

Assessment of Spatial Planning and Integration in Selected Bus Rapid Transit Terminals in Lagos State

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Abstract

Efficient spatial planning and integration are essential to the functionality of Bus Rapid Transit (BRT) terminals and commuter experience in rapidly urbanising cities. However, limited empirical attention has been given to the spatial and architectural performance of BRT terminals in Lagos State. This study assessed the spatial planning and integration of selected BRT terminals in Lagos State, focusing on Ikeja Bus Terminal, Oshodi Transport Interchange, and Yaba Bus Terminal. A quantitative case study design was adopted, combining field observation with a structured questionnaire administered to commuters. A total of 384 valid responses were analysed using descriptive statistics, multiple regression analysis, and Linear Discriminant Analysis. The findings showed that pedestrian circulation (Mean = 3.23), accessibility (Mean = 3.17), and wayfinding (Mean = 3.13) were among the highest-rated spatial attributes, while waiting area comfort (Mean = 2.88) recorded comparatively lower performance. Regression analysis indicated that pedestrian circulation ($\beta = 0.120$, $p = .022$) and signage/wayfinding ($\beta = 0.188$, $p = .001$) significantly predicted perceived transport connectivity. Comparative assessment identified Oshodi Transport Interchange as demonstrating relatively stronger spatial integration, while Yaba recorded comparatively weaker spatial performance. The study concludes that spatial organisation, movement efficiency, accessibility, and wayfinding are important considerations in improving BRT terminal performance. It recommends user-centred spatial planning, improved pedestrian circulation, accessible facilities, better waiting environments, and stronger multimodal integration for future transport terminal development in Lagos State.

Keywords: Bus Rapid Transit (BRT), Commuter Satisfaction, Spatial Planning, Spatial Integration, Transport Terminals.

Introduction

Movement is a fundamental component of urban development, and the efficiency with which people move within cities significantly influences economic productivity, environmental sustainability, and social well-being. Consequently, transportation terminals have evolved beyond their traditional role as passenger transfer points to become strategic urban spaces that facilitate accessibility, connectivity, and spatial interaction. The effectiveness of these facilities depends not only on transport operations but also on the quality of their spatial planning and integration, which influence pedestrian circulation, functional zoning, accessibility, safety, and commuter experience (Bleil de Souza et al., 2019; Cervero, 2013). As noted by Ahmad et al. (2024), well-planned spatial configurations

improve pedestrian movement and minimise congestion, while Oluwatayo and Nzeh (2025) emphasised that coherent circulation systems and spatial legibility enhance user experience in transport environments. In rapidly urbanising cities such as Lagos, increasing travel demand has intensified pressure on existing transport infrastructure, making efficient and integrated Bus Rapid Transit (BRT) terminals essential for achieving sustainable urban mobility (Mobereola, 2009; Aderinlewo et al., 2020; Huang et al., 2025). The introduction of the Lagos BRT system in 2008 represented a significant milestone in improving public transportation through affordable, high-capacity transit services (Mobereola, 2009). Although the system has enhanced mobility and reduced travel time, empirical evidence indicates that many BRT terminals continue to experience overcrowding, poor circulation, inadequate waiting areas, accessibility constraints, weak intermodal connectivity, and insufficient spatial organisation, all of which adversely affect commuter satisfaction and terminal performance (Amiegbebor et al., 2014; Osoja et al., 2023). Studies by Akinyemi and Soyinka (2022) and Olawole (2012) further demonstrate that accessibility and terminal layout significantly influence public transport utilisation, while Rahnema et al. (2024) and Zheng et al. (2021) found that passenger satisfaction is strongly associated with spatial quality, environmental comfort, and ease of movement within transport facilities. Despite growing scholarship on BRT operations and service quality, limited attention has been given to assessing spatial planning and integration from an architectural perspective within Lagos terminals (Ojadi et al., 2024). This study therefore assesses the spatial planning and integration of selected Bus Rapid Transit terminals in Lagos State to identify existing strengths and deficiencies and provide evidence-based recommendations for designing more integrated, accessible, and user-centred transport facilities that support sustainable urban mobility (Aderibigbe & Olajide, 2023; Sagawa et al., 2025; Tolu-Alalade & Ibitoye, 2026).

Statement of the Problem

Rapid urbanisation and population growth in Lagos have intensified pressure on the city's transportation infrastructure, resulting in congestion, prolonged travel times, overcrowding, and increasing demand for efficient public transportation systems (Aderinlewo et al., 2020; Ojadi et al., 2024). The introduction of the Bus Rapid Transit (BRT) system provided an important intervention for improving mass transit accessibility and mobility in Lagos. However, despite these improvements, persistent challenges remain within BRT terminal environments, particularly in relation to pedestrian circulation, waiting conditions, accessibility, wayfinding, safety, functional organisation, and connectivity (Amiegbebor et al., 2014; Akinyemi & Soyinka, 2022; Osoja et al., 2023).

Existing studies on Lagos BRT have largely focused on operational efficiency, service quality, accessibility, and commuter satisfaction, with comparatively limited attention to the spatial and architectural characteristics of terminal environments. Evidence indicates that inefficient circulation systems, inadequate waiting areas, limited accessibility

provisions, and weak spatial organisation can negatively influence commuter experience and the functional performance of transport facilities (Ahmad et al., 2024; Oluwatayo & Nzeh, 2025). This indicates that the effectiveness of BRT terminals cannot be assessed solely through operational performance; their spatial configuration and integration must also be examined.

