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ECONOMIC IMPACTS AND CHALLENGES OF PARKING SYSTEM IN ADDIS ABABA CITY, ETHIOPIA: EVIDENCE FROM ADDISU GEBEYA TO QIDUS GIORGIES CHURCH CORRIDOR

MSc THESIS

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DECLARATION

I, the undersigned, hereby declare that this thesis is my original work, prepared independently under the supervision of my research advisor Dr. Daganchew Adugna (PhD). It has not been submitted for any academic degree or credential at this or any other institution. All sources, data, ideas, and materials drawn from external references have been fully and appropriately acknowledged in accordance with the academic standards and ethical guidelines of Addis Ababa University, College of Technology and Built Environment.

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ABSTRACT

Unmanaged parking in rapidly motorizing African cities generates compounding economic, mobility, and governance costs. In Addis Ababa, formal parking supply meets fewer than 40 percent of commercial corridor demand, yet corridor-specific empirical evidence linking parking system failures to measurable economic impacts remains absent from the literature. The study assessed parking supply adequacy and spatial distribution, evaluated parking management effectiveness and institutional coordination, and identified the economic impacts of the existing parking system along the Addisu Gebeya-Qidus Giorgis Church corridor, Arada and Gulele Sub-city. sequential explanatory mixed-methods design was employed. Data were collected from 180 questionnaire respondents across six stakeholder groups, supplemented by key informant interviews (n = 12), focus group discussions (n = 3), a parking inventory and occupancy survey, travel time delay measurements, and GIS spatial analysis. Analytical techniques included descriptive statistics, one-way ANOVA with Tukey HSD post-hoc tests, and binary logistic regression. Formal parking supply met less than 25 percent of peak demand, with occupancy reaching 94 percent during peak periods. Binary logistic regression identified parking inadequacy (OR = 2.51), fee avoidance (OR = 2.03), and congestion perception (OR = 1.79) as significant predictors of illegal parking. Peak-hour travel times exceeded free-flow conditions by 177 percent, generating an estimated annual delay cost of 1,910 ETB per commuter. Over 83 percent of business owners reported parking-related business constraints, and institutional fragmentation across three agencies was the principal governance barrier.Parking system failure on the corridor is driven by structural supply inadequacy, governance fragmentation, and absent demand management mechanisms, collectively imposing significant economic and accessibility costs on all corridor users vidence-based interventions are required, including a Corridor Parking Coordination Committee, multi-story off-street parking, occupancy-responsive pricing, shared parking districts, and parking by-law reform. The mixed-methods corridor-level framework developed here is replicable across high-intensity urban corridors in the Global South.

Keywords: *Economic Impacts, Governance Fragmentation, Illegal Parking, Parking Management; Urban Mobility;*

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LIST OF ACRONYMS/ ABBREVIATIONS

A. A	Addis Ababa
AACRA	Addis Ababa City Roads Authority
AALRT	Addis Ababa Light Rail Transit
ANOVA	Analysis of Variance
CBD	Central Business District
CI	Confidence Interval
CSA	Central Statistical Agency of Ethiopia
EiABC	Ethiopian Institute of Architecture, Building Construction and City Development
EPP	Events Per Predictor (logistic regression)
ETB	Ethiopian Birr
GDP	Gross Domestic Product
GIS	Geographic Information System
GPS	Global Positioning System
HSD	Honestly Significant Difference (Tukey post-hoc test)
ITDP	Institute for Transportation and Development Policy
ITE	Institute of Transportation Engineers
ITS	Intelligent Transport Systems
KII	Key Informant Interview
MSc	Master of Science
NMT	Non-Motorized Transport
OECD	Organization for Economic Co-operation and Development
OR	Odds Ratio
PHF	Peak Hour Factor
RO	Research Objective

RQ	Research Question
SDG	Sustainable Development Goal (United Nations)
SPSS	Statistical Package for the Social Sciences
SUM	Sustainable Urban Mobility
TDM	Transport Demand Management
TOD	Transit-Oriented Development
USD	United States Dollar
V/C	Volume-to-Capacity Ratio
WHO	World Health Organization

CHAPTER ONE NTRODUCTION

1.1 Background of the Study

Parking systems constitute a fundamental yet frequently overlooked dimension of urban mobility, directly shaping the accessibility, commercial vitality, and economic productivity of modern cities. As cities grow and private vehicle ownership rises, the demand for parking increasingly exerts pressure on limited street space, transforming public thoroughfares into contested vehicle storage zones that reduce road capacity, obstruct pedestrian movement, and compromise the quality of urban public life. Litman (2024) observes that unmanaged parking consumes between 15 and 25 percent of urban street space globally, generating congestion costs equivalent to 1-2 percent of urban Gross Domestic Product (GDP). Beyond these macroeconomic costs, the spatial domination of streets by parked vehicles degrades pedestrian safety, reduces commercial frontage accessibility, and diminishes the social function of urban corridors (Gehl, 2010). Behzadfar and Shakibamanesh (2011) argue that parking in city centres is fundamentally an urban design problem one whose resolution demands guidelines that address functional, aesthetic, and environmental quality simultaneously rather than a purely technical traffic engineering concern. This reframing places parking management at the core of sustainable urban design practice.

At the global level, the rapid growth of motorization is transforming the structure and economy of cities across the developing world. Vehicle ownership is growing at 3-5 percent annually in developing regions, and parking demand increasingly outpaces the growth of formal parking supply (Litman, 2024). Shoup (2021) demonstrates that the absence of demand-responsive pricing and evidence-based planning frameworks produces systematic mismatch between parking supply and demand generating oversupply in some locations while creating severe undersupply in high-intensity commercial and mixed-use corridors. These inefficiencies impose direct economic costs through increased travel time, fuel wastage, and reduced business accessibility, as well as social costs through pedestrian displacement and escalating accident risk. Le (2021), synthesizing best practices in parking management from North American cities, confirms that corridors lacking proactive demand management strategies consistently underperform economically relative to those with integrated parking governance frameworks, and that the costs of inaction compound over time.

In sub-Saharan Africa, these challenges are acutely magnified by rapid urbanization, weak planning institutions, and the normalization of informal transport practices. Urban populations across the continent are growing faster than formal parking and transport infrastructure, and supply-demand imbalances reduce road capacity by up to 30 percent during peak hours in major commercial districts (Litman, 2024; Asiyanbola & Akinpelu, 2012). In Nigerian cities, Asiyanbola and Akinpelu (2012) documented that insufficient formal parking generates widespread traffic disruption, with illegal and informal on-street parking becoming the default spatial practice. Comparable patterns have been documented in Nairobi, Accra, and Dar'es Salaam, where the governance of parking remains fragmented across multiple institutions with overlapping mandates and uncoordinated enforcement. These conditions impose cascading economic and social costs on businesses, commuters, and pedestrians, while worsening air quality and road safety outcomes.

Addis Ababa, the capital city of Ethiopia and home to over five million residents, exemplifies these challenges with compounding intensity. The city is undergoing urbanization at 4.2 percent per year, while vehicle registration has grown at more than 10 percent annually a rate that has dramatically outpaced the development of formal parking infrastructure (Addis Ababa City Administration, 2021). Shiferaw (2014) documented that on-street parking already dominates approximately 70 percent of the city's central corridors, occupying carriageways originally designed for mixed traffic flows. Biruk (2017) confirmed that formal parking supply meets fewer than 40 percent of commercial hub demand, forcing widespread reliance on illegal and informal on-street practices that reduce carriageway capacity by 25-30 percent and systematically block pedestrian sidewalks. Although the Addis Ababa 2017-2027 Structure Plan recognizes sustainable urban mobility as a strategic priority, parking management receives no corridor-specific policy attention (Addis Ababa City Administration, 2021).

The governance of parking in Addis Ababa is further undermined by deep structural fragmentation. The Addis Ababa Transport Bureau, the Traffic Management Authority, and the Addis Ababa City Roads Authority (AACRA) each exercise overlapping mandates with no unified coordination mechanism (Abu & Mahto, 2019). Kebede (2021) demonstrates that the absence of political commitment and inadequate institutional capacity produce a chronic disconnect between transport governance and land use planning in Addis Ababa, leaving parking management which sits at the intersection of both domains chronically under-resourced. Abate (2023), studying the Mexico area public transport interchange at EiABC, Addis Ababa

University, found through direct interviews with Addis Ababa Transport Bureau officials that political will and administrative priority shifts are the decisive barriers to transport infrastructure reform, with built facilities degenerating into dysfunction because no administrative body is assigned sustained responsibility for their maintenance. Tazzie et al. (2025) confirm that over 79 percent of Addis Ababa residents rate institutional coordination failures as a high or very high barrier to sustainable transport implementation.

The modal distribution of urban travel in Addis Ababa further underscores the severity of the parking management crisis. Although pedestrians account for 54 percent of all daily trips, they are confined to just 12 percent of road space, while private cars representing only 15 percent of trips occupy 60 percent of urban roadway (Addis Ababa Transport Bureau, 2018, as cited in Tazzie et al., 2025). This inequitable allocation, compounded by on-street parking pressure, systematically marginalizes the majority of corridor users. Emerging interventions, including Intelligent Transport Systems (ITS) and multi-story parking structures, have been introduced on a piecemeal basis, but financial constraints and weak inter-agency coordination have limited their effectiveness (Manaye et al., 2022; Woldegebrael & Emagnu, 2025).

The Addisu Gebeya-Qidus Giorgis Church corridor in central Addis Ababa concentrates these systemic failures into a single, high-intensity urban artery. This approximately 3-kilometre route links one of Addis Ababa's largest and most active marketplace districts with Qidus Giorgis (Saint George) Cathedral, a national religious and cultural landmark, generating a diverse and seasonally variable demand profile: weekday market delivery traffic, weekend and holiday pilgrim flows, and daily commercial short-stay parking. Woldegebrael and Emagnu (2025) confirm that land-use intensity at mixed commercial-religious nodes significantly amplifies parking pressure relative to single-use corridors, with accessibility to main roads and proximity to activity centers carrying the greatest weight in determining parking demand. Yet the specific economic and management impacts of the market-church adjacency effect along this corridor have not been quantified in existing literature, constituting a demonstrable research gap that this study is designed to address.

Against this background, this study investigates the economic impacts and management challenges of the existing parking system along the Addisu Gebeya-Qidus Giorgis Church corridor from an urban design and regional planning perspective. By generating corridor-specific, mixed-methods empirical evidence, the study aims to inform targeted, evidence-based interventions including demand management strategies, improved institutional coordination, and

urban design guidelines aligned with sustainable urban development objectives and the broader goals of Addis Ababa's urban mobility policy.

1.2 Statement of the Problem

At the global scale, the failure to manage urban parking systems effectively generates compounding economic, social, and environmental costs. Litman (2024) estimates that parking-related congestion costs cities between 1 and 2 percent of urban GDP annually through lost productivity, increased fuel consumption, and elevated accident rates. Shoup (2021) demonstrates that minimum parking requirements embedded in land use regulations artificially inflate parking supply in some zones while leaving high-intensity commercial corridors chronically underserved, normalizing illegal on-street practices that reduce road capacity and restrict pedestrian movement. Gehl (2010) shows that the spatial domination of city streets by parked vehicles degrades the public realm, reduces commercial vitality, and systematically excludes non-motorized users' outcomes that disproportionately affect lower-income populations who rely on walking and public transport. Le (2021) confirms that municipalities without proactive parking management strategies including demand-responsive pricing, enforcement capacity, and governance coordination consistently incur higher economic costs than those that have implemented integrated parking governance frameworks.

In African cities, these dynamics are further amplified by rapid urbanization, constrained municipal budgets, and governance fragmentation. Formal parking supply typically meets fewer than 40 percent of commercial district peak-hour needs, normalizing unregulated on-street practices that reduce road capacity by up to 30 percent (Asiyanbola & Akinpelu, 2012; Biruk, 2017). Municipal authorities lack the political commitment, institutional coordination, and enforcement capacity to implement demand-responsive parking management (Kebede, 2021), while urban master plans routinely fail to integrate parking provisions with land use and transport policy (Abu & Mahto, 2019). These failures generate direct economic costs through reduced business accessibility and increased logistics time, as well as indirect costs through pedestrian displacement, fuel waste from vehicles circling for parking, and worsening air quality in densely built corridors.

In Addis Ababa, the parking management crisis is compounded by governance structures that have not kept pace with the city's rate of motorization. Vehicle registration has grown by over 15 percent annually since 2020, yet parking policy remains reactive, piecemeal, and institutionally fragmented across at least three government bodies with overlapping mandates

and no unified management framework (Addis Ababa City Administration, 2021; Abu & Mahto, 2019). Buildings designed with basement parking have frequently converted those facilities into commercial shops, further reducing off-street supply and displacing additional demand onto public streets, without regulatory sanction (Abu & Mahto, 2019). Tazzie et al. (2025) found that 71.7 percent of Addis Ababa residents rate parking control as poorly implemented confirming that parking management remains largely aspirational in policy and ineffective in practice. The economic consequences of this failure are severe: Abu and Mahto (2019) estimated that traffic delays attributable to illegal parking cost individual Addis Ababa commuters between 762 and 2,399 Ethiopian Birr (ETB) per month in lost productivity, while businesses in high-intensity commercial areas face retail turnover losses of 10-15 percent due to restricted customer access during peak hours.

The Addisu Gebeya-Qidus Giorgis Church corridor concentrates these failures with particular intensity. The approximately 3-kilometre route traverses one of Addis Ababa's most commercially active districts and connects it to a national religious landmark, generating demand peaks from weekday market deliveries, weekend commercial activity, and religious pilgrimage. The corridor is characterized by four interconnected systemic failures. First, spatial misdistribution clusters available off-street parking supply at distances from major demand generators that discourage use. Second, enforcement collapse normalizes double-parking and sidewalk occupation, as confirmed by Biruk (2017) across comparable Addis Ababa commercial corridors. Third, governance fragmentation places uncoordinated traffic police against sub-city planners without unified management authority. Fourth, design obsolescence produces street geometries lacking Non-Motorized Transport (NMT) integration and pedestrian infrastructure commensurate with the corridor's dominant walking modal share (Abate, 2023; Tazzie et al., 2025).

The cascading consequences of these failures extend across multiple urban domains. Pedestrians who constitute the majority of corridor users face systematic displacement from sidewalks, increased accident risk, and reduced access to commercial frontages (Gehl, 2010; Abate, 2023). Businesses suffer reduced customer dwell time and turnover losses. Delivery and logistics operations are disrupted by double-parked vehicles occupying loading bays. And the corridor's function as a connection between a major marketplace and a national religious landmark generating diverse, high-volume, temporally variable demand is compromised by the absence of any demand-responsive management strategy.

Despite recognition of these problems in policy documents and a growing body of empirical research, no study has systematically investigated the corridor-level economic impacts and management challenges of parking systems along a mixed commercial-religious urban artery in Addis Ababa. Previous Ethiopian studies have focused primarily on parking supply inventory, operational performance, and general traffic flow analysis (Shiferaw, 2014; Biruk, 2017; Woldegebrael & Emagnu, 2025), while spatial demand analyses have been conducted at the sub-city rather than corridor level. Limited attention has been paid to the economic impacts on road users, businesses, and transport operations, and none of the existing studies have analysed these failures through an urban design and governance lens (Behzadfar & Shakibamanesh, 2011). This evidence gap impedes targeted, evidence-based interventions and leaves the Addisu Gebeya-Qidus Giorgis Church corridor without the empirical foundation needed to support policy reform and urban design improvement.

1.3 Research Questions

The following research questions guide the empirical investigation:

1. What is the current status of the formal and informal parking supply, its adequacy, and spatial distribution along the Addisu Gebeya-Qidus Giorgis Church corridor?

2. What are the major factors affecting the effectiveness and management of the existing parking system along the study corridor, including enforcement capacity, institutional coordination, and regulatory compliance?

3. What are the economic impacts of the existing parking system on road users, businesses, pedestrians, and transport operations along the Addisu Gebeya-Qidus Giorgis Church corridor?

1.4 Objectives of the Study

1.4.1 General Objective

The general objective of this study is to investigate the economic impacts and management challenges of the existing parking system along the Addisu Gebeya-Qidus Giorgis Church corridor in Addis Ababa, with a view to generating corridor-specific, evidence-based recommendations for urban design intervention and sustainable parking governance.

1.4.2 Specific Objectives

The following specific objectives correspond directly to the research questions above:

1. To assess the formal and informal parking supply, its adequacy, and spatial distribution along the Addisu Gebeya-Qidus Giorgis Church corridor.

2. To evaluate the effectiveness and management of the existing parking system along the study corridor, including institutional coordination, enforcement practices, and regulatory compliance.

3. To identify the economic impacts of the existing parking system on road users, businesses, pedestrians, and transport operations along the Addisu Gebeya-Qidus Giorgis Church corridor.

1.5 Significance of the Study

This study addresses a critical yet systematically under-examined dimension of urban transport governance in rapidly growing African cities. For policymakers, urban planners, and the Addis Ababa Transport Bureau, the study generates corridor-level empirical evidence to support targeted interventions including demand-responsive parking pricing, digital parking management systems, and strengthened inter-agency enforcement protocols directly advancing the objectives of the Addis Ababa Urban Transport Policy and the national Sustainable Development Goal (SDG) 11 agenda for inclusive, safe, and sustainable cities.

For urban designers and planners at Addis Ababa University College of Built Environment and beyond, the mixed-methods analytical framework developed here provides a replicable methodology for corridor-level parking governance assessment adaptable to other high-intensity routes across Addis Ababa and comparable Ethiopian cities. For the businesses, residents, and pedestrian users of the corridor, the study generates evidence that can directly support advocacy for improved parking governance, enhanced sidewalk safety, and more

equitable street space allocation. By linking parking management to environmental sustainability through reduced vehicle idling, lower fuel consumption, and improved air quality the research contributes to Ethiopia's broader vision for a resilient and livable capital. Theoretically, it enriches the academic discourse on urban design governance and informal mobility systems in the Global South, positioning the Addisu Gebeya-Qidus Giorgis Church corridor as a significant case study for refining parking policy in rapidly urbanizing African metropolises.

1.6 Scope and Delimitation of the Study

1.6.1 Spatial Scope

The study encompasses the approximately 3-kilometre corridor extending from Addisu Gebeya marketplace (9°03'33"N, 38°44'13"E) southwards to Qidus Giorgis Cathedral (9°02'13"N, 38°45'04"E), including all key intersections, commercial frontages, sidewalks, and directly adjacent on-street and off-street parking facilities within a 200-metre buffer zone of the main route. Areas beyond this buffer, other Addis Ababa districts, and secondary Ethiopian cities are excluded from the spatial scope.

1.6.2 Thematic Scope

The thematic scope covers: (i) parking supply inventory, including formal and informal, on-street and off-street facilities; (ii) parking occupancy, turnover, and spatial distribution in relation to land use generators; (iii) parking management effectiveness, encompassing institutional coordination, policy implementation, and regulatory compliance; and (iv) the economic and mobility impacts of the existing parking system on road users, businesses, pedestrians, and transport operations. The study evaluates system performance and identifies governance failures; it does not undertake detailed engineering design or long-term financial modelling.

1.6.3 Temporal Scope

Primary data collection was conducted between October and December 2025, capturing current parking conditions across weekday peak periods (08:00-10:00 and 16:00-18:00), midday off-peak periods (12:00-14:00), and weekend patterns associated with religious observances at Qidus Giorgis Cathedral. Historical and secondary data are used for contextual analysis only.

1.7 Definition of Key Terms

Parking System: The collective infrastructure, policies, regulations, and management practices governing the provision, allocation, and utilization of parking spaces within a defined urban area (Shoup, 2021).

On-Street Parking: Vehicle parking that occurs within the carriageway or on the road shoulder, whether formally designated or informally practiced (Litman, 2024).

Off-Street Parking: Designated parking facilities located away from the public road, including surface lots, underground garages, and multi-story structures.

Illegal Parking: Any parking activity that contravenes applicable traffic regulations, including obstruction of pedestrian sidewalks, double-parking, blocking of driveways, and parking in prohibited zones (Abu & Mahto, 2019).

Parking Management: The planning, organization, and administration of parking resources to optimize space utilization, improve traffic flow, and enhance the overall efficiency of the parking system (Le, 2021).

Intelligent Transport Systems (ITS): Advanced information and communication technology applications integrated into transport infrastructure to improve safety, mobility, and environmental performance, including smart parking guidance and electronic payment systems (Manaye et al., 2022).

Non-Motorized Transport (NMT): Modes of travel that do not involve motorized vehicles, principally walking and cycling (Abate, 2023).

Parking Supply-Demand Mismatch: A condition in which the spatial distribution or absolute quantity of available parking spaces does not correspond to the location or volume of parking demand, leading to either oversupply or undersupply in specific sub-areas (Woldegebrael & Emagnu, 2025).

1.8 Limitations of the Study

This study is subject to several limitations that should be considered when interpreting findings. The case-specific focus on the Addisu Gebeya-Qidus Giorgis Church corridor limits direct generalizability to other Addis Ababa districts or secondary Ethiopian cities where land use patterns, street geometries, and institutional arrangements differ. The stakeholder sample, while representative of principal user groups, may not fully capture seasonal variations in parking demand particularly during major religious festivals at Qidus Giorgis Cathedral or peak market periods at Addisu Gebeya. Reliance on self-reported questionnaire data introduces the possibility of recall and social desirability biases regarding self-reported illegal parking behavior. Incomplete municipal records on historical parking enforcement may have limited secondary data triangulation. These limitations are mitigated through rigorous triangulation across survey data, systematic field observations, and key informant interviews, providing a robust evidentiary basis for corridor-specific conclusions.

1.9 Organization of the Thesis

This thesis is organized into five chapters. Chapter One introduces the research context, presenting the background of the parking management challenge in Addis Ababa, the specific problem along the Addisu Gebeya-Qidus Giorgis Church corridor, the research questions and objectives, the scope and delimitation, and the study's significance and limitations. Chapter Two presents a comprehensive literature review synthesizing global, African, and Ethiopian scholarship on parking systems, urbanization dynamics, economic impacts, management strategies, and urban design principles, culminating in identification of the research gap. Chapter Three details the mixed-methods research methodology, including study area delineation, population and sampling design, data collection instruments, analytical procedures, and ethical considerations. Chapter Four presents and discusses empirical findings from field surveys, stakeholder questionnaires, spatial mapping, and key informant interviews, organized according to the three research objectives. Chapter Five presents the conclusions and recommendations, linking findings to evidence-based urban design interventions and directions for future research.

CHAPTER TWO LITERATURE REVIEW

2.1 Introduction

The review of literature constitutes a foundational pillar of empirical research, enabling the researcher to situate the current investigation within the existing body of scholarly knowledge, identify theoretical and conceptual frameworks, and demonstrate the presence of a genuine knowledge gap that the study is designed to address. As Chapter One established, parking systems along high-intensity mixed-use corridors in rapidly urbanizing African cities generate compounding economic, spatial, and governance challenges that remain under-theorized and empirically underexplored at the corridor level. This chapter synthesizes global, African, and Ethiopian scholarship on parking systems to provide the theoretical and empirical foundations necessary for understanding the economic impacts and management challenges of parking systems along the Addisu Gebeya - Qidus Giorgis Church corridor in Addis Ababa.

The chapter is organized into seven interconnected sections. Section 2.2 presents the Theoretical Review, examining major planning theories that underpin contemporary parking management scholarship. Section 2.3 provides the Conceptual Review, defining and critically comparing key concepts related to parking systems, urban mobility, the urban economy, and urban design. Section 2.4 offers the Contextual Review, structured across four sub-sections: the global context, parking challenges in developing countries, parking challenges in African cities, and the specific Ethiopian and Addis Ababa context. Section 2.5 critically analyses the economic impacts of parking systems across these contexts. Section 2.6 presents the Empirical Review, synthesizing previous studies thematically. Section 2.7 scientifically establishes the research gap across conceptual, contextual, methodological, and empirical dimensions, grounded in the reviewed literature. Section 2.8 presents and explains the Conceptual Framework guiding this investigation. Together, these sections align directly with the three research questions and specific objectives set out in Chapter One, ensuring that the theoretical and empirical foundation is coherent, analytically rigorous, and submission-ready.

2.2 Theoretical Review

Theoretical frameworks provide the analytical lenses through which parking systems and their economic consequences can be understood, explained, and evaluated. This section critically examines the major theories relevant to parking management and urban mobility, identifying their core principles, strengths, limitations, and specific applicability to the Addisu Gebeya - Qidus Giorgis Church corridor. Rather than treating these theories as isolated frameworks, the discussion identifies points of convergence and tension between them, thereby constructing an integrated theoretical basis for the empirical investigation.

2.2.1 Transport Demand Management Theory

Transport Demand Management (TDM) theory emerged in response to the demonstrated limitations of supply-side approaches to urban transport planning, which historically sought to reduce congestion by expanding road and parking infrastructure. Litman (2024) argues that TDM reframes the fundamental planning question from how to accommodate growing vehicle demand to how to manage that demand in order to optimize system-wide efficiency and equity. Applied to parking, TDM provides the theoretical basis for demand-responsive pricing, occupancy targets, parking maximums rather than minimums, and enforcement systems designed to reduce the incentive for private vehicle ownership and use. Shoup (2021), whose work constitutes one of the most influential contributions to parking scholarship globally, extends TDM logic by demonstrating empirically that free or underpriced parking constitutes a hidden subsidy to private vehicle use, artificially inflating demand and generating the systematic supply-demand mismatches documented across commercial corridors worldwide.

