

Assessment of Transportation planning Challenges and opportunities for integrated
urban mobility In the case Adama city , Ethiopia



Yonas Getachew

A Thesis Submitted to Department of Architecture

College of Civil Engineering

Office of Graduate Studies

Adama Science and Technology University

June /2025

Adama / Ethiopia

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Adviser, DR Belay Zeleke (PHD)

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APPROVAL SHEET

I hereby declare that the proposal and recommendation offered by the proposal review committee are properly captured in the completed thesis/dissertation proposal entitled “Assessment of Transportation planning Challenges and opportunities for integrated urban mobility In case adama city” and developed by Yonas Getachew.

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DECLARATION

I hereby declare that this thesis proposal entitled " Assessment of Transportation planning Challenges and opportunities for integrated urban mobility In case adama city " is original work and has not been submitted elsewhere to any university for similar purpose. The references utilized here are correctly credited through proper citations.

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RECOMMENDATION

I, the Major advisor of this research proposal, certify that I have closely advised/guided/ the student in the preparation of this proposal and examined the draft thesis titled "Assessment of Transportation planning Challenges and opportunities for integrated urban mobility In case adama city" prepared under my supervision by Yonas Getachew. Therefore, I recommend the submission of the proposal to the department for further appraisal and review.

Dr. Belay Zeleke (PHD.)

Major Advisor/Supervisor

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Approval Page

I/we, the advisors of the thesis entitled Assessment of Transportation planning Challenges and opportunities for integrated urban mobility In case adama city ” and developed by Yonas Getachew hereby certify that the recommendation and suggestions made by the board of examiners are appropriately Incorporated into the final version of the thesis.

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We, the undersigned, members of the Board of Examiners of the thesis by Yonas Getachew have read and evaluated the thesis entitled “Assessment of Transportation planning Challenges and opportunities for integrated urban mobility In case adama city” and examined the candidate during open defense. This is, therefore, to certify that the thesis is accepted for partial fulfillment of the requirement of the degree of

Master of Science in **Urban Planning and Design**

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LIST OF ABBREVIATION AND ACRONYMY

Central Statistical Agency - CSA

Ethiopian Roads Authority - ERA

Ethiopian Transport Authority - ETA

World Health Organization - WHO

Mobility as a Service - MaaS,

Sustainable development goal- SDG

Chapter 1, Introduction

1.1 Background

1.1 Background and Context

Transportation planning is the core axis of urban mobility and, as such, has a fundamental role to play in the sustainable development of cities. The unprecedented growth of urban areas-where, by 2050, more than 68% of the world population will live (United Nations, 2018)-underscores the need for an efficient and inclusive transportation system capable of facing growing demands by bringing environmental and social impacts to a minimum. Public Transport Integrated urban mobility is one of the major strategies being thrown up in response, focusing on seamless connectivity within modes of transport.

(i) Globally

Public transport has been evolving as an answer to growing urbanization, climate change, and changing technologies. The debate also revolves around how car-centric urban development can be given a turn towards more sustainable and multimodal transportation systems. While there are developed nations that have done quite a lot in the path of promoting public transit, cycling, and walking, numerous cities in the rest of the world face major obstacles to adopting integrated and sustainable urban mobility solutions. The most debated topics relate to sustainability versus growth: whereas urban mobility policies increasingly emphasize the need to reduce the environmental impact of transport systems by increased public transport, electric vehicles, and cycling, on the other side stand economic growth and car ownership demands, which in many cases bring about further investment in road infrastructure and increased use of motor vehicles. This dichotomy creates a challenge in balancing the need for efficient, affordable transport options with the urgency of achieving sustainable cities. Cities such as Copenhagen and Amsterdam are often cited as examples of integrating green transportation solutions, while many other cities, especially in the global south, still give priority to roads and car-based infrastructure (Kenworthy, 2017).

This disparity is reflected in the huge difference in the debate between high-income, low-, and middle-income nations. High-income countries can afford to put finances and political will into shifting toward integrated, green, and multimodal transport modes, while most developing countries lack the infrastructure, financial capacity, and institutional frameworks necessary to make such a transition. In these regions, a lot of reliance is still placed on informal transport systems, which include minibuses, tuk-tuks, and shared taxis that are usually inefficient, unreliable, and pollute the environment (Pucher & Buehler, 2017). Further, lack of data and poor transport planning complicates the challenge of attaining sustainable mobility.

A reflection of this global gap can also be seen in transportation planning, from a technological point of view. It is while smart mobility solutions-for instance, electric vehicles, autonomous transport, and data-driven transport management systems-penetrate the markets in developed countries that these are innovations not often accessible in the developing world. This technological divide underlines uneven opportunities for cities to shift toward integrated urban mobility systems leveraging innovation for efficiency, sustainability, and inclusivity (Geels et al., 2017).

(ii) Regional

At the regional level, the discourse is mostly about the balance regarding the enhancement of public transportation and the ownership of private vehicles. In Adama, with little to no public transport services, most residents engage in informal arrangements that are not only ineffective but also increase traffic and air pollution. The lack of options that are sustainable transport, presents one fundamental flaw in the regional mobility plan (Yehualaeshet et al., 2015).

One other important gap is the lack of use of new technologies and data oriented mobility applications. Though smart mobility paradigms have become fashionable across the world, their application in Oromia and other regions is very low due to lack of funds as well as low level of technology. Hence, in other areas, it is a shortfall in regard to making transportation systems more effective and satisfactory to users.

An emerging issue is the horizontal disconnect in the planning between various levels of government on the one hand, and between regional and urban planning agencies on the other hand. Adama is in some ways an ethnical enclave in Australia owing to its location relative to Addis Ababa and Djibouti corridor but local transport systems are still lack of developed systems that can link commuters and freight with regional and urban areas. But to fill this gap requires some methodological holistic strategy which incorporates both the regional and urban planning strategies (Gebeyehu & Takano, 2007).

(iii) Nationally:

The course of transportation planning at the national level in Ethiopia mirrors overarching policies on economic development and regional integration. A related debate concerns how to strike a proper balance between investing in big infrastructure projects, such as the Addis Ababa–Djibouti railway, and investing in improvements to urban mobility in such cities as Adama. Although national priorities continue to stress infrastructure that can serve a facilitating role in economic corridors, urban centers face shortages in funding and policy interest in localized mobility solutions (UN-Habitat, 2014).

Another national gap in integration is the limited integration of multimodal transport systems. Lack of efficient linkages in Adama between rail, road, and informal transport systems costs the city its role as a transit hub, reflecting a broader challenge of fragmentation in planning and governance in developing unified and efficient transport networks at the national level.

This has, in addition, placed the Ethiopian economy at odds, which seriously hinders a shift toward sustainable mobility due to weak regulatory frameworks and very low technical capacity that enforces greening of transport initiatives. This makes a shift toward the adoption of electric vehicles, nonmotorized transport, or other environmentally friendly alternatives in cities such as Adama very slim.

1.2 Problem Statement.

A key gap in existing knowledge is the lack of comprehensive studies on integrated urban mobility systems within medium-sized African cities, such as Adama. Gebeyehu & Takano (2007) highlight the lack of coordinated transportation planning and the fragmented nature of public transport in Addis Ababa, which reflects similar issues in other Ethiopian cities. However, there is limited research that explores how these challenges can be addressed in medium-sized urban centers, especially in the context of Ethiopia's rapid urban growth. Yimer (2017) emphasizes the significant transportation deficiencies in Ethiopian cities, particularly the absence of a robust public transportation network and the over-reliance on informal transport modes. This gap in knowledge extends to the socio-economic and cultural factors influencing transportation choices, which are rarely studied in-depth within the Ethiopian context.

The absence of such studies addressing these gaps in the Ethiopian context limits the development of tailored transportation strategies that take into consideration the socio-economic, political, and infrastructural conditions characterizing cities like Adama. While much of the global discourse on sustainable urban mobility relates to large cities in developed countries, there is a clear research gap with regard to how smaller developing cities can actually implement integrated mobility systems that are context-specific and resource-sensitive. The localized research and knowledge gaps in urban mobility planning have resulted in inefficient transport systems that cannot meet the ever-increasing demand from the urban population.

This, in other words, means that the absence of current knowledge on integrated urban mobility planning in cities like Adama results in hindering the making of effective and contextually relevant policies and strategies. The present study attempts to fill this lacuna by focusing on the transport challenges and opportunities for integrated mobility in Adama and contributing to the larger knowledge base on sustainable urban mobility solutions for medium-sized cities in sub-Saharan Africa.

1.3 Research Objectives

This research will identify the transportation planning challenges and opportunity in Adama, Ethiopia, not covered by any previous studies on urban mobility in medium-sized cities in sub-Saharan Africa.

The specific objectives of this study are as follows:

- To identify and analyze the key transportation challenges in Adama
- To assess the role and limitations of informal transport modes in Adama
- To assess the potential for adopting innovative mobility solutions.
- To explore the opportunities for integrating different transportation modes to identify how such integration can enhance urban mobility, improve accessibility, and promote sustainable transportation practices.

1.4 Research Questions

The research on transportation planning challenges and opportunities for integrated urban mobility in Adama Ethiopia aims to address the main issues identified in the city urban mobility system as well as provide recommendations for improvement. The research questions have been developed as a scaffold for the research as follows:

- What are the Key Transportation Challenges Facing Adama?
- What are the role and limitations of informal transport modes in Adama
- What is the potential for adopting innovative mobility solutions?
- What are opportunities for integrating different transportation modes?

1.5 Significance of the Study

The study is significant because it answers the growing transport needs of Adama, Ethiopia a rapidly expanding urban town in its struggle to adapt to mounting mobility demands through old infrastructure and piece-meal planning approaches. The city experiences high traffic congestion, inadequate public transport, connectivity issues, and rising environmental concerns that are all contributing to the declining quality of life, economic productivity, and sustainability of urban growth. As Adama grows, such issues are bound to escalate unless timely, inclusive, and sustainable responses are implemented. By critically addressing the issues, the study makes a contribution towards a better understanding of the mobility's complex dynamics in Adama's urban environment. It identifies planning, governance, and infrastructure requirements in systems and defines the implications for economic efficiency, environmental sustainability, and social justice, including that for groups such as low-income residents, women, elderly, and disabled persons. It also considers areas where to engage informal transport modes, implement novel mobility solutions, and design multimodal connectivity. The research outputs are expected to guide the formulation of a responsive and inclusive urban mobility plan that is sensitive to local needs and global needs for sustainability. The study contributes to the scarce peer-reviewed literature on urban transport planning in secondary Ethiopian cities. Whereas the majority of research conducted has been concentrated in Addis Ababa, smaller cities such as Adama are also experiencing vast urban change but are underrepresented in policy and research discourse. The research, by using Adama as a point of focus, offers lessons applicable to other rapidly growing cities in Ethiopia and Sub-Saharan

Africa that are also experiencing similar urban mobility challenges. It forms the foundation of an area-based and locally specific urban transport planning strategy that is scalable and replicable in other emerging urban centers.

The research is significant for its potential to advise on local and national transport policy, promote sustainable urban development, enhance social justice, and advise the global debate on urban mobility in Africa. Employing an integrated and evidence-led approach, it aims to support the creation of more habitable, connected, and robust cities in Ethiopia and worldwide.

1.6, Scope of the Study

The study is within the scope of investigating the challenges and opportunities in transportation planning for integrated urban mobility in Adama city, Ethiopia i.e. unveil the main problems as well as provide roadmap to improve city transport system. The study is based on the urban Adama city, which is the case study to identify what challenges the big-sized cities face in Ethiopia on urban mobility. The research also deals with the economic-socio-ecological-organizational dimension of transportation planning, with particular emphasis on the effects of transportation systems on urban dwellers, businesses and nature.

1.6.1. Geographical Scope

1. Geographical Scope:

The study focuses on Adama, a medium-sized city in the Oromia regional state of Ethiopia. Adama is considered one of the fastest-growing cities in the country, playing a critical role within the regional economy. As such, the research activities will focus on transportation infrastructures and systems, and the mobility patterns within city limits; however, some necessary consideration of the broader Oromia region will be made where relevant in terms of regional connectivity and integration.

3. Thematic Scope:

The research addresses significant issues in urban transportation in Adama, including master transport issues like congestion, inadequate public transport, reliance on informal networks, safety issues, and environmental impacts. The research assesses transport infrastructure and available facilities, and coverage gaps and quality. The research also undertakes socioeconomic and cultural determinants of transport behaviors like income and public perception. It analyzes integrated mobility solutions by assessing the way in which various transport modes can work together effectively. The research also considers sustainability and innovation, including electric vehicles and intelligent systems, and analyzes the policy and institutional frameworks regulating urban mobility in Adama.

4. Limitations:

In conducting a study on Adama City, integration of transport modes in Ethiopia, there are various limitations that could arise, including:

Availability and Quality of Data: Lack of access to available sufficient and reliable data on modes of transportation, passenger trends, and population factors can restrict the validity of the study findings.

Infrastructure Constraints: Existing transport infrastructure will not support planned integration actions, and therefore, will not be possible to implement recommendations.

Financing: Unavailable transportation project budgets may constrain the ability to design and maintain integrated systems and thus proposed solutions will be infeasible.

Involvement of Stakeholders: Inability to engage all stakeholders (e.g., government, private sector, neighborhood residents) can lead to incomplete insights and exasperate consensus decision-making.

Cultural and Attitudinal Issues: Resistance to changing travel modes or resident choice may limit implementation of new integrated systems, requiring special education and outreach.

Political and Regulatory Obstacles: Political or regulatory shifts in priorities can have an effect on the implementation of integrated transport plans, leading to delay or alteration in plans.

1.7. Structure of the Thesis

The thesis is arranged to take a reader from the introduction to the end, which makes the chapters build on each other to give a coherent framework for the transportation planning challenges and opportunities in Adama, Ethiopia. St. The plan is as follows:

Chapter 1: Introduction

It gives a background-to-the-study, context and purpose of research for the topic in this chapter
Summary Text Offers a general overview of the research which decides you write all previous chapters and conduce too analyzing by place_Modernity Display all Argument provides as well phases a segment with key transportation issues that Adama have and hence aiding for an integrated urban mobility solution It also gives the research question and the purpose of study as well points of interest and importance of the project.

Chapter 2: Literature Review

This chapter offers an overview of the urban mobility literature and urban transportation planning, with a view to see global reviews and some case studies from cities with developing economies. Topics include urbanization transport infrastructure, sustainable mobility and an integrated transport systems. It will additionally delve into describes challenges and prospects of comparable cities in other Sub-Saharan Africa cities to give the story for Adama case study.

Chapter 3: Research Methodology

This chapter provides the description of the research design, approach and how data was collected and analysed. It describes the reasons for choosing Adama as a case study, and how data are collected (e.g., from surveys, interviews, etc.) as well the analysis techniques. It also details research ethics, with says that everything from data collection to processes of analysis is done openly in a responsible way.

Chapter 4: Results and Discussion

These chapters briefly describe results and Discursion of the study investigated the Transportation planning Challenges and opportunities for integrated urban mobility in Adama City, Ethiopia,

Chapter 5: Conclusions and Recommendations

Concluding chapter synthesizes the main outcomes of the study, outline the contributions to urban mobility planning in Adama and emphasizes importance of the policy implications. It will also offer directions for future research, identifying omissions or trends within transportation planning that need additional work.

.Chapter 6: Reference

This end of section gives all references of the thesis (ac, journals,bestsellers reports etc) that particularly contribute some parts of referencing up.

Chapter 7: Appendix

Will contain appendices (surveys and interviews guides raw data, other important information that supports the research)

This format establishes an organized and structured fashion of explaining the research results, characterizing the transportation problems and opportunity of Adama, as well as proposes actions for the improvement of its urban mobility system

2. Literature Review

2.1 Overview of Transportation Planning

Urban development involves a core of transportation planning that focuses on how transportation systems are designed, organized and provided to the mobility of people and goods. This is at the nexus of urban planning, engineering, economics and environmental sciences oriented to reconcile societal demands with sustainable use of resources.

Transportation Planning from its early days

For centuries, transportation planning first got its start during the era of the industrial revolution due to the necessity of building roads, cities and railways to support ever increasing demands for mobility caused by urbanization and industrialization.

The first planning period was leading road infrastructure to support economic activity, in particular building roads, railways and ports (Barnes 1971). Yet interest in transportation planning expanded to include land use, transportation environmental impacts and equity as cities grew and challenges of congestion and pollution emerged (Litman, 2021).

After a more systematic approach in the mid-20th century through the 4-step planning model (trip generation, trip distribution, mode choice and traffic assignment), this relied on quantitative models to plan infrastructure. But criticisms of their overly focused concern for vehicle mobility and the often neglect of social and environmental concerns in this movement led to development of more holistic and integrated approaches between the decades (Banister, 2008).

Key Objectives of Transportation Planning

Transportation planning aims to achieve the following objectives:

1. **Accessibility:** Ensuring that all individuals, including those in disadvantaged groups, have equitable access to essential services, employment, and leisure activities. Accessibility is increasingly viewed as a measure of a city's livability (Geurs & van Wee, 2004).
2. **Efficiency:** Maximizing the functionality of transportation networks to reduce travel times, costs, and energy consumption. Efficient systems contribute to economic productivity and competitiveness (Litman, 2021).
3. **Sustainability:** Reducing the environmental impact of transportation by promoting low-emission modes, such as public transit, cycling, and walking. This aligns with global commitments to mitigate climate change and urban air pollution (Banister, 2008).
4. **Integration:** Facilitating seamless connectivity between different modes of transportation (e.g., bus, rail, and walking) to enhance user convenience and reduce reliance on private vehicles (Cervero & Kockelman, 1997).
5. **Safety and Security:** Ensuring that transportation systems are safe from accidents and resilient to disruptions, such as natural disasters or security threats.

Transportation Planning in Urban Contexts

Urban transportation planning is central to accommodate the mobility required by expanding urban populations with some of the problems like congestion, pollution and land gendarism. Second, transportation systems are central to cities which in turn shape and are shaped by urban form.

Compact, transit-oriented developments promote public transit use and decrease auto dependency; sprawl creates more traffic and environmental destruction Ewing & Cervero 2010) impede control of land use in the long-run.

Urban Transport Planning in Developing Countries: The Case of Ethiopia planning urban transportation within developing countries (like Ethiopia) has special difficulties. This represents the rapid urbanization a real challenge for sustainable transport, with fiscal capacity also under pressure and informal sector remains dominant.

But, they need context-driven innovate approaches that are cognizant of the local barriers (Pojani & Stead, 2015).

2.2.Theoretical Literature Review

Theoretical and literature review elucidates typologies, models, and theories, which inform the research on transport planning and urban mobility integration. In this section, the above theoretical perspectives are discussed, including their implications toward the research study; thus it provides a theoretical foundation to analyze the challenges and opportunities associated with an integrated approach to urban mobility.

1. Systems Thinking and Urban Mobility

Systems thinking is a vital methodology for understanding urban mobility, as it views transportation networks as interconnected systems shaped by economic, political, social, environmental, and technological factors. It is grounded in key principles such as **interconnectedness**, which acknowledges that a change in one part of the transport system affects other parts (Checkland, 1999); **feedback loops**, which involve recognizing both reinforcing and balancing mechanisms within urban transport dynamics (Sterman, 2000); and a **holistic perspective**, which situates urban mobility within the broader context of the urban ecosystem (Bertalanffy, 1968).

Application: Systems thinking equips the designer with insight into interdependent modes of transport, land use, and policy frameworks, which should be considered when designing integrated transport solutions.

Application: Sustainable Development Theory provides very broad guidance for designing urban mobility systems that minimize environmental impacts while maximizing access and inclusivity.

2. Multi-Level Perspective (MLP) on Socio-Technical Transitions

The Multi-Level Perspective (MLP) methodology takes the transition to sustainable transport into account by examining three interconnected levels: the landscape level with broad societal trends like urbanization and climate change; the regime level as the dominant structures and practices in current transport systems; and the niche level as where new technologies such as electric vehicles and autonomous shuttles emerge (Geels, 2002). MLP helps in the understanding of how social transformation and technological innovation combine to facilitate movements towards sustainable and integrated urban mobility.

4. Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (TPB) is a psychological model of individual transport choice, based on three root determinants: attitudes towards the benefits and drawbacks of a mode of transport, subjective norms or social influence to make a choice, and perceived behavior control, reflecting an individual's self-confidence in using a particular mode (Ajzen, 1991). TPB can be used for designing interventions that achieve sustainable and integrated mobility through targeted measures to affect these root drivers of behavior.

5. Theories of Accessibility and Justice

Theories of accessibility highlight an individual's ability to reach areas and generally define transportation in social and economic inclusion terms. For example, Hansen's Accessibility Theory (1959) conceptualizes accessibility as proximity to opportunities, while social equity models (Lucas, 2012) focus on compensating for variations in access to transport across socioeconomic groups. These theories guide planning mobility systems toward focusing on equity and inclusion in urban transport planning.

6. Theory of Collaborative Governance

Participative governance emphasizes engaging government institutions, private interest groups, and territorial communities in transportation planning (Ansell & Gash, 2008). Central to it is inclusiveness through stakeholder plurality, collective decision making through accommodation and compromise, and transparency and accountability through clearly established description of responsibilities and roles. Partnerships in implementing integrative participatory urban transport development are theory-driven.

7. The Example of Innovation Diffusion Theory

Rogers' theory of Diffusion of Innovations (2003) describes the diffusion of new ideas and technologies, such as smart ticketing systems and driverless vehicles, in society. Key drivers are innovators and early adopters that initiate take-up, diffusion rate influenced by perceived usefulness, compatibility, and simplicity, and the role played by social networks in transmitting innovations. Applied to urban mobility, the theory helps predict how new technologies will be adopted in multi-modal transport systems.

2.3. Conceptual Literature Review

This conceptual literature review integrates foundational theories, frameworks, concepts in integrated urban mobility, and transportation planning. It reviews existing studies, identifies critical gaps, and sets the agenda for research.

1. Transportation Planning and Urban Mobility

Transport planning involves creating systems that enable effective, fair, and sustainable movement of humans and commodities. Mobility underlines urbanization through provision of access to opportunities and services by transport systems, with accessibility being a key measure of success. These main concepts are multi-modal transport (Litman, 2021), which promotes coordination across various modes of transport; sustainable urban mobility, via low-emission zones and green infrastructure mechanisms (Banister, 2008); and accessibility and equity, which emphasize overcoming barriers for marginalized groups through inclusive design (Lucas, 2012). Facilitating structures include physical integration through infrastructure connecting different modes of transport (Curtis & Scheurer, 2010), operational integration such as joint ticketing and coordinated timetables (Zhang et al., 2018), and policy integration, offering regulatory consistency across stakeholders (Hull, 2008).

3. Challenges in Integrated Urban Mobility

Literature identifies several key impediments to integrated urban mobility. Fragmentation of policy arises from divergence in objectives between regional and local authorities (Marsden & Reardon, 2017), while technological differences hinder progress through under-exploitation of digital technology for real-time data transfer (Geels, 2012). Budget constraints represent another key challenge, with inadequate funding for huge integration projects (Medda, 2012). Furthermore, social resistance like behavioral inertia and resistance to changed transport behavior further impedes integration processes (Anable, 2005).

4. Opportunities for Integrated Urban Mobility

New urban mobility opportunities highlight promising trends in technology and planning. Intelligent technologies like AI, IoT, and big data offer greater system efficiency and real-time responsiveness (Benevolo et al., 2016). Green mobility strategies such as electric vehicles and better cycling infrastructure favor environmentally friendly transport choices (Sperling & Gordon, 2009). In addition, collaborative models—specifically public-private partnerships—present effective means of propelling infrastructure development and integrated planning (Hodge et al., 2018).

5. Relevant Theoretical Frameworks

There are many theoretical bases for mobility and transportation planning studies. Systems Thinking views transport as an interdependent, dynamic system influenced by numerous variables (Checkland, 1999). Sustainable Development Theory emphasizes balancing mobility with environmental and social goals in the long term (WCED, 1987). Behavioral Theories, such as the Theory of Planned Behavior, account for transport choices at the individual level by taking

into account attitudes, social norms, and perceived control (Ajzen, 1991). Combined, these frameworks provide an extensive basis for the analysis and optimization of urban mobility.

6. Gaps in the Existing Literature

Despite immense advancements in transportation planning research, there still remain some critical gaps. Fair access in well-integrated systems is less emphasized for marginalized communities (Lucas, 2012). The majority of the studies fail to account for context-sensitive issues of developing countries and therefore the findings prove to be of poor applicability (Cervero, 2013). In addition, the field lacks uniform metrics to compare the performance of urban mobility integration (Litman, 2021), and the long-term impacts of new technologies on urban mobility systems remain underresearched (Geels, 2012).

2.4. Empirical Literature Review

An empirical literature review evaluates existing research and evidence-based studies about the transport planning and the integrated urban mobility challenges and opportunities. It delineates important methodologies, findings, and gaps that justify the idea of research being proposed.

1. Multi-Modal Transportation Systems

Empirical studies on multi-modal transportation systems analyze how different transport modes can be integrated into a single system and the realization of goals on improved connectivity and efficiency.

➤ Study by Zhang et al. (2018):

- Focus: The study investigated shared autonomous vehicle (SAV)-based shuttle services.
- Methodology: Simulation-based modeling of dynamic routing and scheduling.
- Findings: Evidence shows that travel time and operational costs for using SAVs will be significantly reduced through their integration with public transit systems.
- Gap: Current literature lacks user acceptance and behavioral effects data.

