Moderation of Perceived Safety in Public Bus Transport on the Link between Bus Route-Time Design and Commuters' intentions

M V Praveen*, K Sravana†, Binoy T A† and Divakaran M‡

Abstract

Ensuring public transportation is safe is not only vital but also a fundamental aspect of developing inclusive, reliable, and sustainable mobility for everyone. This paper examines the moderating effect of safety in the privately-owned State Road Transport Corporation (KSRTC) under the Government of Kerala on the impact of Bus Route-Time design on continuing and word-of-mouth (W-o-M) intentions of passengers through a comparative analysis. The study on daily public bus passengers in Kerala selected a sample size of 686 with 252 State-owned bus passengers and 434 private bus passengers proportionate to Kerala's bus population ratio. The research was conducted at fourteen key bus stations using purposive and lottery random sampling. The reliability was assessed using Cronbach's alpha, ensuring strong internal consistency. The study verified the data's reliability and validity using CFA and pilot testing. The IBM SPSS AMOS 21 software was utilised to investigate the moderating effects. It is evident from studies that bus routes and time design have a substantial influence on different aspects of service quality and passenger behaviour. Safety is still essential no matter the other aspects of service quality. The research shows that perceived safety strengthens the connection between route and time design and passenger intentions, which is more visible in state-owned bus services.

Keywords: Perceived Safety, Route-Time Design, Behavioural Intention, Continual intention, KSRTC, Moderating Effect, Privately Owned Bus, W-o-M intention

---

* Government College Madappally, Madappally, Kerala, India, 673102; praveenmvneelambari@gmail.com
† Central University of Kerala, Kasaragod, Kerala, India, 671320; drksravana@cukerala.ac.in; binoy@cukerala.ac.in
‡ Department of English, Sree Gokulam Arts & Science College Balussery (Affiliated to the University of Calicut), Kozhikode, Kerala, India - 673612; divaprem10@gmail.com

1. Introduction

Insufficient transportation infrastructure and low-quality services hinder economic growth (Chakrabarti & Srivastava, 2015). The primary mode of transportation in India is public buses, which offer an economical and efficient way for people to travel to all parts of the country. There is an immediate need to enhance the country's bus passenger transportation system to address issues such as pollution, traffic congestion, and road accidents, which are major societal concerns (Sudhakar & Rao, 2019). That Kerala registers the third highest number of road accidents in India, though it is in 21st position in size, is alarming. Buses account for only 5 per cent of the total accidents in Kerala. Out of that, state-owned buses account for one per cent, and private buses account for four per cent (Plan FF, 2022). Although many developed countries have shifted towards sustainable transport and are moving from private vehicles to public transportation, Kerala, which shares many characteristics with developed countries, is moving away from public transportation, particularly buses. There has been a substantial decline in the volume of passengers in the bus industry. The congested road network of Kerala is filled with motorcycles and personal vehicles, responsible for 70 per cent of traffic accidents in Kerala. It is concerning that Kerala records the highest rate of road accidents in India for every one lakh population, i.e., 115 per lakh (MoRTH, 2022). Even though people in Kerala rely heavily on private transportation, which is expensive and unsafe, the public bus system needs to do a better job of encouraging passengers to fill empty seats.

As per the records of the Kerala State Planning Board, 2022-23, the KSRTC buses provide transportation for 37 per cent of Kerala's public bus passengers, while private bus operators cater to 63 per cent. Regulatory oversight is stricter for KSRTC, a state-operated service than for private bus operators. This results in frequent and improved adherence to safety regulations and practices. KSRTC implements rigorous accountability procedures for its drivers, such as frequent health assessments and supervision of driving conduct. Private bus operators, however, may not consistently implement such rigorous rules. KSRTC is trusted by the general public for their commitment to safety measures despite occasional accidents. Though the private bus services massively contribute to Kerala state in terms of financial resources like road tax, permit fee, etc, and lakhs of employment opportunities, they are frequently approached with caution because of their aggressive driving behaviours and increased likelihood of accidents (Sivaraman, 2016). In short, although KSRTC and private buses in Kerala encounter difficulties ensuring passenger safety, KSRTC is commonly considered safer because of more stringent regulatory supervision and safety precautions. However, KSRTC's name has been consistently heard in prominent cases of harassment and misconduct targeting women (New Indian Express, 2024, May 1). Nevertheless, both require further measures to enhance their safety records and boost passengers' behavioural intentions.

The government claims that KSRTC's route network design is such that it operates heavily on unprofitable routes and timings, emergencies, etc., targeting only public service, and that such network design is the cause of the corporation's losses. In contrast, private buses operate only on profitable routes and times. It is also a general view that private operators do not operate in emergency and risky situations. KSRTC services are more reliable in emergencies, public strikes, late nights, etc. However, the credibility of KSRTC buses is undermined because of the frequent reporting of conspicuous incidents involving harassment and misconduct against women.

Several studies show that the design of bus routes and schedules significantly influences passengers' behavioural attitudes. Departure frequency, timeliness, and service reliability significantly impact travel behaviour and intention consistency (Meng et al., 2024). Creating an ideal timetable with spare time and intervals can reduce passenger waiting time and delay expenses (Wiransinghe & Liu, 1995). The importance of service quality and public transport's perceived value impacts behavioural intentions (Sumaedi et al., 2012). Gender variations also have an effect, as women's intentions are more affected by travel satisfaction, while men's travel timeliness has a more significant influence. To boost bus ridership and promote eco-friendly transportation, strategies must consider various factors and customised route designs for different types of passengers. Enhancing bus travel service quality, perceived value, and catering to gender-specific time and route design can lead to favourable behavioural intentions towards bus travel (Li et al., 2024).

Strengthening public bus transport is essential for a small state like Kerala. After all, it is better suited to Kerala's unique topography and a much cheaper and better mode of transit with a lower carbon footprint (Jaiswal et al., 2024). However, a massive decrease in bus ridership and the number of buses has been noted in Kerala, particularly following the Covid-19 outbreak. While the KSRTC has decreased by over one million passengers, the private bus service industry has witnessed the disappearance of around ten thousand buses (Verma et al., 2021). In the stated public bus transport scenario, it is crucial to answer some important concerns such as: Could the insufficient or faulty route and time design (bus network) of service be the reason for not attracting a large number of commuters by the bus transport system in Kerala? Can improving route and time design and improved safety measures bring back passengers who fell behind during the COVID-19 pandemic? Is perceived safety a factor in strengthening passengers' behavioural intentions? To address these inquiries, it is vital to understand how passengers view the route-time design and safety measures provided by KSRTC bus services (State-owned) and privately owned transport services in Kerala.

