (hours of service), overcrowding of passengers (passenger load factors) and limited coverage as growth development is moving rapidly (coverage area) [23].

Due to low demand by passengers and users, operators would decrease the service frequencies on their schedule to reduce operation costs. There were few routes which only have two trips daily. Therefore, quality of good service would help to improve and produce good customer perception on the services given. The service hours is also one of the important aspects to determine service quality of bus services as service hours would affect the daily operations whereby the longest operation is from 4:00 am to 12:00 am daily.
The service hours are not the same for each route as it is totally based on the total demand [15]. Based on previous studies, it was shown that passengers only could feel comfortable if they got a seat [24]. Behavioural intentions, involvement, and overall satisfaction would be a key indicator to measure the service quality of bus performance qualitatively [25]. Comfort is also one of the important areas to measure the quality of service and it would influence passenger satisfaction with bus transit significantly [26,27]. Passenger evaluations about all attributes such as on-time performance, service hours, passenger load factors, and service frequency could be considered as subjective measurement of service quality (qualitative measurement). Meanwhile measurement continent on bus operators for all attributes could be considered as objective measurement of service quality (quantitative measurement) [28]. Therefore, this paper is to determine the service quality of bus performance in Alor Setar, Kedah.

2. Methodology

This study covered the steps described to determine the service quality for bus services in Alor Setar, Kedah. The study was conducted in April, 2019. Figure 1 shows the area covered in this study. Service quality data was taken at Terminal Shahab Perdana, Alor Setar. There were several operators that had operated bus services in these areas based on different locations such as MyBas, Mara Liner Sdn. Bhd., Kuala Kedah Transport Co Sdn. Bhd. also known as the HBR group, and Redbus Sdn. Bhd. All buses in these routes used different size of buses based on different routes. There were 13 routes operating bus services in this terminal. These routes were My Bas (UUM, Kangar via Jitra and Kangar via Ayer Hitam), Mara Liner Sdn. Bhd. (Baling, Yan - Sg. Petani, Kuala Nerang, Langgar - Sungai Tiang, Tokai – Sungai Tiang and Sik), Kuala Kedah Transport Co Sdn. Bhd., (Kuala Kedah and Kuala Nerang) and Redbus Sdn. Bhd (Sungai Petani), Intercity buses in Alor Setar connect the whole district in the state of Kedah as the state is considered a small state in Malaysia.

Transit Capacity and Quality of Service Manual (TCRPM) has been referred as the specific guidelines and key indicators to determine the quality of service of bus performances in the designated area. Four specific areas have been focused in this study such as hours of service, service frequency, passenger load factors, and on time performance. The hours of service for the bus service for that particular route were obtained from the service operator and it was considered from the first trip of services until the last trip of services. It was also obtained through the website updated by Land Public Transport Commission (SPAD)

Figure 1. The area covered in The State of Kedah
for all routes. Hence, comparing the hours of service between the service operators, the quality of service performance can be obtained as shown in Table 1.

**Table 1. Quality of Services (QOS) for hours of services (Sources: Transit capacity and quality of service manual [17])**

| Quality of Services | A   | B   | C   | D   | E   | F   |
|---------------------|-----|-----|-----|-----|-----|-----|
| Hours of Service (Hr) | 19 - 24 | 17 - 18 | 14 - 16 | 15 - 12 | 11 - 4 | 0 - 3 |

The analysis gave a quality of service for five routes used by Rapid Kuantan for the passenger load factor. Quality of Service could be determined based on specific variables. The method to determine the service frequency of the bus service is by using a bus schedule timetable in order to evaluate the average time between the intervals of the bus departure times. The bus schedule timetable will be obtained from the counter at the station where the route begins. Table 2 shows quality of service (QOS) for service frequency to classify the quality of service based on the average departure time between intervals.

