INTEGRATED MOBILITY OPTIONS FOR SUSTAINABLE URBAN DEVELOPMENT IN AHERO TOWN

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DECLARATION

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This research project is my original work and it has neither been presented nor submitted for examination in any other institution. No part of this research should be reproduced without the authors' consent or that of the University of Nairobi.

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ABSTRACT

The rapid and unplanned growth of urban areas has resulted in informal expansion, leading to congestion, pollution, segregation, urban poverty, and social exclusion. This study focuses on Ahero Town in Kisumu County, which faces challenges due to a growing population and limited road space for transportation. The research seeks to comprehend how the interconnection of various mobility options contributes to the advancement of sustainable urban development within this particular setting. To achieve this, the study pursued specific objectives: mapping existing land use, assessing mobility system characteristics, identifying obstacles to integrated mobility, and exploring strategies for mobility improvement in Ahero Town. Employing a cross-sectional design, both qualitative and quantitative methods were used, involving purposive and stratified sampling of 80 road users and interviews with 4 key informants including the Physical Planner, KeNHA Engineer, KeRRA Engineer, and Traffic Officer. The findings reveal a pedestrian-dominated population (44%) with cyclists accounting for 21%. The town's land use is diverse, with agriculture (43.36%) being prominent, followed by residential (39.14%) and transportation (9.15%). The main route is the Kisumu-Kericho Highway, serving as the backbone for internal roads. While other roads are murram roads maintained by both KeRRA and County Government of Kisumu. Limited space for both motorized and non-motorized transport systems lead to accidents and high greenhouse gas emissions. Business/work-related trips are the common trips with 59% taking over 15 minutes to reach destinations, and boda-boda riders are more exposed to accidents. Mobility barriers include; limited/lack of financial resources, limitation of existing infrastructure, changing behavior patterns, land use and zoning regulations, data and technological capabilities. Tuesday and Friday are the most difficult days to operate in Ahero town due to market days that draws a larger population of business people. Implementing integrated mobility strategies is thus a pivotal for fostering sustainable urban development, ensuring equitable transportation access, and promoting social inclusion. Recommendations include improving public transportation, establishing dedicated walking and cycling infrastructure, and creating car-free zones. By addressing these challenges, Ahero Town and the upcoming towns within the country can work towards a more balanced, sustainable and eco-friendly urban areas.

Key words: land use, mobility, integration, sustainable development

DEDICATION

"Cities have the capability of providing something for everybody, only because and only when they are created by everybody."

Jane Jacobs.

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ACRONYMS

CO_2	Carbon dioxide
COVID-19	Coronavirus Disease 2019
EIA	Environmental Impact Assessment
GIS	Geographic Information System
KeNHA	Kenya National Highways Authority
KeRRA	Kenya Rural Roads Authority
MDGs	Millennium Development Goals
NLP	National Land Policy
NMT	Non-Motorized Transport
NUDP	National Urban Development Policy
SDGs	Sustainable Development Goals
SMRT	Seoul Metropolitan Rapid Transit Corporation
SPSS	Statistical Package for Social Sciences
TOD	Transit Oriented Development
UNFCCC	United Nations Framework Convention on Climate Change

CHAPTER ONE:
INTRODUCTION TO THE STUDY

1.1 Overview

This chapter outlines the background of the study, statement of the problem, research questions, objectives of the study, justification of the study, and definition of terms.

1.2 Background of the Study

Globally, more than 50% of the populace currently resides in urban regions. The present-day world boasts a greater number of urban areas compared to a decade or two ago (The World Bank, 2022). According to the United Nations, it is projected that by 2050, over 68% of the global population will have transitioned to urban living (United Nations, 2018). This upsurge is propelled by both population growth and the migration of people to urban locales. Consequently, there will be an elevated demand for urban space and the facilitation of services for the expanding populace. Urban areas serve as economic centers that offer employment and prospects, drawing individuals from diverse backgrounds to adopt urban lifestyles. Conversely, unregulated urbanization heightens the necessity for mobility, which has concurrently risen. This trend is linked to two outcomes: the emergence of an interconnected system of megacities that present paramount challenges to urban mobility, and the focal point of demands concentrated within specific urban zones, such as central business districts and primary transportation routes (Jean-Paul, 2022).

The swift urbanization and economic expansion witnessed in recent times have led to a notable surge in requirements for urban transportation and mobility. Consequently, this has spurred the emergence of effective, interconnected, promptly accessible, and systematic sustainable mobility ideas (Jittrapirom et al., 2017). Research has indicated that roughly 24% of energy-related greenhouse gas emissions can be attributed to the transportation sector, while urban areas are accountable for approximately 67% of these emissions (Gota et al., 2019).

The advancements in human transportation technology occurred more than a century ago, this prompted corresponding changes in our urban landscapes and infrastructure leading to a predominant focus on automobiles in urban planning and transportation engineering, resulting in a significant shift in our cities. As we observe the enduring effects and outcomes of those planning decisions, urban planners have been working on a fresh concept for our roadways known as ‘integrated mobility’. This concept revolves around facilitating smooth movement for individuals according to their specific

requirements (Botello et al., 2019). This involves adopting a transit-centered strategy that interconnects all forms of travel, including walking and cycling, alongside car travel. The aim is to establish a comprehensive and continuous mobility system throughout the urban environment, accessible to all members of the community (Kjærup, 2021).

To address the ongoing problems associated with ineffectiveness and the lack of sustainability in urban transportation, a transformation is necessary. This transformation demands increased openness, synchronization, competitiveness, collaboration, and innovative endeavors when it comes to reimagining our neighborhoods, enterprises, and governing structures. Achieving significant change also involves establishing connections with existing remedies, such as the 'Integration' concept (Serrano-Lopez et al., 2019). Nevertheless, the current obstacles to progress lie in the fragmentation of providers offering mobility services and the absence of harmonization among stakeholders involved in the formulation of policies. These factors presently impede the advancement and acceptance of enhanced solutions for urban mobility (Zawieska & Pieriegud, 2018).

The Paris Agreement, in conjunction with insights from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report, urged countries to enhance their worldwide efforts to mitigate climate change (Masson-Delmotte et al., 2018). The notion of integration is believed to reinforce these efforts across various aspects of urban mobility. In the realm of transportation, avenues for action encompass the reduction of emissions and carbon footprint in transportation, encompassing strategies like the wider adoption of electric vehicles and increased utilization of energy-efficient technologies (Masson-Delmotte et al., 2018).

Adapting and enhancing the urban constructed landscape to better facilitate sustainable transportation stands as a primary challenge within contemporary urban planning. Previous studies underscore that land utilization significantly shapes people's travel patterns (Ding et al., 2018). Furthermore, the convergence of land usage planning and transportation planning is pivotal for the achievements of cities that have promoted the use of public transportation, walking, and cycling while reducing car usage (Buehler et al., 2018). These transformations result from deliberate endeavors to implement the concept of Transit Oriented Development (TOD) as a guiding principle for intensifying built environments surrounding public transport nodes and along transit corridors (Papa, 2019).

1.3 Statement of the Problem

The degradation of urban areas is swiftly deteriorating across many developing regions due to population growth. This decline has repercussions on the overall urban living standards, encompassing social dynamics and economic advancements. Challenges such as the full-scale motorization that clashes with the existing urban layout, persistent traffic gridlocks, accidents, the requirement for efficient public transport, and the disregard for essential pedestrian networks due to commercialization and unauthorized encroachments, collectively highlight the necessity for a shift in our approach to urban mobility.

Creating sustainable urban centers constitutes a significant aspect of the 17 Sustainable Development Goals (SDGs), overseen by international and intergovernmental bodies such as the United Nations and the World Bank. By urging nations, both those in development and those developed, to take decisive measures, the SDGs advance the cause of both environmental preservation and overall prosperity. The strategy of sustainable urbanization aims to establish cities that are characterized by inclusivity, resilience, minimal carbon footprint, productivity, and enhanced quality of life, all under the framework of SDG 11.

Urban regions urgently require innovative approaches to enhance the caliber of urban mobility in response to the rapid surge in population. As urban areas necessitate expansion to accommodate this growth, there arises a pressing need for a more efficient and advanced urban mobility framework. While respecting the cultural and individual requirements of the urban populace, aiming for an improved standard of urban life through enhanced mobility, diverse transportation models and forecasts project a rise in car usage, culminating in traffic congestion and environmental repercussions due to greenhouse gas emissions. The conventional remedy for tackling these challenges has centered on providing infrastructure to accommodate potential new drivers. This approach, however, contributes to a destructive loop of urban mobility, fostering escalated traffic congestion, accidents, and carbon emissions.

Ahero town has recently been elevated to town status as part of the urban development efforts in Kisumu County. The urban center is home to approximately 11,801 residents, as reported by the 2019 Kenya population census data. With a growth rate of 3.43%, the current population of the town is estimated to reach 13,505 individuals. The town is, however, faced with a myriad of mobility challenges with the demand for transportation often exceeding the capacity of the available road

network thus causing delays, waste of fuel, and increased gas emissions that cause climate change. Further, limited access to transportation options/alternative modes of transportation such as foot-bridge, bike lanes, and pedestrian walkways, makes it difficult for people to access employment, education, and other opportunities. Inadequate parking spaces for both public & private vehicles and road signs within the study area have led to unregulated parking, pick-up, and drop-offs of passengers along the busy Kisumu-Kericho highway thus causing human-vehicular conflicts and accidents. The study, therefore, sought to unearth the integrated mobility options for a sustainable Ahero Town.

1.4 Research Questions

i. What is the existing land use situation in Ahero Town?
ii. What are the characteristics of the mobility system in Ahero Town?
iii. What are the barriers to integrated mobility in Ahero Town?
iv. What strategies can be applied to enhance integrated mobility in Ahero Town?

1.5 Objectives of the Study

i. To map out the existing land use in Ahero Town.
ii. To analyze the characteristics of the mobility system in Ahero Town.
iii. To identify barriers to integrated mobility in Ahero Town.
iv. To explore strategies for the enhancement of integrated mobility in Ahero Town.

1.6 Justification of the Study

Urban mobility is deteriorating swiftly across most of the developing world. This decline significantly impacts the quality of life in Kenyan urban centers, influencing various aspects such as social interactions and economic advancements. Challenges such as the full-scale adoption of motor vehicles that don't align with our current urban layout, persistent traffic jams, accidents, the necessity for efficient public transport, and the disregard for essential pedestrian networks due to commercialization and unauthorized encroachments underscore the need for a shift in our approach to urban mobility.

The emergence of new towns within Kisumu County that act as nodes for the greater Kisumu city has seen a steady rise in population density within these urban centers. A high population coupled with inadequate infrastructural development has led to mobility challenges. Ahero town being an

agricultural town attracts a higher population due to its location and proximity to the major highway (Kisumu-Kericho Highway).

Informal development within the urban center may lead to further challenges that would eventually increase the level of traffic congestion. In order to enhance the quality of urban transportation to accommodate the swift rise in population, particularly in expanding urban zones like Ahero town, it is crucial to introduce advanced and more effective methodologies and ideas. These approaches should also be sensitive to the local culture and individual requirements of the community, aiming to improve the overall urban lifestyle. This improvement can be achieved through the implementation of an integrated mobility strategy.

The study aimed to provide insights into the integrated mobility options for sustainable urban development and ways to improve and elevate urban elements in an integrated concept to better the lives of people, especially in urban areas. The findings can be used to inform policy decisions and promote sustainable urban development.

1.7 Glossary of Terms

Constraints: Limitations or factors that restrict or influence the choices or options available in a given situation. In the context of urban development, constraints can refer to a range of factors that may impact the planning and development of a city or urban area.

Integrated Mobility: Transportation system that is designed to provide seamless and convenient movement of people and goods within a city or region. It involves the provision of different modes of transportation, such as public transit, cycling, walking, and car-sharing, into a single, cohesive system.

Mobility: The capacity for unrestricted and effortless movement. In the realm of transportation, mobility pertains to the capability to reach various destinations and navigate within a given locality or area. It can also signify the self-reliant and unrestricted movement of individuals, encompassing actions like walking, utilizing assistive devices such as wheelchairs, or engaging public or private transit options.

Opportunities: Potential avenues or possibilities that can be embraced or taken advantage of in order to attain a specific aim or target. Within the scope of urban advancement, opportunities can

encompass a variety of elements that aid or amplify the strategic organization and growth of a city or urban locale.

Sustainable Urban Development: The approach of designing and constructing urban areas in a manner that satisfies present requirements while safeguarding the potential of forthcoming generations to fulfill their own necessities. This encompasses incorporating economic, societal, and environmental factors into the strategic organization and evolution of cities, resulting in the establishment of urban spaces that are habitable, effective, and robust.

Urban Development: The procedure of strategizing and constructing cities and urban localities. This encompasses a spectrum of undertakings, including the organization of land usage, zoning regulations, transportation strategizing, and the establishment of edifices and supplementary infrastructures. The primary objective is to establish urban environments that are inhabitable, resourceful, and enduring, thereby addressing the necessities of the inhabitants and labor force within them. This might encompass the formulation and creation of novel neighborhoods and communities, as well as the renewal and revitalization of pre-existing ones.

CHAPTER TWO:
LITERATURE REVIEW

2.1 Overview

This chapter delves into the notion of sustainable urban mobility, conducts a review of relevant theoretical literature, presents case studies, examines policy and legal structures, identifies areas where the study can contribute to filling information gaps, and outlines the conceptual framework.

2.2 Concept of Sustainable Urban Mobility

Mobility characterizes the movement of individuals and economic entities during necessary journeys. This movement is limited by the dimensions of the urban landscape and significantly influenced by the intricacy of the undertakings carried out within that vicinity. Furthermore, individual traits such as income, age, and gender, as well as, more significantly, the attributes of the urban setting and the accessibility of transportation, can influence mobility (ANTP, 2003).

Numerous existing challenges concerning mobility stem from factors like the prioritization of individual travel over communal transit, leading to extensive investments in automobile infrastructure. Additionally, unchecked and spontaneous urban expansion, particularly in developing nations, along with the ongoing transition toward unsustainable transportation modes, contribute to these problems. This amalgamation of elements detrimentally impacts the general urban living conditions. Consequently, addressing mobility issues involves a shift in perspective, which can be effectively enacted by adopting principles of sustainability and incorporating concepts that strive to enhance the well-being of city residents (Turok, 2016).

Given this scenario, a novel approach to urban mobility must prioritize public transportation and modes that don't rely on motor vehicles. This involves rearranging urban functions to promote more condensed cities and a decrease in lengthy journeys. The key aspect is to establish a more equitable distribution of transportation options that is harmonized with the spatial layout of urban activities (Turok, 2016).

Several essential tactics for enhancing mobility towards a sustainable standpoint encompass: the introduction of more effective technologies capable of diminishing energy consumption; the embrace of non-motorized commuting methods like walking and cycling; measures to regulate urban expansion, focusing on curbing travel durations and air pollution from traffic; the enhancement of efficacy and efficiency within transit systems; the judicious and coordinated application of diverse

transportation modes; the advancement of fresh technologies and their assessment for community integration; the curtailment of travel necessities through the reconfiguration of urban functions and the integration of mixed land use; the establishment of improved accessibility for individuals with special requirements, such as the disabled, expectant mothers, children, and seniors; and the establishment of equitable transportation charges (Kenworthy & Svensson, 2022).

2.3 Theories of Integrated Mobility

The sub-section highlights key mobility theories and concepts that informed the study which include; the theory of urban fabric, transport-oriented development (TOD), and the 15-minute city concept.

2.3.1 Theory of Urban Fabrics

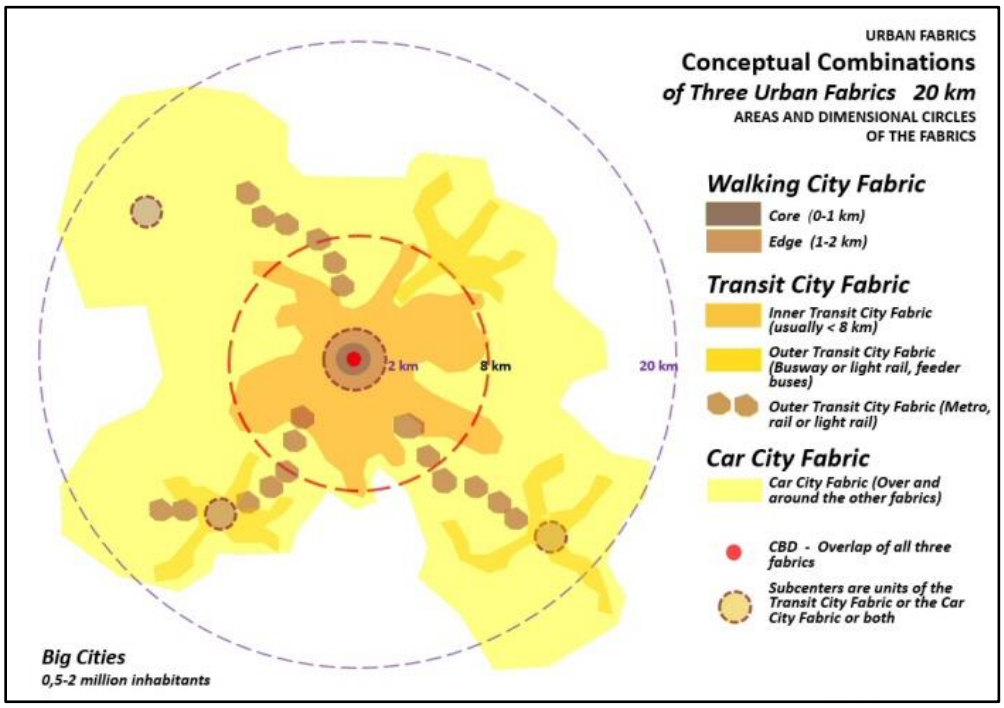
Urban areas can have their form changed as a result of differing transportation priorities. Newman et al., 2016 explain that in a city, areas are structured in such a way that they would take an individual no longer than an hour to get from one end of the city to the other. In the event that this timeframe is not suitable for the city and its inhabitants, changes to the infrastructure and land allocations can take place in order to accommodate this. Such alterations can ultimately lead to the emergence of three distinct urban systems: those that rely on walking, public transport, and the automobile.

The concept of the pedestrian-friendly city originates from historical settlement practices where walking served as the primary mode of transportation for navigating urban areas. Records suggest that in the past, pedestrians typically moved at an average pace of 3-4 kilometers per hour (Kosonen, 2020). These cities designed for walking were characterized by their compact layout, featuring narrow streets and concentrated developments within a one-kilometer radius. In contemporary times, as described by Kosonen (2020), modern cities are striving to reintroduce vibrant urban life and intricate street networks conducive to walking, achieved through initiatives like pedestrian zones and traffic calming measures.

Transit-oriented urban infrastructure revolves around the presence of trains and public transit systems that connect central urban zones with their suburban surroundings, offering faster mobility compared to walking. The emergence of the automobile-centric city marked a transition away from pedestrian and transit-oriented models, as it ushered in the era of road networks and designated parking areas to accommodate cars. This shift towards automobile-oriented urban planning resulted in the development of sprawling, less densely populated cities in all directions, attributed to the increased speed of automobile travel.

Contemporary patterns reveal a growing inclination toward pedestrian-oriented and public transportation-centric urban infrastructure compared to car-centric urban design (Newman *et al.*, 2015). The practice of walking within urban settings has an extensive historical background. Walking served as a primary mode of transportation within cities for a substantial span, spanning 8,000 years before the emergence of 19th-century trolley lines and subways, followed by 20th-century internal combustion engines (Kanemoto, 2006; Newman *et al.*, 2016).

Figure 1: Conceptual Combinations of Three Urban Fabrics



Source: Kosonen, 2020

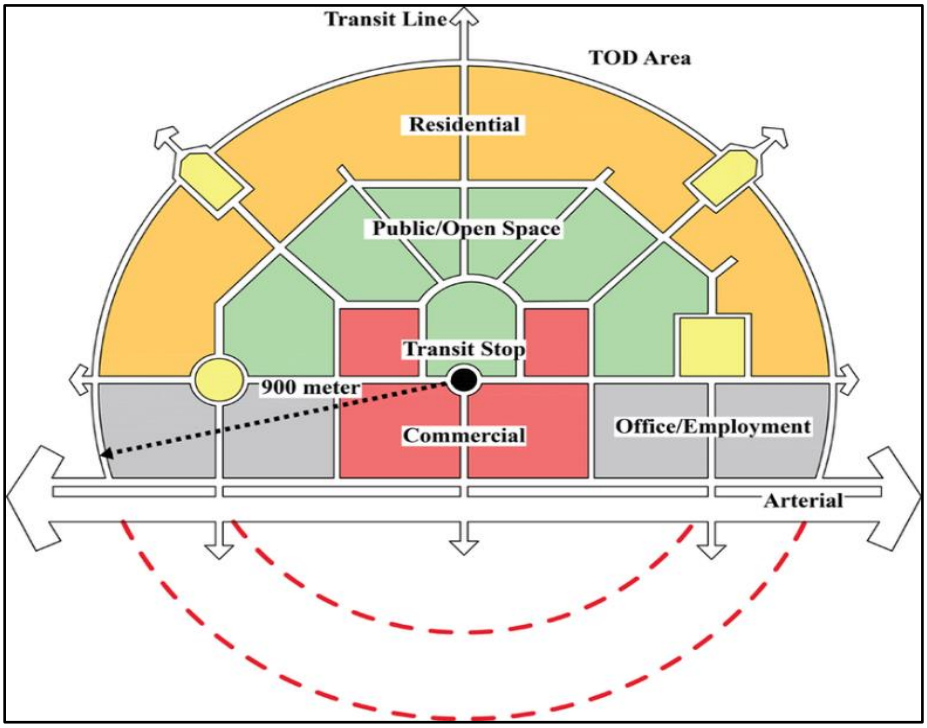
2.3.2 Transport-Oriented Development (TOD)

Since the 1980s, various models for urban design have emerged with the aim of fostering sustainable communities and cities. These models include the eco-city, urban villages, traditional neighborhood development, and the compact city. They draw inspiration from historical cities as well as suburban development trends in 19th and early 20th-century Europe. Shared principles encompass aspects of land utilization, urban structure, and infrastructure. These include concentrated development, moderately to high population density, a density gradient from the city center to the outskirts, mixed-use zoning, interconnected pedestrian pathways, and accessible public transportation (Urban Task Force, 1999, 2007; Dieleman et al., 1999; Kenworthy, 2006). Central to these models is an emphasis on creating walkable neighborhoods and communities, reinvigorating and adapting Clarence Perry's

concept of the ‘Neighborhood Unit’ from 1929. This notion, as translated by Collison in 1954, has evolved into present-day principles of neo-traditional neighborhood development, which found expression in the ‘New Urbanism’ movement in the United States.

