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UNIVERSITY STUDENTS' PERCEPTIONS OF PUBLIC BUS SERVICE EFFICIENCY AND EFFECTIVENESS IN INFLUENCING RIDERSHIP

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Abstract

The efficiency and effectiveness of public bus services are essential for fostering sustainable urban transportation. In Malaysia, despite widespread concerns about lengthy commutes, congestion-related stress, and high traffic fatality rates, private vehicles remain the dominant mode of transport, even among university students. This examines university students' perceptions of public bus service efficiency and effectiveness, aiming to identify areas for improvement to increase public transport usage. A mixed-method approach was adopted to provide a comprehensive analysis of users' experiences and perceptions. Findings indicate that economic factors significantly influence ridership rates, particularly among young adults who often face financial constraints. At the same time, this demographic is highly mobile, relying on transportation for social, educational, and physical activities. Furthermore, satisfaction with service quality emerges as a critical determinant of public bus loyalty. To enhance efficiency and increase ridership, the study recommends addressing the multifaceted factors influencing public bus service use through a comprehensive strategy. Future research should delve into socioeconomic analyses to better understand these dynamics.

Keywords: Urban Mobility, Public Bus, User Perception, Service Quality, Ridership Rate

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INTRODUCTION

The transportation sector plays a pivotal role in driving economic development and supporting society by enabling the efficient movement of people and goods, thereby facilitating urbanisation (Othman & Ali, 2020). Access to transportation not only connects individuals to employment opportunities but also significantly contributes to the GDP through the movement of goods and services (Kriswardhana & Esztergár-Kiss, 2024). However, the sector also imposes environmental and societal costs (Roslan et al., 2024). Transportation is a major contributor to air and noise pollution, with fossil fuel-dependent vehicles exacerbating climate change, smog formation, and respiratory illnesses (Rahmat et al., 2023). Additionally, it intensifies traffic congestion, which negatively impacts time management, energy consumption, mental well-being, and overall quality of life. Prolonged congestion further increases traffic-related fatalities, as frustration and impatience heighten risks (Afrin & Yodo, 2020).

Sustainable transportation aims to minimise environmental harm, promote social equity, and ensure economic feasibility for current and future generations. It encompasses diverse modes, such as walking, cycling, public transit, and electric vehicles (Othman & Ali, 2020). Among these, public transport is particularly significant in urban areas, offering an alternative to private vehicles and mitigating traffic congestion, air pollution and carbon emissions. Key to assessing public transport services like bus systems are the concepts of "efficiency" and "effectiveness". Efficiency refers to the optimal use of resources – time, money, and energy – to provide reliable and timely services (Victorino et al., 2023). For example, Curitiba's Bus Rapid Transit (BRT) system in Brazil enhances efficiency through dedicated bus lanes and precise scheduling, reducing congestion and increasing reliability.

Effectiveness, on the other hand, measures how well a system meets users' needs, considering factors such as accessibility, convenience, and satisfaction (Tavassoli et al., 2022; Catalano et al., 2019). A system may be efficient but ineffective if it fails to address diverse user requirements. Thus, an ideal public bus network should integrate both objectives. While environmental factors, traffic issues, and societal impacts are relevant to public transport performance, they are not the sole determinants of outcomes. The focus should be on effectively managing these factors to enhance the quality and sustainability of public transit. For instance, Stockholm's public transport network integrates environmentally friendly buses with real-time information. This approach not only improves efficiency by optimising routes but also enhances effectiveness by increasing user satisfaction and engagement.

Several studies have emphasised that the quality of public transportation services significantly influences their performance (Hamzah et al., 2023; Ermagun & Witlox, 2024; Wang et al., 2022). Factors such as insufficient investment in infrastructure, inadequate maintenance, poor service quality, limited connectivity, safety concerns, accessibility challenges, and ineffective information dissemination have contributed to the subpar performance of public transportation services (Sukereman, et al 2024). In Malaysia, declining service quality has adversely affected user perception and satisfaction, leading to reduced ridership and a diminished willingness to use public transport (Baharum & Haron, 2020). Addressing these issues requires more than simply expanding infrastructure and capacity. A deeper understanding of the key determinants of public bus performance and requirements of users – particularly among young adults – is essential to enhance public bus services in the coming years.