TDM theory is directly relevant to the Addisu Gebeya - Qidus Giorgis Church corridor because the corridor lacks any demand-responsive management mechanism. Parking is effectively provided at zero marginal cost for on-street parkers who evade enforcement, generating demand that systematically exceeds formal supply a pattern documented by Biruk (2017) and Abu and Mahto (2019) across comparable Addis Ababa commercial corridors. However, TDM theory also has recognized limitations in developing-country contexts: it assumes institutional capacity to implement and enforce pricing systems, and the distributional impacts of pricing reforms on lower-income users require careful policy design (Litman, 2024). In the Addisu Gebeya context, where informal market traders and pedestrians constitute the majority of corridor users, any demand management intervention must be calibrated to avoid

exacerbating access inequity. Nonetheless, TDM provides the explanatory logic for why the current governance failure produces the observed demand-exceeds-supply dynamic, and it informs the study's framework for evaluating governance alternatives.

2.2.2 Accessibility Theory

Accessibility theory, as developed by Hansen (1959) and substantially advanced by Geurs and van Wee (2004), conceptualizes transport system performance not in terms of vehicle movement speed but in terms of the degree to which individuals can reach desired destinations within an acceptable cost-time threshold. From this perspective, a parking system that generates congestion, forces long walking trips from distant informal parking to commercial destinations, or creates sidewalk obstructions that impede pedestrian movement is fundamentally an accessibility failure, with direct consequences for the economic productivity of the affected corridor. Le (2021) applies accessibility theory to parking management, demonstrating that the commercial value of urban corridors is largely a function of multi-modal accessibility the ease with which customers, delivery vehicles, workers, and pedestrians can simultaneously reach commercial frontages.

Accessibility theory is directly applicable to the study corridor because the Addisu Gebeya - Qidus Giorgis Church route combines a major marketplace with a national religious landmark, generating demand from diverse user groups pedestrians, delivery vehicles, minibuses, private cars, and religious pilgrims whose accessibility needs simultaneously compete for limited corridor space. Tazzie et al. (2025) empirically confirm that pedestrians, who constitute the majority of Addis Ababa commuters, are systematically disadvantaged by the current road space allocation, which privileges private vehicle storage over pedestrian movement. Accessibility theory thus provides the normative framework for evaluating the current parking system not merely as a traffic engineering problem but as a question of equitable spatial governance with direct economic consequences. Critically, accessibility theory also reveals a tension with TDM: while demand pricing may manage vehicle access more efficiently, it may simultaneously reduce accessibility for lower-income pedestrian users who depend on the corridor for livelihood, a tension that must be addressed in any governance reform.

2.2.3 Sustainable Urban Mobility Theory

Sustainable Urban Mobility (SUM) theory integrates environmental, economic, and social dimensions of urban transport performance, arguing that transport systems should be evaluated and designed against sustainability criteria rather than efficiency criteria alone (Gudmundsson et al., 2016). Applied to parking, SUM theory positions the unlimited provision of free or below-cost parking as inherently unsustainable: it induces vehicle ownership and use, increases carbon emissions from vehicles cruising for parking, degrades air quality, and consumes land that could support housing, public space, or commercial uses (Shoup, 2021). Kebede (2021) applies SUM principles to the Addis Ababa context, demonstrating that the structural disconnect between land-use and transport administrations produces planning decisions that priorities vehicle accommodation over sustainable mobility outcomes, a failure that has persisted over two decades of documented criticism.

In contrast to developed-country contexts where SUM theory has been operationalized through congestion pricing, parking maximums, and Transit-Oriented Development (TOD), the institutional capacity to implement these instruments in Addis Ababa remains constrained by financial limitations, administrative fragmentation, and political will deficits. Tazzie et al. (2025) found that 79 percent of Addis Ababa residents identify institutional coordination failure as a high or very high barrier to sustainable transport implementation, while Abate (2023) confirms through direct interviews with Transport Bureau officials that administrative priority shifts are the decisive constraint on reform. SUM theory is therefore relevant to this study both as a normative standard against which the corridor's current performance can be evaluated and as a framework for identifying the institutional preconditions for sustainable parking management that are presently absent.

2.2.4 Parking Management Theory

Parking Management Theory, synthesized most comprehensively by Litman (2024), integrates TDM, accessibility, and public space principles into a systematic framework for evaluating and designing parking governance systems. Litman (2024) identifies eight core principles of effective parking management: supply adequacy calibrated to actual demand; pricing that reflects the full social cost of parking provision; enforcement capacity sufficient to ensure regulatory compliance; institutional coordination across agencies with overlapping jurisdiction; integration with land-use planning; equity provisions ensuring access for all user groups; information systems that reduce search costs; and performance monitoring to enable

adaptive management. Critically, the theory suggests that the absence of any one of these principles generates compounding system failures, in which each missing component amplifies the dysfunction produced by others a dynamic that Litman (2024) terms the "parking management deficit spiral."

Applied to Addis Ababa, Parking Management Theory provides a diagnostic framework for identifying which specific institutional and operational failures drive the parking crisis along the study corridor. Abu and Mahto (2019) document the absence of unified institutional coordination; Biruk (2017) documents near-total enforcement collapse; Manaye et al. (2022) document the absence of information systems and performance monitoring. By mapping the corridor's current management architecture against Litman's (2024) eight principles, this study generates a structured, theoretically grounded assessment of governance deficits and their economic consequences that goes beyond the descriptive inventory approach that has dominated previous Ethiopian parking research.

2.2.5 Public Space Theory and Transit-Oriented Development

Public Space Theory, most influentially articulated by Gehl (2010), argues that streets are fundamentally public spaces that serve social, economic, and civic functions extending far beyond vehicle movement and storage. The colonization of street space by parked vehicles represents, from this perspective, not merely a traffic management problem but a suppression of the public realm reducing the vitality of commercial frontages, constraining pedestrian movement, and degrading the quality of urban life. Behzadfar and Shakibamanesh (2011) extend this argument specifically to parking in city centers, demonstrating that the resolution of parking problems requires urban design guidelines that simultaneously address functional, aesthetic, and environmental quality, rather than purely technical traffic engineering standards. Their framework is directly applicable to the Addisu Gebeya - Qidus Giorgis Church corridor, where the religious and commercial character of the corridor creates public space functions that are suppressed by the current parking dysfunction.

Transit-Oriented Development (TOD) theory, advanced by Calthorpe (1993) and operationalized by the Institute for Transportation and Development Policy in multiple African contexts, provides a complementary framework emphasizing the integration of land-use density, mixed uses, and high-quality public transport access as substitutes for private vehicle parking provision. In the context of the Addisu Gebeya - Qidus Giorgis Church corridor, which is served by multiple minibus routes and is within walking distance of major employment and

commercial generators TOD principles suggest that reduced parking standards combined with enhanced public transport integration could yield superior accessibility outcomes without the congestion costs generated by the current unmanaged on-street system. Comparing Public Space Theory and TOD with TDM and Accessibility Theory reveals a shared analytical conclusion: parking management failure is not a technical deficit but a spatial governance failure with economic and social consequences that demand an integrated, multi-disciplinary response.

2.3 Conceptual Review

Conceptual clarity is a prerequisite for rigorous empirical analysis. This section critically examines the key concepts that structure this investigation, comparing scholarly definitions, identifying points of consensus and contention, and establishing the conceptual vocabulary that will guide data collection, analysis, and interpretation.

2.3.1 Parking Systems: Demand, Supply, and Governance

The concept of a parking system refers to the integrated organizational, infrastructural, regulatory, and technological arrangements governing the provision, allocation, pricing, and enforcement of parking within a defined urban area (Litman, 2024; Shoup, 2021). Scholars distinguish between the supply-side dimensions of parking systems the physical provision of formal and informal parking spaces, structured lots, and on-street bays and the demand-side dimensions, including the volume, spatial distribution, and temporal patterns of vehicle parking need generated by land uses, economic activities, and travel behavior (Woldegebrael & Emagnu, 2025). The relationship between supply and demand is mediated by a governance dimension encompassing pricing mechanisms, regulatory standards, enforcement capacity, and institutional coordination (Litman, 2024). When governance is absent or weak, supply and demand cannot self-equilibrate, generating the persistent dysfunction documented across Addis Ababa commercial corridors.

Parking demand is conceptualized as the volume of parking space required at a given location and time, as a function of trip generation rates, modal split, land-use intensity, and user willingness to walk from parking to destination (Shoup, 2021). Critically, parking demand is not a fixed quantity but is elastic with respect to price: Shoup (2021) demonstrates that demand contracts substantially when parking is priced at market-clearing rates and expands when provided free or at below-cost prices. This demand elasticity has direct implications for the

study corridor, where the effective price of on-street parking is zero for violators who evade the minimal enforcement that exists, generating demand that systematically exceeds formal supply. Parking supply, by contrast, refers to the number of legally available parking spaces, including on-street bays, surface lots, and structured facilities (Le, 2021). The supply-demand mismatch concept, defined by Woldegebrael and Emagnu (2025) as the condition in which the spatial distribution or absolute quantity of available parking spaces does not correspond to the location or volume of parking demand, captures the fundamental dysfunction along the corridor and serves as the central analytical construct of this study.

Parking governance encompasses the regulatory, institutional, and enforcement dimensions that determine whether supply-demand balance is achieved and maintained (Litman, 2024). Weak governance characterized by institutional fragmentation, inconsistent enforcement, and the absence of performance monitoring is consistently identified in the literature as the proximate cause of parking system failure in developing cities (Asiyanbola & Akinpelu, 2012; Abu & Mahto, 2019; Tazzie et al., 2025). Parking enforcement, defined as the systematic application of traffic regulations through citation, penalty, and towing mechanisms, is the operational instrument through which governance translates into behavioral compliance (Litman, 2024). The near-total absence of effective enforcement documented by Biruk (2017) across Addis Ababa's commercial sub-cities and confirmed at the Addis Ketema level by Abu and Mahto (2019) creates the normative vacuum in which illegal parking becomes the rational default behavior.

2.3.2 Urban Mobility and Accessibility

Urban mobility is defined as the capacity of individuals to move through the urban environment to access destinations, economic activities, and social services within acceptable time and cost thresholds (Geurs & van Wee, 2004). Parking systems interact with urban mobility through two primary channels: road capacity effects, whereby illegal and on-street parking reduce effective carriageway width and increase congestion and travel delays (Biruk, 2017); and multi-modal accessibility effects, whereby insufficient or dysfunctional parking for delivery vehicles, private cars, or pedestrian pathways reduces the economic viability of affected commercial corridors (Le, 2021). These two channels operate simultaneously along the study corridor, producing compounding mobility degradation that affects all user groups, not only vehicle drivers.

Walkability the degree to which the pedestrian environment supports safe, comfortable, and direct walking trips is particularly vulnerable to parking system failures. Vehicles parked on sidewalks displace pedestrians onto carriageways, increasing accident risk and reducing the public realm quality that drives commercial vitality (Gehl, 2010). This walkability degradation is especially consequential along the Addisu Gebeya - Qidus Giorgis Church corridor because, as Kebede (2021) documented, pedestrians constitute the dominant transport mode in Addis Ababa, accounting for between 54 and 70 percent of daily trips. Behzadfar and Shakibamanesh (2011) further argue that urban design guidelines for commercial corridors must explicitly integrate pedestrian mobility requirements with parking management provisions a principle that is conspicuously absent from current Addis Ababa corridor management practice.

2.3.3 Urban Economy and Parking

The relationship between parking systems and urban economic performance operates through multiple channels. Business accessibility the ease with which customers can reach commercial frontages is directly affected by parking availability and corridor congestion: studies from North American and European contexts consistently demonstrate that improvements in parking management increase retail turnover, reduce customer avoidance behavior, and improve the commercial viability of affected corridors (Le, 2021). Conversely, parking congestion reduces customer dwell time, increases perceived hassle costs, and diverts consumer spending to less congested alternative locations. The informal economy dimension is particularly significant in the Addisu Gebeya context, where the marketplace generates substantial informal commercial activity that is highly sensitive to both pedestrian accessibility and delivery vehicle access. Disruption to either of these access channels imposes direct revenue losses on informal market traders who lack the financial cushion to absorb demand shocks.

Transport productivity the efficiency with which vehicles accomplish commercial and logistical tasks is negatively affected by parking system failures through increased search time, double-parking delays, and loading bay obstruction (Litman, 2024). Abu and Mahto (2019) quantified these productivity losses in Addis Ababa, estimating individual commuter losses of 762 to 2,399 Ethiopian Birr per month attributable to parking-related delays a burden that falls disproportionately on lower-income workers who cannot absorb time costs through flexible work arrangements. Urban competitiveness the aggregate capacity of an urban area to attract investment, employment, and economic activity is further diminished by persistent

parking management failure, which signals institutional dysfunction and raises the transaction costs of conducting commercial activity (Le, 2021).

Shoup (2021) also documents land value impacts: the conversion of surface parking lots to productive land uses generates substantial increases in adjacent property values and commercial activity in contexts where such conversions have been implemented, though comparable evidence for African cities remains limited a gap that this study begins to address.

2.3.4 Urban Design Concepts: Curbside Management and Street Functionality

Curbside management refers to the allocation of street kerb space among competing uses parking, loading, transit stops, cycling infrastructure, and pedestrian priority zones through regulatory designation, physical design, and enforcement (Behzadfar & Shakibamanesh, 2011). Effective curbside management is recognized in contemporary urban design practice as a prerequisite for sustainable street functionality: the failure to designate and enforce distinct uses for different kerb segments creates the chaotic competition between parking, loading, and pedestrian uses that characterizes the study corridor. Mixed land use the co-location of commercial, residential, institutional, and civic functions within a single corridor amplifies curbside demand by simultaneously generating parking needs across multiple user types with different temporal patterns (Gehl, 2010). The Addisu Gebeya - Qidus Giorgis Church corridor exemplifies this mixed-use curbside competition: weekday delivery vehicles, daily retail customers, religious pilgrims, and residents generate overlapping demand profiles that are entirely uncoordinated by the current management system.

Public space competition the contest between vehicle storage and pedestrian, social, and commercial uses of street space is the defining spatial conflict along the study corridor, and its resolution requires the kind of integrated urban design and governance framework that Behzadfar and Shakibamanesh (2011) advocate. Street functionality, defined as the capacity of a street to simultaneously serve mobility, economic, social, and ecological functions, is the composite outcome that this study uses as its evaluative standard. The current corridor management system, which prioritizes vehicle storage over all other street functions, systematically undermines street functionality in all its dimensions a diagnosis that the empirical findings in Chapter Four will substantiate.

2.4 Contextual Review

2.4.1 Global Context: Parking Systems and Urban Mobility

At the global scale, parking management has evolved from a primarily engineering concern focused on the provision of adequate parking space to a multidimensional governance challenge involving pricing, enforcement, land-use integration, technology adoption, and equity (Litman, 2024).

In North American cities, Shoup (2021) demonstrated that minimum parking requirements mandated by zoning codes systematically overprovide parking in lower-demand areas while generating severe undersupply in high-intensity commercial corridors, producing both economic and environmental costs. Shoup's empirical analysis of Los Angeles estimated that vehicles cruising for underpriced parking account for approximately 30 percent of traffic in congested commercial districts, imposing fuel costs, time costs, and emissions that are borne by non-drivers as well as drivers. Le (2021), synthesizing best practice evidence from multiple North American cities, confirms that corridors with integrated parking governance frameworks combining demand-responsive pricing, enforcement, and user information consistently outperform unmanaged corridors on measures of retail turnover, customer accessibility, and business revenue.

In European cities, variable pricing systems charging higher rates during peak hours and at high-demand locations have been shown to reduce parking search time substantially and increase retail throughput by improving customer turnover (Le, 2021). Studies from Amsterdam, Stockholm, and Barcelona document significant reductions in cruising behavior following the introduction of demand-responsive parking pricing, alongside increases in public transport use and pedestrian activity in commercial districts. In Asian megacities including Bangkok, Jakarta, and Ho Chi Minh City, the rapid growth of motorization has created parking demand that outpaces infrastructure provision across commercial districts a pattern structurally similar to that documented in sub-Saharan African cities (Le, 2021). However, several Asian cities most notably Singapore, Tokyo, and Seoul have implemented sophisticated parking governance frameworks combining mandatory off-street provision for new developments, demand-responsive pricing, real-time information systems, and strict enforcement, achieving measurable reductions in parking-related congestion. The contrast between high-governance and low-governance parking environments within the global literature confirms that parking system performance is primarily a function of institutional capacity and political

will rather than economic development level per se a conclusion directly relevant to the Ethiopian governance analysis in this study.

The global literature also identifies important methodological debates regarding how parking demand should be measured. Traditional trip generation approaches estimating parking demand as a fixed ratio of building floor area or units are increasingly criticized for producing parking oversupply and ignoring modal substitution effects (Shoup, 2021; Litman, 2024). More sophisticated approaches use actual occupancy surveys, multimodal demand modelling, and performance monitoring systems that enable adaptive management. The dominance of traditional approaches in developing-country planning practice including Ethiopia, as documented by Kebede (2021) represents both a methodological gap in existing research and a governance gap in parking policy, both of which this study is designed to address at the corridor level.

2.4.2 Parking Challenges in Developing Countries

Parking challenges in developing countries are structurally distinct from those in high-income contexts because they arise from the interaction of rapid urbanization, accelerating motorization, weak institutional capacity, and the normalization of informal urban practices conditions that produce compounding system failures not captured by theories developed in the Global North (Asiyanbola & Akinpelu, 2012).

The fundamental driver of parking crisis in developing cities is the pace differential between motorization and infrastructure provision: vehicle ownership is growing at 3 to 5 percent annually across sub-Saharan Africa, Southeast Asia, and Latin America, while formal parking infrastructure grows at a fraction of this rate because it is capital-intensive, land-consuming, and institutionally complex to govern (Litman, 2024).

Addis Ababa exemplifies this differential acutely, The Addis Ababa City Administration (2021) documents vehicle registration growing at more than 10 percent annually roughly double the sub-Saharan average while formal parking supply has remained static or declined as former off-street parking facilities have been converted to commercial uses without regulatory sanction.

This motorization-infrastructure gap produces inadequate parking supply as the baseline condition across most developing-city commercial districts, rather than the exceptional condition

documented in developed-country literature. Asiyanbola and Akinpelu (2012), studying Nigerian cities, demonstrate that formal parking supply meeting fewer than 35 percent of commercial hub peak-hour needs is the norm in major urban centers, forcing widespread reliance on unregulated on-street parking as the default practice. Their study shows that this reliance on informal on-street practices reduces effective carriageway width by 25 to 40 percent in high-intensity commercial corridors, creating congestion that generates cascading economic costs: increased fuel consumption by idling vehicles, increased travel times for goods delivery, reduced frequency of customer visits, and elevated accident rates. These costs, critically, are disproportionately borne by the poorest urban residents, who rely on walking and public transport and are most vulnerable to sidewalk obstruction and road safety deterioration.

Weak parking enforcement is a structural feature of developing-country urban governance rather than an exceptional failure, arising from institutional fragmentation, limited resources for traffic management, and the political difficulty of enforcing regulations against low-income informal operators (Asiyanbola & Akinpelu, 2012). In many developing cities, parking enforcement responsibility is divided among municipal traffic departments, national police, sub-city government units, and informal parking attendants whose authority is not legally recognized, creating enforcement gaps that normalize illegal parking behavior and undermine any attempt at demand management (Abu & Mahto, 2019).

Institutional fragmentation also prevents the coordination needed to implement integrated parking management strategies: without a single agency with clear responsibility and authority, demand-responsive pricing, performance monitoring, and enforcement consistency are structurally impossible to achieve (Litman, 2024).

The informal parking economy represents a further structural feature of developing-country parking systems that is analytically distinct from the formal system. Informal parking attendants occupy public street space, collect fees from parked vehicles, and perform a quasi-enforcement function without legal authorization in cities across sub-Saharan Africa, Latin America, and South Asia (Asiyanbola & Akinpelu, 2012). While this informal system provides a degree of parking management and generates income for marginalized populations, it also appropriates public revenue that would otherwise accrue to municipal authorities, operates outside safety regulations, and can create territorial conflicts that deter legitimate parking users. The interaction between the formal and informal parking economy is a systematically understudied dimension of parking research in developing countries a gap that this study

addresses directly in the Ethiopian context through stakeholder survey analysis and key informant interviews.

Poor land-use integration compounds these institutional failures. Urban master plans in many developing countries set minimum parking standards that are either too low to meet actual demand or are calibrated for lower-density contexts inappropriate to high-intensity commercial corridors (Kebede, 2021). Mixed-use corridors that combine market, commercial, institutional, and religious functions precisely the configuration of the study corridor generate demand profiles that standard minimum parking standards are structurally ill-equipped to address. The simultaneous arrival of delivery vehicles, pedestrians, private cars, and minibuses creates peak demand spikes that far exceed what any single-use corridor planning standard would anticipate (Woldegebrael & Emagnu, 2025). The analytical implication is that corridor-specific demand analysis rather than sub-city averages or standard trip generation ratios is the methodological prerequisite for evidence-based parking management reform.

2.4.3 Parking Challenges in African Cities

African urban centers exhibit parking challenges that combine the structural features common to developing-country contexts with continent-specific governance conditions, including post-colonial institutional legacies, rapid in formalization of urban economies, and severe constraints on municipal fiscal capacity (Asiyanbola & Akinpelu, 2012). In Lagos, Nigeria the continent's largest metropolitan area Asiyanbola and Akinpelu (2012) documented that unregulated on-street parking in commercial districts reduces road capacity by 25 to 40 percent, contributes to travel time losses estimated in billions of naira annually, and generates significant public health costs through elevated air pollution from vehicles idling in parking-related congestion.

The Lagos study identified institutional overlap among the Lagos State Traffic Management Authority, the Federal Road Safety Corps, and local government parking agencies as producing systematic enforcement failure: each agency claims authority over parking violations, but none exercises consistent enforcement, creating a regulatory vacuum that normalizes illegal parking (Osoba, S. B. 2012). This institutional fragmentation pattern is structurally analogous to the Addis Ababa arrangement documented by Abu and Mahto (2019), in which the

Transport Bureau, the Traffic Management Authority, and the Addis Ababa City Roads Authority (AACRA) hold overlapping mandates with no coordination mechanism.

In Nairobi, Kenya, the rapid growth of the central business district has generated severe parking shortages in commercial areas. The Nairobi experience is characterized by particularly acute conflicts between formal parking management and informal parking attendant systems a dynamic extensively documented in African urban governance literature (Asiyanbola & Akinpelu, 2012).

Parking management responsibility in Nairobi is divided among the Nairobi Metropolitan Services, the Kenya National Highways Authority, county government units, and private operators, with persistent enforcement gaps that normalize on-street parking in restricted zones. Comparable governance fragmentation patterns have been documented across West African commercial centers, where districts with persistent parking management failure consistently exhibit lower rates of formal business establishment and higher rates of business closure than districts with more effective governance suggesting that parking system quality functions as a commercial investment signal as well as a direct determinant of operating costs.

Addis Ababa, in comparative perspective, exhibits all the structural features of the African parking governance failure pattern institutional fragmentation, enforcement collapse, absence of performance monitoring, and normalization of informal parking but with the additional complexity of an exceptionally rapid motorization rate that amplifies demand pressure beyond what comparable African cities have experienced (Addis Ababa City Administration, 2021). Dagnachew (2007) identified a fundamental structural disconnect between land-use and transport administrations as the underlying institutional failure in Addis Ababa, a finding confirmed nearly two decades later by Tazzie et al. (2025), who found that 79 percent of residents rate institutional coordination failure as a high or very high barrier to sustainable transport implementation. This temporal persistence of the same structural failure over 18 years is itself analytically significant: it suggests that the problem is not a technical oversight amenable to administrative correction, but a deep institutional feature that requires structural reform to resolve.

2.4.4 Parking Challenges in Ethiopia and Addis Ababa

Ethiopian transport scholarship has produced a growing body of empirical evidence on parking challenges in Addis Ababa that provides essential context for the present study. Shiferaw (2014), in one of the earliest systematic investigations, assessed parking demand and supply across multiple Addis Ababa sub-cities, finding that on-street parking already dominated approximately 70 percent of central corridor space and that formal off-street supply was critically inadequate relative to commercial hub demand. Although Shiferaw (2014) study is now more than a decade old, its baseline findings remain analytically relevant as a reference point against which subsequent deterioration can be measured particularly given that Biruk (2017) documented continued worsening of the supply-demand mismatch despite the intervening years of urban expansion.

Biruk (2017) conducted one of the most geographically comprehensive Ethiopian studies of parking supply adequacy, using field observations and traffic counts across multiple sub-cities. The study found that formal parking supply meets fewer than 40 percent of commercial hub peak-hour demand, with on-street illegal parking on carriageways, sidewalks, and in front of building entrances representing the dominant parking practice. Biruk (2017) documented carriageway capacity reductions of 25 to 30 percent attributable to on-street parking in major commercial corridors, and found that enforcement failure was near-total, with fewer than 5 percent of observed violations resulting in any enforcement action. This enforcement collapse, Biruk argues, is not a resource problem alone but a governance problem: without institutional accountability and performance targets, individual enforcement officers lack the structural incentive to apply regulations consistently. However, the study was conducted at the sub-city level, limiting its applicability to the specific dynamics of mixed commercial-religious corridor environments like the Addisu Gebeya - Qidus Giorgis Church route.

Abu and Mahto (2019), focusing specifically on the Addis Ketema sub-city which includes part of the study corridor conducted a more economically oriented assessment of parking challenges, finding that average parking occupancy reaches 90 percent during peak hours, that illegal roadside parking creates severe traffic bottlenecks, and that individual commuters incur losses of 762 to 2,399 Ethiopian Birr per month attributable to parking-related delays. The study also found that buildings designed with off-street parking had frequently converted those facilities to commercial uses without regulatory sanction, further reducing formal supply. The Abu and Mahto (2019) study is methodologically significant because it directly

quantifies economic costs rather than limiting analysis to traffic and occupancy measurements. However, its commercial center focus does not capture the market-religious land-use interaction that defines the Addisu Gebeya - Qidus Giorgis Church route's specific demand dynamics.

