Enhancing Urban Mobility: A Methodology for Multi-Dimensional Evaluation of Bus Service Quality in Kuala Lumpur Using the Go KL City Bus Network

Ts. Dr. Shuhairy Bin Norhisham[1,2]*, Fakrul Irfan Mohd Haron[2], Muhammad Fadhulullah Abu Bakar[1,2]

[1]Institute of Energy Infrastructure, Universiti Tenaga Nasional, Malaysia

[2] Department of Civil Engineering College of Engineering, Universiti Tenaga Nasional, Malaysia

***Corresponding Author**

DOI: https://doi.org/10.47772/IJRISS.2026.100601091

Received: 24 June 2026; Accepted: 29 June 2026; Published: 13 July 2026

ABSTRACT

Urban public transportation plays a critical role in ensuring sustainable mobility, social equity, and economic productivity in rapidly developing cities. Kuala Lumpur, Malaysia, faces growing transportation challenges, particularly due to increasing private vehicle ownership and traffic congestion. This study evaluates the Quality of Service (QoS) of the Go KL City Bus system using three key performance indicators: on-time performance, service frequency, and passenger load factor. A field-based observational methodology was employed to collect real-time operational data from selected routes within the central business district. This study aims to evaluate the operational performance of the Go KL City Bus system by focusing on three main objectives to assess the on-time performance of selected bus routes, to analyse service frequency and headway consistency and to evaluate passenger load factor and capacity utilisation. Findings highlight significant variability in service reliability, frequency consistency, and passenger demand across routes. The results indicate that while the Go KL initiative improves accessibility and promotes sustainable transport, operational inefficiencies still influence user satisfaction and system effectiveness. The study contributes to the growing body of research on urban transport performance and provides strategic recommendations to enhance service delivery and support modal shift from private vehicles to public transport in Kuala Lumpur. The Go KL City Bus system demonstrates potential as a sustainable urban transport solution. However, operational inefficiencies in punctuality, frequency consistency, and passenger distribution limit its effectiveness.

Keywords: Public transport, Quality of Service (QoS), Bus performance, Kuala Lumpur, Sustainable mobility, Go KL City Bus

INTRODUCTION

Public transportation systems are essential components of sustainable urban development, providing accessible mobility for all socioeconomic groups while mitigating congestion and environmental impacts. In densely populated cities, public transit services serve as a vital alternative to private vehicles, particularly for lower-income populations who rely on affordable transport options for daily activities such as commuting, education, and commerce (Mohd Noor et al., 2018; Zainol et al., 2018).

Beyond social equity, public transport also contributes significantly to environmental sustainability by reducing greenhouse gas emissions through shared mobility systems (Abu Bakar et al., 2023). However, the effectiveness of public transport in Malaysia remains constrained by persistent issues such as traffic congestion, limited service coverage, and operational inefficiencies (Azlan et al., 2022). These challenges have led to a continued preference for private vehicles, exacerbating congestion and undermining the sustainability of urban transport systems.

To address these concerns, the Malaysian government introduced the Go KL City Bus service as a free, accessible, and environmentally friendly initiative aimed at improving last-mile connectivity within Kuala

Lumpur's central business district. The success of such initiatives largely depends on the quality of service delivered to users.

Despite sustained investments in public transport infrastructure, Kuala Lumpur continues to face severe congestion due to high private vehicle ownership rates (Abu Bakar et al., 2023). Public bus services, including the Go KL network, often experience reliability issues such as inconsistent schedules, prolonged waiting times, and congestion-related delays (Ngah et al., 2020).

Previous studies indicate that unreliable travel time is one of the most critical factors affecting passenger satisfaction and public trust in bus systems (Azmi & Harun, 2020; Ismail et al., 2019). Reports suggest that more than 60% of users experience delays during peak periods, highlighting the inefficiency of current bus operations.

These issues reduce the attractiveness of public transport and discourage modal shift from private vehicles, thereby undermining sustainability goals. Therefore, a systematic evaluation of bus service quality is required to identify performance gaps and develop strategies for improvement.

Thus, this study aims to evaluate the operational performance of the Go KL City Bus system by focusing on three main objectives, assessment, analysing and on-time performance of selected bus routes, frequency and headway consistency and passenger load factor and capacity utilisation.

