SSR Journal of Arts, Humanities and Social Sciences (SSRJAHSS)

Homepage: https://ssrpublisher.com/ssrjahss

Volume 3, Issue 9, 2026 ISSN: 3049-0391 (Online)

Spatial Mismatch between Public Parking Supply and Motorist Demand in a Planned African Capital City: evidence from Abuja, Nigeria

Amedu Richard Anoghena; Friday A, Ogwu; Eya M.A. & Ali Adamu

Department of Urban and Regional Planning, Nasarawa State University Keffi

Received: 10.08.2026 | **Accepted:** 18.09.2026 | **Published:** 28.09.2026

***Corresponding Author:** Amedu Richard Anoghena

DOI: *10.5281/zenodo.23006612*

Abstract **Original Research Article**

Urban parking problems are frequently described as shortages of parking space. This is to say that the location, accessibility and temporal usability of parking supply may be as important as its aggregate amount. This study examines the spatial relationship between designated public parking supply and motorists parking demand in Phase I of the Federal Capital City (FCC), Abuja, Nigeria. A mixed-method design combined a survey of 384 motorists, field observation, spatial assessment and an inventory of designated public parking facilities. Descriptive statistics, district-level comparisons and spatial interpretation were used to identify patterns of supply, demand pressure and parking-location choice. Seven designated public parking facilities covering 17.92 ha were identified. The Old Parade Ground accounted for 34.54% of the inventoried parking area, while smaller market-oriented facilities were associated with high-activity commercial locations. On-street parking was the most common reported parking location (31.5%), compared with 20.3% for designated lots/garages; sidewalk/pedestrian-area parking accounted for 22.7%, unauthorized green-space parking for 11.5%, and double parking for 6.0%. Seventy percent of reported parking occurred in the morning and afternoon, while 72.1% of respondents parked at least twice weekly. The evidence indicates a spatial mismatch between where formal parking land is concentrated and where motorists seek convenient access to destinations, particularly in high-intensity commercial and administrative areas. The paper therefore operationalises mismatch as an empirically supported spatial misalignment. The findings support demand-responsive parking planning, improved pedestrian connectivity, better information, shared/managed parking, and district-specific management rather than uniform expansion of parking supply.

Keywords: Parking Supply; Parking Demand; Spatial Mismatch; Parking Accessibility; Motorist Behaviour; Public Space; Abuja; Nigeria; GIS; Urban Planning.

1. Introduction

Urban parking is a land-use, accessibility and transport-management problem as vehicles occupy urban space for substantial periods while parking facilities compete with movement, pedestrian space and other public functions. The literature shows that parking demand is shaped by land-use activity, trip attraction, duration,

pricing, accessibility and the characteristics of available facilities. A review by Parmar, Das and Dave (2020) acclaimed that parking demand and parking choice are inseparable from transport planning and that access, walking time, charges and information affect parking decisions. The practical implication is that a city may have a considerable amount of parking land while still experiencing on-street parking stress if supply is poorly located or difficult to use.

Parking choice is inherently spatial. Motorists compare alternative locations using proximity, search time, walking time, cost, availability and facility characteristics. Hilvert, Toledo and Bekhor (2012) conceptualise parking decisions across pre-trip, in-route and in-area search phases, while Chaniotakis and Pel (2015) is in the view that uncertainty about parking availability and search time affects location choice. These studies suggest that the relevant planning unit is not simply the number of spaces in a city, but the relationship between demand-generating destinations and usable parking opportunities around them. Accessibility therefore includes not only physical capacity but also the ease with which a motorist can enter, park, exit and reach the destination on foot.

The issue is particularly important in planned African capitals, where formal spatial structures coexist with rapidly intensifying activity and growing dependence on private vehicles. Abuja was planned around a hierarchy of districts, road corridors, public spaces and activity nodes. Within Phase I of the FCC, administrative, commercial, institutional, religious and residential activities generate different temporal and spatial parking demands. The reconnaissance field survey identified seven designated public parking facilities covering 17.92 ha, suggest that motorists reported heavy reliance on on-street and other informal locations. This raises a planning question: is the observed parking problem simply a shortage of land devoted to parking, or is it partly a mismatch between the location and accessibility of formal supply and the location and timing of demand?

The contribution of this paper is threefold. First, it reframes parking adequacy in Phase I Abuja as a spatial and temporal relationship rather than an aggregate supply question. Second, it combines facility inventory data with motorists reported parking patterns and destination/time indicators to identify where the strongest evidence of misalignment occurs. Third, it distinguishes clearly between what the available data can demonstrate and what requires additional matched capacity occupancy observations.

2. Literature Review

2.1 Parking supply, demand and spatial mismatch

Parking supply refers to the number and characteristics of spaces available to users, whereas parking demand represents the need for parking generated by activities and trips. Traditional parking assessment often compares total spaces with estimated demand, nonetheless this can conceal spatial and temporal variation. A large facility may be poorly positioned relative to demand or unavailable during the period when demand peaks. Equally, a small facility embedded in a high-intensity commercial area may experience severe pressure even when unused capacity exists elsewhere. Parmar et al. (2020) emphasise parking characteristics such as capacity, accumulation, turnover and utilisation because parking performance changes through time.

The concept of spatial mismatch in this paper therefore refers to a condition in which the location, accessibility or temporal availability of usable parking supply does not correspond adequately with the location and timing of parking demand. It is narrower than simply saying that parking is insufficient. It also accommodates the possibility of simultaneous under-utilisation in one location and over-demand in another.

2.2 Accessibility and parking choice

Accessibility provides the bridge between supply and behaviour. Geurs and van Wee (2004) define accessibility in terms of the interaction between land-use opportunities and transport systems (in parking), the concept can be operationalised through walking distance, connectivity, entry

and exit conditions, information and temporal availability. Hilvert, Toledo, & Bekhor, (2012) and Chaniotakis & Pel (2015) show that motorists evaluate parking alternatives through search and access costs, not simply monetary price. This helps explain why a formally designated facility may be bypassed when an on-street location is perceived as faster or closer.

2.3 Parking in Nigerian cities and Abuja

Evidence from Nigerian cities consistently identifies inadequate parking provision, roadside parking and weak management as contributors to traffic disruption. Aderamo and Salau (2013), studying Ilorin, found that parking problems contributed materially to intersection delays and recommended stronger off-street provision and discouragement of problematic on-street parking. In Abuja, Shehu, Kawu and Dere (2023) reported persistent parking-management challenges associated with congestion, pedestrian obstruction and management weaknesses. These studies establish the importance of parking management in Nigerian cities, but the present paper extends the discussion by focusing specifically on the spatial relationship between formal parking land and observed motorist parking patterns in a planned capital.