2. Accessibility and Equity

Research on accessibility emphasizes equitable access to transportation services for all demographic groups.

➤ Study by Lucas (2012):

- Focus: Explored transport-related social exclusion in low-income communities.
- Methodology: Surveys and interviews with residents in the UK.
- Findings: Lack of affordable transport options exacerbates social exclusion.

- Gap: Limited exploration of similar issues in developing countries.

3. Technological Innovations in Urban Mobility

Emerging technologies, such as AI, IoT, and big data, are increasingly used to optimize transportation systems.

➤ Study by Benevolo et al. (2016):

- Focus: Role of smart mobility solutions in urban areas.
- Methodology: Case studies of smart city initiatives in Europe.
- Findings: IoT and big data analytics improve traffic management and enhance user experiences.
- Gap: Limited scalability of smart solutions to developing regions.

4. Sustainability and Environmental Impacts

Sustainable urban mobility research focuses on reducing environmental impacts through greener transportation options.

➤ Study by Banister (2008):

- Focus: Investigated sustainable mobility paradigms in urban planning.
- Methodology: Comparative analysis of cities implementing green transport policies.
- Findings: Cities with robust public transit systems report lower carbon emissions.
- Gap: Need for metrics to measure lifecycle environmental impacts.

5. Behavioral Change and User Acceptance

Behavioral studies examine factors influencing public attitudes and adoption of integrated mobility solutions.

- Study by Anable (2005):
- Focus: Identified travel behavior segments based on attitudes toward sustainable transport.
- Methodology: Surveys and cluster analysis in the UK.
- Findings: Positive environmental attitudes correlate with greater use of public transit and cycling.
- Gap: Need for targeted interventions to address resistant user segments.

2.5 Case Studies and Lessons from Similar Cities

To understand the challenges and opportunities for integrated urban mobility in Adama, Ethiopia, this section reviews case studies from cities that share similar characteristics in terms of size, population growth, urbanization trends, and socio-economic contexts. These case studies provide valuable lessons and best practices that can be adapted to Adama's unique context.

1. Kisumu, Kenya

Overview: Kisumu is a medium-sized city in Kenya facing rapid urbanization and transportation challenges similar to Adama. Informal transport modes, including motorcycle taxis (boda bodas) and matatus (minibuses), dominate the city's mobility landscape.

Key Challenges: Congestion, safety concerns, and a lack of integration between formal and informal transport systems. (Agbiboa, 2016).

Lessons Learned:

Public-private partnerships can be instrumental in improving infrastructure, as seen in Kisumu's investment in modern bus terminals.

Introducing regulatory frameworks for informal transport improved service quality and reduced road accidents.

Non-motorized transport (NMT) investments, such as dedicated bike lanes, enhanced mobility for lower-income populations.

2. Dodoma, Tanzania

Overview: Dodoma, like Adama, is a medium-sized city that has recently experienced increased government focus on infrastructure development due to its status as Tanzania's administrative capital.

Key Challenges: Insufficient public transport options, inadequate infrastructure, and rapid population growth. (Munishi, 2021).

Lessons Learned:

Integrated land-use and transportation planning helped align urban development with transport infrastructure.

Investments in bus rapid transit (BRT) systems demonstrated potential for reducing congestion and promoting public transit.

Community engagement in transportation planning ensured solutions addressed local needs effectively.

3. Hawassa, Ethiopia

Overview: As another Ethiopian city experiencing rapid urbanization, Hawassa faces similar mobility challenges, including reliance on informal transport and limited infrastructure development.

Key Challenges: Fragmented transport systems, environmental concerns, and limited investment in public transportation. (Gebeyehu & Takano, 2007).

Lessons Learned:

Implementing integrated urban plans that incorporate green spaces and pedestrian-friendly infrastructure improved accessibility and sustainability.

Collaboration with international donors facilitated the introduction of electric three-wheelers to reduce pollution from informal transport modes. (Yimer, 2017).

4. Kampala, Uganda

Overview: Kampala, a major city in Uganda, shares characteristics with Adama in terms of reliance on informal transport and a growing population.

Key Challenges: Severe traffic congestion, inefficient transport systems, and limited urban planning. (Goodfellow, 2017).

Lessons Learned:

Development of a coordinated urban mobility plan integrating informal transport with public transit reduced inefficiencies.

Technology-driven solutions, such as mobile apps for ride-hailing and route optimization, enhanced service delivery.

Incremental implementation of mass transit systems, such as BRT, was found to be cost-effective and scalable.

5. Addis Ababa, Ethiopia

Overview: As Ethiopia's capital, Addis Ababa provides insights into challenges faced by rapidly growing Ethiopian cities, including Adama.

Key Challenges: Overcrowded public transport, inefficient traffic management, and high reliance on informal modes. (Berhanu, 2020).

Lessons Learned:

The introduction of the Light Rail Transit (LRT) system demonstrated the feasibility of large-scale public transit investments, though challenges in maintenance and service consistency remain.

The city's focus on multimodal transport strategies, such as integrating minibuses with the LRT system, highlighted the importance of coordination between transport modes.

Public awareness campaigns and capacity building improved the acceptance and usage of formal transport systems.

2.6, Implications for Adama

The lessons from these cities emphasize the importance of:

Integrated Planning: Coordination between urban planning and transport development to create cohesive systems.

Regulation of Informal Transport: Establishing frameworks to regulate and integrate informal transport modes into formal systems.

Infrastructure Investment: Prioritizing the development of multimodal transport facilities, including public transit, NMT, and smart mobility options.

Community Participation: Engaging local stakeholders to ensure transport solutions meet the needs of diverse population groups.

Sustainability Focus: Incorporating environmentally friendly solutions, such as electric vehicles and non-motorized transport infrastructure.

These insights provide a foundation for proposing context-specific solutions to the transportation challenges faced by Adama.

2.7, Gaps to Fill in the Literature

Despite valuable insights from the reviewed case studies, significant gaps remain in the literature regarding transportation planning and urban mobility in medium-sized cities like Adama. These gaps highlight the need for further research tailored to the specific context of Adama and similar cities in Ethiopia:

Limited Focus on Medium-Sized Cities:

While much research emphasizes transportation systems in large metropolitan areas (e.g., Addis Ababa, Kampala), there is a paucity of studies that explore mobility challenges and opportunities in medium-sized cities like Adama. These cities often face unique challenges, including limited resources, lower population densities, and over-reliance on informal transport systems.

Integration of Informal and Formal Transport Systems:

Many case studies discuss informal transport modes but lack detailed frameworks for effectively integrating these systems into formal public transport networks. In Adama, informal transport dominates the mobility landscape, and practical integration strategies remain unexplored.

Role of Socio-Cultural Factors:

Existing literature tends to overlook the socio-cultural factors influencing transportation decisions, such as community preferences, affordability, and the gendered dimensions of mobility. These factors are critical for designing inclusive and sustainable transport solutions in Adama.

Scalability of Innovations:

While innovative solutions, such as Bus Rapid Transit (BRT) or electric vehicles, are discussed in case studies of cities like Dodoma and Kampala, the scalability and adaptability of such solutions to smaller cities with constrained budgets and infrastructure remain inadequately addressed.

Environmental Impacts:

Case studies often lack in-depth analysis of how transportation planning impacts local environmental conditions, particularly in cities with high reliance on fossil-fuel-based informal transport modes. Adama requires specific strategies for promoting green mobility while addressing its existing reliance on informal systems.

Community Participation in Planning:

Few studies explore the mechanisms for involving local communities in transportation planning. Given Adama's socio-economic diversity, incorporating community voices into mobility planning is essential but remains underexamined in the literature.

Institutional Coordination:

The role of institutional frameworks and governance in medium-sized cities is often overlooked. Adama's mobility challenges require better coordination between local, regional, and national institutions, which is a gap not extensively addressed in existing case studies.

Localized Data and Evidence:

Much of the literature relies on general trends or data from larger urban contexts. There is a lack of granular, localized data specific to Adama's transportation challenges, patterns, and needs, which is crucial for evidence-based planning and decision-making.

Economic Feasibility Studies:

While infrastructure investment is often recommended, the economic feasibility of proposed solutions for resource-constrained cities like Adama is rarely addressed. Research is needed to align sustainable mobility solutions with the city's financial capacity.

2.8,Contribution of the Current Study

This study seeks to address these gaps by:

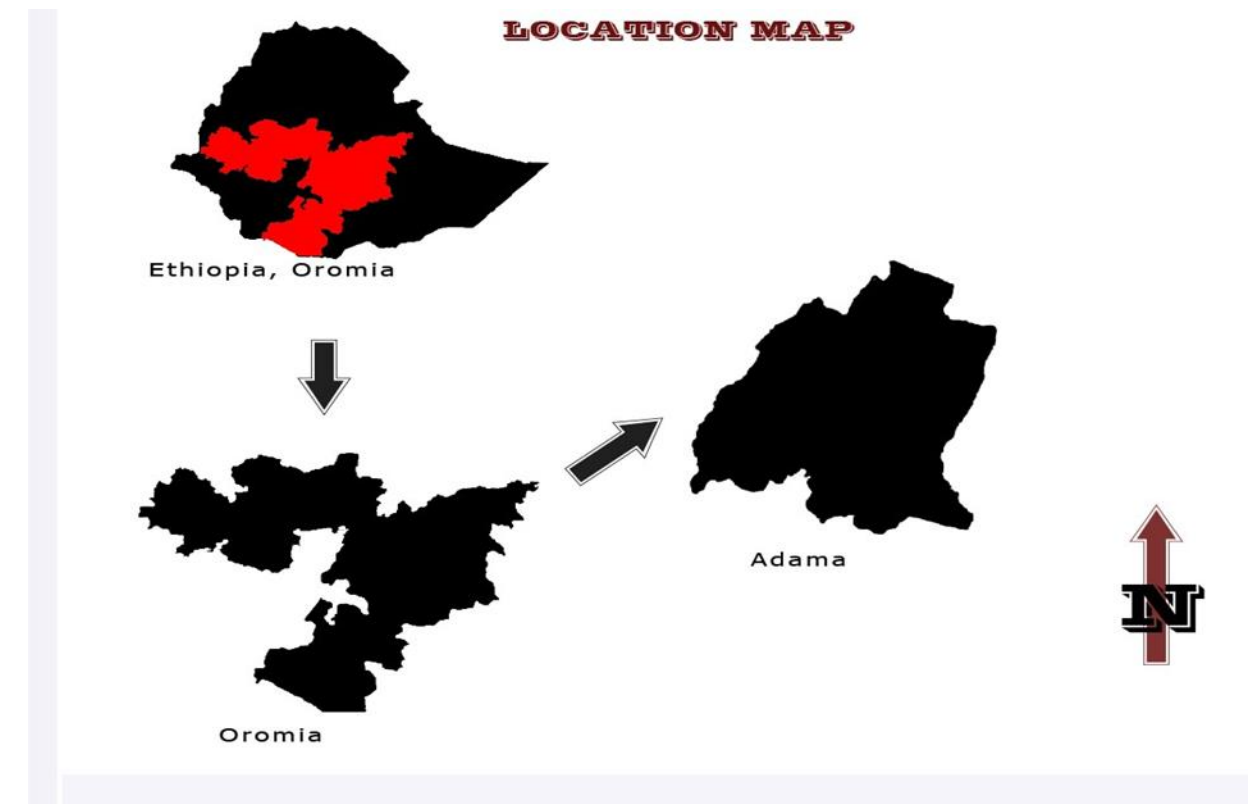
Focusing specifically on Adama as a medium-sized city in Ethiopia, providing localized insights and strategies, Proposing practical integration frameworks for informal and formal transport systems, Exploring socio-cultural and economic factors that shape transportation behavior in Adama, Developing context-sensitive, scalable, and sustainable transportation solutions tailored to the city's resource constraints. Including environmental impact assessments as part of transportation planning. Engaging stakeholders from diverse community groups to ensure inclusive decision-making processes. Examining institutional and governance structures that influence transportation planning in Adama.

By addressing these gaps, this study will contribute to a more comprehensive understanding of transportation planning in medium-sized cities and offer actionable solutions to improve urban mobility in Adama and similar contexts.

Chapter 3: Research Methodology

3.1.1. Study Area Description: Adama, Ethiopia

Adama, formerly Nazret, is among the biggest cities in Ethiopia and serves as the Oromia Regional State capital. Located some 100 kilometers southeast of Addis Ababa, Adama is a critical location in the transport network in Ethiopia since it sits on the Addis Ababa–Djibouti corridor, which is the country's leading trade corridor



Geographic and Demographic Characteristics

The city occupies approximately 133.4 square kilometers and is of an average altitude of 1,712 meters above sea level. Adama has a semi-arid environment with a bimodal mode of rainfall as well as moderately high temperatures when compared to Ethiopia's highlands.

According to recent projections (2025), Adama is an estimated population of about 459,900 residents and is among the fastest growing cities in the country. The city has a high rate of rural-urban migration, which has been depositing large urban growth, increasing population density, and expanding demands for rudimentary infrastructure and services like urban transport.

Economic and Social Significance

Adama is of great economic significance due to its industrial parks, trading centers, and hotel industry. It is home to various manufacturing and service industries and is a top choice for

national conferences, especially given its proximity to the capital. The fact that it is host to institutions such as Adama Science and Technology University (ASTU) and a growing number of private colleges also makes it an education hub.

Urban Mobility Context

There are some significant urban mobility issues in Adama, including:

- Increasing reliance on informal transportation modes (e.g., bajaj, minibuses)
- Insufficient non-motorized transport infrastructure (cycling and walking)
- Congestion, particularly during peak hours
- Insufficient integration between public and informal transportation modes

Despite these issues, Adama has opportunities for sustainable urban mobility due to its comparatively compact urban form and the growing interest of local authorities in improving transportation planning.

This study focuses on Adama as a case study of secondary cities in Ethiopia where urbanization is taking place at a higher speed than the growth of infrastructure. The transport dynamics of Adama provide lessons that can inform integrated mobility interventions in similar urban areas across the country.

3.2. Research Design

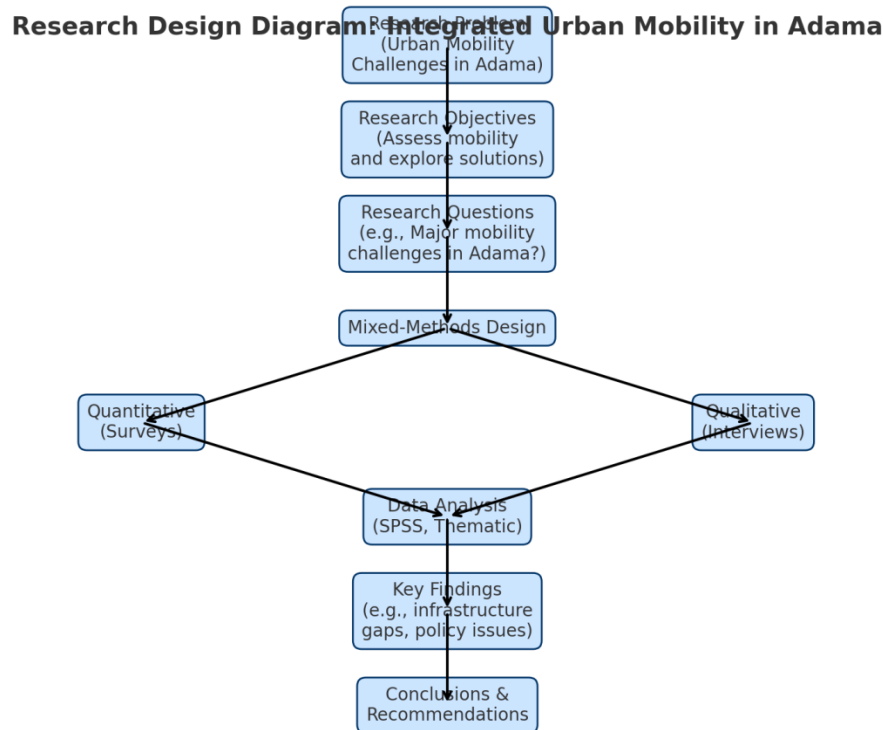
The research design outlines the framework and methodology that will guide the study on the integration of different transportation modes in Adama City, Ethiopia. It encompasses the overall strategy, including the type of research, data collection methods, and analysis techniques to address the research questions effectively.

In this Study, Mixed method Research Design was used to assess the challenges and opportunities of integrated urban mobility in Adama City. The study used both quantitative and qualitative strategies. This adjoined effort was taken in order to understand “measurable” patterns as well as stakeholder insights and contextual details that impact systems and make planning and decision making complex.

The qualitative surveys provided preliminary estimates of travel behavior, modal choice, accessibility, and systems performance that accompanied transport operator and household sample surveys. These insights were supplemented by their reasoning through key informant interviews, open-ended survey responses, and field observation aimed at elucidating institutional frameworks, operational realities, and user experiences associated with transportation systems.

A cross-Sectional approach was utilized in this study. All the respondents were surveyed at single point time. These specific design choices enabled the assessment of mobility trends, infrastructural inadequacies, and user perspectives pertaining to multimodal integration within the city.

Through the integration of both empirical data and institutional data, the research design ensured a complete assessment of the urban mobility system and provided evidence-based recommendations suitable for the specific case of Adama.



3.3. Sampling Techniques and sampling population

The section outlines the sampling techniques and sampling population for the integration of transport modes in Adama City, Ethiopia. It is through the sampling techniques that the sample captured the different opinions and experiences of the providers and users of the transport in the city.

3.3.1 Sampling Techniques

In order to have a representative sample, a stratified random sampling technique applied. This

sampling technique is particularly suitable for the study since the population in Adama City is diverse with varied user groups holding various transportation behaviors and requirements.

1. Stratified Random Sampling:

- The population divided into distinct strata based on significant characteristics like:
- User Type: Students, tourists, businessmen, and commuters.
- Transportation Mode: Taxicab users, bus users, bicycle users, and private automobile owners.
- Demographic Factors: Income, education, age, and gender.
- Random samples will be drawn from every stratum to capture all segments of the population under study. This helps avoid bias and enhance the results' generalizability.

2. Sample Size Determination:

- Statistical equations used to calculate the sample size considering the required confidence level (95% being the most conventional) and margin of error (10% being most common).
- Targeting the calculated preliminary estimation of Adama City population size, a target sample size of around 400 respondents determined for surveys to facilitate robust quantitative analysis.
- For qualitative interviews and focus group discussions, a small sample size (around 30-40 participants) will suffice to achieve data saturation, and no further new themes or insights are derived.

In order to find the suitable sample size for household respondents, Yamane's formula (1967) was used:

$$n = \frac{N}{1 + N(e)^2}$$

Where:

- n = sample size
- N = population size (459,900 for Adama City)
- e = margin of error (0.10)

$$n = \frac{459900}{1+459900(0.05)^2} + \frac{459900}{1+1149.75} = \frac{459900}{1149.75} \approx 400$$

Therefore, the terminal sample size of household respondents was 400.

In addition, purposive sampling was employed to choose informants who occupy strategic positions at institutions such as Adama City Transport Office, Urban Planning Department, Traffic Police, and informal transport organizations. The stakeholders possess advanced knowledge and expertise required for analyzing the institutional schemes, regulatory system, and functional challenges of city mobility in Adama.

Convenience sampling was also used at hectic locations such as public transportation areas and marketplaces to obtain information from passengers of various transport modes. Convenience sampling allowed collection of first-hand experiences, taste, and opinions from commuters on a daily basis.

For transport operators, particularly those who engage in informal public transport services such as bajaj and minibus operations, the population of Adama was 5,000. Using Yamane's formula with a 10% error margin:

$$n = \frac{5000}{1+5000(0.1)^2} + \frac{5000}{1+50} = \frac{5000}{51} \approx 37$$

Hence, the final sample size for transport operators was 37.

For institutional stakeholders, Total of 10 key informants were purposively selected based on their roles and expertise in transportation planning and policy-making within the city.

3.3.2 Sampling Population

The target population is individuals and groups that are involved in or affected by transportation in Adama City. The following groups was taken into account:

1. Commuters: Individuals who commute to work, school, or other destinations within the city utilizing various modes of transport. This group will guide daily travel behavior, decision, and problems.
2. Transport Operators: Public transport network drivers and operators (e.g., taxi operators, bus drivers) who can offer information on service delivery, operations challenges, and integration issues.
3. Business Owners: Small business entrepreneurs who depend on transport for customer access and logistics. Their input was offer information on the impact of transport on business operations and customer access.
4. Students: Young people who travel on public transport to attend schools and institutions. They are able to identify specific needs and wants amongst youth groups.
5. Government Officials and Policy Makers: Players in the Adama City urban planning and transport policy arena. They play a critical role in accessing information about the regulatory arena and transport integration plan development.
6. Community Representatives: Members of the local community organization or advocacy

groups concerned with transportation issues. They can provide valuable information regarding community needs and potential solutions for improving transportation systems.

Table 3.1 sampling population

	Summary of the sample population:		
	Respondent Group	Estimated Population	Sample Size
	Household Respondents	459900	400
	Transport Operators	5000	37
	Institutional Stakeholders	Targeted selection	10

3.4. Data Collection Methods

The research applied mixed-methods approach to collect Quantitative and qualitative information regarding mobility in Adama City. The mixed-methods approach enabled comprehensive examination of the transport system to collect statistical trends, perceptions of users, and institutional perceptions.

3.4 1. Household Surveys

400 household respondents were randomly selected from Adama cities and interviewed with a structured questionnaire. The survey instrument had closed- and open-ended questions intended to collect data on:

- Daily travel behavior and mode choice
- Transport service affordability and accessibility
- Perceptions of safety, convenience, and reliability
- Exposures to infrastructure quality and public transport integration

Enumerators were told to interview the respondents personally to guarantee the accuracy and consistency of the data. The surveys were conducted in indigenous languages to guarantee maximum comprehension and response.

3.4.2. Operator Surveys

A separate questionnaire was administered to 100 transport operators, including bajaj, minibus, and contract taxi drivers. This instrument gathered information on:

- Service operations and challenges (e.g., traffic, fuel costs, route restrictions)
- Vehicle ownership and regulatory compliance
- Interactions with traffic enforcement and municipal authorities
- Willingness to participate in integrated or formalized transport schemes

3.4.3. Key Informant Interviews

Semi-Structured interviews were conducted with with 10 purposively selected institutional stakeholders, including officials from:

- Adama City Transport Office
- Urban Planning and Development Bureau
- Traffic Police Department
- Informal Transport Associations

3.4.4. Field Observations

In addition to surveys and interviews, non-participant field observations were conducted at key transport nodes such as bus terminals, road intersections, and informal stops. Observations focused on:

- Traffic flow and congestion patterns
- Informal transport operations and interactions
- Infrastructure conditions (e.g., road quality, pedestrian access, signage)
- Multimodal transfer points and user behavior

3.4.5. Secondary Data Review

Secondary data were collected from official reports, transport policy documents, academic literature, and previous mobility studies conducted in Adama. These sources provided context for evaluating existing infrastructure, institutional arrangements, and policy initiatives relevant to integrated urban mobility.

3.5. Data Analysis Methods

The study employed both quantitative and qualitative data analysis techniques to interpret the collected data and derive meaningful insights into the challenges and opportunities for integrated urban mobility in Adama City.

3.5.1. Quantitative Data Analysis

Quantitative data from household and operator surveys were keyed in, cleaned, and analyzed

using Statistical Package for the Excel format. Descriptive statistics such as frequencies, percentages, means, and cross-tabulations were used to summarize:

- Travel behavior and modal split
- Accessibility and affordability of transport services
- User satisfaction and perceptions
- Common operational problems encountered by transport providers

Cross-tabulations were conducted to explore relationships between demographic variables (e.g., occupation, income, location) and mobility patterns or preferences. Tables and charts were generated to offer key findings visually and facilitate interpretation.

3.5.2. Qualitative Data Analysis

Open-ended survey responses and key informant interviews were analyzed using thematic content analysis. Transcription, coding, categorization, and interpretation were part of the process. Field observation data were triangulated with survey and interview data in order to cross-validate patterns and provide context understanding.

3.5.3. Triangulation and Integration

The process of triangulation was applied to increase the study's credibility and richness. This triangulation application merged several sources for data collection-usually consisting of quantitative surveys, qualitative interviews, and field observation. Triangulation facilitated cross-validating the findings to reach a more comprehensive interpretation of the issues around urban mobility in Adama City. Quantitative data provided overall trends, while qualitative data gave the contexts and perceptions of stakeholders.

Data Presentation Tools

The results were presented in a combination of tabular, graphical, and thematic formats. Statistical analyses, frequency tables, bar graphs, and pie charts were all prepared using Microsoft Excel and SPSS. Thematic coding was applied to the qualitative data, after which they were presented narratively, often accompanied by direct quotations to allow the stakeholders' voices to resonate. As appropriate, maps and diagrams were also applied to illustrate spatial patterns of mobility and infrastructure arrangements.

Ethical Considerations

Ethical grounds were adhered to during the course of this study. The respondents were first told about the research, and their informed consent was sought before any data collection. Hence,

rights to Anonymity and confidentiality were adhered to in that no names were mentioned in the final report.