LITERATURE REVIEW

Public Transportation

Public transportation encompasses any mode of transit where passengers do not rely on personal vehicles, including buses, taxis, and minibuses. It plays a critical role in providing residents with accessible and convenient travel options, often serving as a more practical alternative to private vehicles (Abu Bakar et al., 2022). In Malaysia, the Land Public Transport Agency classifies public transport services into several categories, including buses, taxis, e-hailing services, and rail (APAD, 2021). Generally, Malaysian public transportation is divided into two main categories: rail and bus services. Public bus services operate along fixed routes and schedules, catering to the community's mobility needs. These services are typically managed by government agencies or private operators. In Kuala Lumpur, for instance, RapidKL serves as a primary bus operator, Under the administration of Prasarana Malaysia Berhad, which oversees public transport operations in the Klang Valley area (Abu Bakar et al., 2022). Additionally, the Land Public Transport Agency (APAD) ensures the provision of safe and efficient public transport services, while the Ministry of Transport Malaysia (MOT) regulates fare structures, including those for bus services (Norhisham et al., 2021).

Efficiency and Effectiveness of Public Bus Operation

In public bus operations, efficiency and effectiveness are interconnected concepts, addressing distinct aspects of service delivery and impact. Efficiency pertains to the optimal utilisation of resources to achieve desired outcomes. It emphasises how effectively resources such as time, fuel, labour, and funds are used to deliver services (Victorino et al., 2023). Efficient public bus services minimise costs, optimise resource allocation, and ensure smooth operations without compromising quality. This reflects operational excellence,

demonstrated by meeting customer needs with the fewest resources while reducing waste and enhancing productivity. While efficiency is vital for sustainability and economic viability, it does not necessarily address user satisfaction or adequate service coverage.

Conversely, effectiveness focuses on how well a public bus system meets the needs and expectations of its users. This includes factors such as accessibility, inclusivity, reliability, and user satisfaction. An effective bus system aligns with societal objectives, such as equitable access to services, increased ridership, and reduced dependency on private vehicles (Tavassoli et al., 2022; Catalano et al., 2019). To improve the service quality of public bus systems, a balance between efficiency and effectiveness is essential. A system that is efficient but not effective may reduce costs but struggle to attract or retain users. In contrast, an effective yet inefficient system may face sustainability challenges due to high operational expenses (Aleksandar Bajić et al., 2022).

Service quality refers to how well a service meets user expectations by fulfilling anticipated needs and desires, ultimately improving user satisfaction. (Ermagun & Witlox, 2024; Wang et al., 2022). User satisfaction represents users' evaluation of an organisation's services, assessed by whether expectations are met or exceeded. In public transportation, user satisfaction is influenced by the alignment between pre-travel expectations and actual travel experiences. Achieving high service quality in public transportation necessitates identifying and prioritising the key factors that influence users' decisions to use or avoid the service. Furthermore, the ease of using public transport positively correlates with overall satisfaction levels among citizens (Ong, 2022).

RESEARCH METHODOLOGY

This study employed a mixed-method research approach to comprehensively examine bus users' perceptions and their relationship to ridership rates. Mixed-method research, which integrates both quantitative and qualitative techniques, is particularly well-suited for studying perceptions as it provides a holistic understanding of the topic (Sinha et al., 2019; Lucas et al., 2021; Saxena et al., 2024; Ratchatakulpat et al., 2024). By capturing both measurable outcomes and nuanced social impacts of transport projects on individuals and communities, this approach offers valuable insights (Lucas et al., 2021). The research design involved simultaneous collection and analysis of numerical and non-numerical data, with subsequent triangulation of findings to enhance reliability and depth.

The study was conducted in two phases: quantitative and qualitative, followed by a triangulation of findings. The qualitative phase included a literature review and content analysis to identify indicators influencing the efficiency and effectiveness of public bus services. Semi-structured interviews were then conducted with a subset of survey respondents to explore these factors further, focusing on user perceptions and their willingness to adopt public buses as a

primary mode of transportation. in the quantitative phase, a questionnaire survey was distributed to gather data on respondents' perceptions of bus service efficiency and effectiveness and their influence on ridership. Data analysis involved descriptive statistics to summarise the key characteristics of the survey responses and Pearson correlation analysis to quantify the linear relationship between satisfaction with specific service indicators and ridership rates. The findings demonstrated how satisfaction with these indicators impacts ridership. The analyses incorporated data collected on campus from diverse user groups, including staff and students, each offering distinct perspectives on the services provided.