A distinctive urban neighborhood development model that originates in the United States, rooted in this particular line of thought and practical approach, is the ‘Transit-oriented development’ (TOD) model introduced by Peter Calthorpe in 1989. This model explicitly tackles the challenges of sustainable mobility through urban layout, placing significant emphasis on efficient public transportation as a strategy to decrease car reliance when moving between neighborhoods. The core of the TOD model revolves around the public transportation hub, strategically situating high-density development around it, complemented by a clustering of commercial and office spaces. Similar principles of walkable neighborhoods are applied to the remaining aspects of the locality, incorporating interconnected street networks, well-designed public areas, and the regulation of automobile usage and parking. Notably, TOD differentiates itself by specifying a larger neighborhood radius (half a mile or 800 meters), as opposed to the ‘Neighborhood Unit’ model (a quarter mile or 400 meters), which caters to the population demands of the public transportation system.

Figure 2: TOD Model Diagram



Source: IEEE Access, 2020

The ‘Transit-oriented development’ (TOD) model extends beyond mere delineation of local neighborhood urban design attributes. Calthorpe (1993) progressed the TOD model to encompass the broader regional dimension, where multiple neighborhood units are dispersed across the terrain and interlinked through transportation systems. Within this regional framework, a hierarchy of TODs (ranging from urban TODs to neighborhood TODs) is established, contingent upon the specific transportation infrastructure available to each unit. These TODs are surrounded by a secondary urban zone and natural areas in the more distant surroundings. Calthorpe unifies the mobility infrastructure model under the concept of the ‘Urban Network’ (2002), establishing a hierarchical structure for both car and transit mode infrastructure networks. This further distinguishes the regional context that shapes the planning of TOD neighborhoods, as well as the various forms of urban development within the larger area.

‘Transit-oriented development’ TOD can take many forms, including mixed-use developments with a mix of residential, commercial, and public spaces located within walking distance of a transit station. These developments often include a range of housing types, including apartments, condominiums, and town-homes, as well as retail and office space. The concept of Transit-oriented development (TOD) can encompass the establishment of communal areas like parks, squares, and pathways designated for pedestrians, fostering a community atmosphere and promoting the adoption of walking and cycling.

Transit-oriented development (TOD) offers a range of possible advantages, which encompass alleviating traffic congestion, enhancing air quality, and stimulating economic growth. It can also increase access to transportation for those who do not have access to a personal vehicle, such as low-income households or individuals with disabilities. However, TOD can also present challenges, such as the potential for increased housing prices and displacement of existing residents. As such, it is important for planners and policymakers to carefully consider these issues and work to ensure that TOD projects benefit all members of the community.

2.3.2.1 The Importance of Transit-Oriented Development

Approximately a quarter, or roughly 25%, of the global energy-related carbon dioxide (CO2) emissions can be attributed to the transportation sector. This proportion is anticipated to rise to 33% by the year 2050. The majority of these emissions, accounting for about 75%, originate from

individual vehicles and trucks. The extent to which people rely on these modes of transport is greatly influenced by the accessibility of public transit and its proximity to the urban environment.

75% of local governments across the world possess direct control over their transit systems, while 80% exercise control over road infrastructure. The responsibilities of municipalities typically encompass planning and implementation of development policies on a community scale. This situation presents local governments with the chance to undertake integrated planning for strategic growth, considering both transportation and urban development aspects.

Despite this opportunity, most cities still opt to independently pursue urban and transportation planning, often favoring car-centric development. Consequently, issues like urban sprawl, segregated land usage, and disjointed urban expansion emerge. Environments centered around cars and lacking access to public transportation pose threats to the environment and directly impact aspects such as social equity, economic progress, and quality of life.

In light of this, Transit Oriented Development (TOD) underscores the significance of reliable public transit and places emphasis on maintaining a closely-knit urban structure through designs that are high-density, mixed-use, and human-scaled, ensuring that residents are within feasible walking distance of transit hubs. Approaches like ‘Transit-oriented development’ TOD have shown potential in reducing carbon dioxide (CO2) emissions by up to 43% and can bring about a 50% reduction in private vehicle usage.

2.3.3 The 15-Minute City Concept

The "15-Minute City" notion stands as an innovative urban planning model conceived by Professor Carlos Moreno, centered on urban development and mobility. Originating at the Sorbonne in Paris, it garnered endorsement from Paris Mayor Anne Hidalgo (Moreno, 2020; Moreno, 2016). In essence, the 15-Minute City envisions an urban environment prioritizing people’s need, where daily necessities are reachable through short walks or bike rides from residences.

This concept champions a human-centered urban approach, with components such as social interaction, personal fulfillment, cultural pursuits, and health accessible within brief commutes. The time taken to access different areas within the urban landscape gains prominence and preference in city planning. This approach emphasizes the strategic positioning of crucial urban amenities, infrastructure, and opportunities to enhance accessibility. By implementing such policies, urban

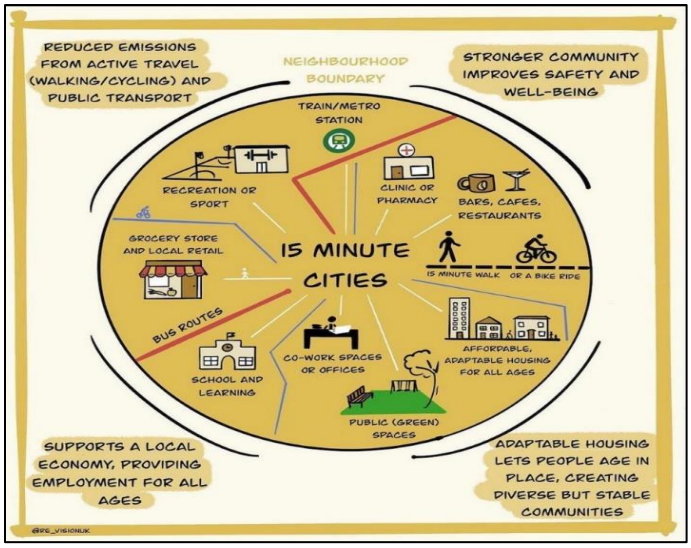
dwellers can comfortably walk or cycle to any point in the city within a 15-minute timeframe (White, 2020).

Consequently, the reliance on cars for intra-city travel diminishes, opening avenues for creating pedestrian pathways and bicycle lanes that conventional urban planning models, primarily focused on vehicular flow efficiencies, might otherwise overlook. This leads to heightened sustainability (Allam et al., 2022).

Moreno et al., 2021, introduce the 15-Minute City concept, strives to ensure that inhabitants can fulfill six essential functions (residence, work, commerce, healthcare, education, and recreation) within a 15-minute walk or bike ride from their homes. This model' s framework comprises four key facets: density, proximity, diversity, and digitization.

The 15-minute city concept aims to revolutionize conventional urban planning practices, shifting the focus from vehicular movement—often resulting in congested cities—to one that bolsters human societal pursuits and urban livability. This aligns with past urban models like the Green City, Slow Movement, and Walkable City. Unlike earlier models, the prominence of the "15-Minute City" stems from its robust political branding and pragmatic implementation, addressing both political and emissions reduction perspectives. This aligns with SDG principles and IPCC's emissions reduction goals, as delineated in its Working Group 3 report on Climate Change Mitigation (IPCC, 2014). By reducing travel demands, this proximity-based urban concept directly curtails urban emissions, which account for a significant portion of the 78% emissions attributed to urban zones.

Figure 3: 15-Minute City Concept



Source: Paris en Commun, 2022

2.3.3.1 Criticism

Despite the concept's endorsements and potential, it has also sparked significant critique. The need for minimizing distances between living, working, local amenities, services, leisure activities, and educational institutions, in order to curtail transportation requirements and congestion, lies at the heart of this approach. Nevertheless, the pronounced emphasis on spatial proximity has drawn notable criticism, particularly for fostering gentrification, resulting in heightened segregation and the isolation of communities. An example of this sentiment was expressed during the digital LSE event 'Urban Age Debate: Localizing Transport,' where Prof. Edward Glaeser of Harvard University, among others, voiced strong reservations about the 15-Minute City.

According to Glaeser, the concept primarily caters to the upper-middle-income bracket, often residing in areas already endowed with above-average amenities. He contends that the concept falls short of addressing the more extensive and intricate challenge of reestablishing cities as inclusive hubs of opportunity for all. Glaeser suggests moving away from the notion of partitioning cities into 15-minute zones, proposing that especially in the aftermath of the COVID-19 pandemic, prioritizing enhanced social interconnectedness across neighborhoods should be the objective. Journalist Alice Delaleu accuses Mayor Hidalgo of marginalizing the economically disadvantaged populations residing in the outskirts. Delaleu argues that by constructing a city composed of quarters, these efforts inadvertently erect new barriers and drift towards self-centeredness, thus detracting from the intended enhancement of urban life in terms of quality, agility, health, and adaptability.

2.3.3.2 Development Opportunities & Risks

The idea faces criticism as an urban model well-suited to European cities (particularly Oslo, London, Barcelona), but not appropriate for contexts in the Global South or North America. In spite of its emphasis on human-centered urban growth, the concept mainly relies on observations related to space and the environment, disregarding socio-economic factors like population demographics, social makeup, jobs, and earnings. Given the evident presence of social disparities, post-colonial influences, and informalities within the urban frameworks of German development cooperation partner nations, as well as the prevalence of sprawling and less compact settlements, the 15-Minute City cannot be readily applied. Instead, it might exacerbate divisions and the process of gentrification.

According to the exponents of the concept, the 15-Minute City paradigm should be targeted to lower-income neighborhoods. This can be achieved through measures such as incorporating inclusive

spatial planning and zoning, establishing affordable housing, and promoting cooperative and community-driven approaches to housing development. It's crucial to grasp that urban planning interventions must be executed in conjunction with socially inclusive developmental processes.

However, delving into the feasibility of adopting this concept in the partner countries holds merit. Apart from Bogotá, numerous cities are actively striving to shorten average commute times from 80 to 30 minutes within city limits, thus forming a 30-minute city.

2.4 Case Studies

2.4.1 Copenhagen, Denmark

Copenhagen, Denmark, has established an objective to achieve carbon neutrality by 2050 concerning Carbon dioxide (CO_2) emissions. A pivotal aim within its urban advancement strategy is to ensure that car usage is limited to a maximum of 33% for journeys originating and/or concluding in Copenhagen, while bicycles and public transportation should encompass the majority. Factoring in pedestrians as well, the aspiration is for 75% of total journeys to be conducted by walking, biking, or utilizing public transit. The city, therefore, has a highly integrated and efficient transportation system, with a strong focus on cycling and public transit. The city has an extensive network of bike lanes and paths and also operates an extensive network of buses and trains. The city also has a successful bike-sharing program, which allows residents and visitors to easily rent bikes for short trips (Buehler, et al., 2017).

Some of the transportation options available include:

- ✓ **Buses:** The city has a network of buses that operate throughout Copenhagen and the surrounding areas. Many of these buses are low-emission vehicles, such as electric buses or buses powered by bio-fuels.
- ✓ **Trains:** The city has an extensive railway network that connects Copenhagen with other cities and towns in Denmark. The trains are a convenient and efficient way to travel within the country.
- ✓ **Metro:** The metro is a rapid transit system that operates in the city center and the suburbs. It is a quick and efficient way to get around the city.
- ✓ **Bycyklen:** Bycyklen is a bike-sharing program that allows residents and visitors to rent bikes from various locations throughout the city. The bikes can be rented using a smartphone app,

and there are many designated bike lanes throughout Copenhagen to make cycling a safe and convenient option.

- ✓ **Electric vehicle charging stations:** The city has a network of electric vehicle charging stations to support the growing number of electric cars on the roads.
- ✓ **Congestion pricing:** To discourage driving in the city center and encourage adoption of other modes of transportation, Copenhagen has implemented a congestion pricing scheme. This involves charging a fee to drivers who enter certain areas of the city during peak times.

Furthermore, a congestion pricing system has been put into effect to discourage the utilization of automobiles within the city core and encourage the adoption of alternate transportation modes. Nevertheless, the prosperous integration of bicycles has brought about fresh obstacles, primarily stemming from heightened congestion within the bicycle lanes. To address this concern, recent years have witnessed the expansion of both lanes and roadways, consequently giving rise to the emergence of freight bicycles. These cargo bikes are now found in no less than 6% of all households in Copenhagen and serve as a means to convey goods and children. Notably, 25% of Copenhagen households consisting of two children own a cargo bicycle. The city of Copenhagen maintains a long-term aspiration where half of its populace would opt for bicycling as their mode of travel (Hofstad & Vedeld, 2020).

Figure 4: Urban Transport in Denmark

Google Image, 2023

2.4.2 Seoul, South Korea

Seoul, South Korea is a city known for its advanced public transportation system, which includes buses, subways, and trains. The city has implemented several innovative programs to improve mobility and reduce traffic congestion in the city. These include the "One Less Car" campaign, which encourages residents to use public transit, cycling, or walking instead of driving, and the "Smart City" program, which uses smart technologies to improve traffic flow and reduce emissions (Popan, 2019).

The Seoul Metropolitan Subway is a comprehensive network of subway lines that serves the city and surrounding areas and is operated by the Seoul Metropolitan Rapid Transit Corporation (SMRT). The subway system is complemented by an extensive network of bus routes, as well as several commuter rail lines operated by Korail, the national railway company. In addition to these traditional forms of public transportation, Seoul also has several alternative modes of transportation available, including taxi and car-sharing services, and a bike-sharing program called "dobike" (Park, et al., 2022).

Figure 5: Transfer Centers connecting various transportation modes in one place

Source: Google Image, 2023

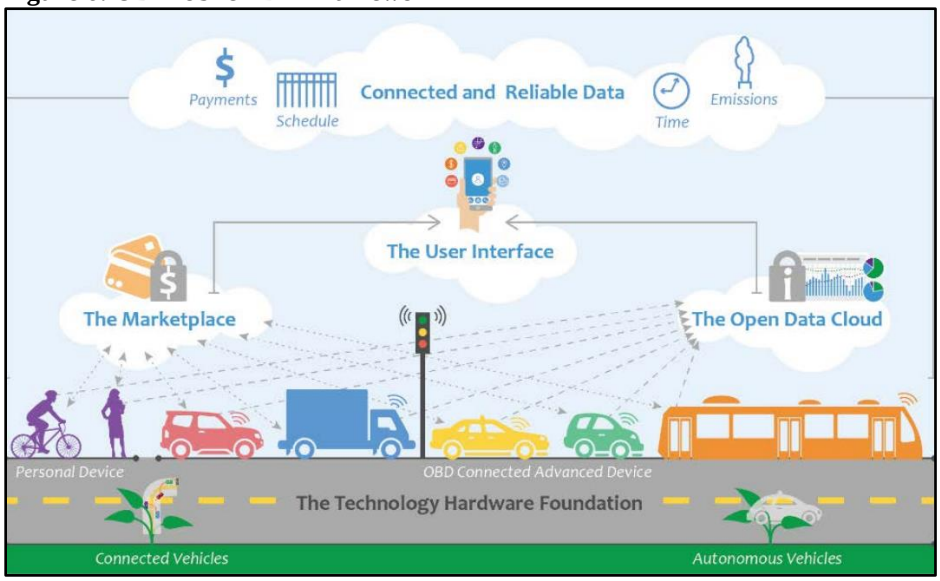
2.4.3 Portland, Oregon, USA

Portland, Oregon has gained renown for its initiatives aimed at fostering eco-friendly transportation choices, encompassing public transit, cycling, and pedestrian activities. The metropolis boasts a seamlessly integrated transportation framework that prioritizes unconventional transportation modes. Noteworthy is its thriving bike-sharing initiative, which spans an expansive array of bike paths and lanes. Additionally, the city effectively manages an all-encompassing network of buses and light rail

services. Portland has implemented various initiatives to incentivize the adoption of electric and low-emission automobiles as well. The city has also invested in infrastructure to support biking, including a network of bike lanes and trails, as well as a bike-sharing program called BIKETOWN. In addition, Portland has implemented several policies to encourage the use of sustainable transportation, such as implementing tolls on certain highways and providing incentives for driving fuel-efficient vehicles (Smith O., 2017).

The planning approach in Portland is designed to foster well-rounded communities, reduce dependence on cars, stimulate the adoption of eco-friendly transportation alternatives, and concentrate urban expansion within the central city and its vicinity. Despite these efforts contributing to Portland's recognition as one of the most desirable cities to live in the United States, communities of minority groups and lower-income individuals continue to confront uneven transportation difficulties. Collaborative efforts with service providers, local communities, and educational establishments will be utilized to distribute UB Mobile PDX devices to those who require them most (Smith O., 2017).

Figure 6: UB Mobile PDX Framework



Source: Portland Bureau of Transportation, 2016

2.4.4 Curitiba, Brazil

Curitiba is known for its innovative and efficient transportation system, which includes a comprehensive network of buses and bike lanes. The city has implemented several strategies to encourage the use of public transit, including the use of dedicated lanes for buses and the development of a comprehensive network of bus shelters and terminals. Curitiba also has a successful bike-sharing

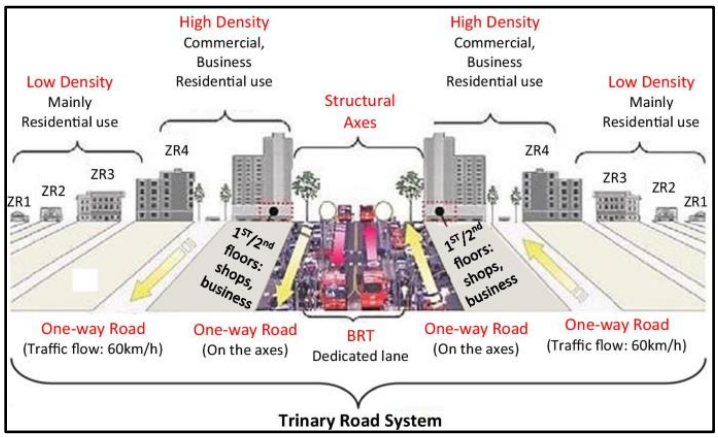
program, which allows residents and visitors to easily rent bikes for short trips (Fryszman, et al., 2019).

The heart of Curitiba's system is a network of dedicated bus lanes, which are separated from regular traffic by physical barriers. This allows the buses to bypass traffic congestion and move more quickly and reliably. To enhance a user-friendly system, the city has integrated various functionalities, such as:

- Pre-paid fare cards: Passengers can purchase fare cards in advance, which they can then use to quickly and easily board the buses.
- High-capacity buses: Curitiba's buses are designed to carry large numbers of passengers, with comfortable seating and plenty of room for standing passengers.
- Elevated platforms: To make boarding and exiting the buses more efficient, the city has built elevated platforms at the bus stops, which are level with the bus floor.
- Off-board fare collection: Passengers pay their fares before boarding the bus, which speeds up the boarding process and makes it more efficient.

In addition to these specific measures, Curitiba's public transportation system is also integrated with other modes of transportation such as bike-sharing, car-sharing, and pedestrian infrastructure. This enables people to easily switch between different modes of transportation depending on their needs. The model of the transportation system in Curitiba receives a lot of recognition as it provides a sustainable and efficient way of transportation for the city with a population of over 1.8 million. Its features are widely studied and adopted by many other cities around the world (Fryszman, Carstens, & Da Cunha, 2019).

Figure 7: Different densities and traffic directions along Curitiba's structural axes



Source: ICLEI Case Studies, 2016

2.5 Policy and Legal Framework

Strategic policies and suitable legal frameworks facilitate the efficient enforcement and management of mobility on both a worldwide and local scale. In this regard, the policy and regulatory stipulations aimed at fostering comprehensive mobility are outlined as follows:

2.5.1 Policy Frameworks

2.5.1.1 Sustainable Development Goals (SDGs)

The UN Member States approved the 2030 Development Agenda, which established an ambitious collection of seventeen Sustainable Development Goals (SDGs) detailed in 167 targets and covers the whole spectrum of human development. Goal 11 of the SDG aims to create sustainable cities and communities that are inclusive, safe, resilient, and environmentally sustainable. The projected high rate of the global population residing in urban regions by 2030, calls for the adoption of technological advancements and harness social advantages to guarantee the safety and sustainability of cities for the well-being of forthcoming generations.

To achieve this goal, Kenya is taking measures such as formulating, reviewing, and legislating policies and laws related to urban development such as the National Urban Development Policy,2016 that aims to improve the sustainability of cities and urban settlements in line with the aspirations of Vision 2030. In particular, they seek to provide the necessary infrastructure and technology to ensure that urban mobility is safe, accessible, and environmentally sustainable through promoting the use of public transport, implementing green transportation systems, and creating pedestrian-friendly urban spaces. For example, the implementation of Kisumu Sustainable Mobility Plan (KSMP).