Validity and Reliability of Data

There can be an attempt to ensure validity and reliability with the research. To enhance validity, the construction of survey instruments was based on literature review and consultation with experts, after which they had to be pilot-tested prior to the full survey. In addition, great care was taken to compose questions that were not ambiguous and were relevant. To ensure reliability, enumerators adhered to strict data collection procedures of training, and standardized tools were utilized. Cross-checks and repeated measures were carried out to further increase the reliability of the data. Moreover, all respondents were free to refuse and drop out at any time.

4, Chapter Four: Results and Discussion

4.1 Introduction

Infrastructure for transportation is a A good existence in a city depends on being able to navigate it, and Adama is no different. This section provides a thorough analysis of Adama's movement with the goal of providing specific recommendations for improving, securing, and environmentally friendly travel. The goal is to contribute to the creation of laws that improve Adama residents' quality of life and support the city's development.

The study uses a mixed-methods approach, integrating qualitative information from key stakeholder interviews with quantitative data from structured questionnaire surveys. This approach enables us to see the opportunities and challenging aspects of Adama's transportation sector.

A wide sample of city dwellers and transportation providers (such as Bajaj, taxi, and bus drivers) were given structured questionnaire surveys.

Structured questionnaire survey works were administered to a mixed bag of residents and transport operators (i.e., Bajaj, Taxi, and Bus drivers) in the city parts. They together expressed their views on the shape of the road, what is being built, safety, and traffic movement. Interactions with government members in the Adama City Transport Office further enlightened on top issues, planning, and difficulties in managing the city's transport system.

This part will lay out the results in order. First, it will show a brief of who answered the study to set the scene for more talks. Then, it will share results sorted by group (people living there, those who run transport, and city leads), pointing out main trends seen in the data from numbers and stories. At the end, it will mix all the insights, link them with ideas from Chapter Two, and tie them to other studies on city travel. The part ends by talking about what the study could not cover and moves to the final part.

The key informants represented three primary stakeholder groups:

- **Local Government Transportation Officials:** This group of people included senior members of the Adama City Transportation Authority and related fields. These members have large amount of experience in the planning, management, and regulation of transport infrastructure and services in the city. In their roles they oversee transport projects, develop transport policies, and address transport related issues. They were key in terms of understanding budgetary constraints and investment plans.

Transportation Engineering Professionals: The group comprised professional and trained engineers who possessed expertise in traffic management, road design, and transportation safety. Some of them belonged to the local government, while others were part of private consulting firms engaged in transport projects in Adama City. They brought with them technical experience and knowledge of the operational issues related to transport systems. The information we

received also included suggestions to implement new technology that would, in turn, ease the issues at hand.

- **Community and Advocacy Representatives:** These were people who belonged to local community organizations and advocacy groups, which had a focus on transportation issues. The needs of walkers, cyclists, users of public transport, and other at-risk populations were championed by these representatives. Their contributions highlighted lived experiences of residents and proposed suggestions for more equitable measures.

All key informants took part on a voluntary basis, and their identities have been kept confidential to ensure candid and unbiased responses. The perspectives obtained from these interviews have been thoroughly woven throughout the analysis, offering a deeper and more nuanced understanding of the challenges and opportunities confronting Adama's transport sector

A minimum of 385 respondents were therefore required to achieve the necessary statistical level of confidence. To allow for potential non-response and ensure sufficient representation across the city, the sample size was inflated by 15%. This increased the overall target sample size to approximately 443 respondents. To surpass the low return rate, information about approximately 450 residents of Adama City was collected and 437 were found to be appropriate for the research project.

The sample comprised 437 Adama City residents, with slightly more males (57.2%) than females (42.8%). Most respondents were aged between 25 and 54, and the largest single level of education attained was a bachelor's degree, at 20.6%. In terms of geographic representation, the sample covered all six sub-cities of Adama City and was distributed fairly proportionately to the actual distribution in the city as a whole. The demographic characteristics of this sample may therefore color its views on issues related to transportation infrastructure and safety. Bearing this demographic context in mind, road conditions and safety are two important factors that will be discussed in terms of residents' perceptions of the quality and safety of the road network in Adama City.

4.2 Respondent Demographic

Data analysis in this chapter is based on data collected from the residents of Adama City. Knowledge of the demographic composition of the respondents is important in order to place their perceptions of transport infrastructure and related challenges in context. This section presents an overview of the gender, age, level of education, and sample distribution per sub-city of the city. This will be preceded by an explanation of who the responders are and what they want to be.

4.2.1

Gender

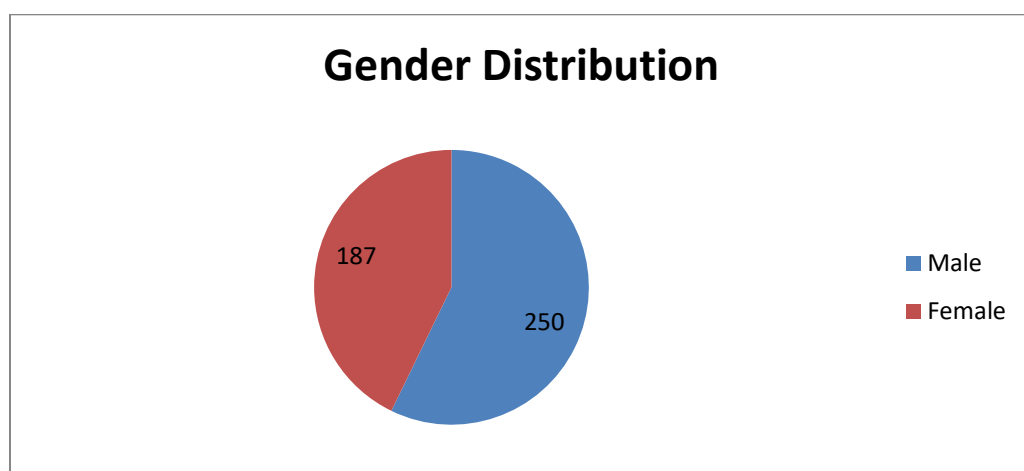
The sample size consisted of 437 respondents, out of which 250 (57.2%) were male and 187 (42.8%) were female.

❖ Data Presentation:

Table 4.1 Total Gender Distribution

Gender	Number	Percentage
Male	250	57.2%
Female	187	42.8%
Total	437	100%

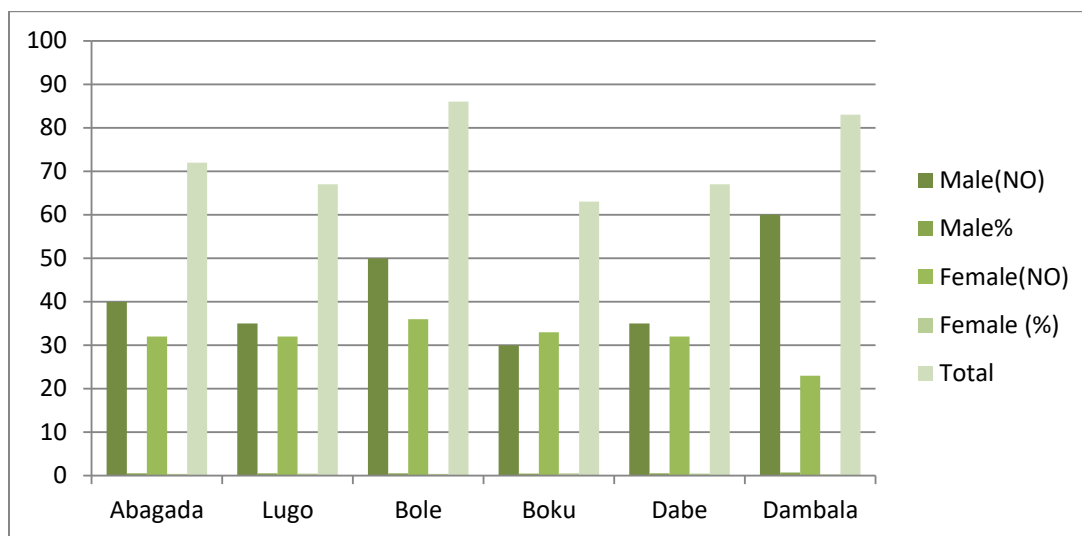
Graph 4.1 Gender Distribution Total



4.2 Gender Distribution by Sub-City

Sub-City	Male(NO)	Male%	Female(NO)	Female (%)	Total
Abagada	40	55.6%	32	44.4%	72
Lugo	35	52.2%	32	47.8%	67
Bole	50	58.1%	36	41.9%	86
Boku	30	47.6%	33	52.4%	63
Dabe	35	52.2%	32	47.8%	67
Dambala	60	72.3%	23	27.7%	83
Total	250	57.2%	187	42.8%	437

Graph 4.2 Total Gender Distribution



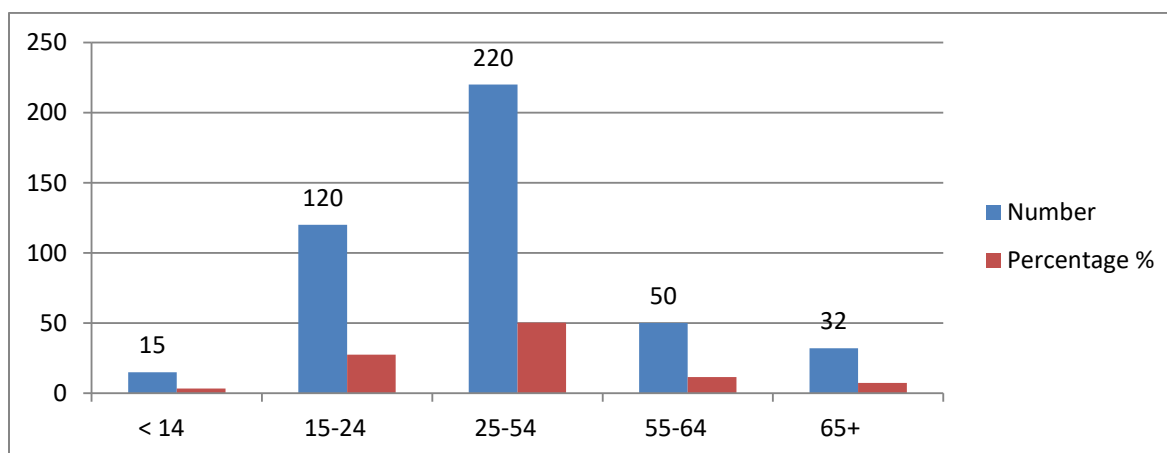
➤ 4.2.2 Age

Data Presentation:

Table 4.3 Age distribution

1	Number	Percentage
< 14	15	3.4%
15-24	120	27.5%
25-54	220	50.3%
55-64	50	11.4%
65+	32	7.3%
Total	437	100%

Graph 4.3 Age distribution



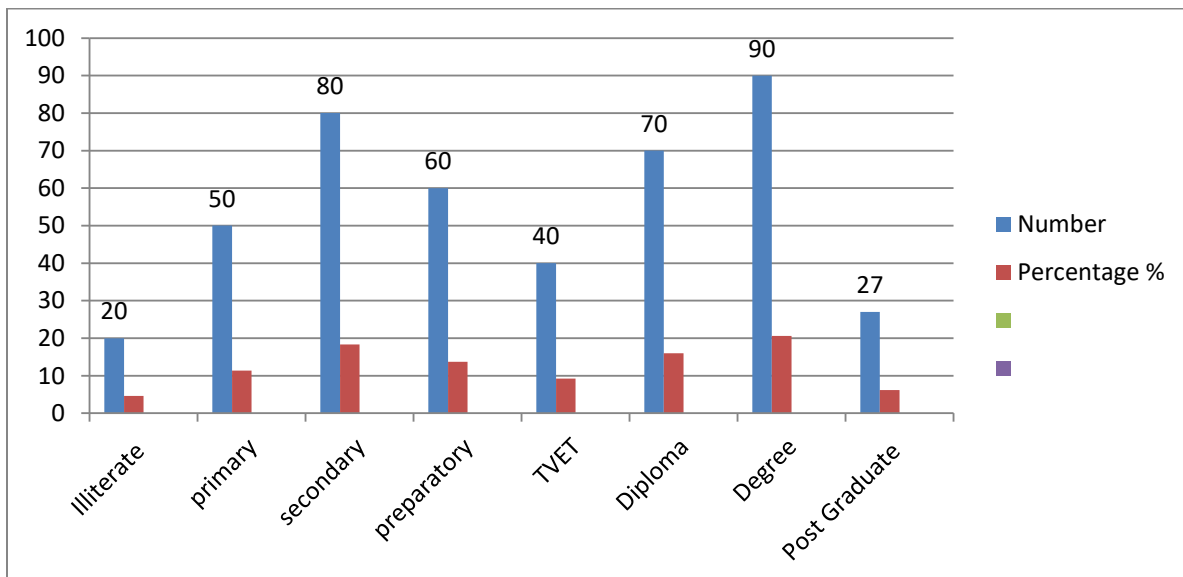
The age distribution of the sample was as follows: 15 respondents (3.4%) were below the age of 14 years, 120 Respondants (27.5%) were between the ages of 15 and 24 Years , 220 respondents (50.3%) were between the ages of 25 and 54 years, 50 respondents (11.4%) were between the ages of 55 and 64 years, and 32 respondents (7.3%) were 65 years and older.

➤ 4.2.3 Educational Status

Table 4.4 Educational Status

Educational Status	Number	Percentage
Illiterate	20	4.6%
primary	50	11.4%
secondary	80	18.3%
preparatory	60	13.7%
TVET	40	9.2%
Diploma	70	16.0%
Degree	90	20.6%
Post Graduate	27	6.2%
Total	437	100%

Graph 4.4 Educational Status



The education level of the sample shows that 20 (4.6%) participants were illiterate, 50 (11.4%) participants had primary education, 80 (18.3%) participants had secondary education, 60 (13.7%) participants had preparatory school, 40 (9.2%) participants had TVET, 70 (16.0%) participants had a diploma, 90 (20.6%) participants had a bachelor's degree, and 27 (6.2%) participants had a postgraduate degree.

It is worth mentioning that a very large percentage had a degree, which indicates high education for this area."

➤ 4.2.4 Sub-City Representation

The sample number was taken from all the six sub-cities of Addis Ababa City as follows: 67 respondents (15.2%) from Luago 72 respondents, , 86 respondents (19.7%) from Bole, 63

respondents (14.3%) from Booku, (16.4%) from Abagaada 67 respondents, and 82 respondents (18.7%) from Daambala. (15.2%) from Daabe

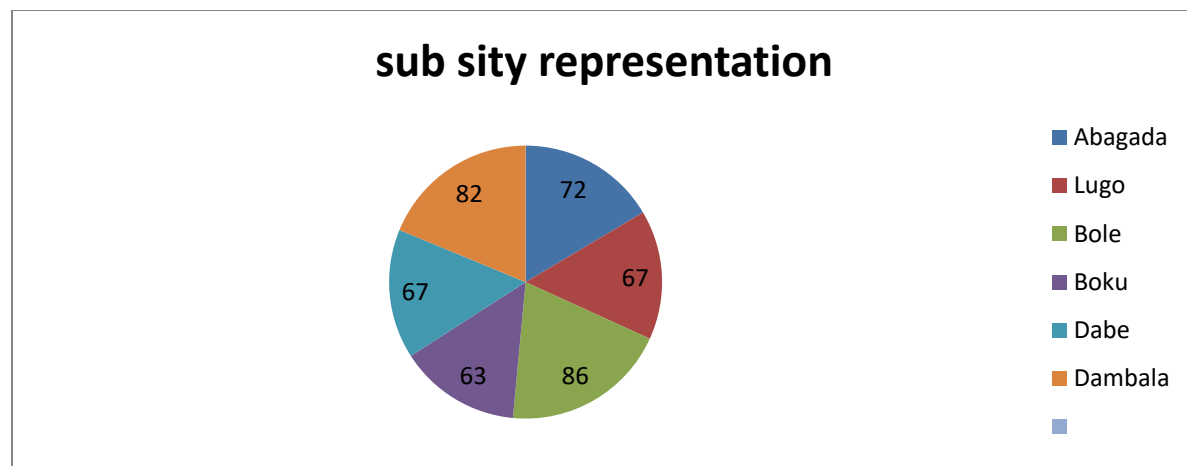
From the 2023 census data, the population composition of Adama's sub-cities is as follows: Abagaada (15%), Lugo (14%), Bole (21%), Booku (13%), Daabe (16%), and Daambala (21%).

The marginal over-representation of Bole in the sample may quite possibly lead to over-stressing of the transport needs and priorities of residents in the sub-city. But because the difference between the sample distribution and the population distribution is fairly narrow, the potential for bias is likely to be small. Table 4.5 Sub-City Representation

Table 4.5 Sub-City Representation

Sub-City	Number	Percentage%
Abagada	72	16.3%
Lugo	67	15.3%
Bole	86	19.7%
Boku	63	14.4%
Dabe	67	15.3%
Dambala	82	18.8%
Total	437	100%

Graph 4.5 Sub-City Representation



4.3 Road Conditions and Safety

This section presents an analysis of road condition and safety in Adama City, based on responses from residents and transport operators. Road safety and quality are critical components of the

urban transportation system, with direct implications for mobility, accessibility, and the health of the city's population. The section will examine views on general road condition, road maintenance, safety for different categories of road users, visibility of road markings, and sufficiency of street lights.

According to a report by Adama city Municipality, the city's road network consists of:

- Asphalt roads: 94.5 kilometers
- Gravel roads: 255.6 kilometers
- Red ash roads: 136.3 kilometers
- Cobblestone roads: 17.2 kilometers

This is approximately 357 km of internal roads, a mix of modern and traditional construction materials..

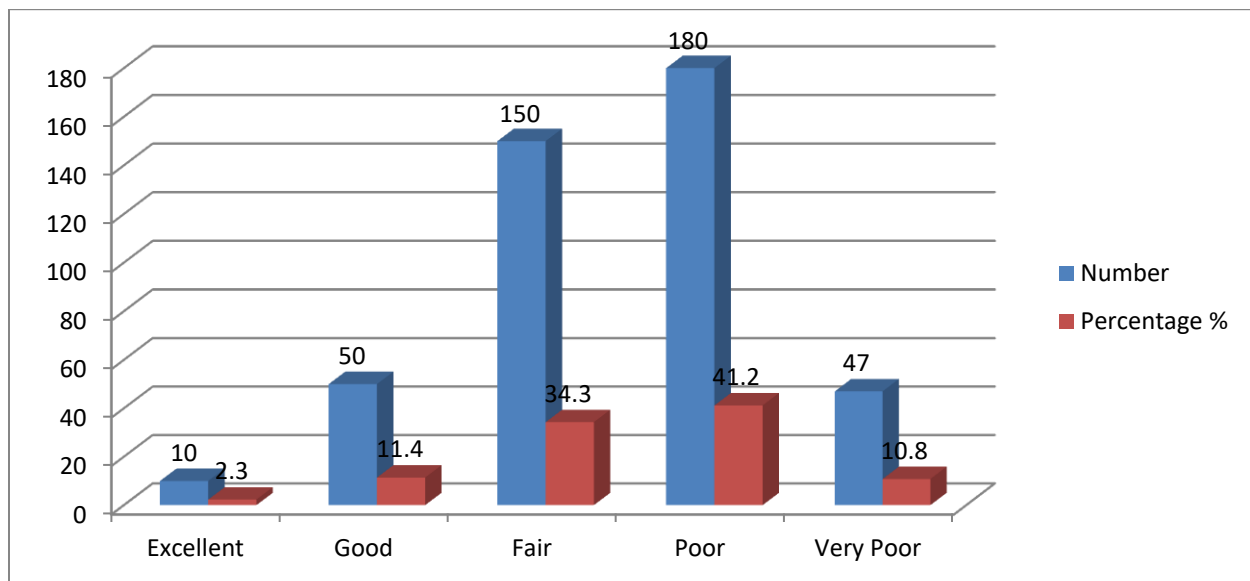
While the asphalt roads are predominantly well maintained, the gravel, cobblestone, and red ash roads are prone to maintenance issues. Factors such as substandard drainage systems, especially in flat plain topographies, lead to road degradation. A poor drainage system can lead to water pooling, leading to road weakness and disuse. Through to 2025, Adama City (Nazret) has matured its road network internally to a large extent, from an estimated 41.1 km in 1965 to approximately 160.3 km in 2004. This is an indication of the fast urbanization of the city and increased demand for transport infrastructure. Despite the increase, road coverage in the city remains just about 10% of the whole area, short of the 30% national average. Low coverage is partly responsible for the high occurrence of traffic jams, particularly within the city center with numerous two-lane narrow streets. High coverage of taxis and motorized rickshaws does not help, as they tend to use pedestrian spaces by vehicles.

4.3.1. Data Presentation

Table 4.6: Frequency Distribution of Ratings for Overall Road Condition

Rating	Number	Percentage
Excellent	10	2.3%
Good	50	11.4%
Fair	150	34.3%
Poor	180	41.2%
Very Poor	47	10.8%
Total	437	100%

Graph 4.6 Frequency Distribution of Ratings for Overall Road Condition



The results of the survey also reflect the concern of the residents about the general state of Adama City's roads. From Table 4.6 and Figure 4.6, it is clear that the most common rating was "Poor," which was selected by 41.2% of the participants. Combining the "Fair" (34.3%) and "Very Poor" (10.8%) ratings, an overwhelming majority of the participants (75.5%) evaluated road conditions negatively. Conversely, few of the responders rated roads as being in good condition with a meager 2.3% scoring "Excellent" and 11.4% scoring "Good." That so low percentage scores "Excellent" is really a strong indication that the roads of Adama City are believed to require a lot of work in order to mend their condition. These results have serious implications for traffic, economic activity, and general welfare of life for individuals of Adama City. Poor roads are responsible for heightened traffic congestion, considering that motorists will be forced to navigate through potholes and other obstacles on the road, resulting in reduced speeds and longer travel times. The extra traveling time has been associated with reduced productivity, in the sense that they drive for longer over a greater distance (Work Foundation, 2018). This will also mean added vehicle maintenance costs through more wear and tear, which will cost the residents a lot of money. Poor road conditions can further discourage investment and economic activity because companies would not be willing to invest in a place that has poor infrastructure. "It costs me more when traveling by transport within the suburb, because the roads are bad and I pay extra for repairing the car" (Resident, Lugo Sub-City).

Additional analysis also found that residents of Lugo Sub-City were more likely to rank the condition of roads as "Poor" or "Very Poor" than residents in other parts of the city. This could be because of insufficient investment in road maintenance and infrastructure in the region, pointing towards a possible problem of unequal resource allocation. This is concurrent with a census, which has discovered that there is decreased spending, and the Lugo Sub-City will overall have lower standards of living. In the other African case studies in Nigeria, they have been experiencing tight financial strain (Alao, 2020).

The Transport officer discussed how although they would prefer to see all road networks being kept up, there are generally budget restraints which do not permit better road upkeep "We would like to see the safety of all residents and members of the population, however, when funds are re-allocated, this has a knock on effect" (Transport Officer) "The limited funding tends to make the city re-allocate fund" Finally, the survey results reveal that there is widespread dissatisfaction with Adama City's overall road condition since a majority of residents describe road conditions as "Fair," "Poor," or "Very Poor." The implications of these results are profound in terms of traffic flow, economic development, and quality of life for residents.

4.3.2. Road Conditions and Maintenance Challenges

Some of Adama's roads are in bad condition with defects like potholes, cracks, edge defects, and surface delamination. The Adama–Melkasa road section, for example, experiences regular pavement distress despite repeated maintenance. Some of the causes of such conditions are overloading, aging, poor drainage, and low-quality construction materials. Additionally, roads leading out of Adama towards areas like Wonji Shewa and Harar have deteriorated, partly due to the region's vertisol soils. These clay-rich soils are prone to shrinking and swelling, causing structural damage to roads and necessitating deeper foundations to mitigate subsidence.

4.3.3 Flooding and Drainage Issues

From what we observed, Adama's vulnerability to flash flooding imposes additional pressures on its road system. Adequate drainage systems are not available in most areas, and where available, culverts are clogged with vegetation and soil and hence forming water ponding on the roads. Cobblestone paving in the residential neighborhoods could be beneficial for some purposes but can impede water infiltration and increase flooding.

4.3.4 Ongoing and Planned Improvements

According to adama city administration statistics, Adama City Administration has initiated projects for improving road conditions, including the construction of an asphalt road from Peacock Asphalt to the expressway and railway. This project, which cost around 171.7 million Ethiopian Birr, is expected to enhance connectivity and ease traffic congestion. In addition, the Integrated Road Asset Management System (I-RAMS) of the Ethiopian Roads Authority offers a system for the overall management and maintenance of Ethiopia's road network, encompassing Adama's system. The system allows for the monitoring of asset performance, programming of maintenance activities, and structural inspection for safety and road durability.

. According to adama construction office information Key Road Maintenance and Development Projects

➤ **Asphalt Road from Peacock Asphalt to Expressway and Railway**

This project focuses on constructing an asphalt road connecting Peacock Asphalt to the expressway and railway. With a budget of approximately 171.7 million Ethiopian Birr, it aims to benefit city residents by improving access and reducing travel time.

➤ **Gravel Road Connecting Goro School to Degaga Kebele**

This initiative involves constructing a gravel road to connect Goro School with Degaga Kebele, enhancing accessibility for students and residents in the area.

➤ **Ali Biraa Street Light Installation**

The project entails fixing streetlights on Ali Biraa with the aim of improving nighttime visibility and safety for motorists and pedestrians.