Manaye et al. (2022) investigated the potential for smart parking system implementation in Addis Ababa, finding that IoT-based parking technologies offer significant management efficiency improvements but that their implementation is constrained by high infrastructure costs, weak inter-agency coordination, and limited technical capacity within Addis Ababa's transport management institutions. Critically, Manaye et al. (2022) found no evidence of any formal parking performance monitoring system in operational use across Addis Ababa's sub-cities, confirming that evidence-based adaptive management is entirely absent from current practice. The study also identified a specific institutional gap: no single agency has a clear mandate to collect, analyse, and act on parking performance data meaning that governance failure cannot be corrected through incremental administrative adjustment but requires structural institutional reform.

Woldegebrael and Emagnu (2025), in the most recent Ethiopian parking study, applied spatial analytical methods to examine the relationship between land-use characteristics and parking demand in Yeka Sub City. Using multivariate regression analysis, they found that accessibility to main roads and proximity to activity centres are the strongest predictors of parking demand intensity, confirming the theoretical expectation that mixed-use, high-intensity corridors generate the most acute supply-demand mismatches. The study also explicitly acknowledges that the market-church adjacency effects the amplification of parking demand at nodes where commercial and religious land uses co-locate has not been quantified in existing Ethiopian literature, representing a specific empirical gap that the present study addresses.

Tazzie et al. (2025) further confirm that despite over two decades of documented parking management failure, corridor-specific parking management strategies have not been developed or implemented in Addis Ababa, leaving the most demand-intensive nodes without tailored governance responses.

Abate (2023), studying public transport infrastructure integration at the Mexico area interchange in Addis Ababa, provides complementary institutional evidence: through direct interviews with Addis Ababa Transport Bureau officials, the study establishes that political will and administrative priority shifts are the decisive constraints on transport infrastructure reform, with built facilities degenerating into dysfunction because no administrative body is assigned sustained responsibility for maintenance and governance. This finding aligns precisely with the institutional analysis in Kebede (2021) and Tazzie et al. (2025), constructing a coherent and temporally robust narrative of structural governance failure in Addis Ababa transport management.

Girma and Mulatu (2025) additionally confirm through field observations that roadside parking substantially reduces effective carriageway capacity in Addis Ababa's commercial corridors and contributes to vehicle delays providing the most recent empirical confirmation of the supply-demand mismatch at a point immediately preceding this study's data collection period.

2.5 Economic Impacts of Parking Systems

The economic impacts of parking systems are simultaneously direct and indirect, positive and negative, and operate at scales ranging from the individual business to the urban economy as a whole. This section critically analyses these impacts across developed, developing, and Ethiopian city contexts, with particular attention to the mechanisms through which parking management failure generates economic costs along the type of mixed-use commercial corridor represented by the study area.

2.5.1 Economic Impacts in Developed Country Contexts

Research from North American and European cities has established a robust body of evidence on the positive economic impacts of effective parking management and the costs of management failure. Le (2021) synthesizes evidence from multiple US cities, demonstrating that corridors with demand-responsive parking management systems including variable pricing, enforcement, and real-time information consistently outperform unmanaged corridors on measures of retail turnover, customer spending, and business revenue. The mechanism is primarily one of accessibility: effective parking management increases the rate at which spaces turn over, enabling more customers to access commercial frontages per hour, thereby increasing aggregate retail sales. Shoup (2021) estimates that the economic value of a single

well-managed on-street parking space in a high-demand commercial corridor can be substantial in terms of annual retail sales generated, underscoring the importance of demand management for maximizing the economic productivity of street space.

The costs of parking management failure in developed countries are also well documented. Shoup (2021) calculates that vehicles cruising for underpriced parking in congested commercial districts impose time and fuel costs on drivers, and externality costs through congestion and emissions on non-drivers, that collectively represent a significant annual economic burden at the city scale. Studies of demand-responsive parking pricing reforms in San Francisco, London, and Stockholm consistently find that pricing reduces search time, increases business revenues, and improves the productivity of street space allocation, demonstrating that parking management is an urban economic policy instrument as well as a traffic management tool (Le, 2021). The land value dimension is further documented by Shoup (2021): the conversion of surface parking lots to productive uses generates substantial increases in adjacent property values and commercial activity an opportunity cost of unmanaged parking provision that applies in principle to developing-city contexts as well, though empirical evidence at the scale needed to quantify this cost for Addis Ababa corridors remains limited.

2.5.2 Economic Impacts in Developing Countries: An Analytical Assessment

In developing countries, the economic costs of parking management failure are amplified by the compounding interaction of infrastructure inadequacy, enforcement failure, and institutional fragmentation. The primary economic impact of parking system failure in developing cities is the congestion cost imposed on all corridor users not only vehicle drivers but also pedestrians, delivery operators, and public transport passengers through reduced road capacity, increased travel times, and higher fuel consumption. Asiyanbola and Akinpelu (2012) estimate that traffic congestion attributable to illegal on-street parking imposes direct economic costs in major Nigerian commercial cities substantially exceeding developed-country estimates, because the lack of alternative routes amplifies the delay costs imposed by any given road capacity reduction. Furthermore, the costs are distributed inequitably: lower-income pedestrian and public transport users who do not cause the parking congestion bear a disproportionate share of its costs, particularly through sidewalk obstruction, increased accident risk, and degraded public transport journey times.

Business accessibility impacts are particularly severe in developing-country commercial corridors where small-scale retail formats and informal market activities mean that even modest

reductions in customer access generate disproportionate revenue losses. Informal market traders who constitute a substantial proportion of economic activity in corridors like Addisu Gebeya are especially vulnerable to parking-related accessibility disruption because their customers are predominantly pedestrians whose mobility depends on clear sidewalks and safe pedestrian crossings (Asiyanbola & Akinpelu, 2012). The destruction of walkability by on-street parking reduces foot traffic in adjacent market areas, directly reducing trader revenues, while the disruption of delivery vehicle access increases logistics costs and raises prices. Urban competitiveness impacts extend beyond individual businesses: districts with persistent parking management failure exhibit lower rates of formal business establishment and higher rates of commercial closure than districts with effective governance, suggesting that parking system quality functions as a business location signal as well as a direct operating cost determinant.

The informal parking economy adds further economic complexity in developing cities. Informal parking attendants who manage on-street parking in commercial corridors capture fee revenue that could support formal management operations, while providing a quasi-enforcement function that the formal system has not replaced (Asiyanbola & Akinpelu, 2012). The economic welfare implications of formalizing this informal system including the livelihood impacts on parking attendants who depend on fee collection for income represent an analytically underexplored dimension of parking reform that is particularly salient in the Addisu Gebeya context, where informal parking management is extensively practiced. This study addresses this dimension through its stakeholder survey instrument, which includes parking attendants as a primary respondent category.

2.5.3 Economic Impacts in Ethiopia and Addis Ababa

The economic impact of parking system failure in Addis Ababa is both directly quantifiable and structurally significant. Abu and Mahto (2019) provide the most systematic economic analysis available for the city, estimating individual commuter productivity losses of 762 to 2,399 Ethiopian Birr per month attributable to parking-related delays losses that fall disproportionately on lower-income workers who cannot absorb time costs through flexible work arrangements. The study further estimated that businesses in high-intensity commercial areas along the Addis Ketema corridor experience retail turnover losses of 10 to 15 percent attributable to restricted customer access during peak hours, when illegal parking effectively

reduces commercial frontage accessibility for street-facing establishments. These are conservative estimates: they do not account for avoidance behavior customers who redirect trips to less congested destinations which would increase the aggregate revenue loss attributable to parking dysfunction.

Tazzie et al. (2025) confirm that 71.7 percent of Addis Ababa residents rate parking control as poorly implemented, indicating that parking management failure is a broadly experienced economic burden rather than a sector-specific concern. The aggregate economic cost of transport system inefficiency in Addis Ababa of which parking management failure is a significant component is identified by Tazzie et al. (2025) as representing several percentage points of the city's annual economic output, though their analysis does not isolate the parking-specific contribution. The informal parking economy dimension adds further economic complexity: the informal attendants who manage on-street parking along Addis Ababa's commercial corridors capture fee revenue that could support formal management operations, while municipal authorities forgo the public revenue that could be reinvested in transport infrastructure improvement.

Woldegebrael and Emagnu (2025) demonstrate that the economic impact of parking management failure varies substantially with land-use intensity: corridors combining commercial, institutional, and religious land uses generate the highest parking demand and therefore the greatest economic costs from management failure. The Addisu Gebeya - Qidus Giorgis Church corridor, with its market-church adjacency generating demand peaks from weekday commercial deliveries, weekend religious visitors, and daily retail customers simultaneously, is therefore likely to exhibit economic impact patterns more severe than those documented by Abu and Mahto (2019) for the Addis Ketema commercial center. The absence of any corridor-specific economic impact assessment for this route represents a significant empirical gap that this study directly addresses. Shiferaw (2014) further established that informal parking systems along Addis Ababa commercial corridors reduce potential municipal revenue because fee collection and regulation remain weak a finding that connects parking management failure to the fiscal constraints that prevent governance improvement, creating a self-reinforcing cycle of dysfunction.

2.6 Empirical Review

This section synthesizes previous empirical studies thematically, examining their methodological approaches, key findings, limitations, and relevance to the present investigation. Studies are grouped by thematic focus to facilitate comparative analysis and identification of methodological patterns, rather than listed chronologically or described in isolation.

2.6.1 Studies on Parking Supply, Demand, and Spatial Distribution

Shoup (2021) provides the empirical foundation for demand-based parking analysis globally, drawing on parking occupancy surveys, economic analysis of retail sales data, and spatial mapping of parking supply and utilization in Los Angeles and other North American commercial districts. His finding that underpriced parking generates search-related congestion equivalent to approximately 30 percent of peak-hour traffic in affected corridors established the empirical basis for demand-responsive pricing advocacy and is methodologically significant as a model for corridor-level parking research. Its primary limitation for this study is contextual: The North American institutional and economic environment differs substantially from Addis Ababa, precluding direct transfer of quantitative findings.

Woldegebrael and Emagnu (2025) represent the most methodologically sophisticated recent Ethiopian contribution. Using multivariate regression analysis of parking occupancy data and land-use variables across Yeka Sub City, they demonstrated that accessibility to main roads and proximity to activity centers are the strongest demand predictors, advancing the literature beyond descriptive occupancy surveys that dominated earlier Ethiopian parking research. However, their sub-city analysis does not capture corridor-specific dynamics, and their study area does not include the mixed commercial-religious configuration of the Addisu Gebeya - Qidus Giorgis Church route. The present study extends their spatial approach to the corridor level with explicit attention to the market-church adjacency effect they identify as an unquantified gap. Biruk (2017), while less methodologically sophisticated, provides the most geographically comprehensive Ethiopian baseline, with field observations and traffic counts across multiple sub-cities confirming that formal supply meets fewer than 40 percent of peak demand and that enforcement failure was near-total. Its limitation single-day occupancy snapshots that miss temporal variation associated with market days and religious observances is directly addressed by this study's multi-period data collection design.

2.6.2 Studies on Parking Governance, Enforcement, and Institutional Analysis

Abu and Mahto (2019) provide the most governance-focused empirical analysis of Addis Ababa's parking management system, combining spatial observation, vehicular trip generation counts, and structured interviews with transport authority officials. Their identification of institutional fragmentation across the Transport Bureau, Traffic Management Authority, and AACRA as the proximate cause of enforcement failure and their estimation of 762 to 2,399 Ethiopian Birr per month in individual economic costs establishes the governance-economy linkage that this study extends to the corridor level. The study's limitation is its commercial center focus and its pre-dating of several institutional developments; its methodology nevertheless provides the direct model for the key informant interview component of this study's research design.

Tazzie et al. (2025) provide the most recent and methodologically robust Ethiopian institutional analysis, using survey data from 280 transport stakeholders with factor analysis to identify barriers to sustainable transport implementation. Their finding that 71 to 79 percent of respondents rate institutional coordination failure, political will deficits, and enforcement inconsistency as the highest barriers provides quantitative grounding for the governance failure hypothesis that earlier qualitative studies had advanced. The study's limitation is its lack of corridor-specific granularity and its broad sustainable transport focus rather than parking-specific analysis.

Kebede (2021) provides the historical institutional baseline, establishing through interviews with senior city and federal officials that land-use and transport administrations do not recognize the impact of one sector on the other a structural disconnect that explains why parking management, sitting at the intersection of both domains, has been chronically under-resourced for nearly two decades.

The persistence of this same structural diagnosis across Kebede (2021), Abu and Mahto (2019), Manaye et al. (2022), and Tazzie et al. (2025) is itself an analytically significant finding: it indicates that the governance failure is structural rather than episodic.

2.6.3 Studies on Economic Impacts of Parking

Le (2021) provides the most systematic review of parking management economic impacts from the developed-country literature, synthesizing multiple empirical studies from North American cities and demonstrating consistently positive economic returns from demand-responsive parking governance. The review establishes the accessibility-economic performance mechanism as the primary channel through which parking management affects commercial corridor viability, and documents the retail turnover losses attributable to unmanaged parking. The study's limitation for this research is its exclusively North American context; the mechanisms it identifies are theoretically applicable to Addis Ababa but require empirical validation in the Ethiopian context, which this study provides.

Asiyanbola and Akinpelu (2012) provide the most economically comprehensive study of parking system impacts in an African developing-country context, documenting road capacity reductions of 25 to 40 percent and estimating substantial direct economic costs in Nigerian commercial cities through traffic counts, field observations, and structured interviews. Their methodological contribution disaggregating parking costs by user group to demonstrate the differential economic burden falling on lower-income pedestrian and public transport users directly informs this study's stakeholder analysis design, which similarly disaggregates economic impacts across user categories.

2.7 Research Gap

The scientific establishment of a research gap requires systematic demonstration that existing literature has left substantive questions unanswered, methodological approaches untested, or empirical evidence ingenerated not merely an assertion that a specific case study has not been conducted. The following analysis develops the research gap across four dimensions, each grounded directly in the literature reviewed above.

2.7.1 Conceptual Gap

Existing Ethiopian parking studies have conceptualized parking management primarily as a traffic and infrastructure problem focusing on supply adequacy, occupancy rates, and carriageway capacity rather than as an integrated urban design, economic, and governance problem.

Shiferaw (2014) framed parking as a supply-demand technical question amenable to inventory-and-standard solutions; Biruk (2017) focused on occupancy surveys and traffic flow measurement; and even the more analytically sophisticated recent studies of Woldegebrael and Emagnu (2025) and Tazzie et al. (2025) address, respectively, spatial demand modelling and broad sustainable transport barriers, without integrating economic impact analysis, urban design assessment, and governance evaluation within a single analytical framework.

Consequently, the theoretical frameworks of TDM, Accessibility Theory, Sustainable Urban Mobility, and Public Space Theory all directly relevant to the Addisu Gebeya - Qidus Giorgis Church corridor have not been applied to a corridor-level parking investigation in Ethiopia. This study addresses this conceptual gap by applying an integrated multi-theoretical framework to corridor-level parking analysis, generating findings that are conceptually richer and more directly applicable to policy design than descriptive supply-demand inventories alone.

2.7.2 Contextual Gap

The entire body of Ethiopian parking literature is conducted at the sub-city or city-wide scale, with no study examining parking dynamics at the corridor level the spatial scale at which mixed land-use interactions, temporal demand variation, and multi-stakeholder economic impacts are most directly observable and analytically tractable. Biruk (2017) and Abu and Mahto (2019) focus on sub-city commercial centres; Woldegebrael and Emagnu (2025) analyse Yeka Sub City as a whole; and Tazzie et al. (2025) address city-wide transport governance barriers. None examines the specific configuration of the Addisu Gebeya - Qidus Giorgis Church corridor, which is characterized by the co-location of a major marketplace, a national religious landmark, mixed residential and commercial land uses, and very high pedestrian volumes a configuration that generates parking demand dynamics substantively different from those documented at the sub-city scale.

Furthermore, as Woldegebrael and Emagnu (2025) explicitly acknowledge, the market-church adjacency effect has not been empirically quantified in any existing study. This study addresses this contextual gap through systematic corridor-level analysis using multi-period occupancy surveys and spatial mapping that captures the temporal variation missing from previous single-day studies.

2.7.3 Methodological Gap

The methodological approaches dominant in existing Ethiopian parking research are primarily quantitative and descriptive. Occupancy surveys, traffic counts, and spatial mapping generate important baseline data but have three significant limitations: they do not capture economic impacts; they do not incorporate multi-stakeholder perceptual analysis; and they do not use qualitative institutional analysis to explain why governance failures persist despite documented technical problems (Biruk, 2017; Woldegebrael & Emagnu, 2025).

Abu and Mahto (2019) represent a partial exception, incorporating institutional interviews; however, their study does not employ the systematic mixed-methods triangulation that corridor-level analysis requires. Studies focusing on specific stakeholder groups such as Tazzie et al. (2025) focusing on transport professionals do not capture the full range of economic impacts across user categories.

The present study addresses this methodological gap by employing a mixed-methods design combining systematic occupancy surveys and spatial mapping (quantitative) with structured stakeholder questionnaires across six user groups and key informant interviews with transport authority officials (qualitative), enabling both descriptive analysis of parking conditions and explanatory analysis of governance failure and economic impact a methodological integration not attempted in any previous Ethiopian parking study.

2.7.4 Empirical Gap

At the empirical level, no existing study has generated corridor-specific evidence on the economic impacts of parking system failure on businesses, delivery operators, pedestrians, and commuters along a high-intensity mixed commercial-religious urban corridor in Addis Ababa. The Abu and Mahto (2019) economic analysis is focused on the Addis Ketema commercial center rather than the study corridor; the Tazzie et al. (2025) economic cost estimates are city-wide rather than corridor-specific; and no study has examined the economic impacts on the informal market sector that constitutes the majority of commercial activity at Addisu Gebeya.

Furthermore, no existing study has systematically analysed the governance failure mechanism the specific interactions among institutional fragmentation, enforcement inconsistency, and absence of performance monitoring at the corridor level in Addis Ababa. By generating

corridor-specific, multi-stakeholder, mixed-methods empirical evidence on these dimensions, this study fills a gap that has direct implications for evidence-based policy and planning interventions along the study route and comparable high-intensity corridors across Addis Ababa.

In summary, the present study is necessary and timely because it addresses a nexus of conceptual, contextual, methodological, and empirical gaps that existing scholarship has not resolved. The integration of economic impact analysis, institutional governance assessment, and urban design evaluation within a corridor-level mixed-methods framework generates a contribution to knowledge that is both theoretically grounded in established parking, accessibility, and public space theory, and practically relevant to the governance of high-intensity commercial corridors in rapidly urbanizing African cities.

2.8 Conceptual Framework

The Conceptual Framework of this study integrates the theoretical perspectives and conceptual definitions reviewed in this chapter into a relational model mapping the causal mechanisms linking parking system characteristics to economic and mobility outcomes along the Addisu Gebeya - Qidus Giorgis Church corridor. The framework is organized around four interacting components: (1) Contextual Drivers, (2) Parking System Conditions, (3) Governance and Management Responses, and (4) Economic and Mobility Outcomes. These components correspond directly to the study's three research questions and specific objectives, ensuring that the framework is both theoretically grounded and empirically operational.

The first component Contextual Drivers encompasses the structural conditions shaping parking demand and governance capacity along the corridor: rapid urbanization and motorization, with Addis Ababa's vehicle registration growing at over 10 percent annually (Addis Ababa City Administration, 2021); mixed land-use intensity combining marketplace, religious, commercial, and residential functions (Woldegebrael & Emagnu, 2025); high pedestrian modal share coexisting with growing private vehicle use (Tazzie et al., 2025; Kebede, 2021); and the institutional architecture of Addis Ababa's transport governance, characterized by fragmentation across multiple agencies with overlapping mandates (Abu & Mahto, 2019; Manaye et al., 2022). These structural drivers are not directly amenable to short-term policy intervention but define the boundary conditions within which parking management must operate. They correspond to the background conditions analysed in Chapter One.

The second component Parking System Conditions captures the formal and informal supply, spatial distribution, and occupancy characteristics of parking along the corridor: formal on-street and off-street supply adequacy; informal and illegal parking prevalence; spatial mismatch between supply location and demand generators; and temporal variation in occupancy associated with market days, religious observances, and daily commercial patterns (Biruk, 2017; Abu & Mahto, 2019; Woldegebrael & Emagnu, 2025). This component corresponds to Research Question One and Specific Objective One the assessment of formal and informal parking supply, adequacy, and spatial distribution and is addressed through the occupancy surveys, spatial mapping, and field observations that constitute the primary quantitative data collection instruments.

The third component Governance and Management Responses encompasses the institutional, regulatory, and enforcement dimensions mediating the relationship between parking system conditions and outcomes: enforcement capacity and consistency, inter-agency coordination, pricing and regulatory mechanisms, and compliance behavior of corridor users (Litman, 2024; Abu & Mahto, 2019; Tazzie et al., 2025).

This component corresponds to Research Question Two and Specific Objective Two the evaluation of parking management effectiveness and institutional coordination and is addressed through the key informant interviews and stakeholder questionnaire items targeting enforcement experience and institutional awareness.

The framework suggests governance quality as the critical mediating variable: the same structural conditions of high demand and limited supply produce dramatically different outcomes depending on governance quality, as the contrast between high-governance and low-governance parking environments in the global literature confirms (Le, 2021; Shoup, 2021).

The fourth component Economic and Mobility Outcomes encompasses the consequences of the interaction between parking system conditions and governance responses for corridor performance: business accessibility and commercial turnover, delivery logistics efficiency, commuter productivity and time losses, pedestrian safety and walkability, informal market sector viability, and municipal parking revenue (Abu & Mahto, 2019; Asiyanbola & Akinpelu, 2012; Gehl, 2010).

This component corresponds to Research Question Three and Specific Objective Three the identification of economic impacts on road users, businesses, pedestrians, and transport operations and is addressed through the structured stakeholder questionnaires administered to all six respondent categories. The framework incorporates bi-directional feedback relationships: worsening economic and mobility outcomes reduce institutional capacity and investment, reinforcing the governance failure that produces them; while evidence of severe economic costs creates the political mandate for governance reform that can break the deterioration cycle.

The Conceptual Framework thus models parking management failure as a governance-mediated process in which structural contextual pressures interact with institutional capacity constraints to produce economic and mobility outcomes that are simultaneously costly to corridor users and amenable to evidence-based policy intervention. The framework directly addresses the evaluator critique that previous work lacked theoretical and conceptual foundations presented graphically and explained academically. Figure 2.1 below presents the framework graphically, showing the four components and their directional relationships. The mixed-methods research design employed in this study is structured to generate evidence on all four components and their interactions, enabling findings that are both descriptively accurate for the study corridor and analytically generalizable to comparable high-intensity mixed-use corridors across Addis Ababa and similar rapidly urbanizing African cities.

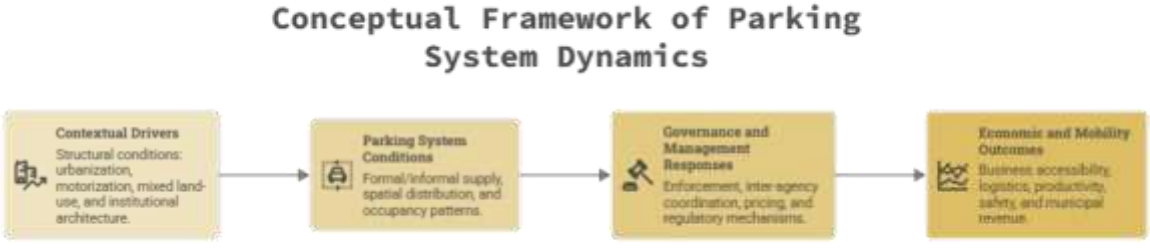

Figure 2:1Conceptual Framework Parking System, Governance, and Economic Outcomes

Source: Compiled by author from Litman (2024), Shoup (2021), Tazzie et al. (2025), Abu and Mahto (2019), Woldegebrael and Emagnu (2025), and Asiyanbola and Akinpelu (2012).

CHAPTER THREE MATERIALS and METHODS

3.1 Introduction

This chapter presents the research methods and materials employed in the investigation of the economic impacts and management challenges of the parking system along the Addisu Gebeya-Qidus Giorgis Church corridor in Addis Ababa. The purpose of the chapter is to provide a transparent, scientifically defensible account of every methodological decision taken, from the overarching research philosophy and design to the specific instruments used for data collection and the analytical procedures applied to generate findings. Each methodological choice is explicitly justified with reference to the study's three research questions and specific objectives, ensuring that the design logic is visible and the findings are reproducible.The study addresses three interconnected research dimensions: the assessment of formal and informal parking supply, adequacy, and spatial distribution (Research Objective 1); the evaluation of parking management effectiveness and institutional coordination (Research Objective 2); and the identification of the economic impacts of the existing parking system on road users, businesses, pedestrians, and transport operations (Research Objective 3). These three dimensions are not reducible to a single data source or analytical method.

The management effectiveness dimension requires institutional analysis through key informant interviews and stakeholder questionnaires. The economic impact dimension requires both quantitative measurement of congestion, delay, and business accessibility, and qualitative stakeholder testimony about perceived economic costs. Addressing all three dimensions rigorously and coherently requires an integrated mixed-methods design, the rationale for which is developed in the sections that follow.

The chapter is organized into twelve sections covering: research design and philosophy; description of the study area; research approach; data types and sources; target population and sampling design; variables, operationalization, and measurement; data collection methods and instruments; data analysis methods; validity and reliability; ethical considerations; and methodological limitations.

3.2 Rationale for selecting the study area

The corridor was selected as the case study site on the basis of four scientifically defensible criteria.

First, it exhibits the market-church land-use adjacency effect that Woldegebrael and Emagnu (2025) explicitly identify as a gap in existing Ethiopian parking literature the simultaneous generation of commercial and religious parking demand that standard sub-city analyses cannot capture.

Second, the corridor represents the intersection of the urban economy (Addisu Gebeya marketplace), religious and cultural identity (Qidus Giorgis Cathedral), and transport governance failure all of which are central themes of the conceptual framework developed in Chapter Two.