2.5.1.2 United Nations Conference on Environment & Development (Agenda 21)

Agenda 21 is a significant document that was developed during the United Nations' Rio Summit on Environment and Development in 1992. The Agenda outlines a plan of action that should be taken Globally, Nationally, and Locally by of the United Nations System, Governments, and groups in areas where has human influence on the environment. Chapter 5 of Agenda 21 is particularly relevant to urban mobility in Kenya as it recognizes the affiliation between demographic trends and sustainable development. The expansion of urban populations carries detrimental consequences for environmental sustainability. Conversely, alterations in the environment and its deterioration can inflict detrimental effects on human communities, particularly those reliant on natural resources for their sustenance.

The consequences of increasing population and the decline of the environment become evident through issues like traffic congestion, air pollution, and insufficient public transportation networks. To address these challenges, Kenya has developed various policies and strategies aimed at promoting sustainable urban mobility. For instance, the National Urban Transport Policy seeks to provide safe, efficient, and environmentally sustainable urban transport systems that cater to the needs of all citizens. Agenda 21 also highlights the need for a coordinated global effort to address the environmental challenges facing urban areas. Within the scope of urban mobility in Kenya, this necessitates the creation and execution of measures and approaches that advocate for sustainable urban transportation systems characterized by safety, effectiveness, and ecological responsibility.

2.5.1.3 United Nations Framework Convention on Climate Change (UNFCCC)

The ultimate objective of the Convention, as stated in Article 2, is to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Urban mobility is a significant contributor to greenhouse gas emissions, particularly in developing countries such as Kenya. The increasing use of private vehicles and inadequate public transport systems contribute to traffic congestion, air pollution, and greenhouse gas emissions. This has adverse effects on public health, the environment, and economic development.

To address these challenges, Kenya has developed policies and strategies aimed at promoting sustainable urban mobility, such as the National Urban Transport Policy. This policy seeks to provide safe, efficient, and environmentally sustainable urban transport systems that reduce greenhouse gas emissions and improve the quality of life for citizens.

However, achieving the ultimate objective of the UNFCCC, as stated in Article 2, requires a global effort to reduce greenhouse gas emissions and mitigate the adverse effects of climate change. In the context of urban mobility in Kenya, this requires the development and implementation of policies and strategies that promote sustainable urban transport systems that reduce greenhouse gas emissions, while ensuring that food production is not threatened, and economic development proceeds in a sustainable manner. Ultimately, the goal is to achieve sustainable urban mobility that benefits both present and future generations.

2.5.1.4 New Urban Agenda

The New Urban Agenda is a significant document that emphasizes the importance of urban patterns in promoting livability and sustainability. The document recognizes that the design of streets, blocks, plots, and building arrangements directly affects the quality of life for residents, as well as the environmental impact and productivity of neighborhoods.

The design of streets, blocks, and plots is particularly relevant as it affects the walkability and safety of neighborhoods. Pedestrian-friendly Street designs can encourage walking and cycling, reduce traffic congestion, and promote physical activity. Additionally, the availability of public space is crucial in promoting sociability and community interaction, which contributes to the overall livability of urban areas.

Accessible areas are also essential for promoting sustainable urban mobility. The New Urban Agenda recognizes the importance of easy access to urban services and the efficient flow of commerce. This requires the development of well-connected transport systems, including public transport, pedestrian walkways, and cycling paths. Such transport systems can help reduce the use of private vehicles, decrease traffic congestion, and promote sustainable urban mobility.

The New Urban Agenda emphasizes the importance of urban patterns in promoting livability and sustainability in urban areas. In the context of urban mobility in Kenya, this requires the development of well-designed streets, blocks, and plots that promote walkability, safety, and sociability. Additionally, the availability of public space and well-connected transport systems are essential for promoting sustainable urban mobility.

2.5.1.5 Africa Agenda 2063

Agenda 2063 is the blueprint and master plan for transforming Africa into the global powerhouse of the future. Agenda 2063 is a significant document that outlines a strategic framework for building well-connected and integrated networks of transport infrastructure that are safe, secure, and sustainable. This is crucial for enabling the country to realize its full economic potential and physical integration. Transport infrastructure plays a critical role in promoting urban mobility, as it enables the efficient movement of people and goods within and between urban areas. The development of well-connected transport systems, including roads, railways, and airports, can help reduce traffic congestion, improve access to urban services, and promote sustainable urban mobility.

Agenda 2063 recognizes the importance of transport infrastructure in promoting economic development and physical integration. The document emphasizes the need for cost-effective, safe, secure, and sustainable transport services that can support the provision of essential services and enable the continent to realize its full economic potential. The policy provides a framework for the development of sustainable transport infrastructure that is well-connected and integrated. This includes the development of efficient and affordable public transport systems, pedestrian walkways, and cycling paths, as well as the expansion of existing transport infrastructure to better serve the needs of urban residents. Agenda 2063 is a significant document in the context of urban mobility in Kenya, as it provides a strategic framework for building well-connected and integrated networks of transport infrastructure that are safe, secure, and sustainable. This is essential for promoting sustainable urban mobility and enabling the country to realize its full economic potential and physical integration.

2.5.1.6 Kenya's Vision 2030

The Kenya Vision 2030 is a significant document that outlines several objectives aimed at promoting nationwide urban planning and development. The Vision aspires to develop a well-connected and integrated network of roads, railways, ports, airports, waterways, and telecommunications, which will enhance the efficient movement of people and goods within and between urban areas. The Vision also emphasizes the importance of setting up a strong institutional framework for infrastructure development and implementing infrastructure projects that target increased connectivity and reduced transport and other infrastructure costs. This is essential for promoting sustainable urban mobility, as it enables the development of cost-effective and efficient transport systems that can support the provision of essential services.

Furthermore, the Vision targets the development and maintenance of an integrated, safe, and efficient transport network. This includes the expansion of public transport systems, the development of pedestrian walkways and cycling paths, and the improvement of existing transport infrastructure to better serve the needs of urban residents. The policy provides a strategic framework for promoting sustainable urban planning and development, which is essential for enhancing the livability, walkability, safety, and productivity of urban areas. The development of a well-connected and integrated transport network is critical for promoting economic development and physical integration, and for enabling the country to realize its full economic potential.

The Kenya Vision 2030 provides a strategic framework for promoting sustainable urban planning and development and for enhancing the efficiency and effectiveness of transport systems. This is essential for promoting sustainable urban mobility and enabling the country to realize its full economic potential and physical integration.

2.5.1.7 National Urban Development Policy (NUDP 2016)

The National Urban Development Policy provides a framework for the sustainable development of transportation systems within urban areas. The policy recognizes that mobility is a critical component of urban development and aims to promote safe, accessible, efficient, and affordable transportation options for all residents. One of the thematic areas addressed by the policy is urban planning, which includes the development of comprehensive and integrated transportation plans that take into account the needs of all users, including pedestrians, cyclists, and public transport users. The policy emphasizes the importance of prioritizing non-motorized transport modes, such as walking and cycling, and promoting the use of public transport to reduce reliance on personal vehicles and alleviate congestion.

Another area addressed by the policy is urban governance and management, which includes the establishment of regulatory frameworks for transport services, ensuring compliance with safety and environmental standards, and improving coordination between national and county-level transport authorities. The policy also recognizes the importance of public-private partnerships in promoting sustainable transport solutions. The policy also emphasizes the need to integrate urban mobility with other aspects of urban development, such as the urban economy and urban safety. This includes promoting the use of clean and sustainable transport technologies, creating job opportunities in the transport sector, and ensuring that transport systems are safe and secure for all users.

The National Urban Development Policy provides an important framework for addressing the complex challenges of urban mobility in Kenya and promoting sustainable and inclusive transport solutions that benefit all residents.

2.5.1.8 Integrated National Transport Policy (2009)

The Integrated National Transport Policy recognizes the importance of addressing the needs of the poor and promoting the health of the entire population through the improvement of public transport and non-motorized transport (NMT) options while also reducing pollution. The policy places a strong emphasis on the harmonization of NMT infrastructure and technical standards within the mandates

of transport agencies, which is essential for the effective implementation of sustainable transport solutions.

However, there are concerns about the mainstreaming of this policy into projects and programs. The policy needs to be effectively integrated into the planning and implementation of urban transport projects to ensure that sustainable transport options are prioritized and implemented. There is a need for greater coordination and collaboration between various stakeholders involved in urban transport, including national and county-level transport agencies, local governments, and civil society organizations, to ensure that the policy is effectively implemented.

Furthermore, there is a growing recognition of the need to update the Integrated National Transport Policy, as it is almost a decade old. The transportation landscape in Kenya has evolved significantly since the policy was developed, with new technologies, innovations, and trends emerging in the sector. Updating the policy would enable it to reflect these changes and help address emerging challenges in the transportation sector.

While the Integrated National Transport Policy recognizes the importance of sustainable transport solutions, including the improvement of public transport and NMT options, there is a need to ensure its effective mainstreaming into projects and programs. Additionally, there is a growing need to update the policy to reflect changes in the transportation landscape in Kenya.

2.5.1.9 Non-Motorized Transport Policy (June 2017)

The Nairobi City County has taken significant steps to promote non-motorized transport (NMT) by developing and passing an NMT Policy. The policy's vision is to make NMT the mode of choice for short and medium trips in the county. This vision aligns with the broader objective of promoting sustainable transportation solutions that reduce congestion, improve air quality, and enhance mobility options for all residents.

The main objectives of the NMT policy are to increase mobility, accessibility, and transport safety, while also improving amenities for NMT users. To achieve these objectives, the policy emphasizes the need for adequate funding and investment in NMT infrastructure, such as pedestrian walkways, cycling lanes, and improved street lighting. Additionally, the policy highlights the need for the development of NMT-friendly policies and regulations, including the integration of NMT into urban planning and land use policies.

The NMT policy is a significant step forward in promoting sustainable urban mobility in Nairobi County. By prioritizing NMT as the mode of choice for short and medium trips, the policy aims to reduce reliance on private vehicles, reduce congestion, and improve air quality. The policy's objectives of increasing mobility, accessibility, and transport safety, along with the provision of adequate funding and investment, are crucial for the effective implementation of sustainable transport solutions in the county.

2.5.1.10 Draft Ahero Integrated Urban Development Plan (IUDP), 2021

This document outlines a comprehensive strategy designed to steer the progress of Ahero until 2030. Despite being in the preliminary phase, the Initial Urban Development Plan (IUDP) recognizes that unplanned urban expansion has contributed to a surge in the usage of personal vehicles. The plan also highlights the informal nature of the public transportation sector, along with insufficient amenities like terminals and designated stops. The lack of efficiency in public transportation and the absence of pedestrian walkways have prompted the proliferation of alternatives such as boda-bodas, tuk-tuks, and taxis to meet the growing demand. Addressing these issues, the IUDP suggests road configurations that prioritize public transportation and non-motorized transport, along with road networks aimed at enhancing urban connectivity. Once finalized and endorsed, the implementation of these recommendations will be overseen and ensured by the Office of Physical Planning in Nyando Sub County.

2.5.2 Legal Framework

2.5.2.1 The Constitution of Kenya, 2010

Implemented in 2010, the Kenyan Constitution has brought about significant changes in the nation's political and economic administration, particularly in the realm of mobility. This transformation has led to the establishment of two self-governing yet interconnected tiers of authority: the central level and the County administrations. The fundamental aim of this decentralization is to distribute authority, resources, and representation to the community level. According to the Constitution, urban management tasks are largely entrusted to the county governments. However, in practical terms, there are instances where these responsibilities overlap with the jurisdiction of national-level entities, leading to a lack of complete devolution in the domain of mobility.

2.5.2.2 County Government Act, No. 17 of 2012

Through the mobility perspective, this legislation requires counties to formulate a comprehensive County Integrated Development Plan spanning five years. This plan serves as the foundation upon which various sector-specific plans are established. Notably, the legislation also assigns the Department of Roads, Transport, and Public Utilities the responsibility of crafting ten-year sectoral plans, specifically a mobility plan along with policies. These plans are designed to offer guidance for the allocation of funds and the effective administration of transportation systems within the purview of each county's authority.

2.5.2.3 Physical and Land Use Planning Act, No. 13 of 2019

The legislation includes a provision for the management, utilization, oversight, and advancement of land with a mobility-oriented perspective. Transport is recognized as a vital component in numerous development blueprints, underscoring the need for a comprehensive assessment and enhancement of transport systems to adequately address forthcoming demands.

2.5.2.4 Kenya Roads Act, No. 2 of 2007

Through the urban mobility perspective, this legislation introduces the framework governing the organization and facilitation of road infrastructure, which encompasses non-motorized transport as well. This framework extends across all categories of roads within diverse administrative bodies. The Act formally creates three key bodies: the Kenya National Highways Authority (KeNHA), the Kenya Urban Roads Authority (KURA), and the Kenya Rural Roads Authority. These bodies are endowed with specific powers and duties in alignment with their roles. Notably, a recent roads bill was presented in 2017, aiming to establish a Public Roads Standards Board. However, parliamentary endorsement for this bill is still pending.

2.5.2.5 The Traffic Act Cap. 403

This legislation outlines the regulations overseeing traffic on roads and establishes the structure for upholding traffic laws, encompassing those applicable to individuals using non-motorized forms of transport. Under the traffic signs rules Sec. 12 (1), the act promotes the utilization of pedestrian traffic light signals to control the movement of pedestrians. This involves integrating a light positioned across the roadway, equipped with a lens that, when lit up, displays either "CROSS" or "CROSS NOW" in white or green text, or the image of a walking pedestrian in green, set against a black backdrop.

2.5.2.6 Urban Areas and Cities (Amendment) Act, No. 3 of 2019

This law was crafted to lay down a structure governing the management and supervision of urban areas and cities, with a specific focus on engaging residents in the development of plans and decision-making protocols, particularly in matters related to urban mobility. As per the legislation, cities are mandated to establish a governance system that actively encourages residents' participation in their functioning. Furthermore, the Act establishes effective methods, strategies, and guidelines to ensure the inclusion of locally acknowledged resident organizations in processes that involve consultations, especially in matters concerning urban mobility planning.

2.5.2.7 Kisumu County Integrated Urban Development Plan (2023-2027)

The Kisumu CIDP (2023-2027) focuses on enhancing urban mobility and sustainable transportation within the region. The plan outlines strategic initiatives to improve the efficiency of public transportation, enhance non-motorized transport infrastructure, and manage traffic congestion. It prioritizes the development of pedestrian-friendly pathways, dedicated cycling lanes, and efficient public transit systems to promote eco-friendly and accessible modes of transportation. Additionally, the plan emphasizes coordination between various stakeholders, such as local authorities and transportation agencies, to ensure effective implementation and monitoring of urban mobility projects. The plan aims to create a well-connected and accessible urban environment that enhances mobility options for residents while minimizing environmental impacts.

2.6 Information Gaps

From the studies undertaken above, it's evident that urban areas encounter mobility issues. The necessity for individuals to travel between different locations on a daily basis underscores the need for a dependable transportation system that accommodates diverse means of commuting.

Although research on incorporating diverse transportation choices for promoting sustainable urban growth is expanding, there remains a notable absence in the literature concerning the evaluation of how distinct integrated mobility strategies perform within varying urban settings. In particular, there is a dearth of studies delving into the precise elements that influence the outcomes of integrated mobility solutions, encompassing their accomplishments or shortcomings, including:

- The role of local governance structures in promoting or hindering integrated mobility initiatives

- The impact of existing transportation infrastructure on the adoption and effectiveness of integrated mobility solutions
- The attitudes and behaviours of urban residents towards different integrated mobility options, and how these factors influence adoption rates
- The potential for integrating emerging technologies, such as autonomous vehicles or electric scooters, into existing integrated mobility systems
- The economic viability of different integrated mobility solutions, and the potential for public-private partnerships to support these initiatives

The study aimed to provide insights into the integrated mobility options for sustainable urban development and ways to improve and elevate urban elements in an integrated concept to better the lives of people, especially in urban areas. The findings can be used to inform policy decisions and promote sustainable urban development.

2.7 Conceptual Framework

The concept of "Integration" represents a contemporary planning approach closely linked to the intricate nature of urban areas and the need to establish settlements that are both sustainable and resilient (Bilojevic, 2018). The term ‘integrated’ encompasses all aspects of sustainable development and administration. The execution of comprehensive urban planning is directly tied to socio-economic conditions, legal structures, technological advancements, present spatial concerns, the environment, and the human dimension (enhancing the quality of residents’ lives).

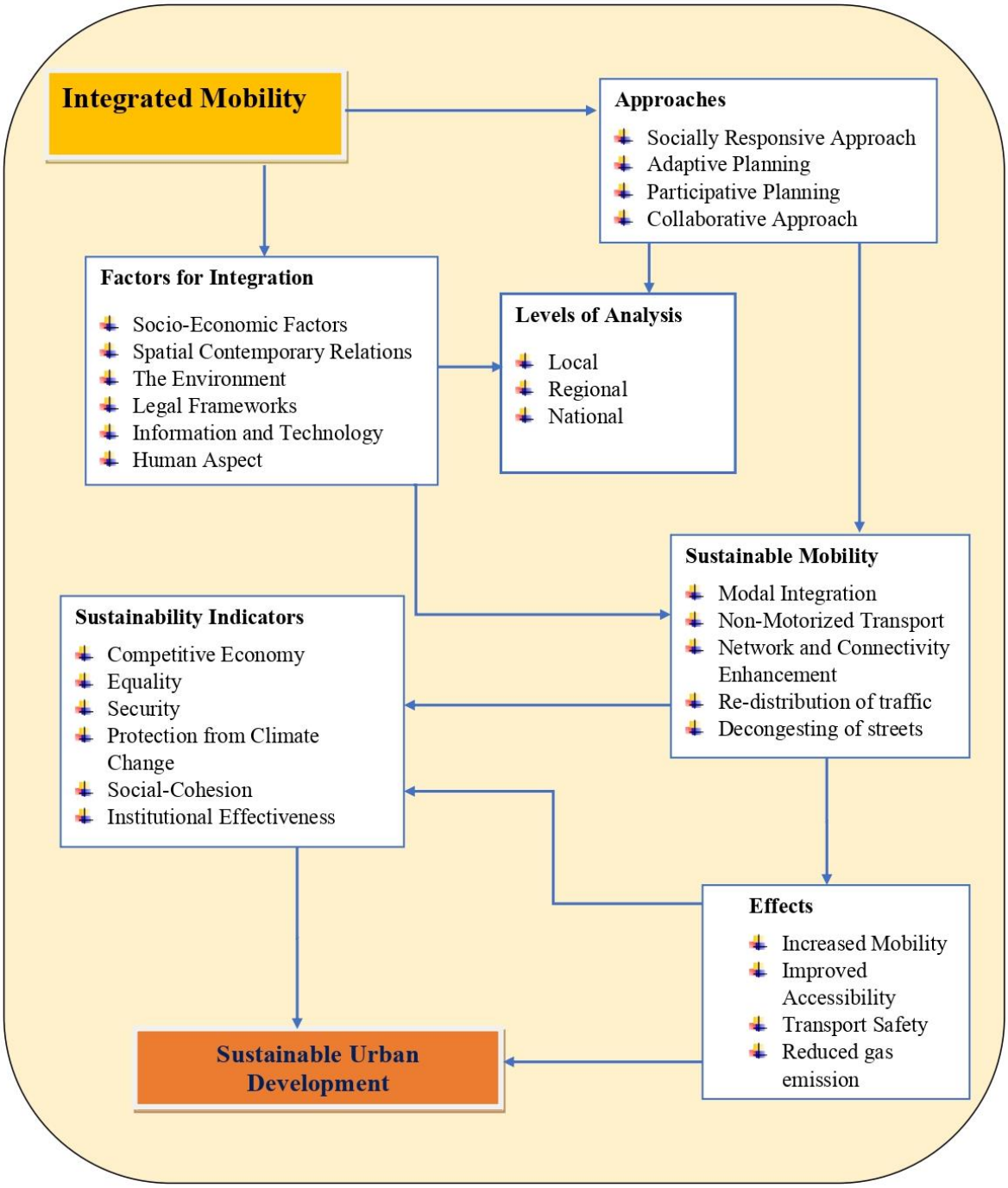
The rapid, unplanned, and disjointed expansion of towns and cities has resulted in informal growth that has compromised existing transportation systems and intensified the difficulty of establishing sustainable land use for mobility. Sustainable mobility is a pivotal factor for cities and towns globally, serving as a prerequisite for economic engagement and societal involvement.

Beyond its significance as an urban service for the movement of individuals and goods, mobility significantly contributes to prosperity and employment. Analyzing the mobility associated with land use necessitates consideration across all spatial scales, ranging from local to regional and national levels, while also encompassing the temporal dimension that activates both immediate and long-term facets of challenges and prospects. The perceived strategies that can be explored to decrease pollution and fossil fuel dependency in transport planning include; modal integration, incorporation of non-motorized transport in the transport system, network and connectivity enhancement, re-distribution

of traffic, and decongestion of streets. The resultant effects are sustainable mobility and accessibility, transport safety, and reduced gas emission translating to sustainable and resilient communities.

The sustainability indicators include a competitive economy, equality among the citizens, security, protection from climate change, social cohesion, and institutional effectiveness.