➤ **Drainage Projects – Five Lots**

To address water management and prevent flooding, the city is undertaking drainage construction across five designated lots, enhancing the resilience of road infrastructure.

➤ **Goro Kebele Gabion and Culvert Construction**

This project focuses on building gabions and culverts in Goro Kebele to strengthen road structures and manage water flow, thereby extending the lifespan of the roads.

➤ **Adama–Awash Expressway Construction**

A significant infrastructure project involves constructing a 130 km expressway between Adama and Awash. Managed by the Ethiopian Roads Authority, this \$544 million project aims to improve the route from Addis Ababa to Dire Dawa, facilitating trade and transportation.

➤ **Community Engagement and Planning**

The Adama City Administration prioritizes people's participation in its infrastructural development projects. As an example, public hearings were conducted while planning the Adama–Awash Expressway to take suggestions and clarify doubts to ensure that the projects serve the purpose of local citizens.

Figure 4.1 adama city road condition

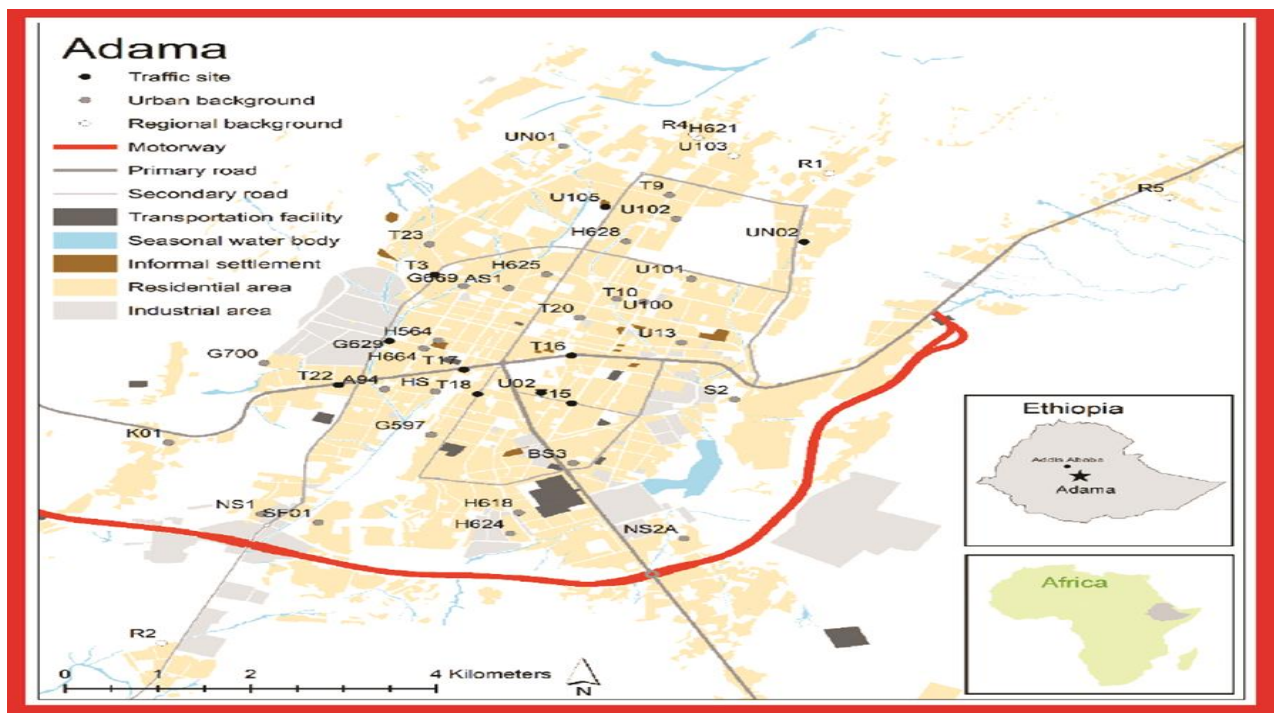
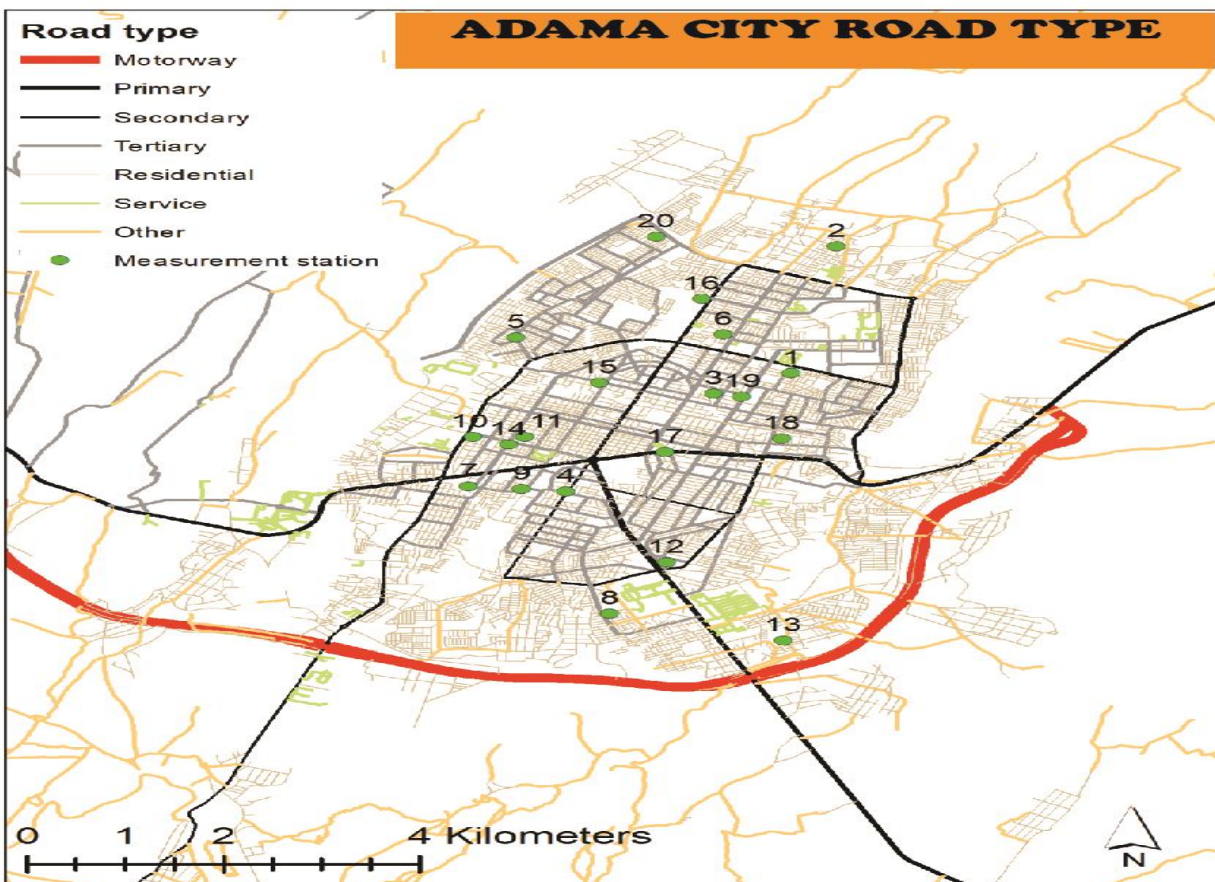


Figure 4.2 adama city road type



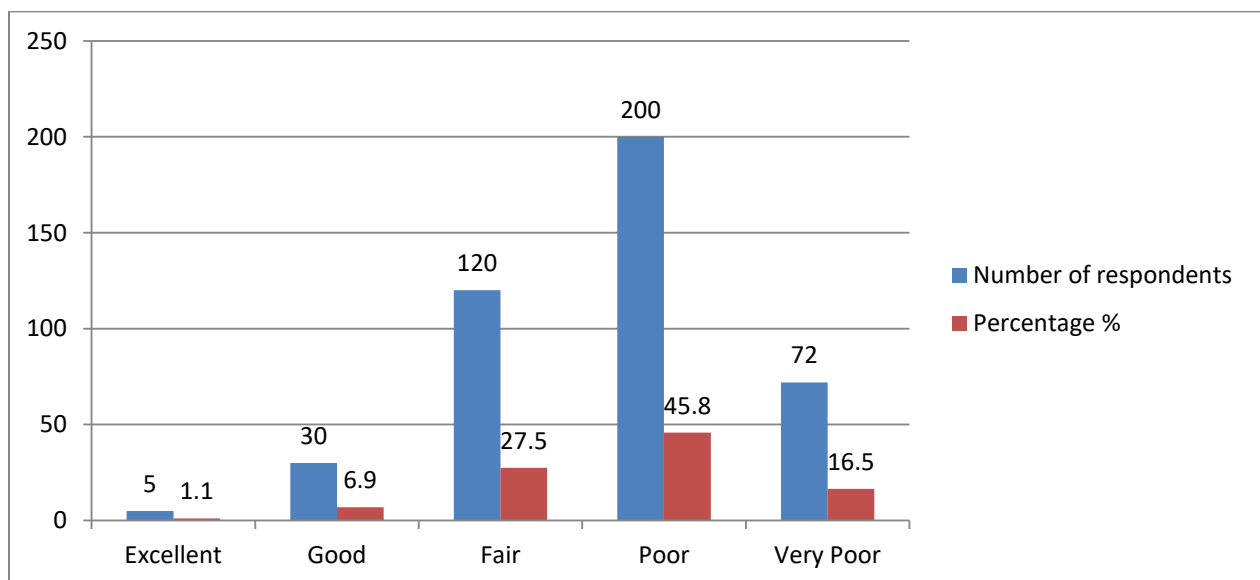
4.3.2 Road Maintenance

Data Presentation

Table 4.7: Frequency Distribution of Ratings for Road Maintenance

Rating	Number of respondents	Percentage
Excellent	5	1.1%
Good	30	6.9%
Fair	120	27.5%
Poor	200	45.8%
Very Poor	72	16.5%
Total	427	100%

• **Graph 4.7: Ratings of Road Maintenance**



The survey results show even greater dissatisfaction with road maintenance compared to the overall road condition. As Table 4.7 and Figure 4.7 show, a large majority of the respondents rated road maintenance "Poor" (45.8%) or "Very Poor" (16.5%), totaling 62.3%. Less than 1% of the survey participants gave positive scores to road maintenance, where 1.1% ranked it as "Excellent" and 6.9% ranked it as "Good." The huge gap between negative and positive scores indicates a critical issue with the sufficiency of road maintenance activities in Adama City. The poor ratings on road maintenance always point to a potential shortage of investment, ineffective resource allocation, or ineffective maintenance techniques. This lack of maintenance can cause the roads to deteriorate prematurely, prompting costlier repairs in the future. Poor maintenance can also aggravate prevailing issues of road safety, posing risks to motorists, pedestrians, and cyclists.

Comparing these with the road condition overall scores (Section 4.3.1), it is evident that residents are perceiving road maintenance to be worse than the prevailing condition of the roads, suggesting that the situation could be deteriorating over time. A case study in Kenya shows that a lack of maintenance has intensified road transport issues. As there is less road to be used, and an increase number, there is a negative productivity for business (Smith, 2019). The quality and maintenance may not be available. The impact has resulted in a cost to business, and therefore the commodities. "I cannot believe what I pay for things sometimes, but the transport costs are so high, that the costs get passed on to me" (Resident, Boku Sub-City). It does result in additional stress. Further disaggregation showed that the inhabitants of Lugo Sub-City, who had already registered the worst overall road condition (Section 4.3.1), also registered the worst perceptions of road maintenance, with a total of 75% rating it "Poor" or "Very Poor". The representative of the city brought up, that these plans had been postponed because there were no resources to enable

4.3.3 Integration of Qualitative Data

"The issue is always, that a road might just need the tiniest thing repaired. But if we don't repair it quickly enough, then it gets so much worse. The issue is, we do possess the resources and funds to repair it right away, and this winds up being more of a prolonged issue" (City Official). This has led to a lot of walking, particularly for those in a lower income class. In conclusion, the results of the survey confirm extensive dissatisfaction with road maintenance in Adama City, as most of the residents assessed maintenance works to be "Poor" or "Very Poor." The poor maintenance tends to raise the cost, which is transferred to residents.

4.3.5 Safety While Walking

- The poor ratings for walking safety can be explained by a mix of factors such as poor road quality, lack of pedestrian infrastructure (e.g., sidewalks), dense traffic congestion, and risky driving habits. The absence of walkways for pedestrians makes people share roads with automobiles, which elevates the possibility of accidents. The problems that we have are a challenge, owing to the high cost of living. A journal has shown that an increased cost of living for an individual can lead to stress and affect their health (Wheatley,
- Pedestrian safety in Adama City remains a significant concern despite heightened efforts towards the development of infrastructure and non-motorized transportation. Walking is a primary mode of transport for a large portion of the city's inhabitants, particularly for short-distance travel, access to public transport, and daily activities. Pedestrian safety, however, is compromised by several factors, including a lack of sidewalk facilities, limited pedestrian crossings, lack of lighting, and lack of traffic calming in residential and highly populated areas.
- Observational surveys and stakeholder interviews indicate that many sidewalks in Adama are either absent, poorly maintained, or obstructed by informal vendors, forcing pedestrians to walk on the road alongside motorized traffic. This exposes them to higher

risks of traffic accidents. Furthermore, pedestrian crossings are infrequent or poorly marked, and traffic signals, where present, often fail to prioritize pedestrian movement.

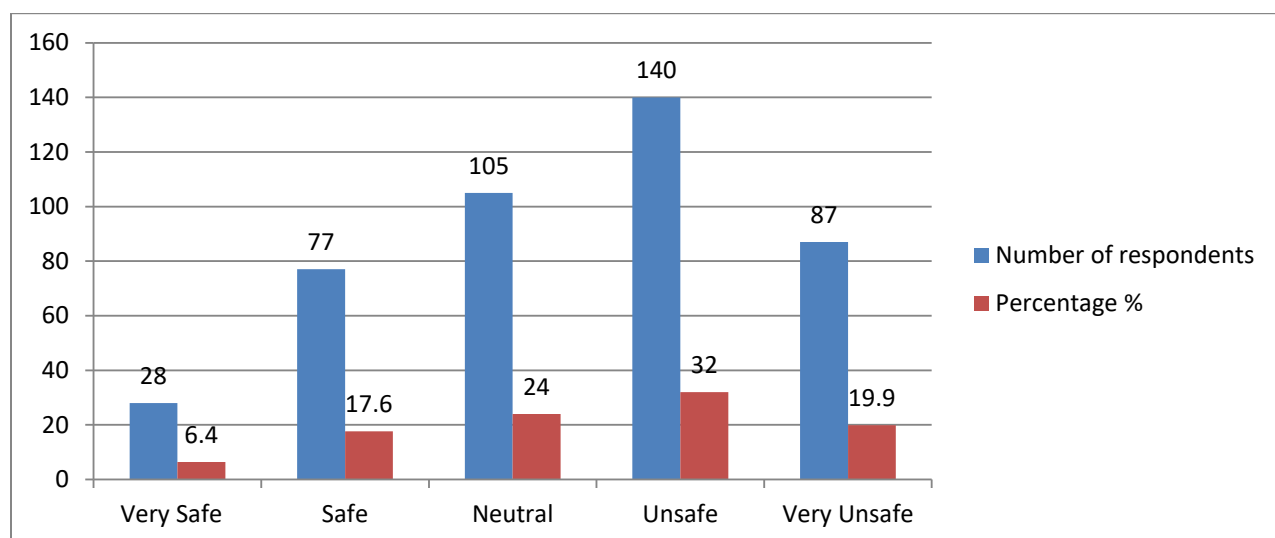
- The issue is particularly acute near schools, markets, and transport terminals, where pedestrian volumes are high. Vulnerable groups, such as children, the elderly, and people with disabilities, face disproportionate risks due to the lack of inclusive and barrier-free walking environments. According to the Ethiopia NMT Strategy (2020–2029), cities like Adama must implement design interventions such as raised crosswalks, curb extensions, and pedestrian refuge islands to enhance walkability and safety.
- Efforts are underway to address these challenges. Adama’s participation in the national initiative for harmonized safe street design standards is a positive step. These standards, supported by organizations such as the UN Road Safety Fund and UN-Habitat, emphasize pedestrian-prioritized infrastructure and integrated traffic management. The city has also launched some localized projects for sidewalk repair and lighting installation, such as along Ali Biraa Street, which improve night-time visibility and security.
- However, enforcement is still limited. Drivers often neglect pedestrian rights-of-way, and traffic control authorities themselves often have inadequate resources to monitor compliance or ensure consistent infrastructure maintenance. Strengthened community education, increased regulatory enforcement, and continued investment in safe pedestrian infrastructure are necessary for enhancing walking safety throughout Adama.

➤ Data Presentation

• Table 4.8: **Frequency Distribution** of Ratings for Safety While Walking

Rating	Number of respondents	Percentage
Very Safe	28	6.4%
Safe	77	17.6%
Neutral	105	24.0%
Unsafe	140	32.0%
Very Unsafe	87	19.9%
Total	437	100%

- Graph 4.8: Ratings of Safety While Walking



The survey findings indicate severe concerns with safety while walking along the roads of Adama City. As Table 4.8 and Graph 4.8 show, a majority of the respondents indicated they were "Unsafe" (32.0%) or "Very Unsafe" (19.9%), which is a total of 51.9%. Just 6.4% were "Very Safe" and 17.6% were "Safe," which suggests a severe lack of security. 24% described themselves as "Neutral".

4.3.6 Safety While Cycling

Cycling in Adama City is yet an undeveloped but growing mode of transport, particularly if considered against the background of sustainable urban transportation and exacerbating traffic congestion. However, the safety of cyclists is the overriding limiting factor to increased usage. Cycling is currently regarded as risky due to a lack of defined cycling facilities, the public having low awareness, and cyclists poorly accommodated into the city road traffic environment. Most roads in Adama lack designated cycling lanes or cycling signs to protect cyclists. Cyclists often ride on the road with high-speed vehicles, including minibuses and Bajaj three-wheelers, and this renders the area unsafe, especially during peak hours. In residential areas, ad hoc paths are used for cycling, but these are not continuous and are not officially recognized as part of the transport network. Consequently, cyclists are vulnerable to accidents, especially at intersections and roundabouts where motor vehicles have priority. Survey respondents and key informants regularly identified fear of road crashes as the greatest disincentive to cycling. Deterrence of daily commuting by police through a lack of secure bicycle parking and storage also applies. Furthermore, motorists widely neglect to treat cyclists as legitimate road users and do not regularly yield or maintain adequate distances. This is not particularly helpful and can create an unforgiving road culture that drives non-motorized users to the fringes.

Despite these challenges, there are fresh prospects for improving cycling safety. The Ethiopian Non-Motorised Transport Strategy encourages the building of physically separated cycle lanes, intersection treatment, and behavioural change campaigns for drivers and cyclists alike. Adama

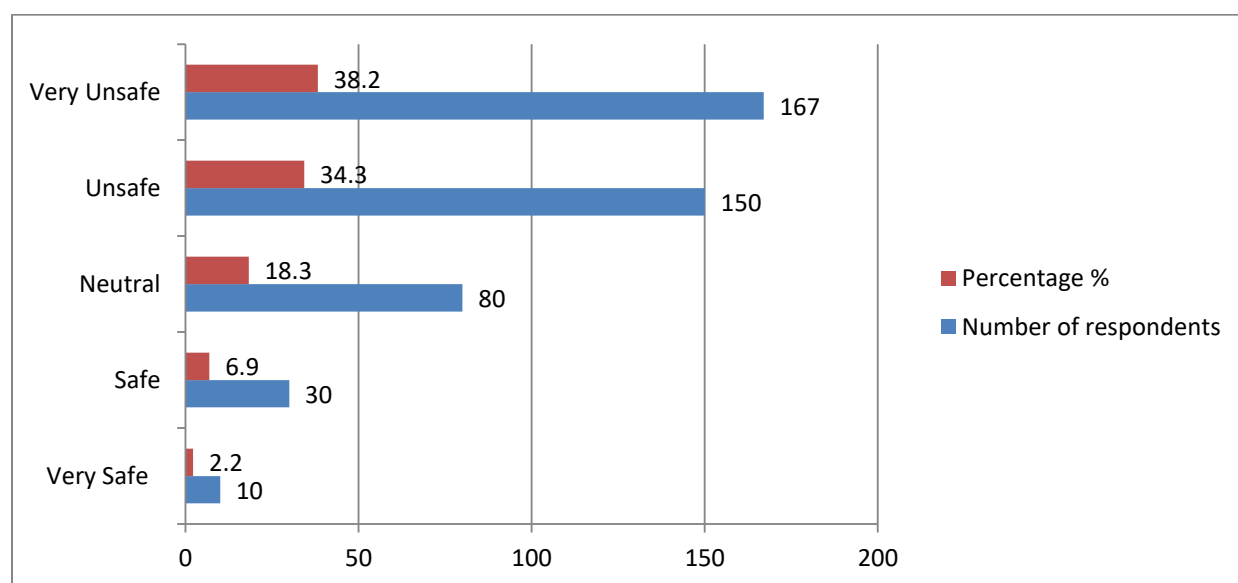
will apply these standards to the national Safe Street Design Guidelines, which promote inclusive infrastructure for all. To facilitate this, pilot projects and city-wide consultations have been undertaken to determine corridors where cycling lanes may be introduced. Additionally, the relatively flat topography of the city and high-density urban morphology provide conducive conditions for cycling as long as combined with supportive policy and infrastructure investment. In the future, focus must be placed on integrating cycling infrastructure into urban planning practice, improving enforcement of the law regarding cyclist rights, and undertaking public education campaigns to develop respect by all road users.

➤ Data Presentation

• Table 4.9 **Frequency Distribution** of Ratings for Safety While Cycling

Rating	Number of respondents	Percentage
Very Safe	10	2.2%
Safe	30	6.9%
Neutral	80	18.3%
Unsafe	150	34.3%
Very Unsafe	167	38.2%
Total	437	100%

Graph 4.9: Ratings of Safety While Cycling



The survey result indicates even higher safety concerns when cycling on roads in Adama City compared to walking (Section 4.3.3). As highlighted in Table 4.9 and Graph 4.9, the overwhelming majority of participants reported their safety while cycling as "Unsafe" (34.3%) or "Very Unsafe" (38.2%), which totals up to 72.5%. A negligible amount of participants replied as being "Very Safe" (2.3%) or "Safe" (6.9%), indicative of a gargantuan shortage of cyclist safety. The high rate of cycling also suggests that there is a vast gap, due to what would be found as the largest impact

The extremely low ratings for safety in cycling are likely due to a range of factors, including

- ❖ **Dedicated Cycling Infrastructure:** Inadequate dedicated bike lanes or separated cycle paths result in cyclists needing to use the same roads as motor vehicles, increasing the risk of crashes.
- ❖ **Poor Road Conditions:** Potholes, rough road surfaces, and other hazards on the road raise the risk and challenge of cycling.
- ❖ **. Heavy Traffic:** High traffic volumes and inconsiderate driving discourage cyclists from using the road.

Cyclists would also prefer their safety to be given top priority," "Cycling involves some cost, which makes it more challenging, and tends to deter people from doing so" (Resident, Lugo).

If money was raised, there would be additional advantages. "It will encourage greater participation for all areas of transport"

4.3.7 Visibility of Road Markings

Road markings visibility and clarity are central elements of city traffic regulation and road safety. Adama City boasts the condition and visibility of road markings such as directional arrows, pedestrian crossing signs, stop lines, and lane dividers being predominantly uneven, and in the majority of areas seriously damaged or missing. Such substandard road demarcations confuse drivers, induce unstable driving habits, and present more dangers to pedestrians and cyclists.

Field observations and survey answers indicate that in the majority of arterial and secondary roads in Adama, road markings have degraded due to weathering, poor paint quality, and insufficient regular maintenance. This is particularly problematic at roundabouts and intersections, where markings are essential to guide turning movements and ensure orderly traffic flow. At night or during rain, the absence of reflective or well-painted markings exacerbates safety risks for all road users.

Furthermore, pedestrian crossings are often unmarked or poorly painted, so drivers are less likely to obey pedestrian right-of-way laws. This issue is especially serious around schools,

markets, and bus stops, where pedestrian traffic is highest. Without visual signals, drivers will be less likely to yield, posing an additional threat to pedestrians.

Sparse usage of reflective paint or thermoplastic has been documented as a technical deficiency in road maintenance protocols in Adama. Additionally, the absence of periodic budgetary allocation as well as fixed standards for routine repainting has led to a drop in traffic management efficiency. Traffic safety stakeholders in this research indicated the necessity for the integration of road marking visibility into Adama's overall infrastructure maintenance protocols.

Initiatives toward enhancing road marking visibility are already on the scene. Some new roads and interchanges that were recently rehabilitated, especially along those linked with the Adama–Awash Expressway as well as along urban development axes, have provided improved-quality marking. Yet they are still only in a minimal scope and without systematization throughout the city.