**Table 2. Quality of Services (QOS) for service frequency (Sources: Transit capacity and quality of service manual [17]).**

| Quality of Service | A   | B   | C   | D   | E   | F   |
|---------------------|-----|-----|-----|-----|-----|-----|
| Average Departure Interval (min) | <10 | 10 – 14 | 15 – 20 | 21 – 30 | 31 – 60 | >60 |

As per the journey, the average passenger load will be counted. The number of passengers was divided with the number of seats to become a load factor. This analysis will give the quality of service for five different routes in Kuantan for the load factor. Passenger load was taken on weekdays only. The Load Passenger was calculated by dividing the total passenger selected time and the total seat provided in each bus. Table 3 shows quality of services based on load passenger factor.

**Table 3. Quality of Services (QOS) for load factor (Sources: Transit capacity and quality of service manual [17]).**

| Quality of Service | A   | B   | C   | D   | E   | F   |
|---------------------|-----|-----|-----|-----|-----|-----|
| Load Passenger (Passenger/seat) | 0.00 – 0.50 | 0.51 – 0.75 | 0.76 – 1.00 | 1.01 – 1.25 | 1.26 – 1.50 | >1.50 |

On-time performance percentage was measured by the degree of the bus departure based on scheduled times. The measurement was conducted at Hentian Bandar, Kuantan. On-time performance was measured when the buses did not arrive and were late. The users usually felt uncomfortable when they had to hurry outside to meet the early arrival time. In certain cases, early arrival may also result no-show of passengers. Table 4 shows the classification of service quality based on percentage of on-time performance.

**Table 4. Quality of Services (QOS) for on-time performance percentage (Sources: Transit capacity and quality of service manual [17]).**

| Service Quality | A   | B   | C   | D   | E   |
|-----------------|-----|-----|-----|-----|-----|
| On Time Performance Percentage (%) | 95 - 100% | 90 - 94% | 80 - 89% | 70 - 79% | < 70% |
3. Results

The data were collected in these studies which have four specific areas as mentioned in the methodology section. The service hours were recorded starting from first trips of the service until the last trip of that day. Table 5 shows the summary for hours of service for all routes. The result shows that the average of QOS for service hours is QOS D. There are three routes that had the best service quality of C which were the route Kangar (Ayer Hitam) and Kangar (Jitra) and Kuala Nerang which were operated by MyBas Sdn. Bhd. The first trip departed at 6:00 am and the last trip departed at 8:15 pm. All routes operated by Maraliner could be classified as class E because there were only a few trips daily as per the schedule in Table 6.

| Route                | First Trip | Last Trip | Hours of Services | LOS | Operator   |
|----------------------|------------|-----------|-------------------|-----|------------|
| Kangar (Ayer Hitam)  | 6.15 AM    | 8.15 PM   | 14.00             | C   | My Bas     |
| Kangar (Jitra)       | 6.00 AM    | 7.45 PM   | 13.45             | C   | My Bas     |
| UUM                  | 6.30 AM    | 7.00 PM   | 12.30             | D   | My Bas     |
| K.Kedah              | 6.30 AM    | 7.30 PM   | 13.00             | D   | HBR Group  |
| K. Nerang            | 6.15 AM    | 8.00 PM   | 13.45             | C   | HBR Group  |
| Baling               | 6.00 AM    | 5.15 PM   | 11.15             | E   | Mara Liner |
| Yan/ Sg. Petani      | 6.30 AM    | 5.30 PM   | 11.00             | E   | Mara Liner |
| K. Nerang            | 6.30 AM    | 7.00 PM   | 12.30             | D   | Mara Liner |
| Langgar /Sg. Tiang   | 6.30 AM    | 5.15 AM   | 10.45             | E   | Mara Liner |
| Tokai / Sg. Tiang    | 7.45 AM    | 4.45 PM   | 9.00              | E   | Mara Liner |
| Bkt Raya/ Sik        | 6.30 AM    | 5.00 PM   | 10.30             | E   | Mara Liner |
| K.Ketil/ Kulim       | 7.30 AM    | 5.00 PM   | 9.30              | E   | Mara Liner |
| Sg. Petani           | 6.30 AM    | 7.30 PM   | 13.00             | D   | Red Bus    |
| **Average**          |            |           | **12.30**         |     | **E**      |

Service frequency was determined for all routes in this study. Table 5 shows the number of intervals in all routes for the respective number of minutes between intervals. The level of service for service frequency was checked by using Fixed Route Service Frequency LOS. The average of QOS for service frequency is QOS F. There are two routes that reached a service quality classification of E which are route Kuala Kedah and Sungai Petani only.