Figure 8: Conceptual Framework



Source: Author, 2023

CHAPTER THREE:
RESEARCH METHODOLOGY

3.1 Overview

This section entails an overview of the research's design, the intended group of subjects, the approach to sampling, methods of data gathering, and the analytical procedures that will be utilized. Additionally, it encompasses a discussion of the framework for selecting samples, the strategies for analyzing data, and the methods for interpreting the results.

3.2 Study Design

The study adopted a cross-sectional design to gather information at a single point in time. Qualitative and quantitative research methods were employed to ensure adequate data collection for the study's scope. Qualitative research methods were particularly useful in capturing detailed descriptions and large amounts of data within a short period. On the other hand, quantitative research methods allowed the researcher to identify the number of non-motorized transport users, including pedestrians, cyclists, people with disabilities, and hand cart pullers, within Ahero town. This approach generated statistical data that guided the research objectives.

Moreover, qualitative research methods provided the opportunity to observe the natural behaviors of study participants from the Ahero town area. By analyzing these behaviors, the study was able to identify the challenges facing urban mobility in the town. Overall, the combination of these research methods allowed the study to collect comprehensive data and gain a deeper understanding of the issues surrounding urban mobility within Ahero town.

3.3 Target Population

The study's target population included road users (pedestrians, cyclists, and PWDs), institutional representatives (KeNHA/KeRRA Officers; Physical Planner; Traffic Police Officer), and key stakeholders in the transport sector within the Ahero town. By focusing on specific categories, such as pedestrians, cyclists, people with disabilities, private care owners, and matatu operators, the study gained valuable insights into unique mobility requirements and barriers. This allowed the study to design integrated mobility solutions that cater to the specific needs of each group, ensuring inclusivity and accessibility for all since different user groups have diverse transportation needs, preferences, and challenges.

3.4 Sample Size and Sampling Design

According to Taherdoost (2016), a sample pertains to a subset of individuals or objects chosen from a larger assemblage to undergo measurement in research. Conversely, a population refers to the complete entity that the researcher aims to draw conclusions about. Hence, sampling denotes the procedure of picking a sample from the overarching population (Shukla, 2020). To address research inquiries effectively, a researcher must opt for a sample taken from the target population due to limitations in resources or time, which preclude studying the entire population. This choice assists the researcher in streamlining the process of data collection and subsequent analysis.

According to the KPHC 2019 Report (Volume II, distribution of population by Administration Units), Ahero Town has an urban population of approximately 11,801 inhabitants. While motorized transportation remains a prevalent mode of travel, certain locations are not reachable via either public or private conveyance. The research employed a combination of probability and non-probability sampling techniques. In the case of non-probability sampling, the purposive sampling approach was implemented to choose participants. The selection was based on their proficiency and familiarity with the transportation domain or their engagement with the urban transport system. Concerning probability sampling, a stratified sampling technique was employed to guarantee comprehensive coverage of all classifications within the study region.

Being that the road network within Ahero town attracts a population that is not necessarily a true representation of the entire administrative unit, the convenience sampling method was adopted in targeting the respondents who were readily accessible and willing to be part of the study. To arrive at the desired sample size, the following formula was used with a standard deviation of 1.96.

$$n = \frac{Z^2pqN}{e^2(N-1) + Z^2pq}$$

Where N = Population size

n = Sample size

p = Assume a 95% confidence level of the target population

q = 1-p

e = Acceptable error (e = 0.05, since the estimated should be 5% of the true value).

Z = The standard deviation = 1.96

Hence:

$$n = \frac{1.962 \times 0.95 \times (1-0.95) \times 16{,}135}{0.052^2(11{,}801-1) + (1.96^2 \times 0.95 \times 1-0.95)} = \mathbf{72}$$

The computed study sample size for road users was **72** as shown in the calculations above. However, the researcher sampled a total of **80** road users within the study area and **4** key informants from different departments and authorities in charge of the transport system within the study area including; the Department of Planning, Ahero Town Traffic police department, KeNHA and KeRRA Offices. Despite efforts to have an audience with some key informants from the County Transport Department and the NTSA, the researcher only managed to reach an officer from the county transport department office who promised to give an audience but later failed to respond.

Table 1 below shows the sample distribution for the road users.

Table 1: Sample Size Distribution

Strata	Population	Frequency
Pedestrians	36	45%
Cyclists (Motorbikes & Bicycles)	16	20%
People with disabilities	12	15%
Private car owners	8	10%
Matatu Operators	8	10%
Total	**80**	**100%**

Source: Author, 2023

3.5 Data Collection Methods and Instruments

3.5.1 Data Collection Methods

Data collection methods refer to the strategies and techniques used to gather information for a research study or other purposes. Both primary and secondary data for the study area were collected using the methods listed below;

3.5.1.1 Primary Data Collection Methods

Primary data collection methods refer to the methods used to collect data directly from participants or sources, rather than collecting it from existing sources. This method was used to capture first-hand information from the field. For this study the following were applied: interviews, instrument administration, photography, and observations as discussed below;

Interviews

The study employed an interview that was administered orally to the key informants within the study area. Interviews conducted inquiries about trip origins and destination, trip purpose, modes, the proportion of trips by different modes, time taken during the trips, and frequency of trips made.

Photography

Photography entails taking pictures of various mobility features for illustration purposes. The major features that were captured through photography contained the physical aspects of mobility within Ahero town such as the road network.

Observation

The researcher adopted an observational approach, actively engaging in the environment where the respondents were situated, carefully observing all aspects, and recording observations as notes. An observation checklist was used to conduct an inventory and assess the quality of transport facilities in Ahero town and take a tally of users which helped come up with a modal split.

Survey Questionnaires

The survey questionnaires were administered to the research population to gather information on their perception of the current state of urban mobility, challenges, and opportunities for sustainable urban development.

3.5.1.2 Secondary Data Collection Method

This involved a literature review that entailed reading books, journals, periodicals, and reports written by previous researchers on relevant areas. Other documents that were reviewed included: policies, legal documents, and standards guiding comprehensive transport planning, case studies, and best practices in integrated urban mobility.

3.5.2 Data Collection Instruments

The study used the following instruments that aided the collection of data in the field; questionnaires, focus group guides, and observation lists.

3.5.2.1 Questionnaires

The questionnaires were administered to the respondents and answered using the Kobo Collect tool. This helped in providing pieces of information that were not readily available or could not be obtained through direct observations and which people are shy to disclose in group discussions.

3.5.2.2 Interview Schedules

Interview schedules were prepared to target mainly the key informants in the transport industry. The interviews were useful in obtaining an in-depth understanding of the status of mobility infrastructure within the study area and the contributions of the interviewees to the state of mobility within the study area.

3.5.2.3 Direct Observation

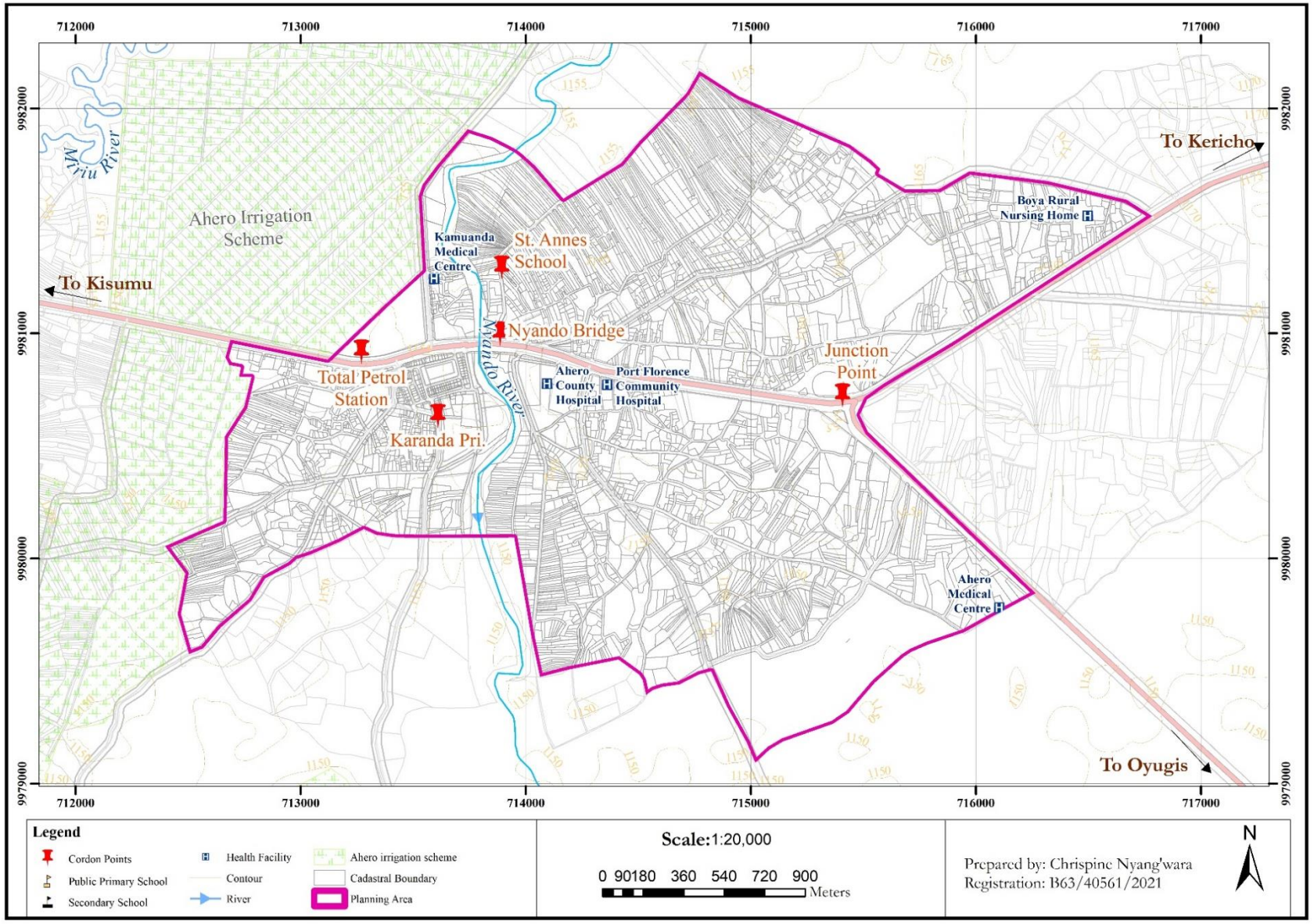
This tool of assessment involved the actual observation of the level of transport infrastructure and facilities within the study area such as the pedestrian walk lanes, street & traffic lighting, cycle trucks, zebra crossing, and footpaths.

3.5.2.4 Traffic Tally

Traffic counts of the cyclists, motorcyclists, private cars, vans, light goods vehicles, heavy goods vehicles, matatus, and large buses (public/private transport) were done using traffic tally sheets which enabled the researcher to conduct traffic within the study area in comparison to the existing infrastructure.

Some of the reasons cited by the traffic police officer include; the majority of the motorists do not observe the 50 km/h speed limit signs, the Nyando River bridge has a narrow space for pedestrians and the junction connecting Awasi, Oyugis, and Kisumu is unmarked. A map indicating the cordon points was generated as shown below:

Map 1: Traffic Cordon Points



Source: Author, 2023

3.5.2.5 Mapping and Photography

Maps were employed to establish the spatial location of the study area and to map out the existing mobility framework within the study area. Photographs of the study area were taken to facilitate the analysis of the status of mobility infrastructure within the study area and the spatial/physical layout of land uses.

3.6 Data Analysis Methods

The in-depth review of literature, policies, and regulations with relevance to integrated mobility provisions formed part of the secondary data that was analyzed. The primary data collected was analyzed using descriptive statistics and thematic analysis to identify patterns, trends, and relationships among the variables. All the data collected from structured questionnaires, observation checklists, and focused group discussions (FGDs) were coded, cleaned, and analyzed using the Statistical Package for Social Sciences (SPSS) and Microsoft Excel which generated various frequencies; cross-tabulation of the category of road users by gender and time taken to get to the destination by estate/village; tables; pie charts and bar graphs. Findings of the data obtained from key informants were sieved and findings were incorporated in the report.

3.7 Data Presentation Plan

The quantitative data collected was presented by the use of charts, maps, and photographs. Photographs were used to illustrate data, as discussed in descriptive analysis, for example in illustrating the condition of mobility infrastructure along the major transport corridor in Ahero town. Spatial data were presented using GIS included; the location of the study area, the various facilities provided, and the different land uses within Ahero town.

3.8 Ethical Considerations

Ethical considerations are important in research because they ensure that research is conducted responsibly and respectfully and that the rights and welfare of respondents are protected. This study was done with a preference for key ethical considerations to ensure the data collected and the information acquired is trustworthy and verifiable. These principles guarantee that all human subjects were willingly chosen to participate in the study and that they were fully informed regarding the procedures of this research project and any potential risks.

These considerations included;

i. **Informed Consent;** where respondents were informed about the purpose of the research, the methods being used, and any potential risks or benefits, and they must give their voluntary consent to participate. The researcher did not acquire information from unwilling participants since all the respondents gave their feedback willingly.

ii. **Confidentiality and Privacy;** where the researcher ensured that the personal information of the respondents was kept secure and not shared without their consent. This was achieved by ensuring that data collected, during analysis is generalized and none of the respondents was disclosed as a unit to avoid any harm. The responses were entered into analysis tools, SPSS, and analyzed then a generalization was drawn.

iii. **Vulnerable Populations;** where the researcher was particularly mindful of the potential vulnerability of certain populations, such as children and individuals with disabilities, and took extra care to ensure that these groups are treated ethically.

iv. **Data Integrity;** The researchers ensured the integrity of the data that was collected and analyzed and took the necessary measures to prevent data manipulation or fabrication.

CHAPTER FOUR:
THE STUDY AREA

4.1 Overview

This section provides an overview of the geographical context of Ahero Town and its surrounding vicinity. It outlines the geographical scope of the planning region and offers a concise overview of planning and developmental components. This furnishes insight into the study area, encompassing its historical background, physiographic attributes, and the demographic makeup of Ahero Town's population.

4.2 Geographical Location

Ahero town is situated approximately 25 kilometers to the Southeast of Kisumu City within Ahero Ward, Nyando Sub-County. This urban center serves as a pivotal transportation hub due to its strategic location at the crossroads of the Nairobi-Kisumu (B1) and Kisii-Kisumu (A1) highways. Nestled within the Kano plains, Ahero thrives in a fertile agricultural region primarily dedicated to cultivating rice, sugarcane, and soya.

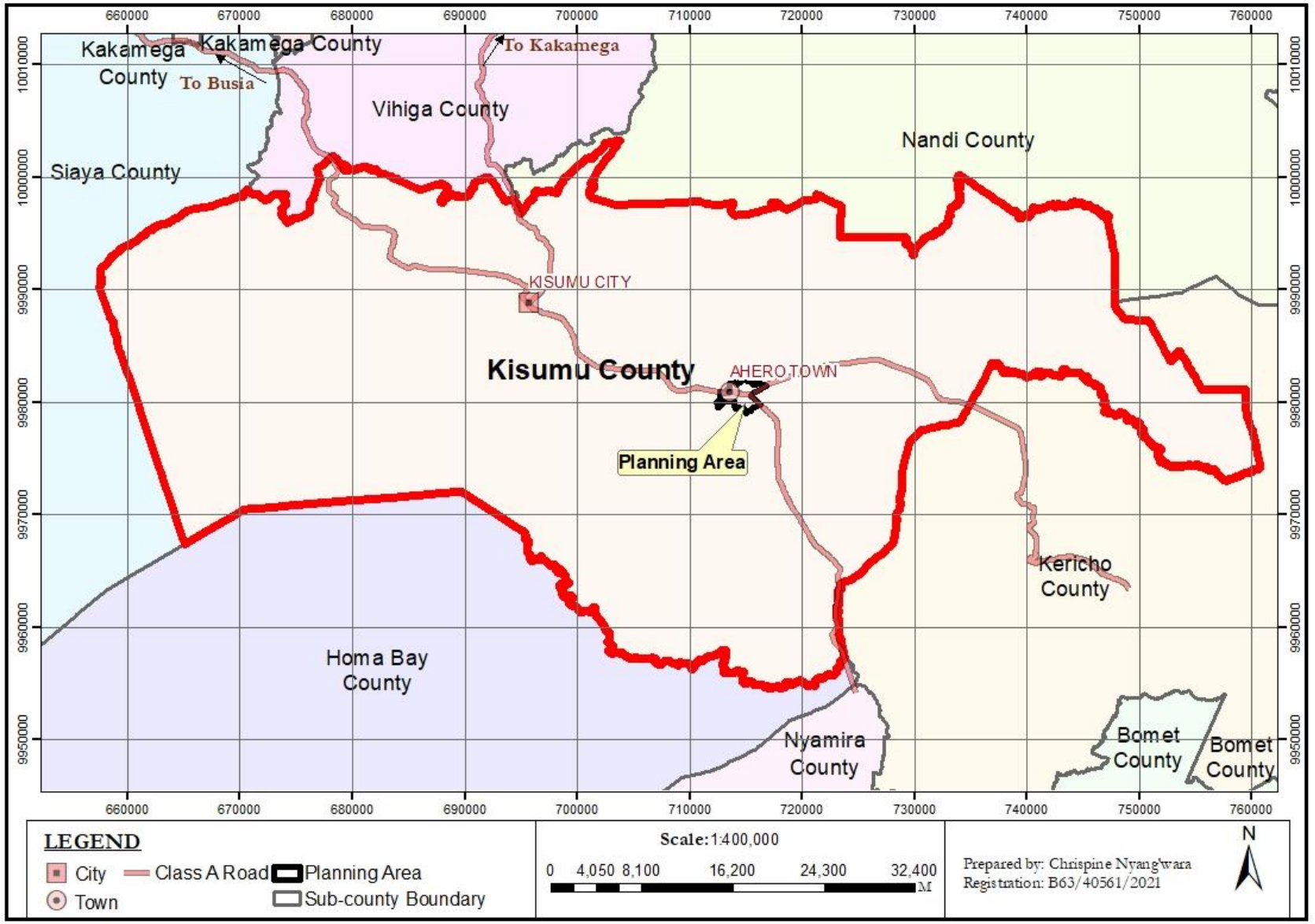
The town accommodates a central retail market that functions as a primary trading nucleus for food and merchandise originating from Kisii, Homabay, and Nandi. This commercial activity significantly contributes to Ahero's economic interactions. Additionally, a substantial portion of the populace derives income from informal sector engagements like vending, kiosks, open-air fish frying, and boda-boda services.

Acknowledging its significance in trade and revenue generation, the study recognizes the imperative to enhance the current mobility scenario within Ahero. The town ranks second only to Kisumu City in trade volume and revenue collection. Furthermore, serving as a gateway to Kisumu City, improved accessibility in Ahero could alleviate traffic congestion, reduce accidents, and facilitate smoother movement within the town.

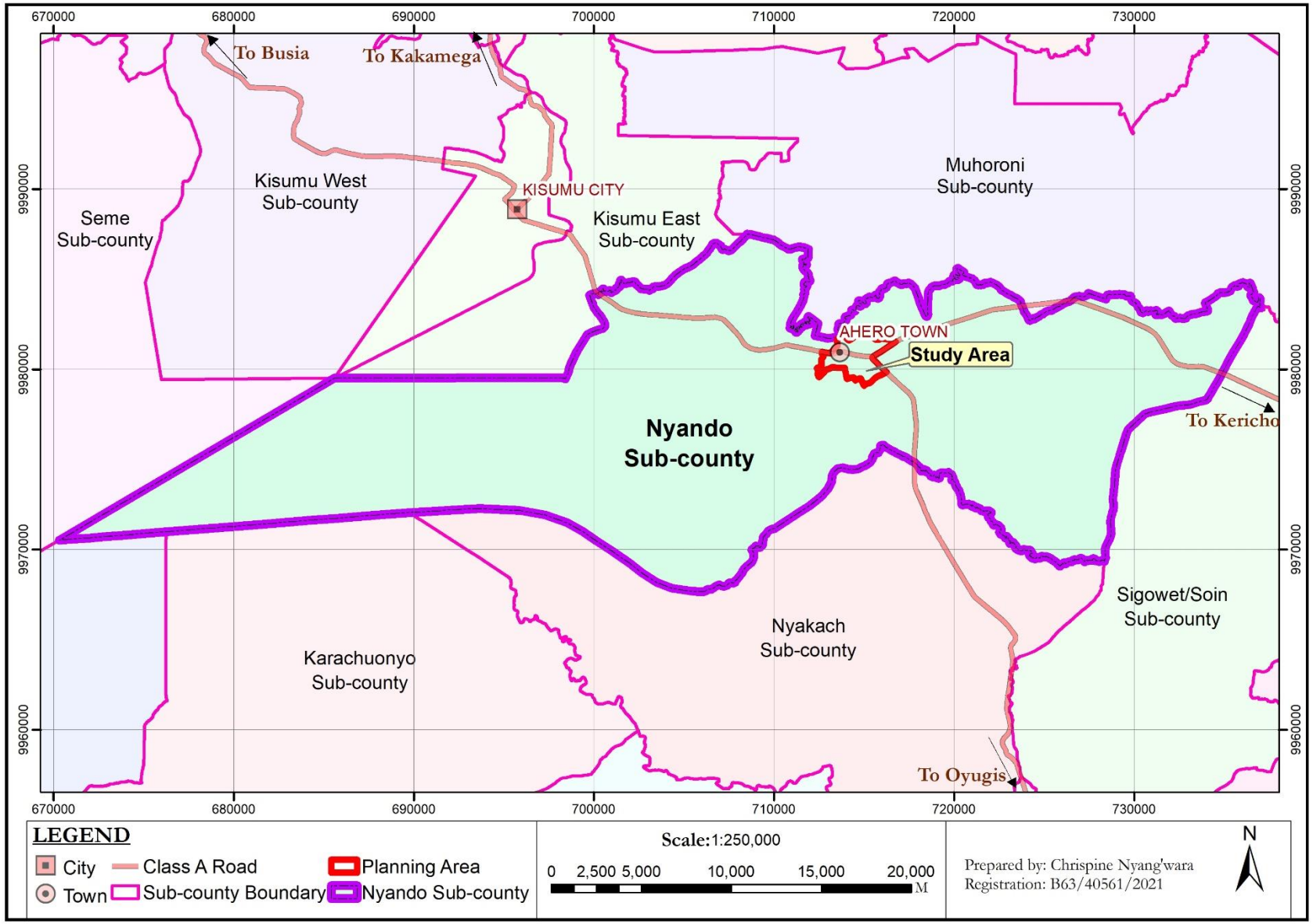
The maps overleaf show the location context of Ahero Town at the National, County, Sub-County, and Ward levels and the Study Area.