In short, though the perceived safety of KSRTC is stronger than privately owned buses, the occasional occurrences of atrocities against women commuters, the need for rationalisation of route-time design and decreased ridership are to be addressed with result-oriented measures so that commuters' behavioural intention can be strengthened.

2. Literature Review

2.1. Bus Route-Time Design and Passengers' Re-use Intention

Customer satisfaction mediates between bus network quality and passengers' intention to reuse. The service quality significantly affects commuter satisfaction, subsequently affecting the re-use intention of public transport bus services (Zinedine et al., 2023). Elements like attitude, subjective norms, and image influence passengers' desire to continue public transportation use (Sumaedi et al., 2016). In the opinion of Wang et al. (2020), functional and technical aspects, comfort, cleanliness, and route and time reliability are service quality dimensions in urban rail transit that influence reuse intention through customer satisfaction. Providing clear information regarding route and time schedules, running status, and implementing standardised pricing can boost the public's willingness to utilise bus services (Balcombe et al., 2004). It is essential for transport agencies to comprehend these relationships to enhance services, boost ridership, and implement sustainable transport policies (Kim & Lee, 2022). In general, route networks and time designs/schedules affect passengers' loyalty and re-use (continual) intention of passengers, and accordingly, the following hypothesis was formulated.

> **H1:** *Bus route- time design positively affects the continual intention*

2.2. Route-Time Design and Passengers' W-o-M Intention

Research into the quality of public transportation services and how passengers behave has identified several important factors that impact passenger satisfaction and intentions. According to Widianti et al. (2015), service quality, perceived value, and sacrifice greatly influence passengers' intentions to recommend and repurchase. According to Wu et al. (2016), Bayesian network analysis reveals that being on time, reasonable wait times, seat availability, cleanliness, and convenient connections are key factors for overall satisfaction. Passengers will choose to use buses based on whether their schedules match their desired travel times, making the timing of bus services crucial (Van, 1987). In service disruptions, the accuracy and adequacy of information given to passengers influence their decisions on routes and expectations, as perfect information reduces delays but raises passenger expectations (Leng & Corman, 2022). These findings emphasise how service attributes, Bus networks, route and time schedules, information provisions,

etc., shape passengers' WoM intention towards transport services. These observations form the base for the second hypothesis.

H2: *Bus Route- Time design positively affects the W-o-M intention*

2.3. Perceived Safety and Passengers' Behavioural Intentions

The role of perceived safety in the public transport system is a crucial element influencing user satisfaction, ridership, and overall behavioural intention. Studies show that passengers' perceptions of safety and knowledge of safety information significantly impact their behaviour in transportation situations. Sense of safety has a marginal but significant and positive impact on public transport usage frequency (Desbosc & Currie, 2011). Moon et al. (2017) discovered that passenger satisfaction and behavioural intentions in airports directly affect how safe passengers feel. Research indicates that how passengers perceive aviation safety information can benefit their attitudes towards safety and intentions towards safety-related actions (Choi, 2021). Certain factors contribute to the safety behaviour of passengers regarding public transport. Factors, like perceived behavioural control, attitudes, and subjective norms, play an important role in shaping their sense of safety awareness (Verma et al., 2021). Furthermore, perceived price, SQ, and operator image have also been recognised as factors affecting passengers' re-use intentions in air travel, as Park et al. (2008) explained. These results highlight the significance of providing effective safety education and information to improve passengers' awareness and behaviour in different transportation modes. Improving safety measures and communicating them effectively can enhance passenger satisfaction and encourage repeated public transport use. The above findings torch the formulation of the other two hypotheses of the study such as:

H3: *Perceived Safety in bus service positively affect the continual intention*

H4: *Perceived Safety in bus service positively affect the W-o-M intention*

2.4. Moderating effect of perceived safety

The inter-relationships between various independent variables and behavioural outcomes have been studied in different settings, considering the moderating effect of perceived safety. In airport environments, perceived safety did not impact the connection between satisfaction and behavioural intentions, but it did directly affect satisfaction (Moon et al., 2017). Perceived risk is a moderator in the relationship between product safety and purchase intention (Ismail & Mokhtar, 2015). According to petrochemical firefighting, the perceived safety climate has a significant role in the relationship between fatigue and safety behaviour, according to Ghasemi et al. (2022). In community settings, the link between green features and physical activity

was influenced by perceived safety, showing beneficial impacts only for those who felt very safe (Weimann et al., 2017). These studies emphasise the important role of perception of safety in influencing behaviour in different areas, demonstrating its significance as both a direct factor and a moderator in various environmental and safety-related situations.

A comsrehensive literature review revealed a dearth of studies based on perceived safety as a moderating factor in transport sector-related studies, primarily until the arrival of the COVID-19 pandemic. The epidemic significantly impacted mobility behaviours, affecting public transport users' sense of safety and mental comfort, leading many to avoid it. According to a survey, 90 per cent of commuters either stopped or reduced the use of public transport. While nearly 75 per cent plan to return once the situation stabilises, the rest have felt a trust deficit in its safety. This highlights that the future of urban public transport depends on maintaining high levels of perceived comfort and safety during epidemics. Transport policies should enhance these perceptions to prevent further decline in public transport use and ensure a sustainable future (Przybylowski et al., 2021). Psychological factors, rather than economic factors like fuel prices or public transport fares, are crucial for people's reluctance to switch to public transport for commuting (Urbanek, 2021) and perceived SQ, perceived safety, and satisfaction substantially influence passenger loyalty towards bus services, with female passengers being more loyal when having higher safety perceptions.

Since night public transport services potentially enhance public safety, the public transport system is considered the safest mode of transport (Henezı & Wınkler, 2023). A sense of safety enhances users' overall satisfaction with public transport services, but anxiety negatively affects perceived safety (Dong et al., 2021). Enhancing the safe ambience in public transport, such as improving motivation and knowledge, has a determining cause-and-effect relationship with reducing safety violations by bus rapid transport drivers (Safitri, 2020). Switching from personalised transport means to public transport systems such as trains, trams, and buses would reduce total and severe accidents (Truong & Currie, 2019). Perceived safety in public transport is influenced by mutual trust, feeling of indoor or outdoor safety at night, age, and gender, with age having a more significant indirect effect than gender over behavioural intention (Desbosc & Currie, 2012). The following hypotheses were formulated in light of the hints from the mentioned studies.