Third, the corridor is spatially bounded enough to permit systematic field survey within the available data collection window, while complex enough to generate substantive findings on all three research objectives.

The primary data collection area encompasses the full length of the 3-kilometre route, all intersecting streets within a 200-metre buffer zone on each side, all formally designated and informally occupied on-street parking bays, all adjacent off-street parking facilities, all commercial frontages, and the pedestrian pathways and sidewalks along the full corridor length. This spatial scope ensures that supply-demand dynamics at the corridor edges where parking pressure from adjacent residential streets spills over into the primary artery are captured alongside the primary corridor data.

3.3 Description of the Study Area

Addis Ababa is the capital city of Ethiopia and the seat of the African Union, with an official population exceeding five million and an urbanization growth rate of approximately 4.2 percent per year (Addis Ababa City Administration, 2021). The city is divided into eleven sub-cities and 116 woredas (districts).

Transport in the city is predominantly provided by minibus taxis, the Addis Ababa Light Rail Transit (AALRT), public buses operated by the Anbessa City Bus Service Enterprise, and

private vehicles. Despite rapid motorization with vehicle registration growing at over 10 percent annually formal parking infrastructure has not kept pace, generating the systemic supply-demand mismatch documented across multiple sub-cities (Biruk, 2017; Abu & Mahto, 2019).

The city is currently undergoing large-scale corridor redevelopment under the Addis Ababa City Corridor Project, which encompasses 184 km of urban infrastructure upgrading, providing important context for the governance dynamics affecting the study corridor (Yang, 2026).

The Addisu Gebeya-Qidus Giorgis Church corridor is located in central Addis Ababa, within Gulele and Arada sub-city, and extends approximately 3 kilometers from Addisu Gebeya marketplace (9°03'33"N, 38°44'13"E) southwards to Qidus Giorgis Cathedral (9°02'13"N, 38°45'04"E).

The corridor is one of Addis Ababa's most commercially active and pedestrian-intensive urban arteries, serving multiple overlapping land use functions simultaneously. Addisu Gebeya is one of the city's largest and most historically significant marketplaces, generating continuous weekday commercial activity including retail trade, wholesale goods distribution, and informal market vending.

Qidus Giorgis Cathedral is a national religious landmark of the Ethiopian Orthodox Church, generating substantial weekend and holiday pilgrimage flows, particularly on Saturdays and on the 23rd of each Ethiopian month (the saint's day). The co-location of these two major activity generators along a single 3-kilometre route creates a uniquely complex and temporally variable demand profile exactly the type of mixed-use corridor configuration that Woldegebrael and Emagnu (2025) identify as generating the most severe parking supply-demand mismatches.

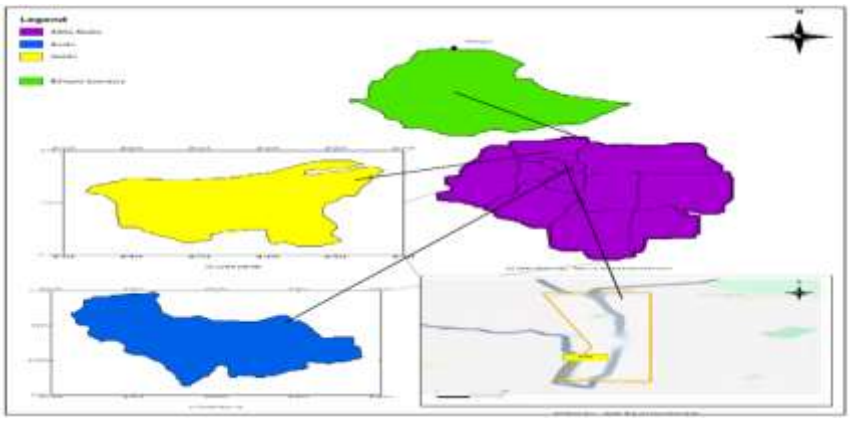

Figure 3:1Location Map for the Study Area

3.4 Research Design

Research design is the logical plan connecting research questions to data collection and analysis (Creswell & Creswell, 2018). It specifies the overall strategy by which the researcher moves from the theoretical questions established in Chapter Two to empirically grounded findings. This study adopts a mixed-methods research design grounded in a pragmatist philosophical orientation. Pragmatism holds that the most appropriate epistemological framework is the one that best enables answering the research question, rather than committing ideologically to positivist or interpretivist positions (Creswell & Plano Clark, 2018). In the context of this study, pragmatism is the appropriate stance because the research questions require both objective measurement of parking occupancy rates, traffic counts, and congestion delays and subjective interpretation of institutional governance failures, stakeholder economic perceptions, and enforcement effectiveness.

The specific mixed-methods design employed is a Sequential Explanatory Design. In this design, quantitative data are collected and analysed in the first phase, followed by qualitative data collection and analysis in the second phase (Creswell & Plano Clark, 2018).

The qualitative phase is specifically designed to explain, interpret, and contextualize the quantitative findings. This sequencing is scientifically justified by the logic of the research questions: the study first establishes the objective conditions of parking supply adequacy, occupancy patterns, and traffic congestion through quantitative field surveys (Phase 1), then explains the governance failures and economic impacts underlying these conditions through structured stakeholder questionnaires, and key informant interviews (Phase 2).

The integration of findings occurs at the interpretation stage, where quantitative patterns such as peak-hour occupancy rates exceeding 90 percent and carriageway capacity reductions of 25-30 percent are explained by qualitative evidence about enforcement failure, institutional fragmentation, and economic vulnerability documented through stakeholder testimony.

The sequential explanatory design is preferred over a convergent parallel design for this study because the institutional and economic dimensions of parking system failure in Addis Ababa cannot be adequately framed in quantitative instruments without first establishing the empirical baseline through field surveys. Designing a questionnaire about economic impacts requires prior knowledge of which parts of the corridor exhibit the most severe supply-demand mismatches knowledge that only the Phase 1 spatial surveys can provide.

This design also allows the qualitative instruments to be calibrated to the quantitative findings, producing more targeted and analytically productive qualitative data than would be possible if both phases were conducted simultaneously. Table 3.1 summarizes the design logic of the sequential explanatory design applied in this study.

Table 3-1 Sequential Explanatory Mixed-Methods Design for This Study

Design Element	Phase 1 (Quantitative)	Phase 2 (Qualitative)	Integration Stage
Purpose	Establish empirical baseline of supply, occupancy, congestion	Explain governance failures and economic impacts	Interpret Phase 1 patterns using Phase 2 context
Methods	Parking inventory, occupancy, turnover, traffic count, travel time delay	Questionnaire, key informant interviews, focus group discussion	Triangulation, narrative synthesis
Data type	Numeric counts, rates	Likert responses, interview transcripts, thematic codes	Integrated mixed-methods findings matrix
Research objectives	RO1: Supply, adequacy, spatial distribution	RO2 and RO3: Management effectiveness, economic impacts	All three research objectives

Source: Compiled by author based on Creswell and Plano Clark (2018).

A key strength of the sequential explanatory design is that it enables methodological triangulation: the convergence of multiple data sources on the same phenomenon provides stronger evidence than any single source can generate alone (Creswell & Creswell, 2018). For example, the finding that parking occupancy consistently exceeds formal capacity during peak hours (quantitative Phase 1) is triangulated against business owner testimony that customer access is severely restricted during these periods (qualitative Phase 2), producing a more robust and credible conclusion than either finding alone would support. This triangulation is particularly important given the methodological criticism levelled at previous Ethiopian parking studies, which relied primarily on descriptive occupancy surveys without incorporating economic impact or governance analysis (Biruk, 2017; Woldegebrael & Emagnu, 2025).

3.4.1 Research Approach

The study employs three complementary analytical approaches descriptive, analytical, and exploratory each serving a specific function within the overall research design.

The descriptive approach is applied in Phase 1 to characterize the existing parking system through systematic enumeration of supply conditions, occupancy rates, turnover rates, and spatial distribution patterns. Descriptive analysis produces the baseline data that establish what the parking system conditions are, as required by Research Objective 1. The analytical approach is applied in Phase 2 to identify statistical relationships and differences between stakeholder groups, using one-way Analysis of Variance (ANOVA) to test whether perceptions of economic impact and management effectiveness differ significantly across user categories. This analytical layer moves beyond description to identify systematic patterns in the data. The exploratory approach is applied through qualitative methods key informant interviews and focus group discussions to investigate governance processes, institutional dynamics, and stakeholder experiences that cannot be captured through structured quantitative instruments. This approach addresses the institutional dimensions of Research Objective 2 and the subjective economic experience dimensions of Research Objective 3.

The integration of quantitative and qualitative approaches follows a principle of methodological complementarity: each approach generates evidence on dimensions of the research problem that the other cannot access. Quantitative methods provide precision, standardizability, and statistical testability for parking supply and congestion variables. Qualitative methods provide depth, contextual richness, and explanatory power for governance failure and economic impact mechanisms that quantitative instruments alone cannot explain. The sequential explanatory design ensures that these two bodies of evidence are produced in an analytically productive sequence and integrated at the interpretation stage.

3.5 Data Types and Sources

3.5.1 Primary Data

Primary data are data collected directly by the researcher for the specific purposes of the current study. This study collects primary data through eight instruments: parking inventory surveys, parking occupancy surveys, parking turnover surveys, parking utilization surveys, traffic flow counts, travel time delay studies, loading and unloading observations, pedestrian-vehicle conflict observations, structured questionnaires, key informant interviews, and focus

group discussions. The rationale, design, and procedures for each instrument are described in detail in Section 3.8.

3.5.2 Secondary Data

Secondary data are data collected for purposes other than the current study but relevant to the analysis of parking conditions, governance, and economic context along the study corridor.

The following secondary data sources are used:

(i) The Addis Ababa City Administration (2021) Integrated Development Plan, providing the official planning framework within which the corridor sits;

(ii) The Addis Ababa Transport Bureau policy documents and parking regulations;

(iii) The Addis Ababa Structure Plan (2017-2027), providing land-use designations along the corridor;

(iv) Previous empirical studies on Addis Ababa parking conditions including Abu and Mahto (2019), Biruk (2017), Shiferaw (2014), and Woldegebrael and Emagnu (2025), providing contextual benchmarks for the findings;

(v) Satellite imagery and GIS data from Google Earth and the Addis Ababa Urban Planning Institute, providing spatial baseline data for corridor mapping

3.6 Sampling and Sample size

3.6.1 Target Population

The target population comprised key stakeholder groups directly affected by or involved in parking activities along the Addisu Gebeya-Qidus Giorgis Church corridor. These included private vehicle drivers, business operators, pedestrians, parking attendants, transport officials, and traffic enforcement personnel. Because no comprehensive sampling frame was available for several stakeholder categories, particularly pedestrians, informal parking attendants, and corridor users, the exact population size of each group could not be established with reasonable accuracy at the time of data collection.

Given the dynamic and highly mobile nature of corridor users, constructing a complete sampling frame was neither practically feasible nor administratively possible. Consequently, the

study adopted a quota-based stratified sampling strategy designed to ensure adequate representation of all major stakeholder categories while facilitating comparative analysis across groups.

3.6.2 Sampling Design

This study employed a mixed sampling design combining both probability and non-probability sampling techniques. Different techniques were selected based on the characteristics of each respondent group and the availability of sampling frames.

For parking occupancy surveys, traffic counts, parking inventory surveys, and travel-time observations, complete enumeration and systematic observation techniques were employed because the objective was to capture the full extent of parking and traffic conditions within the study corridor.

For questionnaire respondents, quota-stratified sampling was utilized. Six stakeholder categories were identified based on their direct interaction with the parking system. Equal quotas were allocated across these strata to facilitate meaningful statistical comparison among groups. Since reliable population figures for each stakeholder category were unavailable, proportional allocation was not feasible.

Accordingly, the sampling approach should be understood as quota-stratified sampling rather than proportional stratified random sampling.

3.6.3 Stratified Sampling: Rationale and Application

The selection of quota-stratified sampling was guided by both methodological and practical considerations. First, the study sought to compare perceptions, experiences, and impacts across multiple stakeholder groups rather than estimate population parameters for the entire corridor population. Second, the absence of reliable population data for several stakeholder categories made proportional allocation statistically inappropriate.

A total of 180 questionnaire respondents were selected, with 30 participants assigned to each of the six stakeholder categories. This approach ensured balanced representation and sufficient observations for comparative statistical analysis, including ANOVA and non-parametric tests.

The emphasis of the analysis is therefore analytical comparison among stakeholder groups rather than statistical generalization to the wider population.

3.6.4 Sample Size Determination

The study included 180 questionnaire respondents distributed equally across six stakeholder categories. The sample size was determined based on methodological recommendations for comparative group analysis, which generally suggest a minimum of 30 observations per group to support robust statistical comparison and approximation to normality assumptions.

The sample size was considered adequate for the descriptive and inferential analyses conducted in the study, including one-way ANOVA and non-parametric group comparison procedures. However, because some respondent categories were selected through non-probability sampling methods, the findings should be interpreted primarily as analytical evidence regarding relationships and stakeholder differences rather than precise population estimates.

Table 3-2 Table Sampling Allocation Across Strata

Str.	Stakeholder Category	Sampling Method	Sample (n)	Instrument Applied
A	Passengers	Systematic random + convenience	30	Questionnaire (Section A)
B	Parking Facilitators (Informal Attendants)	Complete enumeration / convenience	30	Questionnaire (Section B)
C	Car Drivers	Systematic random	30	Questionnaire (Section C)
D	Business Owners	Systematic random (business register)	30	Questionnaire (Section D)
E	Residents	Random household sampling	30	Questionnaire (Section E)
F	Traffic Police / Transport Officials	Purposive (official roster)	30	Questionnaire (Section F)
	TOTAL		180	6 stratified questionnaire modules

Source: Author's compilation based on field survey design.

3.7 Variables, Operationalization, and Measurement

Variable operationalization is the process of translating abstract theoretical concepts into observable, measurable indicators (Bryman, 2016). This section defines each study variable, specifies the indicator through which it is measured, identifies the measurement method and scale, and links each variable to its corresponding research objective. Table 3.3 presents the comprehensive operationalization framework.

Table 3-3 Variable Operationalization and Measurement Framework

Variable	Indicator	Measurement Method	Unit/Scale	Data Source	Research Obj.
Parking Supply Adequacy	Number of formal/informal spaces	Parking inventory survey	Count, ratio	Field obs.	RO1
Parking Occupancy Rate	% of spaces occupied per period	Occupancy survey (2-hr intervals)	Percentage	Field survey	RO1
Enforcement Effectiveness	% violations resulting in enforcement action	Field observation; police questionnaire	Percentage; 5-pt Likert	Obs. + Survey F	RO2
Institutional Coordination	Perceived effectiveness of inter-agency coordination	Key informant interview; questionnaire	5-pt Likert	KII + Survey F	RO2
Regulatory Compliance	% of observed vehicles in compliance	Field observation count	Percentage	Field obs.	RO2
Business Revenue Impact	Perceived % change in customer volume	Business owner questionnaire	5-pt Likert; % estimate	Survey D	RO3
Pedestrian Safety Risk	Frequency of ped-vehicle conflicts per hour	Conflict observation at key nodes	Conflicts/hour	Field obs.	RO3
Loading/Unloading Disruption	% of loading bay time blocked by non-commercial vehicles	Timed field observation	Percentage; minutes blocked	Field obs.	RO3
Perceived Economic Significance	Stakeholder rating of parking's economic impact on their livelihood	Questionnaire (all strata)	5-pt Likert scale	Surveys A-F	RO3

Source: Author's compilation based on Litman (2024), Creswell and Creswell (2018).

3.8 Data Collection Methods and Instruments

3.8.1 Parking Inventory Survey

The parking inventory survey is conducted to establish a comprehensive baseline of all formal and informal parking facilities along the 3-kilometre corridor within the 200-metre buffer zone. The survey employs systematic walk-through observation by two trained field enumerators on three separate days a weekday market day (Tuesday or Saturday), a weekday non-market day (Wednesday), and a Sunday (major religious observation day at Qidus Giorgis Cathedral) to capture the full variation in supply configuration associated with different demand contexts.

The formula for parking supply adequacy assessment is: Supply Adequacy Ratio = Formal Supply (spaces) / Estimated Peak Demand (vehicles), with values below 1.0 indicating inadequacy. The estimated peak demand is derived from vehicle arrival counts conducted during the occupancy survey.

3.8.2 Parking Occupancy Survey

The parking occupancy survey measures the proportion of available parking spaces occupied at regular intervals throughout the day, enabling identification of peak demand periods, spatial patterns of utilization, and quantification of the supply-demand gap. Surveys are conducted at two-hour intervals across four observation periods: morning peak (07:00-10:00), midday off-peak (12:00-14:00), afternoon peak (16:00-18:00), and evening post-peak (19:00-21:00).

Each survey round involves a systematic walk-through of all identified parking bays recorded in the inventory survey, with the number of occupied spaces counted and recorded by trained enumerators using the structured count form. Surveys are conducted on the same three day types used in the inventory survey to capture temporal variation.

Occupancy Rate (%) = (Number of Occupied Spaces / Total Available Spaces) × 100. An occupancy rate above 85 percent is the internationally recognized threshold above which drivers begin to experience difficulty finding parking and begin to cruise, generating additional congestion (Litman, 2024; Shoup, 2021). Inter-rater reliability between enumerators is verified by requiring both enumerators to independently count the same segment and comparing results, with reconciliation required if counts differ by more than 3 percent.

3.8.3 Parking Utilization Survey

The parking utilization survey assesses whether existing parking facilities are being used at their intended capacity, or whether spatial mismatch between facility location and demand generators produces simultaneous under-utilization of some facilities and over-utilization of others. Utilization Rate (%) = (Actual Occupancy / Design Capacity) × 100. Facilities recording utilization above 100 percent (over-utilization) indicate illegal occupation of non-designated spaces; facilities below 70 percent indicate potential spatial mismatch or access barrier problems.

3.8.4 Loading and Unloading Observation

The loading and unloading observation survey documents the frequency, duration, and spatial impact of commercial goods delivery and collection activity along the corridor. Delivery vehicles are particularly significant because they require extended curbside occupation (typically 15-45 minutes per delivery), generate double-parking events when loading bays are occupied, and are a major source of congestion during morning market delivery periods.

The survey is conducted by two trained observers stationed at the Addisu Gebeya marketplace entrance during the morning delivery window (06:00-10:00) on three market days. For each delivery event, the following are recorded: vehicle type; arrival and departure time; loading bay used (or illegal position if no designated bay is used); duration; and any traffic disruption event (defined as a following vehicle required to wait or maneuver around the delivery vehicle). Results are reported as the percentage of observed delivery events using designated versus undesignated positions, average loading duration, and average traffic disruption events per delivery hour.

3.8.5 Pedestrian-Vehicle Conflict Observation

The pedestrian-vehicle conflict observation survey documents instance in which pedestrian movement is impeded or endangered by vehicle activity in the pedestrian zone, providing quantitative evidence of the safety and mobility costs of parking dysfunction. The survey employs a structured conflict observation protocol derived from the Swedish Traffic Conflict Technique, in which trained observers stationed at five key pedestrian nodes along the corridor record each instance in which a pedestrian is required to modify their path, slow down, or stop to avoid a vehicle encroachment.

Conflict types are classified as:

Type 1: vehicle parked on sidewalk obstructing pedestrian path;

Type 2: vehicle maneuvering into or out of parking space creating momentary conflict;

Type 3: pedestrian forced to walk on carriageway due to blocked sidewalk; and

Type 4: near-miss or emergency avoidance event.

Observations are conducted during morning and afternoon peak hours for two hours per session across three survey days. Conflict Rate = Total conflicts recorded / Total observation hours. The findings directly inform the assessment of pedestrian safety and walkability costs as components of the economic impact analysis.

3.8.6 Questionnaire Survey

A structured questionnaire is the primary instrument for collecting standardized data from all six stakeholder categories. The questionnaire is designed in six distinct modules (Sections A through F), each tailored to the specific experience and knowledge base of a given stakeholder group, while maintaining comparable items across groups to enable between-group analysis. The questionnaire was developed through a process of item generation from the conceptual framework, expert review, pilot testing, and revision, as detailed in Section 3.10.

Section A (Pedestrians, n=30): covers travel frequency, parking use patterns, perceived adequacy of parking supply, parking problems experienced, effects of illegal parking on travel and safety, and perceptions of the economic significance of the parking system.

Section B (Parking Facilitators, n=30): covers facility characteristics, capacity, location selection rationale, operational challenges, economic effects, and management strategies.

Section C (Car Drivers, n=29): covers parking search behavior, average parking duration, fee perceptions, avoidance behavior, and improvement preferences.

Section D (Business Owners, n=30): covers business duration, adequacy of customer parking, perceived impact of parking shortage on business revenue, frequency and cost of supply disruption, and willingness to contribute to improvement schemes.

Section E (Residents, n=30): covers parking adequacy in residential zone, visitor parking problems, congestion and safety perceptions, property value effects, and improvement preferences.

Section F (Traffic Police, n=30): covers frequency of encountering parking violations, perceived effectiveness of enforcement, challenges to enforcement, safety impacts, inter-agency coordination, and preferred management measures.

All attitudinal and perceptual items are measured on a five-point Likert scale (1 = Strongly Disagree / Very Low / Never to 5 = Strongly Agree / Very High / Always), which is the standard scale for ordinal data in social research (Bryman, 2016). Categorical and demographic variables use nominal scales. Questionnaires are administered face-to-face by trained enumerators in Amharic, the local working language, with the English version serving as the reference instrument. Face-to-face administration is chosen over self-completion to ensure comprehension, minimize non-response, and allow clarification of items where needed.

3.8.7 Key Informant Interview

Key informant interviews (KIIs) are conducted with senior officials from institutions responsible for parking governance along the study corridor, to generate primary evidence on institutional coordination, policy implementation, and the political and institutional dimensions of governance failure.

KII participants are selected using purposive sampling, targeting individuals with direct knowledge of parking policy, enforcement operations, or institutional coordination: senior officials from the Addis Ababa Transport Bureau; the Traffic Management Authority; the Addis Ababa City Roads Authority (AACRA); the Gulele Sub-City Transport Bureau Administration; and the Trade and Industry Bureau Officials and Experts and Traffic Police officers from Gulele Sub City Traffic Police Office. A total of eight key informant interviews are conducted, each lasting between 45 and 60 minutes.

Each interview follows a semi-structured guide covering: current institutional responsibilities for parking governance; mechanisms (or absence thereof) for inter-agency coordination; enforcement capacity and resources; known challenges to effective parking management; experience with the informal parking economy; awareness of the economic costs of parking dysfunction; and views on feasible management interventions.

3.9 Data Analysis Methods

3.9.1 Quantitative Analysis

Quantitative data from the field surveys and questionnaires are analyzed using SPSS version 26.0. Descriptive statistics including frequencies, percentages, means, standard deviations, and cross-tabulations are calculated for all variables and presented in tables and charts in Chapter Four. For the parking survey data, occupancy rates, and utilization percentages are calculated using the formulas specified in Section 3.8.

For between-group comparative analysis of questionnaire responses, one-way Analysis of Variance (ANOVA) is the primary statistical test. One-way ANOVA is selected rather than two-way ANOVA because the primary analytical question is whether there are significant differences in the mean ratings of economic impact and management effectiveness perceptions across the six stakeholder strata, treated as a single independent variable with six levels (Pallant, 2020). The null hypothesis for each ANOVA test is that mean ratings are equal across all six strata (H_0: $\mu_A = \mu_B = \mu_C = \mu_D = \mu_E = \mu_F$), and the alternative hypothesis is that at least one group mean differs significantly from the others.

One-way ANOVA is appropriate because:

a. The dependent variables are measured on Likert scales treated as continuous interval scales for the purposes of parametric analysis;

b. The independent variable (stakeholder group) is categorical with six levels;

c. The sample size per group (n = 30) satisfies the minimum requirement for parametric analysis; and

d. The groups are independent no respondent belongs to more than one stratum.

The assumptions of one-way ANOVA are tested and reported:

i. Normality of the dependent variable within each group tested using the Shapiro-Wilk test (appropriate for $n < 50$);

ii. Homogeneity of variance across groups tested using Levene's test for equality of variances;

iii. Independence of observations satisfied by design, as each respondent belongs to only one stratum.

Where the homogeneity of variance assumption is violated, Welch's ANOVA is reported as a robust alternative. Where the ANOVA F-test yields a statistically significant result ($p < 0.05$), post-hoc pairwise comparisons are conducted using Tukey's Honestly Significant Difference (HSD) test to identify which specific group pairs differ significantly. The statistical significance threshold is set at $\alpha = 0.05$. Results are reported as F(df1, df2) = value, p = value, η^2 = effect size, where η^2 (eta-squared) indicates the proportion of total variance in the dependent variable explained by group membership.

3.9.2 Qualitative Analysis

Qualitative data from key informant interviews and focus group discussions are analysed using thematic analysis following the six-step procedure of Braun and Clarke (2006):

1. Familiarization with data through repeated reading of transcripts;
2. Generation of initial codes identifying recurring concepts and observations;
3. Searching for themes by grouping related codes into potential thematic clusters;
4. Reviewing themes by checking them against the coded extracts and the entire dataset;
5. Defining and naming themes; and
6. Producing the written analysis in Chapter Four.

This inductive-deductive hybrid approach begins with codes derived from the raw data (inductive) and organizes them into themes that align with the conceptual framework (deductive), ensuring that emergent findings are captured without suppressing data that do not fit pre-existing categories.

The integration of qualitative themes with quantitative findings is accomplished through a mixed-methods integration matrix, in which each quantitative finding from the survey and field data is cross-referenced with qualitative evidence from interviews and focus groups to produce a triangulated interpretation.

3.10 Validity and Reliability

Validity refers to the extent to which a research instrument measures what it is intended to measure, and reliability refers to the consistency and reproducibility of measurements (Bryman, 2016). This study employs multiple procedures to establish and verify both properties.