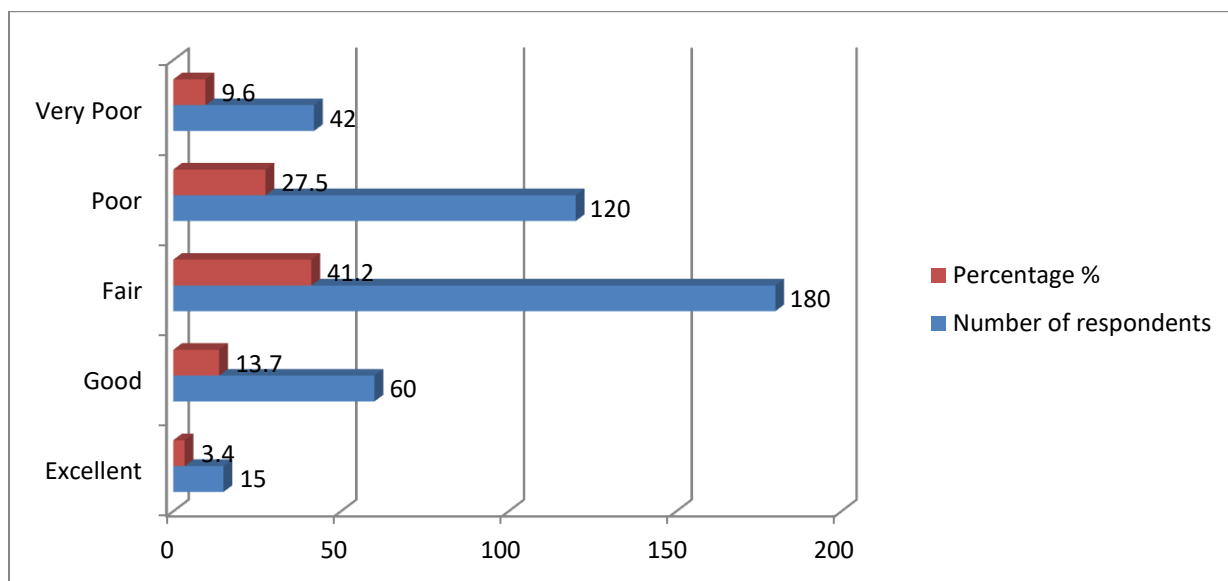
Enhancing the legibility of road markings through regular maintenance, use of durable materials, and compliance with national design standards is significant. Such improvement would not only make driving safer but also more predictable and easy to use for all urban travelers.

Data Presentation

Table 4.10: **Frequency Distribution** of Ratings for Visibility of Road Markings

Rating	Number of respondents	Percentage
Excellent	15	3.4%
Good	60	13.7%
Fair	180	41.2%
Poor	120	27.5%
Very Poor	42	9.6%
Total	417	100%

graph 4.11: Ratings of Visibility of Road Markings



The results of the survey indicate a split perception of legibility of road markings in Adama City. As can be seen from Table 4.10 and Graph 4.10, Majority results where people who had marked it as fair. People who had marked it as poor was approximately 30%, which means almost 80% of the roads are not clear. With the good or excellent at less than 20%, this means there has to be drastic measures.

The adequacy of road transport has a direct relationship with traffic and economic effect and the efficiency. By revising and experimenting with existing, new options will reduce the accident rates, and improve traffic flow (ETSC, 2018). This can also increase the economic activity, which means there will be better traffic and investment. Better markings that are visible will assist in both of these. When comparing to, the people showed there was higher traffic flow, where markings on the roads are worst. "When I had arrived at work, I missed a lane, because I couldn't see. I caused an accident, and this was very stressful, as I would have to pay to fix their car" "The traffic volume and road markings require a growth to improve road efficiency.". A policy that has more investment and the standard will show these, and reduce traffic accidents. "Sometimes I can't tell which roads I am meant to be on. If I drive at night then its even worse" A Taxi Driver.

4.3.8 Adequacy of Street Lighting

Street lighting is critically vital in making road safety easy, improving visibility for pedestrians and cyclists, and improving overall attitudes towards urban safety. The coverage of street lighting varies widely among neighborhood and road types in Adama City, and much is still uncovered. Although there are some trunk roads and new developed roads that have efficient lighting facilities, the majority of residential neighborhoods, subsidiary roads, and slums remain infested with lack of or inefficient street lighting. Resident and transport stakeholder survey responses recognize poor lighting as a marker of

heightened road safety risk, particularly at night. Inadequate lighting is associated with higher traffic crashes, reduced evening night walking trips, and heightened vulnerability to crime. This is especially difficult for those cyclists and pedestrians who are unable to steer clear of cycling or walking during the night, e.g., students, shift workers, and informal traders. Ground verification confirms that even where light poles are installed, they are most frequently either not operational because of maintenance neglect or too infrequently spaced, with very lengthy stretches of road left unlit. This is compounded by the frequent incidence of power failure and the lack of alternative sources of lighting, like solar-powered setups which, for all their growing suitability in energy-constrained urban settings, have continued to be underutilized.

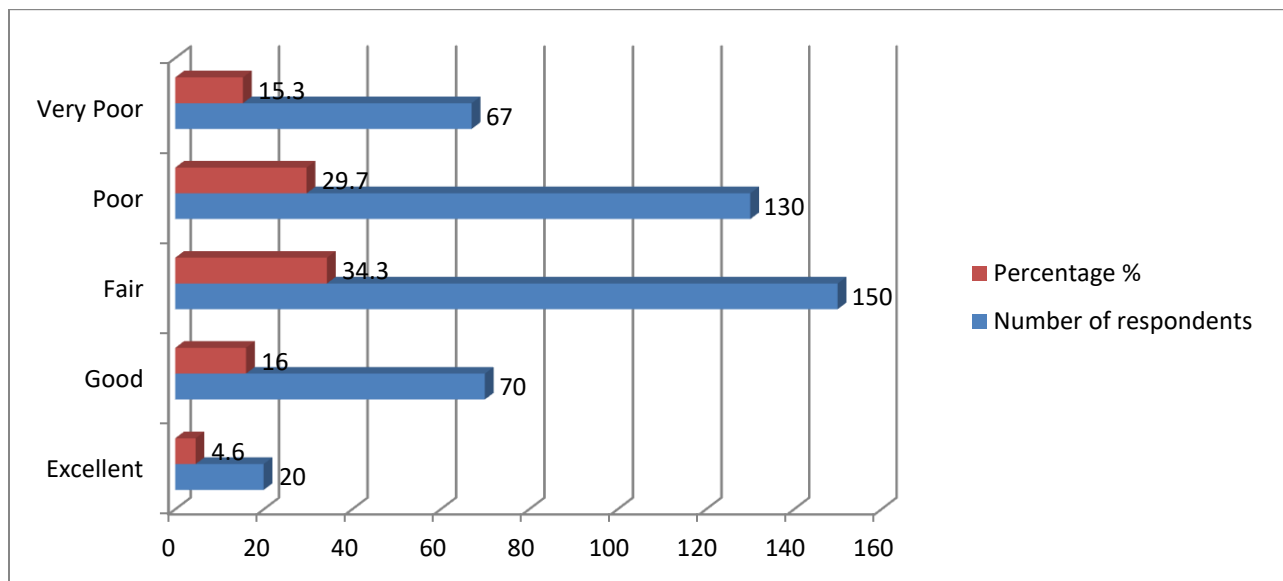
Adama City Administration has made certain street lighting projects, such as the installation of streetlights along Ali Biraa Street and sections of the road network for utilization in expressway ramps. These are, nonetheless, limited and have not managed to penetrate most poor neighborhoods. The demand for an equitable and citywide street lighting initiative—that is well integrated with urban mobility and security goals—remains. Improving the sufficiency of street lighting in Adama will require an integrated strategy, from planning out deficiencies in lighting, replacing outdated infrastructure, spending on solar-powered and energy-saving LED lights, and conducting periodic maintenance practices. Mainstreaming street lighting improvement in road and area development plans will be instrumental in providing opportunities for all citizens to enjoy an inclusive and safe urban transport system.

Data Presentation

Table 4.11: **Frequency Distribution** of Ratings for Adequacy of Street Lighting

Rating	Number of respondents	Percentage
Excellent	20	4.6%
Good	70	16%
Fair	150	34.3%
Poor	130	29.7%
Very Poor	67	15.3%
Total	437	100%

Graph 4.11: Ratings of Adequacy of Street Lighting



The findings of the survey identify a significant issue with the adequacy of street lighting in Adama City. As Table 4.6 and Figure 4.6 indicate, merely 4.6% and 16.0% gave either excellence or good ratings. The largest figures of the raters who gave the lighting were categorized as "fair" (with 34.3%). The very high "poor" and "very poor",

showing how it is in a poorer condition, indicating the safety.

Poor levels of lighting are linked to high levels of crime. There may be a necessity to try more cost-effective and sustainable light" (A Local Resident Adama) "The lack of lighting puts me off going out at night"

With those findings, the council ought to try to put first the impact on the residents and bear in mind any transport plans with it. "The street lighting means I have to work, and it makes me work shorter hours."

"We have a fixed budget, and there are always rival priorities. It indicates how insignificant it is for people" (Local Government.

4.3.9 Synthesis of Key Findings:

- **Recap of Overall Perceptions:** Begin with the description of the overall impressions of road safety and conditions in Adama City from the principal findings under Sections 4.3.1 to 4.3.8

- ❖ The observations presented in this section reflect a disappointing situation regarding road conditions and safety in Adama City. The citizens expressed deep disappointment with the overall condition of roads, road maintenance, visibility of road markings, and streetlighting.

- ❖ High proportions of respondents reported feeling unsafe when walking and cycling, showing the exposure of pedestrians and cyclists on Adama's roads.
- ❖ Even at traffic lights, I always feel like those there can be a chance of accidents. The constant flow means that something will happen""This is a constant worry"" – Cyclist
- ❖ The statistics tell us that road maintenance is a primary concern, and that the money does not consider this at all."
- ❖ With the roads, lighting and road markings it all adds up to show a primary concern.

. 4.3.10 Integration of Quantitative and Qualitative Data:

The residents' concerns regarding road conditions and safety were also supported by findings from key informant interviews.

The findings of the survey revealed that the Lugo Sub-City residents had particularly unfavorable perceptions of road conditions and safety. In-depth interviews conducted among residents of the sub-city showed that inability to maintain can be more difficult for individuals who have fewer economic needs

Include more discussions that have already been talked about "The lighting is very bad, with the residents citing difficulties for it"

4.4 Pedestrian and Cycling Infrastructure

Adama City is also promoting cycling and walking infrastructure as part of Ethiopia's general effort to promote sustainable and inclusive urban transport.

National Programs Supporting Non-Motorized Transport (NMT)

Ethiopia's Non-Motorised Transport Strategy (2020–2029) puts emphasis on building pedestrian and cycling infrastructure within the country. The strategy calls for physically separated non-motorised transport lanes and supplemented by traffic calming and upgraded intersections in a bid to make safety and accessibility possible. In order to enable this, the UN Road Safety Fund is assisting in the implementation of harmonized street design guidelines in Ethiopian cities such as Adama. The guidelines aim at promoting safer and more accessible environments for pedestrians and cyclists, and preparation for the rollout of guidelines to the 69 largest cities in Ethiopia is underway.

Local Developments in Adama

In addition to the Ministry of Transport and Logistics, Adama is developing quality cycle tracks and walkways under a strategic street design strategy. The effort is a response to the city's efforts to improve non-motorized transport infrastructure as well as encourage better, accessible urban transport options that are safer.

Integration with Major Infrastructure Projects

The Adama–Awash Expressway Project incorporates pedestrian overpasses and special crossings. They are designed to secure the safety of non-motorized road users and integrate smoothly with the overall city NMT network. These provisions cumulatively demonstrate Adama's aggressive response to the upgrade of pedestrian and cycling infrastructure, focusing on making urban transport safer and more sustainable.

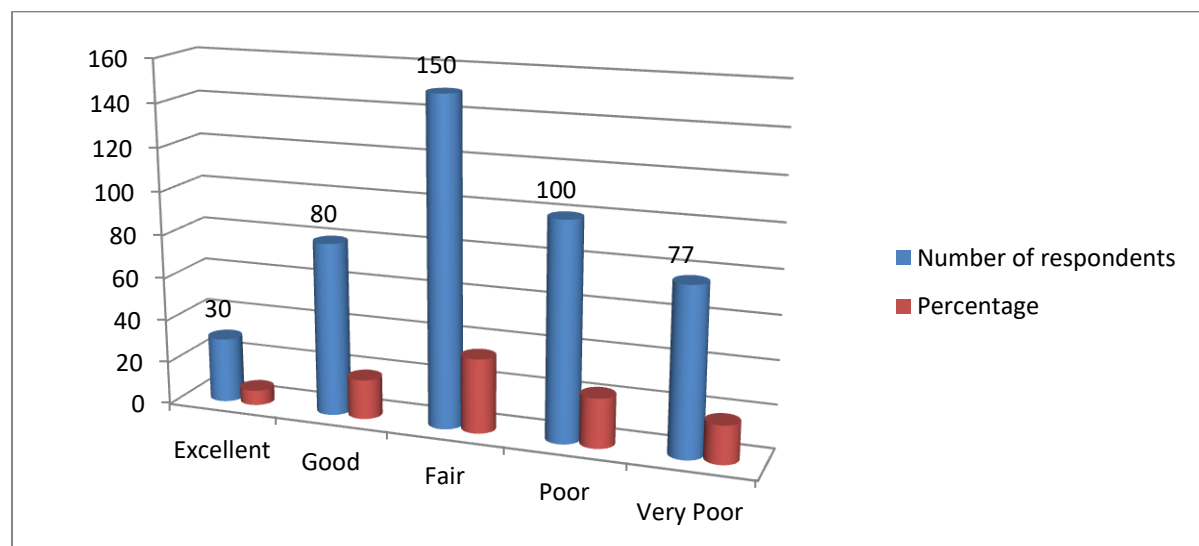
4.4.1 Availability of Sidewalks

Data Presentation

Table 4.12: Frequency Distribution of Ratings for Availability of Sidewalks

Rating	Number of respondents	Percentage
Excellent	30	6.9%
Good	80	18.3%
Fair	150	34.3%
Poor	100	22.9%
Very Poor	77	17.6%
Total	437	100%

Graph 4.12: Ratings of Availability of Sidewalks





The results of the survey are depicting a worrisome situation regarding the availability of sidewalks in Adama City. As it is evident from Table 4.11 and Graph 4.11, the overwhelming majority of the respondents complained. While 6.9% showed the availability to be "Excellent" and 18.3% stated that it is "Good", in total 40.5% of the respondents marked the availability as "Poor" (22.9%) or "Very Poor" (17.6%). A significant 34.3% rated the availability "Fair", meaning there is an imbalanced scenario where sidewalks are available but not necessarily throughout the whole city. This means that 40% of respondents do not have sidewalks available. The partial nature of sidewalk availability has several significant implications for residents of Adama City.

- ❖ **Pedestrian Safety Impact:** Lack of sidewalks forces pedestrians to move along roads with motor vehicles, and this makes walking risky (World Health Organisation, 2019). So far, there have been 67%, mainly due to individuals who are disabled, our research has established. It is a humongous challenge.
- ❖ **The condition of the disabled individuals who use wheelchairs demands immediate action.** "I have to take long routes to ensure safety for me and my family""This can be very challenging."
- ❖ **Effect on Vulnerable Groups:** The lack of sidewalks disproportionately affects vulnerable groups such as children, the elderly, and people with disabilities. These groups will struggle to utilize roadways without sidewalks, limiting their mobility and autonomy even more. "Because there aren't safe walkways, I tend not to take my children because of traffic (Resident, Lugo).".

This results indicate an intensified call for change that is going to affect many for a very long-term". "Change will not be abrupt, there must be quick initiatives to improve the transport".

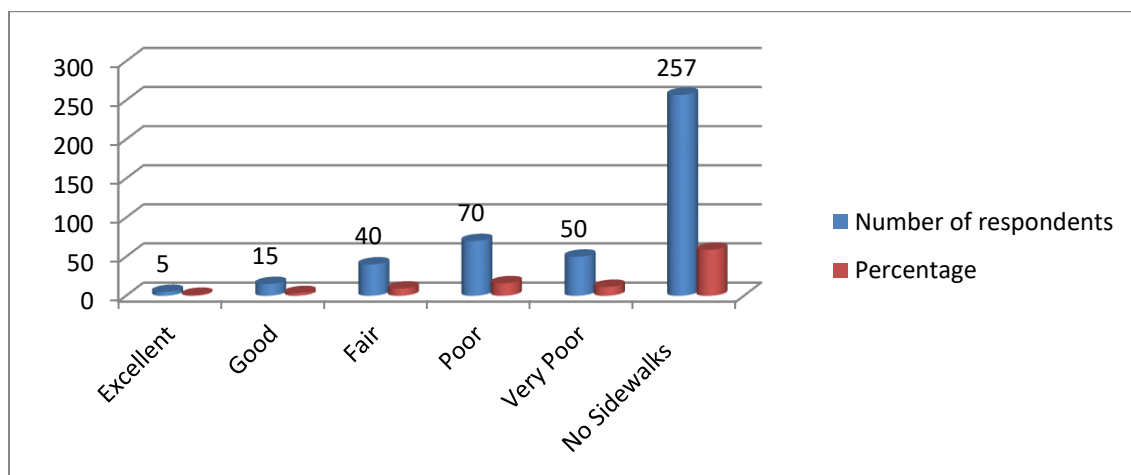
4.4.2 Condition of Sidewalks

Data Presentation:

* Table 4.13: **Frequency Distribution** of Ratings for Availability of Sidewalks

Sidewalk Condition	Number of respondents	Percentage
Excellent	5	1.10%
Good	15	3.40%
Fair	40	9.20%
Poor	70	16%
Very Poor	50	11.40%
No Sidewalks	257	58.80%
Total	437	100%

Graph 4.13: Ratings of Availability of Sidewalks



The results from the survey indicate a disturbing situation for sidewalk provision in Adama City. As shown from Table 4.12 and graph 4.12, an overwhelming majority of interviewees were dissatisfied. While 6.9% answered that the availability was "Excellent" and 18.3% answered it was "Good", together 40.5% of respondents answered that the availability was either "Poor" (22.9%) or "Very Poor" (17.6%). A significant 34.3% rated the availability as "Fair", which implies that there is a mixed situation of some available sidewalks but not always in the city. This implies that 40% of the respondents lack sidewalks available.

The lack of sidewalks has some significant implications for the residents of Adama City.

-Impact on Pedestrian Safety: -Impact on Pedestrian Safety: No sidewalks to force pedestrians onto the road, where they face greater chances of colliding and getting hurt. Past research has confirmed there have been 67%, especially by the disabled (World Health Organisation, 2019). It's something to be concerned about.

- The requirements of wheelchair users should be met in advance. "I need to go longer distances for me and my family's safety" "It can be really tough."

- Impacts on the Vulnerable: The absence of sidewalks disproportionately affects vulnerable populations such as children, the elderly, and the disabled. Such groups might be unable to cross the road without a sidewalk, decreasing mobility and independence even further. "Because there were no safe sidewalks, sometimes I would not take my children, because of traffic (Resident, Lugo)."

-

• There must be action carried out quickly and safely.

-There also must be measures in the longer term for all parties involved""There must be things reviewed, but if these consistently get pushed back then the situation will be difficult and not able to deliver (City Transport Leader).".

For the challenge to be rectified then action will require there to be swift action, and continued scrutiny, so change can be promptly governed.

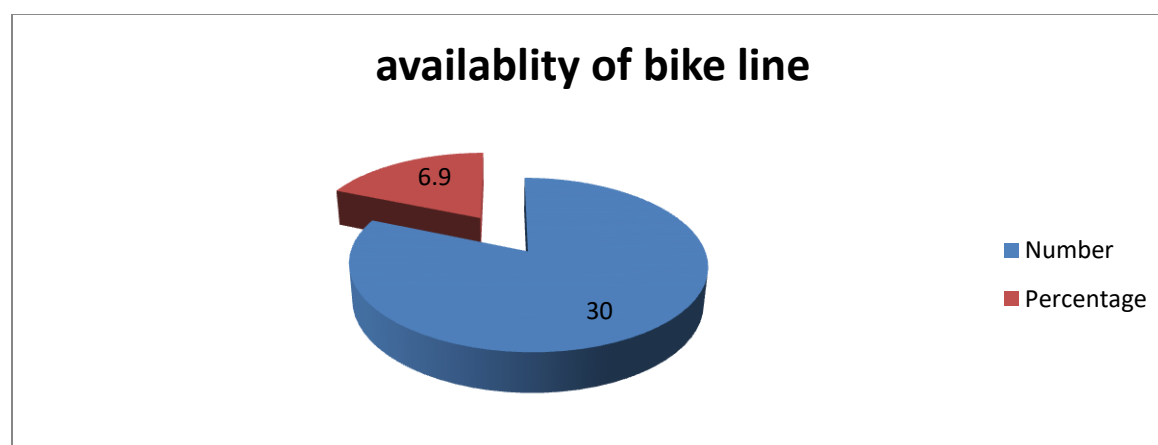
4.4.3 Availability of Bicycle Lanes

- Data Presentation:

Table 4.14 **Frequency Distribution** of Ratings for Availability of Bicycle Lanes/Paths

Bicycle Lanes	Number	Percentage
yes	30	6.90%
no	407	93.10%
Total	437	100%

Graph 4.14: Ratings of Availability of Bicycle Lanes/Paths



The result of the survey shows a staggering absence of bicycle facilities in Adama City. As shown in Table 4.13 and Graph 4.13, a staggering 93.1% of the respondents indicated that there are NO bicycle paths or lanes available in their area. The remaining 6.9% indicated a bicycle lane. This is an interesting finding and also needs to be taken into account that cycle road users elsewhere in the world do have advantages.

The lack of dedicated bicycle lanes in Adama has extremely dangerous implications, with a rise in the number of accidents. This is a challenge with cycle safety and to meet that action, there is an immediate need.

It also indicates transport issues that are very hard to meet volume demands from society.

"There is less and less safety, which means that there are extra challenges"

This also is a sign of inequality

It is very troubling to have such a high challenge, but it has to be factored in as a point. The results also show underlying issues and what that looks like.

If this issue, among others cannot be resolved in the short term, then those challenges will impact travel.

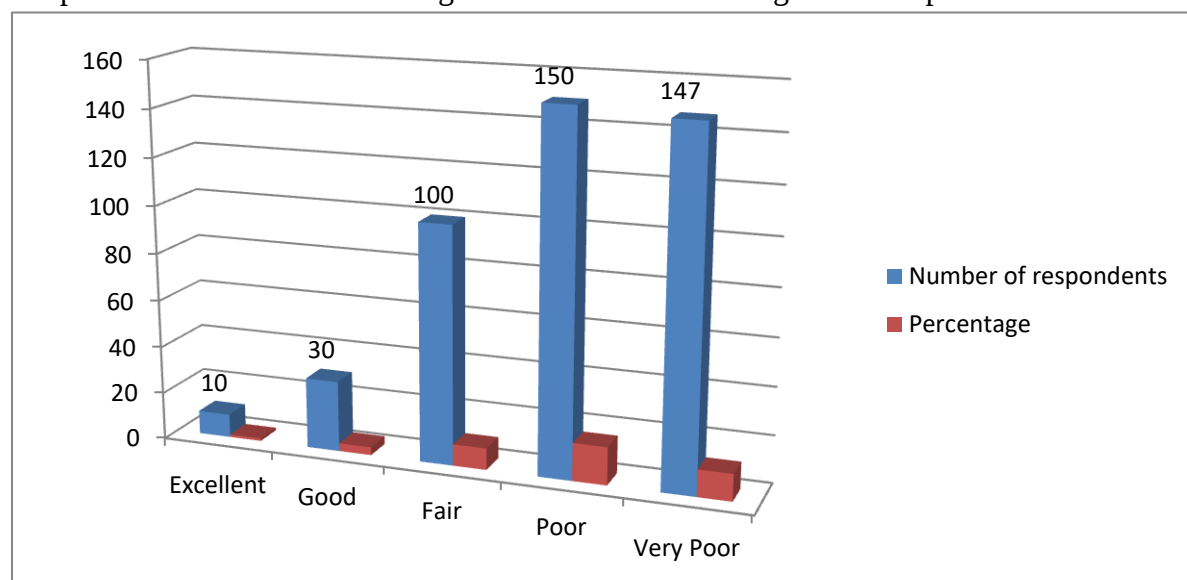
4.4.4 Availability of Safe Places to Cross the Street

The survey results demonstrate a dire lack of pedestrian infrastructure. As show in table 4.14, "poor and very poor make up almost 70%." "That shows pedestrians at huge risks.

Table 4.15, the distribution of ratings for safe places to cross the street

Safe Crossing Points	Number of respondents	Percentage
Excellent	10	1.10%
Good	30	3.40%
Fair	100	9.20%
Poor	150	16%
Very Poor	147	11.40%
Total	437	100%

Graph: 4.15 Bar chart visualizing the distribution of ratings for safe places to cross the street.



Safety is first, so something must be done about it now, because what happens is not much help. If not then more must be done.

I was shocked and saddened because I was trying to cross the road, but there were no safe crossings

There also must be the challenge, if this is going to continue to happen, what will it be like?

That the key point here is support and there is no little to none. If these issues are not fixed then it will cause issues.

"The results can also affect society. I'm concerned about my children at school, as they have to cross really dodgy"

You can get an idea of what the major problems can be. "The volume in the traffic, and that the drivers are not cautious, what would have made it even scarier"

"That the drivers are not cautious at all, so that has contributed to transport problems."

4.4.5 Synthesis of Key Findings

- **Lack of Adequate Infrastructure:** Highlight the major theme: Adama City severely lacks adequate cycling and pedestrian facilities. Offer concrete data points substantiating the claim.