Although previous studies have identified deficiencies within Lagos transport terminals, there remains insufficient empirical evidence on how specific spatial planning attributes collectively influence perceived connectivity and differentiate the spatial performance of selected BRT terminals. In particular, limited attention has been given to the relationship between pedestrian circulation, accessibility, waiting environments, signage, safety, and perceived transport connectivity from the users' perspective. This limits the availability of evidence-based guidance for architects, transport planners, and policymakers seeking to improve existing BRT terminals and develop more integrated transport infrastructure in Lagos.

Therefore, this study assesses the spatial planning and integration of selected BRT terminals in Lagos State by examining key spatial planning attributes, evaluating their relationship with perceived transport connectivity and commuter experience, and comparing the spatial performance of Ikeja Bus Terminal, Oshodi Transport Interchange, and Yaba Bus Terminal. The study seeks to provide evidence-based recommendations for improving accessibility, circulation efficiency, spatial legibility, user experience, and integration within BRT terminal environments.

The aim of this study is to assess the spatial planning and integration of selected Bus Rapid Transit (BRT) terminals in Lagos State.

The Objectives are to:

- i. assess the existing spatial planning characteristics of selected BRT terminals in Lagos State;
- ii. evaluate the level of spatial integration within the selected BRT terminals;
- iii. examine the influence of spatial planning and integration on commuter movement and satisfaction; and
- iv. identify planning and design strategies that can improve the spatial performance of BRT terminals in Lagos State.

Research Questions are:

- i. What are the existing spatial planning characteristics of selected BRT terminals in Lagos State?
- ii. What is the level of spatial integration within the selected BRT terminals?
- iii. How do spatial planning and integration influence commuter movement and satisfaction within the selected BRT terminals?

- iv. What planning and design strategies can improve the spatial performance of BRT terminals in Lagos State?

This study contributes to transportation planning and architectural research by providing empirical evidence on the relationship between spatial planning, spatial integration, and the performance of Bus Rapid Transit terminals. The findings will assist architects, urban planners, transport authorities, and policymakers in identifying design deficiencies and developing more efficient, accessible, and user-centred transport terminals. The study also contributes to sustainable urban development by supporting improved public transport infrastructure that encourages greater public transport usage, enhances commuter satisfaction, and aligns with the objectives of Sustainable Development Goal (SDG) 9 on resilient infrastructure and SDG 11 on sustainable cities and communities (United Nations, 2015; Aderibigbe & Olajide, 2023).

Literature Review

Spatial planning has become an essential component of contemporary transportation infrastructure because it determines how physical spaces are organised to facilitate efficient movement, accessibility, safety, and user comfort. In transportation architecture, spatial planning extends beyond the physical arrangement of buildings to include circulation systems, functional zoning, pedestrian connectivity, environmental quality, and wayfinding mechanisms that collectively influence commuter experience (Bleil de Souza et al., 2019). According to Cervero (2013), the success of Bus Rapid Transit (BRT) systems depends not only on operational performance but also on the effectiveness of terminal design in supporting seamless passenger movement. Similarly, Ahmad et al. (2024) observed that spatial configuration significantly affects pedestrian flow, congestion management, and the overall efficiency of transport terminals. These findings indicate that transportation facilities should be designed using coherent spatial layouts capable of accommodating high passenger volumes while maintaining operational efficiency.

Within the Nigerian context, the rapid expansion of urban populations has intensified demand for well-planned transportation infrastructure. Mobereola (2009) explained that the introduction of the Lagos BRT system represented a major intervention aimed at improving public mobility; however, increasing passenger demand has exposed several spatial planning deficiencies within terminal environments. Empirical investigations by Ojadi et al. (2024) and Osoja et al. (2023) revealed that overcrowding, poorly organised waiting areas, inadequate circulation paths, and insufficient supporting facilities continue to constrain commuter experience. Likewise, Oluwatayo and Nzeh (2025) emphasised that effective pedestrian circulation strategies including clearly connected corridors, logical spatial organisation, and well-dimensioned movement spaces are fundamental to improving terminal functionality. Consequently, contemporary BRT terminals require integrated spatial planning approaches that balance operational efficiency with architectural quality and user experience.

Spatial Integration and Intermodal Transportation Systems

Spatial integration refers to the deliberate coordination of transportation facilities, land uses, circulation networks, and supporting urban functions to create seamless mobility systems. Modern transportation planning increasingly advocates integrated transport hubs that connect multiple travel modes including buses, rail, ferries, taxis, cycling, and pedestrian networks to minimise transfer time while improving accessibility and operational efficiency (Sagawa et al., 2025). According to Aderibigbe and Olajide (2023), integrated transportation systems contribute significantly to sustainable urban mobility by strengthening connectivity between transport infrastructure and surrounding urban activities. Bleil de Souza et al. (2019) similarly argued that transport hubs should function as user-oriented environments where physical integration supports intuitive movement, spatial legibility, and efficient passenger transfers.

