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Assessment of Vehicular Traffic Congestion ~~in~~ Ilorin City Centre

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Abstract

Urban traffic congestion has emerged as a critical challenge in rapidly growing medium-sized cities of developing countries, where transportation infrastructure struggles to keep pace with increasing vehicular demand. This study assesses vehicular traffic congestion in Ilorin city centre, Kwara State, Nigeria, focusing on traffic volume, vehicle composition, and operational constraints along seven principal arterial corridors and six unsignalised intersections. Employing a descriptive survey research design, the study combined traffic observations with questionnaire surveys administered to motorists, commercial drivers, pedestrians, and traffic officials to examine congestion patterns and their underlying causes. The findings reveal that traffic congestion in Ilorin city centre is driven primarily by operational and behavioural factors rather than high traffic volumes alone. Key contributors include indiscriminate parking, roadside trading and passenger loading, weak traffic enforcement, inadequate signalisation, and pedestrian interference. The study identifies significant variation in congestion severity across corridors, with the Emir's Road-Post Office and Post Office-A-Division corridors experiencing the most severe delays, while Unity Road operates under relatively acceptable conditions. Respondents strongly supported interventions such as strict parking enforcement, removal of roadside trading, designated off-carriageway stops, improved traffic signalisation, and enhanced pedestrian facilities. The study concludes that effective congestion management in Ilorin requires integrated operational improvements, stronger enforcement mechanisms, and targeted infrastructure enhancements rather than reactive, temporary measures. These findings contribute empirical evidence to inform evidence-based transportation planning and traffic management strategies in medium-sized Nigerian cities.

Keywords: Developing cities, Traffic congestion, Transportation planning, Urban mobility, Ilorin city centre

1.0 INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Urban traffic congestion has become a major challenge confronting many cities across the world, particularly in rapidly urbanizing regions of developing countries. As urban populations expand and economic activities intensify, the demand for road transportation often grows faster than the capacity of available infrastructure. This imbalance between travel demand and transport supply leads to traffic congestion, characterized by slower speeds, longer travel times, increased fuel consumption, and higher environmental pollution (Aderamo & Atomode, 2021). In many Nigerian cities, the problem is further aggravated by poor urban planning, weak traffic

management systems, and the concentration of commercial and administrative activities within central urban areas.

The world bank (2026) posited that Nigeria, as Africa's most populous nation, faces significant urban mobility challenges. Major cities such as Lagos, Abuja, Kano, Port Harcourt and Ibadan frequently experience heavy traffic congestion due to rapid population growth and increased motorization. However, congestion is no longer limited to large metropolitan centres; medium-sized such as Ilorin are increasingly experiencing similar mobility problems as urban growth accelerates. These cities often lack adequate transportation planning frameworks and data-driven traffic management strategies needed to manage growing travel demand effectively (Wada et al, 2023)

Ilorin, the capital of Kwara State, represents one of the rapidly growing medium-sized cities in Nigeria. The city has experienced considerable demographic and spatial expansion over the past two decades. The population of Ilorin was estimated at about 777,000 during the 2006 national census and has since grown significantly due to urban migration, educational opportunities, and expanding commercial activities. The presence of major institutions such as the University of Ilorin, government ministries, hospitals, and large markets has transformed the city centre into an important economic hub that attracts large volumes of vehicular movement daily (Kwara State Ministry of Works, 2013).

The city centre of Ilorin functions as the commercial and administrative core of the metropolis where most socio-economic activities are concentrated. As a result, major roads and intersections within this area experience high traffic volumes throughout the day. The increasing number of private vehicles, taxis, buses, motorcycles, and tricycles operating within the central district has intensified traffic pressure on the available road network. This growth in vehicular movement has contributed to frequent traffic congestion, particularly during peak periods when commuters travel to and from work, markets, and educational institutions (Kwara State Ministry of Works, 2013).