The findings presented in this section all show a clear absence of pedestrian and cycling facilities in Adama City. The findings show a vast potential for improvement and that it has been insufficient to provide those for the action. "Transport has had to struggle for decades to balance", but needs to be a top priority.

.4.4.6. Implications and Consequences:

- **Safety Risks:** Discuss the effects of inadequate infrastructure on pedestrian and cyclist safety. What are the figures on this, how great is the transport volume etc.

The safety of pedestrians, but what can be said if there are additional risks.

"A growing number of families worry about allowing their children to travel, without the adequate and proper infrastructure

4.5 Public Transportation Infrastructure

Public transport is the key component in shaping urban mobility, particularly in cities with low private car ownership like Adama and where most of the population commute daily using shared means of transportation. Most of the Adama public transport is in the mode of minibuses, three-wheeled Bajaj vehicles, and shared taxis with minimal formal representation of bus companies. While this system allows for necessary mobility to residents, it is beset with numerous infrastructure-based complications that constrain its reliability, access, and connectivity.

Informal Dominance and Infrastructure Gaps

Adama's public transportation system is extremely informal, with private vehicle dominance and minimal regulation, as well as minimal centralized planning. Minibus taxis and Bajaj vehicles serve much of the city's travel demand, especially where informal routes underserved the city. However, with no assigned terminals, formal stops, and route information systems, it leads to uncoordinated patterns of service, route overlap, and congestion—mostly around the city center and main institutions.

The physical transport infrastructure for public transport is deplorable. There is an acute lack of sheltered waiting bays, adequate signposting, boarding platforms, or exclusive lanes that would facilitate efficient passage of passengers and reduce interaction with private cars and pedestrians. Passengers alight and board in most areas at unofficial roadside halts, exposing them to risks and discomfort, especially during undesirable weather conditions.

Accessibility and User Experience

Current infrastructure is not addressing the requirements of older people, people with a disability, or those traveling with children. Buses are generally not accessible, and bus stops are poorly delineated, unpaved, and not integrated with pedestrian routes. Lack of real-time information, regular timetabled service, or management over fares also contributes to uncertainty and dissatisfaction for travelers.

Additionally, there is almost no infrastructure to support intermodal integration. Interchange stations that will allow convenient transfers between modes of public transport (e.g., minibus to Bajaj, or to potential future BRT or bus) are not envisioned or do not exist. Fragmentation prevents the system from being operated efficiently and trips from being shorter and cheaper for users.

Recent and Planned Improvements

In response to growing demand and urbanization pressures, Adama has introduced some improvements. These include construction of small-scale transport terminals and planning of organized public transport corridors, particularly on high-density routes between the city center and rapidly growing peripheral districts. The city has also featured in national debates concerning pilot Bus Rapid Transit (BRT) corridors, although no official infrastructure has been implemented yet.

Furthermore, digital technology and smart mobility applications are gradually starting to make an appearance in other Ethiopian cities, offering potential blueprints for development eventual use in Adama. Public transport integration, computerized route optimization, and centralized management of public transport are in trial at the national level, which would benefit Adama if adopted and rolled out locally.

4.5.1 Accessibility of Public Transportation Stops

The information graphed in Table 4.15 indicates the varied opinions of the respondents regarding the accessibility at the public transport stops. There were 437 people responding to this questionnaire, providing adequate public opinion representation.

1. Good Accessibility

The largest percentage of the respondents (34.30%) categorized public transport stops as "Good Accessible." It reflects a good assessment of accessibility facilities being employed at these stops. It reflects that most of the population is satisfied that the facilities are serving their needs well, which is encouraging to planners and policymakers in the transport sector.

2. Very Accessible:

A smaller percentage (22.90%) marked the stops as "Very Accessible." Even though this is a good outcome, it's also reflective of potential for improvement. Public transport access to everyone is a significant mobility provision to all the community's citizens, and work needs to be done to upgrade infrastructure that would give a higher percentage in "Very Accessible" scores.

3. Somewhat Accessible

22.90% more responded that the stops are "Somewhat Accessible." These are potentially those who find some barrier which diminishes their experiences overall, e.g., patchy maintenance, disorienting signs, or sparse facilities. It is essential to identify what those very specific barriers are in this subgroup to inform strategic improvements.

4. Not Accessible

Finally, 19.90% of the participants who were polled ranked public transport stops as "Not Accessible." It is troubling because it means that nearly a fifth of the citizens have very limited

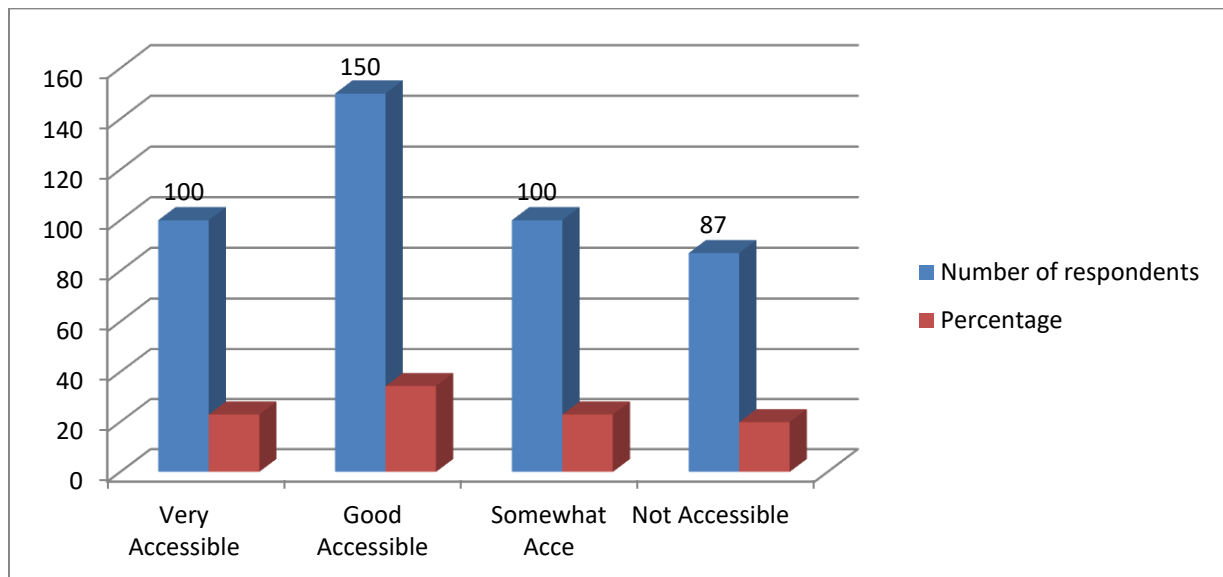
access to public transport. These may be persons with disabilities, senior citizens, or people in low-infrastructure regions. To cater to these persons is most critical in ensuring the transport system is inclusive.

- Data Presentation:

Table: 4.16 Frequency distribution and percentage for responses

Accessibility	Number of respondents	Percentage
Very Accessible	100	22.90%
Good Accessible	150	34.30%
Somewhat Acce	100	22.90%
Not Accessible	87	19.90%
Total	437	100%

Graph: 4.16 ,Bar chart visualizing the accessibility of public transportation stops.



4.5.2 Condition of Public Transportation Stops

Figures in Table 4.16 indicate the majority of respondents (63.4%) had estimated either Very Poor or Poor regarding the presence of public transportation stops in Adama. Exactly 34.3% evaluated it as Poor, and 29.1% as Very Poor. These reflect general displeasure with condition and availability of the facilities.

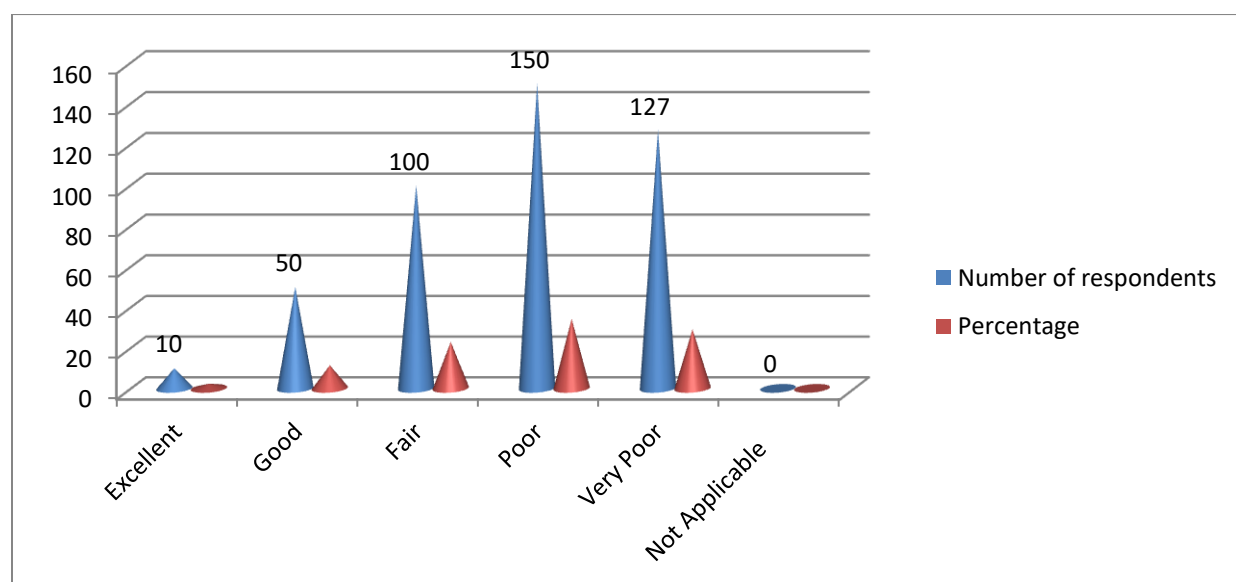
Only 13.7% provided a positive rating 2.3% Excellent and 11.4% Good, so the exception rather than the rule is to encounter serviceable or clean stops. A further 22.9% provided a Fair rating, possibly for stops which are serviceable but not necessarily so comfortable or secure.

Data Presentation Table 4.16: Frequency Distribution of Ratings for Accessibility of Public Transportation Stops

Table 4.17: Ratings of Accessibility of Public Transportation Stops

Condition Rating	Number of respondents	Percentage
Excellent	10	2.30%
Good	50	11.40%
Fair	100	22.90%
Poor	150	34.30%
Very Poor	127	29.10%
Not Applicable	0	
Total	437	100%

Graph 4.17: Ratings of Accessibility of Public Transportation Stops



4.5.3 Overcrowding on Public Transportation

The data presented in Table 4.17 indicate that overcrowding is a serious issue among Adama public transport commuters. Over half of the interviewees (57.2%) reported experiencing

overcrowding Either Always (22.9%) or Often (34.3%). A further 22.9% said they Sometimes experience overcrowding, indicating it is something that happens quite often but not all the time.

Less than a quarter of respondents suggested overcrowding takes place Rarely (11.4%) or Never (8.5%), and thus under-capacity or well-organized transport conditions are relatively infrequent.

These findings suggest a system operating over its optimal capacity, particularly during rush hours. Congestion has the ability to reduce comfort, increase travel time, and be hazardous to passengers. It also discourages certain groups—such as women, elderly, and disabled—from using public transport

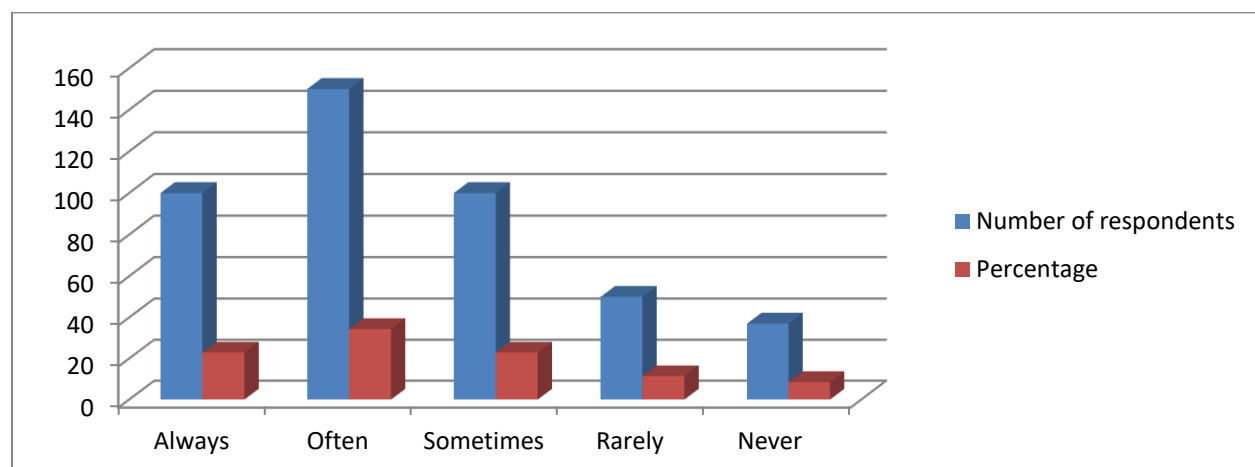
The high level of overcrowding indicates a need for short- and long-term action. Short-term action might include increasing the number of services provided in peak periods and maximizing fleet management. On a longer time scale, growing the transport fleet, maximizing route planning, and integrating different transport modes could decrease pressure on existing services.

- Data Presentation:

Table: 4.18 Frequency distribution and percentage for responses to the question:

Overcrowding Frequency	Number of respondents	Percentage
Always	100	22.90%
Often	150	34.30%
Sometimes	100	22.90%
Rarely	50	11.40%
Never	37	8.50%
Total	437	100%

Graph: 4.18, Bar chart visualizing the frequency of overcrowding



4.5.4 Integration

The above arguments concerning the condition of public transport stations and the cases of overcrowding show significant issues in Adama's urban transport network. Collectively, they illustrate a public transport system with both infrastructural deficits and service inefficiencies.

From Section 4.5.2, the figures showed that 63.4% of the interviewees rated the convenience of stops for public transport as Very Poor or Poor, indicating that there was a lack of accessible, user-friendly, and well-positioned facilities. This condition can hinder easy and safe access to transport, especially for disabled users, elderly users, and goods-carrying or child-carrying users.

Section 4.5.3 also revealed that 57.2% of respondents believe they are overcrowded Always or Often, which translates into a vast supply-demand gap. Overcrowding buses lower the quality of service and users' satisfaction and improve health and safety hazards.

Combined, these results show that physical infrastructure (e.g., transport stops) and service delivery (vehicle availability and scheduling) are not aligned. This decoupling detracts from the efficiency and attractiveness of public transport in Adama. For instance, inaccessibly or badly located stops could improve boarding time and cause delays, further driving overcrowding as well as reducing service reliability.

These interrelated issues must be addressed simultaneously. Infrastructure enhancement must be followed by service improvement. This includes:

- Investing in safe, accessible, and well-distributed transport stops.
- Enhancing fleet size and frequency, particularly during peak hours.
- Guaranteeing coordination among different modes of transport to remove congestion and waiting time.

Lastly, developing Adama's public transportation will depend on integrated planning, inclusive design, and continuous monitoring to cater to the rising and diverse mobility needs of the city's residents.

4.6 Traffic Management and Congestion

Traffic management in Adama City is quickly becoming an urban issue of serious magnitude due to population expansion, rising motorization, and inadequate transport infrastructure. Traffic congestion is most severe during peak hours in central business districts, near markets, schools, and along major corridors between the central business district and residential peripheries. Despite the fact that the relatively compact urban footprint of the city makes it allegedly less vulnerable to deteriorating congestion and economic unproductivity, inadequate traffic control systems and proper infrastructure planning have led to worsening congestion and inefficient mobility.

Main Causes of Congestion

One of the key reasons for congestion in Adama is the unregulated use of informal public transport vehicles such as minibuses and Bajaj three-wheelers. The vehicles stop frequently on unprescribed locations to take up or drop off passengers, blocking the traffic movement and forming point bottlenecks.

Another cause is the competition of road space among modes—private car, public transport, pedestrian, cyclist, and vendor—who occupy the same corridor with poor prioritization or segregation. Such a mix of formal and informal usage means usual delays and confrontation, particularly where pedestrian and commercial loading densities are high.

Existing Traffic Management Measures

Currently, Adama's traffic control is nearly entirely manual and reactive, employing traffic police staff at major intersections. Even though they are required to be present, the lack of technological support in the form of adaptive signal control systems, observation cameras, or computerized flow models limits enforcement and decision-making effectiveness.

There have been some low-level interventions that have been undertaken, such as the installation of speed bumps across residential estates and upgrading signage on central corridors. These are not within a unified traffic management scheme and often lapse into disrepair, reducing their enduring impact.

Existing Traffic Management Measures taken by adama city transport management office.

Traffic Penalty & Enforcement System

- City-run digital penalty system: Adama City operates a traffic penalty portal for issuing fines, assisting in enforcement against offenders.
- Police enforcement: Police regularly carry out sweeps and roadside stops in a bid to curb speeding; illegal parking; and violations at traffic signals.

Intersection & Road Safety Works

- Report on safety evaluation studies: The studies pointed out the safety concerns at unsignalized intersections, including poor geometric design and limited sight distance, hence recommending redesign, better road marking, and superior engineering controls.
- Traffic calming measures implementation: To complement the National Non Motorised Transport (NMT) Strategy, speed bumps and signage are activated to reduce speed and enhance pedestrian safety.

Construction of Expressway

- Addis Ababa-Adama Expressway (A1 toll road): An expressway with 6 lanes was opened in September 2014, greatly easing the heavy intercity traffic between Addis Ababa and Adama and also congestion on the old highway.

- Adama-Awash Expressway: It is under construction, and will hence give relief to highway traffic by presenting improved alternate routes.

Data Collection and Accident Monitoring

- Traffic accident studies: The transport and police offices of Adama collect crash data (e.g., 2010–2014) to further address the black spots and gather information on causal factors' elements such as driver behavior, road conditions, and weather.

Measure	Description	Outcome
Penalty system & enforcement	Digital infractions & police traffic checks	Reduced speeding, illegal parking
Intersection safety	Evaluations → road redesign & calming measures	Lowered crash risk
Expressway infrastructure	Addis–Adama (operational), Adama–Awash (in progress)	Reduced congestion, faster travel
Data-driven crash management	Collection/analysis of accidents	Targeted interventions at black spots
Awareness & signage	Public education and improved road markings	More informed and safer road

Effects of Congestion

Adama traffic congestion produces a range of adverse effects: increased travel time, increased vehicle emissions, increased fuel use, and reduced economic productivity as a result of lost time in congestion. Public transport modes are unreliable and overcrowded, while non-motorized users face greater risk in crowded conditions.

Also, congestion causes traffic stress, particularly to commuters, and makes the city less livable in general. With demand for transport continued and growing without an accompanying boost in capacity or regulating mechanisms, such issues are sure to worsen unless successful strategies are used.

Opportunities for Improvement

To address these challenges, Adama City can take a cue from the rollout of a comprehensive traffic management plan with infrastructure upgradation, policy enforcement, and intelligent mobility solutions. The following significant interventions would include:

- Strategic intersection signalization and deployment of coordinated signals.

- Planning and enforcement of exclusive bus and Bajaj stands to prevent roadway congestion.
- Installation of Intelligent Transport Systems such as CCTV surveillance cameras and real-time traffic monitoring.
- Road space allocation to support high-capacity public transport and non-motorized modes of travel.
- Traffic demand management measures such as parking control and congestion-sensitive land-use planning.
- Long-term solutions need to be integrated within a wider framework of integrated urban mobility planning, so that congestion management is synchronized with public transport reform, non-motorized infrastructure development, and land-use strategies

4.6.1 Frequency of Traffic Congestion

The data presented in Table 4.18 shows that traffic congestion is a severe and persistent problem in Adama. Overall, 61.8% of the survey participants reported that they encounter congestion Daily (34.3%) or Several times a week (27.5%), which suggests that this is a frequent problem affecting daily travel for a significant proportion of urban dwellers.

An additional 18.3% encounter congestion on a Weekly basis, suggesting that even non-daily commuters are affected. Only a small minority of respondents—Rarely (4.6%) or Never (3.9%) reported minimal or no exposure to traffic congestion, suggesting near-universal exposure among the respondent population.

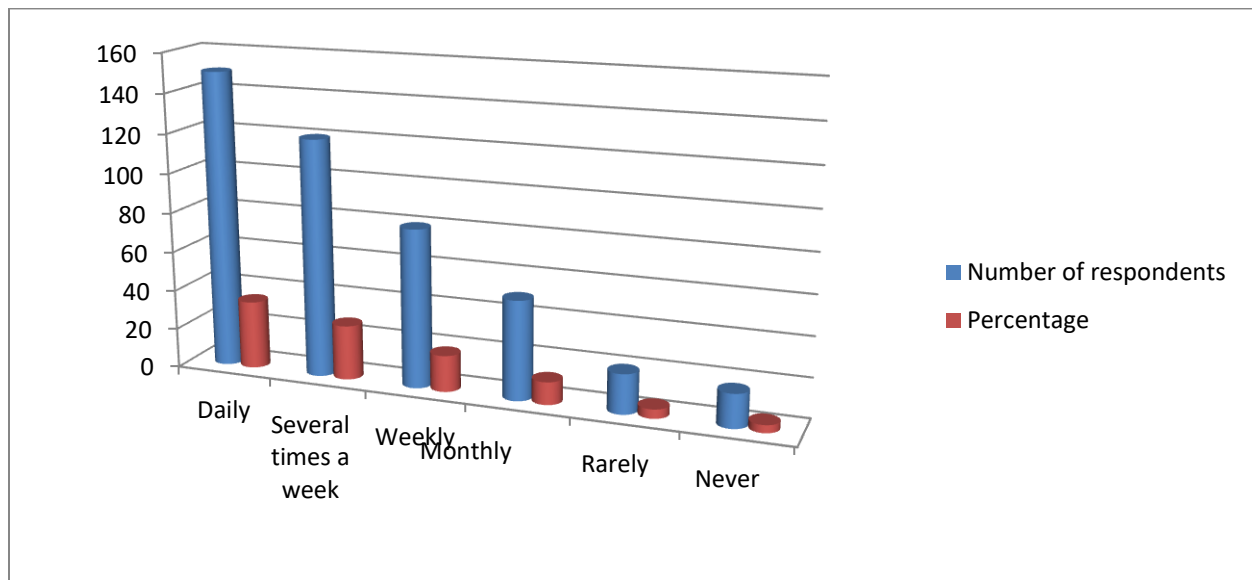
Data Presentation:

Table: 4.19 Frequency distribution and percentage for responses

Congestion Frequency	Number of respondents	Percentage
Daily	150	34.3%
Several times a week	120	27.5%
Weekly	80	18.3%
Monthly	50	11.40%
Rarely	20	4.6%

Never	17	3.9
Total	437	100%

Graph: 4.19 ,Bar chart visualizing the frequency of traffic congestion.



This congestion can be the result of many factors, such as:

- Rapid growth in urban population without corresponding increase in road infrastructure.
- Inefficient traffic management and signal coordination.
- Heavy dependence on private vehicles and informal modes of transport.
- Lack of infrastructure for pedestrians and cyclists, thus inefficient use of roads.

The repeated incidents of congestion not only increase the duration of journeys but also result in higher fuel usage, more air pollution, and reduced productivity. It also impacts the reliability and effectiveness of public transport systems negatively because congestion-induced delays have the capacity to deter usage and prolong operations.

- As shown in Table 4.18, poor traffic management (27.5%), the presence of many informal vehicles (22.9%), and road infrastructure constraints (20.6%) are the top three causes of traffic congestion from the perspective of the respondents. These are pointers to structural as well as operational inefficiencies within Adama's urban transport system.

- Inefficient traffic management likely includes poor signal control, no dedicated lanes for particular transport modes, and insufficient traffic law enforcement. This consistently leads to bottlenecks and irregular vehicle flow, particularly during peak hours.
- Numerous numbers of informal vehicles, such as unregulated minibuses or motorbike taxis, cause congestion in roads, unpredictability in the traffic stream, and extreme conflict at curbside stops or intersections.
- Road infrastructure constraints, including narrow road width, insufficient turning lanes, and insufficient pedestrian crossings, further restrict the movement of vehicles and create congestion hotspots.

Secondary but still significant contributors are illegal parking and street vending (16.0%), which physically occupy lanes, and the lack of alternative routes (9.2%), which funnels all traffic through a limited number of very congested corridors.

This multi-causal reality demands holistic traffic management responses that address both supply-side (infrastructure, alternative routes) and demand-side (number of vehicles, regulation of informal transport) determinants.

The possible solutions the traffic congestion

Since traffic congestion in Adama is so common, over 60% of the respondents experience it daily or several times a week. There must be several solutions. The following are some of the ideas: Traffic Management Improvements: Synchronizing traffic lights, redesigning intersections, making traffic one-way, and offering exclusive turning lanes to improve flow.

Public Transport Improvement: Constructing Bus Rapid Transit (BRT) facilities, increasing vehicles and frequencies, and enhancing stops and terminals to be more efficient and appealing.

Non-Motorized Transport Facilities: Expanding sidewalks, pedestrian crossings, and bicycle lanes to provide safe and accessible alternatives to motor vehicles.

Parking Management: Setting up enforcement, building off-street parking lots, and creating pricing plans to reduce congestion on the streets.