Map 2: Location of Kisumu County in National Context

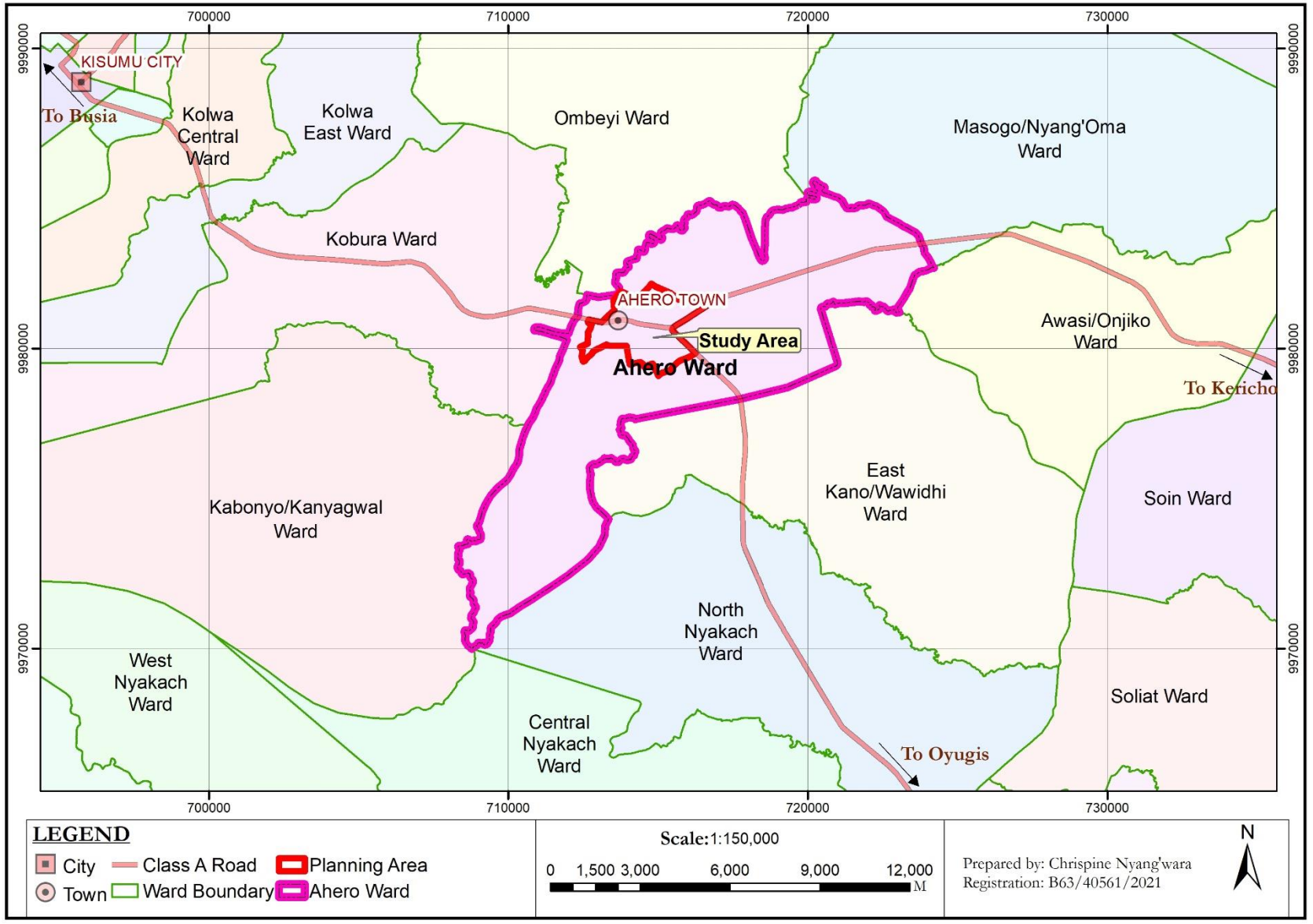
Map 3: County Context



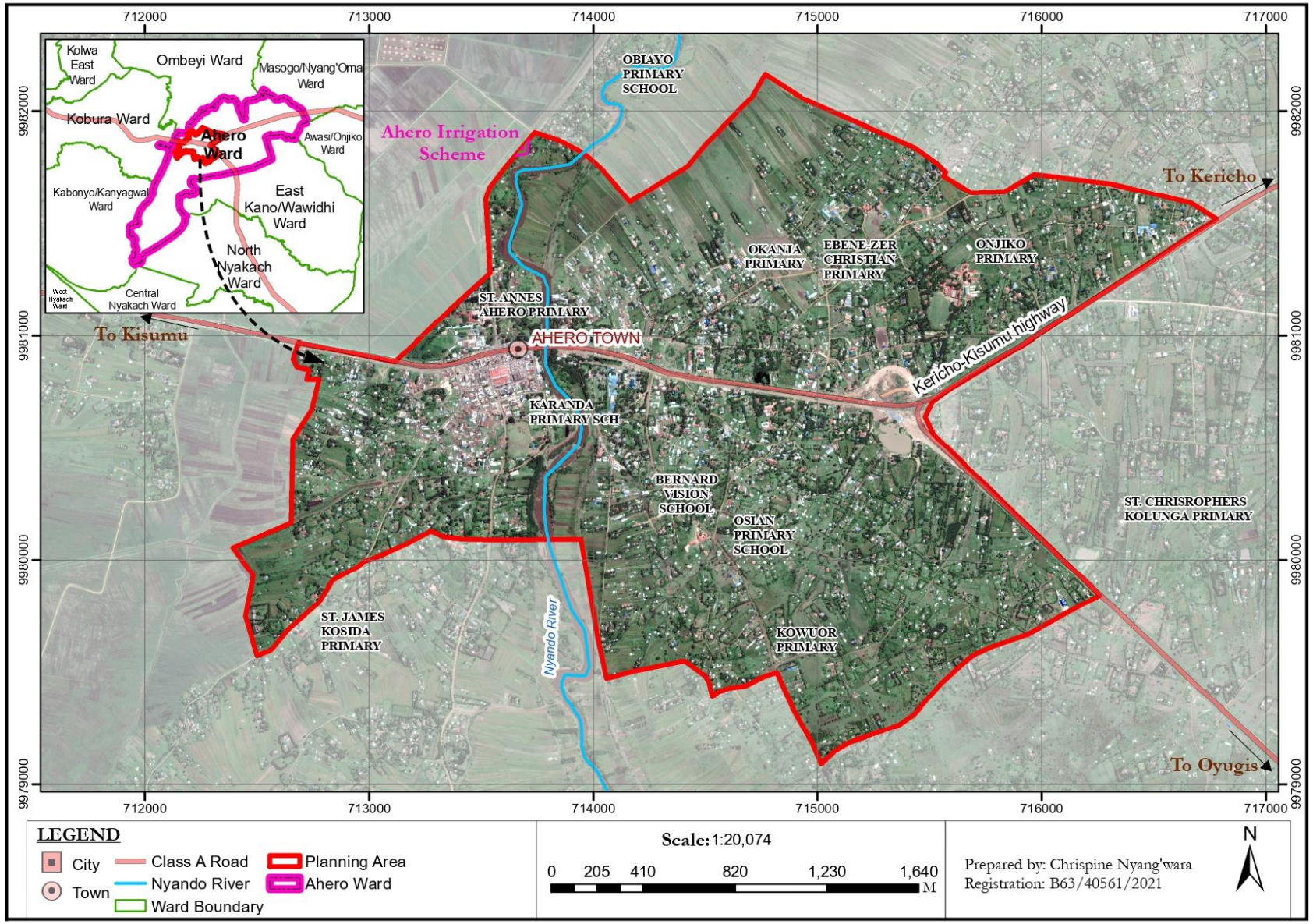
Map 4: Sub-County Context



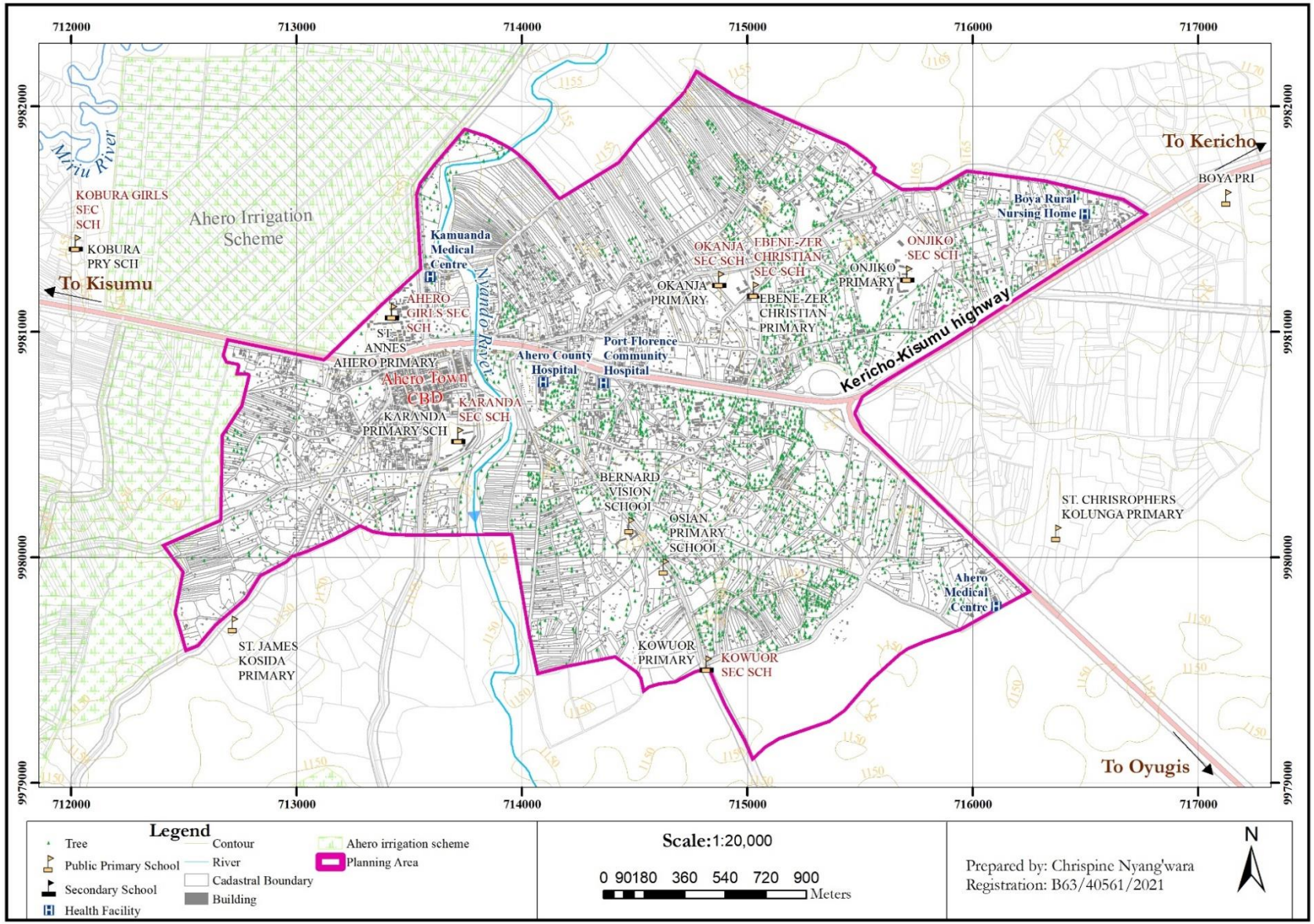
Map 5: Ward Context



Map 6: Study Area



Map 7: Study Area Base Map



4.3 Population and Demography

Over the years, Ahero Town has experienced continuous population growth. According to the KPHC 2019 Report (Volume II, distribution of population by administration units), the town's current urban population is approximately 11,801 persons; Male-5,384, Female-6,414, and Intersex-3. As the population continues to grow, the demand for efficient and accessible transportation systems intensifies. The differing gender and intersex representation within the population suggests the importance of tailoring mobility services to accommodate diverse identities and preferences, ensuring that no group is marginalized in their ability to move freely within the urban environment.

4.4 Climate and Rainfall Condition

The weather in Ahero Town remains consistently warm, with only slight monthly temperature fluctuations between 23°C and 33°C throughout the entire year. The precipitation patterns are shaped by a modified equatorial climate, which brings extended rainy periods from March to May and shorter ones from September to November. The average yearly rainfall ranges from 1000 to 1800mm during the prolonged rainy season and 450 to 600mm during the brief rainy season. The town's elevation fluctuates, spanning from 1,144 meters above sea level across the plains, significantly impacting local temperatures and precipitation patterns. Effective planning and infrastructure development must consider the demographic dynamics to ensure that mobility remains efficient, equitable, and sustainable for all members of the town.

4.4.1 Temperature

Ahero town experiences annual maximum temperature ranges between 25°C (77°F) and 33°C (91.4°F) with the annual minimum temperature ranges between 16°C (60.8°F) and 18°C (64.4°F). This consistency in temperature may lead to a steady preference for walking, cycling, and other forms of active transportation. Public transport systems also experience consistent demand due to the favorable climate, encouraging people to travel comfortably. The temperature ranges have implications for urban mobility by influencing transportation choices, outdoor activities, infrastructure development, and sustainability initiatives. The consistent and favorable temperature range can foster a more active and accessible urban mobility landscape.

4.4.2 Topography and Physiographic Features

Ahero town is positioned near the base of the Nandi escarpment, characterized by a level terrain that gradually inclines in the direction of Lake Victoria. When rainfall occurs, there is a movement of

excess water along the surface, as well as stormwater originating from the Nandi hills, which follows pathways like watercourses, rivulets, and the Nyando River. Frequently, the Nyando River exceeds its normal limits, resulting in the inundation of neighboring areas. The accessibility of roads and transportation routes can be severely impacted during such flooding events, necessitating contingency plans for alternative routes, emergency services, and transportation assistance for residents.

CHAPTER FIVE:
RESEARCH FINDINGS

5.1 Overview

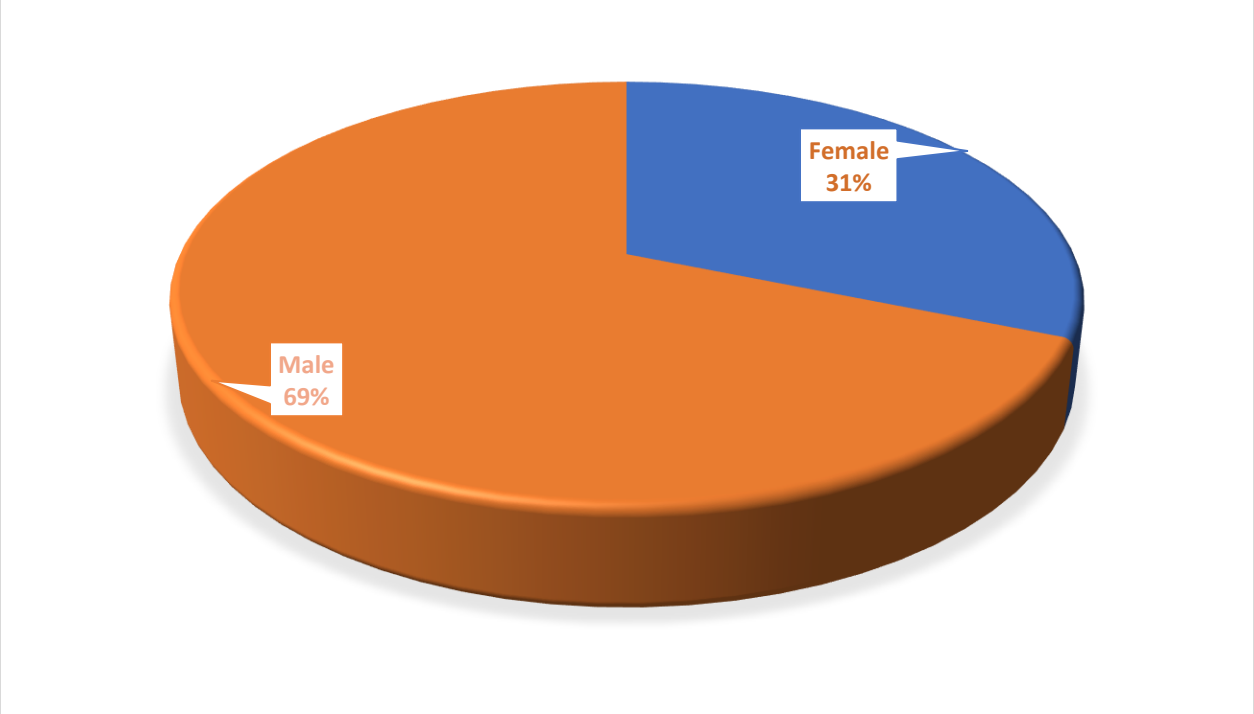
This section presents the findings obtained from traffic assessments, analysis of infrastructure, and a review of existing literature. It details the scrutiny and assessment of population features, changes in land utilization, traffic analyses, and the transport infrastructure in Ahero Town. The information amassed for this research was acquired through interviews with individuals of significance, surveys of road users, evaluations of traffic conditions, and assessments of infrastructure. These activities were conducted from May 29th, 2023, to June 16th, 2023.

5.2 General Demographic Characteristics

5.2.1 Gender of the Respondents

The majority (69%) of respondents were male while 31% were female. This implies that the male gender is the most active participant in mobility activities such as cycling and motorized transportation. On the other hand, the lower percentage of female respondents suggests the potential barriers that impact women's mobility such as safety concerns and limited access to sustainable transportation options within the town.

Graph 1: Gender of the Respondents

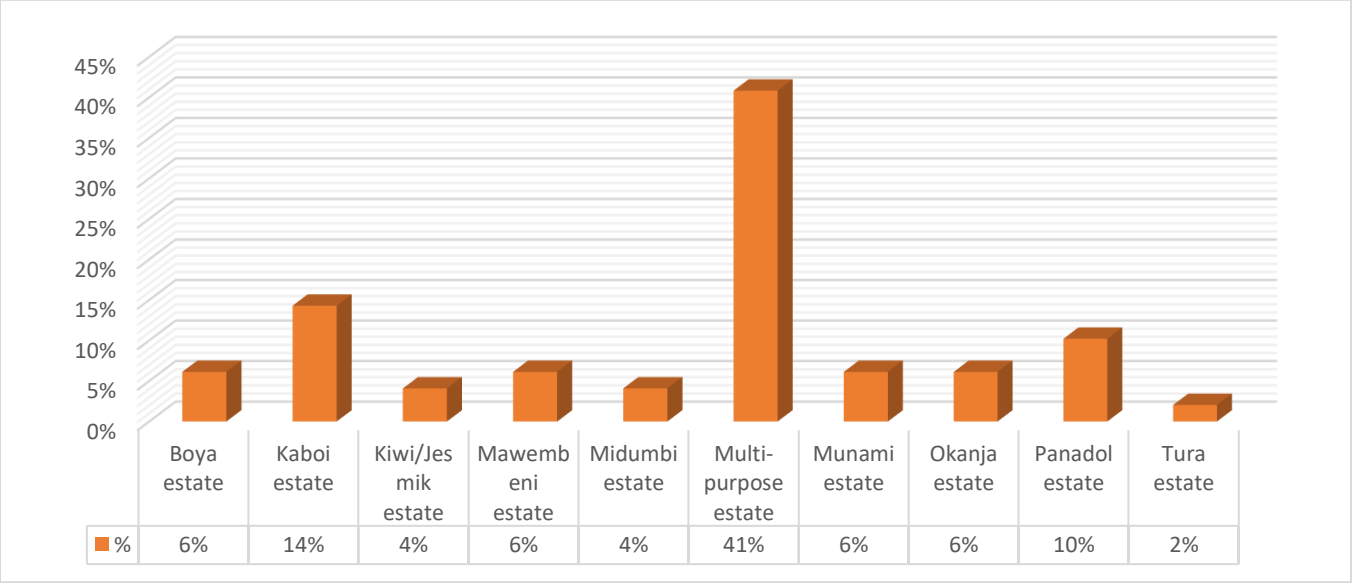


Source: Field Survey, 2023

5.2.2 Respondent's Area of Residence

The majority of respondents interviewed (41%) reside at Multi-purpose estate as shown in the graph below. This can be attributed to the proximity of the estate to town and being nearer to the main highway.

Graph 2: Respondent's Area of Residence



Source: Field Survey, 2023

5.2.3 Respondent's Age Bracket

The majority of respondents (41%) were of the age bracket between 18-38 years, 33% were above 48 years with 26% being between 38-48 years of age as shown in the graph below. This implies that the study area is dominated by the youthful population.