H5: Perceived safety in the bus service has a moderating effect on the strength of the Bus Route-Time design and continual intention relationship

H6: Perceived safety in the bus service has a moderating effect on the strength of the Bus Route-Time design and W-o-M relationship

2. Methodology

2.2. Research Objective

The researcher hypothesises from the indices of literature that the design of Bus Routes and Time has a notable impact on passengers' behavioural intention. Regardless of how well the service quality factors are met, people are unlikely to use such bus services without safety. These assumptions are the foundation for the study's objective to decide whether the perceived safety in bus services enhances the relationship between the bus route-time design and passengers' behavioural intentions.

2.3. Research Design

The research embraces an interpretive, humanistic, and naturalistic philosophy by utilising an inductive approach to gather information on passenger perceptions, satisfaction, post-service behaviour, and intentions from a survey of selected passengers. Additionally, the research employs a combination of qualitative and quantitative methods, incorporating aspects such as perception, satisfaction, and behavioural intention in the qualitative analysis and utilising quantitative research for data collection, coding, analysis, and interpretation. The research employs a cross-sectional and descriptive study design. Surveys are a swift, inexpensive, and effective method for gathering qualitative research data (Khalid, 2012) and (Zikmund, 2000). Therefore, a passenger questionnaire is selected to collect essential information for this research, targeting Kerala bus riders who utilise government-run or privately operated bus facilities monthly. The research utilises a pair of datasets. The primary data was obtained from surveys evaluating passenger perceptions and behavioural intentions. Secondary data will be collected from the KSRTC annual report, other public sector bus operators, financial reviews from the Kerala State Planning Board, budget reports, and the Bus Owners Association.

2.4. Sample Design and Procedure

Due to the unknown population size of daily public bus passengers in Kerala (usually over 1 million), a sample size of 686 was chosen with a 99per cent confidence level and 5per cent margin of error as suggested by Serdar et al. (2021), consisting of 252 KSRTC passengers and 434 private bus passengers. Both categories of passengers were chosen under the population distribution of KSRTC buses and private buses in Kerala, i.e.37:63. A survey was carried out in person at fourteen key bus stations in Kerala. Districts in Kerala were arranged in order from south to north for this purpose. The researcher used the "RAND" function in MS Excel to randomly select 50 per cent of the districts for the passenger surveys. The research began on March 15, 2024, due to the high passenger traffic in Kerala in late March, and it was

finished after 8 weeks. Vacations and holidays were also included due to the increased commuting during those times. Purposive sampling is employed to choose passengers from specific bus stops to ensure the respondents have taken a bus trip at least once a month. Two bus stations (1 private and 1 KSRTC) were randomly selected from each district's major private and KSRTC bus stations using lottery random sampling.

2.5. Reliability and Validity

In this study, the researcher assesses the reliability using Cronbach's alpha. Cronbach's alpha assists in assessing the extent of consistency. Outcomes vary from 0 to 1. An alpha value of 0.70 or higher signifies strong internal consistency, while a value of 0.60 or higher is deemed meaningful, according to Cronbach and Meehl (1955). A pilot study with a sample size of 60 tests and validates the reliability of 18 constructs and items using Cronbach's alpha. The study thoroughly and extensively verified the reliability and validity of the complete data. Confirmatory factor analysis (CFA) is used to verify the construct validity (convergent and discriminant) and reliability (composite reliability). Composite reliability (CR) is used to establish the reliability of the overall constructs. In contrast, construct validity (convergent and discriminant validity) is assessed through 'Average Variance Extracted' (AVE).

2.6. Data Analysis Tools

Structural equation modelling examines how perceived safety in private and KSRTC bus services influences the impact of route and time design on passengers' behavioural intention. The significance of this moderation effect is tested using two-way interaction graphs with the assistance of IBM SPSS AMOS graphics 21 and MS Excel.

3. Results and Discussion

A variable that alters one variable's effect on another, like an independent variable affecting a dependent variable, is called a 'moderating variable'. In social sciences, the term "moderator" was initially coined to describe a factor that disrupts the inter-relationship between an independent variable and its corresponding dependent variable. For example, in the inter-relationship between X and Y, the moderator variable can be indicated as M. This means that M serves as a moderator by adjusting the extent of X's influence on Y (E-Vahdati et al., 2018) and (Zaindin, 2012). In this study, bus route and time design, passengers' behavioural intention (continual and W-o-M intention),

and perceived safety are independent, dependent, and moderating variables, respectively. Moderation analysis under the study has two parts: moderation analysis for privately owned bus services and KSRTC bus services.

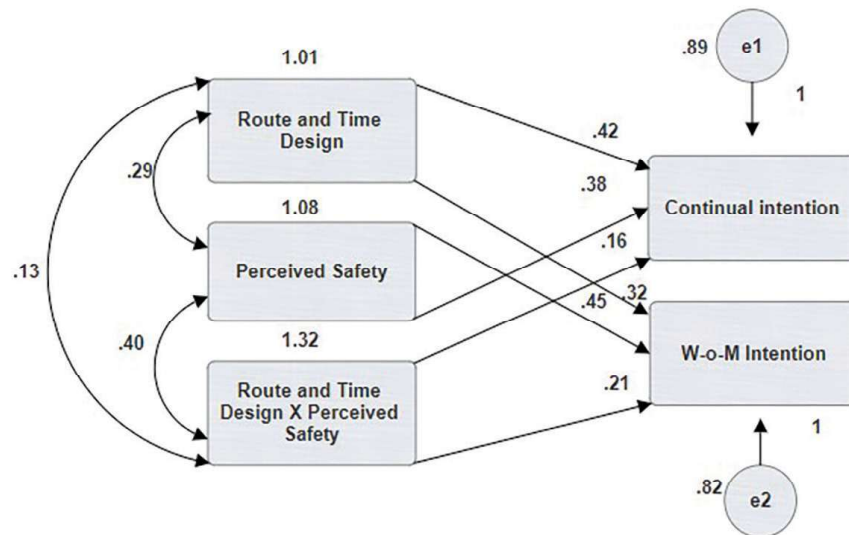## A. Moderation Analysis on Privately Owned Bus Services

Figure 1: Unstandardized Regression Coefficients-based Interaction Moderation Model

Table 1: Model fit indices for examining how the independent variable X affects its corresponding dependent variable Y through the moderating variable M

Attributes	CMIN/DF	P-Value	GFI	AGFI	CFI	RMSEA
Study model	3.458	0.000	0.978	0.941	0.991	0.045
Recommended value	Acceptable fit [1-5]	Greater than 0.05	Greater than 0.9	Greater than 0.9	Greater than 0.9	Less than 0.08

CFA model fit indicators are shown in Table 1. A good model has a Chi-Square to degrees of freedom ratio under 5. 3.485 is well within the acceptable maximum range. The 'Route Mean Square Error Approximation' (RMSEA) is 0.045, far below the suggested value of 0.08. A good fit is denoted by indices such as the goodness of Fit Index (GFI), 'Adjusted Goodness of Fit Index' (AGFI), and 'Comparative Fit Index' (CFI), together with scores above 0.9 and 1.0.