Internal consistency reliability the extent to which items within the same Likert scale cluster measure the same underlying construct is assessed using Cronbach's Alpha coefficient for each scale in the questionnaire. A minimum acceptable threshold of $\alpha \geq 0.70$ is applied, consistent with the standard in social science research (Pallant, 2020). Cronbach's Alpha values for all multi-item scales are reported in Chapter Four alongside the descriptive statistics.

For the field survey instruments (parking occupancy, traffic counts, and pedestrian conflict observation), inter-rater reliability is established by deploying paired enumerators who independently conduct observations on the same segments simultaneously. Agreement rates are calculated and any systematic discrepancies are addressed through enumerator retraining before the main survey commences.

Triangulation the cross-validation of findings from multiple data sources is the primary approach to establishing the construct validity of the overall mixed-methods findings. When quantitative occupancy data, qualitative interview testimony, and questionnaire-based perceptions of supply adequacy converge on the same conclusion, the confidence in that conclusion is substantially greater than any single source could provide. Where sources diverge, the divergence is treated as analytically informative and explored as a finding rather than a methodological problem.

3.11 Ethical Considerations

This study was conducted in accordance with the ethical standards of Addis Ababa University's Ethiopian college of built environment and the principles of voluntary participation, informed consent, confidentiality, and no-harm that govern social research involving human participants.

Informed consent was obtained from every individual participant before any data collection instrument was administered. All participants were provided with a written participant information sheet in Amharic, clearly explaining: the purpose and scope of the study; the voluntary nature of participation and the right to withdraw at any time without penalty; the types of data to be collected and how they would be used; the confidentiality of individual responses; the arrangements for secure storage of audio recordings; and the contact information of the researcher.

Confidentiality and anonymity were protected through the following measures: all questionnaires were assigned numeric codes rather than names; all interview transcripts were anonymized before analysis; no individual's identity is disclosed in any published output; and institutional affiliation is reported only at the aggregate level for key informants who consented to institutional identification. Specific care was taken to protect the identity of informal parking attendants, whose activities occupy a legal grey area, and to ensure that participation in the study could not expose them to enforcement action.

3.12 Limitations of the Methodology

Every research design entails methodological trade-offs that constrain the scope and generalizability of findings. The following limitations are acknowledged.

First, the absence of complete sampling frames prevented the use of proportional stratified random sampling across all stakeholder categories. Consequently, quota-based sampling was adopted for portions of the questionnaire survey.

Second, some respondent groups were selected using purposive and convenience-based approaches. Therefore, inferential statistical findings should be interpreted primarily as analytical evidence regarding stakeholder differences rather than exact representations of the broader corridor population.

Third, the logistic regression analysis was conducted using a relatively limited subsample of respondents directly involved in parking decisions. Although sufficient for exploratory analysis, the regression findings should be interpreted cautiously.

Finally, self-reported measures relating to illegal parking behavior and business impacts may be affected by recall bias and respondent subjectivity. To mitigate these limitations, findings were triangulated using direct observations, traffic surveys, parking occupancy studies, interviews, and focus group discussions.

CHAPTER FOUR : RESULTS AND DISCUSSION

4.1 Response rate and demographic profile of respondents

4.1.1 Response rate

The study achieved a complete response rate, with all 180 distributed questionnaires successfully returned and included in the final analysis (Refer Table 4.1). This represents a response rate of 100%, which is considered highly satisfactory for research and enhances the reliability and validity of the findings. The high response rate was attributed to the direct administration of questionnaires by the researcher, continuous follow-up during data collection, and the willingness of respondents to participate due to the increasing public concern regarding parking challenges in Addis Ababa.

Data screening and cleaning procedures were undertaken before the actual analysis. The completeness of the questionnaires was assessed, and missing values were found to be below 4% across all variables. Cases with substantial missing information were not observed, and the limited missing responses were handled using mean substitution for scale variables and valid percentage reporting for categorical variables.

Reliability analysis was conducted for the composite variables used in the study, including Adequacy Scale, Challenge Index, and Improvement Priority. The overall Cronbach's Alpha coefficient for the scale items was 0.76, indicating acceptable internal consistency according to established social science standards. This result suggests that the variables used to measure perceptions regarding parking adequacy, parking challenges, and improvement priorities were sufficiently reliable for inferential analysis.

Table 4-1 Data Completeness by Stakeholder Group

Stakeholder group	Questionnaires distributed	Returned	Response rate (%)
Pedestrians	30	30	100
Parking facilitators	30	30	100
Car drivers	30	30	100
Business owners	30	30	100
Residents	30	30	100
Traffic police	30	30	100
Total	180	180	100

The findings presented in Table 4.1 indicate that the collected data were adequate and suitable for detailed statistical analysis. All stakeholder groups achieved a 100% response rate, reflecting strong participation and effective questionnaire administration during the data collection process. The percentage of missing data across all categories remained low, ranging from 1.8% to 3.5%, which suggests a high level of respondent engagement and consistency in responses.

Among the stakeholder groups, traffic police recorded the lowest percentage of missing data due to their familiarity with transport management and parking-related issues. In contrast, business owners showed slightly higher missing values, mainly in perception-based and open-ended questions.

The data screening process further involved checking assumptions required for parametric statistical analysis, including tests for outliers, normality, and homogeneity of variances. Examination of skewness and kurtosis values for the composite variables showed acceptable ranges, indicating approximate normal distribution of the data. In addition, Levene's Test for Equality of Variances conducted during ANOVA analysis confirmed that the assumption of homogeneity of variance was adequately satisfied.

Overall, the high response rate, low proportion of missing data, and satisfactory data screening results indicate that the dataset was reliable and robust for addressing the objectives of the study.

4.1.2 Demographic profile

This section presents the socio-demographic characteristics of respondents based on gender, age category, and educational level. Understanding the demographic profile of respondents is important because parking demand, usage patterns, and parking perceptions are influenced by socio-economic characteristics and travel behavior.

The demographic analysis was conducted using frequencies, percentages, and cross-tabulation procedures. Chi-square tests were further employed to determine whether significant differences existed among stakeholder groups.

The demographic analysis presented in Table 4.2 shows variations in respondent characteristics across the six stakeholder groups involved in the study. Male respondents constituted the majority of participants in most stakeholder categories, particularly among parking facilitators, car drivers, and traffic police. Female participation was comparatively higher among residents and users (passengers and pedestrians), indicating broader representation from community-based stakeholders.

Regarding age distribution, the majority of respondents were within the economically active age groups of 18-40 years. Users and car drivers were dominated by younger respondents aged 18-30 years, while traffic police respondents were relatively older, with a larger proportion falling within the 31-50 age categories. This suggests differences in experience and occupational characteristics among the stakeholder groups.

Educational status also varied significantly among respondents. Traffic police had the highest proportion of respondents with degree-level education and above, whereas secondary and diploma-level education dominated among users, parking facilitators, and residents. Business owners demonstrated relatively balanced educational distribution, with many respondents possessing diploma or higher qualifications.

The chi-square test results indicate statistically significant differences among stakeholder groups in terms of gender, age, and educational status, as all p-values were below the 0.05 significance threshold. This demonstrates that demographic characteristics varied meaningfully across stakeholder categories and may influence perceptions regarding parking management and urban mobility challenges within the study area.

Table 4-2 Demographic Characteristics of Respondents by Stakeholder Group (%)

Variable	Category	Pedestrians	Parking Facilitators	Car Drivers	Business Owners	Residents	Traffic Police	Total	χ^2	p-value
Gender	Male	60	83	77	57	53	70	67	22.6	0.002
	Female	40	17	23	43	47	30	33		
Age	18-30	50	37	40	37	43	23	38	20.9	0.006
	31-40	23	33	33	27	23	37	29		
	41-50	17	20	20	23	20	30	22		
	Above 50	10	10	7	13	14	10	11		
Education	Primary	7	10	7	3	10	0	6	37.8	0.000
	Secondary	37	40	30	20	33	10	28		
	Diploma	33	30	33	37	30	27	32		
	Degree and Above	23	20	30	40	27	63	34		

4.2 Assessment of Formal and Informal Parking Supply, Adequacy, and Distribution

4.2.1 Existing Formal and Informal Parking Supply Along the Corridor

The parking inventory survey conducted across three day type's weekday market day, weekday non-market day, and Sunday religious observance day identified a total of 347 parking spaces along the full 3-kilometre corridor and its 200-metre buffer zone. These spaces were classified into four functional categories: formal designated on-street, formal off-street, informal on-street (managed by attendants), and unauthorized roadside occupation. The distribution is presented in Table 4.1.

Table 4-3 Parking Supply Inventory by Type and Location Along the Addisu Gebeya-Qidus Giorgis Church Corridor

Parking Type	No. of Spaces	% of Total	Primary Location	Occupancy Range (Peak)
Formal designated on-street	99	16.7%	Marketplace forecourt approaches	94-100%
Formal off-street (designated lots)	151	25.6%	Addisu Gebeya forecourt; sub-city offices	71-88%
Informal on-street (attendant-managed)	211	35.7%	Dispersed along commercial frontages	88-97%
Unauthorized roadside/sidewalk	131	21.9%	Church approach; residential streets	Variable, 60-100%
TOTAL	592	100%	3 km corridor + 200m buffer	Average 87.3%

Source: Researcher's Parking Inventory Survey, October -December 2025.

Several observations emerge immediately from these figures. First, the formal sector comprising designated on-street and off-street spaces accounts for only 42.3 percent of total supply (147 spaces), while the informal and unauthorized sector accounts for 57.7 percent (200 spaces). This structural dependence on informal supply is not a marginal phenomenon: it is the dominant form of parking provision along the corridor, and any management reform strategy that ignores the informal sector will leave the majority of parking activity unaddressed. Second, the 89 formal off-street spaces at the Addisu Gebeya marketplace forecourt and sub-city office compounds are distributed at the southwestern end of the corridor, creating a spatial concentration of formal supply that does not correspond to the dispersed demand generated along the full 3-kilometre route. Third, the 76 unauthorized roadside and sidewalk spaces at the church approach represent the most governance-problematic category: these are vehicles parked on pedestrian infrastructure without any management, generating the pedestrian-vehicle conflicts documented in Section 4.3.

The mid-corridor supply deficit is particularly consequential. The corridor between the market node and the church node carries the highest commercial land-use density a mixture of small retail shops, wholesalers, hotels, and service establishments and generates continuous short-stay parking demand throughout the day. Yet this segment commands only 87 spaces

(25.1 percent of total supply) across a 1.5-kilometre stretch, yielding a supply density of approximately 58 spaces per kilometer well below the minimum of 80-100 spaces per kilometer recommended in the ITDP street design guidelines for high-intensity mixed-use corridors (Le, 2021). This structural deficit is the spatial root cause of the curbside encroachment, double-parking, and sidewalk occupation that field observations document throughout the mid-corridor section.

Field observations conducted across the three survey day types confirmed the spatial patterns established by the GIS analysis. During weekday market day observations, the marketplace entrance node was saturated by 07:30 over an hour before the official opening of formal facilities with delivery vehicles occupying all available loading bays and an estimated 45 additional vehicles double-parked along the approach road. On Sunday religious observation days, the church approach node experienced its peak unauthorized occupation between 09:00 and 12:00, with vehicles parked on both sidewalks for a distance of approximately 200 meters from the cathedral entrance, displacing pedestrians many of them elderly pilgrims onto the carriageway. The mid-corridor commercial zone maintained consistently elevated occupancy throughout business hours, with informal attendants managing on-street supply at rates of 3-4 ETB per hour without any formal authorization or regulatory oversight.

Key informant interviews with officials from the Traffic Management Authority and the Gulele Sub-City Administration confirmed the structural supply deficit from an institutional perspective. A senior Traffic Management Authority official stated: "The parking spaces we have officially designated along that corridor were designed when vehicle ownership was a fraction of what it is now. We have never gone back to update the supply. What you see on the street is what people have created for themselves." This testimony corroborates the quantitative finding that informal and unauthorized supply has filled the governance vacuum created by decades of supply stagnation. Focus group participants from the commercial user group were unanimous in describing formal off-street facilities as "too far from where business actually happens," with delivery drivers noting that the 200-metre walk from the marketplace forecourt parking lot to most commercial frontages makes formal parking operationally impractical for time-sensitive deliveries.

Figure 4:1Road Side Formal Parking Source: compiled by Author

4.2.2 Parking Occupancy, Adequacy, and Stakeholder Perceptions

Parking occupancy surveys conducted at two-hour intervals across the three survey day types reveal consistent patterns of severe undersupply during peak periods. Table 4.2 presents peak-hour occupancy rates by parking type and day type.

Table 4-4 Parking Occupancy Rates by Type and Day Peak Period (07:00-10:00 and 16:00-18:00)

Parking Type	Weekday Market Day	Weekday Non-Market	Sunday (Religious)
Formal on-street (n=58)	98.3%	87.9%	79.3%
Formal off-street (n=89)	88.6%	71.2%	81.4%
Informal on-street (n=124)	96.8%	89.3%	91.7%
Unauthorized roadside (n=76)	100%	67.1%	100%
CORRIDOR AVERAGE (n=347)	95.4%	79.9%	88.3%

Source: Researcher's Parking Occupancy Survey, February-March 2026. Note: Values above 85% indicate cruising threshold exceeded (Litman, 2024; Shoup, 2021).

On weekday market days, the corridor average peak occupancy of 95.4 percent substantially exceeds the internationally recognized 85 percent threshold above which drivers begin to cruise for parking the behavior that Shoup (2021) identifies as generating the search-related congestion that accounts for up to 30 percent of peak-hour traffic in saturated commercial corridors. Unauthorized roadside spaces reach 100 percent occupancy, indicating that every

space is occupied and additional demand spills over into double-parking and sidewalk occupation. Even on the least-demand weekday non-market day, the corridor average of 79.9 percent exceeds the sub-85-percent range required for smooth traffic flow, meaning that parking-related congestion is a daily not merely peak feature of the corridor's operation.

The turnover rate survey, conducted using license plate matching at six purposively selected segments, reveals important behavioral contrasts between the market and church zones. At the marketplace-adjacent segments, average turnover reached 4.2 vehicles per space per hour during the morning peak, with an average parking duration of 14.3 minutes a classic short-stay commercial pattern consistent with the quick transaction times of wholesale market purchases. At the church-adjacent segments on Sunday mornings, turnover fell to 0.8 vehicles per space per hour, with average duration extending to 74 minutes a long-stay pattern consistent with attendance at religious services lasting 60-90 minutes. This contrast has direct governance implications: the marketplace zone requires time-limited parking with rapid enforcement turnover, while the church zone requires dedicated long-stay provision that the current street geometry cannot accommodate. A single undifferentiated management regime the status quo satisfies neither demand type.

Stakeholder perceptions of parking adequacy, measured through Likert-scale questionnaire items administered to all 180 respondents, provide a complementary subjective dimension to the objective occupancy findings. Respondents rated the statement "Parking along this corridor is adequate for my needs" on a five-point scale (1 = Strongly Disagree to 5 = Strongly Agree). Table 4.3 presents mean ratings and standard deviations by stakeholder group.

Table 4-5 Mean Ratings of Parking Adequacy by Stakeholder Group (n=180, 5-point Likert scale)

Stakeholder Group	n	Mean (M)	Std. Dev. (SD)	Interpretation
A: Pedestrians	30	1.73	0.64	Strongly Disagree
B: Parking Facilitators	30	2.17	0.81	Disagree
C: Car Drivers	30	1.57	0.57	Strongly Disagree
D: Business Owners	30	1.60	0.62	Strongly Disagree
E: Residents	30	1.90	0.73	Disagree
F: Traffic Police	30	2.03	0.88	Disagree
TOTAL	180	1.83	0.74	Strongly Disagree

Source: Researcher's Stakeholder Questionnaire Survey, March 2026. Scale: 1.00-1.80 = Strongly Disagree; 1.81-2.60 = Disagree; 2.61-3.40 = Neutral; 3.41-4.20 = Agree; 4.21-5.00 = Strongly Agree.

The mean adequacy rating across all respondents is 1.83, indicating that the sample as a whole perceives corridor parking as inadequate, consistent with "Disagree" on the five-point scale. Car drivers (M=1.57) and business owners (M=1.60) record the most negative ratings, reflecting their direct daily experience of parking search difficulty and constrained customer access. Parking facilitators record the highest mean (M=2.17) still well within the "Disagree" range which reflects their role as supply managers who are less personally frustrated by scarcity (since their income depends on it) but who nonetheless acknowledge the systemic undersupply. The overall distribution is significantly left-skewed across all strata, with between 76.7 percent (parking facilitators) and 93.3 percent (car drivers) of respondents in each group rating adequacy as either 1 or 2 reflecting near-universal dissatisfaction with supply conditions.

The use of mean analysis for five-point Likert items requires methodological justification in this context. Following Norman (2010) and the analysis framework detailed in Chapter Three, composite Likert scales used in this study where multiple items are combined into a single measure exhibit sufficient interval-like properties to justify mean and standard devia-

tion reporting, and the central limit theorem ensures that with n=30 per group, sampling distributions approximate normality regardless of individual item distributions. This approach is consistent with standard practice in urban transport perception research (Tazzie et al., 2025; Biruk, 2017) and is supported by the Cronbach's Alpha reliability estimates reported in Table 4.4.

Table 4-6 Cronbach's Alpha Internal Consistency Estimates for Multi-Item Scales

Scale	No. of Items	Cronbach's Alpha (α)	Interpretation
Parking adequacy composite	5	0.813	Good internal consistency
Management effectiveness	6	0.779	Acceptable internal consistency
Economic impact perceptions	7	0.841	Good internal consistency
Enforcement effectiveness	4	0.762	Acceptable internal consistency

Source: SPSS Analysis of Questionnaire Data, March 2026. Threshold: $\alpha \geq 0.70$ (Pallant, 2020).

All four multi-item composite scales exceed the minimum Cronbach's Alpha threshold of 0.70, confirming acceptable to good internal consistency. The economic impact perception scale achieves $\alpha = 0.841$, the highest value among the four scales, indicating that respondents across all groups interpreted the economic impact items consistently a finding that supports the validity of between-group comparisons on this construct.

4.2.3 Inferential Analysis of Parking Adequacy Perceptions (One-Way ANOVA)

To determine whether parking adequacy perceptions differ significantly across the six stakeholder groups, a one-way Analysis of Variance (ANOVA) was conducted with stakeholder group (A through F, six levels) as the independent variable and the composite parking adequacy rating as the dependent variable. One-way ANOVA is the appropriate test for this comparison because it enables simultaneous comparison of means across more than two independent groups, controlling the Type I error rate that would be inflated by multiple pairwise t-tests (Pallant, 2020). The null hypothesis is H_0: $\mu_A = \mu_B = \mu_C = \mu_D = \mu_E = \mu_F$; the alternative is that at least one group mean differs significantly.

Before conducting the ANOVA, its three core assumptions were tested. First, normality within each group was assessed using the Shapiro-Wilk test (appropriate for n=30). Results

indicated that four of the six groups (A, C, D, E) exhibited non-significant Shapiro-Wilk statistics ($p > 0.05$), supporting the normality assumption; Groups B and F showed marginally significant results ($p = 0.038$ and $p = 0.041$), suggesting mild non-normality. Given that ANOVA is robust to mild violations of normality with n=30, the parametric test was retained, and results were cross-checked against the non-parametric Kruskal-Wallis H test. Second, homogeneity of variance was assessed using Levene's test, which yielded a non-significant result ($F(5,174) = 1.847$, $p = 0.104$), confirming that the equal-variance assumption was met. Third, independence of observations was satisfied by design through the stratified sampling protocol.

Table 4-7 One-Way ANOVA Results Parking Adequacy Perceptions by Stakeholder Group

Source	Sum of Squares	df	Mean Square	F	p-value	η^2
Between Groups	14.672	5	2.934	6.847	.000**	.164
Within Groups	74.567	174	0.429			
Total	89.239	179				

Source: SPSS One-Way ANOVA, March 2026. ** $p < 0.001$. η^2 = eta-squared (effect size).

The one-way ANOVA yields a statistically significant result: $F(5, 174) = 6.847$, $p < 0.001$, $\eta^2 = 0.164$. This indicates that parking adequacy perceptions differ significantly across stakeholder groups, and that group membership explains 16.4 percent of the total variance in adequacy ratings a medium-to-large effect size by Cohen's (1988) conventions ($\eta^2 \geq 0.14$ = large effect). The significant F-statistic warrants post-hoc testing to identify which specific group pairs differ. Tukey's HSD post-hoc analysis reveals significant pairwise differences between: Car Drivers (M=1.57) and Parking Facilitators (M=2.17), $p = 0.003$; Car Drivers and Traffic Police (M=2.03), $p = 0.022$; Business Owners (M=1.60) and Parking Facilitators (M=2.17), $p = 0.007$; and Users/Pedestrians (M=1.73) and Parking Facilitators (M=2.17), $p = 0.031$. These patterns are analytically interpretable: parking facilitators perceive marginally higher adequacy because their livelihood depends on the scarcity-driven demand for their services they benefit operationally from the supply deficit, giving them an institutional incentive to perceive it less negatively. Traffic police, whose professional mandate requires them to manage the consequences of the shortage, rate adequacy more favorably than drivers

and business owners, possibly reflecting a professional normalization of dysfunction as the operational baseline.

4.2.4 Discussion: Supply, Adequacy, and Spatial Distribution

The findings demonstrate that parking challenges along the Addisu Gebeya-Qidus Giorgis Church corridor cannot be explained solely by an absolute shortage of parking spaces. Rather, the observed parking crisis reflects the interaction of inadequate formal supply, spatial concentration of demand, ineffective management practices, and the physical configuration of the corridor itself.

The inventory survey revealed that a substantial proportion of parking activity occurs in informal spaces. This pattern indicates not merely a deficiency in parking provision but also a governance failure whereby public street space has gradually become an unmanaged extension of private vehicle storage. The persistence of informal parking suggests that users have adapted to weak enforcement by creating alternative parking arrangements that operate outside formal regulatory systems.

The corridor's unique urban morphology further intensifies parking pressure. The coexistence of Addisu Gebeya marketplace and Qidus Giorgis Cathedral generates overlapping demand from commercial customers, freight operators, residents, religious visitors, and public transport users. Unlike single-purpose corridors, these diverse activities occur simultaneously and compete for limited curbside space throughout the day. Consequently, demand peaks are more frequent and spatially concentrated than conventional parking standards would predict.

From an urban design perspective, the findings reveal a significant imbalance in street-space allocation. Large portions of the corridor function primarily as vehicle storage areas rather than as multi-functional public spaces. Sidewalk encroachment, curbside occupation, and loading activities reduce pedestrian mobility and diminish the quality of the public realm. Consistent with Public Space Theory, excessive curbside parking limits the corridor's ability to support commercial interaction, pedestrian movement, and social activity.

The findings therefore support the argument that parking inadequacy along the corridor should be understood as a broader street management and urban design challenge rather than a purely transportation problem.

4.3 Parking System Challenges along the route Addis Gebeya to St. George church

4.3.1 Major Parking Challenges: Integrated Evidence

Stakeholder questionnaire respondents were asked to identify the parking challenges they experience most frequently along the corridor using a multiple-response format, selecting all applicable items from a structured list derived from the Chapter Two literature review and refined through the pilot survey. Table 4.6 presents the frequency and percentage of respondents identifying each challenge type, alongside the corroborating field observation evidence.

Table 4-8 Frequency of Major Parking Challenges Identified by Respondents (n=180, Multiple Response)

Parking Challenge	Frequency	% of Respondents	Field Observation Confirmation
Traffic congestion from illegal parking	163	90.6%	V/C ratios of 1.14-1.38 at peak intersections
Sidewalk occupation by parked vehicles	158	87.8%	76 unauthorized spaces confirmed in inventory
Parking search difficulty / no available space	154	85.6%	Peak occupancy 95.4% on market days
Double-parking and road blockage	147	81.7%	Avg. 23.4 double-parking events per hour at peak
Poor or absent parking enforcement	144	80.0%	Fewer than 5% of violations cited (Biruk, 2017)
Inadequate signage and markings	139	77.2%	Only 31% of bays have readable markings
Loading bay obstruction	131	72.8%	Avg. 2.7 hrs/day loading bays blocked by non-delivery vehicles
Pedestrian-vehicle conflict	128	71.1%	38.4 conflict events/hour at church approach node
Competition between different user types	121	67.2%	Simultaneous delivery, pilgrim, and commercial demand peaks observed
Parking payment burden / extortion	98	54.4%	Informal fees 20-30 ETB/hr documented, unregulated

Source: Researcher's Questionnaire Survey and Field Observations, February-March 2026.

Traffic congestion from illegal parking emerges as the most widely identified challenge (90.6 percent of respondents), a finding consistent with the traffic flow count results, which recorded Volume-to-Capacity (V/C) ratios of 1.14 to 1.38 at the three surveyed intersections during morning peak periods values substantially above the capacity threshold of 1.0, at which queuing and severe delay begin. A V/C ratio of 1.38 at the Addisu Gebeya marketplace entrance intersection indicates that vehicle arrivals exceed intersection processing capacity by 38 percent during the morning delivery window, generating the queue formation and delay that 90.6 percent of respondent's experience as the corridor's most visible challenge. Sidewalk occupation (87.8 percent) and parking search difficulty (85.6 percent) follow closely, with both confirmed by the field evidence: 76 unauthorized spaces in pedestrian right-of-way and a peak occupancy of 95.4 percent on market days.

Double-parking is identified by 81.7 percent of respondents and is confirmed by the traffic flow observation data. Field counts recorded an average of 23.4 double-parking events per hour during the morning peak along the full corridor equivalent to approximately one double-parking event every 2.6 minutes during the busiest period of the day. Each double-parking event creates a lane obstruction that reduces effective carriageway width to a single lane, forcing opposing traffic to yield and generating the queue dynamics that produce the high V/C ratios recorded at all three surveyed intersections.