2.4 Research gap

The main gap is methodological as well as substantive. Existing studies frequently discuss inadequate parking supply or illegal parking without jointly examining the spatial distribution of formal facilities, the destinations and timing of parking activity, and the locations motorists actually use. Equally, a numerical supply-demand mismatch index requires matched measurements of usable capacity and demand for the same spatial units and periods. The paper therefore uses spatial misalignment as the empirical construct to buttress the argument.

2.5 Theoretical and Conceptual Framework

2.5.1 Theoretical framework

The study integrates three complementary perspectives (Figures 1&2). First, Parking Choice/Random Utility Theory explains motorists' selection among alternative parking locations based on perceived benefits and costs, including proximity, convenience, search time, walking time, price and enforcement risk. Second, Land-use-Transport Interaction Theory explains why different land-use intensities generate different spatial and temporal patterns of travel and parking demand. Third, the Spatial Accessibility perspective explains why nominal supply is not equivalent to usable supply such as location, connectivity, walking distance, access and information determine whether a parking facility is a practical alternative.

The integrated theoretical proposition is that parking behaviour emerges from the interaction between where demand is generated, where usable supply is located, how accessible that supply is, and how motorists evaluate the costs and benefits of competing alternatives. The proposition predicts that spatially concentrated demand combined with poorly located or inaccessible formal supply will increase pressure on convenient curb-side and informal spaces.

PARKING CHOICE / RANDOM UTILITY THEORY	LAND-USE–TRANSPORT INTERACTION THEORY	SPATIAL ACCESSIBILITY PERSPECTIVE
Motorists select parking locations according to perceived utility: proximity, convenience, time saving, cost, search/walk time and enforcement risk.	Land-use intensity and spatial structure generate and distribute travel and parking demand; parking is part of the land-use–transport system.	The usefulness of a facility depends on capacity plus location, walking distance, connectivity, access, information and temporal availability.

↓

INTEGRATED THEORETICAL PROPOSITION
Parking behaviour is produced by the interaction between where parking demand is generated, where usable parking supply is located, how accessible that supply is, and how motorists evaluate the costs and benefits of alternative parking locations.

↓

EMPIRICAL EXPLANATION FOR PHASE I, FCC ABUJA
Land-use/activity intensity → demand pressure → supply/accessibility conditions → spatial–temporal mismatch → motorist choice → compliance/non-compliance → congestion, safety and public-space outcomes

↓

PLANNING IMPLICATION
Effective parking management should align supply location and accessibility with demand while using context-sensitive enforcement, signage, restrictions, pricing and information systems to influence parking choices.

Figure 1: Theoretical Framework-Integrated Theoretical Basis.

Source: Researcher, 2026

THEORIES	CONSTRUCTS	MECHANISM	BEHAVIOURAL RESPONSE	OUTCOMES
Parking choice Land-use-transport interaction Accessibility	Demand Supply Accessibility Mismatch Management	Spatial + temporal mismatch changes perceived parking utility	Compliance / non-compliance On-street / off-street choice	Congestion Safety Pedestrian access Public-space efficiency

Figure 2: Theoretical-to-Conceptual Linkage.

Source: Researcher, 2026

2.5.2 Conceptual framework

The conceptual model shown at figure 3 moves from urban structure and land-use intensity to parking demand pressure, usable parking supply and accessibility, spatial-temporal mismatch, motorist parking choice, parking behaviour and urban outcomes. Governance variables such as enforcement visibility, parking restrictions, signage, pricing, clamping/towing and information systems to moderate the pathway. The framework treats mismatch as a relational condition rather than a simple shortage of spaces.

