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THE IMPACT OF ON-TIME PERFORMANCE TOWARDS QUALITY OF URBAN BUS SERVICES: A CASE STUDY IN STATE CAPITALS OF PENINSULAR MALAYSIA

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Abstract

Urbanisation have given significant impact on escalating the traffic volume as the tremendous traffic congestion daily, especially during peak hours in weekdays. The objective of this paper is to assesses the impact of on-time performance towards quality of urban bus services in Malaysia. Therefore, this study was conducted at 11 state capitals in Peninsular Malaysia. The main local bus terminals had been designated in this study. The Transit Capacity and Quality of Service Manual (TCQSM, 2013) was chosen as the guideline used in this study. The results showed that Johor Bahru recorded a total 648 departure daily which considered the highest departure. There were 4 state capitals that recorded more than 80% of overall on-time departure for each route, such as Kuala Terengganu (94.39%), Shah Alam (82.45%,), Ipoh (80.74%) and Kangar (80.06%). The overall quality of services for on-time performance in state capitals of Peninsular Malaysia was classified as QOS D. Based on the study results, several rectifications on bus services in state capitals of Peninsular Malaysia is highly required.

***Keyword**:* sustainable urban bus services, quality of service (QOS), on-time performance, carbon footprint, green energy

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INTRODUCTION

Urbanisation have given significant impact on people's migration from rural to urban area for the last few decades (Farahani et al., 2016). In 2013, world's population passed 7.3 billion and forecasted that the Earth will have 10 billion inhabitants by year 2100 (Irwan et al., 2022). Therefore, the migration process had caused an extreme traffic volume and environmental change as the tremendous movement occurred daily and caused a rapid traffic congestion daily, especially during peak hours in weekdays (Al-Mansob et al., 2022; Chow et al., 2019). Unlike in many developed countries, urban public transport in this country only just reached the development phase as first option by public, not self-sustain and more towards government funded model in which only 20% of people were urban public transport users (Ministry of Transport Malaysia, 2019). Land-use and transport planning inevitably linked to the development of working, people oriented and energy efficient in urban area (Najib et al., 2020). However, the authority is still in the process to improve urban bus services in other state capitals by underlying and implementing a significant policy in identified locations (Minhas et al., 2020). Comparison and differentiation in terms of regulations, policy implementation and bus services performance should be assessed between developing and developed countries (Sotaro et al., 2014).

Malaysia Government via Agensi Pengangkutan Awam Darat (APAD) gave full commitment to improve the quality of urban bus services in Malaysia despite challenges and competitions faced by bus operators in this country (Norhisham et al., 2021; Mohamad et al., 2017). Transportation is categorised under the economic well-being Malaysian Well-Being Index (MWI) component as to evaluate the population quality of life in this country and promoting for balance in every aspect of people's daily life (Rabe et al., 2018). Public transport including bus services is still one of the travel options from one place to another in major cities in this country, especially in Klang Valley (Ramli et al., 2017). Bus performance should be assessed in terms of various key areas, such as quality, effectiveness, reliability, and efficiency of the system (Ponrahono et al., 2017). The authority is highly suggested to deal with various issues that raised continuously by urban stakeholder (Pira et al., 2021). Every public transport has specific attributes that will influence their service performance. The public had emphasised the demand on effective public transportation system, especially bus services to accommodate their daily movement. Passengers had expressed their concerns on the consistency of performance and dependability of the service according to schedule provided in bus terminals (Ngadiman et al., 2020). On-time departure of bus services according to existing schedule would develop a significant trustworthiness by passengers and users towards the public transportation services (Bakar et al., 2022).

The inclination of dependency towards bus services as a main public transport mode has decrease recently as this transportation mode had found less competitive service performance as compared to motorised mode (Shukri et al., 2020). It is reported that the problem on public transportation, especially bus services in this country that caused by current demand (passengers)–supply (operators) which is not well-planned and proper monitoring. Therefore, it required a vigorous and definite solution to mitigate the current problem of urban public transportation in this country (Ponrahono et al., 2018). Quality of services (QOS) rating would be a preference approach to assess the quality of transportation based on specific element and attributes (Georgiou et al., 2021). On-time performance was recognised as one of the main attributes and addressed as reliability of bus services based on the timetable approved by the authority (Rohani et al., 2013). The knowledge of bus performance is essential to be shared between stakeholders as to facilitate better information flow between the authority, bus operators and passengers (Saad, 2016). Punctuality of the services would influence passengers' decision about their daily travel movement from one place to another (Borhan et al., 2019). A previous study stated that on-time performance was highly influenced by the passengers' expectation and perception as users of bus services (Deb & Ahmed, 2018). These attributes would develop a significant trustworthiness towards bus services if the bus operators could provide an accurate time of departure according to their schedule (Norhisham et al., 2019). It is important to measure the urban bus services, particularly on the quality of urban bus performance provided by the bus operators. Hence, this paper aimed to assess the impact of on-time performance towards quality of urban bus services in state capitals of Peninsular Malaysia.