In many developing cities, the composition of traffic is highly heterogeneous, consisting of a mix of vehicle types with different operational characteristics. Motorcycles, taxis, and minibuses often dominate urban traffic streams, while heavy vehicles and private cars also contribute to road congestion. Such diversity in vehicle types affects traffic performance because different vehicles have varying speeds, sizes, and manoeuvrability. Consequently, roads that were originally designed for lower traffic volumes may become congested when faced with increasing demand and mixed traffic conditions (Garber and Hoel, 2024)

Despite the growing traffic pressure in Ilorin city centre, traffic management interventions are often implemented without adequate empirical data regarding traffic volume and vehicle composition across major corridors. Decisions regarding intersection control, lane allocation, and traffic enforcement are frequently based on observation rather than systematic traffic studies. Without reliable information about the magnitude and composition of vehicular flow within the city centre, it becomes difficult for planners and traffic engineers to design effective strategies for managing congestion (Ajiboye et al, 2023). This study therefore focuses on examining extent of traffic congestion within the area and to develop evidence-based, stakeholder-specific recommendations for traffic management interventions that address the

identified causes of congestion and can be implemented by relevant authorities in Ilorin, Kwara State.

2.0 LITERATURE REVIEW

2.1 CONCEPTUAL REVIEW

2.1.1 Spatial Concentration of Traffic Demand

Spatial traffic distribution reflects the structure of urban areas, particularly within Central Business Districts (CBDs). Typically, CBDs experience high inbound traffic flows during the morning**,** high outbound flows during the evening**,** and multidirectional traffic movements during mid-day commercial activities**.** This pattern creates a temporal-spatial imbalance in traffic movement (Ortúzar & Willumsen, 2023). In many developing cities, this pattern is further distorted by informal bus stops, roadside trading, and irregular parking, which introduce friction points that disrupt traffic flow within the road network (Oyesiku, 2020).

2.1.2 Challenges Associated with Vehicular Flow

Vehicular traffic flow in urban centres is influenced by multiple interacting factors rather than a single cause. Congestion often results from a combination of geometric, operational, and demand-related factors, which are intensified in rapidly urbanizing cities due to infrastructure limitations, weak enforcement, and mixed traffic conditions (Oyesiku, 2020).

Geometric challenges relate to the physical design of roads and intersections, including lane width, number of lanes, intersection layout, turning lanes, and road curvature. Road capacity is strongly affected by these design elements (Transportation Research Board, 2016). Narrow carriageways restrict vehicle manoeuvrability and overtaking opportunities, while poorly designed intersections lacking channelization or turning lanes create conflict points that reduce traffic discharge rates and increase queue lengths (Garber & Hoel, 2024). In many developing cities, infrastructure development has not kept pace with rising travel demand, resulting in capacity constraints (Oyesiku, 2020).

Operational challenges concern traffic management and control systems rather than infrastructure design. These include inefficient signal timing, poor signal coordination, weak enforcement, illegal parking, informal passenger loading, and roadside trading. Inefficient traffic signals can significantly reduce intersection capacity even when road geometry is adequate (Transportation Research Board, 2016). Illegal parking and roadside commercial activities reduce effective lane width and introduce side friction, causing disruptions in traffic flow (Garber & Hoel, 2024). Such disturbances increase traffic density and reduce average speed, leading to unstable traffic flow conditions as described in classical traffic flow theory (Greenshields, 1935).

Demand-side challenges arise from increasing travel demand within the urban system. Factors such as rapid population growth, increasing car ownership, concentration of commercial activities, limited public transport alternatives, and peak-hour travel patterns contribute to congestion. Because transport demand is derived from land-use activities, central business districts typically attract large numbers of trips for work, trade, and services (Ortúzar &

Willumsen, 2023). When travel demand exceeds the available road capacity, persistent congestion occurs, particularly in cities with weak mass transit systems (Oyesiku, 2020).

2.1.3 Conceptual Implication for the Study

In this very study, as depicted by figure 1, vehicular traffic congestion in Ilorin city centre is conceptualized as the outcome of interacting geometric, operational, and demand-related constraints within the urban transport system, which together influence the intensity and pattern of congestion.