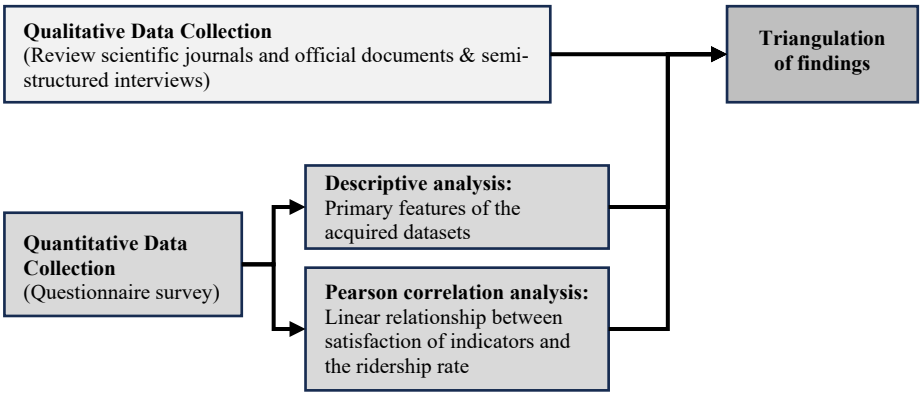

Figure 9: Research Methodology
Source: Author's work

ANALYSIS AND FINDINGS

Socio-demographic profile of the respondents

The socio-demographic data reveals that a substantial majority of respondents (69.1%) fall within the 18-24 age group. This finding aligns closely with the study's primary objective, which is to investigate young adults, particularly university students', perceptions of the efficiency and effectiveness of public bus services within their university environment. The research also aims to assess the reliability of these services in enabling students to commute between campus and home without significant reliance on private vehicles.

Table 8: Respondents Profile

Total Respondent: 191		
	Frequency	Percentage (%)
Age		
18-24	132	69.1
25-29	19	9.9
35-39	30	15.7
40-44	5	2.6
50-54	5	2.6
Occupation		
Student	151	79.1
Employed	40	20.9
Transit Service: Frequency of Using Bus		
Current Ridership	182	95.3
Future Ridership with Alternative Option	40	20.9

Source: Author's work

With regard to occupation, only 20.9% of respondents utilising the public bus service on campus are employed, suggesting that the service primarily caters to students without private transportation and is less favoured by those with stable incomes. Supporting this, 95.3% of respondents identified public buses as their primary mode of transport, indicating significant dependence on the service. However, when asked about their willingness to continue using public bus services if more convenient alternatives, such as affordable e-hailing options, campus rail transit, or electric motorcycles, became available, 79% expressed a preference for these alternatives. Only 21% of current bus users stated they would continue using the service, underscoring dissatisfaction with the current system.

These findings suggest that while ridership rates are high, they may not necessarily reflect satisfaction with the service. Instead, the elevated ridership appears driven by a lack of viable alternatives, particularly among students with limited financial resources. For this group, public buses provide a cost-effective solution to meet their basic transportation needs, offering affordability compared to the expenses associated with private vehicle ownership and maintenance. However, their reliance on public buses stems more from necessity than preference, indicating a strong likelihood of switching to better alternatives should they become available.

Factors Influencing User Perception

User perception plays a crucial role in sustaining the quality of public transportation services. For public bus services to meet user expectations, their efficiency and effectiveness must align with perceived quality. Researchers have identified key built environment factors that significantly influence user perceptions of the efficiency and effectiveness of public transit services. Through qualitative research methods, such as literature reviews and content analysis, several factors were highlighted for assessing public transit services. These

factors were subsequently validated through semi-structured interviews and questionnaire surveys with users. The built environment factors identified through qualitative approaches include the following:

Table 2: Identified factors influencing user perception of public transit

Factors Influencing User Perception	***References***
a. Spatial availability Spatial availability refers to the ease with which individuals can access public transportation, particularly the proximity of bus stops or train station to their starting location. This concept aligns with the first-last mile principle, which underscores the importance of the journey to and from transport hubs. It highlights users' willingness to travel specific distances, often by walking, to access dependable transit options. The surrounding environment thus plays a critical role in fostering public transport usage by ensuring accessibility and convenience.	(Kåresdotter et al., 2022 & Soukhov et al., 2024)
b. Information availability Real-time information (RTI) systems significantly enhance passengers' travel experiences by delivering up-to-the-minute updates on the expected arrival times of buses and trains. Leveraging GPS tracking and electronic display boards, these systems provide accurate information, enabling commuters to reduce waiting times and plan their journeys more efficiently. By minimising uncertainty, RTI improves the perceived reliability of transit services and facilitates smoother connections between various modes of transportation.	(Deng & Chen, 2021)
c. Passenger occupancy When numerous individuals are densely packed into a confined space, it often creates discomfort, negatively impacting their perception of travel satisfaction. The lack of personal space can lead to frustration, anxiety, and irritation, overshadowing any positive aspects of the journey. Consequently, the overall experience is likely to be perceived as unpleasant, reducing both enjoyment and comfort.	(Hensher, 2020 & Wang & Zacharias, 2020)
d. Reliability Reliability refers to a bus service's capacity to consistently adhere to scheduled departure and arrival times. It reflects trustworthiness and predictability, assuring passengers that buses will operate as planned. This dependable performance is crucial for enabling users to make informed travel decisions without concerns about unexpected delays.	(Paudel, 2021; Pulugurtha et al., 2022)
e. Travel time Travel duration is a critical factor in trip planning and transport mode selection. A key aspect of this experience is the waiting time at bus stops, which can significantly impact a user's overall	(He et al., 2019)

journey. Prolonged waiting periods often influence users' satisfaction and their choice of transportation, highlighting the importance of minimising delays to enhance the travel experience.	
f. Safety and security Safety in public transportation refers to the absence of dangers or risks that could harm passengers, ensured through measures such as well-maintained vehicles, clear signage, and trained personnel for emergency management. Security focuses on protecting passengers from potential threats through surveillance systems, security personnel, and crime deterrence protocols. Together, safety and security foster a reliable environment, instilling confidence and a sense of protection among public transport users.	(Sukereman, et al. 2024; Meena, 2024; Rodriguez-Valencia et al., 2022)
g. Cost Affordable transit fares are essential for many public transportation users, particularly those unable to afford the high costs of automated and connected vehicles. Reasonable pricing ensures access to reliable transportation, mitigating significant mobility challenges for financially constrained individuals.	(Dong, 2022)
h. Appearance and comfort of bus stop Developing efficient transit infrastructure is vital for increasing the convenience and appeal of public transportation compared to private cars. Improving waiting areas and shelters, particularly for protection during adverse weather conditions, can create a more welcoming environment that encourages greater public transit use.	(Dzyuban et al., 2022; Sun et al., 2020)
i. Customer relations The quality of driver service is essential to passenger satisfaction and significantly impacts their sense of safety. Professional and attentive drivers who prioritise safety foster a comfortable environment, enabling passengers to travel with peace of mind. Conversely, poor service can compromise passengers' sense of security. Therefore, transportation providers must emphasise rigorous training programmes to enhance service quality, improve passenger experiences, and cultivate long-term loyalty.	(Frinaldi et al., 2020; Weng et al., 2023)

Source: Author's own work

To evaluate user satisfaction levels, researchers adopted a quantitative approach based on the factors influencing perceptions. Data were collected through a combination of questionnaire surveys and semi-structured interviews. The results provide insights into satisfaction with current services, as illustrated in Figure 2, which ranks nine aspects affecting bus ridership from most impactful (rank 1) to least impactful (rank 9).

Among these, "reliability" emerged as the top priority for passengers, underscoring the critical need for buses to adhere to schedules and provide dependable service. Respondent feedback highlighted partial dissatisfaction with

reliability, signalling a clear opportunity for improvement in this area. Enhancing the consistency and punctuality of bus services could significantly increase ridership. The second-ranked factor, "information availability," emphasises the importance of accurate real-time updates and accessible route and timetable details. The findings suggest room for improvement in these areas, particularly in providing clear and reliable transit information. The third significant factor is "passenger occupancy," which pertains to maintaining an optimal number of passengers on board to ensure comfort. Overcrowding negatively affects the travel experience, leading to discomfort and dissatisfaction. Ensuring adequate space for passengers to sit or stand comfortably can substantially improve their overall journey. Addressing these critical aspects can enhance the user experience, better enable passengers to plan their journeys, and foster greater satisfaction and loyalty among riders.