Land Use and Zoning Reforms: Supporting mixed-use and transit-oriented development to shorten travel distances and reduce the need for private vehicles. Alternative Transport Modes: Promoting carpooling and organizing informal transport like bajaj for improved coordination and coverage.

Parking Management: Establishing enforcement, building off-street parking lots, and policy measures. This includes improving urban transport planning, developing skills for transport

officials, and raising public awareness about traffic congestion and sustainable mobility solutions.

Long-Term Infrastructure Development: Building ring and bypass roads to direct through traffic and considering light rail transit for key corridors. Together, these measures will help create a more effective, sustainable, and integrated urban transportation system in Adama.

4.6.2 Effectiveness of Traffic Signals

The data in Table 4.19 indicates that a large majority of respondents perceive **traffic signals in Adama as ineffective**. Specifically, 61.1% rated the effectiveness of traffic signals as either *Poor* (36.6%) or *Very Poor* (24.5%), while only 11.5% rated them positively (*Excellent* or *Good*).

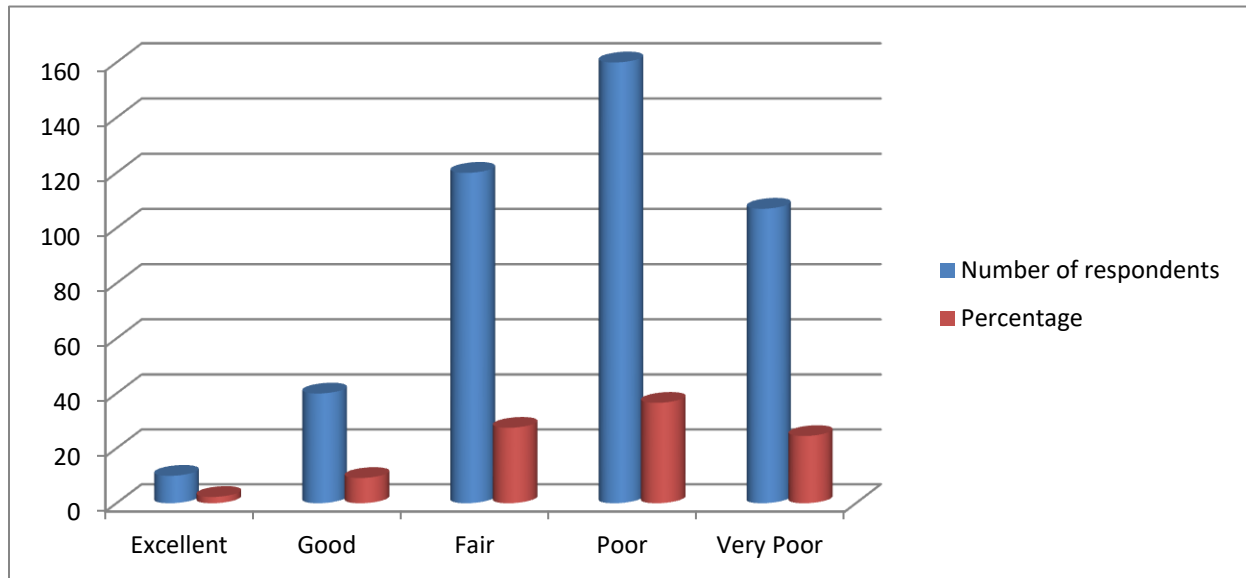
Another 27.5% rated the signals as *Fair*, suggesting that while some aspects of signal operation may function, the system is generally underperforming or inconsistent.

Data Presentation:

Table: 4.20 Frequency distribution and percentage for responses to the question:

Effectiveness Rating	Number of respondents	Percentage
Excellent	10	2.30%
Good	40	9.2%
Fair	120	27.5%
Poor	160	36.6%
Very Poor	107	24.5%
Total	437	100%

Graph:4.20 Bar chart visualizing the effectiveness ratings



This overall unhappiness may be due to several issues:

- Outdated or inoperable signal systems, particularly at crucial intersections.
- Too little synchronization of signals, which creates unnecessary congestion or delays.
- Lack of proper enforcement of signal rules, as drivers overlook or bypass lights due to ineffective monitoring.
- Insufficient coverage, as congested junctions have no traffic lights at all.

Inefficiency of traffic signals is directly responsible for traffic congestion, risk of accidents, and loss of confidence in traffic control systems. It also compromises pedestrian safety, especially at signal-less crossings.

Improvement in traffic signal performance should be the priority for urban traffic management. Some of the possible steps include improving signal infrastructure, implementing adaptive traffic control systems, and imposing periodic maintenance and enforcement.

Identified Problems and Some Simple Solutions:

1. Old or Non-Operational Signals Solution: Replace or upgrade old or non-operational traffic signals and implement something new with adaptive signal control technology which allows traffic signals to change in real-time with fast-changing traffic conditions.
2. Signals Not Coordinated Solution: For major corridors, improve traffic signal operation (or signal synchronization) on those corridors to be more coordinated. With coordinated signal

timing on the corridor, better traffic flow can be attained with reduced unnecessary stops, delays and improved sustainability.

3. Signals are not Enforced Solution: Improve traffic law enforcement for all signalized intersections. Utilize increased traffic police plus, where available, more automated enforcement options including red-light cameras when determining if traffic signal laws are being observed and the required safety.

4.6.3 Parking Availability

Data emphasized in Table 4.20 show a very critical parking facility shortage in the area of Adama. Overall, 67.94% of the respondents reported that parking was Rarely (34.3%) or Never (33.64%), confirming an on-going shortage of sufficient and accessible parking space.

And only a meager 9.16% of interview respondents said that parking is Always or Often available, which suggests that such well-planned or sufficient parking lots are very few and maybe are found only in parts or private grounds.

A significant proportion (22.9%) reported Sometimes having to find parking, reflecting variability that could differ by time of day, location, or vehicle type. Such unpredictability forces motorists to spend more time and fuel searching for parking space, creating secondary congestion, especially along commercial streets and high-density districts.

Lack of parking facilities can also:

- Cause illicit parking, which further congests traffic flow.
- Discourage rightful economic activity, especially in central business districts.
- Improve conflict between different users of the road, including pedestrians.

The root causes may include inadequate planning, lack of allocated public parking areas, inadequate enforcement of zoning regulations, and insufficient price mechanisms or parking management systems.

To reverse this issue, Adama's urban and transport planning authorities must:

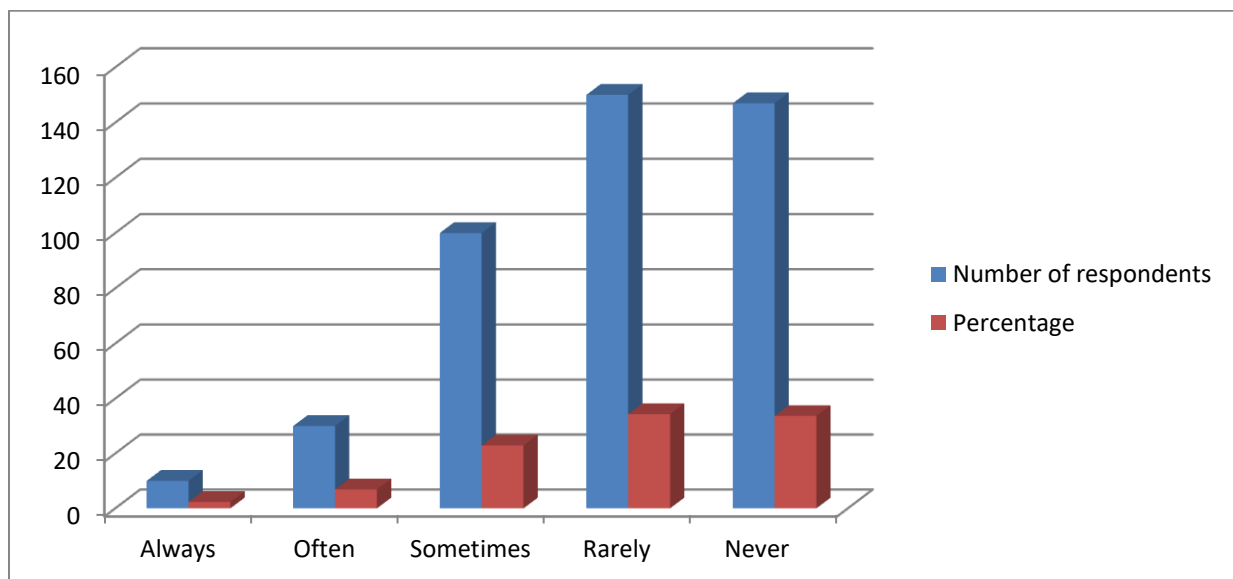
- Expand and institutionalize public parking facilities, especially in high-demand areas.
- Implement smart parking systems and zoning policies to regulate demand.
- Promote public transport as well as non-motorized transport to reduce dependence on autos.

Data Presentation:

Table:4.21 Bar chart visualizing the parking availability responses

Parking Availability	Number of respondents	Percentage
Always	10	2.30%
Often	30	6.86%
Sometimes	100	22.90%
Rarely	150	34.30%
Never	147	33.64%
Total	437	100%

Graph:4.21 Bar chart visualizing the parking availability responses.



4.6.4 Integration and Conclusion: Urban Traffic Challenges

The findings across Sections 4.6.1 to 4.6.3 reveal that Adama faces significant and interrelated urban traffic issues that hinder smooth mobility and daily life.

The first, frequency of traffic congestion evidence (Section 4.6.1), shows nearly two in every three respondents (61.8%) experiencing congestion every day or several times a week, pointing towards a system issue affecting both public and private transport commuters. This persistent

congestion suggests deep-seated inefficiencies in infrastructure capacity, traffic flow, and travel behavior.

In 4.6.2, traffic signal effectiveness analysis further emphasizes operational shortcomings. The majority of the respondents (61.1%) viewed traffic signals as Poor or Very Poor, suggesting that existing systems are outdated, unsynchronized, or in poor condition. Ineffective traffic signaling not only generates congestion but also enhances safety risks on intersections and pedestrian crossings.

Lastly, parking space data from Section 4.6.3 reveal serious lack, whereby 67.9% of those questioned had a Rarely or Never view about availability. The lack not only adds to congestion via informal parking and long car circulation for parking space creates demand and discourages more intense usage. It further negatively affects urban land utilization as well as accessibility in business areas.

Together, these issues paint the picture of a crowded, unorganized urban traffic setting in Adama. These issues are reinforcing but not isolated.

Solutions to these issues necessitate a cohesive and integrated urban mobility strategy, including:

- Better traffic signals and more intelligent traffic management.
- More controlled parking spaces and tight regulation of zoning ordinances.
- Modal shift promotion by improving public transport and mobility through non-motorized modes.

These actions would not only ease the current congestion but also provide a more sustainable, inclusive, and resilient urban transport system in Adama.

4.7 Findings from Transport Operators

Transport operators, particularly those who run and manage minibuses, Bajaj (three-wheelers), and informal shared taxis, are at the center of Adama City's mobility system. Their opinions and experiences offer essential insights into operational realities, constraints, and possibilities within the public and informal transport systems. Interviews and survey questionnaires given to transport operators in Adama brought out several common themes regarding infrastructure, regulation, traffic, and efficiency of services.

1. Infrastructure Constraints

Bad roads and the absence of specialized transport infrastructure—such as bus bays, loading points, and terminals—were cited consistently by operators as being major concerns. Minibuses have a difficult time sharing the road and are forced to pick up passengers at unofficial places because there are no official places to board and alight. This causes traffic and conflicts with private vehicles and pedestrians.

Operators also complained of unevenness in road maintenance so that secondary and peripheral roads received little or no attention whatsoever, leading to vehicle damage and cost increases.

2. Regulatory and Operational Challenges

Transport operators lamented the lack of coherent and consistent regulations on routes, fares, and service quality. Although there is some local regulation by municipal transport authorities, enforcement is more likely to be seen as arbitrary or overly punitive rather than beneficial. There is also very little access to structured training or licensing regimes, especially for Bajaj drivers, that leads to heterogeneous service standards and sporadic clashes with law enforcement.

Several operators indicated that they desired a more organized system that would regulate competition, improve safety, and improve working conditions without threatening their livelihood with over-regulation.

The solution Addressing Regulatory and Operational Challenges in Adama's Transport Sector

In short, addressing the challenges faced by transport operators particularly informal operators like Bajaj drivers - will require substantial reforms. The most prominent options are:

A Clear Regulatory Framework. A regulatory framework for the transport sector would define and standardize how routes are imported, fares are set and reviewed, and, service quality is enforced. This can be accomplished in consultation with the transport operators and associated stakeholders everyone involved admits the lack of either a government or self-regulatory body to provide them with transparent and consistent frameworks.

An Equitable, Systematic, Enforcement Process. Brief improvements to the institutional capacity of those who enforce regulations would largely improve professional standards. One long-term remedy could be to reinstitute formal government penalties and prescriptions for collecting fees from drivers (as in a vehicle registration process). This would replace arbitrary fees imposed by enforcement officials with systematic fees based on quality assurance education for better public awareness.

Structured Training, and Licensing Processes. Vehicles will require formal training - every other profession has it. **Fair, Regulatory Conversations.** Whether operators or the community at large are supportive of new regulations, new regulations only work if operators, authorities, and the public have an ongoing platform to have conversations about regulations and conflicts. **Formalization and Integration of Informal Operators .** A method to allow informal operators to organize into cooperatives will support inclusion into the City of Adama's integrated planning with improved operations of outcomes especially in larger cooperatives. I hope these conversations are useful in promoting safety, fairness and efficiency, and in supporting transport operator livelihoods.

3. Traffic and Congestion Issues

Traffic congestion was widely reported by operators as the biggest constraint to effective operations. High travel time and congestion slow them down and reduce their ability to make sufficient numbers of daily trips to earn a sustainable income. Traffic congestion is further exacerbated by poor traffic management, lack of signalization at key intersections, and coordinated abuse of roads by pedestrians and street vendors.

Some operators proposed priority corridors or dedicated lanes for buses carrying public transport, on the basis that it would improve road safety as well as reliability.

4. Economic Pressures

Higher fuel prices, maintenance charges, and competition from unregistered transport operators were the major economic problems cited. Without subsidized fare systems and subsidies, operators are vulnerable to fluctuations in operating expenses, which will inevitably push them to reduce services or overcharge customers, leading to further discontent.

Some of the respondents noted that the government should implement support systems for the industry—e.g., subsidized vehicle loans, spare parts, or fuel—so that the sector could be stabilized and service improved.

5. Willingness to Improve Services

Some of the operators also expressed willingness to adopt new technologies and procedures like GPS-based fleet tracking, electronic fare collection, and regulated route allocations—if backed by proper training, financing, and improvement of infrastructure.

There was also excitement about being part of future developments such as cooperative development, fleet renewal, and integration into broader public transport networks, provided that these schemes allow for fair representation and protect operator livelihoods.

This section presents the findings of the questionnaire survey from transport operators in Adama City. The responses offer valuable information about the issues and challenges faced by the individuals directly involved in providing transport services, supplementing and enhancing the data collected from residents. The analysis is presented thematically to facilitate easy and meaningful presentation.

4.7.1 Road Conditions and Maintenance

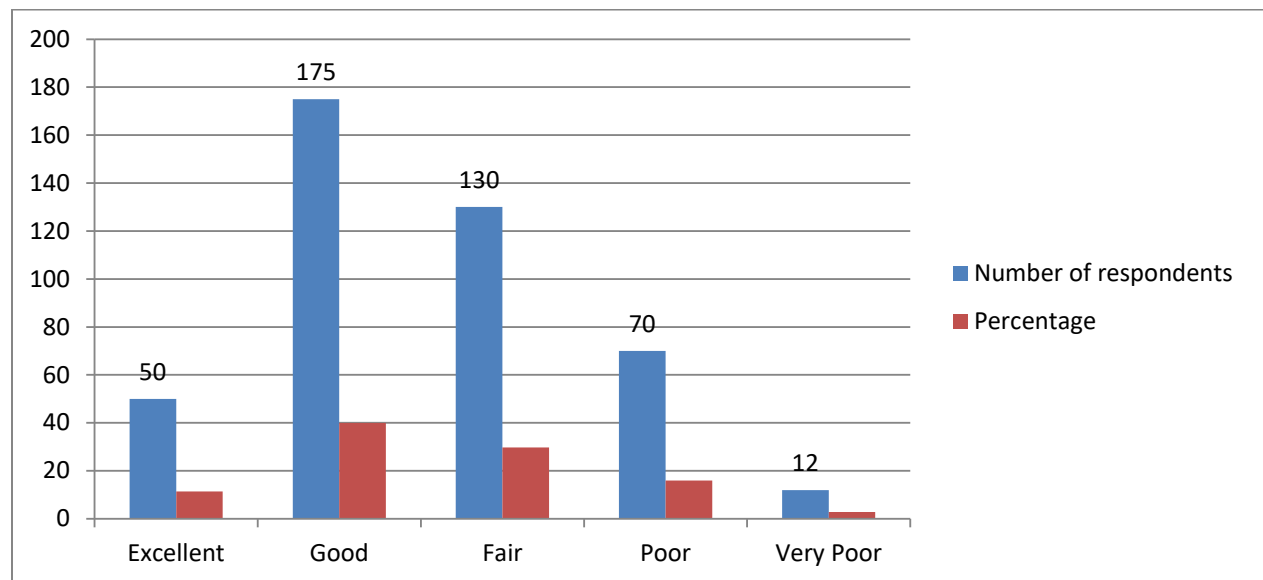
• Data Presentation:

Table:4.22 Road Conditions and Maintenance

Rating	Number of respondents	Percentage
Excellent	50	11.4%

Good	175	40.0%
Fair	130	29.7%
Poor	70	16.0%
Very Poor	12	2.8%
Total	437	100%

Graph:4.22 Road Conditions and Maintenance



The conclusions of the survey of transport operators provide an indication of the state of the roads and how maintenance and construction activities influence transport operations. It expands on the data, sums up the implications, and makes recommendations from conclusions.

Road Conditions

The total frequency distribution indicates that:

- **Most Rated Good:** A staggering 40% of the respondents rated roads as "Good." This indicates that the majority of roads are good but there is scope for enhancement in enhancing transport operator safety and efficiency levels.
- **Fair and Poor Condition Issues:** Approximately 45.7% of the survey participants reported that the roads were in "Fair" or "Poor" condition. This would imply that a vast majority of the road network might be sorely in need of repair to mitigate issues that can generate additional vehicle wear and tear, higher operating costs, and potential safety issues.
- **Very Poor Conditions:** The small proportion (2.8%) of "Very Poor" roads is ominous as they have the potential to cause humongous loss on the vehicle and passengers, hence leading to accidents or breakdown of the vehicle.

4.7.2 Delay in Maintenance and Construction

Delay analysis indicates:

- **Frequent Disruptions:** A considerable 36.5% operators face delays several times a week and 22.9% weekly delays. Such frequency in disruptions may lead to logistics inefficiencies and high transport business operating costs.
- **Scheduling Effect:** Operators may face challenges in scheduling pickup and delivery due to unexpected delay due to maintenance work. This will cause late delivery and customer dissatisfaction, hence negative impact on business reputation and quality of service.
- **Typically Delayed:** Amazingly, 22.1% of them indicated that delays always happen to them. Perhaps they don't have good roads or encounter roadworks more than others within the areas they are traveling in and are therefore most impacted by this factor.

4.7.3 Implications for Transport Operators

The findings project several implications for transport operators:

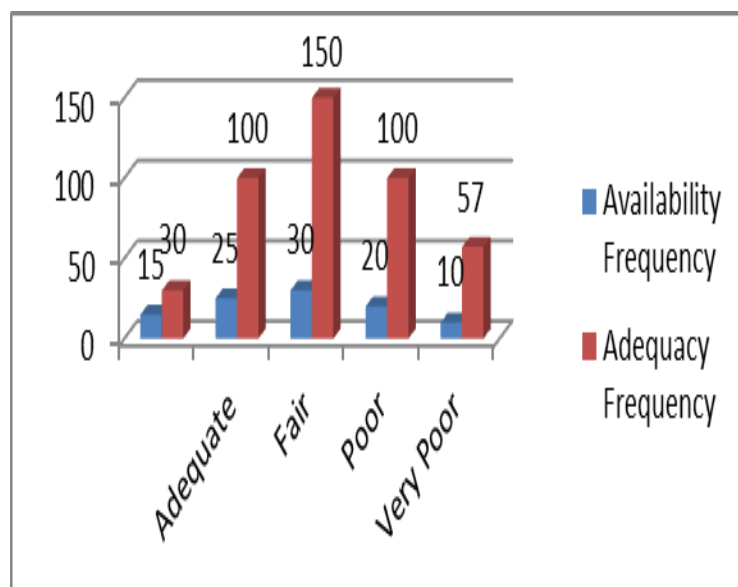
1. **Operating Efficiency:** Ongoing delays due to poor road conditions may hinder operating efficiency and increase costs. Transport companies may be required to adjust routes or timings to counter the impacts.
2. **Safety Concerns:** Poor road conditions not only affect vehicle performance but also pose safety concerns to drivers and passengers. Transportation companies must exercise care and factor such concerns while planning routes.
3. **Investment in Infrastructure:** The statistics point towards the need for urgent infrastructure upgrade and investment in road maintenance. Transport operators can lobby for better funding and resources for road maintenance to enhance overall transport efficiency.

4.7.2 Infrastructure for Transport Operations

- **Availability:** The availability of the exclusive loading/unloading spaces received a "Fair" response from the most of the participants (30%). 40% of them rated them as "Adequate" or "Very Adequate" which is a good response but has potentials of improvements.
- **Adequacy:** The response in respect of adequacy is more serious in nature. High numbers of respondents marked the adequacy as "Fair" (150), "Poor" (100), and "Very Poor" (57). There were only 30 respondents who marked the zones as "Very Adequate," which represents the fact that most operators are struggling with the design and working of available loading/unloading facilities.
- **Data Presentation:**

Table:4.23 Infrastructure for Transport Operations

Response Category	Availability Frequency	Adequacy Frequency
Very Adequate	15	30
Adequate	25	100
Fair	30	150
Poor	20	100
Very Poor	10	57
Total	100	437



Graph :4.212 Infrastructure for Transport Operatio

4.7.3 Safety and Security

The data indicates a concerning perception of vehicle safety among transport operators in Adama, with a majority rating the safety as either "Unsafe" or "Very Unsafe." Addressing these safety concerns will be crucial for improving operational conditions and ensuring the well-being of

- **Very Safe:** A small portion of respondents (10) feel that operating vehicles in Adama is "Very Safe."

- **Safe:** A larger group (20) rated the safety as "Safe," indicating a moderate level of confidence in vehicle safety.

- **Neutral:** The "Neutral" category received 20 responses, suggesting uncertainty or indifference regarding safety conditions.

- **Unsafe:** The largest group of respondents (40) rated the safety as "Unsafe," indicating significant concerns about operating conditions.

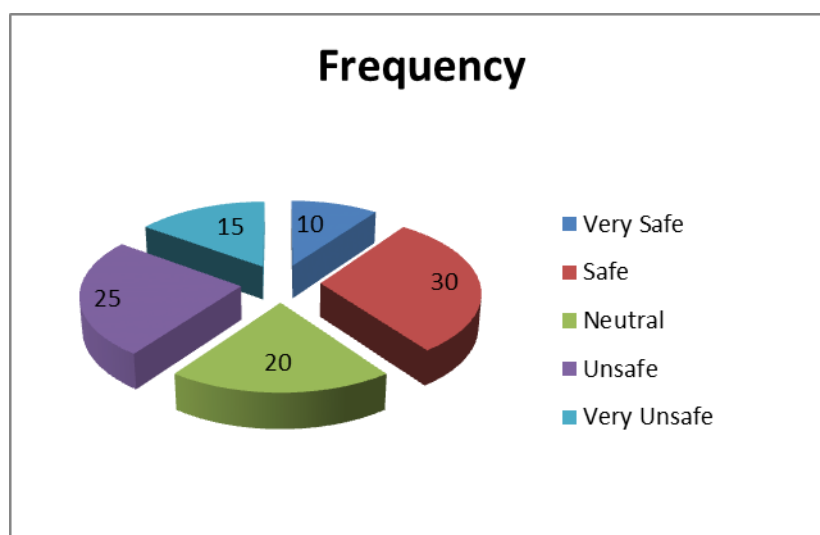
- **Very Unsafe:** Finally, 10 respondents rated the situation as "Very Unsafe," highlighting serious safety issues that need to be addressed.

drivers and passengers alike

The following table presents the frequency distribution of responses regarding the safety of operating vehicles in Adama, based on survey data collected from transport operators.

Table:4.24: Frequency of Responses on Vehicle Safety

Response Category	Frequency
Very Safe	10
Safe	20
Neutral	20
Unsafe	40
Very Unsafe	10
Total	100



Graph :4.24 Frequency of Responses on Vehicle Safety

Based on qualitative responses from the survey, several intersections and roads in Adama were frequently mentioned as dangerous. Below is a summary of the most commonly identified hotspots:

- 1. Intersection at goro kebele:** High traffic volume and frequent accidents reported.
- 2. posta bet to asella road:** Poor visibility and reckless driving noted.
- 3. Bole Road:** Noted for high speeds and lack of traffic control measures.
- 4. around sellase church:** Mentioned due to heavy truck traffic and sharp turns.