Figure 1. Conceptual Framework (Source: Author's conceptualization)

2.2 THEORETICAL REVIEW

2.2.1 Demand-Supply Congestion Theory (Intersection Perspective)

Demand-Supply Congestion Theory originates from classical economic supply-demand principles and was adapted to transport studies by scholars such as Downs (1962), Vickrey (1969), and Small and Verhoef (2007). The theory explains congestion as a situation where traffic demand exceeds the available road capacity. In traffic systems, demand represents the number of vehicles wishing to use a roadway or intersection, while supply refers to the available infrastructure capacity. When demand is equal to or less than supply, traffic flows smoothly; however, when demand exceeds supply, congestion and queues occur.

At intersections, the supply side is determined by factors such as the number of lanes, turning bays, and signal timing. Turning movement imbalances and poor capacity allocation can further reduce effective intersection capacity. In the context of this study, the theory helps explain why congestion occurs at selected intersections in Ilorin city centre and complements Queuing Theory by showing that queues form primarily when traffic demand surpasses available intersection capacity (Subair et al, 2023).

2.2.2 Land Use-Transport Interaction Theory

Land Use-Transport Interaction (LUTI) Theory emerged from urban spatial and accessibility studies, with early contributions by Hansen (1959) and later developments by Wegener (2004). The theory explains the mutual relationship between land use patterns and transportation

systems**.** It argues that land use activities generate travel demand, while transport infrastructure influences the location and intensity of development.

Key principles of the theory indicate that commercial concentration increases trip attraction, mixed land uses intensify local traffic movements, and central business districts generate strong directional traffic flows. As a result, congestion in urban centres is often a product of spatial land-use patterns rather than solely operational traffic problems (Hansen, 1959; Wegener, 2004).

2.3 EMPIRICAL REVIEW

Nwaigwe (2019) investigated the causes and consequences of traffic congestion in Lagos State using urban transport and traffic flow theory. Through qualitative case study analysis of traffic patterns and infrastructure data, the study found that poor road planning, limited road capacity, lane indiscipline, and weak traffic management systems significantly contribute to congestion during peak periods. The research concluded that improving urban mobility requires integrated road planning, stronger traffic control systems, and improved public transport support.

Wada, et al, (2023) examined traffic congestion and delays at intersections in Abuja, Nigeria, using intersection delay and conflict theory. Data collected through intersection delay counts and field observations revealed severe congestion, especially in mixed-use areas. Illegal parking, mixed land use patterns, and peak-hour travel demand were identified as major causes of delay, with about 42% of vehicles experiencing significant intersection delays. The study recommended improved intersection design, stricter parking enforcement, and better peak-period traffic control.

Salisu et al, (2020) evaluated traffic congestion and the effectiveness of Intelligent Transport Systems (ITS) in Ibadan. Using field observations and traffic data analysis, the study found that traditional traffic management approaches were largely ineffective due to poor motorist behavior and weak enforcement. The authors concluded that integrating ITS technologies with improved traffic discipline and urban transport planning could significantly reduce congestion.

Arowosegbe & Qudus (2025) analyzed congestion along Ipaja-Ikotun Road in Lagos through traffic count surveys and delay analysis at major intersections. The results revealed extremely high delay rates and significant economic losses exceeding ₦10 billion annually. Population growth and inadequate road capacity were identified as the major contributors to congestion, leading the study to recommend road rehabilitation, improved traffic control, and infrastructure expansion.

Onyeneke (2018) examined the causes and impacts of traffic congestion across Nigeria using surveys and interviews. The study identified high vehicular volumes, poor land-use coordination, chaotic vehicle registration systems, and inadequate transport infrastructure as major contributors to congestion. These conditions result in travel delays, vehicle conflicts, and reduced productivity. The author recommended comprehensive transport planning and infrastructure development to improve mobility.

Chow (2024) conducted an empirical study on urban traffic congestion using network performance theory. Panel data analysis showed that excessive traffic demand, limited

infrastructure capacity, and inefficient signal control systems contribute significantly to recurring congestion. The study concluded that operational improvements in traffic management and infrastructure expansion are necessary to enhance traffic flow efficiency.