Table 2: Summary of Estimates of the Moderation Model

Construct	Path	Construct	Estimate	S. E	C. R	P-value
Continual intention	←	Bus Route-Time Design	0.42	0.035	6.98	<0.001**
W-o-M intention	←	Bus Route -Time Design	0.32	0.039	4.87	<0.001**
Continual intention	←	Safety in the private bus service	0.38	0.032	7.56	<0.001**
W-o-M intention	←	Safety in the private bus service	0.45	0.040	7.56	<0.001**
Continual intention	←	Bus Route-Time Design x Safety in the private bus service	0.16	0.021	3.62	<0.001**
W-o-M intention	←	Bus Route -Time Design x Safety in the private bus service	0.21	0.020	4.01	<0.001**

** denotes 1per cent significance level

Table 2 demonstrates that Bus Route-Time design significantly and positively affects the intention to continue and use word-of-mouth. The perceived safety of private bus services in Kerala positively and significantly affects the probability of continued use and word-of-mouth promotion by the passengers. The interaction of bus routes, time design, and safety in private bus services significantly influence the intention to continue using the service or recommend it to others. The model's moderation effect is explained in more detail below.

Table 3: Summary of Moderation Effect – I and II for Private Bus Services

Construct names			Unstandardised Regression Coefficients		
Independent construct	Moderator	Dependent construct	Independent construct	Moderator	Interaction
Bus Route-Time Design	Safety in the private bus services	Continual intention	0.42**	0.38**	0.16**
Bus Route -Time Design	Safety in the private bus services	W-of-M intention	0.32**	0.45**	0.21**

** denotes 1per cent significance level; NS denotes Not Significant

Table 3 indicates the strength of the inter-relationship between the Bus Route-Time design of the private bus services and the continual and word-of-mouth intention of the passengers is significantly moderated by perceived safety in the privately owned bus services in Kerala. As a moderator, perceived safety in the private bus services strengthens or weakens the relationship between the Bus Route and Time design of the private bus services in Kerala and the continual and W-o-M intentions of the passengers of the bus services. Perceived Safety in the private bus service positively moderates the relationship between bus route and time design

and continual intention and W-o-M intention. This reveals that higher safety in the private bus service strengthens the positive impact of the bus route and time design on behavioural intentions. Perceived Safety, the network of operations and the schedule are the critical successful components of every type of bus service. If operators consider these two services carefully in their service delivery, the chances of success in their operation will be much higher. In this viewpoint, the results will be higher if these two components are joined together. A continuous moderation analysis was carried out to measure these things. The statistical testing for the significance reveals a significant moderating effect on these two factors.

I. Simple slope test (two-way interaction effect) for unstandardised variables for moderation effect– I: Private bus services.
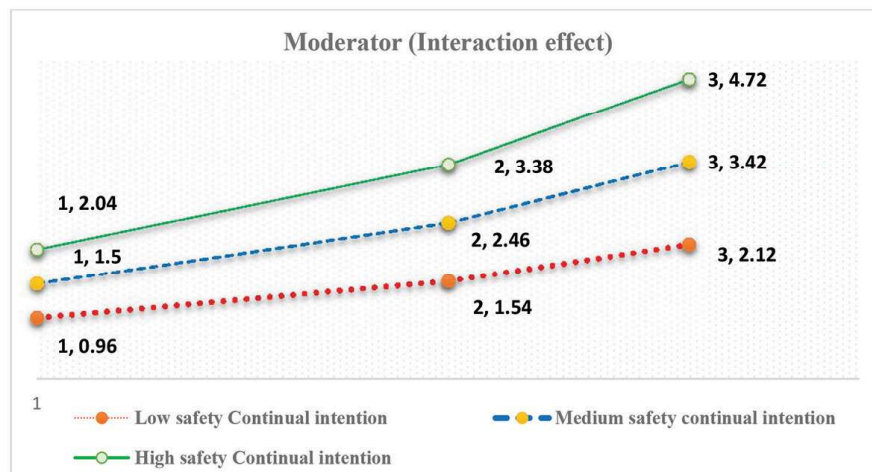

Figure 2: Interaction of Bus Route and Time Design and Safety to Predict Continual Intention in Private Bus Services

Result of Two-way interaction: The simple slope curve (Figure 2) for the interaction effect indicates that the perceived safety moderately affects the relationship between Bus Route-Time design and passengers' continual intention.

II. Simple slop test plots (two-way interaction effect) for unstandardised variables for moderation effect– II: Private bus services
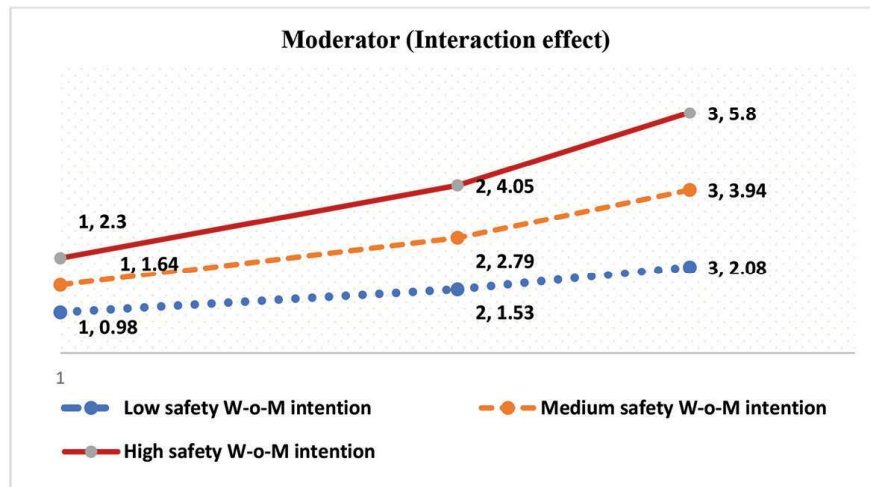

Figure 3: Interaction of Bus Route and Time Design and Safety to Predict Word-of-Mouth Intention of Private Bus Services

Result of Two-way Interaction: The sloping curve of the interaction effect (Figure 3) shows that safety does not moderate the link between the bus route and time design and word-of-mouth intention.