The effectiveness of spatial integration is particularly important within rapidly urbanising cities where fragmented transport systems often create mobility challenges. Smith (2009) maintained that successful transport planning depends on integrating land-use planning with transportation infrastructure to promote sustainable development and improve urban functionality. Similarly, Liu et al. (2023) demonstrated that analysing spatial operating conditions enables transport agencies to optimise passenger flow, reduce delays, and improve service delivery. Research by Huang et al. (2025) further highlights that smart urban mobility increasingly depends on integrated transportation systems capable of accommodating growing travel demand while enhancing user experience. Within Lagos, however, limited physical integration between transport modes and inadequate terminal connectivity continue to reduce transfer efficiency and commuter convenience (Mobereola, 2009; Ojadi et al., 2024). These observations underscore the need for improved spatial integration strategies in existing BRT terminals.

Commuter Satisfaction and User-Centred Transport Terminal Design

Commuter satisfaction has become one of the most widely accepted indicators for evaluating the effectiveness of transportation infrastructure because it reflects passengers' perceptions of accessibility, comfort, safety, convenience, and service quality. User-centred design principles advocate the incorporation of commuters' behavioural patterns and spatial needs throughout the planning and design process to ensure transportation facilities respond effectively to user expectations (Chammas et al., 2015). According to Zheng et al. (2021), passenger satisfaction within BRT systems is influenced by both operational performance and the physical quality of terminal environments, including circulation efficiency, environmental comfort, and waiting facilities. Rahnema et al. (2024) similarly found that spatial quality significantly contributes to passenger perceptions of service reliability and overall transport experience.

Studies conducted within Lagos reveal similar relationships between terminal design and commuter satisfaction. Amiegbegbor et al. (2014) established that improvements

introduced through the Lagos BRT system significantly enhanced passenger mobility but noted that spatial deficiencies within terminal facilities continued to affect user experience. Olawole (2012) further observed that accessibility to BRT terminals influences public transport utilisation, particularly where walking distances, entry design, and pedestrian connections are inadequate. Akinyemi and Soyinka (2022) also reported that passengers' perceptions of accessibility significantly influence satisfaction levels within Lagos BRT corridors. More recently, Eghosa and Emmanuel (2024) found that security measures and terminal design collectively affect user confidence and satisfaction. Collectively, these studies demonstrate that commuter satisfaction extends beyond transport operations and is strongly associated with the spatial planning and architectural quality of transport terminals.

Empirical Studies on Spatial Planning and BRT Terminal Performance

Empirical investigations across different countries consistently demonstrate that spatial planning significantly influences the operational performance and usability of transportation terminals. International studies have shown that effective spatial organisation improves passenger circulation, reduces congestion, enhances accessibility, and strengthens overall transport efficiency (Ahmad et al., 2024; Liu et al., 2023). Similarly, Mohamed et al. (2025) identified service quality, environmental comfort, accessibility, and infrastructure provision as major determinants of passenger satisfaction within public transportation facilities. Sagawa et al. (2025) further demonstrated that well-integrated BRT infrastructure stimulates surrounding economic activities and contributes to broader urban development. These findings collectively reinforce the growing importance of spatial planning in creating transport environments that support both mobility and sustainable urban growth.

Within Lagos State, however, empirical evidence indicates that several BRT terminals continue to experience deficiencies associated with spatial planning and integration. Osoja et al. (2023) reported that overcrowding, limited waiting spaces, and poor terminal organisation reduce commuter satisfaction despite improvements in transport operations. Likewise, Ojadi et al. (2024) identified persistent infrastructural limitations and congestion as major challenges affecting terminal performance. The study by Tolu-Alalade and Ibitoye (2026) provides perhaps the strongest architectural evidence by establishing that inefficient circulation systems, inadequate spatial integration, poor zoning, and insufficient accessibility significantly influence commuter perception and satisfaction within selected Lagos BRT terminals. Their findings further reveal that spatial planning variables are directly associated with commuter experience and terminal functionality, thereby shifting attention from purely operational performance towards architectural and spatial determinants of transport infrastructure effectiveness. Nevertheless, there remains limited empirical research specifically assessing the overall level of spatial planning and integration across selected BRT terminals in Lagos State, thereby justifying the present study.

Conceptual Framework

The conceptual framework for this study is premised on the proposition that spatial planning significantly influences the level of spatial integration and overall performance of Bus Rapid Transit (BRT) terminals. Contemporary transportation planning recognises that the effectiveness of transport terminals extends beyond operational efficiency to include the quality of spatial organisation, accessibility, circulation systems, pedestrian connectivity, environmental comfort, and functional zoning (Bleil de Souza et al., 2019; Cervero, 2013). According to Ahmad et al. (2024), well-organised spatial configurations facilitate efficient pedestrian movement and reduce congestion, while Oluwatayo and Nzeh (2025) emphasised that coherent circulation systems improve user experience and movement within transport facilities. Similarly, Chammass et al. (2015) argued that user-centred design enhances the functionality of public spaces by responding to users' behavioural patterns and accessibility needs. Therefore, this study conceptualises spatial planning as the independent variable comprising circulation efficiency, accessibility, wayfinding, waiting environments, functional zoning, and supporting facilities that collectively determine the quality of terminal integration.