Alkaissi *et al* (2024) assessed urban congestion in Baghdad using traffic delay and impedance theory. Statistical analysis of field traffic data revealed that high traffic volumes and heavy vehicle movements significantly increase travel delays and reduce mobility. The study recommended improved intersection management, vehicle flow control, and optimized signal timing as key solutions to reduce congestion.

Subair *et al* (2024) examined the broader impacts of urban traffic congestion through literature review and secondary data analysis. Their findings indicated that congestion not only increases travel time but also raises fuel consumption, environmental pollution, and stress among road users. The study concluded that smart traffic management systems and integrated urban planning approaches are essential for improving urban mobility and reducing congestion.

2.3.1 RESEARCH GAPS

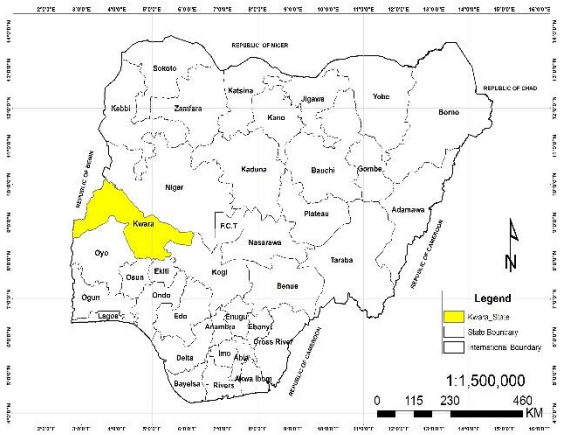
The reviewed literature reveals significant geographic and methodological limitations that constrain the understanding of urban traffic congestion in Nigeria. Existing studies demonstrate a pronounced bias toward large metropolitan areas such as Lagos, Abuja, and Ibadan, while medium-sized cities like Ilorin remain empirically under-examined despite their rapid urbanisation and increasing congestion challenges. This city-size bias is compounded by methodological narrowness, as most researchers rely on single-method approaches—qualitative case studies, intersection delay counts, or field observations—without integrating road user perceptions or conducting corridor-specific analyses. Furthermore, the literature inadequately addresses the realities of mixed traffic conditions characteristic of Nigerian cities, with limited examination of how heterogeneous vehicle types (motorcycles, tricycles, minibuses, and private cars) interact to create congestion, and insufficient analysis of pedestrian-vehicle conflicts that frequently disrupt traffic flow in central business districts.

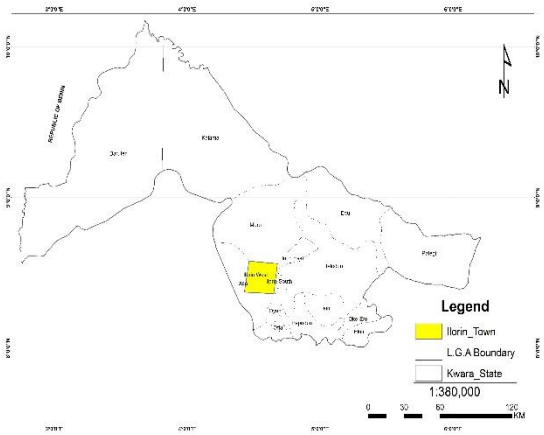
Beyond these empirical and methodological gaps, the literature suffers from weak institutional integration and insufficient quantification of congestion impacts. Most studies offer generic recommendations without identifying specific implementing authorities or examining the institutional capacity constraints that hinder enforcement, leading to implementation failures. Additionally, there is limited application of theoretical frameworks such as queuing theory and demand-supply congestion models, with no studies employing traffic simulation to test intervention scenarios before implementation. The economic and environmental costs of congestion remain largely unquantified outside Lagos, depriving policymakers of evidence to justify infrastructure investments, while temporal dynamics and real-time data collection through intelligent transport systems are virtually absent from the research. These gaps collectively undermine the ability of existing studies to provide actionable, context-specific guidance for traffic management in medium-sized Nigerian cities.