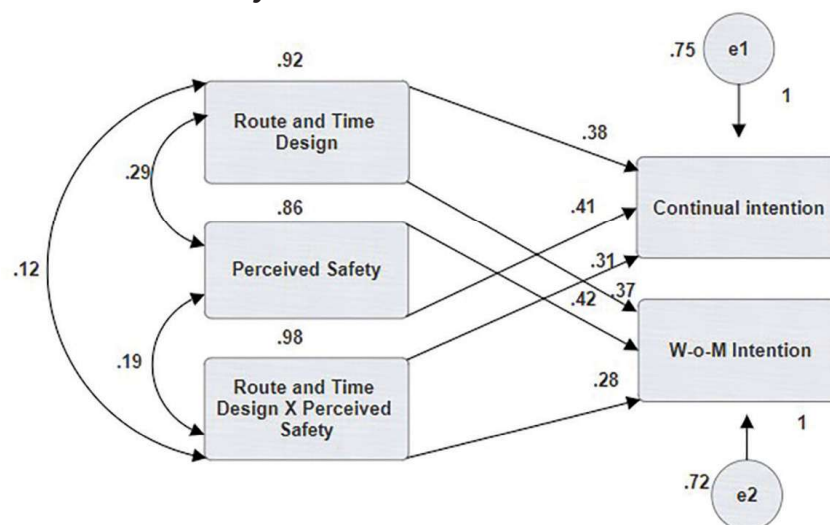## A. Moderation Analysis on KSRTC Bus Services

Figure 4: Unstandardized Regression Coefficients-based Interaction Moderation Model

Table 4: *Model Fit Indices for examining how the Independent Variable X affects its corresponding Dependent Variable Y through a Moderating Variable M*

Attributes	CMIN/DF	P-Value	GFI	AGFI	CFI	RMSEA
Study model	3.786	0.000	0.968	0.940	0.992	0.049
Recommended value	Acceptable fit [1-5]	Greater than 0.05	Greater than 0.9	Greater than 0.9	Greater than 0.9	Less than 0.08

Ans appropriate model should have a 'Chi-Square to degrees of freedom ratio' (CMIN/DF) of less than 5.0. In this instance, the number is 3.786, within the permitted upper limit. The suggested threshold level 0.08 is greatly exceeded by the RMSEA score of 0.049. There is an acceptable fit when the GFI, AGFI, and CFI values are all greater than 0.9 and better than 1.0.

Table 5: Summary of Estimates of the Moderation Model for KSRTC Bus Services

Construct	Path	Construct	Estimate	S. E	C. R	P-value
Continual intention	←	Bus Route -Time Design	0.38	0.031	5.76	<0.001**
W-o-M intention	←	Bus Route-Time Design	0.37	0.036	5.09	<0.001**
Continual intention	←	Safety in the private bus service	0.41	0.035	6.45	<0.001**
W-o-M intention	←	Safety in the private bus service	0.42	0.029	6.98	<0.001**
Continual intention	←	Bus Route and Time Design x Safety in the private bus service	0.31	0.020	4.68	<0.001**
W-o-M intention	←	Bus Route and Time Design x Safety in the private bus service	0.28	0.023	4.26	<0.001**

** denotes 1per cent significance level; NS denotes non-significant

The 'interaction moderation model' (Table 5) shows that Bus Route-Time design significantly and positively affects the continual and W-o-M intention of passengers of KSRTC services. The perceived safety of the KSRTC bus services positively and significantly affects the continual and W-o-M intentions. Interaction of the Bus Route -Time design and the perceived safety in the KSRTC bus services significantly affect the continual intention and W-o-M intention in the KSRTC bus services. The particulars of the moderation effect from the model are presented below.

Table 6: Summary of Moderation Effect – I and II for KSRTC bus services

Construct names			Unstandardised Regression Coefficients		
Independent construct	Moderator	Dependent construct	Independent construct	Moderator	Interaction
Bus Route-Time Design	Safety in the KSRTC bus services	Continual intention	0.38**	0.41**	0.31**
Bus Route-Time Design	Safety in the KSRTC bus services	W-o-M intention	0.37**	0.42**	0.28**

** denotes 1per cent significance level

Table 6 demonstrates that the safety of the KSRTC bus services in Kerala substantially moderates the strength of the link between the Bus Route-Time design of the KSRTC bus services and the continuous and W-o-M intention of the passengers. As a moderator, it can be inferred that the KSRTC bus service's safety either strengthens or weakens the relationship between the Bus Route and Time design of the KSRTC bus service and its passengers' continual and W-o-M intentions.

The data presented in the table above demonstrates that the robustness of the safety and network of operation of buses, as well as the schedule of the bus service, are the critical components that contribute to the successful operation of any bus service. The possibilities of the operators' business being successful will significantly improve if they consider these two aspects of the service they provide to customers. According to this point of view, the outcomes will be improved if these two aspects are combined into a single whole. Surprisingly, the statistical test's outcome reveals a significant moderating impact on these two factors.

I. Simple slop test plots (two-way interaction effect) for unstandardised variables for moderation effect– I: KSRTC bus services
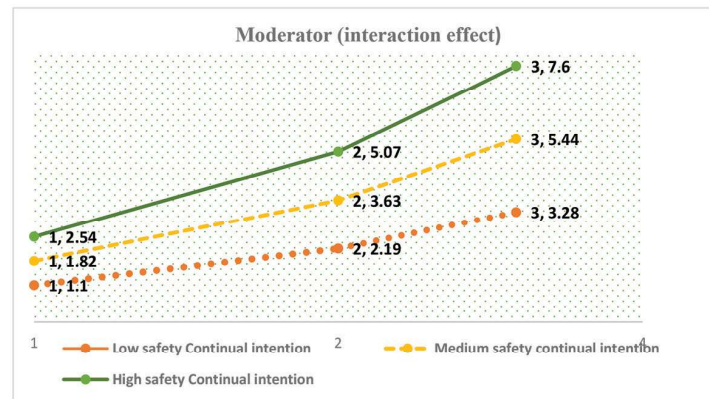

Figure 5: Interaction of Bus Route and Time Design and Safety to Predict Continual Intention in KSRTC Service

Result of Two-way interaction: The simple slope curve for the interaction effect (Figure 5) indicates that the perceived safety moderately affects the relationship between Bus Route- Time design and the continual intention of KSRTC bus services.