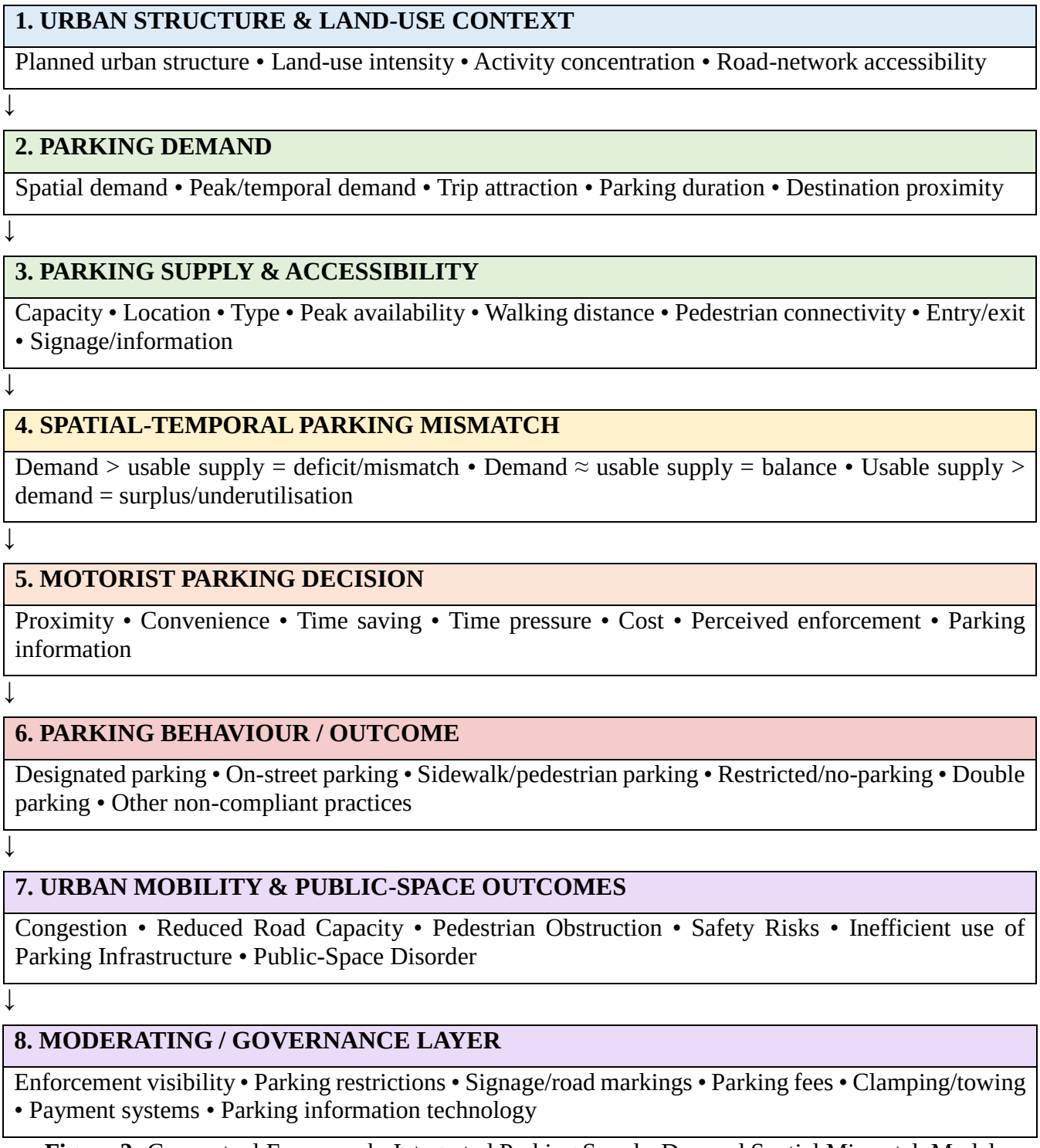

Figure 3: Conceptual Framework: Integrated Parking Supply-Demand Spatial Mismatch Model (IPSDSMM).

Source: Author's conceptualisation based on the study findings, 2026.

3. Materials and Methods

3.1 Study area

The study covers Phase I of the Federal Capital City, Abuja, comprising about eight major districts: Asokoro, Maitama, Guzape, Central Area, Garki I, Garki II, Wuse I and Wuse II

respectively (Figure 4). Phase I comprises major administrative, commercial, institutional and residential functions and is served by important arterial corridors including Ahmadu Bello Way, Shehu Shagari Way, Nnamdi Azikiwe Expressway and Tafawa Balewa Way. The district structure provides a useful spatial basis for comparing different activity environments.

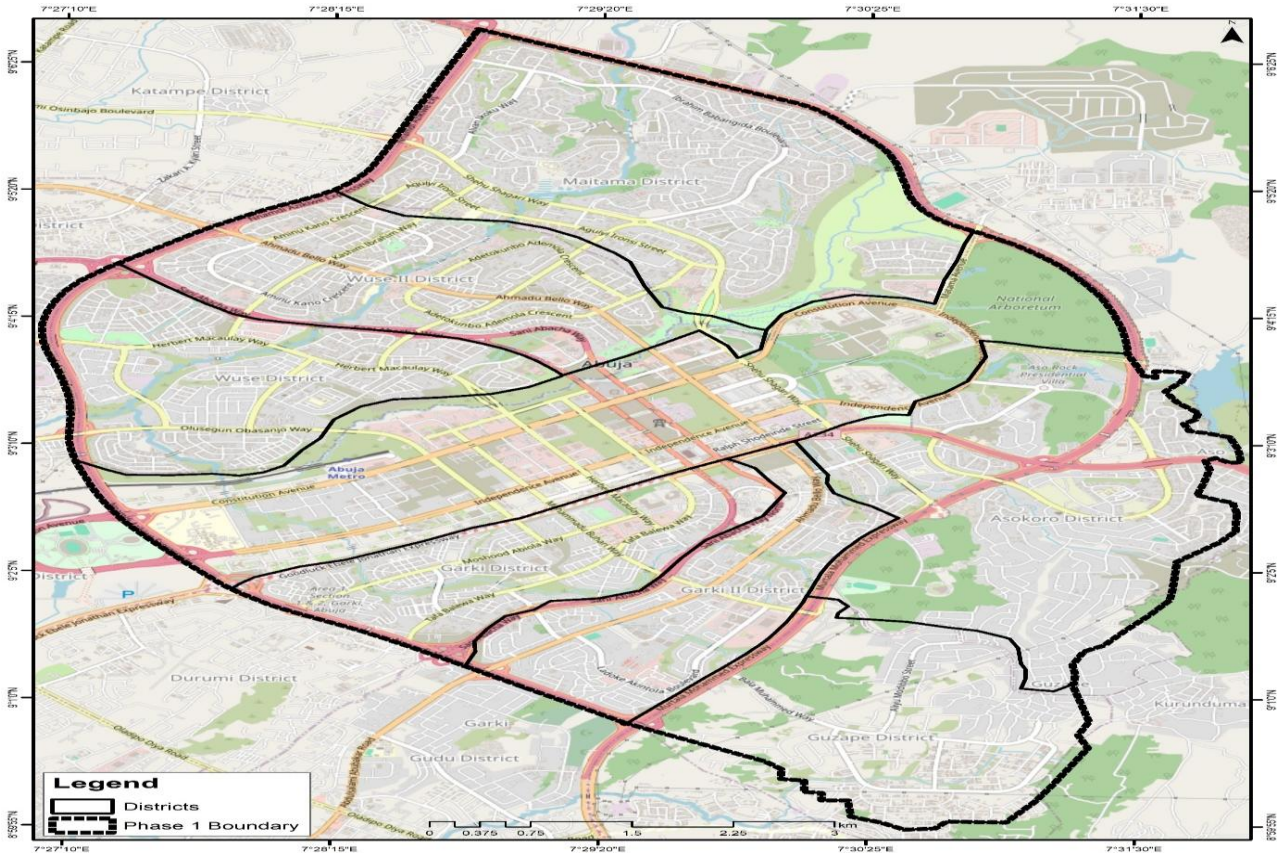

Figure 4: Map of FCC-Phase 1

Source: FCDA (2026)

3.2 Research design and sample

A mixed-method design was used. Primary evidence came from a structured questionnaire, field observation, reconnaissance, interviews/focused discussions and spatial assessment. Secondary evidence included planning documents, maps, records and satellite imagery. A sample of 384 respondents was used, with 48 questionnaires allocated to each of the eight districts. A combination of purposive, stratified and simple-random sampling components was also used. The survey captured parking frequency, time of parking, usual location, parking behaviour, perceived problems, behavioural factors and perceived effectiveness of management measures.