Spatial availability, encompassing the ease of accessing bus stops and the comprehensiveness of available routes, ranked fourth in priority. This underscores the importance of establishing a well-designed and user-friendly transportation network. Survey results indicated significant dissatisfaction among respondents regarding various aspects of spatial availability, such as the distance to the nearest bus stop, the walk from bus stops to final destinations, the absence of accessible stops directly at destinations, the pedestrian environment surrounding bus stops, and the implementation of universal design principles. These findings highlight the urgent need for enhanced accessibility and convenience of public transportation infrastructure. "Cost" ranked seventh, suggesting that while fare affordability is a consideration, it is not the most critical factor for riders. Survey results indicate general satisfaction with pricing, with respondents viewing the cost of public bus services as reasonable and offering good value for money.

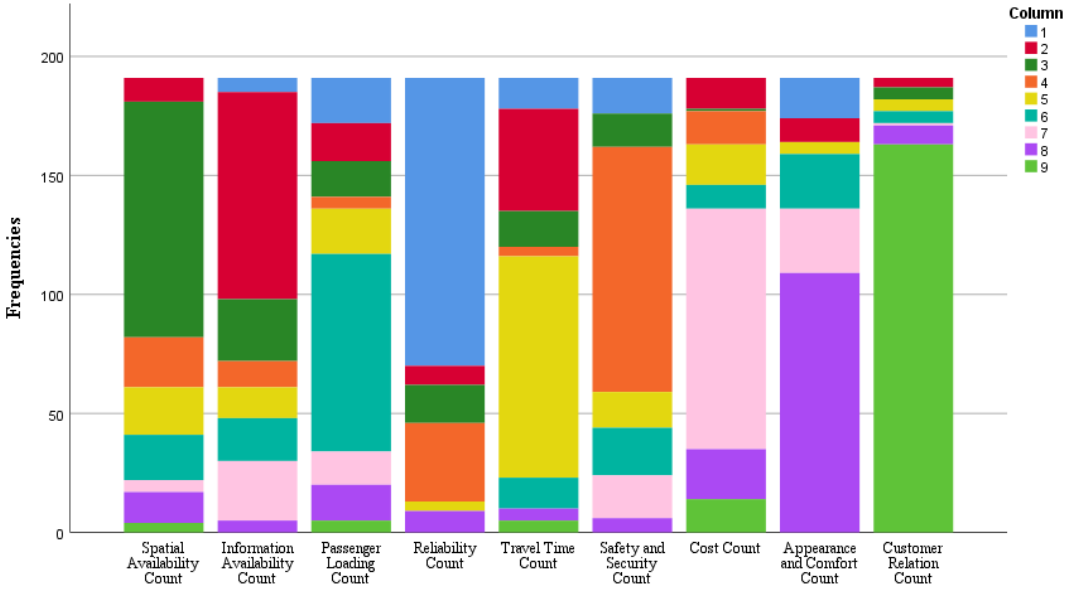

Figure 2: Ranking of the aspects affecting the public bus ridership.
Source: Author's work

Conversely, "appearance and comfort" ranked eighth, indicating that aesthetic appeal and physical comfort have a relatively low impact on ridership. However, noticeable dissatisfaction was reported in this area. Riders frequently mentioned issues such as inadequate seating, limited shelter at bus stops, and lack of information boards providing schedules and routes. These shortcomings negatively affect the passenger waiting experience and can confuse first-time users. Lastly, "customer relations" ranked ninth, suggesting it has the least influence on ridership. While survey responses reflected moderate satisfaction, categorised as "neither very good nor very bad," there remains room for improvement. Commuters highlighted opportunities to enhance interactions by focusing on friendliness, consistent staff training, adherence to speed limits, and better accommodation of passenger needs.

Pearson correlation analysis

Pearson correlation analysis was conducted to identify relationships between future ridership and satisfaction with various factors. The strength of the correlation highlights the degree to which each factor influences passengers' likelihood to continue using the service.