Passenger load factor was determined based on number of passengers who got seats on the bus divided by numbers of seats provided in the bus. Data collection for the number of passenger seated on the bus was done in a one-time frame only. Table 7 shows load factors summary for Alor Setar routes. The data for the return route was also recorded. Finally, average passenger load factor was translated to percentage to analyse the quality of service. Based on Table 7, it shows that the average load factors for Alor Setar routes was 0.22 which was classified as an A service quality for these attributes.

On-time performance was compared with the real schedule to get the classification on the departure status of buses and to record whether they were on time departure, early departure, late departure or no departure. Table 8 shows the on-time performance percentage details for all routes. As a result, it shows that only Kangar (Ayer Hitam) and Yan/ Sungai Petani achieved the classification of quality of service A and most of the other routes achieved QOS E only where less than 70% of buses departed exactly based on the schedule provided by the operator at Terminal Shahab Perdana.
Table 6. The Quality of Service for Service Frequency for all routes.

| Route                        | Minute | Average Interval | LOS | Operator |
|------------------------------|--------|------------------|-----|----------|
| Kangar (Ayer Hitam)         | 8      | 105 F            | F   | MyBas    |
| Kangar (Jitra)              | 11     | 75 F             | F   | MyBas    |
| UUM                         | 5      | 150 F            | F   | MyBas    |
| K. Kedah                    | 13     | 60 F             | E   | HBR Group|
| K. Nerang                   | 2 1 1 3 2 1 1 | 63.36 F         | F   | HBR Group|
| Baling                      | 3 1 1 1 2 1 | 123.33 F        | F   | Mara Liner|
| Yan/Sg. Petani              | 1 1    | 165 F            | F   | Mara Liner|
| K. Nerang                   | 3 1 1 1 2 1 | 123.33 F        | F   | Mara Liner|
| Langgar/Sg. Tiang           | 1 1    | 215 F            | F   | Mara Liner|
| Tokai/Sg. Tiang             | 3      | 180 F            | F   | Mara Liner|
| Sik                         | 1 1    | 210 F            | F   | Mara Liner|
| Kulim                       | 1 2    | 200 F            | F   | Mara Liner|
| Sg. Petani                  | 13     | 60 F             | E   | Red Bus  |
| Average                     |        | D                |     |          |

Table 7. Summary of Load Factors for Alor Setar Routes.

| Route                        | Passenger Load Factors | Quality of Service |
|------------------------------|------------------------|--------------------|
| Kangar (Jitra)              | 0.26                   | A                  |
| UUM                         | 0.29                   | A                  |
| Kuala Kedah                 | 0.18                   | A                  |
| Kuala Nerang                | 0.15                   | A                  |
| Average                     | 0.22                   | A                  |

Table 8. On-Time Performance Percentage for all routes

| Route                        | Total Actual Departure | No. of On Time Departure | On-Time Departure Percentage (%) | Quality of Service |
|------------------------------|------------------------|--------------------------|---------------------------------|--------------------|
| Kangar (Ayer Hitam)         | 9                      | 9                        | 100.0                           | A                  |
| Kangar (Jitra)              | 12                     | 10                       | 83.3                            | C                  |
| UUM                         | 10                     | 5                        | 50.0                            | E                  |
| K. Kedah                    | 14                     | 1                        | 7.1                             | E                  |
| K. Nerang                   | 14                     | 7                        | 50.0                            | E                  |
| Baling                      | 4                      | 3                        | 75.0                            | D                  |
| Yan/Sg. Petani              | 3                      | 3                        | 100.0                           | A                  |
| K. Nerang                   | 5                      | 3                        | 60.0                            | E                  |
| Langgar/Sg. Tiang           | 4                      | 1                        | 25.0                            | E                  |
| Tokai/Sg. Tiang             | 4                      | 1                        | 25.0                            | E                  |
| Sik                         | 4                      | 2                        | 50.0                            | E                  |
| Kulim                       | 4                      | 2                        | 50.0                            | E                  |
| Sg. Petani                  | 14                     | 4                        | 28.6                            | E                  |
| Average                     |                        |                          | D                               |                    |