The framework further assumes that effective spatial planning enhances spatial integration, which subsequently improves terminal performance and commuter experience. Spatial integration refers to the coordination of transport modes, pedestrian networks, supporting facilities, and surrounding urban activities to create seamless mobility systems (Aderibigbe & Olajide, 2023; Sagawa et al., 2025). Previous studies have shown that deficiencies in accessibility, circulation, and spatial organisation contribute to congestion, reduced passenger satisfaction, and inefficient terminal operations (Olawole, 2012; Akinyemi & Soyinka, 2022; Osoja et al., 2023). Likewise, Rahnama et al. (2024) and Zheng et al. (2021) established that passenger satisfaction improves when transport facilities provide integrated movement systems, comfortable waiting environments, and efficient spatial layouts. More recently, Tolu-Alalade and Ibitoye (2026) demonstrated that spatial planning deficiencies are among the major factors influencing commuter satisfaction within Lagos BRT terminals. Consequently, this framework proposes that improvements in spatial planning attributes strengthen spatial integration, leading to enhanced accessibility, reduced congestion, improved commuter satisfaction, and more efficient BRT terminal performance in Lagos State.

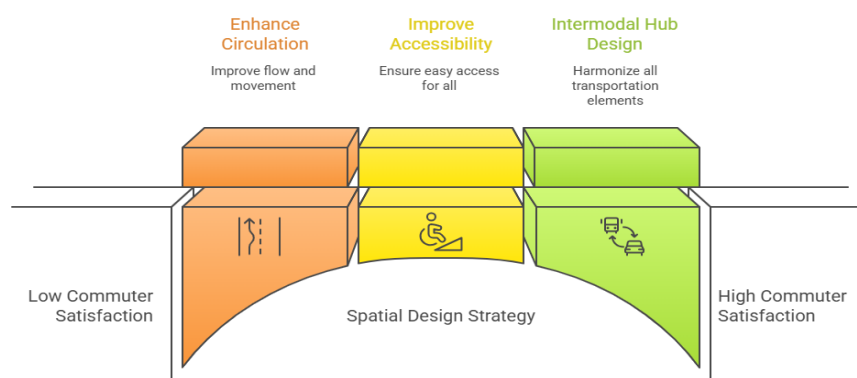


Figure 1: Diagram of Conceptual Framework

Source: Author (2026)

Theoretical Framework

Several theories provide useful perspectives for understanding the relationship between transportation infrastructure, spatial planning, and user experience. User-Centred Design (UCD) Theory emphasises the active consideration of users' needs, behaviours, and preferences throughout the planning and design process to improve functionality, accessibility, and satisfaction within public spaces (Chammas et al., 2015; Bleil de Souza et al., 2019). Similarly, Sustainable Urban Mobility Theory advocates the integration of transport systems with land-use planning to enhance accessibility, environmental sustainability, and efficient movement within cities (Aderibigbe & Olajide, 2023; Sagawa et al., 2025). Although these theories provide valuable insights into transport planning and commuter satisfaction, they primarily focus on users' experiences and broader transport policy objectives rather than explaining how the physical arrangement of space influences movement and integration within transport terminals.

This study is therefore anchored on Spatial Configuration Theory, as it provides the most appropriate theoretical lens for assessing the spatial planning and integration of Bus Rapid Transit (BRT) terminals. The theory posits that the organisation, connectivity, and configuration of physical spaces directly influence pedestrian movement, accessibility, circulation efficiency, wayfinding, and the overall performance of the built environment. Ahmad et al. (2024) argued that spatial configuration significantly determines pedestrian flow and congestion levels within BRT stations, while Oluwatayo and Nzeh (2025) demonstrated that well-organised circulation systems enhance navigation and user experience within transport facilities. Similarly, Cervero (2013) and Bleil de Souza et al. (2019) emphasised that effective transport terminals require spatial layouts that promote seamless movement, accessibility, and integration between transport modes. Empirical studies within Lagos also reveal that deficiencies in circulation systems, accessibility, waiting environments, and spatial organisation contribute significantly to commuter dissatisfaction and reduced terminal efficiency (Olawole, 2012; Akinyemi & Soyinka, 2022;

Osoja et al., 2023). More recently, Tolu-Alalade and Ibitoye (2026) established that spatial planning variables have a direct influence on commuter satisfaction and terminal performance in selected Lagos BRT terminals. Consequently, Spatial Configuration Theory was adopted because it directly explains the core variables investigated in this study spatial planning and spatial integration and provides a stronger theoretical foundation for evaluating how the arrangement of physical spaces affects terminal functionality and commuter experience than the broader user-centred and sustainable mobility theories.

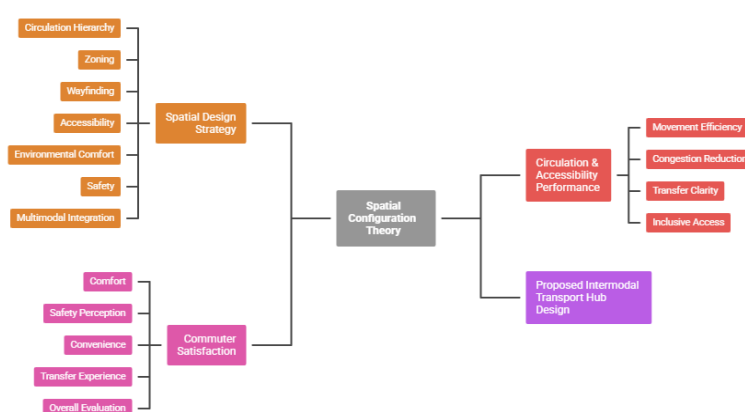


Figure 2: Spatial Configuration Theory in Intermodal Transport Hub Design

Source: Author (2026)

The framework illustrates that spatial connectivity, integration, accessibility and movement hierarchy influence pedestrian flow and spatial experience. These principles provide the theoretical basis for evaluating spatial planning and integration within the selected BRT terminals.