Table 3: Summary of correlation analysis for nine aspects

	No	**Correlation analysis between future ridership rate and**	**Correlation coefficient (r)**
Spatial Availability	1	distance from the origin to the bus stop	0.225
	2	distance from the bus stop to the destination	0.299
	3	location of the bus stop	0.194
	4	walking environment	0.297
	5	universal design application	0.275
Information Availability	6	accuracy of real-time information	0.266
	7	accessibility to route and timetable information	0.316
Passenger Occupancy	8	having an empty seat available when taking the bus	0.388
	9	comfortability when taking the bus	0.407
Reliability	10	frequency of bus arrivals following the schedule	0.266
	11	bus arrival time is consistent with the application	0.144
Safety and Security	12	feeling safe when waiting at the bus stop alone during the daytime	0.402
	13	feeling safe when waiting at the bus stop alone at night	0.123
	14	feeling safe inside the bus as CCTV is provided	0.459
Cost	15	affordability of current fare	0.064
Bus Stop Appearance and Comfort	16	sitting area provided	0.007
	17	standing area comfortability	0.027
	18	sheltered bus stop	0.081
	19	information boards at bus stops	0.104
Travel Time	20	travel time when using public buses	0.236

	No	**Correlation analysis between future ridership rate and**	**Correlation coefficient (r)**
Customer Relation	21	bus drivers' friendliness	0.114
	22	well-trained bus drivers who obey the law	0.327
	23	bus drivers following the speed limit	0.111
	24	drivers waiting for passengers who are running	0.054

** Correlation is significant at the 0.01 level (2-tailed).

Source: Author's work

The results of Spearman's correlation test, as presented in Table 3, demonstrates how various aspects of service quality are positively correlated with the anticipated ridership rate. While the correlations between the individual service quality factors and future ridership are generally weak, the consistency of this pattern suggests a stable influence across all factors. This indicates that even small improvements or changes in these aspects can significantly impact ridership outcomes over time. The moderate correlation between these variables highlights that passengers perceive the various service quality aspects as equally important, reinforcing their collective influence on ridership, even if the strength of the connection is not strong. This suggests that addressing multiple factors in a balanced manner can improve future ridership, as each factor contributes to a stable and predictable user experience.

TRIANGULATION AND DISCUSSION

The investigation into the impact of service quality on satisfaction reveals significant insights into the relationship between user perceptions and future ridership rates. The analysis highlights a direct link between lower satisfaction levels and a decline in future ridership, with negative perceptions across various dimensions. Specifically, 15 out of 24 factors from the nine service quality dimensions (see Table 3) were found to correlate negatively with future ridership, suggesting that dissatisfaction stems from multiple sources rather than a single determinant. The correlation analysis indicates that no single factor has an overwhelmingly strong effect on future ridership; instead, the decline is the result of a cumulative effect of various factors.

This suggests that to improve ridership, a comprehensive, holistic approach is necessary. Addressing the interconnected issues that contribute to dissatisfaction can help create a more positive perception of public bus services, even in the face of alternative transport options.

From an economic perspective, the analysis also sheds light on the cost-effectiveness of public bus services. The presence of more affordable alternatives, such as e-hailing services, leads to a decrease in bus ridership, reinforcing the importance of pricing in transportation decisions. This finding suggests that

affordable transit options are a key driver of continued public bus use. A deeper analysis of income levels and their influence on transportation choices could further reveal the relationship between economic factors and commuters' preferences for public buses versus other transport modes.

CONCLUSION

In conclusion, this study underscores the importance of addressing the complex relationship between service quality, user satisfaction, and ridership rates to ensure the long-term success of public bus services. The cumulative impact of various factors and the economic motivations behind ridership provide valuable insights for strategic improvements in public transport. This study emphasises the critical relationship between the effectiveness and efficiency of service delivery, highlighting the role of economic factors in shaping public bus ridership. The findings indicate that enhancing service quality – by improving spatial availability, ensuring reliable information systems, increasing comfort during rides, and maintaining affordable fares – is essential for attracting a diverse user base. As economic conditions evolve, it is crucial for public transport systems to remain adaptive to meet the needs of all community segments and to prevent a shift toward private vehicle use. Future research should expand its focus to capture a broader range of perspectives, particularly exploring preferences across different income levels and professions. A deeper understanding of these factors will not only support the sustainability goals of public transportation systems but also encourage greater public trust and satisfaction with these services.

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