LITERATURE REVIEW

Quality of Service in Public Transport

Quality of Service (QoS) is a comprehensive indicator used to evaluate the effectiveness and user satisfaction of public transportation systems. It encompasses multiple dimensions, including reliability, accessibility, comfort, safety, and efficiency (Anil Minhans et al., 2022; Ubaidillah et al., 2022).

Studies in Malaysia have consistently highlighted that passenger satisfaction is strongly influenced by punctuality, frequency, and service coverage (Rahman et al., 2021). High-quality service encourages greater ridership and supports the transition toward sustainable mobility (Mani, 2022).

On-Time Performance

On-time performance (OTP) reflects the reliability of public transport services in adhering to scheduled departure and arrival times. It is commonly measured as the percentage of trips that operate within an acceptable time window, typically ±5 minutes from the schedule (Abu Bakar et al., 2023).

Bus systems are particularly vulnerable to delays due to mixed traffic conditions, unlike rail systems that operate on dedicated tracks (Ery Sugito & Roosli, 2022). Factors affecting OTP include traffic congestion, operational inefficiencies, and inadequate scheduling.

Technological advancements such as Automatic Vehicle Location (AVL) systems have improved real-time monitoring and scheduling, enabling better performance management (Haziman et al., 2023).

Service Frequency

Service frequency refers to the number of bus trips within a given time period and is a key determinant of waiting time and passenger convenience. Higher frequency reduces waiting time and improves the attractiveness of public transport (Azmi & Harun, 2020).

However, inconsistent frequency and irregular headways often lead to passenger dissatisfaction (Anil Minhans et al., 2022). Maintaining balanced and predictable service intervals is essential for improving reliability and perceived service quality.

Passenger Load Factor

Passenger Load Factor (PLF) measures the utilisation of bus capacity and is calculated as the ratio of passengers to available seating capacity. It is a critical indicator of operational efficiency and passenger comfort (Transportation Research Board, 1999).

High load factors may indicate overcrowding, while low values suggest underutilisation of resources. Optimal levels ensure efficient resource allocation while maintaining passenger comfort (Fazeera Zul' Azman et al., 2022).

METHODOLOGY

Research Design

This study adopts a quantitative observational approach to evaluate the operational performance of selected Go KL bus routes. Data collection was conducted through field observations at major bus terminals, particularly the Pasar Seni hub.

Selected routes include:

- Green Line (KLCC–Bukit Bintang)
- Purple Line (Pasar Seni–Bukit Bintang)
- Red Line (Titiwangsa–KL Sentral)
- Blue Line (Titiwangsa–Bukit Bintang)

The methodology of this study was developed to systematically collect, analyze, and evaluate data related to the performance of the Go KL City Bus service. The research focuses on selected Go KL routes within Kuala Lumpur's central area to ensure detailed observation and manageable data collection.

As the sole researcher, the researcher conducted this study independently, taking full responsibility for planning, coordination, data collection, and analysis. A series of preparatory meetings and literature reviews were held to establish a clear data collection strategy and align the evaluation criteria with the Transit Capacity and Quality of Service Manual (TCQSM) guidelines to ensure methodological accuracy.

Prior to field data collection, information regarding the Go KL City Bus routes, schedules, and operational details was obtained from the official Go KL websiteand the Kuala Lumpur City Hall (DBKL) portal. Go KL currently operates several major routes across key zones of the city, including the Green, Purple, Blue, and Red lines, which connect major commercial and residential areas. Due to time constraints and feasibility, this study focuses on two selected routes that represent distinct operational characteristics, one with higher passenger density and another with moderate passenger flow.

The Go KL Central Market (Pasar Seni) bus terminal, being one of the main interchange hubs for all routes, was selected as the central observation point. The timetable and route information were used to identify the first and last bus trips, service frequency range, and scheduled headways for each selected route.

Before beginning field data collection, a detailed preparation checklist was created to ensure smooth execution of the research process once on-site in Kuala Lumpur. The list consisted of six key tasks to be completed prior to the start of data collection. Firstly, the bus schedules at the Go KL City Bus terminal were verified, as accurate schedule information is essential for evaluating on-time performance. Secondly, the payment system used on the buses was checked to confirm whether services operate on a cashless basis or accept other payment methods, ensuring preparedness during field observation. Thirdly, the number of passenger seats available on each bus type was recorded to assist in later assessment of the passenger load factor.