II. Simple slop test plots (two-way interaction effect) for unstandardised variables for moderation effect– II: KSRTC bus services.
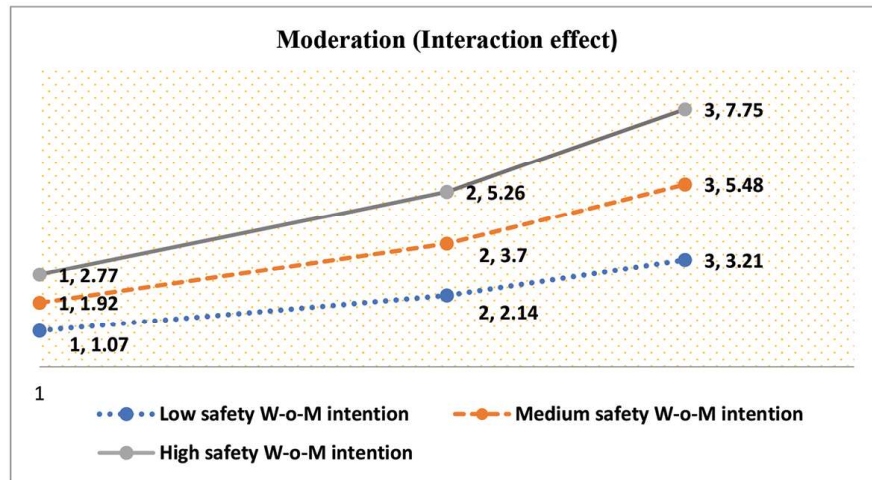

Figure 6: Interaction of Bus Route and Time Design and Perceived Safety to Predict Word-of-Mouth Intention in KSRTC Bus Services

Result of Two-way interaction: The connection between Bus Route and Time design and the desire to recommend KSRTC bus services is moderated by perceived safety, according to the simple slope curve for the interaction effect (figure 6).

Table 7: Summary of Hypotheses testing

Hypotheses	Hypotheses statements for moderation analysis	Result
H.1	Bus route and time design positively affect the continual intention	Supported
H.2	Bus Route and Time design positively affect the W-o-M intention	Supported
H.3	Perceived Safety in bus service positively affects the continual intention.	Supported
H.4	Perceived Safety in bus service positively affects the W-o-M intention	Supported
H.5	Perceived safety in the bus service has a moderating effect on the strength of the Bus Route-Time design and continual intention relationship.	Supported
H.6	Perceived safety in the bus service has a moderating effect on the strength of the Bus Route-Time design and W-o-M relationship.	Supported

Discussion: The results of the moderation effect testing reveal that the level of perceived safety provided by the private and KSRTC bus services act as a moderator in the relationship between Bus Route-Time design, continual intention, and W-o-M intention. This indicates that perceived safety strengthens the relationship between bus route and time design, as well as continuous intention and W-o-M intention. The moderation impact is further clarified in the following paragraphs.

- **Moderating Effect in Private Bus Services**: In private bus services, the moderation estimates regarding passengers' perceived safety on the relationships between route-time design and continuity intention, route-time design and W-o-M intention were 0.16 and 0.21, respectively. This suggests that perceived safety positively moderates the relationship between route-time design and passengers' behavioural intention. Among the components of behavioural intention, the strength of this moderation is more on the effect of route and time design on W-o-M intention in private bus services.

- **Moderating Effect in KSRTC bus services**: In KSRTC bus services, the moderation estimates regarding passengers' perceived safety on the relationships between route-time design and continuity intention, route-time design and W-o-M intention were 0.31 and 0.28, respectively. This reveals that passengers' perceived safety register a more substantial positive moderating effect on the relationship between route and time design and passengers' behavioural intention in KSRTC services. Among the components of behavioural intention in KSRTC, the strength of this moderation is more on the effect of route and time design on continual intention.

- **Comparison**: Comparing the two moderation estimates (0.16 and 0.21 for private bus services and 0.31 and 0.28 for KSRTC bus services) concerning continual and W-o-M intentions, respectively, it is established that the influence of the passengers' perceived safety on the relationship between bus route-time design and passengers' behavioural intention is more substantial in the state-owned KSRTC bus services. This implies that improving bus safety and security significantly enhances passengers' likelihood of re-using and recommending to others in KSRTC services than it does for private services. This study rightly explores how safety impacts the relationship between Bus routes and Time design on passenger intentions in privately owned and state-owned bus services in Kerala. Safety strengthens the link between design and intentions, particularly in state-owned services.

- **Recommendation**: It is established from the study that commuters' behavioural intention is a crucial factor in enhancing ridership in the public bus transport system. Notably, perceived safety is pivotal in

positively turning commuters' behavioural intentions. Further, the route and time design of public bus transport service impacts commuters' continual and W-o-M intention. Since perceived safety has a more positive impact on KSRTC bus services, the operators and policymakers should bring in more safety measures and rationalisation of route and time design that have a visible manifestation regarding the operational dynamics of KSRTC. The same pattern can be adopted in private-sector bus services.