Table 2: Respondent's Age Bracket

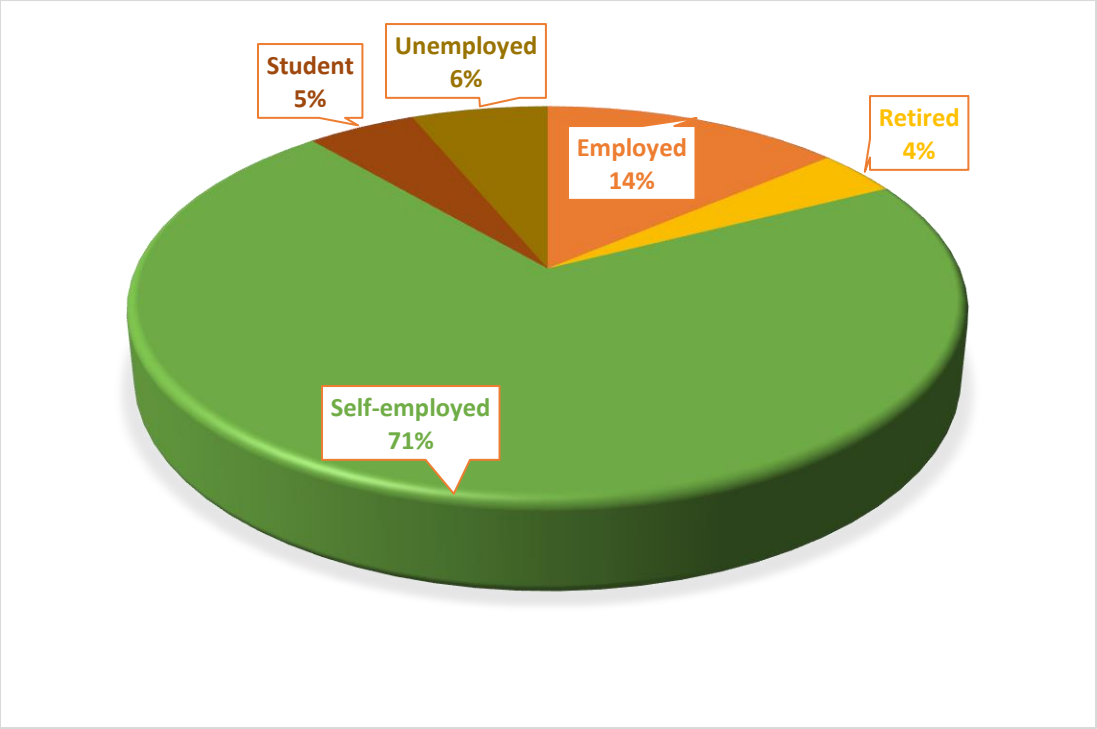
AGE OF THE RESPONDENTS (YEARS)	FREQUENCY	PERCENTAGE	CUMULATIVE PERCENTAGE
18-38	33	41.3	41.3
38-48	21	26.3	67.5
Above 48	26	32.5	100.0
Total	**80**	**100.0**	

Source: Field Survey, 2023

5.2.4 Respondent's Main Occupation

The majority of respondents (71%) within the study area are self-employed with a relatively low level of unemployment at 6% as shown in the graph below. This can be attributed to the fact that the majority of households are engaged in farmers and small-scale businesses within the study area as was observed by the researcher during data collection.

Pie Chart 1: Respondent's Main Occupation

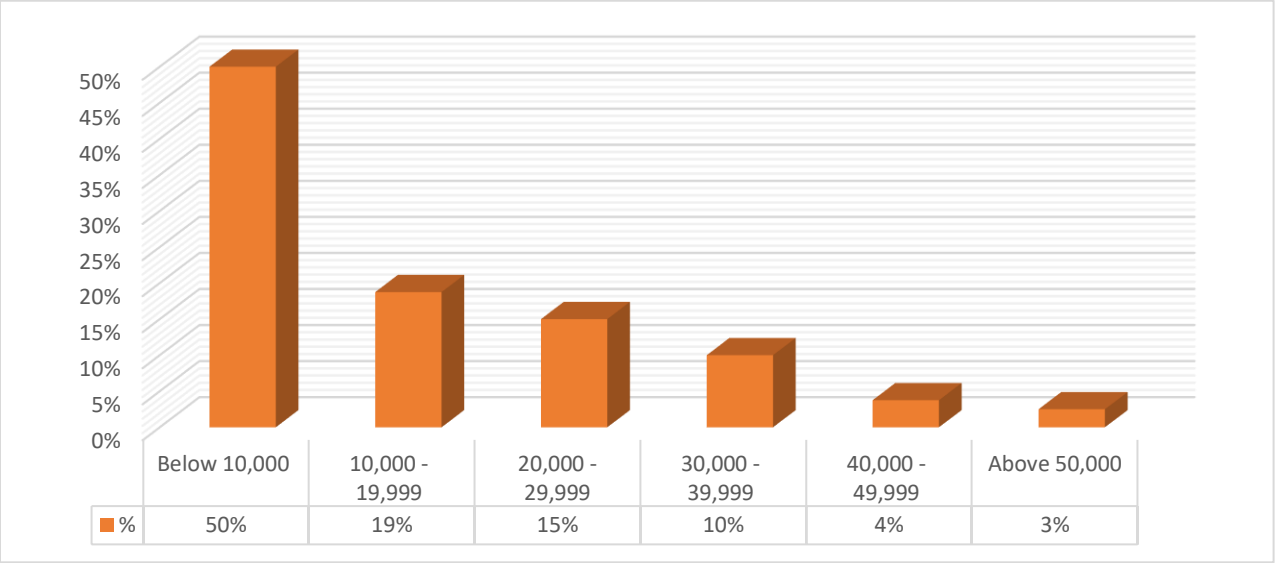


Source: Field Survey, 2023

5.2.5 Respondent's Income Level

The choice of trips within households is influenced by their income levels, as income determines the capacity of household members to afford travel expenses and access services at their destination. The majority (50%) of respondents within the study area have an income that is below Kshs. 10, 000 with only 3% earning above Kshs. 50,000 as shown in the graph below.

Graph 3: Respondent's Monthly Income Level

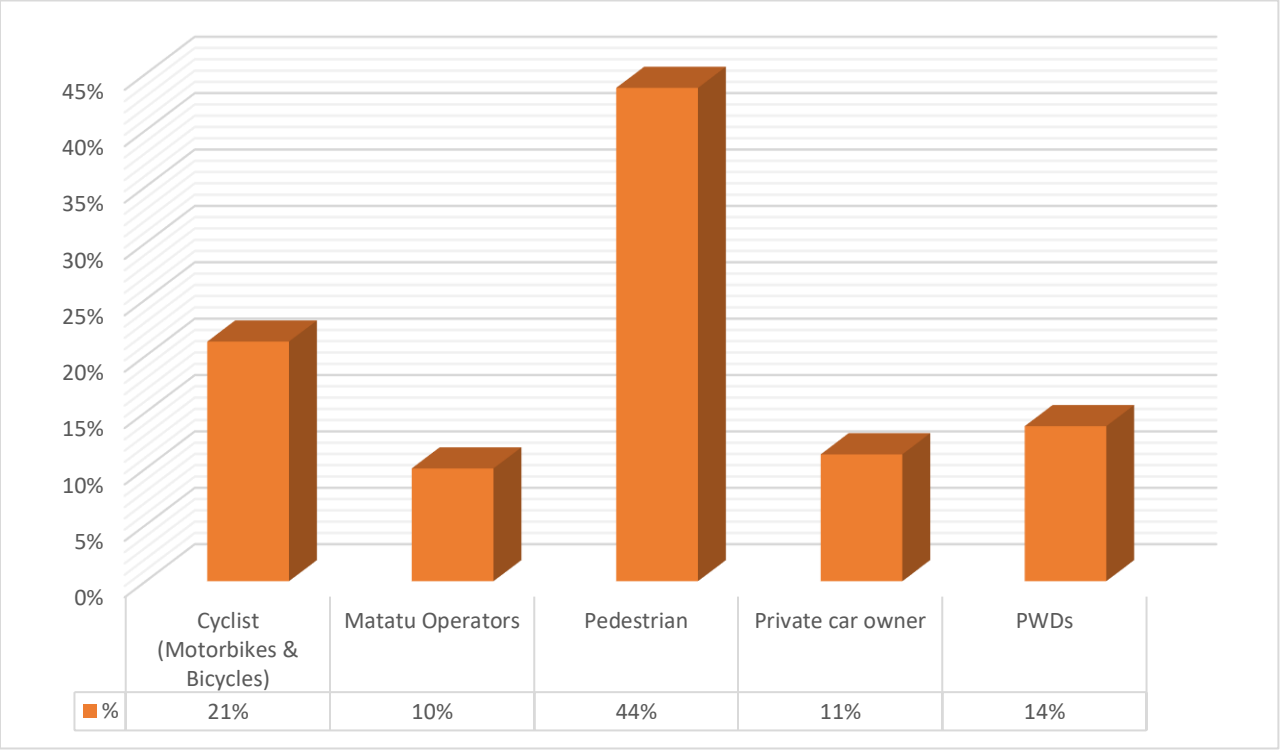


Source: Field Survey, 2023

5.2.6 Category of Road Users

The majority of respondents (44%) within Ahero Town are pedestrians, cyclists account for 21%, PWDs at 14%, and private car owners at 11% while matatu operators accounted for 10% of the total number of respondents interviewed as shown in the graph below.

Graph 4: Category of Road Users



Source: Field Survey, 2023

5.3 Land Use Dynamics in Ahero Town

The study area has various land uses; these include residential, light industrial, educational, recreational, public purpose, commercial, public utility, transportation, and agricultural. The predominant land use within the study area is agricultural (43.36%) followed by residential (39.14%). Commercial land use is mainly concentrated within Ahero Town CBD. Despite the transportation land use being the 3rd largest land use with approximately an area of 101.21 Ha, the study area still experiences mobility challenges such as traffic congestion, pollution, poor road networks, and lack of connectivity between the first and last mile options. There is a compelling need to promote the integration of mobility by reducing the high reliance on single-occupancy vehicles to help alleviate congestion and reduce emissions within the study area.

The table overleaf summarizes the existing land use within the study area.

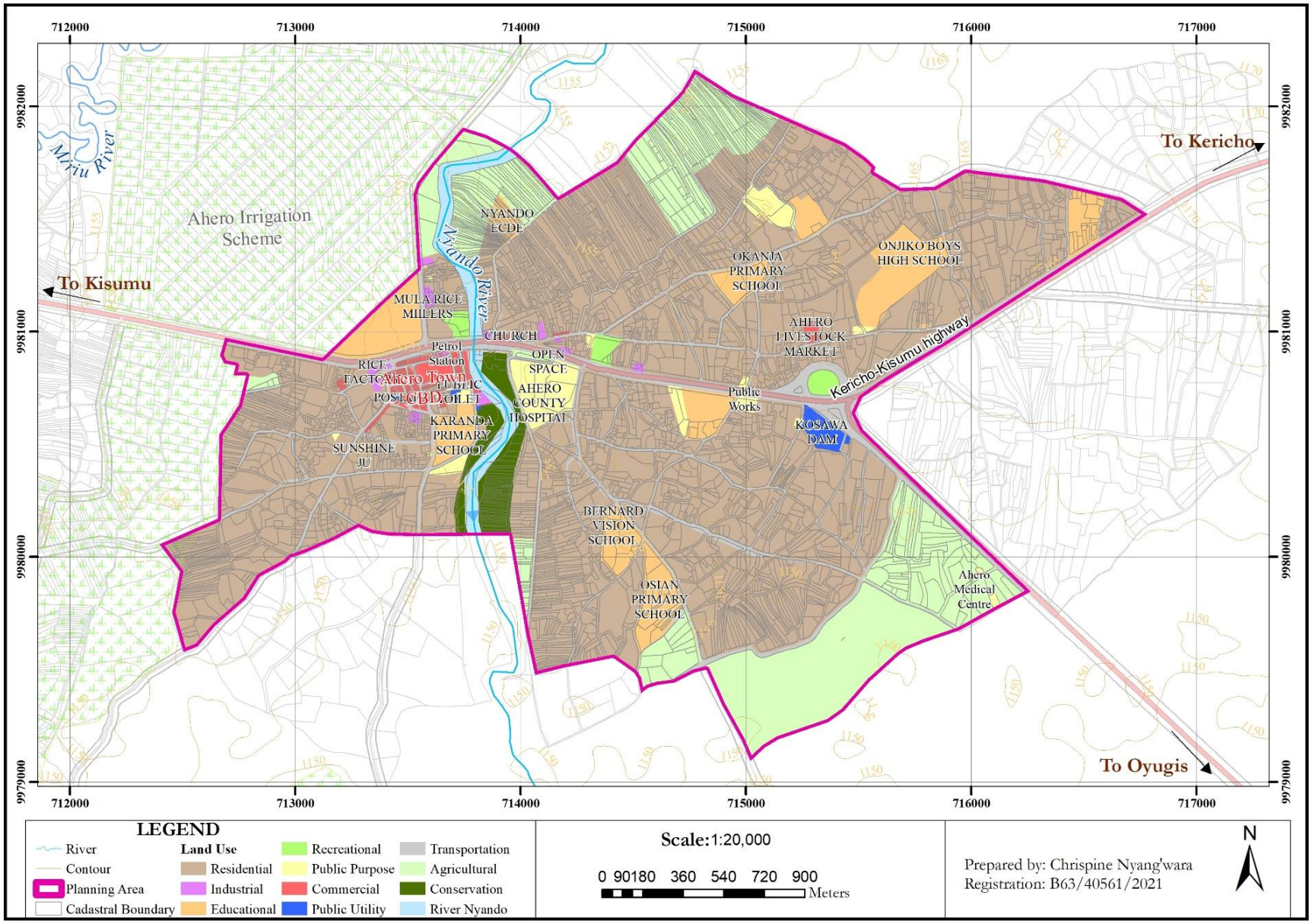
Table 3: Ahero Town Existing Land Use Budget

Land Use Name	Area in Hectares	Percentage (%)
Agricultural	479.39	43.36%
Residential	432.73	39.14%
Transportation	101.21	9.15%
Educational	37.48	3.39%
Recreational Conservation	33.62	3.04%
Public purpose	10.98	0.99%
Commercial	5.61	0.51%
Public utility	3.44	0.31%
Industrial	0.79	0.07%
Recreational	0.42	0.04%
Total	**1,105.67**	**100.00**

Source: Author, 2023

The map overleaf shows the spatial representation of the existing land use within the study area:

Map 8: Existing Land Use Map



5.4 Mobility Characteristics in Ahero Town

5.4.1 Road Network in Ahero Town

The Town has a road system that allows access to different activity areas. However, there is a drawback as the outskirts suffer from limited accessibility because of the subpar road conditions. The Kisumu-Kericho Road corridor cuts across the study area from east to west and serves as the main artery of the internal road network within the CBD. This particular stretch accommodates both motorized and non-motorized traffic.

The major operators of public transport within the study area include 14-seater matatus, tuk-tuk, and motorcycles. The 14-seater matatus and tuk-tuk connect the area with Kisumu city while the motorcycles connect the various households and activity spaces within the study boundary. The town however lacks a well-designated bus terminus and shades for motorbikes, this has led to matatus picking and dropping of passengers along the highway as captured in the plates attached herein. This poses the danger of accidents and increased traffic congestion along the highway.

Non-motorized transport (NMT) is inadequately catered for within the study area. There are no designated paths, walkways, and cyclist lanes hence, NMT utilizes the roadsides. This increases the risk of vehicular accidents. The pedestrians have not been provided with walk lanes and thus have to use the carriage. This conflict leads to reduced vehicular speeds and exposes pedestrians to the risk of accidents.

The plates below and the problem map below show the condition of the transport network within Ahero.

Plate 1: Roads Condition in Ahero Town

Source: Field Survey, 2023

Map 9: Existing Transportation Network Map

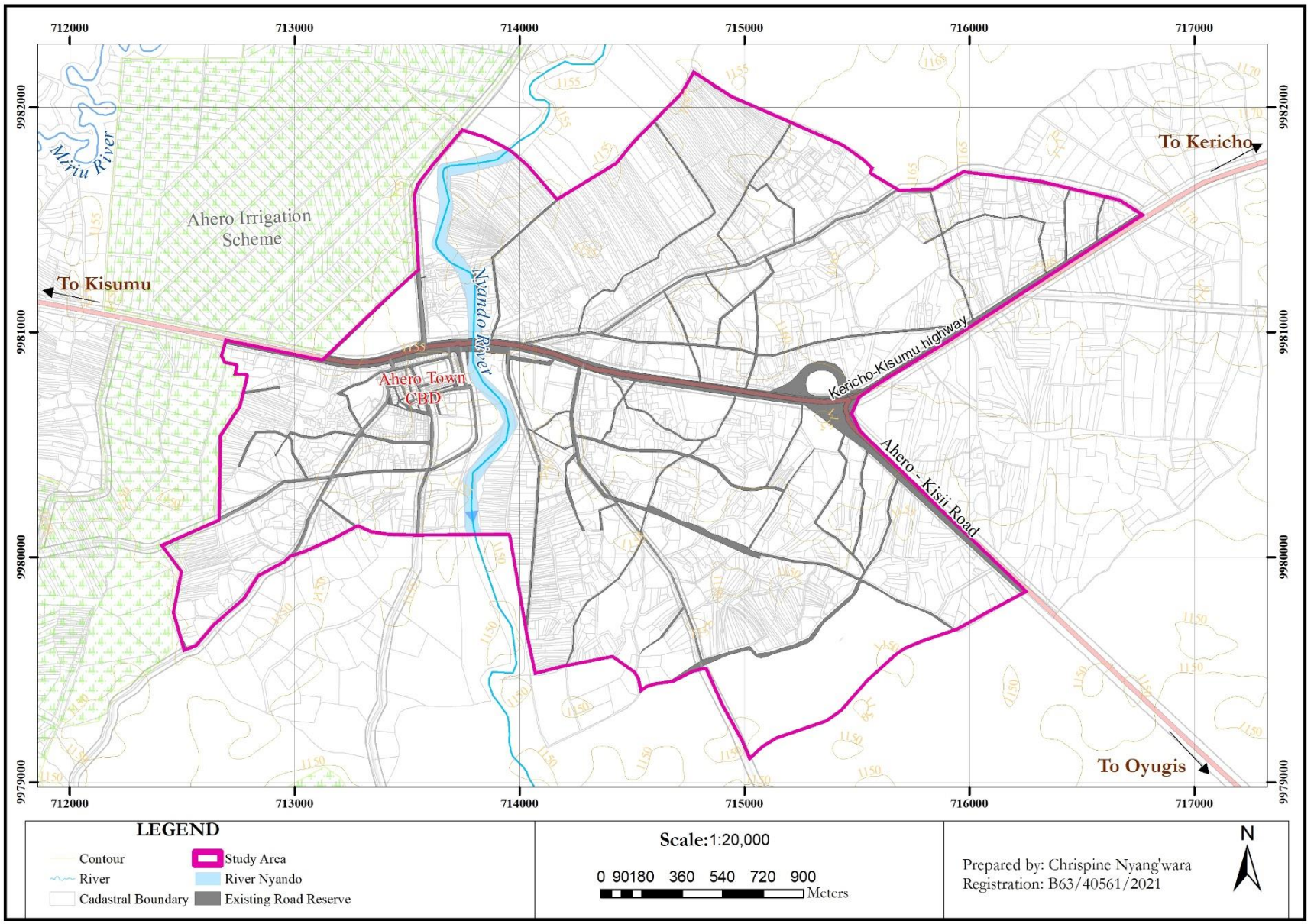
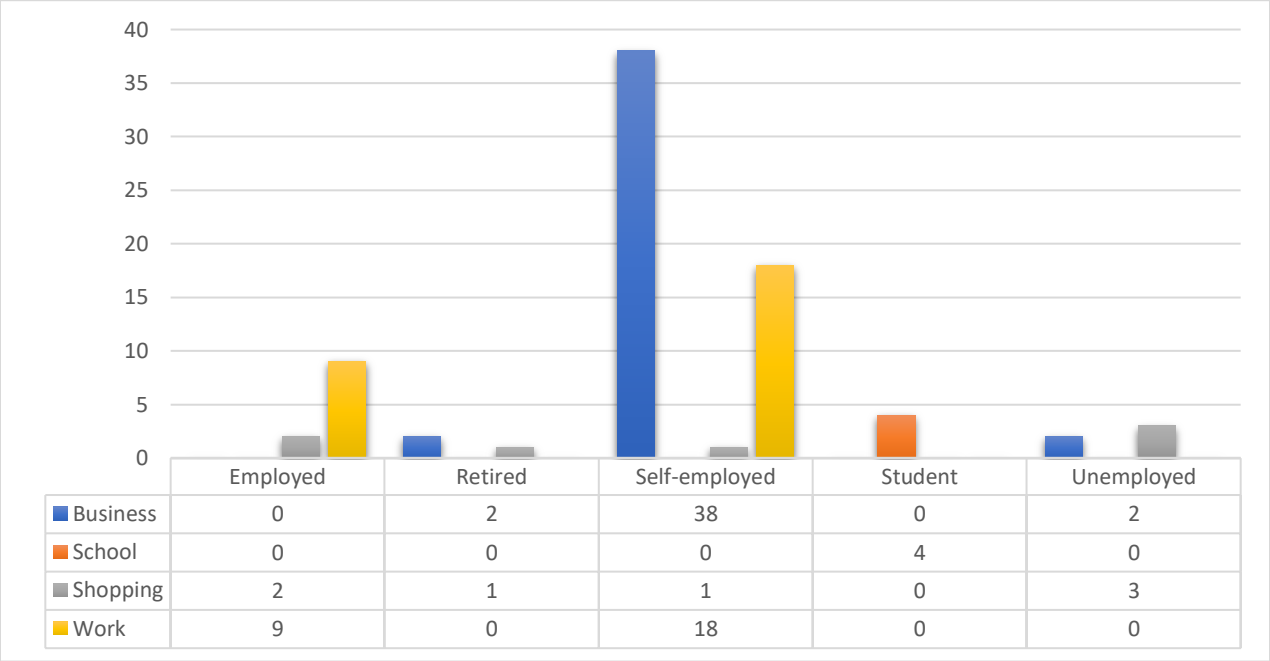


Figure 9: Ahero Town Problem Map

Source: Field Survey, 2023

5.4.2 Comparative Respondent's Trip Purpose by Occupation



	Employed	Retired	Self-employed	Student	Unemployed
Business	0	2	38	0	2
School	0	0	0	4	0
Shopping	2	1	1	0	3
Work	9	0	18	0	0

Source: Field Survey, 2023

5.4.3 Time taken to get to Primary Destination

The majority (59%) of respondents within the study area take more than 15 minutes to get to their primary destination as shown in the graph below. This implies that most of the residents within the study area cover a distance of more than 2km to get to their daily destination.