Table 9 shows the quality of service score versus quality of service attribute. Overall quality of service could be determined based on quality of service based on attributes. Based on Table 9, it shows that hours of service, service frequency, passenger and on-time performance have quality of service of D, F, A and D respectively.
Table 9. QOS Score vs. QOS Attributes

| Attributes             | QOS | QOS Score | Mean QOS | Overall QOS |
|------------------------|-----|-----------|----------|-------------|
| Hours of Service       | D   | 2         |          |             |
| Service Frequency      | F   | 0         |          |             |
| Passenger Load         | A   | 5         |          |             |
| On Time Performance    | D   | 2         | 2.25     | D           |
| Total                  |     | 9         |          |             |

4. Conclusion

This study was aimed to determine the quality of service for bus performance in Terminal Shahab Perdana, Alor Setar. This study was done by using rating for service method which was based on Transit Capacity and Quality of Service of Manual (TCPRM). There were a total of 13 routes operating in this terminal including few routes to another state of Perlis. Since there was less demand by passengers to Alor Setar town, most of the operators connected their routes with other districts in the state of Kedah such as, Baling, Sungai Petani, Sik, and Pendang. Four different attributes have been selected in this study which are hours of service, passenger load, service frequency, and on-time performance. Based on the results, it showed that only passenger load factor was classified as A quality of service in this study. These three attributes should be improved in order to improve the quality of service. On-time performance also should be addressed by authorities and operators as there were several punctuality issues carried out by several bus drivers on few routes. In conclusion, the overall quality of service for the Kuantan route has been classified as a D class, which is considered as moderate for a small city like Alor Setar and there are some upgrading of quality of bus services that should be addressed in several areas. The outcome of this study could be used as a reference by operators to evaluate their on-site operation. Authorities also could use the outcome of this study to determine and identify the significant improvements needed for bus services in these areas. Further studies in this areas is highly needed in the future.

References

[1] Yao, L., Siali, F., Darun, M. R., & Ismail, M. F., 2014. Service quality and customers satisfaction: Rapid Kuantan In Kuantan Route, Malaysia. Proceedings of SOCIOINT-14- International conference on social science and humanities. 8-10 Sept.
[2] Shaaban, K., & Khalil, R. F. 2013. Investigating the customer satisfaction of the bus service in Qatar. Procedia - Social and behavioral sciences, 104(1), 865–874. doi: 10.1016/j.sbspro.2013.11.181.
[3] Margaret, J. D. L.,(2018). Spatial dynamics of tour bus transport within urban destinations. Tourism Management, 64, 129-141.
[4] Calvo, F., Eboli, L., Forciniti, C., & Mazzurall, G. 2018. Factors influencing trip generation on metro system in Madrid Spain), Transportation research part D transport and environment, 67:156-172.
[5] Adebola, O., Samuel, O., Feyisola, A., & Enò, O. 2014. An assessment of public transport security and safety: An examination of Lagos Bus Rapid Transit (BRT). Nigeria. Journal civil and environment research, 6(4), 105–117.
[6] Aziz, A., & Mohamad, J., 2013. Urban public transport in Penang: Some public considerations, Conference of eastern asia society for transportation studies, 9:1-9.
[7] Wahjono I. S., (2010). Bisnis modern. Graha Ilmu Publisher, Yogyakarta, Indonesia.
[8] Suh W, Park S, and Lee E 2011. Fault tolerant intelligent transportation systems with an agent. In the 3rd international conference, advanced computer science and information technology, Seoul, Korea: 16-25. Available online at: http://link.springer.com/content/pdf/10.1007/978-3-642-24267-0.pdf#page=28
[9] Saberi, M., Ali Zockaie, K., Feng, W., & El-Geneidy, A. 2013. Definition and properties of alternative bus service reliability measures at the stop level. Jurnal pengangkutan awam, 16(1), 97–122.