Designated parking facilities were identified and their land areas were delineated using field assessment and high-resolution imagery, with GPS/GIS and Google Earth Pro used as spatial tools. Facility shares were calculated as facility area divided by total inventoried parking area. Descriptive statistics were used for parking patterns and Likert-scale variables. One-way ANOVA was used to examine district differences. For this paper, the principal spatial-

mismatch inference is based on triangulation of facility distribution, parking location, parking time, destination patterns and district activity characteristics.

A proposed Parking Supply–Demand Spatial Mismatch Index (PSDSMI) is specified as PSDSMIi = (Di − Si) / (Di + Si), where Di is parking demand and Si is usable parking supply in spatial unit i. Positive values indicate demand deficit, negative values indicate supply surplus, and zero indicates balance.

4. Results

4.1 Designated public parking supply

The seven inventoried facilities cover 17.92 ha. The Old Parade Ground alone represents 34.54% of the total inventoried area, while the three largest facilities together account for approximately 67.07%. This concentration is important because land area is not synonymous with daily usable capacity: some facilities have event-oriented or functional restrictions and may not be equally available to ordinary daily parkers (Figure 5).

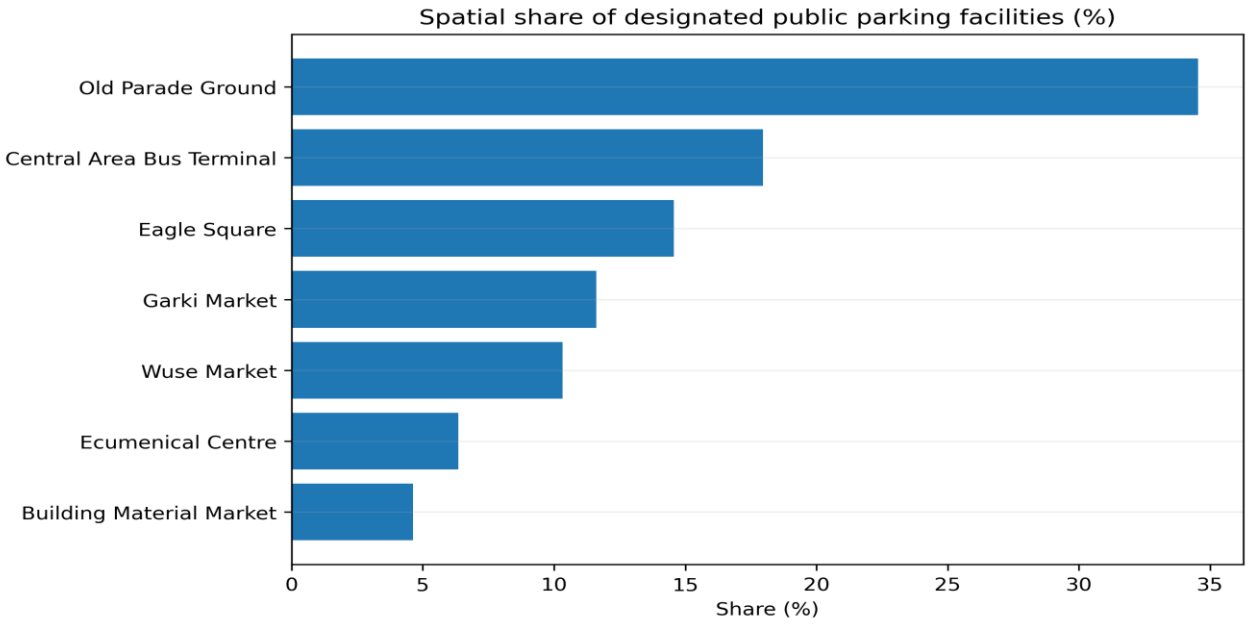

Figure 5: Spatial share of designated public parking facilities in Phase I, Abuja.

Source: Field Survey (2026).

4.2: Temporal pattern and frequency of parking

Morning and afternoon parking together account for 70.4% of responses, while 72.1% of respondents park at least twice per week. This concentration implies that parking demand is temporally structured rather than constant, reinforcing the need to distinguish nominal supply from peak-period usable supply (Table 3, Figures 6&7).

Table 3: Time of parking and frequency of respondents

Parking characteristic	Category	n	%
Time	Morning	168	43.8
Time	Afternoon	102	26.6
Time	Evening	91	23.7
Time	Night	23	6.0
Frequency	Daily	153	39.8
Frequency	2-4 times/week	124	32.3
Frequency	Once/week	51	13.3
Frequency	Occasionally	56	14.6

Source: Field Survey (2026).

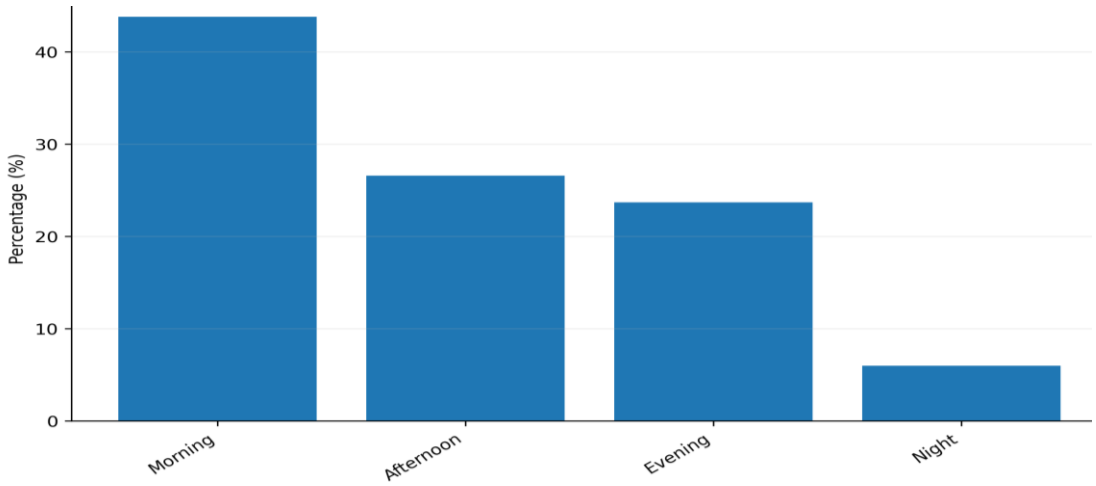

Figure 6: Time of parking.

Source: Field Survey (2026).