Identification of Gaps in Literature

This chapter identifies the existing research gaps relating to the assessment of spatial planning and integration in Bus Rapid Transit (BRT) terminals in Lagos State. Although there is an increasing body of literature on Bus Rapid Transit systems, transportation planning, commuter satisfaction, and sustainable urban mobility, most previous studies have concentrated on operational performance, service delivery, and accessibility, with limited attention given to the architectural and spatial planning dimensions of BRT terminals. Consequently, important gaps remain regarding the comprehensive assessment of spatial planning and integration within Lagos BRT terminals.

- i. **Limited Empirical Studies on Spatial Planning:** There is a paucity of empirical studies that comprehensively assess spatial planning attributes such as circulation systems, functional zoning, wayfinding, pedestrian movement, waiting

environments, and supporting facilities within Lagos BRT terminals. Most existing studies primarily evaluate service quality, operational efficiency, and commuter satisfaction without examining how spatial planning influences terminal performance (Amiegbehor et al., 2014; Zheng et al., 2021; Osoja et al., 2023).

- ii. **Inadequate Assessment of Spatial Integration:** Existing studies acknowledge the importance of integrated transportation systems but provide limited empirical evidence on the extent of spatial integration between transport modes, pedestrian networks, and surrounding urban land uses within Lagos BRT terminals. Although international studies have highlighted the significance of integrated transport infrastructure, these findings are rarely contextualised to the unique urban and transportation conditions of Lagos State (Bleil de Souza et al., 2019; Aderibigbe & Olajide, 2023; Sagawa et al., 2025).
- iii. **Limited Architectural Perspective:** Previous research on Lagos BRT systems has predominantly been undertaken from transportation engineering, urban planning, and transport management perspectives, with insufficient emphasis on architectural design and spatial configuration. Consequently, important spatial variables such as circulation hierarchy, accessibility, environmental comfort, spatial organisation, and user-oriented terminal design have not been comprehensively investigated despite their influence on commuter movement and terminal efficiency (Ahmad et al., 2024; Oluwatayo & Nzeh, 2025; Chammas et al., 2015).

This study therefore addresses these gaps by providing a comprehensive assessment of the spatial planning and integration of selected Bus Rapid Transit terminals in Lagos State. The findings are expected to contribute to architectural scholarship, transportation planning, and urban development by providing evidence-based recommendations for designing more integrated, accessible, and user-centred BRT terminals.

Methodology

This study adopted a pragmatic research philosophy using a quantitative case study research design to assess the spatial planning and integration of selected Bus Rapid Transit (BRT) terminals in Lagos State. The methodology was implemented in two complementary phases. The first phase involved a comparative assessment of three case study terminals Ikeja Bus Terminal, Oshodi Transport Interchange, and Yaba Bus Terminal which were purposively selected because they are among the busiest transport nodes in Lagos, represent different spatial and operational characteristics, and serve significant commuter populations. Field observations were conducted to evaluate the existing spatial planning characteristics of each terminal, including accessibility, circulation systems, functional zoning, pedestrian movement, wayfinding, waiting environments, supporting facilities, and intermodal connectivity. These case studies provided the contextual basis for understanding the strengths and deficiencies of existing BRT terminal planning and integration within Lagos. The second phase consisted of a questionnaire survey

administered to commuters using the selected terminals to capture users' perceptions of the identified spatial planning variables (Saunders et al., 2019).

The study population comprised commuters using the selected BRT terminals, including workers, students, traders, business owners, and other regular users whose daily interaction with the terminals provided relevant information on spatial planning and integration. A simple random sampling technique was adopted to minimise sampling bias and ensure equal chances of participation among commuters. Since the target population was large and indeterminate, the Cochran formula for large or unknown populations was used to determine the minimum sample size at a 95% confidence level and 5% margin of error. Using a population proportion of 0.5 and a Z-value of 1.96, the calculated sample size was 384.16, which was rounded to 384 respondents. A total of 384 valid questionnaires were obtained from commuters across the three selected BRT terminals. The final valid responses comprised 105 respondents from Ikeja Bus Terminal, 161 respondents from Oshodi Transport Interchange, and 118 respondents from Yaba Bus Terminal. The distribution of valid responses reflected the number of usable questionnaires retrieved from respondents at each terminal. The structured questionnaire consisted of demographic information and Likert-scale statements measuring accessibility, pedestrian circulation, waiting areas, safety, signage, environmental comfort, connectivity, and commuter satisfaction, while the case study observations provided qualitative validation of the physical spatial characteristics observed within the terminals (Saunders et al., 2019; Zheng et al., 2021).

Data obtained from both the case study assessment and questionnaire survey were analysed using the Statistical Package for the Social Sciences (IBM SPSS). Descriptive statistics, including frequencies, percentages, mean scores, and standard deviations, were used to summarise respondents' characteristics and evaluate the spatial planning attributes of the selected terminals. The findings from the statistical analysis were then integrated with the field observations from the case studies to provide a comprehensive assessment of spatial planning and integration in the selected BRT terminals and to generate evidence-based recommendations for improving transport terminal design in Lagos State (Rahnama et al., 2024; Saunders et al., 2019).