RESEARCH METHODOLOGY

Study Area

This section described all essential methods taken to evaluate the impact of on-time performance towards quality of urban bus services in Peninsular Malaysia. The data was collected at every state capitals in Peninsular Malaysia as shown in Figure 1. Main local bus terminals were chosen in this study as these terminals were considered as public transport hub for each state. The selected location details for each state in Peninsular Malaysia is listed in Table 1. There were numerous bus operators that operated local bus services which were also known as stages bus in selected area. Due to demand on specific routes, bus operators were allowed to use different type of buses but subject to service approval by the authority. This study only selected local bus which covered bus services within the local area of each state capital only.

Figure 1: Selected State Capitals in Malaysia (Qoura, 201; Google Maps, 2022)

Table 1: Selected State Capitals location

States	State Capitals	Selected Bus Terminal
Johor	Johor Bahru	JB Sentral
Kedah	Alor Setar	Terminal Bas Shahab Perdana
Kelantan	Kota Bahru	Stesen Bas Kota Bahru
Melaka	Bandaraya Melaka	Melaka Sentral
Negeri Sembilan	Seremban	Terminal 1
Pahang	Kuantan	Hentian Bas Bandar Kuantan
Perak	Ipoh	Medan Kidd
Perlis	Kangar	Terminal Bukit Lagi
Pulau Pinang	Georgetown	Pangkalan Raja Tun Uda
Selangor	Shah Alam	Terminal Bus Seksyen 17
Terengganu	Kuala Terengganu	Hentian Bas Majlis Perbandaran Kuala Terengganu

Quality of Services (QOS)

To measure the bus services quality performance, Transit Capacity and Quality of Service Manual (TCQSM, 2013) (Transportation Research Board, 2013) was chosen as guidelines in this study. Therefore, this study would present the impact of on-time performance towards quality of urban bus services in selected location. At the end of this study, on- time performance attributes for each state were categorised based on grades stated in the guidelines and overall QOS for Peninsular Malaysia were identified as well.

On-time Performance

On-time performance of bus service refers to reliability of bus departure compared with the preliminary schedule posted by the bus operators. On- time performance also refers to actual time of bus departure and arrival on each stop. On-time performance results normally presented in percentage value with higher percentage of on-time performance shows a higher punctuality on bus departure or arrival as compared to its schedule. Next, the average results of QOS for each location were categorised based on QOS of 'A' until 'F' by the score of '6' until '1', respectively. Lastly, average of QOS scores was measured, and the results of average QOS were categorised according to guidelines as a QOS overall of on-time performance in state capitals of Peninsular Malaysia. Specific bus terminals have been selected in this study. Actual time of bus departure time for all routes in selected terminal were taken and actual time of bus departure were compared with departure scheduled for all routes provided by the bus operators. On-time performance could be classified as actual time of departure between one minute earlier and five minutes later. To determine the bus service quality, the percentage of on-time performance was calculated by using a formula as shown in Equation 1.

$$\text{Percentage of on time performance (\%)} = \frac{\text{Total of on time service}}{\text{Total of scehuled service}} \text{X } 100\% \quad (1)$$

Table 2 indicates the grade of quality of services (QOS) for on-time performance. Table 2 would be referred after comparison between actual time of departure and departure schedule have been made. The results of on-time performance of every route were calculated. Percentage of each route was classified accordingly based on Table 2.