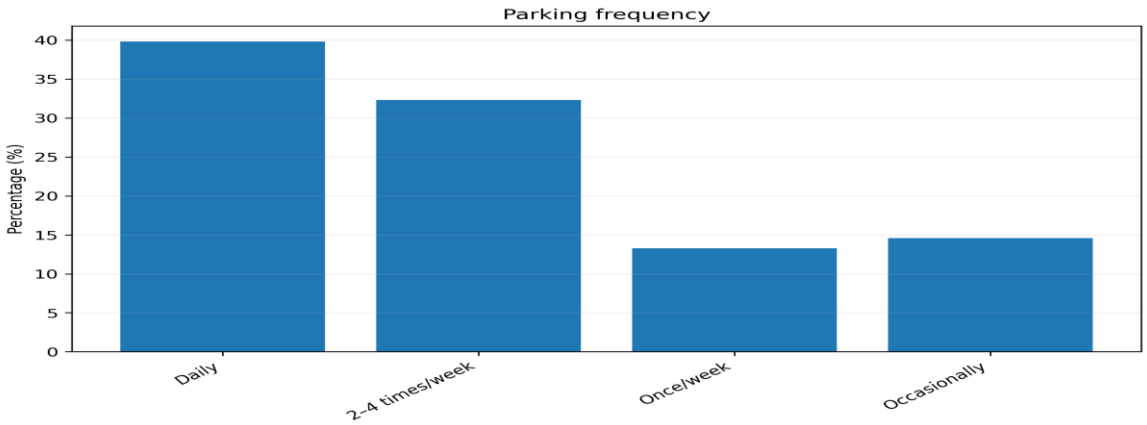

Figure 7: Parking frequency.

Source: Field Survey (2026).

4.3: Where motorists park

On-street parking is the single largest category at 31.5%, whereas designated lots/garages account for only 20.3% of reported usual parking locations. Sidewalk/pedestrian-area parking is 22.7%, unauthorized green-space parking 11.5%, and double parking 6.0%. The three explicitly non-designated categories sum to 40.2%. The earlier thesis statement of 48.2% is therefore not retained because it cannot be reproduced from the reported categories and would require treating the unspecified "other" category as illegal (Figure 8).

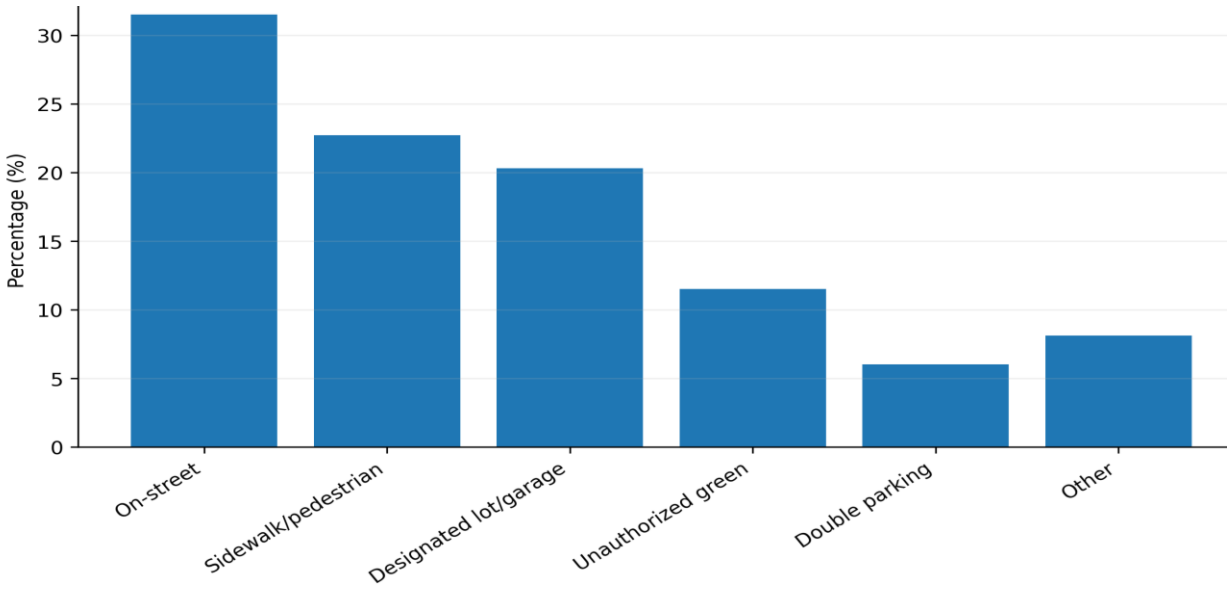

Figure 8: Usual parking location of respondents.

Source: Field Survey (2026).

4.4 Parking Behaviour and Associated Problems

The findings in Table 5 reveal a clear behavioural pattern in which motorists' illegal parking is driven more by convenience and destination proximity than by indiscriminate obstruction. Parking on sidewalks or pedestrian paths was the most frequently reported behaviour (M = 4.20), followed by parking in front of shops/businesses (M = 3.90) and in no-parking/no-stopping zones (M = 3.44), indicating a tendency to appropriate spaces immediately adjacent to destinations despite their intended pedestrian or traffic-management functions. In juxtapose, beyond-time-limit parking, double parking, driveway/access obstruction, and use of disabled/reserved spaces recorded substantially lower means (2.07–2.70), reinforcing the dominance of proximity-oriented violations. The relatively low variation for frontage parking (SD = 0.99) suggests consistent reporting of this behaviour, whereas the higher variation for no-parking/no-stopping zones (SD = 1.23) indicates greater differences in exposure or experience. Taken as a whole, the results suggest that motorists may knowingly trade compliance for immediate accessibility when the perceived benefits of convenience and time

saving outweigh the perceived costs of violating restrictions.

Table 5: Mean scores for reported parking behaviours

Behaviour	Mean	SD
Sidewalk/pedestrian path	4.20	1.06
Front of shop/business	3.90	0.99
No-parking/no-stopping zone	3.44	1.23
Beyond time limit	2.70	1.22
Double parking	2.31	1.13
Blocking driveway/access	2.28	1.17
Disabled/reserved space	2.07	1.07

Source: Field Survey (2026).