The reliability of the questionnaire was assessed using Cronbach's alpha. The instrument produced an overall Cronbach's alpha coefficient of **0.82**, indicating good internal consistency among the Likert-scale items and confirming the suitability of the instrument for the study.

Ethical Considerations

Ethical approval for the study was obtained from the Caleb University Lagos Ethical Clearance Committee (CULREC) before commencement of data collection. Respondents were informed of the purpose and objectives of the study, and informed consent was obtained before participation in the questionnaire survey. Participation was voluntary, and

respondents were informed of their right to decline participation or withdraw from the study without penalty. Confidentiality and anonymity were maintained throughout the research process, and no personally identifiable information was collected. The information obtained was used strictly for academic purposes.

Results and Discussion

Demography of Respondents

A total of 384 valid questionnaires were analysed for this study, representing commuters across the selected BRT terminals in Lagos State. The demographic profile revealed a relatively balanced gender distribution, with 40.10% female respondents, 39.32% male respondents, and 20.57% who preferred not to disclose their gender. The respondents also represented different age groups, with those aged 46 years and above (28.65%) constituting the largest proportion, followed by 36–45 years (26.30%), 18–25 years (26.04%), and 26–35 years (19.01%). In terms of occupation, civil servants (36.20%) formed the largest respondent group, followed by students (27.08%), self-employed individuals (19.27%), and private sector workers (17.45%). These findings indicate that the selected terminals serve a broad cross-section of urban commuters whose travel needs are largely associated with employment, education, and commercial activities. The diversity of respondents enhances the reliability of the study by ensuring that the assessment reflects the perceptions of different categories of terminal users (Aderinlewo et al., 2020; Liu et al., 2023; Ahmad et al., 2024).

The distribution of respondents across the three terminals showed that Oshodi Transport Interchange had the highest participation (161 respondents), followed by Yaba Bus Terminal (118 respondents) and Ikeja Bus Terminal (105 respondents). This distribution reflects the strategic importance of Oshodi as one of the busiest and most integrated transport hubs in Lagos. The travel pattern further revealed that occasional use was the dominant mode of BRT patronage across all terminals, accounting for 55.24% of users at Ikeja, 50.31% at Oshodi, and 37.29% at Yaba. Nevertheless, Yaba recorded the highest proportion of daily users (19.49%) and commuters travelling several times per week (25.42%), suggesting a relatively higher dependence on the terminal for routine trips. Overall, the socio-demographic profile and travel characteristics demonstrate that the selected BRT terminals accommodate commuters with diverse travel frequencies and mobility requirements, highlighting the need for inclusive, accessible, and user-centred spatial planning strategies capable of supporting varying patterns of terminal use and improving commuter satisfaction (Javid et al., 2024; Mohamed et al., 2025; Ojadi et al., 2024).

Table 1: Demographic distribution of respondents

Gender	Count	Percent
Female	154	40.10%

Gender	Count	Percent
Male	151	39.32%
Prefer not to say	79	20.57%
Age group	Count	Percent
18-25 years	100	26.04%
26-35 years	73	19.01%
36-45 years	101	26.30%
46 and above	110	28.65%
Occupation	Count	Percent
Civil Servant	139	36.20%
Private Sector Worker	67	17.45%
Self-Employed	74	19.27%
Student	104	27.08%
Grand Total	384	100.0%

Author's fieldwork (2026)

Table 2: Frequency of BRT use by terminal

	BRT Terminal		
Frequency of BRT use	Ikeja	Oshodi	Yaba
Daily	12.38%	14.29%	19.49%
Occasionally	55.24%	50.31%	37.29%
Once a week	13.33%	18.63%	17.80%
Several times per week	19.05%	16.77%	25.42%
Grand Total	100.00%	100.00%	100.00%

Author's fieldwork (2026)

Analysis and Discussion of Results by Objectives

The findings revealed that the selected BRT terminals exhibited varying levels of spatial planning and integration. Overall, commuters expressed positive perceptions of pedestrian circulation (Mean = 3.23), accessibility (Mean = 3.17), wayfinding (Mean = 3.13), and transport connectivity (Mean = 3.12), while waiting area comfort (Mean = 2.88) recorded the lowest rating, indicating the need for improvements in passenger waiting facilities. Regression analysis further established that pedestrian circulation ($\beta = 0.120$; $p = 0.022$) and signage/wayfinding ($\beta = 0.188$; $p = 0.001$) were the only spatial planning attributes that significantly influenced perceived transport connectivity, whereas accessibility, waiting areas, and safety did not show statistically significant relationships. These findings suggest that efficient movement systems and clear wayfinding contribute more strongly to commuters' perceptions of integrated transport terminals than other spatial attributes. The results are consistent with previous studies that identified circulation efficiency and effective wayfinding as essential determinants of transport terminal performance and commuter satisfaction (Ahmad et al., 2024; Javid et al., 2024; Tekin et al., 2025).