3.0 RESEARCH METHODOLOGY

3.1 STUDY AREA

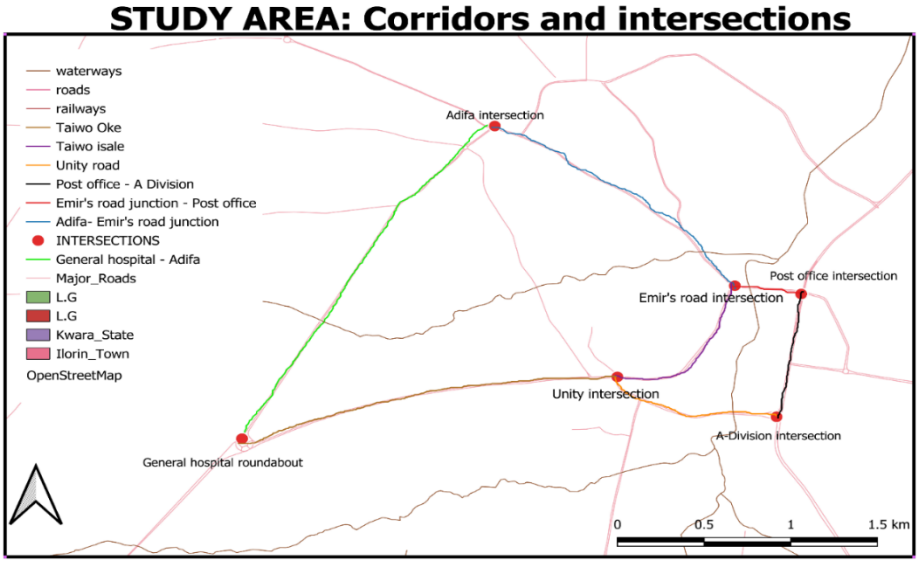
The research is conducted within the Ilorin City Centre, Kwara State, Nigeria, Ilorin city centre is located at approximately 8.48°N latitude and 4.54°E longitude. Figures 2, 3, and 4 are maps showing Kwara state in Nigeria, Ilorin in Kwara state and selected traffic corridors within Ilorin city respectively.





Source: Google open-source map, 2026

Figure 2 Map of Nigeria showing Kware state Figure 3 Map of Kwara state showing



Source: Author's demarcation, 2026

Figure 4: Map of the study area showing selected intersections and traffic corridors

3.2 RESEARCH DESIGN

This study adopted a descriptive survey research design to examine vehicular traffic congestion in Ilorin city centre. The design was considered appropriate because it allows for systematic observation, measurement, and analysis of traffic conditions as they occur in real-world environments. The approach enabled the collection of empirical data on traffic volume and vehicle composition along selected traffic corridors.

3.3 Data: Sources, collection techniques and analysis

This study requires both quantitative and qualitative data collection methods. Researcher observe operational bottlenecks such as illegal parking, roadside trading, narrow lanes, encroachments, poor signage, pedestrian interference, and so on. These observations were then developed into structured questionnaires. The questionnaire which ~~was~~ then administered to motorists, commercial drivers, pedestrians, traffic wardens, and transport officials. Other source ~~includes~~ secondary information obtained from relevant literature, government reports, and previous studies on urban traffic congestion.

The collected data were analysed using descriptive statistical techniques, including frequency counts and percentage distribution. The results were presented using tables and charts to illustrate the magnitude of traffic volume and the composition of vehicles within the study area. These analyses helped in identifying congestion patterns within Ilorin city centre.