5. Conclusions and Implications

The current study is initiated to examine and compare the moderating effect of the passengers' perceived safety on the impact of bus route-time design on the private and state-owned bus passengers' behavioural intention in Kerala. Many studies have revealed that the quality of the services offered by both sectors was relatively high, but the dropout rate of passengers is widely felt in both sectors. Therefore, this study tried to determine the behavioural intention of passengers based on a moderating factor called passenger safety, which is given more consideration by enlightened passengers in Kerala. Hence, the moderation effect of the perceived safety of the bus services operated by both the private and KSRTC was investigated in this paper. The investigation revealed a moderating role played by passengers' perceived safety in the relationship between Bus Route and Time design, continual intention and word-of-mouth intention. While passengers' perceived safety positively influences the relationship between bus route and time design and behavioural intention in private and KSRTC services, this effect is more pronounced in KSRTC services. The fit statistical indices of the model demonstrate that the model is a precise and flawless representation of the data. The findings of the moderation effect were also verified with the assistance of the interaction graph. Examining perceived safety's impact on passenger behaviour in transportation services reveals key implications. Recognising safety's importance helps providers enhance service quality, increasing passenger satisfaction and behavioural intentions. Research findings can aid in improving marketing strategies and policymaking, ultimately leading to a safer, more efficient transportation system with economic benefits. Fostering a sense of safety for passengers in transportation can have positive social and psychological effects, reducing stress and anxiety while increasing use of public transportation. This shift can aid environmental sustainability by decreasing reliance on private cars and other personalised vehicles, while cultural considerations can enhance safety measures and passenger experiences.

6. Limitations and Scope for Further Research

A limitation that cannot be avoided in the present study is comparing the moderating effect of the perceived safety between a significant public sector undertaking (KSRTC) in Kerala and private bus services operated by individuals or small businesses. While abundant evidence shows a strong link between behavioural intentions and authentic behaviour, relying on post-service variables like "behavioural intention" can pose challenges. The research relies on cross-sectional data instead of longitudinal data to examine the cause-and-effect relationship between the variables, which could be a potential constraint. Despite the numerous valuable contributions and implications of this study, research gaps still need to be addressed in the field of public transport in Kerala. Some of the researcher's concerns can be explored, like conducting a comparative analysis of behavioural intentions between state transport services in Kerala and top-performing state-owned services in nearby states or other countries. Research can examine how government policy influences the connection between service quality and behavioural intention. Examining the causal connection may be better suited for studying the relationship between route and time design, service quality, safety, etc, and passengers' post-service behaviour in a longitudinal study. In addition to the safety of services and passenger behaviour, relationships like corporate governance and behavioural intention (BI), passenger amenities and BI, asset/resource management, SQ, and passengers' BI are important in the transportation service industry.

Ethical Statement: It is declared that the authors have taken permission and met all ethical clearances before and while conducting the study titled "Moderation of Perceived Safety in Public Bus Transport on the Link between Bus Route-Time Design and Commuters' Intention in Kerala"**.** The authors also declare no conflict of interest and compliance with ethical standards as requested in the publisher's submission guidelines.

List of Abbreviations

AGFI: Adjusted Goodness of Fit Index

AVE: Average Variance Extracted

BI: Behavioural Intention

CFI: Comparative Fit Index

GFI: Goodness of Fit Index

KSRTC: Kerala State Road Transport Corporations

RMSEA: Root Mean Square Error of Approximation

SQ: Service Quality

W-o-M: Word of Mouth.

References

Balcombe, R., Mackett, R., Paulley, N., Preston, J., Shires, J., Titheridge, H., Wardman, M., & White, P. (2004). The demand for public transport: A practical guide. https://discovery.ucl.ac.uk/id/eprint/1349

Chakrabarti, P. D., & Srivastava, N. (2015). *Green federalism: Experiences and practices.* The Energy and Resources Institute.

Choi, J. H. (2021). Changes in airport operating procedures and implications for airport strategies post-COVID-19. *Journal of Air Transport Management*, 94, 102065. https://doi.org/10.1016/j.jairtraman.2021.102065

Cronbach, L. J., & Meehl, P. E. (1955). Construct validity in psychological tests. *Psychological Bulletin*, 52(4), 281–302. https://doi.org/10.1037/h0040957

Delbosc, A., & Currie, G. (2012). Modelling the causes and impacts of personal safety perceptions on public transport ridership. *Transport Policy*, 24, 302–309. https://doi.org/10.1016/j.tranpol.2012.09.009

Delbosc, A., & Currie, G. (n.d.). Modelling the causes and consequences of perceptions of personal safety on public transport ridership.

Dong, H., Ma, S., Jia, N., & Tian, J. (2021). Understanding public transport satisfaction in post-COVID-19 pandemic. *Transport Policy*, 101, 81–88. https://doi.org/10.1016/j.tranpol.2020.12.004

E-Vahdati, S., Zulkifli, N., & Zakaria, Z. (2018). A moderated mediation model for board diversity and corporate performance in ASEAN countries. *Sustainability*, 10(2), 556. https://doi.org/10.3390/su10020556

Ghasemi, F., Zarei, H., Babamiri, M., & Kalatpour, O. (2022). Fatigue profile among petrochemical firefighters and its relationship with safety behaviour: The moderating and mediating roles of perceived safety climate. *International Journal of Occupational Safety and Ergonomics*, 28(3), 1822–1828. https://doi.org/10.1080/10803548.2021.1935142

Government of Kerala, Kerala State Planning Board. (2022). *Plan FF*.

Henezi, D., & Winkler, A. (2023). The role of public transport in transport safety and public safety. *The Eurasia Proceedings of Science Technology Engineering and Mathematics*, 23, 505–512. https://doi.org/10.55549/epstem.1374907

Ismail, S., & Mokhtar, S. (2015). The antecedents of herbal product actual purchase in Malaysia. *Management Science Letters*, 5(8), 771–780. https://doi.org/10.5267/j.msl.2015.5.011

Jaiswal, A., Manoj, M., & Tiwari, G. (2024). Exploring India's intermediate public transport: A comprehensive overview. *Transportation in Developing Economies*, 10(1), 14. https://doi.org/10.1007/s40890-024-00202-4

Khalid, K., Abdullah, H. H., & Kumar, M. D. (2012). Get along with the quantitative research process. *International Journal of Research in Management*.

Kim, H., & Lee, N. (2022). The effects of the in-flight safety information characteristics on the safety behavioral intention of airline passengers. *Sustainability*, 14(5), 2819. https://doi.org/10.3390/su14052819

Leng, N., & Corman, F. (2022). Communicating delays and adjusted disposition timetables: Modelling and evaluating the impact of incomplete information to passengers. *Expert Systems with Applications*, 191, 116265. https://doi.org/10.1016/j.eswa.2021.116265

Li, Q., Jing, R., & Zhu, X. (2024). Determinants of travel satisfaction for commercial airlines: A data mining approach. *Engineering Applications of Artificial Intelligence*, 133, 108597. https://doi.org/10.1016/j.engappai.2024.108597

Meng, F., Wang, X., Zong, W., Wang, S., & Sun, S. (2024). Analyzing the deviation between bus behavioral intention and actual behavior: A case study in Suzhou, China. *Transportation Planning and Technology*, 1–32. https://doi.org/10.1080/03081060.2024.2331647

Ministry of Road Transport and Highways (MoRTH). (2021-22). *Road transport yearbook*.