The study further showed that commuter satisfaction extends beyond transport operations to include the quality of the physical environment. Respondents identified easy terminal access, smooth pedestrian movement, comfortable waiting areas, and seamless connections to other transport modes as the principal factors influencing their travel experience. In addition, commuters considered supporting facilities such as ticketing and information centres, toilets, passenger lounges, retail spaces, and charging points to be important components of modern transport terminals, with well-ventilated indoor waiting halls emerging as the most preferred waiting environment. Comparative analysis revealed that Oshodi Transport Interchange demonstrated the strongest performance in accessibility, pedestrian circulation, and multimodal integration, Ikeja Bus Terminal performed better in signage and safety, while Yaba Bus Terminal recorded comparatively weaker performance due to limited accessibility, waiting facilities, and passenger amenities. Furthermore, discriminant analysis showed that accessibility was the only spatial variable that significantly differentiated the three terminals ($p = 0.003$), indicating that differences in terminal performance were largely driven by access conditions, whereas the remaining spatial attributes were relatively similar across the terminals. These findings informed the development of a spatial design framework centred on accessibility, pedestrian circulation, passenger comfort, wayfinding, and safety, providing practical guidance for the planning and design of future integrated transport hubs in Lagos State (Bleil de Souza et al., 2019; Aderibigbe & Olajide, 2023; Huang et al., 2025; Ojadi et al., 2024).

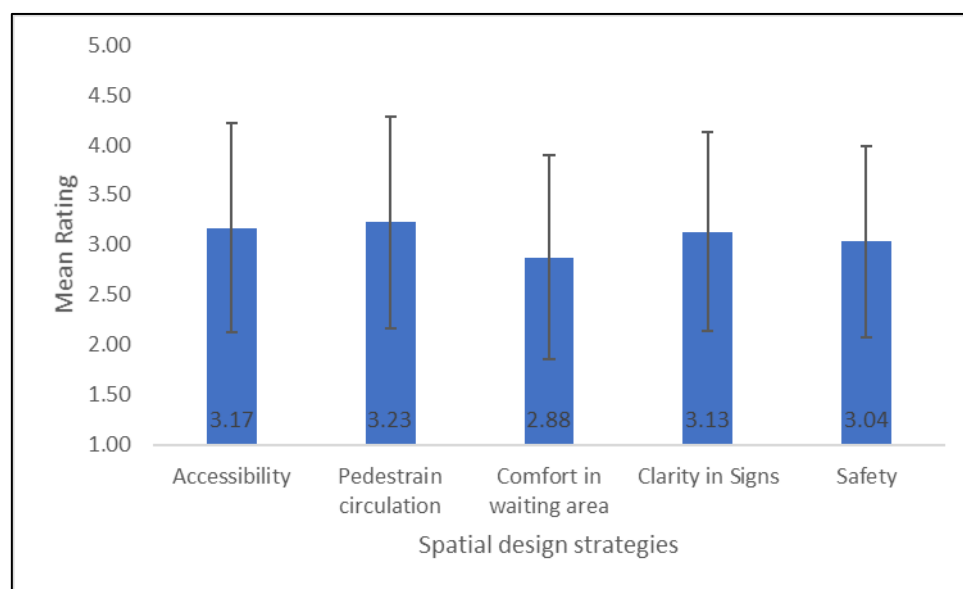


Figure 3: Overall mean rating of spatial design strategies

Source: Author's Fieldwork (2026)

Table 3: Regression of spatial design strategies vs transport connectivity

	Coefficients	Standard Error	t Stat	P-value
Intercept	1.556805905	0.260055	5.98645	4.99E-09
Accessibility	0.038932058	0.052251	0.745104	0.456672
Pedestrian	0.119693776	0.052208	2.29265	0.022417
Waiting	0.067722323	0.050646	1.33717	0.181971
Signs	0.188270057	0.054133	3.477897	0.000564
Safety	0.089209665	0.05559	1.604778	0.109378

Source: Author's Fieldwork (2026)

Table 4: Respondents' satisfaction on travelling ease

Agreement	Ikeja	Oshodi	Yaba
Agree	38.10%	37.27%	22.03%
Disagree	10.48%	12.42%	22.03%
Neutral	25.71%	25.47%	23.73%
Strongly Agree	13.33%	14.29%	13.56%
Strongly Disagree	12.38%	10.56%	18.64%
Grand Total	100.00%	100.00%	100.00%

Source: Author's Fieldwork (2026)

Table 5: Mean Perception of Spatial Design by Terminal

Variable	Ikeja	Yaba	Oshodi	Total
Accessibility	3.17	2.92	3.35	3.17
Circulation	3.09	3.19	3.33	3.22
Waiting	2.93	2.81	2.89	2.88
Signage	3.21	3.06	3.11	3.13
Safety	3.10	2.99	3.03	3.04
Connectivity	3.11	3.14	3.11	3.12

Source: Author's Fieldwork (2026)

Table 6: Univariate Discriminant Power of Variables

Variable	Wilks' Lambda	F	Sig.
Accessibility	0.971	5.779	0.003
Circulation	0.991	1.816	0.164
Waiting	0.998	0.440	0.644
Signage	0.997	0.617	0.540
Safety	0.998	0.355	0.702
Connectivity	1.000	0.043	0.958

Source: Author's Fieldwork (2026)

The regression findings can be interpreted through Spatial Configuration Theory, which emphasises the relationship between the organisation and connectivity of physical space

and patterns of movement within built environments. The significant influence of pedestrian circulation on perceived transport connectivity suggests that the organisation of movement paths within BRT terminals plays an important role in shaping how commuters experience connectivity. This is consistent with the proposition that spatial connectivity and integration influence pedestrian movement and the efficiency with which users navigate transport environments (Ahmad et al., 2024). Similarly, the significant contribution of signage and wayfinding indicates that spatial legibility is important to users' ability to identify routes, destinations, and transfer points within complex transport environments. This finding supports the view that clearly organised circulation systems and spatial cues improve navigation and user experience (Oluwatayo & Nzeh, 2025).