Next, a suitable observation point was identified near the Go KL Central Market terminal to clearly monitor and record each bus's departure time. A timekeeping plan was then arranged to systematically record departure and arrival times for all observed trips without missing any scheduled services. Finally, preliminary test observations were conducted to familiarize with the route timing, passenger flow, and overall terminal operations before beginning the full data collection phase.

During the observation period, multiple data tables were prepared to record and tabulate findings relevant to each objective, including on-time performance, service frequency, and passenger load factor. The data collection process was conducted through direct field observation, where actual departure and arrival times were compared against published schedules, and passenger counts were recorded at designated stops. These datasets were later analyzed to assess the operational reliability and service efficiency of the Go KL City Bus network.

On-Time Performance

On-time performance is typically represented as a percentage, where a higher percentage indicates a greater proportion of buses operating within the acceptable time range. This parameter serves as a crucial measure of service efficiency and system reliability, as consistent adherence to scheduled times allows passengers to plan their journeys effectively. Infrequent or delayed services can disrupt daily travel patterns and reduce public confidence in the transit system.

Preparation (before site visit)

Step 1.The official timetable(s) for the selected routes is obtained from the Go KL website .

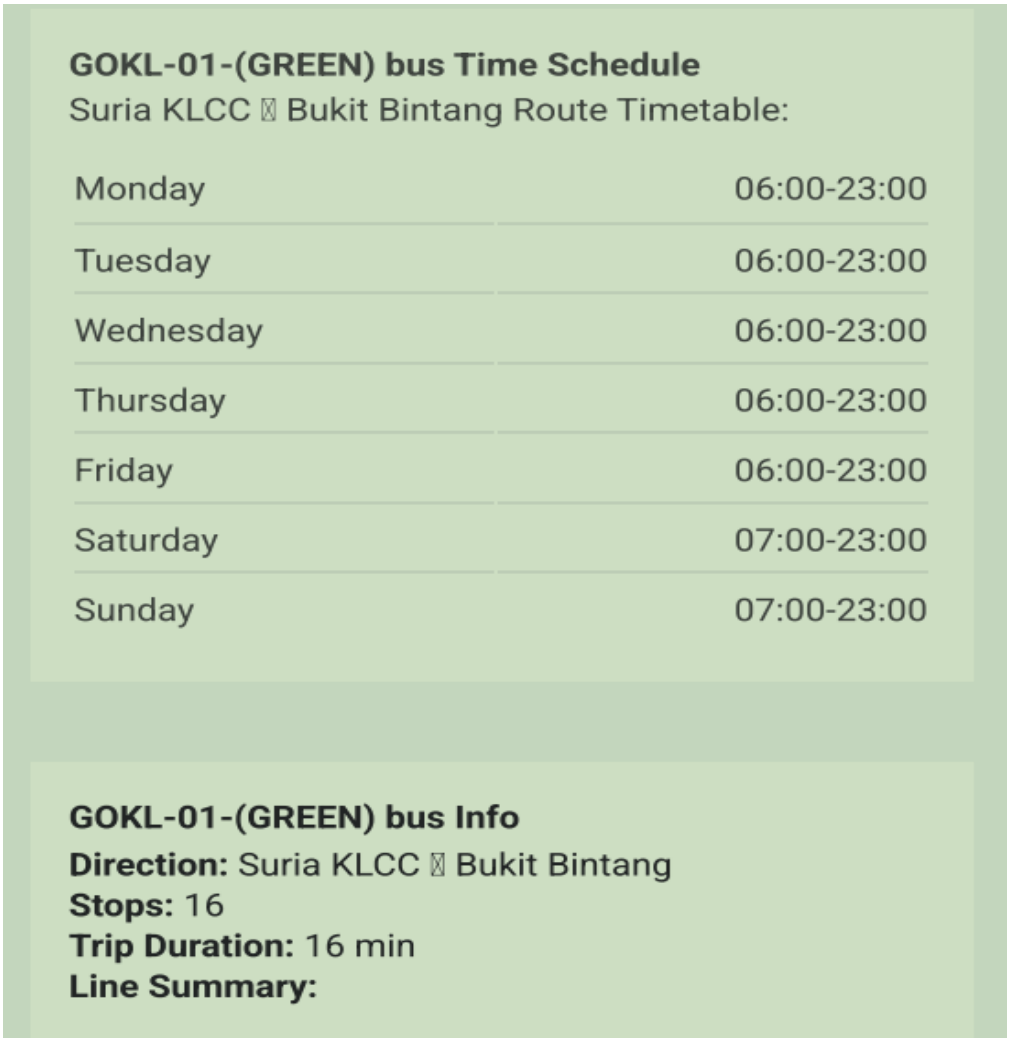
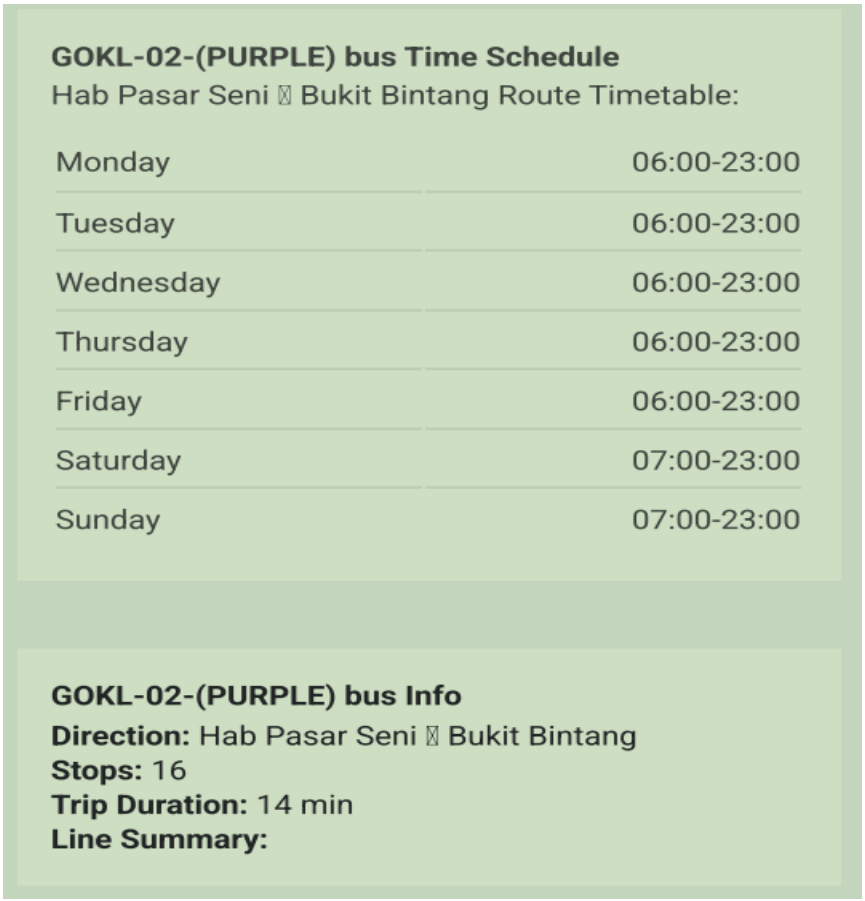