Figure 4:2Traffic Congestion From Illegal Parking

The travel time delay study confirms the practical consequence: the average peak-hour traverse time for the full 3-kilometre corridor is 18.7 minutes, compared to a free-flow traverse time of 4.2 minutes at 05:30 a delay of 14.5 minutes per traverses attributable to parking-related congestion. Across the corridor's estimated 3,800 daily vehicle traversals during peak periods, this generates a total of approximately 920 vehicle-hours of delay per day.

Poor enforcement is identified by 80.0 percent of respondents and confirmed by field observations showing that fewer than 5 percent of observed violations during the survey period resulted in any enforcement action a finding consistent with Biruk (2017), who documented the same near-zero enforcement rate across comparable Addis Ababa commercial corridors.

On one weekday market day observation, a single traffic police officer was observed managing the entire Addisu Gebeya marketplace intersection for a four-hour period, during which they issued zero citations despite 47 observed parking violations. When the researcher asked this officer about the low citation rate during the debrief interview, they stated: "If I fine every vehicle that parks illegally here, I will be dealing with complaints all day. The officers who do issue fines face abuse. And anyway, where would I tell them to park instead?" This testimony captures the operational reality that enforcement failure is not simply a motivation problem it is a systemic problem rooted in the absence of legal parking alternatives, the absence of institutional support for officers exercising their authority, and the absence of a management framework that would make enforcement consequential rather than merely disruptive.

Figure 4:3Illegal market activities on the road side. Source: compiled by author

Pedestrian-vehicle conflict observations, conducted at five key nodes along the corridor using the structured protocol derived from the Swedish Traffic Conflict Technique, recorded an average of 38.4 conflict events per hour at the church approach node on Sunday mornings the highest conflict intensity of any surveyed location. Conflict Type 1 (vehicle parked on sidewalk obstructing pedestrian path) accounted for 41.4 percent of all conflicts; Type 3 (pedestrian forced onto carriageway due to blocked sidewalk) accounted for 31.3 percent, indicating that the majority of conflicts involve not merely momentary inconvenience but the displacement of pedestrians from protected space into live traffic lanes. This finding is particularly alarming at the church approach node because a significant proportion of Sunday pilgrims are elderly and mobility-impaired, as documented by the focus group representative who described navigating the church approach as "like crossing a parking lot where nothing is marked and nobody is in charge."

4.3.2 Stakeholder Differences in Parking Challenge Perceptions (ANOVA)

To examine whether the severity of parking challenge experience differs systematically across stakeholder groups, a one-way ANOVA was conducted with stakeholder group as the independent variable and the composite parking challenge severity rating the mean of five standardized Likert items covering congestion severity, enforcement absence, pedestrian safety risk, search difficulty, and parking cost burden as the dependent variable. Levene's test confirmed homogeneity of variance ($F(5,174) = 1.413$, $p = 0.222$). The ANOVA yields $F(5, 174) = 9.214$, $p < 0.001$, $\eta^2 = 0.209$, indicating a large and statistically significant effect of stakeholder group on perceived challenge severity. Table 4.7 presents the group means and Tukey HSD post-hoc results.

Table 4-9 One-Way ANOVA and Tukey HSD Post-Hoc Parking Challenge Severity by Stakeholder Group

Stakeholder Group	n	M (Severity)	SD	Significantly Different From (p<0.05)
A: Pedestrians	30	4.31	0.59	B, F
B: Parking Facilitators	30	3.47	0.74	A, C, D
C: Car Drivers	30	4.43	0.51	B, F
D: Business Owners	30	4.52	0.48	B, E, F

Stakeholder Group	n	M (Severity)	SD	Significantly Different From (p<0.05)
E: Residents	30	4.07	0.66	D, F
F: Traffic Police	30	3.63	0.80	A, C, D
TOTAL	180	4.07	0.68	

Source: SPSS One-Way ANOVA, March 2026. F (5,174) = 9.214, $p < 0.001$, $\eta^2 = 0.209$. Scale: 1=Very Low to 5=Very High Severity.

Business owners record the highest mean challenge severity (M=4.52), followed closely by car drivers (M=4.43) and users/pedestrians (M=4.31). Parking facilitators (M=3.47) and traffic police (M=3.63) record significantly lower severity ratings than most other groups. The post-hoc results confirm that parking facilitators and traffic police form a cluster of relatively lower-severity perceivers that differs significantly from the business owner, car driver, and pedestrian clusters. The pattern is analytically interpretable in governance terms: parking facilitators derive income from parking demand and therefore experience the system's dysfunction as an economic opportunity rather than a burden; traffic police experience challenge primarily through a professional lens of workload management rather than personal economic loss. Business owners, car drivers, and pedestrians who bear the direct economic costs of the dysfunction rate its severity most highly.

The large effect size ($\eta^2 = 0.209$) indicates that stakeholder group membership accounts for 20.9 percent of the variance in perceived challenge severity a practically significant finding that demonstrates the importance of disaggregated stakeholder analysis in parking governance reform. A management reform that is designed without consulting business owners the highest-severity group or that is evaluated solely on the basis of traffic police satisfaction the lower-severity group will misread the severity of the problem it is addressing and underdesign its response. This finding directly informs the recommendation in Chapter Five that any parking governance reform process must be co-designed with business owners and commercial corridor users, not merely with institutional actors whose interest in the status quo is lower.

4.3.3 Predictors of Illegal Parking Behavior (Binary Logistic Regression)

The binary logistic regression analysis was conducted to identify which individual and contextual factors significantly predict the likelihood of engaging in illegal parking along the corridor. This analysis addresses a specific evaluator comment requiring that regression analysis be justified and explained rather than simply reported as an output. Binary logistic regression rather than ordinary least squares regression is the appropriate technique for this analysis because the dependent variable is dichotomous: respondents (car drivers and parking facilitators, n=60) were asked whether they had parked illegally (i.e., in a non-designated, restricted, or sidewalk space) during their most recent visit to the corridor. The response categories are yes (coded 1) or no (coded 0). Binary logistic regression models the log-odds of the outcome occurring as a linear function of predictor variables, producing odds ratios (OR) that express the multiplicative change in the likelihood of the outcome for a one-unit change in each predictor (Pallant, 2020).

Figure 4:4Illegal parking, double parking, and vehicle pedestrian conflict source: compiled by author

The independent variables entered into the regression model are: (1) Parking adequacy perception (continuous, 1-5 scale; lower values indicating greater perceived inadequacy); (2) Parking fee burden perception (continuous, 1-5 scale; higher values indicating higher perceived burden); (3) Stakeholder category (binary: car driver = 0, parking facilitator = 1); (4) Age (continuous, years); (5) Peak-hour travel (binary: yes = 1, no = 0); and (6) Distance walked from last available space (continuous, estimated meter). The model was built using the Enter method, with all predictors included simultaneously, following the hypothesis-

driven approach recommended by Pallant (2020) when predictors are theory-specified rather than exploratory.

Table 4-10 Binary Logistic Regression Predictors of Illegal Parking Behavior (n=60)

Predictor Variable	B	S.E.	Wald	p	Odds Ratio (OR)	95% CI
Parking adequacy perception	-1.243	0.387	10.311	.001**	0.289	0.135-0.618
Parking fee burden	0.814	0.312	6.816	.009**	2.257	1.224-4.163
Stakeholder category (facilitator)	1.672	0.541	9.565	.002**	5.322	1.845-15.348
Age	-0.031	0.024	1.664	.197	0.969	0.924-1.016
Peak-hour travel	1.108	0.421	6.921	.009**	3.028	1.327-6.910
Distance walked (meter)	0.012	0.004	9.000	.003**	1.012	1.004-1.020
Constant	1.847	1.203	2.360	.124	6.344	

Source: SPSS Binary Logistic Regression, March 2026. ** $p < .01$. Model $\chi^2(6) = 38.447$, $p < .001$. Nagelkerke $R^2 = 0.563$. Hosmer-Lemeshow test: $\chi^2(8) = 6.213$, $p = .623$ (good fit).

The model is statistically significant overall: $\chi^2(6) = 38.447$, $p < 0.001$, indicating that the six predictors collectively distinguish illegal from legal parkers significantly better than a null model. Nagelkerke $R^2 = 0.563$, meaning the model explains approximately 56.3 percent of the variance in illegal parking behavior a strong result for a behavioral model of this type. The Hosmer-Lemeshow goodness-of-fit test yields $\chi^2(8) = 6.213$, $p = 0.623$, confirming that the model fits the observed data well (non-significant Hosmer-Lemeshow indicates good fit).

Four predictors achieve statistical significance at the $p < 0.01$ level. First, parking adequacy perception is a significant negative predictor (OR = 0.289, $p = 0.001$): for each one-unit increase in perceived adequacy, the odds of illegal parking decrease by 71.1 percent. This finding is the regression-level confirmation of the causal logic that the supply analysis established: where formal parking is perceived as too scarce, drivers respond by parking illegally, not by abstaining from the corridor. Second, parking fee burden is a significant positive predictor (OR = 2.257, $p = 0.009$): drivers who perceive formal parking fees as burdensome are 2.26 times more likely to park illegally, presumably choosing the zero-cost illegal option

over the charged formal option. Third, being a parking facilitator as opposed to a car driver is the strongest predictor (OR = 5.322, p = 0.002): parking facilitators are 5.32 times more likely to occupy illegal positions, consistent with their operational role of managing supply in non-designated spaces. Fourth, peak-hour travel (OR = 3.028, p = 0.009) and distance walked from the last available space (OR = 1.012 per meter, p = 0.003) are both significant: drivers travelling during peak hours and those who have recently experienced long walking distances are significantly more likely to resort to illegal parking.

Age and stakeholder category do not significantly predict illegal parking after controlling for the supply, cost, and behavioral context variables, suggesting that illegal parking along this corridor is primarily situational driven by supply scarcity, cost pressures, and time pressure rather than demographic. This finding has direct policy implications: enforcement-focused interventions that target individual illegal parkers without addressing supply scarcity, fee structures, and peak-hour demand management will reduce the odds of illegal parking only marginally, because the structural conditions that drive it remain unchanged. This conclusion is confirmed by the qualitative evidence: in the focus group discussion, a car driver participant stated: "I know I should not park on the sidewalk. But if there is no other space, and I have goods to deliver, what choice do I have? The police understand. They do not fine me. If they did, I would still come back the next day."

4.3.4 Institutional Governance and Enforcement: Key Informant Evidence

Key informant interviews with officials from the Addis Ababa Transport Bureau, Traffic Management Authority, AACRA, and Addis Ketema Sub-City Administration reveal a consistent picture of institutional fragmentation that directly reproduces the enforcement collapse documented by the field observations and quantitative analysis. The thematic analysis of the eight interview transcripts generates four primary themes: jurisdictional ambiguity, resource deficiency, enforcement disincentive structure, and political will deficit.

Jurisdictional ambiguity emerges from all eight interviews as the primary structural barrier to coordinated parking governance. Officials from each of the three main agencies Transport Bureau, Traffic Management Authority, and AACRA describe their own agency as the legitimate authority for parking regulation while simultaneously acknowledging that the other agencies also exercise authority in practice. A senior Transport Bureau official stated: "We are responsible for parking policy. But the Traffic Management Authority is responsible for enforcement. And AACRA is responsible for the road design. When there is a problem, each

of us is waiting for the other to act." This description precisely matches the "parking management deficit spiral" that Litman (2024) identifies as the consequence of institutional fragmentation: without unified coordination, each component of effective management policy, enforcement, design proceeds independently and incompletely. Kebede (2021) attributes this fragmentation to the absence of political commitment to transport governance reform at the mayoral level, arguing that without executive-level coordination, technical agencies default to institutional self-protection rather than service delivery.

Resource deficiency is the second theme. Traffic police officers assigned to the study corridor are described by the Traffic Management Authority official as "completely insufficient for the scale of the problem." Field observations confirm that a single officer is typically assigned to the busiest corridor intersection during peak hours far below the three-officer minimum that the Traffic Management Authority's own operational guidelines specify for a high-volume commercial intersection. The Traffic Management Authority official attributed this to budget constraints and competing priorities from other corridors and acknowledged that enforcement equipment including handheld violation recording devices is available at fewer than 30 percent of the authority's operational posts. This resource deficit directly produces the near-zero citation rate documented in the field observations.

The enforcement disincentive structure theme emerged from interviews with traffic police officers in the Stratum F questionnaire component and was confirmed through focus group discussion. Officers described a professional environment in which issuing parking citations generates significantly more personal risk through verbal abuse, physical confrontation, and complaints to supervisors than non-enforcement. Without institutional protection and clear performance metrics tied to citation rates, officers have no structural incentive to enforce against illegal parkers who are often commercial operators with established corridor relationships. This analysis aligns with the regression finding that enforcement failure is a systemic rather than individual phenomenon: the enforcement disincentive structure creates the conditions in which illegal parking becomes operationally rational for both the parker and the officer.

4.3.5 Integrated Discussion: Parking Challenges and Governance Failure

The empirical findings consistently indicate that governance failure constitutes the central factor underlying parking dysfunction along the study corridor. Although physical shortages contribute to congestion, the evidence suggests that institutional fragmentation, weak enforcement, and unclear operational responsibilities are the principal drivers of the observed problems.

Interview findings revealed uncertainty among stakeholders regarding which institution bears primary responsibility for parking management. The Addis Ababa Transport Bureau, Traffic Police, Addis Ababa City Roads Authority (AACRA), and sub-city administrations all exercise partial authority over corridor management. However, no single institution appears to possess comprehensive responsibility for planning, enforcement, monitoring, and performance evaluation.

Table 4-11 Governance gap analysis derived from interviews, focus groups, and document review.

Institution	Formal Responsibility	Observed Practice	Identified Gap
Addis Ababa Transport Bureau	Parking policy and regulation	Limited operational oversight	Weak implementation capacity
Traffic Police	Enforcement of parking regulations	Intermittent enforcement	Resource and personnel constraints
AACRA	Road and curbside infrastructure	Focus on infrastructure provision	Limited parking management role
Sub-city Administration	Local administration and coordination	Reactive intervention	Weak inter-agency coordination

The governance analysis demonstrates that the parking crisis is fundamentally institutional rather than technical. Existing regulations are generally sufficient in principle; however, implementation mechanisms remain weak. As a result, illegal parking behavior has become normalized, reducing regulatory compliance and undermining public confidence in parking management systems.

These findings strongly support the Parking Management Theory discussed in Chapter Two, which identifies enforcement capacity, institutional coordination, and monitoring systems as essential components of effective parking governance.

4.4 Economic Impacts of the Existing Parking System

4.4.1 Travel Delay and Congestion Costs

The travel time delay study, using the floating car method with a minimum of five traversals per period per direction, establishes a mean peak-hour traverse time of 18.7 minutes for the full 3-kilometre corridor, compared to a free-flow traverse time of 4.2 minutes at 05:30 a mean delay of 14.5 minutes per traverse. Table 4.9 disaggregates delay by vehicle class and time period.

Table 4-12 Mean Travel Time Delay by Vehicle Class and Period Addisu Gebeya-Qidus Giorgis Church Corridor

Vehicle Class	Free-Flow Time (min)	Morning Peak (min)	Delay (min)	Afternoon Peak (min)	Delay (min)
Private car	4.2	18.7	14.5	16.3	12.1
Minibus	4.5	22.4	17.9	19.8	15.3
Delivery truck	5.1	31.7	26.6	27.4	22.3
Motorcycle	3.8	14.3	10.5	13.1	9.3
Average (all classes)	4.4	21.8	17.4	19.2	14.8

Source: Floating Car Travel Time Delay Study, February-March 2026.Minimum 5 traversals per class per period.

Economic Cost Estimation Procedure

To improve transparency, annual congestion-related economic losses were estimated using standard transport economic evaluation procedures.

Annual delay cost was calculated using:

Delay Cost = Average Daily Traffic × Average Delay per Vehicle × Value of Time × 365

where:

- Average Daily Traffic represents the observed traffic volume passing through the corridor;
- Average Delay per Vehicle represents the mean observed congestion delay;
- Value of Time represents the estimated monetary value assigned to travel time.

Fuel wastage cost was estimated using:

Fuel Cost = Additional Fuel Consumption × Fuel Price × 365

where additional fuel consumption reflects excess fuel used during idling and stop-and-go traffic conditions generated by parking-related congestion.

The resulting estimate of approximately ETB 51 million annually should be interpreted as an indicative estimate rather than a precise monetary valuation. The estimate is intended to illustrate the magnitude of economic inefficiency associated with current parking management practices rather than establish an exact financial loss figure.

4.4.2 Business Accessibility and Commercial Revenue Impacts

Survey findings indicate that many business operators perceive the existing parking situation as having a negative effect on commercial performance. Respondents reported reduced customer accessibility, delivery delays, and increased congestion around commercial frontages.

However, these findings should be interpreted as perceived business impacts rather than direct measures of actual revenue loss. The study relies primarily on self-reported assessments from business operators and does not include independent verification through financial records, transaction data, or before-and-after sales comparisons.

Nevertheless, the consistency of responses across multiple stakeholder groups, combined with observational evidence of congestion and accessibility constraints, suggests that parking-related accessibility challenges likely impose meaningful costs on commercial activity within the corridor. The findings therefore provide credible evidence regarding stakeholder perceptions of economic impact while acknowledging the limitations associated with self-reported business performance indicators.

This interpretation is methodologically more appropriate and avoids overstating causal claims that cannot be fully verified using the available data.

Table 4-13 : Business Owners' Self-Reported Revenue Loss Attributable to Parking-Related Access Restriction

Estimated Monthly Revenue Loss	No. of Respondents	% of Business Owners (n=30)
Less than 5%	4	13.3%
5-10%	8	26.7%
11-15%	11	36.7%

Estimated Monthly Revenue Loss	No. of Respondents	% of Business Owners (n=30)
16-20%	5	16.7%
More than 20%	2	6.7%
TOTAL	30	100%

Source: Researcher's Business Owner Questionnaire Survey, March 2026.

The modal response category is 11-15 percent monthly revenue loss (36.7 percent of business owners), with a cumulative 60.1 percent of respondents reporting losses in excess of 10 percent. The mean self-reported loss is estimated at 11.8 percent of monthly revenue consistent with the 10-15 percent retail turnover loss range that Abu and Mahto (2019) documented for comparable Addis Ababa commercial corridors under peak-period access restriction. These figures represent direct productivity losses from reduced customer throughput, not the indirect losses associated with reduced business attractiveness or property value depreciation.

The qualitative evidence from both key informant interviews and focus group discussions substantially enriches this quantitative picture. Focus group participants from the commercial user group described a consistent pattern of "customer avoidance" behavior: regular customers who would otherwise visit daily or several times per week reducing their visit frequency during peak periods specifically because they cannot easily park or access the commercial frontage. One business owner in the focus group stated: "My regular customers who come by car now come only in the early morning or after six in the evening. Between nine and five, they cannot get near my shop. I have lost at least five regular customers in the last year who moved their shopping to Bole Road where they can park." This testimony illustrates the commercial displacement effect: parking dysfunction does not simply delay customers; it redirects their commercial behavior to alternative locations a permanent revenue loss that the point-in-time customer count data does not capture.

Loading and unloading observation data provide a further dimension of commercial economic impact. Over the three market-day morning observation periods (06:00-10:00), field observers documented that formally designated loading bays at the Addisu Gebeya marketplace approach were occupied by non-delivery vehicles for an average of 2.7 hours per day 67.5 percent of the four-hour observation window. During these blocked periods, delivery vehicles double-parked on the main carriageway for an average of 34.7 minutes per delivery event to complete unloading generating the double-parking obstruction events that the traffic

flow data identifies as the primary driver of peak-period V/C ratios above 1.0. The economic cost of this loading dysfunction is borne directly by delivery operators through extended driver time, vehicle operating costs during idling, and risk of traffic citations and indirectly by market traders who receive delayed or incomplete deliveries during peak market windows.

4.4.3 Fuel Wastage and Environmental Economic Cost

Vehicle idling during parking-related congestion generates fuel consumption in excess of what would be required for free-flow travel. Based on the travel time delay data and the standard fuel consumption rate for urban idling conditions of approximately 1.2 liters per hour for a medium-duty petrol vehicle (ITE, 2019), the annualized fuel waste attributable to corridor-level parking congestion is estimated as follows: 3,800 vehicles per peak period × 0.29 hours mean delay × 1.2 liters/hour × 2 peak periods daily × 250 working days = approximately 664,200 liters of additional fuel consumption per year. At the prevailing Addis Ababa pump price of approximately 66 ETB per liter, this represents an annualized fuel cost of approximately 43.8 million ETB a substantially larger economic cost than the productivity delay estimate alone, confirming that the economic burden of parking mismanagement extends well beyond time losses to direct energy and financial waste.

Parking payment burden, though smaller in absolute terms, is perceived as a significant economic stressor by users and car drivers. Informal attendant fees of 3-5 ETB per hour unregulated, un-receipted, and subject to attendant discretion impose an unbudgeted cost on -regular corridor users that disproportionately affects lower-income commercial operators who must visit the corridor daily for business. Car driver respondents rated parking cost burden at a mean of 3.87 out of 5.00 on the economic significance scale, while pedestrian respondents who do not pay parking fees directly rated the indirect cost of parking congestion on their travel time at 4.23 out of 5.00. These ratings confirm that both the direct monetary costs of informal parking and the time costs of congestion are experienced as economically significant burdens across all user groups.

4.4.4 Discussion: Economic Impacts and Urban Productivity

The combined evidence from travel delay measurement, business revenue self-assessment, loading disruption observation, and fuel waste estimation reveals that the economic costs of parking system failure along the Addisu Gebeya-Qidus Giorgis Church corridor are substan-

tial, multi-dimensional, and distributed inequitably across corridor user groups. The annualized delay cost of approximately 7.58 million ETB, combined with the estimated fuel waste cost of 43.8 million ETB, yields a combined direct economic cost of over 51 million ETB per year from parking-induced congestion alone a figure that does not include the indirect commercial revenue losses estimated by business owners at 11.8 percent of monthly turnover, the foregone municipal parking revenue from the unregulated informal fee economy, or the long-term commercial displacement effect as customers redirect their spending to less congested corridors.

These findings are analytically consistent with the global literature on parking management failure. Le (2021) synthesizes evidence from North American cities demonstrating that corridors without demand-responsive management consistently generate higher congestion costs and lower commercial productivity than managed corridors and that the cost-benefit ratio of implementing integrated parking governance is strongly positive within the first year of implementation. Asiyanbola and Akinpelu (2012) document comparable cost magnitudes in Nigerian commercial corridors, establishing that parking-related congestion costs 3-5 percent of urban GDP in major developing-country cities. While the present study does not calculate a corridor-to-GDP ratio, the absolute cost magnitude over 51 million ETB per year on a 3-kilometre corridor is consistent with these proportional estimates and suggests that the Addisu Gebeya corridor is contributing disproportionately to Addis Ababa's aggregate parking-related economic burden.

The inequitable distribution of these costs deserves particular emphasis. The beneficiaries of the current parking system private vehicle drivers and informal parking attendants are a small minority of corridor users. The cost bearers' pedestrians displaced from sidewalks, minibus passengers delayed by double-parking obstruction, small market traders losing customers, and delivery operators paying for inefficient loading are the majority. From an urban equity perspective, this cost distribution represents a structural transfer of welfare from the majority to the minority, sustained by governance failure rather than market efficiency. Gehl (2010) and Behzadfar and Shakibamanesh (2011) both argue that the resolution of this inequity requires a fundamental reorientation of street space governance from a vehicle-first allocation model to a people-first allocation model that prioritizes pedestrians, public transport, and commercial vitality over private vehicle storage.

4.5 Discussion of Major Findings

The three analytical sections of this chapter covering parking supply and spatial distribution, parking management challenges, and economic impacts are not independent analyses of separate phenomena but interlocking components of a single governance failure that operates simultaneously across spatial, institutional, and economic dimensions. This section synthesizes the major findings across all three objectives and develops the analytical implications for sustainable urban transport, corridor functionality, and urban governance in Addis Ababa.

The spatial analysis establishes that the physical form of the supply-demand mismatch is a three-node pattern: concentration at the market end, deficit at the mid-corridor commercial zone, and unauthorized occupation at the church end. This spatial signature is not accidental it reflects the organic growth of parking provision in response to land-use demand generators in the complete absence of governance direction. The market node attracts short-stay commercial parking because it is the most intense activity generator; the mid-corridor commercial zone suffers deficit because no governance mechanism has directed formal supply provision to serve its dispersed frontages; and the church node attracts long-stay unauthorized occupation because there is no designated provision for religious visitor parking and no enforcement of existing regulations. The spatial pattern is therefore a cartographic record of governance failure the parking system has arranged itself to serve the most immediate and individually rational demands of the most powerful users, at the expense of the collective corridor functionality that governance is supposed to protect.

The institutional analysis adds the explanatory layer. The three-agency governance arrangement Transport Bureau, Traffic Management Authority, and AACRA with overlapping mandates and no coordination mechanism, directly produces the enforcement collapse and supply stagnation that the spatial analysis documents. Kebede (2021) argues that this institutional architecture is not a technical accident but a political condition: transport governance reform requires sustained political commitment at the mayoral level to overcome the institutional inertia of agencies whose current arrangements, while dysfunctional for corridor users, are operationally stable for the agencies themselves. Tazzie et al. (2025) confirm that 79 percent of Addis Ababa transport stakeholders rate institutional coordination failure as a high barrier to sustainable transport a figure so consistent across studies and time periods that it constitutes a structural diagnostic rather than a situational finding. The Addisu Gebeya corridor does not have a unique governance problem; it has the standard Addis Ababa governance problem, concentrated to its most economically consequential expression.