The findings shown in table 6 indicate that parking problems in Phase I of Abuja are perceived primarily through their direct impacts on urban mobility, parking accessibility and road-user safety. Illegal parking causing traffic congestion recorded the highest severity (M = 3.69), closely followed by the shortage of legal parking during peak periods (M = 3.68), safety risks (M = 3.59) and vehicle/property damage (M = 3.50). The narrow differences among these scores suggest that respondents do not experience parking as only single-dimensional problem rather, parking pressure simultaneously affects traffic flow, access to legitimate parking, pedestrian and driver safety, and protection of property. This pattern strengthens the argument that parking behaviour has consequences extending beyond the individual motorist to the wider functioning and efficiency of the urban street system.

Table 6: Perceived severity of parking problems

Problem	Mean	SD	Rank
Shortage of legal parking during peak hours	3.68	1.25	2
Safety risks to pedestrians and other drivers	3.59	1.21	3
Illegal parking causing traffic jams	3.69	1.20	1
Vehicle/property damage	3.50	1.28	4
Lack of enforcement	3.11	1.36	5
Inadequate signage	2.99	1.31	6
Poor lighting/security	2.97	1.33	7

Source: Field Survey (2026).

The comparatively lower ratings for lack of enforcement, inadequate signage and poor lighting/security should therefore be understood as less visible underlying conditions rather than insignificant problems. Respondents appear to recognise the immediate consequences of parking pressure more strongly than the institutional and environmental factors that may facilitate it, while the relatively high standard deviations indicate variation in motorists' experiences across locations and circumstances. Taken together with the reported prevalence of sidewalk, business-frontage and restricted-zone parking, the results suggest that the problem is not simply an absolute deficiency of parking supply. Instead, motorists appear to favour parking locations that maximise proximity, convenience and destination accessibility, even when these spaces have other important public functions. The evidence thus provides a behavioural basis for interpreting parking stress in Phase I Abuja as a spatial mismatch between formal parking provision and the locations motorists actually prefer to use, rather than merely a city-wide shortage of parking spaces.

4.5: Demand Pressure, Destinations and District Variation

The findings in table 7 indicate that illegal parking behaviour in Phase I Abuja is driven primarily by the interaction of parking supply, accessibility and regulatory conditions, rather than by a single behavioural determinant. Inadequate legal parking during peak periods recorded the highest mean score (M = 4.05), followed by the perception that illegal parking is more convenient or time-saving (M = 3.84) and weak enforcement (M = 3.73). This hierarchy suggests that motorists respond to practical constraints within the parking environment: when formal spaces are perceived as unavailable, inconveniently located or difficult to access, illegal parking becomes a rational response to reduce walking and parking-search costs. Importantly, the finding points to a distinction between nominal parking supply and effective parking supply. These indicates that increasing the number of spaces alone may not resolve illegal parking if those spaces are poorly located, inaccessible or temporally mismatched with demand.

Table 7: Factors associated with motorists parking behaviour

Factor associated with parking behaviour	Mean	SD
Inadequate legal parking spaces during peak hours	4.05	1.05
Illegal parking saves time/is more convenient	3.84	1.14
Weak enforcement	3.73	1.20
Time pressure	3.20	1.31
Clear signage	3.49	1.22
Parking fees	2.92	1.25
Social norms	2.82	1.28
Fear of fines/clamping	2.64	1.24

Source: Field Survey (2026).

The behavioural evidence is reinforced by the spatial and functional concentration of parking demand. Workplace/office destinations account for 26.3% of reported destinations, commercial/shopping destinations 21.9%, and residential destinations 20.3%, together representing 68.5% of demand. These patterns vary significantly across districts, with Asokoro and Central Area dominated by workplace activity, Maitama and Guzape by residential activity, and Wuse II and Garki II by commercial/shopping activity. The significant ANOVA result ($F(7,376) = 17.892$, $p < .005$) confirms that parking demand is not spatially uniform across Phase I. Accordingly, motorists encounter different combinations of parking pressure, destination accessibility and temporal demand depending on where they travel. This challenges the assumption that Phase I constitutes a homogeneous parking environment and suggests that parking management should be differentiated according to land-use function, activity intensity and temporal demand.

General, the results appeared to provide a strong behavioural explanation for the spatial-mismatch argument of the study. Illegal parking appears to emerge where concentrated destination demand is not adequately matched by accessible and conveniently located formal parking, while weak enforcement further reduces the perceived cost of non-compliance. The relatively lower scores for parking fees ($M = 2.92$), social norms ($M = 2.82$) and fear of fines/clamping ($M = 2.64$) suggest that immediate access and convenience are more prominent perceived influences than conventional deterrence mechanisms, although these factors should not be interpreted as behaviourally irrelevant. The central implication is therefore that illegal parking should not be addressed through enforcement alone. Effective parking management requires a coordinated alignment of parking supply, location, accessibility, temporal availability and enforcement with the spatial distribution of urban activities and motorists' demand.

4.6: Evidence of Spatial Mismatch

The evidence demonstrates in table 8 shown that spatial mismatch in Phase I Abuja is not adequately explained by the aggregate quantity of formal parking land alone. Although 17.92 ha of formal parking land exists across seven facilities, its concentration and the fact that land area does not directly translate into usable parking capacity limit what can be inferred about overall supply adequacy. More compellingly, only 20.3% of reported parking locations were designated lots or garages, compared with 31.5% on-street parking, while 40.2% occurred in sidewalks/pedestrian areas, green spaces and through double parking. This indicates that the problem is fundamentally one of effective accessibility and spatial distribution, whereby formal parking provision does not necessarily correspond with where motorists actually seek to park.

Table 8: Planning-Based Spatial Mismatch between Formal parking Provision and Motorists' Effective Parking Demand

Evidence dimension	Observed pattern	Spatial implication	Evidence status
Formal parking land	17.92 ha across seven facilities; largest facility shares 34.54%	Supply is spatially concentrated	Empirical
Actual parking location	On-street 31.5%; designated lots 20.3%	Motorists often select curbside space over formal lots	Empirical

Pedestrian/informal spillover	Sidewalk 22.7%; green space 11.5%; double parking 6.0%	Demand pressure spills into non-designated space	Empirical
Temporal pressure	Morning + afternoon = 70.4%	Usable supply must be assessed by time period	Empirical
Activity geography	Work, commercial and residential destinations = 68.5%	Demand is concentrated around activity nodes	Empirical
District variation	Destination pattern differs significantly by district	Uniform supply/management is unlikely to fit all districts	Empirical

Source: Field Survey (2026).