Image 3-3: KL City Bus Green route Schedule

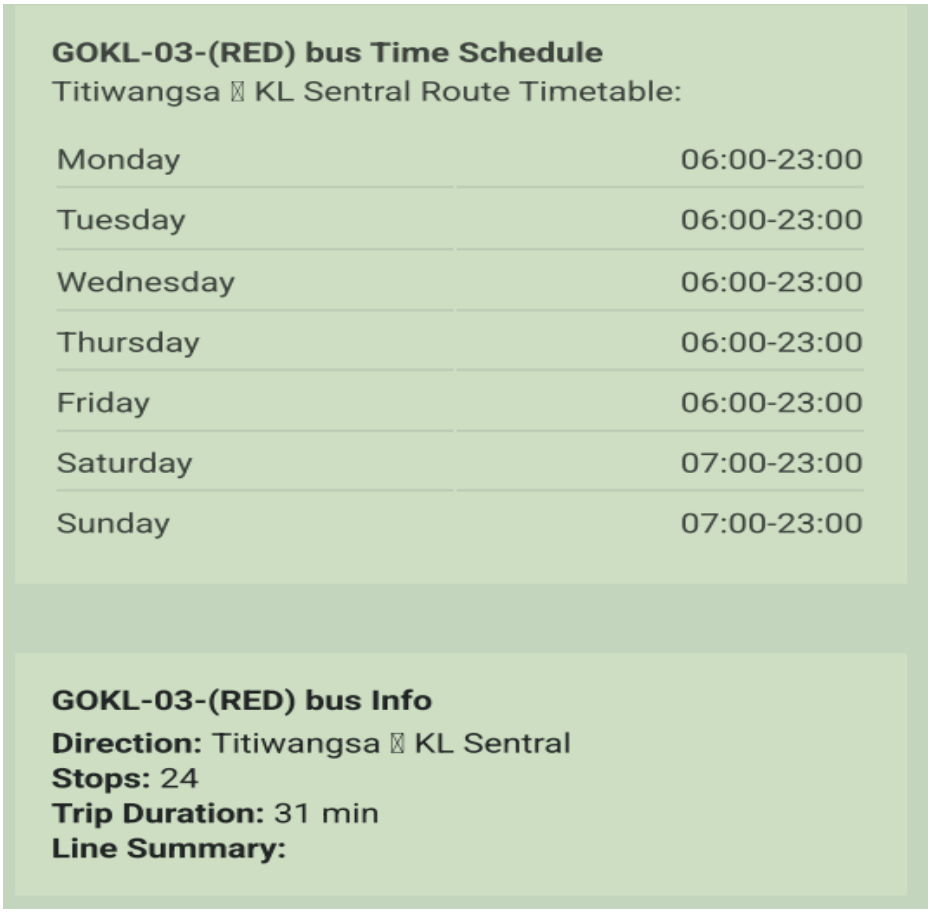


GOKL-02-(PURPLE) bus Time Schedule
Hab Pasar Seni Bukit Bintang Route Timetable:

Monday	06:00-23:00
Tuesday	06:00-23:00
Wednesday	06:00-23:00
Thursday	06:00-23:00
Friday	06:00-23:00
Saturday	07:00-23:00
Sunday	07:00-23:00

GOKL-02-(PURPLE) bus Info
Direction: Hab Pasar Seni Bukit Bintang
Stops: 16
Trip Duration: 14 min
Line Summary:

Image 3-4: KL City Bus Purple route Schedule

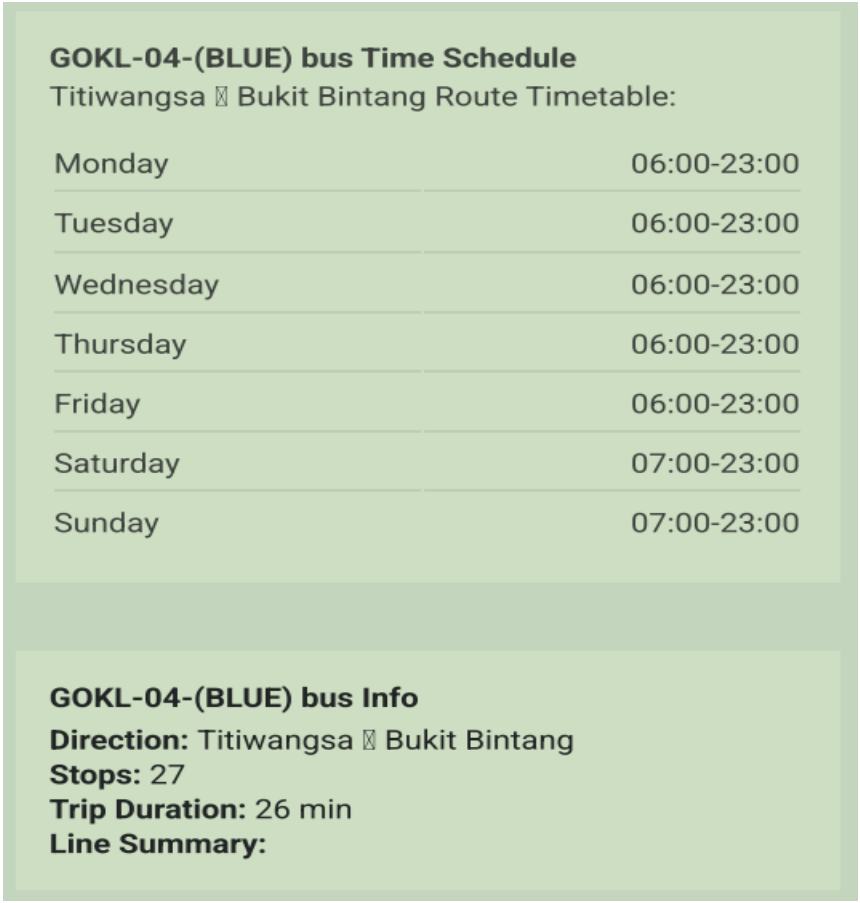


GOKL-03-(RED) bus Time Schedule
Titiwangsa KL Sentral Route Timetable:

Monday	06:00-23:00
Tuesday	06:00-23:00
Wednesday	06:00-23:00
Thursday	06:00-23:00
Friday	06:00-23:00
Saturday	07:00-23:00
Sunday	07:00-23:00

GOKL-03-(RED) bus Info
Direction: Titiwangsa KL Sentral
Stops: 24
Trip Duration: 31 min
Line Summary:

Image 3-5: KL City Bus Red route Schedule



GOKL-04-(BLUE) bus Time Schedule
Titiwangsa Bukit Bintang Route Timetable:

Monday	06:00-23:00
Tuesday	06:00-23:00
Wednesday	06:00-23:00
Thursday	06:00-23:00
Friday	06:00-23:00
Saturday	07:00-23:00
Sunday	07:00-23:00

GOKL-04-(BLUE) bus Info
Direction: Titiwangsa Bukit Bintang
Stops: 27
Trip Duration: 26 min
Line Summary:

Image 3-6: KL City Bus Blue route Schedule

Step 2. Data sheets is prepared ahead of time for during-research use:

TABLE 3-1: ON-TIME PERFORMANCE RESEACH PAPER

Bus Operator & Route No : -

Route : -

Date : XX / XX/ XX (Weekday/Weekend)

Time : XX AM – XX PM

Enumerator : -

Bus Stop : -

Scheduled Arrival	Actual Arrival	Time Difference	Remarks (Late/OnTime)	Headway
6.00 AM	-	-	-	-
7.00 AM	-	-	-	-
8.00 AM	-	-	-	-
9.00 AM	-	-	-	-
10.30 AM	-	-	-	-
12.00 PM	-	-	-	-

1.30 PM	-	-	-	-
3.00 PM	-	-	-	-
4.30 PM	-	-	-	-
5.30 PM	-	-	-	-
6.30 PM	-	-	-	-
7.30 PM	-	-	-	-
Average Headway				-

Total Scheduled Arrivals-

Total Actual Arrivals-

Late Arrivals-

Early Arrivals-

On Time Arrivals-

3On-site set-up

The researcher arrived at the terminal at least 30 minutes before the first scheduled observation to: locate the departure lane, choose a fixed vantage point with a clear view of buses leaving, and verify the posted timetable at the terminal.

Observation routine (for each scheduled trip)

At the scheduled departure time listed on the timetable, watch for the bus assigned to that trip. If the bus departs, record the exact Observed Departure Time (HH:MM:SS). If a bus does not appear, mark “No-show” and note the time you officially stop waiting for that trip.

Calculate Deviation (min) = Observed Departure Time − Scheduled Departure Time (express in minutes; negative if early).

Determine Status using the TCQSM rule:

On-time: departure between 1 minute early and 5 minutes late

Early departure: deviation < −1 minute.

Late departure: deviation > +5 minutes.

No-show: bus did not operate that scheduled trip.

During continuous observation (multiple trips / whole day)

Maintain consistent timekeeping: always use the same synchronized time source for every recorded time. Note any time adjustments or interruptions.

Data validation and backup

At the end of each observation day, review the data sheet on site to correct any obvious errors (illegible entries, missing fields). Create a digital backup (scan or photograph sheets) before leaving the terminal.

Enter the data into a spreadsheet

Data processing and classification

For each recorded trip compute deviation in minutes (to one decimal if using seconds). Automatically classify status based on the TCQSM thresholds described above.

Flag uncertain records (e.g., ambiguous bus ID, disputed matching) for follow-up include the original note explaining uncertainty.]