[10] Vien, L. L., Bagheri, Y., & Sadullah, A. F. B. M. 2010. Analysis of headways on passenger loads for public bus services: Case study of Penang Island, Malaysia. Jurnal penyelidikan saintifik Eropah, 45(3), 476–483. http://www.eurojournals.com/ejsr.htm.

[11] Azadi, M., Shabani, A., Khodakarami, M., & Farzipoor, S. R. 2015. Reprint of Planning in feasible region by two-stage target-setting DEA methods: An application in green supply chain management of public transportation service providers, Transportation research part E: Logistics and transportation review, Elsevier, 74:22-36.

[12] Wahjono, I. S., Bachok, K. Y. M., Marina, A., & Mochklas, M., 2017. The importance of MPIS on RK for further ITS implementation in Malaysia, International journal of advanced and applied science 4(9):53-6

[13] Chuen, C. O., Karim, R. M., and Yusoff, S., 2014. Mode Choice between private and public transport in Klang Valley, Malaysia. The scientific world journal, 2014:14.

[14] Majid, R., & Samat, N., 2017. GIS Hot Spot Mapping In Theft Of Motorcycle Theft In Alor Setar City, Kedah Darul Aman. GIS & Geomatics Bulletin. 1394-5505: 9-19. (In Bahasa)

[15] Eboli, L., & Mazzulla, G. 2008. A Stated preference experiment for measuring service quality in public transport. Jurnal perancangan dan teknologi pengangkutan, 31(5), 510–521.

[16] Juan, D. O., Rocia, D. O., Eboli, L., & Mazzulla, G. 2014. Heterogeneity in perceptions of service quality among groups of railway passengers. International journal of sustainable technology, 9(8):612-626.

[17] Bekhet, H. A., & Ivy, Y. L. L. 2014. Highlighting energy policies and strategies for the residential sector in Malaysia. Int.J. Energy Econ. Policy, 4(3):448–456.

[18] Soh, K. L., Chong, C. Le, Wong, W. P., & Hiew, Y. H. 2014. Proclivity of university students to use public bus transport service. Comprehensive research journal of education and general studies, 2(2), 24–34.

[19] Ensor, J. D. 2004. Malaysia transport pricing strategies, measures, and policies inception report. Malaysia transport research group Massachusetts Institute of Technology.

[20] Mazzulla, G., & Eboli, L. 2006. A Service Quality experimental measure for public transport Gabrilla. european transport, 34, 42–53.

[21] Ibrahim, N. I., Adji, B. M., & Karim, M. R. 2013. public transport passengers’ perception and demand satisfaction: A case study At Petaling Jaya Municipal District , Malaysia. Dalam Persidangan Kajian Pengangkutan Pertubuhan Asia Timur 9, m.s. 1–13).

[22] Yaakub, N., & Napiah, M. 2011a. Public Transport : Punctuality index for bus operation. World. Academy of science, engineering and technology, (60), 857–862.

[23] Abdullah, A. A., ss2013. Rapidkl bus service in city center , Kuala Lumpur , Malaysia: An epitome of good service? International journal of academic research in business and social sciences, 3(4), 333–349.

[24] Lai, W., & Chen, C., 2011 Behavioral intentions of public transit passengers—the roles of service quality, perceived value, satisfaction and involvement. Transp Policy 18:318–325.

[25] Purba, A., 2015. A study on evaluating urban bus service performance in developing countries: case study of medium - sized cities in Indonesia. Ph.D. dissertation. Yokohama National University.

[26] Eboli, L., & Mazzulla, G. 2012. Performance indicators for an objective measure of public transport service quality. Jurnal Pengangkutan Awam, (51), 1–21.

[27] Rohani, M. M., Wijeyesekera, D. C., & Karim, A. T. A. 2013. Bus operation, quality service and the role of bus provider and driver. Procedia Engineering, 53, 167–178. https://doi.org/10.1016/j.proeng.2013.02.022.
[28] Eboli, L., Forciniti, C., & Mazzulla, G. 2018. Spatial variations of the perceived transit service quality at rail stations. *Transportation research part a policy and practice*. **114**:67-83.

**Acknowledgement**
The authors would like to acknowledge the Innovation Research Management Centre (IRMC), Universiti Tenaga Nasionals.