Table 2: Quality of services (QOS) for On-Time Performance [27]

Quality of Service (QOS)	A	B	C	D	E
On Time Performance (%)	95 - 100%	90 - 94%	80 - 89%	70 - 79%	< 70%

RESULT AND DISCUSSION

Summary of Departure

This section described the outcome of this study in details. The on-time performance data were collected according to the method described in Methodology section. Bus services in most of state capitals were operated by single bus operators and these bus operators were semi-funded by the Government through Agensi Pengangkutan Awam Darat (APAD) and

Government Linked Agency (GLC) under Treasury of Malaysia (MOF). On the other hand, there were bus operators in several states that managed to continue bus services despite all the challenges faced recently. Figure 2 explains the summary of overall departure and daily on-time departure for each state capital in Peninsular Malaysia.

The results showed that Johor Bahru recorded the highest number of departures with total of 648 daily departure and 438 of daily on-time departure followed by Georgetown that recorded total of 476 daily departure and 230 of daily on-time departure. Whereas 3 state capitals recorded less than 100 of daily departure were Alor Setar, Kuala Terengganu and Kangar (89, 77 and 74 of total departure, respectively). The results highlighted difference of total daily departure between the most developed states (Johor and Penang) and the less developed states (Kedah, Terengganu and Kangar).

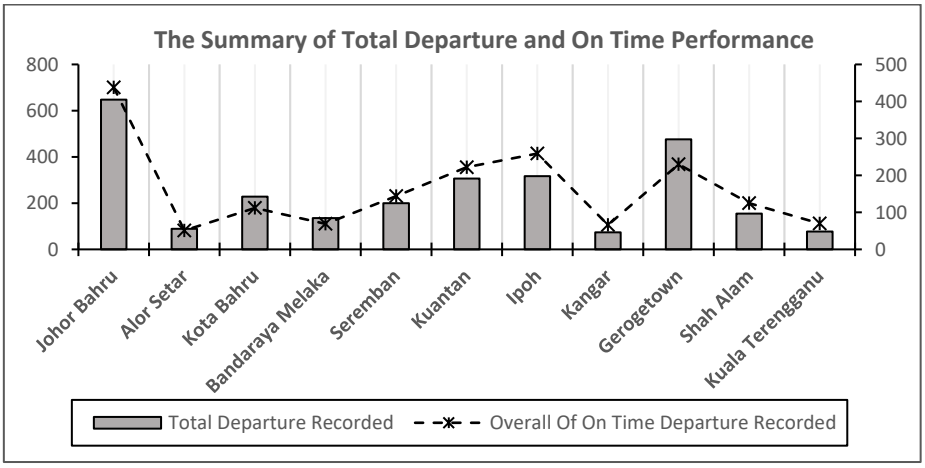

Figure 2: Summary of total departure and on-time departure

On-Time Performance

Next, on-time performance percentage based on respective routes were calculated based on Equation 1 in previous section. Figure 3 shows the on- time performance percentage based on routes for all state capitals in this study. The average of on-time performance percentage based on routes for each state capital in Peninsular Malaysia was 71.17%. There were 4 state capitals that recorded more than 80% of overall on-time departure for each route, such as Kuala Terengganu (28 routes), Shah Alam (3 routes), Ipoh (21 routes) and Kangar (8 routes) calculated at 94.39%, 82.45%, 80.74% and 80.06%, respectively. On the other hand, 2 state capitals recorded less than 60% of overall on-time performance for each route, such as Bandaraya Melaka (15 routes) and Alor Setar (13 routes) representing

56.15% and 53.42%, respectively. Based on observations, there were several external factors highlighted by the bus operators in developed capital cities, such as heavy traffic congestion during peak hour (morning and late afternoon) and excessive number of passengers that affecting the overall of on-time performance for certain routes.

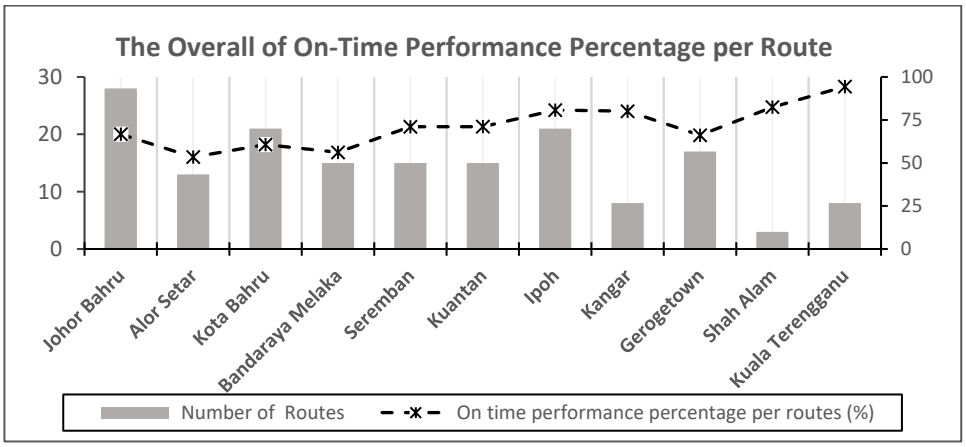

Figure 3: The overall of on-time performance percentage per route

Quality of Services (QOS)