The mismatch is also temporal, functional and behavioural. Morning and afternoon periods account for 70.4% of parking activity, while work/office, commercial/shopping and residential destinations constitute 68.5% of reported parking destinations, indicating that demand is concentrated at particular times and activity nodes rather than being evenly distributed. The high behavioural propensity for sidewalk/pedestrian-path parking (M = 4.20) and parking in front of businesses (M = 3.90) reinforces the spatial evidence that motorists frequently appropriate spaces close to their destinations.

The findings generally support a multidimensional planning-based conception of parking mismatch. It reinforces that the critical issue is not simply how much parking exists, but where it is located, when it is available, how accessible it is, and how well it serves major destinations. The coexistence of concentrated formal provision, substantial on-street and informal parking, peak-period pressure and significant district differences provides a coherent basis for concluding that formal parking supply is not consistently aligned with effective motorist demand. The planning implication is therefore to move beyond simply expanding parking land towards demand-location and time-sensitive parking management, including improving access to existing facilities, strengthening connections to major activity nodes, and protecting pedestrian and other public spaces from spillover. Future occupancy, capacity, turnover, duration, walking-distance and time-specific observations would allow this qualitative mismatch to be quantified more precisely.

4.7 Discussion

The planning implications of the findings point to the need for a spatially differentiated and evidence-based parking strategy in Phase I Abuja. The study demonstrates that parking pressure varies according to destination characteristics, land-use intensity, accessibility and temporal activity patterns; consequently, treating Phase I as a homogeneous parking environment risks directing interventions to locations where they are least needed. Parking provision and standards should therefore be related to the functional character of individual districts and the intensity and type of activities they accommodate. This requires moving beyond the conventional assessment of parking in terms of physical land area towards a concept of effective parking capacity, encompassing the number of usable spaces, occupancy, turnover, parking duration, operating periods, accessibility and proximity to destinations. Such an approach is consistent with evidence that motorists' parking decisions are influenced not simply by the existence of parking spaces but also by their availability, search time, location and convenience (Chaniotakis & Pel, 2015; Hilvert et al., 2012; Waraich & Axhausen, 2012). The institutionalisation of a GIS-based parking

inventory, supported by periodic field observations, would therefore enable the FCTA to distinguish between genuine capacity constraints and parking pressure arising from spatial misallocation, restricted availability or inefficient utilisation of existing facilities. This would also provide a stronger empirical foundation for parking standards and investment decisions than aggregate measures of parking land alone (Parmar et al., 2020).

The findings further indicate that parking policy should be integrated with land-use planning, transport management and public-space protection, rather than being treated primarily as an isolated traffic-management problem. Parking demand should be incorporated into development control, district redevelopment and corridor planning, with interventions calibrated to the different demand profiles of administrative, commercial, mixed-use and residential areas. This is particularly important because parking availability and location influence accessibility and, in turn, the attractiveness and functioning of different urban destinations (Geurs & van Wee, 2004). The observed dependence on sidewalks, road edges, frontages and other non-designated spaces also suggests that enforcement by itself cannot provide a sustainable solution. Evidence from Nigerian cities indicates that inadequate management and inappropriate parking behaviour can generate substantial pressure on available urban space (Aderamo & Salau, 2013; Shehu et al., 2023; Whyte et al., 2024). Consequently, the protection of pedestrian and circulation spaces should combine appropriate physical design, clear signage and consistent enforcement with realistic and conveniently located legal alternatives, particularly short-stay and destination-oriented parking where demand warrants provision. This is preferable to an enforcement-only approach that merely displaces unauthorised parking from one location to another without addressing the underlying spatial relationship between parking supply and demand.

Finally, Abuja requires a proactive parking governance and monitoring framework capable of identifying and responding to emerging parking pressure before it becomes entrenched. Enforcement should be visible, consistent and institutionally coordinated, while motorists should receive clear information and directional guidance that make compliant parking easier and more predictable. This is important because uncertainty regarding parking availability and the time required to search for spaces can influence parking-location decisions and contribute to inefficient parking behaviour (Chaniotakis & Pel, 2015; Shoup, 2006). More importantly, the FCTA should establish a periodic supply-demand monitoring programme that combines georeferenced parking inventories with repeated measurements of occupancy, turnover, parking duration, operating periods and peak-period demand. Such a system would progressively strengthen the evidence base for distinguishing where parking mismatch exists, why it occurs, and how its magnitude varies spatially and temporally. The resulting evidence could support targeted interventions rather than indiscriminate expansion of parking supply, thereby reinforcing a shift from a conventional supply-expansion model towards a supply-demand alignment approach in which parking is managed as an integral component of urban mobility, land-use planning and public-space management.

5. Conclusion and Recommendations

The study concludes that the parking problem in Phase I of Abuja is better understood as a spatial and functional mismatch between formal parking supply and effective motorist demand, rather than as a simple shortage of parking space. Although 17.92 ha of formal parking provision exists across seven facilities, motorists continue to depend substantially on on-street and non-designated spaces because formal parking is not consistently located, accessible, or available at the destinations and times where demand is concentrated. This mismatch reflects the importance of destination characteristics, temporal demand patterns, accessibility, proximity and user convenience in determining whether available parking supply is actually functional. The resulting encroachment onto roads, sidewalks and other public spaces has

implications not only for parking but also for traffic circulation, pedestrian movement and the quality of urban public space.

Importantly, the study establishes the existence and mechanisms of parking mismatch without claiming to quantify a city-wide or district-level parking deficit, since matched spatial and temporal data on usable capacity and actual occupancy were not available. The findings therefore support a shift in Abuja's parking planning from a supply-expansion approach to a supply-demand alignment approach, where parking provision is evaluated according to where, when and how motorists need to park. Effective parking management should consequently prioritise appropriately located and accessible facilities, peak-period demand, destination characteristics and behavioural responses, while making compliant parking a practical alternative to informal parking. Such an approach offers a more context-sensitive basis for improving parking management, mobility and public-space use in Abuja and potentially other rapidly urbanising African cities.

Based on the evidence of spatial, temporal, and functional mismatch between formal parking provision and motorists' demand within Phase I of the Federal Capital City, the study recommends the adoption of a spatially differentiated parking management strategy rather than a uniform city-wide approach. Parking management should recognise differences in land use, activity intensity, trip purpose, and parking pressure across districts. High-intensity activity areas such as the Central Area, Wuse I, Wuse II, Garki I and Garki II should receive priority attention through targeted parking management measures, while predominantly residential districts such as Maitama, Asokoro and Guzape may require different interventions. This approach would enable parking resources and management measures to be directed towards locations where demand pressure and competition for public space are greatest.