Analysis and reporting

Calculate on-time performance per route as:

$$\text{On-time \%} = \frac{\text{Number of trips classified as On-time}}{\text{Total observed trips (excluding planned cancellations if documented)}} \times 100$$

Report counts/percentages for Early, Late, and No-show, and provide summary statistics of deviations (mean, median, standard deviation, and distribution histogram).

Annotate the results with contextual observations (peak vs off-peak periods, weather, special events, observable operational causes) and attach raw data tables as an appendix.

Quality control and ethics

Keep observations discreet and non-intrusive; do not interact with drivers or staff in ways that will influence normal operations.

Maintain confidentiality of any personal data inadvertently observed (do not record passenger identities). Document any deviations from this procedure in the methodology (e.g., missed trips, equipment failures) and explain how such issues were handled during analysis.

Analyse the data.

Expected Result

The analysis will produce the quality of service for each route. The results will be present in a simple table to compare all QOS in every route.

Data Collection

Three datasets were collected:

1. **On-Time Performance:** Comparison of actual vs scheduled departure times
2. **Service Frequency:** Measurement of headway between consecutive buses
3. **Passenger Load Factor:** Counting of boarding and alighting passengers

Data collection was conducted across peak and off-peak periods to capture variations in service performance.

Data Analysis

- OTP calculated as percentage of on-time trips

- Headway used to determine frequency and consistency
- Load factor calculated using passenger-to-seat ratio

QoS levels were determined based on TCQSM standards.

Expected Results and Discussion

On-Time Performance

Results indicate moderate reliability across routes, with peak hours showing higher delays due to congestion. Routes operating in heavily trafficked areas recorded lower OTP values.

Service Frequency

Service frequency varied significantly between peak and off-peak periods. While peak hours maintained acceptable headways, off-peak intervals were inconsistent, leading to longer waiting times.

Passenger Load FACTOR

Passenger distribution was uneven, with some routes experiencing overcrowding while others were underutilised. This indicates inefficient resource allocation and the need for demand-based scheduling.

DISCUSSION

The findings confirm that reliability, frequency, and demand management are interdependent factors affecting service quality. Improvements in scheduling systems and real-time monitoring are necessary to enhance system performance.

CONCLUSION

The Go KL City Bus system demonstrates potential as a sustainable urban transport solution. However, operational inefficiencies in punctuality, frequency consistency, and passenger distribution limit its effectiveness.

ACKNOWLEDGEMENT

The authors would like to thank Universiti Tenaga Nasional (UNITEN) and Tenaga Nasional Berhad (TNB) for facilitating this research and publication under NEC Grant 2025 (Grant Code: J510051152). The authors sincerely thank the Institute of Energy Infrastructure (IEI), Innovation Research Excellence Centre (REC) and for supporting this research as well.

REFERENCES

1. Abu Bakar, M. F., Norhisham, S., Saad, N. M., et al. (2023). The impact of on-time performance towards quality of urban bus services. Planning Malaysia, 21(25).
2. Anil Minhans, S., Shahid, S., & Hassan, S. A. (2022). Assessment of bus service quality using passengers' perceptions. Jurnal Teknologi.
3. Azlan, N. N. I. M., Norhisham, S., et al. (2022). Analysing on-time performance of public bus service. Lecture Notes in Civil Engineering.
4. Azmi, N. A., & Harun, N. A. (2020). Passenger satisfaction in bus services.
5. Eboli, L., & Mazzulla, G. (2008). Measuring service quality in public transport. Transportation Planning & Technology.
6. Ery Sugito, D. B. M., & Roosli, R. (2022). Impact of traffic congestion on bus performance. Progress in Energy and Environment.

7. Fazeera Zul' Azman, N. A., et al. (2022). Quality performance of Rapid Bus operation. Journal of Administrative Science.
8. Haziman, Z., et al. (2023). Evaluation of AVL systems for city buses.
9. Mani, K. (2022). Passenger satisfaction in BRT systems.
10. Ngah, A. H., et al. (2020). Service quality factors in public transport.
11. Transportation Research Board. (1999). Transit Capacity and Quality of Service Manual.
12. Ubaidillah, N. Z., et al. (2022). Bus service quality and user satisfaction.
13. Zainol, N. N., et al. (2018). Public transport accessibility in Malaysia.