Moon, H., Yoon, H. J., & Han, H. (2017). The effect of airport atmospherics on satisfaction and behavioral intentions: Testing the moderating role of perceived safety. *Journal of Travel & Tourism Marketing*, 34(6), 749–763. https://doi.org/10.1080/10548408.2016.1223779

Moon, H., Yoon, H. J., & Han, H. (2017). The effect of airport atmospherics on satisfaction and behavioral intentions: Testing the moderating role of perceived safety. *Journal of Travel & Tourism Marketing*, 34(6), 749–763. https://doi.org/10.1080/10548408.2016.1223779

Park, J. Y., Kim, D. J., & Lim, Y. (2008). Use of smart card data to define public transit use in Seoul, South Korea. *Transportation Research Record*, 2063(1), 3–9. https://doi.org/10.3141/2063-01

Przybylowski, A., Stelmak, S., & Suchanek, M. (2021). Mobility behavior in view of the impact of the COVID-19 pandemic—Public transport users in Gdansk case study. *Sustainability*, 13(1), 364. https://doi.org/10.3390/su13010364

Safitri, D. M., Surjandari, I., & Sumabrata, R. J. (2020). Assessing factors affecting safety violations of bus rapid transit drivers in the Greater Jakarta Area. *Safety Science*, 125, 104634. https://doi.org/10.1016/j.ssci.2020.104634

Serdar, C. C., Cihan, M., Yücel, D., & Serdar, M. A. (2021). Sample size, power and effect size revisited: Simplified and practical approaches in pre-clinical, clinical and laboratory studies. *Biochemia Medica*, 31(1), 27–53. https://doi.org/10.11613/BM.2021.010502

Sivaraman, M. (2016, November). Challenges to the role of private participation in public transportation: A case of Kerala's private buses.

Sudhakar, G., & Rao, R. S. (2019). The determinants of commuters' perception using public transport services and its impact on passenger satisfaction at Hyderabad, Telangana, India. *ITIHAS the Journal of Indian Management*, 9(4), 53–62.

Sumaedi, S., Bakti, I. G., & Yarmen, M. (2012). The empirical study of public transport passengers' behavioral intentions: The roles of service quality, perceived sacrifice, perceived value, and satisfaction (Case study: Paratransit passengers in Jakarta, Indonesia). *International Journal for Traffic & Transport Engineering*, 2(1), 1–12.

Sumaedi, S., Bakti, I. G., Rakhmawati, T., Astrini, N. J., Widianti, T., & Yarmen, M. (2016). Factors influencing public transport passengers' satisfaction: A new model. *Management of Environmental Quality: An International Journal*, 27(5), 585–597. https://doi.org/10.1108/MEQ-05-2015-0084

The New Indian Express. (2024, May 1). Kerala KSRTC driver to take legal route as police refuse to act on his complaint. *The New Indian Express*. https://www.newindianexpress.com/states/kerala/2024/May/01/kerala-ksrtc-driver-to-take-legal-route-as-police-refuse-to-act-on-his-complaint

Truong, L. T., & Currie, G. (2019). Macroscopic road safety impacts of public transport: A case study of Melbourne, Australia. *Accident Analysis & Prevention*, 132, 105270. https://doi.org/10.1016/j.aap.2019.105270

Urbanek, A. (2021). Potential of modal shift from private cars to public transport: A survey on the commuters' attitudes and willingness to switch–A case study of Silesia Province, Poland. *Research in Transportation Economics*, 85, 101008. https://doi.org/10.1016/j.retrec.2020.101008

Van Knippenberg-den, C. W. (1987). *Time in travel*. https://pure.rug.nl/ws/portalfiles/portal/14475086/van_Knippenberg.PDF

Verma, A., Harsha, V., & Subramanian, G. H. (2021). Evolution of urban transportation policies in India: A review and analysis. *Transportation in Developing Economies*, 7(2), 25. https://doi.org/10.1007/s40890-021-00136-1

Verma, A., Harsha, V., & Subramanian, G. H. (2021). Evolution of urban transportation policies in India: A review and analysis. *Transportation in Developing Economies*, 7(2), 25. https://doi.org/10.1007/s40890-021-00136-1

Wang, X., Yuen, K. F., Shi, W., & Ma, F. (2020). The determinants of passengers' safety behavior on public transport. *Journal of Transport & Health*, 18, 100905. https://doi.org/10.1016/j.jth.2020.100905

Weimann, H., Rylander, L., van den Bosch, M. A., Albin, M., Skärbäck, E., Grahn, P., & Björk, J. (2017). Perception of safety is a prerequisite for the association between neighborhood green qualities and physical activity: Results from a cross-sectional study in Sweden. *Health & Place*, 45, 124–130. https://doi.org/10.1016/j.healthplace.2017.03.011

Widianti, T., Sumaedi, S., Bakti, I. G., Rakhmawati, T., Astrini, N. J., & Yarmen, M. (2015). Factors influencing the behavioral intention of public transport passengers. *International Journal of Quality & Reliability Management*, 32(7), 666–692. https://doi.org/10.1108/IJQRM-01-2013-0002

Wirasinghe, S. C., & Liu, G. (1995). Determination of the number and locations of time points in transit schedule design—Case of a single run. *Annals of Operations Research*, 60, 161–191. https://doi.org/10.1007/BF02031945

Wu, J., Yang, M., Rasouli, S., & Xu, C. (2016). Exploring passenger assessments of bus service quality using Bayesian networks. *Journal of Public Transportation*, 19(3), 36–54. https://doi.org/10.5038/2375-0901.19.3.3

Zainudin, A. (2012). *Structural equation modeling using AMOS graphic*. Universiti Teknologi MARA Publication Centre (UPENA).

Zikmund, W. G., Babin, B. J., Carr, J. C., & Griffin, M. (2000). *Business research methods*. Dryden Press.

Zinedine, J., Claudia, R., & Remiasa, M. (2023). Pengaruh service quality terhadap customer satisfaction dan dampaknya pada reuse intention bus pariwisata di Kota Surabaya. *Jurnal Keuangan dan Bisnis*, 21(2), 116–133. https://doi. org/10.32524/jkb.v21i2.948