Table 5 shows the quality of services (QOS) for each state capital and overall quality of services (QOS) of on-time performance attributes for Peninsular Malaysia. The overall QOS score for on-time performance in state capitals of Peninsular Malaysia was classified as QOS D. The results indicated that 1 state capital achieved to be categorised as QOS B, followed by 2 state capitals classified as QOS C and the remaining state capitals were classified as QOS D & QOS E representing 5 state capitals and 3 state capitals, respectively. The results showed that there were a significant number of departures recorded in urban area of developed states, such as Johor Bahru, Penang and Shah Alam as compared to urban area of less developed states, such as Alor Setar, Kuala Terengganu and Kangar.

From the findings, the authority had made several improvements in monitoring the actual bus departure in certain state capitals in Peninsular Malaysia. Since on-time performance had given a significant impact towards quality of services (QOS), several rectifications should be made by bus operators to improve quality of services (QOS), especially in big urban states, such as Johor Bahru and Penang. On the other hand, the authority, local council, and bus operators should cooperate closely to ensure that bus services could depart according to the designated routes. Based on the results, it can be observed that

the bus operators had difficulties to provide a significant number of trips due to inadequate demand by passengers and users.

Table 5: The overall quality of service (QOS) of on-time performance attribute

Capital States	QOS	QOS Score	Mean QOS	Overall QOS
Johor Bahru	E	2		
Alor Setar	D	3		
Kota Bahru	D	3		
Bandaraya Melaka	E	2		
Seremban	D	3		
Kuantan	D	3	3.09	D
Ipoh	C	4		
Kangar	D	3		
Georgetown	E	2		
Shah Alam	C	4		
Kuala Terengganu	B	5		

**Score range: A = 6, B = 5, C = 4, D = 3, E = 2, F = 1*

In addition, there were significant concerns by passengers and users which required a real-time information of bus departure for the whole bus route to encourage people to use bus services as their mode of transportation. This study was conducted before the Covid-19 pandemic. Therefore, it is highly recommended to assess the impact of on- time performance during the post Covid-19 pandemic. The major limitation of this study was the concentrated quantitative engineering approach which focused directly to on-time performance attributes in urban area of Peninsular Malaysia only. However, current study would be used as a fundamental knowledge on quality of urban bus services in this country and it is highly suggested to combine both the quantitative and qualitative approach in future study.

CONCLUSION AND RECOMMENDATION

This study focused on evaluating the impact of on-time performance towards quality of urban bus services in state capitals of Peninsular Malaysia. This study utilised a method that stated by Transit Capacity and Quality of Service of Manual (TCPRM). A total of 2,706 departure were recorded in this study from 164 routes. The results showed that Johor Bahru achieved the highest departure with total of 648 departure. There were 4 state capitals that recorded more than 80% of overall on-time departure for each route, such as Kuala Terengganu (94.39%), Shah Alam (82.45%), Ipoh (80.74%) and Kangar (80.06%). The overall QOS for on-time performance in state capitals of Peninsular Malaysia was classified as QOS D. Based on the results, several rectifications on bus services should be made, especially in major state capitals like Johor Bahru and Penang as on- time

performance would impact the quality of services. Both cities had accommodated a high volume of passengers, specifically during weekdays for both peak hour and non-peak hour.

In terms of practical implications, this research found that on-time performance of bus services in state capitals of Peninsular Malaysia showed empirical evidence and must be monitored continuous by the authority. System on departure information also should be upgraded for passengers' trustworthiness towards bus services. It is an opportunity to explore related attributes other than on-time performance in state capitals of Peninsular Malaysia. The outcomes of this study can be a reference by the authority and bus operators to upgrade the quality of services (QOS) of urban bus services. Further study in this topic by other researchers is highly recommended.

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