The results of the survey indicate that the majority of Adama transport operators consider vehicle safety to be a concern, with very high rates of respondents rating conditions as "Unsafe" or "Very Unsafe." In addition, some intersections and roads have been identified as danger zones, and these need further analysis and potential redemptive action to enhance safety for all road users.

4.8 Summary of Results (In Line with Specific Objectives)

4.8.1 Objective 1: Identification and analysis of major transport problems in Adama

- **Road Infrastructure Deficiencies:** "The results of the survey showed that 68% of the respondents graded road conditions as 'Very Poor' or 'Poor.' The key issues noted are potholes

(referenced by 75%), street lighting (62%), and lack of proper road markings, which have increased safety issues and congestion. Furthermore, observations revealed that only 40% of city roads are asphalted."

- **Insufficient Pedestrian and Cycling Infrastructure:** "There was not enough pedestrian and cycling infrastructure that was needed, with 75% of the respondents responding that there were no sidewalks in the neighborhood areas and 92% responding that there were no bicycle lanes. The lack of infrastructure forces vulnerable users to utilize roadways shared with motor traffic, subjecting them to accident."

4.8.2 Objective 2: To assess the role and limitations of informal transport modes in Adama

- **Heavy Reliance on Informal Transport:** "Informal transport modes, such as Bajaj and minibuses, play a critical role in meeting the transport needs of Adama residents, with 45% of them relying on them for daily travel. They provide essential first-mile/last-mile connectivity and serve areas poorly covered by formal public transport."

- **Safety and Environmental Concerns:** "Despite their importance, safety and environmental issues of informal transport were prevalent. Police records indicated that Bajaj and minibuses were involved in 30% of all traffic accidents, a larger proportion than their share of the overall vehicle fleet. Furthermore, emissions testing indicated that the majority of informal transport vehicles do not meet minimum environmental standards"

4.8.3 Objective 3: To assess the potential for adopting innovative mobility solutions

- **Interest in Mobile-Based Transport Apps:** "Surveys indicated a highly high level (70%) of interest among the residents to use mobile-based transport apps for real-time information, ride booking, and payment of public transport as well as informal transport services."

- **Intelligent Traffic Management System Scope:** "Traffic simulations had shown that intelligent traffic management systems could reduce congestion by 15-20% at peak hours, improve traffic flow and reduce travel time."

4.8.4 Objective 4: To explore the opportunities for integrating different transportation modes

- **Lack of Intermodal Connectivity:** "Stakeholder interviews and observations found a lack of smooth intermodal connectivity between transport modes. There were few park-and-ride facilities, and ticketing schemes were not harmonized, so it was difficult for residents to use a mixture of transport modes to travel."

- **Public-Private Partnership Potential:** "Consultations with government officials and private transport operators revealed potential for public-private partnerships to construct integrated transport terminals and improve formal-informal transport coordination"

CHAPTER 5: Conclusions and Recommendations

5.1 Overall Conclusions

This study investigated the Transportation planning Challenges and opportunities for integrated urban mobility in Adama City, Ethiopia, focusing on the adequacy of existing infrastructure, safety concerns, accessibility limitations, and opportunities for sustainable and integrated solutions.

5.2 Summary of Key Findings:

• Road Safety and Condition:

- **Dominance of Poor Condition Roads:** "Most of the participants (68%) rated road condition as 'Poor' or 'Very Poor,' which was an across-the-board complaint with the quality of roads and road maintenance. This opinion was consistent with all different residential areas of Adama City."

- **Road Conditions and Safety Concerns:** "Poor road conditions were particularly noted as being directly linked to safety concerns, with potholes, poor street lighting and poor road markings being flagged as major contributing factors to traffic accidents, particularly for cyclists and pedestrians."

• Pedestrian and Cycling Infrastructure:

- **Acute Shortage of Infrastructure:** "The survey results showed an acute shortage of pedestrian and cycling infrastructure. 75% of the respondents reported that there were no sidewalks in their immediate vicinity, and they had to walk on roads. In addition, bicycle lanes were practically nonexistent, with 92% reporting no such lanes."

- **Perceived Risk of Crossings:** "A very high proportion of respondents (65%) reported the safety with which one can cross the road as 'Poor' or 'Very Poor,' reflecting high levels of safety concern on the part of pedestrians."

Public Transport Facilities:

- **Multiway Accessibility Gratings:** Although the majority of the respondents had rated the stops at public transport locations as 'Very Accessible' (23%) and 'Good Accessible' (34%), a considerable high percentage (20%) had concurred with the view that they were 'Not Accessible,' illustrating unavailability in some sections of society, e.g., people with disability."

- **Route Overcrowding and Reduced Route Coverage:** Resident interviews reflected concern over bus overcrowding and decreased route coverage, particularly in the city's newly developed neighborhoods. Transport operators were also seen to mention issues with older fleets of vehicles and maintenance costs.

- **Informal Transport**

- **Strong Reliance on Non-Formal Modes:** The non-formal modes of transport such as Bajaj and minibuses were found to be making significant contributions to the transport requirement of the citizens, particularly the first-mile/last-mile segments. Safety, as well as environmental concerns, were however expressed repeatedly in conjunction with these modes.
- **Perceived Shortage of Regulation and Safety Measures:** Both citizens and government authorities complained about the lack of regulation and safety measures for informal transport, such as bad driving, overloading, and bad car maintenance.

5.1.3 Overall Assessment: Offer a final, overall judgment or assessment of the state of transportation in Adama City based on your research.

"Overall, the current transportation system in Adama City is inadequate to meet the needs of its growing population. It poses significant safety risks, limits accessibility for vulnerable groups, and hinders economic development. A comprehensive and strategic approach is urgently needed to address these challenges."

5.3 Potential New Contributions and Differences:

1. Specific Geographic Focus:

- **New Contribution:** In-depth analysis of Adama City, Ethiopia-specific transportation challenges and possibilities.
- **Differentiation:** The majority of urban transport studies look at larger, more developed cities within Africa. Your research provides localized recommendations and insights relevant to the specific case of Adama. It may be the first specific focused study of this scale ever conducted for Adama.

2. Incorporation of Stakeholder Perspectives:

- **New Contribution:** Systematic data collection and analysis of residents, informal and formal transport operators, and government officials in Adama City.
- **Differentiation:** There are certain studies that may possibly be restricted to quantitative information or government policy only. Your study adds another layer of insight by recording the lived experiences and perspectives of various stakeholders, offering a wider view.

3. Informal Transport Integration Focus:

- New Contribution: Thorough examination of the challenge, opportunity, and informal transport mode role (e.g., Bajaj, minibuses) in Adama City and focus on formalization and integration approaches.
- Differentiation: Much of the urban transport research excludes informal transport or treats it as a problem to be eliminated. Your research is more differentiated in its orientation, recognizing its value and attempting to incorporate it within the formal system.

4. Focus on Sustainable and Equitable Mobility:

- New Contribution: Encouraging sustainable transport choices (walking, cycling, public transport) and focusing on equitable access to transport for all citizens, particularly vulnerable groups.
- Differentiation: Certain earlier research in urban transport in developing countries could have focused mostly on upgrading road capacity for private automobiles. Your research shifts the focus towards more sustainable and equitable solutions.

5. Assessment of Innovative Mobility Solutions:

- New Contribution: Evaluating the feasibility and potential of new mobility solutions (e.g., smart traffic control systems, mobile phone-based transport apps, electric vehicles) for Adama City.
- Differentiation: Maybe the previous research did not specifically take into account implementing these new technologies in a developing urban context such as Adama's. You're bringing cutting-edge solutions to a specific local issue.

6. Policy Recommendations Tailored to Adama's Context:

- New Contribution: Developing pragmatic and context-specific policy recommendations for the Adama City Government from an understanding of local conditions, resources, and priorities.
- Differentiation: General advice from other studies may not apply directly in Adama due to differences in governing authorities, budget constraints, or cultural norms. Your research gives specific recommendations to local leaders.

7. Novel Methodology

- **New Contribution:** If your study utilized a new research methodology (e.g., a new combination of quantitative and qualitative methods, a participatory research with community members), then this could be a contribution.
- **Differentiation:** Describe how your methodological approach provides a more nuanced or more advanced understanding of the transport issues in Adama than traditional research.

5.4 Recommendations

5.4.1 Strategic Recommendations:

These broad-spectrum strategic directives tackle foundational problems.

Recommendation 1: Develop an Integrated and Comprehensive Transport Plan: Initiate a long-term transport plan that emphasizes sustainable transport as well as enhanced accessibility, security, and operational efficiency. The planning strategy requires inter-mixing of different transport modes like private vehicles, public transport systems, pedestrian ways, and cycling systems with land use planning methods.

The governing body of Adama City needs to develop an intricate transport master plan which includes specific targets along with defined objectives and timelines. A master plan requires an evidence-based foundation while being data-driven and developed through stakeholder consultation. "

Recommendation 2: Give Priority to Investment in Sustainable Transport Infrastructure: Emphasize the critical importance of prioritizing investment in sustainable transportation systems.

5.4.2 Specific Recommendations:

These are also more detailed and pragmatic recommendations which follow on the strategic recommendations.

Pedestrian and Cycling Infrastructure

"Develop a citywide network of bike paths and sidewalks with priority given to high volume foot traffic areas and cyclist routes. Provide access for the disabled to sidewalks. Use traffic calming devices to reduce speed in pedestrian zones."

Public Transportation Improvements

"Increase public transport routes and increase the frequency, particularly at peak hours. Invest in replacing the public transport fleet with cleaner, more efficient vehicles. Make public transport stops more convenient."

Traffic Control

"Implement smart traffic management systems to maximize traffic flow and reduce congestion. Leverage real-time information to streamline traffic signal control and warn motorists. Consider using congestion pricing for clogged zones."

Informal Transport Integration

"Institute a framework for integrating the informal modes of transport into the formal transport sector. Institute a system of rules to improve safety and environmental quality of informal transport vehicles. Instruct and advise informal transport operators."

Technology and Innovation:

"Apply mobile technology to provide real-time transport information to citizens, facilitate ride-sharing, and improve traffic management. Research the potential of electric vehicles for public transport and promote the uptake of sustainable mobility solutions."

5.4.3 Recommendations for Further Research:

Recommend where additional studies must be conducted in order to understand and solve transport problems in Adama City.

"Additional research has to be conducted to analyze the economic burden of traffic congestion in Adama City. Additional research has to be conducted to ascertain the performance and viability of alternative innovative mobility modes. Additional research has to be conducted to ascertain the travel behavior and needs of different population groups, such as women, children, and people with disabilities."

5.5 Concluding Statement

The findings of this study highlight that Adama City's transport issues are interconnected and require a unified, long-term solution. Piecemeal approaches and short-term solutions will not succeed. What is required is sustained commitment to coordinated transport planning, forward-planning investment in infrastructure, and public engagement. By embracing its vision of an equitable, sustainable, and accessible transport future, Adama City is able to maximize its full potential as a great, livable city and thereby improve the standard of life of generations yet unborn.

6,Reference

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7. Appendix

Questionnaire

Dear Respondents

Dear respondent :I am Yonas Getachew , from MSC graduating class student from Adama science and technology School of Civil engendering architecture department ,to conducting research study on " Transportation planning Challenges and opportunities for integrated urban mobility " for the purpose of partial fulfilment of Master degree (MSC) in Urban planning and design.

You are respectfully asked to give accurate and appropriate information which is the most precious input for success of my study. Please keep in mind that there is no any political, economic, social or psychological loss for you in responding these questions, therefore the researcher requests you that you will give reply all questions truthfully and confidently. Thank you in advance Carefully read every statement and answer by giving the most correct you are feeling.

If you have questions, do not hesitate to call 0986089060

.N.B:- Don't write your name

This questionnaire is to assess the current state of transportation infrastructure in Adama, City Ethiopia.

I. For Residents

1. Sex ☐ Male ☐ Female

2. Age ☐ Less than 14 ☐ 15-24 ☐ 25-54 ☐ 55-64 ☐ 65 and Above

3. Educational Status

☐ Illiterate ☐ Primary School (1-8) ☐ Secondary School (9-10)

☐ Preparatory School (11-12) ☐ TVET ☐ Diploma

☐ Degree ☐ Post Graguate (Masters/ PhD)

A. Road Conditions and Safety:

1. How would you rate the overall condition of roads in your neighborhood?

☐Excellent ☐Good ☐Fair ☐Poor ☐Very Poor

2. How would you rate the maintenance of roads in your neighborhood (e.g., repairs of potholes, resurfacing)?

☐Excellent ☐Good ☐Fair ☐Poor ☐Very Poor

3. How safe do you feel walking on the roads in your neighborhood?

☐ Very Safe ☐ Safe ☐ Neutral ☐ Unsafe ☐ Very unsafe

4. How safe do you feel cycling on the roads in your neighborhood?

☐ Very Safe ☐ Safe ☐ Neutral ☐ Unsafe ☐ Very unsafe

5. How would you rate the visibility of road markings (e.g., lane lines, crosswalks)?

☐ Excellent ☐ Good ☐ Fair ☐ Poor ☐ Very Poor

6. How would you rate the adequacy of street lighting in your neighborhood?

☐ Excellent ☐ Good ☐ Fair ☐ Poor ☐ Very Poor

B. Pedestrian and Cycling Infrastructure:

1. Are there sidewalks available on most streets in your neighborhood?

☐ Yes ☐ No ☐ Some streets have sidewalks

2. How would you rate the condition of sidewalks in your neighborhood?

☐ Excellent ☐ Good ☐ Fair ☐ Poor ☐ Very Poor ☐ no sidewalks

3. Are there dedicated bicycle lanes in your neighborhood?

☐ Yes ☐ No

4. How would you rate the availability of safe places to cross the street (e.g., crosswalks, pedestrian bridges)?

☐ Excellent ☐ Good ☐ Fair ☐ Poor ☐ Very Poor

C. Public Transportation Infrastructure:

1. How accessible is the nearest public transportation stop (bus stop, taxi stand) from your home?

☐ Very Accessible (within a 5-minute walk) ☐ Accessible (5-10 minute walk)

☐ Somewhat Accessible (10-15 minute walk) ☐ Not Accessible (more than 15-minute walk)

2. How would you rate the condition of public transportation stops in your area (e.g., shelters, seating, information displays)?

☐ Excellent ☐ Good ☐ Fair ☐ Poor ☐ Very Poor

☐ Not Applicable (no designated stops)

3. How often are the public transportation vehicles (buses, taxis) overcrowded?

☐ Always ☐ Often ☐ Sometimes ☐ Rarely ☐ Never

II. For Transport Operators (Bajaj, Taxi, Bus Drivers):

A. Road Conditions and Maintenance:

1. How would you rate the overall condition of the roads you typically use?

☐Excellent ☐Good ☐Fair ☐Poor ☐Very Poor

2. How often do you experience delays due to road maintenance or construction?

☐Daily ☐Several times a week ☐Weekly ☐Monthly ☐Rarely ☐Never

B. Infrastructure for Transport Operations:

1. Are there designated loading/unloading zones for passengers in key areas?

☐Yes ☐No ☐If Yes, how adequate are they?

2. Are there designated parking/waiting areas for your type of vehicle?

☐Yes ☐No ☐If Yes, how adequate are they?

3. How would you rate the availability of fuel and vehicle maintenance services in Adama?

☐Excellent ☐Good ☐Fair ☐Poor ☐Very Poor

2,What are the role and limitations of informal transport modes in Adama?

This questionnaire is designed to explore the role and limitations of informal transport modes in Adama City. I'll present questions suitable for different stakeholder groups:.

I. For Residents

A. Role of Informal Transport:

1. Sex ☐ Male ☐ Female

2. Age ☐ Less than 14 ☐ 15-24 ☐ 25-54 ☐ 55-64 ☐ 65 and Above

3. Educational Status

☐ Illiterate ☐ Primary School (1-8) ☐ Secondary School (9-10)

☐ Preparatory School (11-12) ☐ TVET ☐ Diploma

☐ Degree ☐ Post Graduate (Masters/ PhD)

4. How often do you use informal transport modes (e.g., Bajajs) for your daily travel?

☐Daily ☐ Several times a week ☐ Weekly ☐ Monthly ☐Rarely ☐Never

2. Why do you choose to use informal transport modes?

☐ Convenience (door-to-door service) ☐ Speed (faster than other options)

- ☐ Affordability (cheaper than other options) ☐ Availability (more readily available)
- ☐ Limited alternative options ☐ Other (Please specify: -----)

5. How important are informal transport modes for your ability to access

- ☐ Work ☐ Education ☐ Healthcare ☐ Shopping ☐ Social Activities

B. Limitations of Informal Transport:

1. What are the biggest problems associated with using informal transport modes?

- ☐ Safety concerns (accidents, reckless driving) ☐ Overcharging/Price Gouging
- ☐ Lack of regulation/unlicensed drivers ☐ Traffic congestion
- ☐ Environmental pollution (noise, emissions) ☐ Limited route coverage
- ☐ Poor vehicle condition ☐ other (Please specify: _____)

2. How safe do you feel when using informal transport modes?

- ☐ Very Safe ☐ Safe ☐ Neutral ☐ Unsafe ☐ very Unsafe

3. Have you ever experienced any of the following while using informal transport modes?

- ☐ Accident or near accident ☐ Overcharging ☐ Uncomfortable or overcrowded conditions
- ☐ Rude or unprofessional behavior by the driver ☐ Mechanical problems with the vehicle
- ☐ None of the above

4. Do you think informal transport modes contribute to traffic congestion in Adama City?

- ☐ Yes, significantly ☐ Yes, somewhat ☐ Neutral ☐ No, Not Really ☐ No, Not At All

II. For Informal Transport Operators (e.g., Bajaj Drivers):

A. Challenges & Limitations:

1. What are the biggest challenges you face as an informal transport operator?

- ☐ Competition from other operator's ☐ Harassment from police/authorities
- ☐ High fuel costs ☐ Vehicle maintenance costs ☐ Traffic congestion
- ☐ Lack of access to credit/financing ☐ Safety concerns (theft, accidents)
- ☐ Negative perception from the public ☐ Other (Please specify: _____)

2. How often do you experience problems with law enforcement or regulatory agencies?

- ☐ Frequently ☐ Sometimes ☐ Rarely ☐ Never

3. Do you think the current regulations governing informal transport are fair?

☐ Yes ☐ No ☐ Unsure

3, What is the potential for adopting innovative mobility solutions?

This questionnaire is designed to explore the potential for adopting innovative mobility solutions in Adama City. I'll structure them for various stakeholders (residents, transport operators, government officials).

1. Sex ☐ Male ☐ Female

2. Age ☐ Less than 14 ☐ 15-24 ☐ 25-54 ☐ 55-64 ☐ 65 and Above

3. Educational Status

☐ Illiterate ☐ Primary School (1-8) ☐ Secondary School (9-10)

☐ Preparatory School (11-12) ☐ TVET ☐ Diploma☐ Degree ☐ Post Graduate (Masters/ PhD)

I. For Residents:

A. Awareness and Understanding:

1. Are you familiar with the following innovative mobility solutions?

- Electric vehicles (EVs)
- Bike sharing programs

☐ Ride-hailing services (e.g., similar to Uber/Lyft) ☐ Car sharing programs

☐ Mobile apps for transportation planning and payment ☐ Intelligent traffic management systems

☐ I haven't heard of any of these

B. Attitudes and Willingness to Adopt:

1. How likely would you be to use the following innovative mobility solutions if they were available in Adama City?

Electric vehicles (EVs) - *If charging infrastructure was available and affordable*

☐ Very Likely, ☐ Likely, ☐ Neutral, ☐ Unlikely, ☐ Very Unlikely

- ❖ Bike sharing programs - *If bikes were available, well-maintained, and safe riding lanes were available*

☐ Very Likely, ☐ Likely, ☐ Neutral, ☐ Unlikely, ☐ Very Unlikely

❖ Ride-hailing services - *If the price was comparable to other transport options*

☐ Very Likely, ☐ Likely, ☐ Neutral, ☐ Unlikely, ☐ Very Unlikely

- ❖ Mobile apps for transportation planning and payment

☐ Very Likely, ☐ Likely, ☐ Neutral, ☐ Unlikely, ☐ Very Unlikely

2. What factors would encourage you to use innovative mobility solutions?

☐ Affordability (lower cost than current options) ☐ Convenience (easy to access and use)

☐ Reliability (on-time and predictable) ☐ Safety (safe and secure)

☐ Environmental benefits (reduced pollution) ☐ Improved travel time

☐ Government incentives or subsidies

☐ Other (Please specify: _____)

3. What are your main concerns about using innovative mobility solutions?

☐ Safety risks ☐ High cost ☐ Lack of reliability ☐ Privacy concerns

☐ Complexity (difficult to use) ☐ Limited availability ☐ Job displacement (e.g., taxi drivers)

☐ Other (Please specify: _____)

II. For Transport Operators (Bajaj, Taxi, Bus Drivers):

A. Feasibility and Challenges:

1. How feasible do you think it would be to incorporate electric vehicles into the existing transportation fleet in Adama City?

☐ Very Feasible ☐ Feasible ☐ Neutral ☐ Not Feasible ☐ Very Unfeasible

3. What are the biggest challenges you foresee in adopting electric vehicles?

☐ High upfront cost of EVs ☐ Lack of charging infrastructure

☐ Limited range of EVs ☐ Availability of spare parts and maintenance services

☐ Lack of knowledge and training on EV maintenance

☐ Concerns about battery life and replacement costs

☐ Other (Please specify: _____)

3. Would you be willing to invest in electric vehicles if government subsidies or financing options were available?

☐ Yes ☐ No ☐ Maybe

☐ (If yes/maybe) What incentives would be most helpful? _____

B. Training and Support:

1. What kind of training or support would you need to successfully adopt innovative mobility solutions?

- ☐ Technical training on EV maintenance and repair ☐ Business management training
- ☐ Access to affordable financing ☐ Government subsidies or tax breaks
- ☐ Information on new technologies and best practices
- ☐ Other (Please specify: _____)

2, What are opportunities for integrating different transportation modes.

This questionnaire is focused on exploring the opportunities for integrating different transportation modes in Adama City, tailored for various stakeholders.(residents, transport operators, government officials).

1. Sex ☐ Male ☐ Female

2. Age ☐ Less than 14 ☐ 15-24 ☐ 25-54 ☐ 55-64 ☐ 65 and Above

3. Educational Status

☐ Illiterate ☐ Primary School (1-8) ☐ Secondary School (9-10)

☐ Preparatory School (11-12) ☐ TVET ☐ Diploma

☐ Degree ☐ Post Graduate (Masters/ PhD)

I. For Residents (General Audience):

A. Current Experiences with Multimodal Travel:

1. In a typical week, how often do you use more than one mode of transportation to complete a single trip (e.g., walking to a bus stop, taking a Bajaj after getting off the bus)?

☐ Frequently (4 or more times) ☐ Sometimes (2-3 times)

☐ Rarely (Once a week or less ☐ Never

2. What combinations of transportation modes do you typically use for a single trip? (Check all that apply)

☐ Walking + Public Bus ☐ Walking + Bajaj ☐ Public Bus + Bajaj

☐ Walking + Taxi ☐ Bajaj + Taxi ☐ I don't use multiple modes

☐ Other (Please Specify: _____)

B. Potential for Integration:

1. What improvements would make it easier for you to use multiple modes of transportation?

☐ More convenient transfer points (e.g., integrated bus and Bajaj stops)

- ☐ Better coordination of schedules between different modes
 - ☐ A single payment system for all modes of transportation (e.g., a smart card or mobile app)
 - ☐ Safer and more comfortable waiting areas at transfer points
 - ☐ More affordable fares for multimodal trips
 - ☐ More secure bicycle parking at transit hubs
 - ☐ Other (Please Specify: _____

2. What types of innovative services would make integrated mobility more attractive to you?

- ☐ A mobile app that plans and pays for multimodal trips
- ☐ On-demand shuttle services that connect to public transit
- ☐ Real-time information about traffic conditions and transit delays
- ☐ Designated drop-off/pick-up zones for ride-hailing services at transit hubs
- ☐ Other (Please Specify: _____

II. For Transport Operators (e.g., Bajaj, Taxi, Bus Drivers):

A. Current Interactions with Other Modes:

1. Do you currently coordinate with other transportation services (e.g., dropping off passengers at bus stops, picking up passengers from taxi stands)?

- ☐ Yes, frequently ☐ Sometimes ☐ Rarely ☐ Never

2. What are the challenges in coordinating with other transportation services?

- ☐ Lack of communication ☐ Competition for passenger's ☐ Regulatory restrictions
- ☐ Lack of designated transfer points ☐ Other (Please Specify: _____
- ☐ No challenges.

Interview research questions

For Government Officials (Transportation/Planning):

A. Policy and Planning:

1. What is the city's current strategy for promoting innovative mobility solutions?
2. What are the key goals and objectives of the city's transportation plan?
3. What incentives or regulations are in place to encourage the adoption of sustainable transportation options?
4. What is the city's plan for developing charging infrastructure for electric vehicles

6. Are there any pilot projects or initiatives underway to test innovative mobility solutions?

For Government Officials (Transportation/Planning):

1. What is the city's policy regarding informal transport modes?

2. What are the benefits and drawbacks of informal transport modes in Adama City?

3. What are the main challenges in regulating informal transport? (Open-ended

4. What measures are being taken to improve the safety and quality of informal transport services?

5. Are there any plans to integrate informal transport into the formal public transportation system?

8. Footnotes