4.0 RESULTS AND DISCUSSION

This segment presents the findings derived from method and discusses their implications in relation to the research questions to which answers are sought. Table 1: Frequency Distribution of Perceived Causes of Traffic Congestion by Corridor Beyond what can be measured in traffic counts and speeds, the way vehicles move in urban centres is strongly shaped by everyday human and environmental realities. Practices such as indiscriminate parking, roadside trading, weak traffic control, pedestrian interference, and poor enforcement frequently worsen congestion, particularly in developing cities. This objective therefore explores these underlying issues from the perspective of road users, drawing on questionnaire survey data to complement observed traffic conditions and offer a more complete, real-world understanding of the causes of congestion in Ilorin city centre.

The analysis of the questionnaire responses shows that traffic congestion in Ilorin city centre is largely shaped by day-to-day operational practices and road user behaviour, although the intensity of these problems varies from one corridor to another. Along the General Hospital-Adifa corridor, respondents most frequently pointed to indiscriminate parking, roadside stopping, poor traffic control, and junction blockage as the main causes of congestion, with about 55-65% indicating that these issues occur regularly. In response, a clear majority of respondents (70-75%) expressed strong support for stricter parking enforcement and the provision of designated off-carriageway stops as practical solutions. Similarly, on the Adifa-Emir's Road corridor, roadside trading and passenger loading on the carriageway emerged as the most critical congestion factors, reported by roughly 58-60% of respondents, while the removal of roadside trading and improved enforcement attracted strong approval (about 68-72%).

Congestion was most severe along the Emir's Road-Post Office and Post Office-A-Division corridors. Here, long queues, ineffective traffic signal control, frequent turning-movement conflicts, and pedestrian interference were identified by approximately 60-75% of respondents as major contributors to traffic delay. In line with these challenges, respondents strongly favoured measures such as improved traffic signalisation, junction redesign, better pedestrian facilities, and stricter parking enforcement, with support levels generally above 65% and reaching as high as 75-80% on the Post Office-A-Division corridor. By contrast, the Emir's Road-Unity Junction and Taiwo Oke-Unity Junction corridors experienced relatively lower levels of congestion. In these areas, driver behaviour and pedestrian activities were the most commonly reported issues, mentioned by about 50-60% of respondents, while public awareness campaigns and improved pedestrian infrastructure were identified as the most appropriate responses (around 60-70%).

Unity Road stood out as the least congested corridor within the study area. Only occasional peak-hour traffic surges were reported, affecting about 40-45% of respondents, suggesting that the corridor generally operates under acceptable conditions and requires only minor traffic management improvements. Overall, the findings indicate that congestion in Ilorin city centre is not simply a result of high traffic volumes but is more strongly linked to illegal parking, roadside commercial activities, weak traffic control, and poor enforcement. At the same time, measures such as stricter regulation, designated stopping facilities, improved signal control, and better pedestrian infrastructure were consistently identified as the most effective and widely supported solutions across the study corridors. Table 1 summarises the dominant causes of traffic congestion and preferred mitigation measures across the study corridors.

Table 1: Dominant Causes of Traffic Congestion and Preferred Solutions per Corridor

Traffic Corridor	Highest Causes of Congestion (Dominant Responses)	% of Respondents (Often/Always)	Most Suggested Solutions (Dominant Responses)	% of Respondents (Agree/Strongly Agree)
General Hospital - Adifa	Indiscriminate parking, roadside stopping, poor traffic control, junction blockage	55-65%	Strict parking enforcement; designated off-carriageway stops	70-75%
Adifa - Emir's Road	Roadside trading; passenger loading on carriageway	58-60%	Removal of roadside trading; improved enforcement	68-72%
Emir's Road - Post Office	Long queues; poor signal control; pedestrian interference; turning conflicts	60-75%	Improved signalisation; pedestrian facilities; junction redesign	65-75%
Emir's Road - Unity Junction	Driver impatience; minor intersection conflicts	50-55%	Public awareness; improved traffic control presence	55-65%

Traffic Corridor	Highest Causes of Congestion (Dominant Responses)	% of Respondents (Often/Always)	Most Suggested Solutions (Dominant Responses)	% of Respondents (Agree/Strongly Agree)
Taiwo Oke - Unity Junction	Pedestrian crossing at undesignated locations; roadside activities	50-60%	Pedestrian facilities; removal of roadside trading	60-70%
Post Office - A-Division	Indiscriminate parking; turning-movement conflicts; weak enforcement	65-75%	Strict parking enforcement; turning lanes; improved signal control	75-80%
Unity Road	Occasional peak-hour traffic surges	40-45%	Minor traffic management improvements	50-55%