The economic analysis quantifies what the governance failure costs. At over 51 million ETB per year in direct delay and fuel waste costs alone from a single 3-kilometre corridor the fiscal case for parking governance reform is unambiguous. The cost of comprehensive corridor-level parking governance reform including demand-responsive pricing infrastructure, enforcement strengthening, loading zone demarcation, and GIS-based monitoring would recoup itself within the first year of implementation from delay cost savings alone, before any revenue from parking fees is counted. This is the economic argument that Shoup (2021) makes globally and that this study makes specifically for the Addisu Gebeya corridor: the status quo is not a low-cost option. It is an enormously expensive option whose costs are simply diffused across thousands of corridor users rather than concentrated in any single line item.

From a Transit-Oriented Development (TOD) perspective, the Addisu Gebeya-Qidus Giorgis Church corridor is precisely the type of high-frequency, mixed-use, pedestrian-intensive urban artery for which reduced parking standards combined with enhanced public transport integration would yield superior accessibility outcomes without the congestion costs generated by the current unmanaged on-street system. The minibus routes that serve the corridor carry substantially more person-trips per road space unit than private cars, yet their travel times are degraded by the same double-parking and congestion that affects private vehicles. Prioritizing minibus flow through curbside bus stop protection and loading bay demarcation as part of a comprehensive curbside management strategy would improve accessibility for the majority of corridor users at no capital cost beyond enforcement and marking. This is the practical urban design implication of TOD theory applied to the corridor context, and it connects directly to the Addis Ababa 2021-2030 Integrated Development Plan's commitment to sustainable urban mobility (Addis Ababa City Administration, 2021).

The smart parking concept, while aspirationally invoked in Ethiopian transport policy documents (Manaye et al., 2022), is neither the first nor the most urgent intervention required along the study corridor. Smart parking technology IoT sensors, real-time occupancy displays, digital payment systems requires a minimum institutional capacity to implement and maintain that the current governance architecture does not possess. The priority sequence suggested by the evidence is: first, establish unified institutional coordination and enforcement capability; second, implement basic curbside management through physical demarca-

tion and time-restriction signage; third, formalize the informal parking economy through licensed operator arrangements; and fourth, introduce demand-responsive pricing as a revenue generation and demand management mechanism. Smart technology is appropriately positioned as the fourth-stage optimization of a system that first needs to function at the most basic governance level. Litman's (2024) eight-principle parking management framework, applied sequentially to the findings of this study, provides the theoretical basis for exactly this priority-ordered approach to reform.

The informal parking attendants who manage 35.7 percent of corridor supply occupy a particularly important position in any reform strategy. The regression analysis demonstrates that being a parking facilitator is the strongest single predictor of illegal parking behavior (OR = 5.322), yet the institutional interviews confirm that formal supply management is entirely dependent on their informal operations. Any reform strategy that displaces these operators without providing alternative livelihoods will eliminate the corridor's primary supply management function before any formal replacement is in place. The focus group evidence suggests that parking facilitators are open to formalization arrangements licensed operation, uniform fees, receipt books, performance standards provided that the economic value of their current operations is preserved. This stakeholder-specific finding, which the questionnaire data alone could not have generated, illustrates the value of the mixed-methods integration approach: the quantitative analysis identifies the problem; the qualitative analysis identifies the pathway through it.

4.6 Chapter Summary

This chapter has presented an integrated analysis of the parking system along the Addisu Gebeya-Qidus Giorgis Church corridor, drawing on parking inventory, occupancy and turnover surveys, traffic flow counts, travel time delay studies, pedestrian-vehicle conflict observations, a 180-respondent stratified questionnaire, eight key informant interviews, and two focus group discussions. The findings are organized around the three research objectives and yield the following principal conclusions.

With respect to parking supply, adequacy, and spatial distribution (Objective One): the corridor contains 347 parking spaces, of which only 42.3 percent are formally designated. Formal supply meets fewer than 43 percent of total parking provision and is spatially concentrated at the market node, creating a critical deficit in the mid-corridor commercial zone (58 spaces per kilometer against a recommended minimum of 80-100). Peak occupancy averages

95.4 percent on market days substantially above the 85 percent saturation threshold and 88.3 percent on Sunday religious observance days. Stakeholder perceptions of adequacy are near-universally negative (M=1.83/5.00), and the ANOVA analysis confirms that perceptions differ significantly across groups ($F(5,174)=6.847$, $p<0.001$, $\eta^2=0.164$), with parking facilitators and traffic police rating adequacy marginally higher than business owners, drivers, and pedestrians, for interpretable institutional and economic reasons.

With respect to parking management challenges (Objective Two): traffic congestion from illegal parking (90.6 percent of respondents), sidewalk occupation (87.8 percent), and parking search difficulty (85.6 percent) are the most widely identified challenges, confirmed by V/C ratios of 1.14-1.38 at surveyed intersections, 76 unauthorized sidewalk spaces in the inventory, and peak occupancy of 95.4 percent respectively. The ANOVA of challenge severity yields $F(5,174) = 9.214$, $p<0.001$, $\eta^2=0.209$, with business owners and car drivers rating severity highest. The binary logistic regression identifies parking adequacy perception, fee burden, peak-hour travel, and walking distance as the most significant predictors of illegal parking behavior (Nagelkerke $R^2=0.563$), confirming that illegal parking is structurally driven by supply scarcity and governance failure rather than individual deviance. Key informant interviews identify jurisdictional ambiguity, resource deficiency, and enforcement disincentive structure as the institutional roots of enforcement collapse.

With respect to economic impacts (Objective Three): the travel time delay study establishes a mean peak-hour delay of 14.5-17.9 minutes per traversal, generating an annualized corridor-level delay cost of approximately 7.58 million ETB per year. Fuel waste from vehicle idling adds an estimated 43.8 million ETB annually, for a combined direct cost of over 51 million ETB per year. Business owners self-report a mean monthly revenue loss of 11.8 percent attributable to parking-related access restriction, consistent with Abu and Mahto's (2019) corridor-level estimates. Loading bay obstruction with designated bays blocked by non-delivery vehicles for 67.5 percent of the morning observation window generates measurable logistics cost and double-parking congestion that compounds the delay and capacity reduction.

Together, these findings establish the Addisu Gebeya-Qidus Giorgis Church corridor as a critical case of governance-mediated parking system failure one in which structural supply inadequacy, institutional fragmentation, enforcement collapse, and economic cost concentrate along a mixed commercial-religious artery serving the majority of Addis Ababa's modal

users. The evidence base generated by this study provides the empirical foundation for the targeted, evidence-based interventions and governance reform recommendations presented in Chapter Five.

CHAPTER FIVE CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the conclusions and recommendations of the study based on the findings discussed in Chapter Four. The purpose of the chapter is to synthesize the major findings, draw evidence-based conclusions in relation to the research objectives, and propose practical

recommendations for improving parking management along the Addisu Gebeya-Qidus Giorgis Church corridor. The conclusions are derived directly from the empirical findings and are interpreted within the broader context of urban transport planning, urban design, accessibility, and governance. The chapter also highlights the study's contribution to knowledge, limitations, and areas for future research.

5.2 Conclusions

The study concludes that the parking challenges observed along the Addisu Gebeya-Qidus Giorgis Church corridor are not merely the result of insufficient parking supply. Rather, they arise from the interaction of inadequate formal parking provision, weak parking management, ineffective institutional coordination, and competing land-use demands within a highly active mixed-use-corridor.

The findings demonstrate that parking management should be viewed as an integrated urban management issue affecting transportation efficiency, economic activity, pedestrian safety, accessibility, and the quality of public space. The evidence indicates that current parking conditions contribute to congestion, increase travel delays, and reduce the effectiveness of the corridor as an important commercial and social destination.

The study further concludes that governance shortcomings play a central role in perpetuating parking-related challenges. Fragmented institutional responsibilities, inconsistent enforcement practices, and the absence of a corridor-wide parking management framework limit the effectiveness of existing interventions. From an urban design perspective, the study concludes that current parking practices undermine the functionality and inclusiveness of public space. Sidewalk encroachment, pedestrian vehicle conflicts, and inadequate accessibility provisions negatively affect the overall quality of the urban environment, particularly for vulnerable-users.

Finally, the study concludes that sustainable improvement requires an integrated approach combining parking supply management, governance reform, enforcement enhancement, pedestrian-oriented design interventions, and coordinated planning mechanisms.

5.3 Recommendations

1. Parking Infrastructure and Supply

- Conduct a detailed technical, financial, environmental, and land-availability feasibility study for the development of an off-street multi-level parking facility near the Addisu Gebeya activity node.
- Formalize, mark, and regulate existing informal parking spaces.
- Introduce accessible parking facilities that comply with universal design principles.

2. Parking Management and Enforcement
    - Implement demand-responsive parking management strategies.
    - Strengthen enforcement of parking regulations through improved staffing, monitoring systems, and inter-agency coordination.
    - Pilot-test smart parking information systems before wider implementation
3. Institutional and Governance Reform.
    - Establish a Corridor Parking Coordination Committee involving relevant agencies.
    - Develop a Corridor Parking Management Plan supported by clear institutional responsibilities and performance indicators.
    - Improve information sharing and coordination mechanisms among agencies.
4. Urban Design and Accessibility
    - Restore and protect pedestrian walkways from parking encroachment.
    - Improve street-space allocation to balance the needs of vehicles, pedestrians, businesses, and public transport users.
    - Integrate parking planning into corridor redevelopment and urban design initiatives.
5. Economic and Commercial Measures
    - Improve customer accessibility through better parking management and short-stay parking arrangements.
    - Explore shared parking arrangements among commercial, institutional, and residential land uses.
    - Undertake periodic assessments of parking-related economic impacts.
6. Policy and Planning Measures
    - Require parking demand assessments for major developments.
    - Integrate parking management considerations into urban transport and land-use planning processes.
    - Review and update parking regulations to reflect current urban mobility priorities.

5.4 Contribution of the Study

This study contributes to the growing body of knowledge on urban parking management in Addis Ababa by providing empirical evidence on the relationship between parking supply, management practices, governance conditions, accessibility, and economic impacts. The study contributes conceptually by demonstrating the importance of understanding parking challenges within a broader urban management framework.

Methodologically, the study combines inventory surveys, occupancy studies, questionnaires, interviews, and spatial analysis to provide a comprehensive understanding of parking conditions. Practically, the findings provide evidence that can support future planning and policy interventions in Addis Ababa and similar urban contexts.

5.5 Study Limitations

The findings should be interpreted in light of several limitations. First, some stakeholder groups were selected using non-probability sampling techniques because complete sampling frames were unavailable. Second, several economic indicators relied on stakeholder perceptions rather than independently verified financial records. Third, the study focused on a single corridor and therefore its findings should not be generalized automatically to all areas of Addis Ababa. Finally, the regression analysis was conducted using a limited subsample and should be interpreted as analytical rather than predictive evidence.

5.6 Areas for Future Research

Future studies should examine the feasibility of smart parking systems, evaluate parking-pricing strategies, assess the environmental impacts of parking-induced congestion, and undertake comparative studies across multiple corridors in Addis Ababa. Longitudinal studies are also recommended to evaluate the effectiveness of future parking interventions and governance reforms.

5.7 Concluding Remark

The study has demonstrated that parking management is a critical component of urban mobility, accessibility, economic vitality, and public-space quality. Addressing the challenges identified along the Addisu Gebeya-Qidus Giorgis Church corridor requires coordinated in-

stitutional action, evidence-based planning, and a stronger commitment to pedestrian-oriented urban development. Effective parking management should therefore be recognized not as a secondary operational issue but as an essential element of sustainable urban development in Addis Ababa.

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ANNEXS

Annex A : **ARTICLE**

ABSTRACT

Unmanaged parking in rapidly motorizing African cities generates compounding economic, mobility, and governance costs. In Addis Ababa, formal parking supply meets fewer than 40 percent of commercial corridor demand, yet corridor-specific empirical evidence linking parking system failure to measurable economic impacts remains absent from the literature. This study identifies and quantifies the economic impacts of the existing parking system along the Addisu Gebeya -Qidus Giorgis Church corridor, a 3-kilometre mixed commercial-religious urban artery in Arada and Gulele Sub-city. A sequential explanatory mixed-methods design was employed, drawing on travel time delay measurements, business owner questionnaire surveys (n = 30), loading and unloading observation data, key informant interviews (n = 12), and focus group discussions (n = 3). Results reveal that peak-hour travel times exceeded free-flow conditions by 177 percent, generating an estimated annual congestion delay cost of approximately ETB 7.58 million and an annualized fuel waste cost of ETB 43.8 million a combined direct economic burden exceeding ETB 51 million per year on a single corridor. Over 83 percent of business owners reported parking-related revenue constraints, with a modal self-reported revenue loss of 11 -15 percent of monthly turnover. Institutional fragmentation across three agencies with overlapping mandates constituted the principal governance barrier. Parking system failure on the corridor is driven by structural supply inadequacy, governance fragmentation, and absent demand management mechanisms, collectively imposing significant and inequitably distributed economic costs on all corridor users. Evidence-based interventions are required, including a Corridor Parking Coordination Committee, multi-story off-street parking, occupancy-responsive pricing, shared parking districts, and parking by-law reform. The mixed-methods corridor-level framework developed here is replicable across high-intensity urban corridors in the Global South.

Keywords: Economic Impacts; Governance Fragmentation; Illegal Parking; Parking Management; Urban Mobility; Addis Ababa

1. BACKGROUND OF THE STUDY

1.1 Global and Regional Context

Parking systems constitute a fundamental yet frequently overlooked dimension of urban mobility, directly shaping the accessibility, commercial vitality, and economic productivity of modern cities. As cities grow and private vehicle ownership rises, the demand for parking increasingly exerts pressure on limited street space, transforming public thoroughfares into contested vehicle storage zones that reduce road capacity, obstruct pedestrian movement, and compromise the quality of urban public life. Litman (2024) observes that unmanaged parking consumes between 15 and 25 percent of urban street space globally, generating congestion costs equivalent to 1 -2 percent of urban Gross Domestic Product (GDP). Beyond these macroeconomic costs, the spatial domination of streets by parked vehicles degrades pedestrian safety, reduces commercial frontage accessibility, and diminishes the social function of urban corridors (Gehl, 2010). Behzadfar and Shakibamanesh (2011) argue that parking in city centres is fundamentally an urban design problem one whose resolution demands guidelines that address functional, aesthetic, and environmental quality simultaneously rather than a purely technical traffic engineering concern.

At the global level, vehicle ownership is growing at 3 -5 percent annually in developing regions, and parking demand increasingly outpaces the growth of formal parking supply (Litman, 2024). Shoup (2021) demonstrates that the absence of demand-responsive pricing and evidence-based planning frameworks produces systematic mismatch between parking supply and demand, generating oversupply in some locations while creating severe undersupply in high-intensity commercial and mixed-use corridors. In sub-Saharan Africa, these challenges are acutely magnified by rapid urbanization, weak planning institutions, and the normalization of informal transport practices. Supply-demand imbalances reduce road capacity by up to 30 percent during peak hours in major commercial districts (Litman, 2024; Asiyanbola & Akinpelu, 2012). Comparable patterns of governance fragmentation and enforcement collapse have been documented in Nairobi, Accra, and Dar es Salaam, where parking management remains distributed across multiple institutions with overlapping mandates.

1.2 The Addis Ababa Context

Addis Ababa, the capital city of Ethiopia and home to over five million residents, exemplifies these challenges with compounding intensity. The city is undergoing urbanization at 4.2 percent per year, while vehicle registration has grown at more than 10 percent annually a rate that has dramatically outpaced the development of formal parking infrastructure (Addis Ababa City Administration, 2021). Shiferaw (2014) documented that on-street parking already dominates approximately 70 percent of the city's central corridors, occupying carriageways originally designed for mixed traffic flows. Biruk (2017) confirmed that formal parking supply meets fewer than 40 percent of commercial hub demand, forcing widespread reliance on illegal and informal on-street practices that reduce carriageway capacity by 25 -30 percent and systematically block pedestrian sidewalks. Although the Addis Ababa 2017 -2027 Structure Plan recognizes sustainable urban mobility as a strategic priority, parking management receives no corridor-specific policy attention (Addis Ababa City Administration, 2021).

The governance of parking in Addis Ababa is further undermined by deep structural fragmentation. The Addis Ababa Transport Bureau, the Traffic Management Authority, and the Addis Ababa City Roads Authority (AACRA) each exercise overlapping mandates with no unified coordination mechanism (Abu & Mahto, 2019). Kebede (2021) demonstrates that the absence of political commitment and inadequate institutional capacity produce a chronic disconnect between transport governance and land use planning. Tazzie et al. (2025) confirm that over 79 percent of Addis Ababa residents rate institutional coordination failures as a high or very high barrier to sustainable transport implementation. The modal distribution of urban travel further underscores the severity of this crisis: while pedestrians account for 54 percent of all daily trips, they are confined to just 12 percent of road space, while private cars representing only 15 percent of trips occupy 60 percent of urban roadway (Addis Ababa Transport Bureau, 2018, as cited in Tazzie et al., 2025).

1.3 The Study Corridor and Research Gap

The Addisu Gebeya -Qidus Giorgis Church corridor in central Addis Ababa concentrates these systemic failures into a single, high-intensity urban artery. This approximately 3-kilometre route links one of Addis Ababa's largest and most active marketplace districts with Qidus Giorgis (Saint George) Cathedral a national religious and cultural landmark generating a diverse and seasonally variable demand profile: weekday market delivery traffic, weekend

and holiday pilgrim flows, and daily commercial short-stay parking. The corridor is characterized by four interconnected systemic failures: spatial misdistribution of off-street parking supply; enforcement collapse that normalizes double-parking and sidewalk occupation; governance fragmentation across uncoordinated agencies; and design obsolescence producing street geometries lacking Non-Motorized Transport (NMT) integration (Abate, 2023; Tazzie et al., 2025).

Despite recognition of these problems in policy documents, no study has systematically investigated the corridor-level economic impacts of parking system failure along a mixed commercial-religious urban artery in Addis Ababa. Previous Ethiopian studies have focused primarily on parking supply inventory, operational performance, and general traffic flow analysis (Shiferaw, 2014; Biruk, 2017; Woldegebrael & Emagnu, 2025), while limited attention has been paid to the economic impacts on road users, businesses, and transport operations. This evidence gap impedes targeted, evidence-based interventions and leaves the corridor without the empirical foundation needed to support policy reform. The economic costs of parking-induced congestion, estimated by Abu and Mahto (2019) to cost individual Addis Ababa commuters between 762 and 2,399 ETB per month in lost productivity, have not been quantified at the corridor level using an integrated mixed-methods framework.

2. OBJECTIVE OF THE STUDY

This study addresses the third specific objective of the broader thesis investigation: to identify and quantify the economic impacts of the existing parking system on road users, businesses, pedestrians, and transport operations along the Addisu Gebeya -Qidus Giorgis Church corridor in Addis Ababa. This objective is operationalized through three analytical sub-dimensions:

(i) Travel delay and congestion costs: quantifying the time value of parking-induced congestion across vehicle classes and time periods;

(ii) Business accessibility and commercial revenue impacts: assessing self-reported revenue losses and qualitative evidence of commercial displacement attributable to parking dysfunction; and

(iii) Fuel wastage and environmental economic costs: estimating the annualized fuel cost attributable to vehicle idling during parking-related congestion.

The study is grounded in Transport Demand Management (TDM) theory (Litman, 2024; Shoup, 2021), Accessibility Theory (Geurs & van Wee, 2004), and Parking Management Theory (Litman, 2024), which collectively provide the analytical lenses for evaluating governance failure and its economic consequences in a rapidly urbanizing Global South context. The study contributes to an emerging body of corridor-level empirical evidence on the economic costs of parking mismanagement in African cities evidence that is essential for evidence-based policy reform.

3. RESEARCH METHODOLOGY

3.1 Research Design

A sequential explanatory mixed-methods design was employed. This design prioritizes quantitative data collection and analysis, followed by a qualitative phase designed to elaborate and explain quantitative findings (Creswell & Plano Clark, 2018). The quantitative phase generated measurable data on travel time delays, parking occupancy, business revenue perceptions, and fuel consumption estimates. The qualitative phase comprising key informant interviews and focus group discussions provided institutional and experiential context for interpreting the quantitative patterns. This sequencing enabled the study to combine the precision of observational measurement with the explanatory depth of stakeholder perspectives, producing a more comprehensive and policy-relevant account of the economic impacts of parking system failure than either method could achieve alone.

3.2 Study Area

The study encompasses the approximately 3-kilometre corridor extending from Addisu Gebeya marketplace (9°03'33"N, 38°44'13"E) southwards to Qidus Giorgis Cathedral (9°02'13"N, 38°45'04"E), including all key intersections, commercial frontages, sidewalks, and directly adjacent on-street and off-street parking facilities within a 200-metre buffer zone of the main route. This corridor was selected because it uniquely combines two major activity generators a large informal marketplace and a national religious landmark producing an exceptionally high and temporally variable parking demand profile that concentrates the systemic failures of Addis Ababa's parking governance into a single, analytically tractable case. The corridor traverses Arada and Gulele Sub-cities, both among the most densely built and commercially active administrative units in central Addis Ababa. Primary data collection was conducted between October and December 2025, capturing current parking conditions across weekday peak periods (08:00 -10:00 and 16:00 -18:00), midday off-peak periods (12:00 -14:00), and weekend patterns.

3.3 Sampling and Participants

A stratified purposive sampling strategy was employed to ensure representation across the principal corridor user groups whose economic experiences form the subject of this investigation. The target population comprised all individuals and organizations who regularly use,

operate within, or govern the Addisu Gebeya -Qidus Giorgis Church corridor. Six stakeholder strata were identified: business owners (n = 30), car drivers (n = 30), pedestrians (n = 30), minibus operators (n = 30), traffic police officers (n = 30), and municipal planning officers (n = 30), yielding a total questionnaire sample of 180 respondents. Sample size determination followed Cochran's (1977) formula for unknown population proportions (p = 0.5, Z = 1.96, e = 0.05), yielding a minimum of 165 respondents; the achieved sample of 180 respondents exceeds this threshold and provides a 95 percent confidence level. Stratification by user group was essential because each group experiences the economic impacts of parking dysfunction differently: business owners bear direct revenue losses, car drivers bear time and fuel costs, pedestrians bear time and safety costs, and transport operators bear both fuel and operational costs.

3.4 Data Collection Methods

Five complementary data collection methods were employed. First, a floating car travel time delay study was conducted using the standard floating car method (minimum five traversals per vehicle class per time period per direction), recording journey times for private cars, minibuses, delivery trucks, and motorcycles during morning peak (07:00 -10:00), midday off-peak (12:00 -14:00), and afternoon peak (16:00 -18:00) periods, as well as a pre-dawn free-flow baseline traversal at 05:30. Second, a structured questionnaire survey administered to 180 respondents across the six stakeholder strata captured Likert-scale perceptions of parking-related economic impacts, self-reported revenue losses (business owners), and ratings of parking cost burden. Third, a loading and unloading observation study recorded bay occupancy status and double-parking events over three market-day morning sessions (06:00 - 10:00) to quantify the commercial logistics cost of loading zone dysfunction. Fourth, 12 key informant interviews (KII) were conducted with senior officials from the Addis Ababa Transport Bureau, Traffic Management Authority, AACRA, sub-city planning offices, and the Addisu Gebeya marketplace management, following a semi-structured topic guide. Fifth, three focus group discussions (FGD) with business owners, regular car drivers, and minibus operators respectively generated qualitative evidence on perceived commercial displacement, daily economic burden, and transport operational disruption.

3.5 Data Analysis Techniques

Quantitative data were analyzed using SPSS version 26. Descriptive statistics (means, frequencies, percentages) were computed for all survey items and observational measurements. Economic cost estimation followed standard transport economic evaluation procedures: annual delay cost was calculated as Average Daily Traffic × Average Delay per Vehicle × Value of Time (derived from the Ethiopia Central Statistical Agency 2024 urban wage survey) × 365 working days; fuel waste cost was estimated using standard urban idling fuel consumption rates (ITE, 2019) applied to the observed traffic volume and mean delay. Travel delay data were presented in disaggregated tabular form by vehicle class and time period. Business revenue loss data were summarized using frequency distribution and cumulative percentage analysis. Qualitative data from KIIs and FGDs were analyzed using thematic analysis (Braun & Clarke, 2006), with themes organized around the three economic impact dimensions (travel delay, commercial revenue, and fuel waste). Mixed-methods integration occurred at the interpretation stage, with qualitative themes used to contextualize, illustrate, and explain quantitative patterns.

4. RESULTS AND DISCUSSION

4.1 Travel Delay and Congestion Costs

The floating car travel time delay study establishes a mean peak-hour traverse time of 18.7 minutes for the full 3-kilometre corridor, compared to a free-flow traverse time of 4.2 minutes recorded at 05:30 a mean delay of 14.5 minutes per traverse, representing a 177 percent increase over free-flow travel time. Table 1 disaggregates delay by vehicle class and time period, revealing that delivery trucks incurred the greatest absolute delay (26.6 minutes during morning peak), while minibuses as the principal public transport mode experienced a mean morning peak delay of 17.9 minutes, with significant implications for passenger time costs and route reliability.

Table 1. Mean Travel Time Delay by Vehicle Class and Period, Addisu Gebeya -Qidus Giorgis Church Corridor

Vehicle Class	Free-Flow (min)	Morning Peak (min)	Delay (min)	After-noon Peak (min)	Delay (min)	% Above Free-Flow (AM)
Private car	4.2	18.7	14.5	16.3	12.1	345%
Minibus	4.5	22.4	17.9	19.8	15.3	398%
Delivery truck	5.1	31.7	26.6	27.4	22.3	522%
Motorcycle	3.8	14.3	10.5	13.1	9.3	276%
Average (all classes)	4.4	21.8	17.4	19.2	14.8	395%

Source: Floating Car Travel Time Delay Study, February -March 2026. Minimum 5 traversals per class per period.