Table 4:Time taken to get to Primary Destination

TIME TAKEN TO GET TO REGULAR DESTINATION	FREQUENCY	PERCENTAGE	CUMULATIVE PERCENTAGE
10 to 15 minutes	19	23.8	23.8
5 to 10 minutes	11	13.8	37.5
Less than 5 minutes	3	3.8	41.3
More than 15 minutes	47	58.8	100.0
Total	**80**	**100.0**	

Source: Field Survey, 2023

Table 5: Comparative Time taken to get to Primary Destination by Estate/Village

Estate/Village of Residence	Time taken to get to destination using your primary mode of transportation (min)				
	10 to 15 minutes	5 to 10 minutes	Less than 5 minutes	More than 15 minutes	Total
Boya estate	0	0	1	24	**25**
Kaboi estate	3	2	0	3	**8**
Kiwi/Jesmik estate	2	0	0	2	**4**
Mawembeni estate	0	0	0	3	**3**
Midumbi estate	1	0	0	1	**2**
Multi-purpose estate	9	7	2	8	**26**
Munami estate	0	1	0	2	**3**
Okanja estate	0	0	0	3	**3**
Panadol estate	4	0	0	1	**5**
Tura estate	0	1	0	0	**1**
Total	**19**	**11**	**3**	**47**	**80**

Source: Field Survey, 2023

5.4.3 Traffic Volume Counts

A traffic volume count analysis is a crucial component of transportation planning, providing insights into the flow of traffic through specific roadways. This analysis involved the systematic collection and examination of data related to vehicular movements using traffic count sheets. The data was collected at two hours interval to capture variation throughout the day to help the relevant authorities make informed decisions about road improvements, traffic management, and infrastructure development within the study area.

The analysis revealed that the peak hours during the week are mainly morning and evening hours from 0600hrs to 0900hrs and 1700hrs to 1900hrs respectively with the majority of traffic being caused by motorcycles heavy goods trucks and private cars. This aligns with the typical commuter hours and transportation of goods using heavy trucks. The data further identified two major congestion points that experience significant congestion during peak hours, Total Petrol Station and Nyando bridge, which highlights the need for potential road expansion measures.

This analysis therefore provides a comprehensive understanding of the vehicular flow pattern within the study area, which is critical for effective transport planning. The table below show the combined (inbound and outbound) traffic count at different cordon points that are the major traffic generators within Ahero town.

Table 6: Traffic Volume Counts

Traffic Type	Cordon Points	Traffic Direction	TIME OF TRAFFIC			
			Morning (0600-0900)	Midmorning (1000-1100)	Afternoon (1200-1400)	Evening (1700-1900)
Cyclists	Nyando Bridge	Inbound & Outbound	6	15	4	42
	Total Petrol Station	Inbound & Outbound	9	11	5	31
	St. Annes School	Inbound & Outbound	4	10	6	25
	Karanda Primary School	Inbound & Outbound	12	15	2	30
	Total		**31**	**51**	**17**	**128**
Motorcycles	Nyando Bridge	Inbound & Outbound	100	154	126	138
	Total Petrol Station	Inbound & Outbound	76	111	99	126
	St. Annes School	Inbound & Outbound	89	123	84	106
	Karanda Primary School	Inbound & Outbound	90	84	63	115
	Total		**355**	**472**	**372**	**485**
Private Cars	Nyando Bridge	Inbound & Outbound	92	210	315	362
	Total Petrol Station	Inbound & Outbound	51	136	299	245
	St. Annes School	Inbound & Outbound	63	52	61	79
	Karanda Primary School	Inbound & Outbound	48	58	72	98
	Total		**254**	**456**	**747**	**784**
Vans	Nyando Bridge	Inbound & Outbound	120	98	92	99
	Total Petrol Station	Inbound & Outbound	62	58	199	89
	St. Annes School	Inbound & Outbound	2	1	0	3
	Karanda Primary School	Inbound & Outbound	1	1	0	6
	Total		**185**	**158**	**291**	**197**

Traffic Type	Cordon Points	Traffic Direction	TIME OF TRAFFIC			
			Morning (0600-0900)	Midmorning (1000-1100)	Afternoon (1200-1400)	Evening (1700-1900)
Light Goods Trucks	Nyando Bridge	Inbound & Outbound	63	55	32	51
	Total Petrol Station	Inbound & Outbound	41	58	29	49
	St. Annes School	Inbound & Outbound	15	3	6	2
	Karanda Primary School	Inbound & Outbound	8	7	4	1
	Total		**127**	**123**	**71**	**103**
Heavy Goods Trucks	Nyando Bridge	Inbound & Outbound	213	61	36	111
	Total Petrol Station	Inbound & Outbound	86	53	29	214
	St. Annes School	Inbound & Outbound	2	13	8	13
	Karanda Primary School	Inbound & Outbound	5	21	5	16
	Total		**306**	**148**	**78**	**354**
14-Seater Matatus	Nyando Bridge	Inbound & Outbound	152	112	53	46
	Total Petrol Station	Inbound & Outbound	115	89	76	163
	St. Annes School	Inbound & Outbound	0	0	0	0
	Karanda Primary School	Inbound & Outbound	0	0	0	0
	Total		**256**	**201**	**129**	**209**
Buses	Nyando Bridge	Inbound & Outbound	62	15	19	32
	Total Petrol Station	Inbound & Outbound	12	21	27	56
	St. Annes School	Inbound & Outbound	5	2	1	10
	Karanda Primary School	Inbound & Outbound	2	4	1	5
	Total		**81**	**42**	**48**	**103**

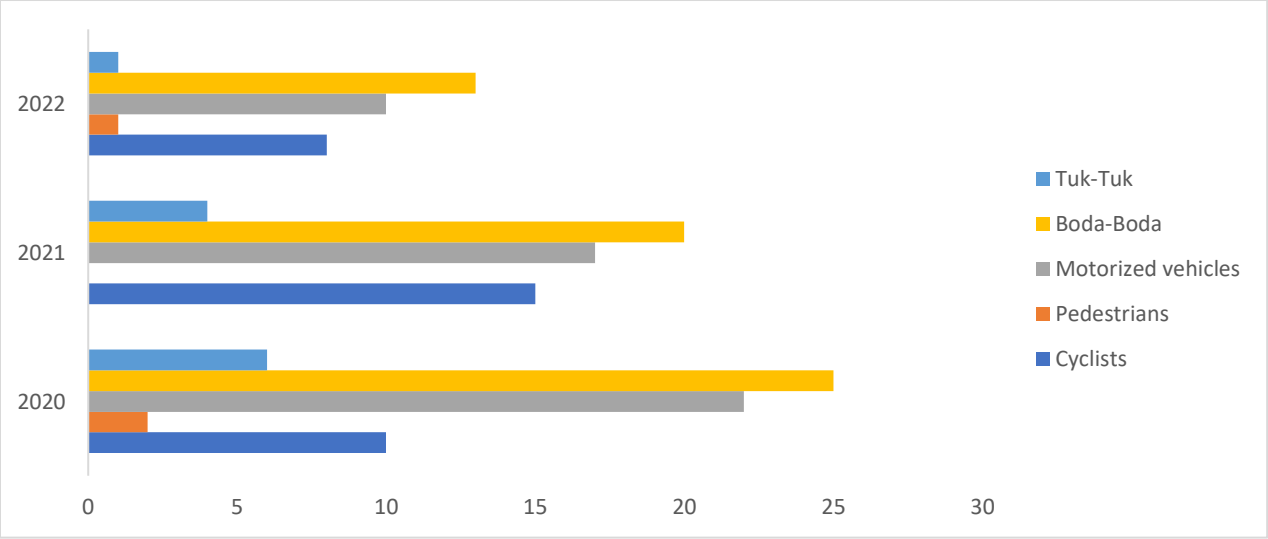
Source: Field Survey, 2023

5.4.4 Accidents Profile

Disaggregated accident data was collected from the traffic police department in Ahero. According to traffic officers (Mr. Ayapar), the majority of accidents happen between 10 pm to 6 am on weekdays and 10 am to 2 pm on the weekends with the male gender being the most prevalent.

Additionally, some of the causes of the accident that were highlighted by the traffic police officer included; lack of concentration by pedestrians while crossing the road, narrow space along the Nyando bridge, unmarked junctions, and failure to observe traffic signs by the road users. The graph below shows a summary of the accidents within the study area between 2020-2022.

Graph 5: Accident Cases Between 2020-2022



Source: Police Record, 2023

5.5 Barriers to Integrated Mobility System in Ahero Town

According to the key informant interviews conducted, some of the barriers towards interpreted mobility that were highlighted by the key informants include;

5.5.1 Limited/Lack of Financial Resources

According to KeRRA Assistant Engineer, Eng. Olang'; adequate funding is crucial for the successful implementation of integrated urban mobility. The KeRRA faces challenges in securing sufficient financial resources for infrastructure development, maintenance, and operational costs. The authority also lacks proper policies to implement mobility infrastructures. To address this, the authority actively seeks partnerships with external stakeholders, including government agencies, development

organizations, and private investors. Collaborative funding approaches, such as public-private partnerships, grants, and donor funding, are explored to leverage additional resources.

5.5.2 Existing Infrastructure Limitations

According planner in charge of Ahero Ward, Plan. Topher, Ahero Town already has established infrastructure that may not be optimized for integrated urban mobility. He further noted that adapting existing road networks, creating pedestrian-friendly infrastructure, and establishing cycling lanes can be challenging. The planning department tackles this by conducting thorough assessments of the existing infrastructure, identifying areas for improvement, and devising retrofitting plans to enhance mobility options. This process involves reallocating road space, optimizing traffic flow, and integrating multimodal transportation systems.

5.5.3 Changing Behavioral Patterns

According to the Physical Planner; Plan. Topher further noted that; Encouraging a shift in behavior towards sustainable modes of transport can be challenging. People may be accustomed to using private vehicles or have limited awareness of alternative options. The planning department addresses this challenge through targeted public awareness campaigns, educational programs, and community engagement initiatives. By highlighting the benefits of sustainable mobility, emphasizing the importance of environmental conservation, and showcasing success stories from other regions, the department aims to foster a culture of sustainable transportation in Ahero.

5.5.4 Land Use and Zoning Considerations

The planner also stated that integrating urban mobility requires careful consideration of land use and zoning regulations. In some cases, existing regulations may not align with the principles of sustainable mobility. The department addresses this challenge by conducting land use assessments, updating zoning regulations, and incentivizing mixed-use development around transit nodes to create compact, walkable neighborhoods where residents have easy access to transportation options.

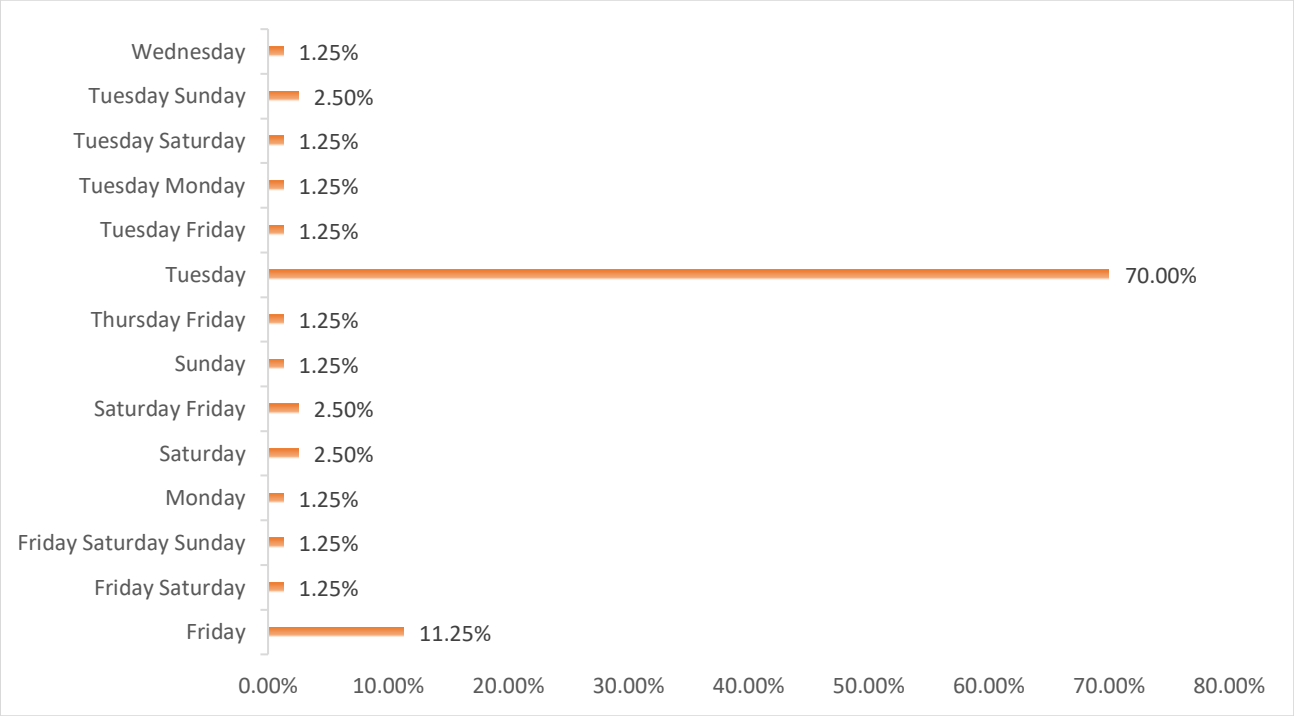
5.5.5 Data and Technological Capabilities

According to the KeNHA residence engineer at Ahero Town, Eng. Quinter, implementing integrated urban mobility often relies on data-driven decision-making and advanced technological systems. The authority faces challenges related to data collection, analysis, and integration, as well as limited technical expertise and resources. To overcome these challenges, the authority collaborates with technology providers, research institutions, and relevant stakeholders to develop data collection

mechanisms, implement intelligent transportation systems, and build capacity for data analysis and interpretation.

Further analysis from the road users' interview conducted indicates that the majority (70%) of respondents consider Tuesday to be the hardest day to move from their residence to their primary destination while 11% picked on Friday as shown in the graph below. The respondents attributed the trend to these days being market days, thus people from within and outside the town converge to sell their goods and offer services.

Graph 6: Respondent's Hardest Days to Get to Primary Destination



Source: Field Survey, 2023

5.6 Strategies to Enhance Integrated Mobility in Ahero Town

This sub-section provides a breakdown of the key strategies to enhance integrated mobility as highlighted by the key informants during the interviews. The strategies included:

5.6.1 Inclusive Design

According to the Physical Planner, the Draft Ahero Town's Integrated Urban Development Plan prioritize inclusivity by incorporating universal design principles. Streets, sidewalks, and public spaces need to be designed in a manner that is accessible and barrier-free by ensuring that people of all abilities can navigate the town safely and comfortably. The physical planning department should

engage with local communities to understand their specific needs and incorporates them into the planning process.

5.6.2 Transit-Oriented Development

The Physical Planner further noted that there is a need to embrace a transit-oriented development (TOD) approach within Ahero Town, where urban planning revolves around public transportation nodes. Strategically locating residential, commercial, and recreational areas around transit hubs, thus, encourage people to use public transport, reducing congestion and promoting a more sustainable and efficient urban environment.

5.6.3 Green Infrastructure

To enhance sustainability, the department integrates green infrastructure elements into the urban fabric of Ahero Town. This includes the incorporation of green spaces, parks, and urban forests that improve air quality, provide recreational opportunities, and contribute to the overall well-being of residents. Additionally, stormwater management systems are designed to minimize runoff and preserve water resources.

5.6.4 Public Engagement and Participation

According to Eng. Olang' from KeRRA, the authority actively engages with residents, community organizations, and other stakeholders in designing the urban mobility master framework together with other consultants to ensure their involvement in the decision-making process. By seeking their feedback, the authority can get valuable insights and foster a sense of ownership and pride in the development of Ahero Town.

CHAPTER SIX:
CONCLUSION AND RECOMMENDATIONS

6.1 Overview

This chapter outlines the conclusion and recommendations on integrated mobility within the study area. Further, it outlines areas for further research that are deemed fit by the researcher.

6.2 Conclusion

The relationship between transportation and land use in urban areas is closely connected. As land uses evolve, they create new transportation patterns driven by the demand for transportation resulting from these land uses. Roads serve as vital conduits that support the thriving economy within urban areas. This section thus provides highlights on the conclusions drawn from the findings based on the study objectives.

6.2.1 Existing Land Use Dynamics in Ahero Town

The predominant land use within the study area is agricultural, covering approximately 43.36% of the total area. Transportation land use ranks as the third most extensive land use category, constituting 9.15% of the entire land use, following residential land use. The rise in the town's population results in heightened need for commercial, residential, and transportation land. Consequently, this could result in a reduction of agricultural land use within the study area. It is imperative to establish a protective buffer zone between the town's perimeter and the agricultural land in order to preserve its integrity. According to the Physical Planning Handbook, 2007, the transportation land use should occupy 7% of the other land uses, this translates to 70.31 hectares of the study boundary. However, the existing transportation land use is approximately 101.21 hectares. Despite transportation land use occupying the third-largest portion, the study area still grapples with persistent mobility challenges. These encompass issues like traffic congestion, environmental pollution, inadequate road networks, and a lack of seamless connectivity between the initial and final stages of travel.

These challenges compromise the efficiency and sustainability of urban mobility casting a stark reminder of the essence of the 15-minute city concept, wherein the aspiration of localized living and accessible services beckons. Only by harmonizing land uses, safeguarding agricultural integrity, and surmounting mobility conundrums can create a path toward a more sustainable and interconnected urban existence, one where daily life's essential are within arm's reach and the harmony between human activities and the natural world is upheld.

In light of these circumstances, a compelling case emerges for prioritizing the integration of mobility solutions. The substantial reliance on single-occupancy vehicles necessitates reconsideration in order to mitigate congestion and reduce emissions. A strategic shift towards promoting multi-modal transportation options becomes crucial to address these challenges effectively. By fostering a holistic approach to mobility, the study area aims to enhance connectivity, alleviate traffic bottlenecks, and contribute to a more environmentally friendly and efficient urban environment.

6.2.2 Existing Mobility Characteristics in Ahero Town

The analysis of the town's transportation landscape reveals a complex interplay of accessibility and infrastructure challenges. While the existing road system grants access to various activity areas, the outskirts encounter a significant hindrance due to the inadequate condition of the roads. An essential transportation corridor, the Kisumu-Kericho Road (B1), bisects the study region from east to west, functioning as the primary conduit within the central business district's internal road network. This corridor accommodates both motorized and non-motorized traffic, signifying its critical role in urban movement. The findings highlight the need to address the town's mobility challenges that include; the compact urban layout, narrow and inaccessible road network, and the growing population of pedestrians and cyclists, through a transportation system that efficiently connects various land uses and caters to the diverse mobility needs of its residents. Integrating diverse modes of transportation, such as public transit, cycling lanes, pedestrian pathways, and shared mobility services, Ahero Town would create a seamless network that encourages the adoption of sustainable transportation choices.

6.2.3 Barriers to Integrated Mobility in Ahero Town

Ahero Town faces a range of challenges in implementing integrated urban mobility, including financial limitations, limited infrastructure, behavioral shifts, land use considerations, and technological gaps. Addressing these challenges requires a comprehensive and collaborative approach involving;

Partnerships: Fostering collaborations between public and private stakeholders, such as transportation companies, technology providers, and local government bodies helps pool resources, expertise, and innovation to create comprehensive mobility solutions that cater to diverse needs.

Policy Adjustments: Review and adapt existing regulations to accommodate new mobility options through updating zoning laws, permitting procedures, and safety regulations to ensure that emerging forms of transportation can operate safely and efficiently.

Infrastructure Enhancements: Invest in the development and enhancement of infrastructure to support integrated mobility by building of dedicated lanes for bicycles and pedestrians, installing charging stations for electric vehicles, and incorporating smart technologies to manage traffic flow.

Community Engagement: Involving the local community in the decision-making process regarding mobility integration helps gather input through surveys, public forums, and workshops to understand the preferences and concerns of residents. This inclusiveness leads to solutions that better align with the needs of the community.

Orchestrating these approaches in a coordinated manner helps craft a well-rounded strategy that integrate various mobility options, thus fostering a more efficient and sustainable urban transportation system.