(Source: Author's field survey, 2026)

It was concluded that the majority of participants determined that traffic congestion experienced in Ilorin city centre is a result of operational, behavioural, and environmental issues rather than vehicle traffic alone. Data collected indicated the following issues were consistently identified by the survey respondents: Indiscriminate parking and roadside passenger loading has contributed to increased congestion, Infringement upon the carriageway by roadside trading has increased congestion, Inadequate or absent traffic control and signalisation has created a hazardous environment for vehicles, Queue movements blocking intersections have created hazardous driving situations for drivers, Driver impatience and lack of enforcement of regulations has added to the congestion Respondents of the questionnaires indicated that they strongly support proposed solutions which would include strict enforcement of regulations, designated off-carriageway stopping areas, removal of roadside trading, and improvements to traffic signal control.

5.0 CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

Congestion in the study area is also closely linked to uneven traffic movements at key intersections. Inefficient intersection operations and unbalanced turning flows lead to queue build-ups, which in turn reduce the overall efficiency of the road network. More broadly, the factors affecting vehicular movement in Ilorin city centre are largely operational and behavioural rather than purely volume-related. Indiscriminate parking, roadside trading, weak enforcement, and inadequate traffic management practices emerge as more influential contributors to congestion than traffic volume alone. Table 2 presents the recommendations as well as the statutory authorities concern in the study area.

5.2 RECOMMEDATIONS

Table 2: Recommendations and concern stakeholders

S/N	Recommendation	Target Authority / Stakeholder
1	Prevent queue spillbacks through clear intersection box markings and strict enforcement.	Kwara State Road Traffic Agency (KERTMA) and Federal Road Safety Corps (FRSC), Kwara State Command should collaborate to implement intersection box markings and deploy enforcement personnel at critical junctions, particularly along Emir's Road-Post Office and Post Office-A-Division corridors.
2	Enforce strict parking and stopping regulations, with penalties for violations.	Ilorin Metropolitan Development Authority (ILMA) and Kwara State Road Traffic Agency (KERTMA) should establish a joint task force to regulate on-street parking, introduce penalty schemes for illegal parking, and ensure consistent enforcement across all study corridors.
3	Provide designated off-carriageway bus and tricycle stops at strategic locations.	Kwara State Ministry of Works and Transport and Ilorin Metropolitan Development Authority (ILMA) should identify suitable locations for purpose-built bus and tricycle terminals, particularly along General Hospital-Adifa and Adifa-Emir's Road corridors where passenger loading currently obstructs traffic flow.
4	Relocate roadside trading activities away from major corridors and intersections.	Kwara State Ministry of Commerce and Industry, in collaboration with Ilorin Metropolitan Development Authority (ILMA) and Kwara State Environmental Protection Agency (KWEPA), should develop alternative market spaces and enforce the removal of traders from carriageways, with priority attention to Adifa-Emir's Road and Tsaiwo Oke-Unity Junction corridors.
5	Improve pedestrian facilities, including zebra crossings and footbridges, to reduce mid-block crossings.	Kwara State Ministry of Works and Transport and Ilorin Metropolitan Development Authority (ILMA) should prioritise the installation of pedestrian crossing facilities and footbridges at high-conflict locations, particularly along Emir's Road-Post Office and Taiwo Oke-Unity Junction corridors.
6	Strengthen public education and driver sensitisation programmes on traffic discipline.	Federal Road Safety Corps (FRSC), Kwara State Command, Kwara State Road Traffic Agency (KERTMA), and Kwara State Ministry of Information and Communications should develop and implement sustained public enlightenment campaigns targeting motorists, commercial drivers, and pedestrians to promote traffic discipline and compliance with regulations.

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