The study further recommends that parking planning should move beyond the measurement of parking provision in terms of land area alone and adopt the concept of effective or usable parking supply. Future parking inventories should record not only the physical extent of parking facilities but also their actual capacity, occupancy levels, turnover, duration of use, operating periods, accessibility, walking distance to destinations, pedestrian connectivity and restrictions on use. Such information should be incorporated into a GIS-based parking management system for Phase I of the FCC to enable planners to identify locations and periods where available parking is insufficient or poorly aligned with demand. This would provide a stronger basis for investment decisions than aggregate measures of parking land.

Parking provision should also be more closely integrated with land-use and transport planning. The concentration of work, commercial and residential destinations within the study area indicates that parking demand is closely associated with the spatial distribution and intensity of urban activities. Consequently, parking requirements should form part of development control, land-use planning and transport assessment, particularly for major commercial, institutional, administrative and mixed-use developments. Parking assessments for new developments and redevelopment projects should consider expected demand, the capacity of surrounding public facilities, pedestrian accessibility and the potential effects of parking spillover on adjoining streets and public spaces.

Given the substantial occurrence of parking on streets, sidewalks, pedestrian areas and other non-designated locations, the study recommends stronger protection and management of public space. Sidewalks and pedestrian paths should be protected from routine vehicle encroachment through appropriate physical design, clearly marked parking boundaries, kerb management, pedestrian infrastructure and consistent enforcement. However, enforcement should not operate independently of parking provision. Where motorists are displaced from informal locations, adequate and conveniently located legal alternatives should be available to reduce the likelihood of simply transferring parking pressure to another part of the public-space network.

The study also recommends a more consistent, visible and coordinated enforcement framework among the agencies responsible for traffic and parking management within the Federal Capital Territory. Enforcement should be targeted towards locations and periods experiencing the greatest parking pressure and should be supported by clear road markings, parking signs, understandable restrictions and publicly communicated regulations. A graduated enforcement approach involving warnings, penalties and, where necessary, towing or clamping may be more effective when motorists can clearly identify the applicable rules and have reasonable access to legal parking alternatives. Improved institutional coordination among the relevant FCT authorities, traffic enforcement agencies and area councils is therefore necessary to reduce inconsistencies in the implementation of parking regulations.

Finally, the study recommends the establishment of a continuous parking supply-demand monitoring and evaluation programme for the FCC. Periodic surveys should combine georeferenced parking inventories with time-specific occupancy counts, parking duration, turnover, demand intensity, walking distances and destination characteristics. Such a database would allow planners to identify emerging spatial and temporal mismatches before they become severe and to evaluate the effectiveness of interventions over time. It would also provide the empirical basis for developing and validating a quantitative Parking Supply-Demand Spatial Mismatch Index in future studies. The overall policy direction should therefore be to improve the alignment, accessibility and management of existing parking resources, alongside selective expansion of provision where robust evidence demonstrates a genuine capacity deficit, rather than relying primarily on increasing parking land.

6. Limitations and Future Research

The study has four principal limitations. First, the analysis is restricted to Phase I and therefore cannot be generalised automatically to Phases II and III or satellite towns. Second, several demand indicators are self-reported, which may be affected by recall or social-desirability bias. Third, facility land area is an imperfect proxy for usable parking capacity because stall layout, restrictions, access, event use and temporal availability are not fully captured. Fourth, the dataset does not contain a complete matched series of parking capacity and observed demand/occupancy for the same spatial units and periods. Consequently, the paper does not report fabricated mismatch scores.

Future studies should undertake repeated occupancy and accumulation surveys at facility and street-segment level, ideally across weekdays, weekends, peak periods and special events. GIS network analysis should measure walking distance and pedestrian connectivity, while automated or manual counts should estimate turnover and duration. These data would permit calculation of the PSDSMI and stronger tests of spatial mismatch. Comparative studies across Abuja's phases and other Nigerian planned cities would also help establish whether the observed pattern is specific to Phase I or characteristic of rapidly growing planned African capitals.

References

Abuja Geographic Information System (AGIS). (2025): Spatial and administrative information for the Federal Capital Territory. Abuja, Nigeria.

Aderamo, A. J., & Salau, K. A. (2013): Parking patterns and problems in developing countries: A case from Ilorin, Nigeria. African Journal of Engineering Research, 1(2), 40-48.

Chaniotakis, E., & Pel, A. J. (2015): Drivers' parking location choice under uncertain parking availability and search times: A stated preference experiment. Transportation Research Part A: Policy and Practice, 82, 228-239. https://doi.org/10.1016/j.tra.2015.10.004

Federal Capital Development Authority (FCDA). (2025): Abuja planning and spatial information materials used for the

study area. Abuja, Nigeria.

Geurs, K. T., & van Wee, B. (2004): Accessibility evaluation of land-use and transport strategies: Review and research directions. Journal of Transport Geography, 12(2), 127-140. https://doi.org/10.1016/j.jtrangeo.2003.10.005

Hilvert, O., Toledo, T., & Bekhor, S. (2012): Framework and model for parking decisions. Transportation Research Record, 2319(1), 31-39. https://doi.org/10.3141/2319-04

Parmar, J., Das, P., & Dave, S. M. (2020): Study on demand and characteristics of parking system in urban areas: A review. Journal of Traffic and Transportation Engineering (English Edition), 7(1), 111-124. https://doi.org/10.1016/j.jtte.2019.09.003

Shehu, A., Kawu, A., & Dere, G. I. (2023): Assessment of parking space management of Federal Capital City, Abuja. International Journal of Research Publication, 125(1), 860-878. https://doi.org/10.47119/IJRP1001251520234943

Shoup, D. C. (1997): The high cost of free parking. Journal of Planning Education and Research, 17(1), 3-20. https://doi.org/10.1177/0739456X9701700102

Shoup, D. C. (2006): Cruising for parking. Transport Policy, 13(6), 479-486.

Waraich, R. A., & Axhausen, K. W. (2012): Agent-based parking choice model. Transportation Research Record, 2319(1), 39-46.

Whyte, A., Henry, B., Eyenghe, T., & Brown, I. (2024): Assessing the challenges of parking systems in neighbourhoods to enhance residents' quality of life of Port Harcourt Municipality. Journal of Research in Humanities and Social Science, 12(1), 49-57.