The non-significant effects of accessibility, waiting areas, and safety in the regression model do not imply that these attributes are unimportant. Rather, the results indicate that, within the statistical model used in this study, pedestrian circulation and wayfinding were stronger predictors of perceived connectivity. From a spatial configuration perspective, this suggests that the relationship between spaces and the clarity of movement routes may exert a more direct influence on perceived connectivity than individual supporting facilities. The findings therefore provide empirical support for applying Spatial Configuration Theory to the assessment of BRT terminal environments in Lagos.

Table 7: Comparative Assessment of Spatial Design Strategies in Selected BRT Terminals

Spatial Design Strategy	Assessment Criteria	Ikeja	Oshodi	Yaba	Implication for Proposed Hub
Accessibility	Ease of entry/exit, universal access	Good	Very Good	Fair	Multiple access points with universal accessibility should be incorporated.
Pedestrian Circulation	Movement efficiency and congestion	Fair	Excellent	Fair	Clear pedestrian circulation hierarchy should be adopted.
Waiting Areas	Seating, shelter and comfort	Poor	Fair	Fair	Spacious waiting lounges with adequate seating are required.
Wayfinding	Signage and directional clarity	Good	Good	Fair	Digital and physical wayfinding

Spatial Design Strategy	Assessment Criteria	Ikeja	Oshodi	Yaba	Implication for Proposed Hub
					systems should be integrated.
Functional Zoning	Separation of activities	Fair	Fair	Good	Passenger, commercial and service areas should be clearly zoned.
Vertical Circulation	Lifts, escalators and stairs	Poor	Poor (non-functional)	Fair	Reliable lifts and escalators should be provided.
Safety & Surveillance	Visibility, lighting and security	Good	Fair	Good	CPTED principles and passive surveillance should guide design.
Multimodal Integration	Connection with other transport modes	Good	Excellent	Fair	Bus, rail, ferry and taxi should be seamlessly integrated.
Commercial Facilities	Shops and supporting services	Fair	Poor (informal use)	Fair	Properly planned retail spaces should support commuters.
Overall Spatial Performance	Overall assessment	Moderate	Good	Fair	Findings informed the proposed intermodal transport hub design.

Source: Author's Fieldwork (2026)

Conclusion and Recommendations

This study demonstrated that the spatial planning and integration of Bus Rapid Transit (BRT) terminals in Lagos State significantly influence commuter movement, terminal functionality, and overall user satisfaction. The comparative assessment revealed that Oshodi Transport Interchange exhibited the highest level of spatial integration due to its extensive pedestrian circulation network, multiple access points, and relatively efficient intermodal connectivity. However, the terminal was constrained by non-functional lifts and

escalators, underutilised upper-floor spaces, and encroachment of commercial activities that affected circulation efficiency. Ikeja Bus Terminal performed relatively well in terms of accessibility, wayfinding, and perceived safety but was limited by inadequate waiting areas, insufficient seating at loading bays, and underutilised passenger facilities. In contrast, Yaba Bus Terminal recorded comparatively lower spatial performance owing to its compact layout, limited passenger amenities, inadequate waiting spaces, and increasing commuter demand, which contributed to congestion and reduced comfort. The questionnaire findings further established that pedestrian circulation, accessibility, and wayfinding were the most influential spatial planning attributes affecting commuters' perceptions, while waiting environments and supporting facilities recorded comparatively lower satisfaction ratings. Statistical analyses also confirmed that improvements in spatial planning were positively associated with commuter satisfaction and terminal performance. These findings indicate that the effectiveness of transport terminals depends not only on transport operations but also on the quality of spatial organisation, circulation efficiency, accessibility, functional zoning, and the integration of supporting facilities. The study therefore concludes that achieving sustainable and user-oriented transport infrastructure in Lagos requires greater emphasis on integrated spatial planning principles that prioritise accessibility, seamless movement, environmental comfort, and commuter needs, thereby supporting the principles of Spatial Configuration Theory and previous findings on integrated transportation planning (Bleil de Souza et al., 2019; Akinyemi & Soyinka, 2022; Osoja et al., 2023; Ahmad et al., 2024; Rahnema et al., 2024; Tolu-Alalade & Ibitoye, 2026).

Based on the findings, the following recommendations are proposed:

- i. **Improve pedestrian circulation:**
Existing and future BRT terminals should provide clearly defined pedestrian circulation routes, adequate corridor widths, and logical movement hierarchies to minimise congestion and improve transfer efficiency.
- ii. **Strengthen wayfinding and signage:**
Clear, visible, and strategically positioned directional signage should be provided at entrances, circulation nodes, ticketing areas, waiting areas, boarding zones, and transfer points to improve spatial legibility.
- iii. **Improve accessibility:**
BRT terminals should incorporate barrier-free access, ramps, tactile pathways, functional lifts and escalators, and accessible pedestrian routes to accommodate elderly persons and persons with disabilities.
- iv. **Upgrade waiting environments:**
Adequate seating, shelter, ventilation, climatic protection, and sufficient waiting capacity should be provided to improve commuter comfort, particularly during peak periods.
- iv. **Improve functional zoning:**

Passenger, commercial, administrative, service, and circulation areas should be clearly organised to reduce conflicts and improve terminal efficiency.

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