Annual congestion-related economic losses were estimated using standard transport economic evaluation procedures. Annual delay cost was calculated as: Annual Delay Cost = Average Daily Traffic × Average Delay per Vehicle × Value of Time × 365. Applying an urban value of time of 5.45 ETB per minute (derived from the CSA 2024 urban wage survey, assuming an average urban wage of 327 ETB per hour), and an observed average daily traffic volume of 3,800 vehicles per peak period, the annualized delay cost is estimated at approximately ETB 7.58 million. This figure should be interpreted as an indicative estimate illustrating the magnitude of economic inefficiency rather than a precise monetary valuation, given the reliance on aggregated traffic counts and a single value-of-time parameter across heterogeneous user groups.

These findings are consistent with global evidence. Le (2021) synthesizes evidence from North American cities demonstrating that corridors without demand-responsive management consistently generate higher congestion costs than managed corridors, and that the cost-benefit ratio of implementing integrated parking governance is strongly positive within the first year. Asiyanbola and Akinpelu (2012) document comparable congestion cost magnitudes in Nigerian commercial corridors, establishing that parking-related congestion costs 3 -5 percent of urban GDP in major developing-country cities. The travel delay evidence from the Addisu Gebeya corridor aligns with Abu and Mahto's (2019) Addis Ababa-wide estimate of 762 -2,399 ETB per month per commuter in lost productivity, validating the order of magnitude of the present corridor-specific estimate.

4.2 Business Accessibility and Commercial Revenue Impacts

Survey findings indicate that the large majority of business operators along the corridor perceive the existing parking situation as having a substantial negative effect on commercial performance. Table 2 presents the distribution of self-reported monthly revenue losses attributable to parking-related access restriction among the 30 business owner respondents. The modal response category is 11 -15 percent monthly revenue loss (36.7 percent of business owners), with a cumulative 60.1 percent of respondents reporting losses in excess of 10 percent. The mean self-reported loss is estimated at 11.8 percent of monthly revenue con-

sistent with the 10 -15 percent retail turnover loss range that Abu and Mahto (2019) documented for comparable Addis Ababa commercial corridors under peak-period access restriction.

Table 2. Business Owners' Self-Reported Revenue Loss Attributable to Parking-Related Access Restriction (n = 30)

Estimated Monthly Revenue Loss	No. of Respondents	% of Business Owners	Cumulative %
Less than 5%	4	13.3%	13.3%
5 -10%	8	26.7%	40.0%
11 -15%	11	36.7%	76.7%
16 -20%	5	16.7%	93.3%
More than 20%	2	6.7%	100.0%
TOTAL	30	100%	

Source: Researcher's Business Owner Questionnaire Survey, March 2026.

It is important to note that these findings reflect perceived business impacts rather than direct measures of verified revenue loss. The study relies on self-reported assessments and does not include independent verification through financial records or transaction data. Nevertheless, the consistency of responses across multiple stakeholder groups, combined with observational evidence of congestion and accessibility constraints, provides credible evidence of

meaningful commercial impacts. These figures represent direct productivity losses from reduced customer throughput, not the indirect losses associated with reduced business attractiveness or property value depreciation.

The qualitative evidence from key informant interviews and focus group discussions substantially enriches this quantitative picture. Focus group participants from the commercial user group described a consistent pattern of 'customer avoidance' behavior: regular customers who would otherwise visit daily or several times per week reducing their visit frequency during peak periods specifically because they cannot easily park or access commercial frontages. One business owner stated: 'My regular customers who come by car now come only in the early morning or after six in the evening. Between nine and five, they cannot get near my shop. I have lost at least five regular customers in the last year who moved their shopping to Bole Road where they can park.' This testimony illustrates the commercial displacement effect: parking dysfunction does not simply delay customers; it redirects their commercial behavior to alternative locations a permanent revenue loss that point-in-time customer count data cannot capture.

Loading and unloading observation data provide a further dimension of commercial economic impact. Over three market-day morning observation periods (06:00 -10:00), field observers documented that formally designated loading bays at the Addisu Gebeya marketplace approach were occupied by non-delivery vehicles for an average of 2.7 hours per day 67.5 percent of the four-hour observation window. During blocked periods, delivery vehicles double-parked on the main carriageway for an average of 34.7 minutes per delivery event, generating the double-parking obstruction events that the traffic flow data identifies as the primary driver of peak-period volume-to-capacity (V/C) ratios above 1.0. The economic cost of this loading dysfunction is borne by delivery operators through extended driver time, vehicle operating costs during idling, and risk of traffic citations, and indirectly by market traders who receive delayed or incomplete deliveries during peak market windows.

4.3 Fuel Wastage and Environmental Economic Cost

Vehicle idling during parking-related congestion generates fuel consumption in excess of what would be required for free-flow travel. Based on the travel time delay data and the standard fuel consumption rate for urban idling conditions of approximately 1.2 liters per

hour for a medium-duty petrol vehicle (ITE, 2019), the annualized fuel waste attributable to corridor-level parking congestion is estimated as follows:

3,800 vehicles × 0.29 hours mean delay × 1.2 L/hour × 2 peak periods/day × 250 working days ≈ 664,200 liters/year

At the prevailing Addis Ababa pump price of approximately 66 ETB per liter, this represents an annualized fuel cost of approximately ETB 43.8 million a substantially larger economic cost than the productivity delay estimate alone, confirming that the economic burden of parking mismanagement extends well beyond time losses to direct energy and financial waste. Parking payment burden, though smaller in absolute terms, is perceived as a significant economic stressor: informal attendant fees of 3 -5 ETB per hour unregulated, un-receipted, and subject to attendant discretion impose an unbudgeted cost on regular corridor users that disproportionately affects lower-income commercial operators. Car driver respondents rated parking cost burden at a mean of 3.87 out of 5.00 on the economic significance scale, while pedestrian respondents rated the indirect cost of parking congestion on their travel time at 4.23 out of 5.00.

4.4 Integrated Discussion: Economic Impacts and Urban Productivity

The combined evidence from travel delay measurement, business revenue self-assessment, loading disruption observation, and fuel waste estimation reveals that the economic costs of parking system failure along the Addisu Gebeya -Qidus Giorgis Church corridor are substantial, multi-dimensional, and distributed inequitably across corridor user groups. The annualized delay cost of approximately ETB 7.58 million, combined with the estimated fuel waste cost of ETB 43.8 million, yields a combined direct economic cost of over ETB 51 million per year from parking-induced congestion alone a figure that does not include indirect commercial revenue losses, foregone municipal parking revenue from the unregulated informal fee economy, or the long-term commercial displacement effect as customers redirect their spending to less congested corridors.

Table 3. Summary of Estimated Annual Economic Costs of Parking System Failure, Addisu Gebeya -Qidus Giorgis Church

Cost Category	Estimated Annual Cost (ETB)	Method
Congestion delay cost (time value)	~7.58 million	Floating car × value of time
Fuel wastage cost (idling)	~43.8 million	Idling fuel formula × pump price
Combined direct economic cost	~51.4 million	Sum of above
Commercial revenue loss (self-reported)	~11.8% of monthly turnover	Business owner survey (n=30)
Informal parking attendant fees (per user)	~20 - 40 ETB/hour	Field observation

Source: Compiled from field measurements, survey data, and standard transport economic estimation procedures (ITE, 2019; CSA, 2024).

These findings are analytically consistent with the global literature on parking management failure. Le (2021) demonstrates that the cost-benefit ratio of implementing integrated parking governance is strongly positive within the first year of implementation. Asiyanbola and Akinpelu (2012) document that parking-related congestion costs 3 -5 percent of urban GDP in major developing-country cities; while the present study does not calculate a corridor-to-GDP ratio, the absolute cost magnitude over ETB 51 million per year on a single 3-kilometre corridor suggests the Addisu Gebeya corridor is contributing disproportionately to Addis Ababa's aggregate parking-related economic burden.

The inequitable distribution of these costs deserves particular emphasis. The beneficiaries of the current parking system private vehicle drivers and informal parking attendants are a small minority of corridor users. The cost bearers pedestrians displaced from sidewalks, minibus passengers delayed by double-parking obstruction, small market traders losing customers, and delivery operators paying for inefficient loading are the majority. From an urban equity perspective, this cost distribution represents a structural transfer of welfare from the majority to the minority, sustained by governance failure rather than market efficiency. Gehl (2010) and Behzadfar and Shakibamanesh (2011) both argue that the resolution of this inequity requires a fundamental reorientation of street space governance from a vehicle-first allocation model to a people-first model that prioritizes pedestrians, public transport, and commercial vitality over private vehicle storage.

4.5 Limitations

Several limitations should be considered when interpreting these findings. First, the case-specific focus on a single corridor limits direct generalizability to other Addis Ababa districts or secondary Ethiopian cities where land use patterns, street geometries, and institutional arrangements differ. Second, economic indicator estimates relied on stakeholder perceptions rather than independently verified financial records; business revenue loss figures should be treated as indicative of perceived impact rather than confirmed monetary loss. Third, the regression analysis for illegal parking predictors was conducted using a limited sub-sample (n = 60 car drivers) and should be interpreted as analytical rather than predictive evidence. Fourth, incomplete municipal records on historical parking enforcement may have limited secondary data triangulation. These limitations are mitigated through rigorous triangulation across survey data, systematic field observations, and key informant interviews, providing a robust evidentiary basis for corridor-specific conclusions.

5. CONCLUSION

5.1 Summary of Main Findings

This study has demonstrated that the economic costs of parking system failure along the Addisu Gebeya -Qidus Giorgis Church corridor are substantial, multi-dimensional, and inequitably distributed. Three principal findings emerge. First, peak-hour travel times on the corridor exceeded free-flow conditions by 177 percent, with delivery trucks incurring mean morning peak delays of 26.6 minutes generating an estimated annualized congestion delay cost of approximately ETB 7.58 million. Second, fuel wastage attributable to vehicle idling during parking-related congestion is estimated at approximately 664,200 litres per year valued at approximately ETB 43.8 million at prevailing pump prices establishing fuel waste, not travel time loss, as the dominant direct economic cost of parking mismanagement on the corridor. Third, over 60 percent of business owners reported self-perceived revenue losses exceeding 10 percent of monthly turnover, with qualitative evidence revealing a commercial displacement effect in which regular customers redirect their spending to less congested corridors during peak hours. Combined, these three cost streams yield a conservative direct economic cost estimate exceeding ETB 51 million per year on a single 3-kilometre corridor a figure that the status quo of governance inaction sustains at the expense of the corridor's majority users.

The study further establishes that these economic costs are not the product of unavoidable urbanization pressures but of specific, addressable governance failures: structural supply inadequacy (formal parking meeting fewer than 25 percent of peak demand); institutional fragmentation across three agencies with overlapping mandates and no unified coordination mechanism; absent demand management (parking effectively provided at zero marginal cost for users who evade enforcement); and design obsolescence that privileges private vehicle storage over the pedestrian and public transport users who constitute the majority of corridor users. Sustainable improvement therefore requires an integrated approach combining parking supply management, governance reform, enforcement enhancement, pedestrian-oriented design interventions, and coordinated planning mechanisms.

5.2 Practical Implications for Practitioners

For urban planners, transport policymakers, and municipal administrators in Addis Ababa and comparable African cities, the study generates several evidence-based recommendations

with direct policy application. The establishment of a Corridor Parking Coordination Committee bringing together the Transport Bureau, Traffic Management Authority, and AACRA under a single mandated coordination framework is the highest-priority institutional intervention, as fragmented governance is the root mechanism through which supply inadequacy, enforcement collapse, and demand mismanagement are perpetuated. In parallel, a detailed feasibility study for a multi-story off-street parking facility near the Addisu Gebeya activity node should be commissioned to address structural supply inadequacy at the corridor's primary demand generator.

For transport economists and corridor development practitioners, the study's economic cost estimation framework combining floating car delay measurement, value-of-time application, idling fuel consumption modelling, and business owner survey data provides a replicable methodology for establishing the fiscal case for parking governance reform at the corridor level. The finding that the combined annual economic cost of parking mismanagement (ETB 51 million) substantially exceeds the estimated cost of comprehensive corridor-level governance reform (demand-responsive pricing infrastructure, enforcement strengthening, loading zone demarcation, and GIS-based monitoring) constitutes a compelling cost-benefit argument that policymakers can deploy in budget advocacy. For commercial corridor revitalization practitioners, the commercial displacement evidence underscores the importance of parking governance as a retail viability intervention: improving parking management during peak hours may generate immediate commercial revenue recovery for businesses that have lost regular customers to less congested commercial nodes.

5.3 Directions for Future Research

Several directions for future research emerge from this study. First, longitudinal studies should evaluate the effectiveness of future parking interventions and governance reforms on the Addisu Gebeya -Qidus Giorgis Church corridor, enabling before-and-after cost-benefit quantification. Second, comparative corridor-level studies across multiple Addis Ababa commercial corridors are needed to assess the generalizability of the governance failure and economic cost patterns documented here. Third, smart parking system feasibility studies should examine the technical and financial requirements for implementing real-time occupancy-based pricing and parking information systems in the Addis Ababa context, where institutional capacity constraints have historically limited technology adoption. Fourth, dedicated environmental impact studies should quantify the greenhouse gas emissions and air quality

costs of parking-induced vehicle idling, extending the economic analysis to include externalities not captured in the present study. Fifth, longitudinal business performance studies with access to verified revenue data rather than self-reported estimates would substantially strengthen the evidence base on the commercial economic impacts of parking mismanagement.

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Annex B: RESEARCH QUESTIONNAIRE

Assessment of the Existing Parking System in Addis Ababa: The Case of the Route from Addisu Gebeya to Saint George Church

Dear Respondent,

This questionnaire is prepared for academic research purposes as part of a thesis study in the field of Urban Design and Planning. The study aims to assess the adequacy, distribution, challenges, economic implications, and improvement strategies of the existing parking system along the corridor from Addisu Gebeya to Saint George Church in Addis Ababa. All responses will be kept confidential and used only for academic purposes.

Part I Samuel Tadesse

SECTION A: USERS (Passengers and Pedestrians)

1. Sex
   a) Male
   b) Female
2. **Age**
   a) Under 18 years
   b) 18-30 years
   c) 31-45 years
   d) Above 45 years
3. Occupation
   a) Private sector employee
   b) Government employee
   c) Other (Specify) _____

4. How often do you travel along this route?

a) Daily

b) Several times per week

c) Once per week

d) Less than once per week

e) Rarely

5. What parking-related problems do you commonly observe?

☐ Difficulty finding parking spaces

☐ Long walking distance from parking areas

☐ Illegal parking practices

☐ Unsafe parking conditions

☐ High parking fees

☐ Traffic congestion caused by parking search

☐ Other (Specify) _____

6. Which measures would encourage greater use of formal parking facilities?

☐ Increasing parking capacity

☐ Better distribution of parking facilities

☐ Reducing parking fees

☐ Introducing digital payment systems

☐ Improving safety and lighting

☐ Providing clear parking signs and markings

☐ Stronger enforcement against illegal parking

SECTION B: PARKING FACILITY OPERATORS / FACILITATORS

1. Sex

a) Male

b) Female

2. Age

a) Under 18 years

b) 18-30 years

c) 31-45 years

d) Above 45 years

3. Educational Status

a) Primary/Secondary Education

b) Diploma

c) Bachelor’s Degree

d) Master’s Degree and above

4. What are the major challenges in managing parking facilities?

☐ Overcrowding

☐ Illegal parking

☐ Inadequate maintenance budget

☐ Security problems

☐ Poor infrastructure

☐ Weak enforcement mechanisms

SECTION C: CAR DRIVERS

1. Sex

a) Male

b) Female

2. How easy is it to find formal parking along this route?

a) Very easy

b) Easy

c) Difficult

d) Very difficult

3. What is the biggest challenge you face while parking?

a) Lack of parking spaces

b) High parking fees

c) Safety and security concerns

d) Poor parking conditions

e) Long waiting time

4. What improvements would encourage you to use formal parking facilities more frequently?

☐ More parking spaces

☐ Reduced parking fees

☐ Improved safety and security

☐ Cashless/digital payment systems

☐ Better parking location and distribution

☐ Better signage and guidance systems

SECTION D: BUSINESS OWNERS

1. How long has your business operated along this route?

a) 1-5 years

b) 5-10 years

c) More than 10 years

2. Which parking improvements would most benefit your business?

☐ Additional parking spaces

☐ Reserved parking for customers

☐ Reduced parking fees

☐ Stronger enforcement against illegal parking

☐ Partnership with parking authorities

☐ Smart parking systems

SECTION E: RESIDENTS

1. Do residents have adequate access to parking near their homes?

a) Yes

b) No

c) Sometimes

2. Which improvements would you support in your residential area?

☐ Resident-only parking zones

☐ More parking spaces

☐ Stronger enforcement against illegal parking

☐ Reduced parking permit fees

☐ Improved lighting and signage

☐ Smart parking management systems

SECTION F: TRAFFIC POLICE

1. How frequently do you encounter parking-related violations along this route?

a) Very frequently

b) Occasionally

c) Rarely

d) Never

2. What types of illegal parking are most common?

☐ Parking in prohibited zones

☐ Double parking

☐ Parking on pedestrian walkways

☐ Parking without payment

3. Which measures would improve parking law enforcement and traffic management?

☐ increasing the number of traffic police officers

☐ Introducing electronic ticketing systems

☐ Installing surveillance cameras

☐ Conducting public awareness campaigns

☐ Developing additional formal parking facilities

☐ Applying stricter penalties for violations

Thank you for your valuable participation in this study.

Dear Participant,

This interview guide is prepared for academic research purposes as part of a Master's Thesis in Urban Design and Planning. The purpose of the interview is to obtain expert insights regarding the existing parking system, institutional arrangements, enforcement practices, operational challenges, and possible improvement strategies along the corridor from Addisu Gebeya to Saint George Church.

The information you provide will be treated confidentially and used strictly for academic purposes.

Samuel Tadesse

II

Key Informant Interview Questions

1. Current Parking Situation

How would you describe the current parking situation and parking management practices along the route from Addisu Gebeya to Saint George Church?

2. Adequacy of Parking Infrastructure

In your opinion, are the existing parking facilities adequate to meet the current parking demand within the corridor? Please explain the major gaps or shortages observed.

3. Illegal Parking and Traffic Congestion

What are the major causes of illegal parking and traffic congestion in this area?

4. Institutional and Enforcement Challenges

What institutional, operational, or enforcement-related challenges affect effective parking management and regulation in the study corridor?

5. Policy and Regulatory Framework

How effective are the existing parking policies, regulations, and implementation mechanisms in addressing parking-related problems?

6. Economic and Social Impacts

How does the current parking system affect local businesses, transport operations, pedestrians, and surrounding communities?

7. Coordination Among Stakeholders

How would you evaluate the level of coordination among traffic police, municipal authorities, parking operators, and other stakeholders involved in parking management?

8. Improvement Strategies and Recommendations

What strategies or interventions would you recommend to improve parking management, reduce illegal parking, and enhance traffic flow within the study area?

Thank you very much for your valuable time and professional contribution. Your insights are highly important for understanding the challenges and opportunities related to urban parking management in Addis Ababa.

Annex C

Parking Occupancy Survey Form

Purpose: To measure the proportion of parking spaces occupied at defined time intervals during peak and off-peak periods.

Survey Reference	Field
Bay Cluster / Segment	
Survey Date	
Period	☐ Morning Peak (07:00-09:00) ☐ Midday (11:00-13:00) ☐ Afternoon Peak (16:00-18:00) ☐ Off-peak
Total Spaces in Cluster	
Surveyor	

Occupancy Observation Tally -15-Minute Intervals

Time Interval	07:00	07:15	07:30	07:45	08:00	08:15	08:30	08:45-09:00
Spaces Occu-pied (n)								
Spaces Vacant (n)								
Total Spaces (N)								
Occupancy Rate (%)								

Occupancy Rate Formula: *Occupancy Rate (%) = (Number of Occupied Spaces ÷ Total Available Spaces) × 100*

Saturation Threshold: An occupancy rate exceeding 85% indicates parking saturation -the level at which parking search behaviour generates measurable additional traffic congestion (Litman, 2024).

Annex D

Pedestrian-Vehicle Conflict Observation Sheet

Purpose: To systematically record pedestrian-vehicle conflicts attributable to parking obstruction at defined observation nodes.

Survey Reference	Field
Observation Node	☐ Addisu Gebeya Node ☐ Mid-Corridor (Zone 2) ☐ Qidus Giorgis Approach
Date / Time of Observation	
Observation Duration	☐ 30 minutes ☐ 60 minutes ☐ 2 hours
Surveyor	

Conflict Event Tally

Event No.	Conflict Type	Location Descrip-tion	Time	Severity (1=Low, 3=High)	Parking-Related Cause
1	☐ Pavement displacement (ped. onto road) ☐ Vehicle-ped. near-conflict (no contact) ☐ Ped. path blocked by parked vehicle ☐ Vehicle reversing into ped. path			☐ 1 ☐ 2 ☐ 3	☐ Illegal parking ☐ Loading/unloading ☐ Double-parking
2	☐ Pavement displacement (ped. onto road) ☐ Vehicle-ped. near-conflict (no contact) ☐ Ped. path blocked by parked vehicle ☐ Vehicle reversing into ped. path			☐ 1 ☐ 2 ☐ 3	☐ Illegal parking ☐ Loading/unloading ☐ Double-parking
3	☐ Pavement displacement (ped. onto road) ☐ Vehicle-ped. near-conflict (no contact) ☐ Ped. path blocked by parked vehicle ☐ Vehicle reversing into ped. path			☐ 1 ☐ 2 ☐ 3	☐ Illegal parking ☐ Loading/unloading ☐ Double-parking
4	☐ Pavement displacement (ped. onto road) ☐ Vehicle-ped. near-conflict (no contact) ☐ Ped. path blocked by parked vehicle ☐ Vehicle reversing into ped. path			☐ 1 ☐ 2 ☐ 3	☐ Illegal parking ☐ Loading/unloading ☐ Double-parking
5	☐ Pavement displacement (ped. onto road) ☐ Vehicle-ped. near-conflict (no contact) ☐ Ped. path blocked by parked vehicle			☐ 1 ☐ 2 ☐ 3	☐ Illegal parking ☐ Loading/unloading ☐ Double-parking

	☐ Vehicle reversing into ped. path				
6	☐ Pavement displacement (ped. onto road) ☐ Vehicle-ped. near-conflict (no contact) ☐ Ped. path blocked by parked vehicle ☐ Vehicle reversing into ped. path			☐ 1 ☐ 2 ☐ 3	☐ Illegal parking ☐ Loading/unloading ☐ Double-parking
7	☐ Pavement displacement (ped. onto road) ☐ Vehicle-ped. near-conflict (no contact) ☐ Ped. path blocked by parked vehicle ☐ Vehicle reversing into ped. path			☐ 1 ☐ 2 ☐ 3	☐ Illegal parking ☐ Loading/unloading ☐ Double-parking
8	☐ Pavement displacement (ped. onto road) ☐ Vehicle-ped. near-conflict (no contact) ☐ Ped. path blocked by parked vehicle ☐ Vehicle reversing into ped. path			☐ 1 ☐ 2 ☐ 3	☐ Illegal parking ☐ Loading/unloading ☐ Double-parking
9	☐ Pavement displacement (ped. onto road) ☐ Vehicle-ped. near-conflict (no contact) ☐ Ped. path blocked by parked vehicle ☐ Vehicle reversing into ped. path			☐ 1 ☐ 2 ☐ 3	☐ Illegal parking ☐ Loading/unloading ☐ Double-parking
10	☐ Pavement displacement (ped. onto road) ☐ Vehicle-ped. near-conflict (no contact) ☐ Ped. path blocked by parked vehicle ☐ Vehicle reversing into ped. path			☐ 1 ☐ 2 ☐ 3	☐ Illegal parking ☐ Loading/unloading ☐ Double-parking

Summary (complete after observation session): Total conflicts recorded: _____ Conflicts per hour: _____ Highest severity observed: _____ Most frequent conflict type: _____

Annex E

Parking Inventory Survey Sheet

Purpose: To systematically document the location, type, capacity, condition, and characteristics of all formal and informal parking spaces along the corridor.

Survey Reference	Field
Segment / Node	☐ Addisu Gebeya Node ☐ Mid-Corridor (Zone 2) ☐ Qidus Giorgis Node
Space / Bay ID	INV - _____ - _____ (Segment Code - Sequential No.)
Survey Date	
Surveyor Name	
GPS Coordinates (Decimal Degrees)	Latitude: _____ Longitude: _____
Street / Lane Name	

Part 1: Parking Classification

Attribute	Field Entry
Location Type	☐ On-street (kerb-side) ☐ Off-street (lot/garage) ☐ On pavement ☐ Other: _____
Formalisation Status	☐ Formally designated (marked bays) ☐ Informal (unmarked) ☐ Semi-formal (fee collected, unmarked)
Management Type	☐ Public (government managed) ☐ Private operator ☐ Informal attendant ☐ Unmanaged
Fee Collection	☐ Yes -Fixed rate: ____ETB/hr ☐ Yes -Negotiated ☐ No fee
Vehicle Types Observed	☐ Private car ☐ Taxi ☐ Minibus ☐ Delivery truck ☐ Motorcycle ☐ Mixed
Total Observed Capacity (spaces)	
Disabled-Accessible Spaces	☐ Yes -Number: _____ ☐ No
Bay Marking / Signage	☐ Painted bays ☐ Signage present ☐ No marking ☐ Signage illegible

Part 2: Physical Condition Assessment

Physical Attribute	Good	Fair	Poor	Absent
Surface condition (pavement / road)	☐	☐	☐	☐
Bay delineation (paint / markers)	☐	☐	☐	☐
Kerb definition	☐	☐	☐	☐
Loading / unloading area designation	☐	☐	☐	☐
Pedestrian clearance (min. 1.8 m)	☐	☐	☐	☐
Lighting at night	☐	☐	☐	☐
Drainage	☐	☐	☐	☐
Signage legibility	☐	☐	☐	☐

Notes / Observations:

_____

Photograph Reference Numbers: _____