6.2.4 Strategies for the Enhancement of Integrated Mobility in Ahero Town

The implementation of integrated mobility options holds immense potential for fostering sustainable urban development in Ahero Town and other upcoming towns within the country. Through a comprehensive analysis of the town's transportation needs, infrastructure, and environmental considerations, it becomes evident that integrated mobility can significantly contribute to the town's progress toward a greener, more resilient, and economically vibrant future.

Ahero being one of the recently upgraded market centers to town within Kisumu County, stands at a critical juncture to shape its future trajectory concerning urban mobility and sustainable development. Embracing integrated mobility options and fostering a culture of sustainable transportation would lay the foundation for a resilient, livable, and environmentally friendly urban landscape that will benefit its residents for generations to come.

The successful implementation of integrated mobility options in Ahero Town however requires collaboration among various stakeholders, including local authorities, transportation agencies, private sector entities, and the community. Public engagement and participation will be crucial in ensuring that the mobility solutions address the specific needs and preferences of residents and businesses. Equitable access to transportation services and social inclusion should remain at the forefront of planning efforts to create a truly inclusive and sustainable urban environment in Ahero Town.

6.3 Recommendations

To foster sustainable urban development in Ahero Town, it is crucial to adopt integrated mobility that caters to the needs of the community while reducing the environmental impact. From the findings of the study, radical integrated mobility recommendations for the study in Ahero Town are as follows;

Bolstering the Public Transportation System

One of the most vital recommendations for achieving integrated mobility in Ahero Town is to bolster the public transportation system. Putting up more investment in and improving the existing infrastructure, Ahero Town will provide its residents with efficient, accessible, and sustainable transportation that covers both the first and last miles options. The benefits of a robust public transportation system extend beyond convenience and accessibility. According to the International Energy Agency report on Net Zero by 2050, transportation creates more than a fifth of the world's greenhouse gas emissions. Shifting people from private cars to public transit can do a lot to lower our impact on the climate. Prioritization and development of a well-connected and efficient public transportation network will actively contribute to the reduction of carbon footprint and play a significant role in mitigating the adverse effects of climate change.

Adopting this recommendation and tailoring it to the unique characteristics of each town, local authorities can create a resilient and sustainable public transportation system. This system not only enhances the mobility of residents but also contributes to a cleaner environment, reduced traffic congestion, and a more climate-resilient future.

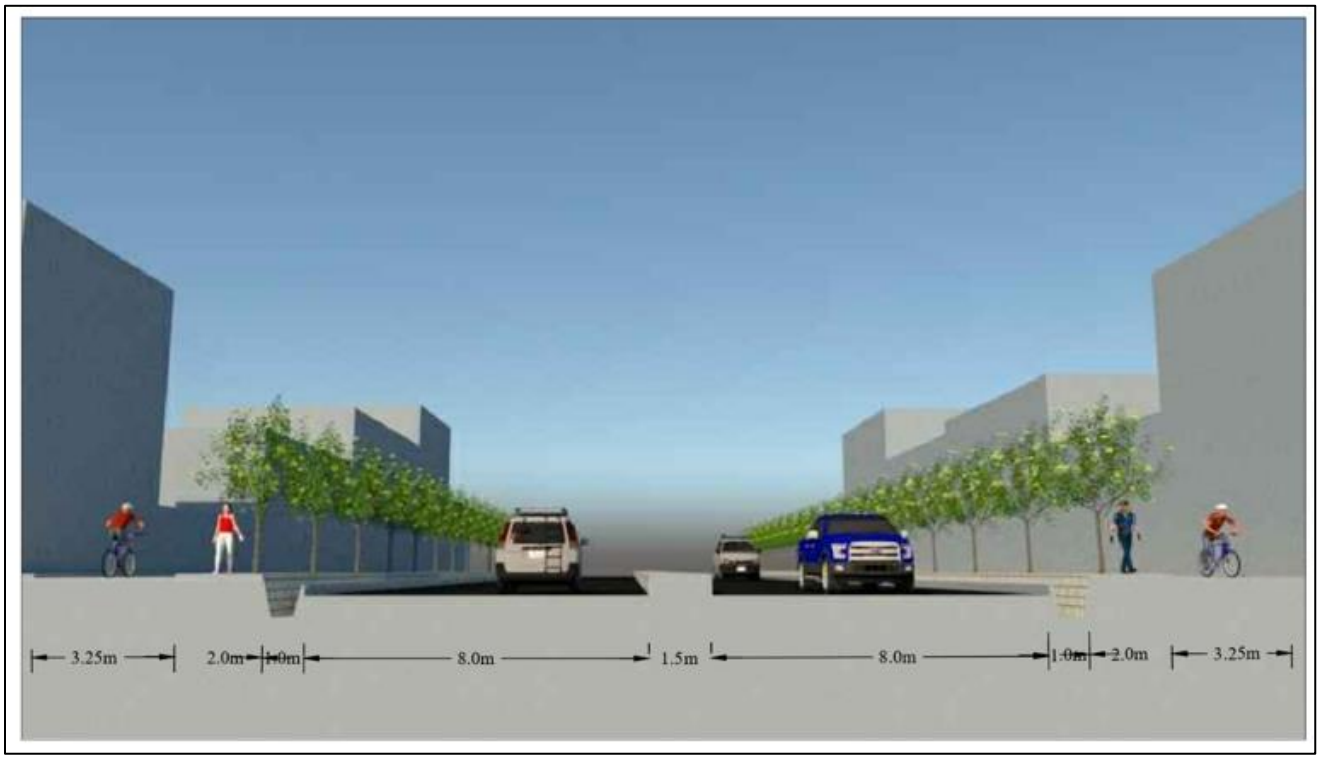
Creation of Dedicated Walking and Cycling Infrastructures

A well-developed public transportation system will help ensure that the residents have access to mobility options, regardless of their income, age, or physical abilities. It will promote social inclusion and reduces transportation-related disparities within the Ahero town.

The study recommends widening access roads to help provide smooth connection of the first and last mile options within the study areas. The roads will provide adequate space for walkability and cycling due to the higher percentage of pedestrian flow. This will encourage more residents to choose bicycles for short trips and reduce their reliance on motor vehicles, thus, not only promoting an active and healthier life but also reducing the overall carbon footprint of the town. The speed calming measures will also be put in place and a maximum speed of 30Km/h should be maintained.

The space used will be as indicated overleaf.

Figure 10: Integrated Space Use



Source: Author, 2023

Creation of Car-Free Zones

The implementation of car-free zones within holds a multitude of benefits that extend to both the well-being of residents and the overall urban environment. By designating specific areas as car-free zones, a paramount emphasis is placed on ensuring the safety and security of pedestrians and cyclists. These zones provide a haven where individuals can navigate without the constant worry of vehicular traffic, fostering an environment that prioritizes their protection and freedom of movement.

Furthermore, it catalyzes economic vitality within the local communities. By welcoming a surge of foot traffic, these zones invigorate commercial areas, offering a conducive environment for businesses to thrive. The interaction between residents and local enterprises within these zones fosters a sense of community and active engagement, enhancing the social fabric of the towns.

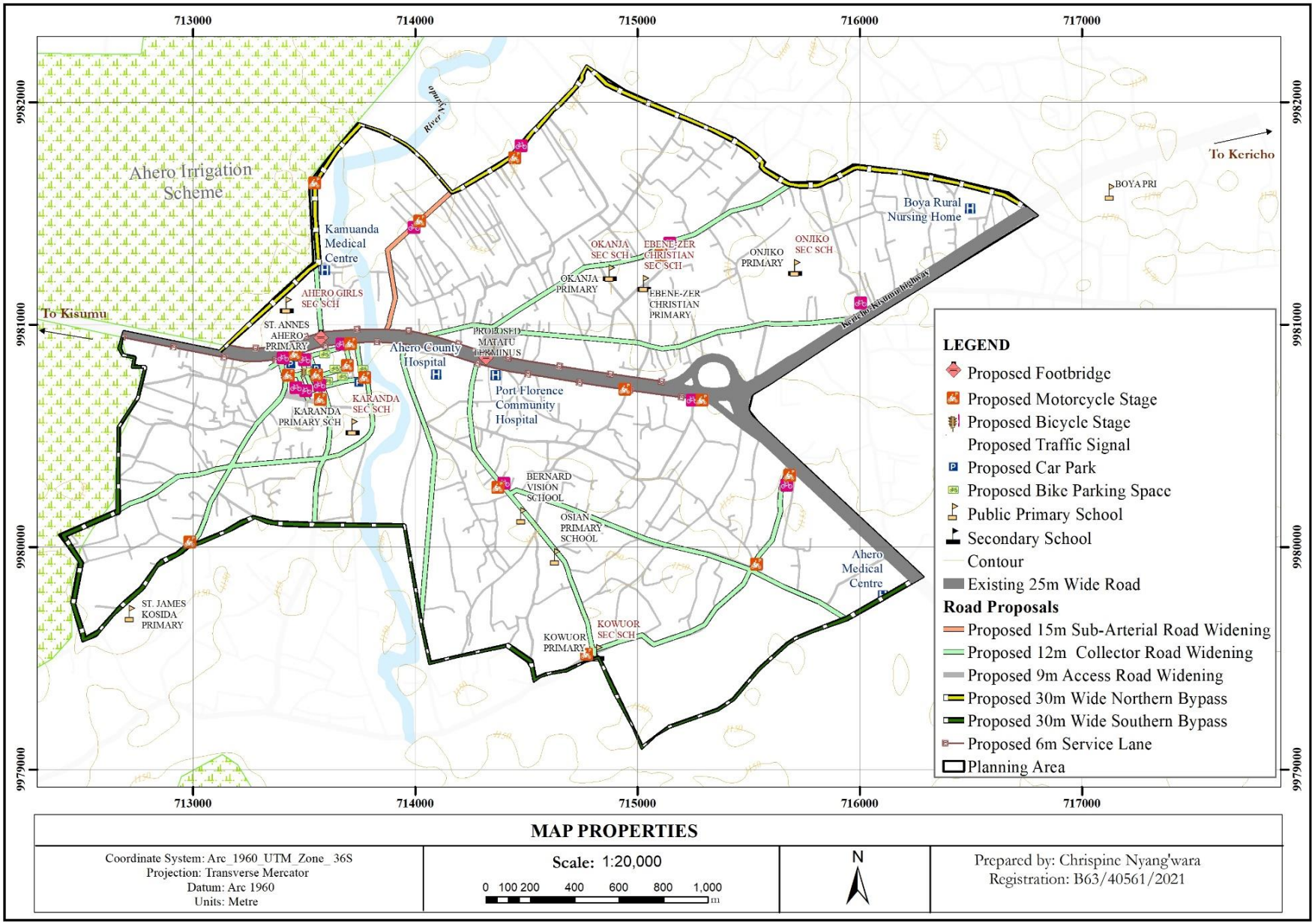
In essence, the implementation of car-free zones stands as a testament to Ahero and other towns' commitment to progress and well-being. It embarks on a transformative journey toward safer streets, healthier living, reduced carbon footprints, and vibrant local economies. As these towns reimagine their urban spaces, they not only promote active and sustainable modes of transportation but also set

forth a pioneering example for the wider world to follow. A harmonious coexistence of people, mobility, and the environment.

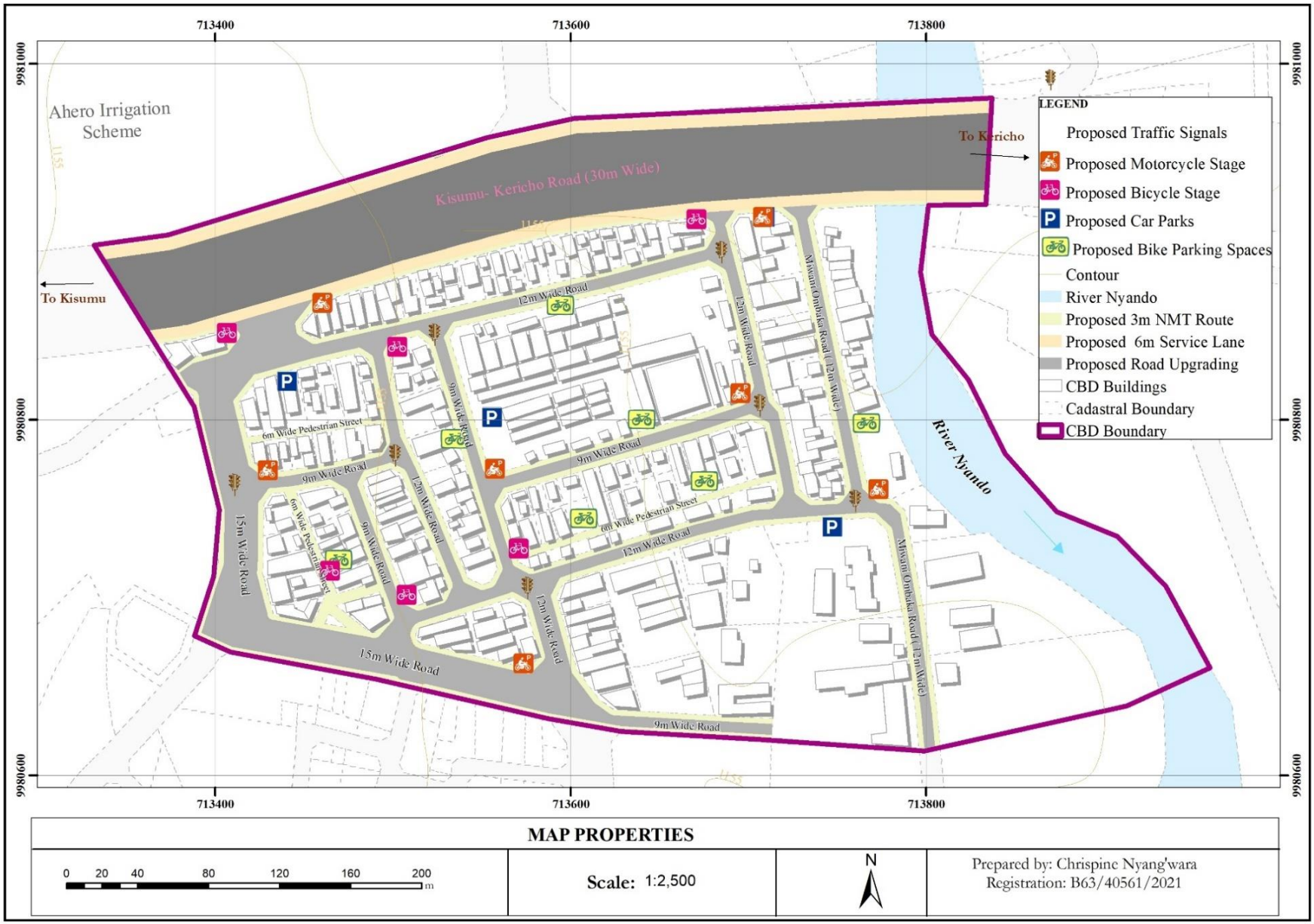
Figure 11: Car-free Zone Model

Source: Author, 2023

Map 10: Ahero Town Mobility Recommendations



Map 11: Ahero Town CBD Mobility Recommendations



6.4 Areas for Further Research

The study of integrated mobility options for sustainable urban development has necessitated the following areas for further research to be studied.

a) To examine the impact of integrated mobility on equity and social inclusion. As urban areas adopt integrated mobility systems, it becomes imperative to understand how these changes affect different socio-economic groups. Researchers can investigate whether the introduction of new transportation modes and services disproportionately benefits certain populations while potentially marginalizing others. Understanding the barriers and challenges faced by vulnerable communities in accessing integrated mobility will help in devising strategies to ensure that these systems promote inclusivity and do not exacerbate existing inequalities.

b) To investigate the costs associated with the development, maintenance, and operation of mobility systems compared to their long-term benefits and explore various funding mechanisms and financing models to support the deployment of integrated mobility solutions in urban areas. Understanding the potential for public-private partnerships, innovative funding sources, and revenue-sharing models will be critical in ensuring the financial sustainability of these projects.

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APPENDICES

Appendix I: Questionnaire

Road Users' Questionnaire

INTEGRATED MOBILITY OPTIONS FOR SUSTAINABLE URBAN DEVELOPMENT IN AHERO TOWN

Road Users' Questionnaire

Section A: Respondent Profile

Category of Road User

Category	Tick Appropriately
Pedestrian	
Cyclist	
Motorcyclist	
Private car owner	
Matatu Driver	
Other (Specify)	

1. Name of the Respondent (Optional) _____
2. What is your age bracket? (Tick as appropriate)
   - ☐ Below 18
   - ☐ 18-38
   - ☐ 38-48
   - ☐ Above 48
3. What is your gender? (Tick as appropriate)
   - ☐ Male
   - ☐ Female)
   - ☐ Rather not say
4. Level of education: (Tick as appropriate)
   - ☐ Primary
   - ☐ Secondary
   - ☐ College
   - ☐ University
   - ☐ None
5. What is your main occupation? (Tick as appropriate)
   - ☐ Student
   - ☐ Employed
   - ☐ Self-employed
   - ☐ Not employed
   - ☐ Retired
6. What is your level of income?
   - ☐ Below 5,000
   - ☐ 5,000-10,000
   - ☐ 10,000-20,000
   - ☐ Above 20,000
7. Do you reside within Ahero Town?
   - ☐ Yes
   - ☐ No

8. If yes, in which estate/village do you live?

- □ Kaboi
- □ Munami
- □ Panadol
- □ Multi-purpose
- □ Oketha
- □ Mawembeni
- □ Kiwi/Jesmic
- □ Midumbi
- □ Others Specify……

11. How many years have you stayed in Ahero Town?

- □ Less than 5 years
- □ 10 – 15 years
- □ 5 – 10 years
- □ More than 15 years

Section B: Trip Profile

12. What is the purpose of your trip?

- □ Work
- □ Shopping
- □ School
- □ Business
- □ Others Specify……

13. How frequently do you make this trip?

- □ Daily
- □ Monthly
- □ Weekly
- □ Yearly

14. How long are you taking to travel to your daily destination within Ahero town (in minutes)?

a) Less than 5 minutes
b) 5 to 10 minutes
c) 10 to 15 minutes
d) More than 15 minutes

Section C: Characteristics of the Urban Mobility System in Ahero Town

15. Rate the ease of using the stated means of transport above within Ahero town
    a) Very difficult
    b) Difficult
    c) Neutral
    d) Easy
    e) Very Easy
16. Have you changed the main means of transport you used frequently in the last 3 years?
    ☐ Yes ☐ No
17. If yes, why did you change your MAIN means of transport?
18. Overall, how satisfied are you with the means of transport available in Ahero town?
    a) Very satisfied
    b) Somewhat satisfied
    c) Neutral
    d) Somewhat dissatisfied
    e) Very dissatisfied
19. On what days of the week is it hardest for you to operate within Ahero Town? Give reason.

Days of the Week Hardest to Operate	**Reason**	**Best Days to Operate**	**Reason**
Monday		Monday	
Tuesday		Tuesday	
Wednesday		Wednesday	
Thursday		Thursday	
Friday		Friday	
Saturday		Saturday	
Sunday		Sunday	

20. During what time(s) of the day is it hardest for you to move from one point to another within Ahero Town? Give reason.
    a. Early morning (5:00–8:30 a.m.)
    b. Late morning (8:30 a.m.– noon)
    c. Early afternoon (noon–3:00 p.m.)
    d. Noon
    e. Late afternoon (3:00–6:00 p.m.)
    f. Evening (6:00–9:00 p.m.)
    g. Late night (9.00p.m or late)

21. How would you rate the reliability of public transit in the Town?
    a) Very reliable
    b) Somewhat reliable
    c) Neutral
    d) Somewhat unreliable
    e) Very unreliable

22. Would you be willing to use public transit more often if service frequency was increased?

☐ Yes ☐ No

Barriers towards integrated urban mobility in Ahero Town.

23. What are some of the challenges you experience when moving from one point to another within Ahero Town?.....

24. How would you rate personal safety when walking/cycling/driving within Ahero Town?
    a) Very good
    b) Good
    c) Average
    d) Poor
    e) Very Poor

Best Approaches/Strategies to Enhance Integrated Urban Mobility in Ahero Town.

25. In your own opinion, what should be done to alleviate the problems of road transport in Ahero Town?
    a) Provision of Non-motorized transport facilities.
    b) Public transport services, including routes, stops, and frequencies.
    c) Volumes of Non-motorized transport users and public transport users on major corridors.
    d) Volumes of non-motorized, public, and personal vehicles on major corridors.
    e) The supply of on-street and off-street parking facilities and usage at current prices.

Key Informant Questionnaire

Kenya National Highway Authority (KeNHA)

You are kindly requested to answer all questions in the interview guide, the information provided shall be treated with strict confidentiality and only used for academic purposes.

I. General Information

1. Name of the respondent……...
2. Position of the respondent……
3. Gender……...
4. Level of Education……...
5. Number of years in the current position……..
6. Email address……...

II. Roads Authority

What road(s) infrastructure activities does the Authority have in Ahero Town? (Both Current and Planned)

……..……
……..……
……..……

How has the Authority ensured the effectiveness of these initiatives or projects towards the improvement of mobility in Ahero Town?

……..……
……..……
……..……

Does the Authority engage with the local community within Ahero Town? If yes, how?

……..……
……..……
……..……

In your opinion, what role does community participation play in promoting and achieving integrated urban mobility in Ahero Town?

……..……
……..……
……..……

What climate-resilient transport infrastructure mechanisms does the Authority use in Ahero Town and its environs given the flooding situation within the area?

……..……
……..……
……..……

Does the Authority engage in partnerships or collaborations with other agencies in the provision of services within Ahero Town? If yes, provide a list of the agencies and their roles.

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……..……
……..……

How does the Authority ensure the sustainability of its integrated urban mobility projects and initiatives in Ahero Town?

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What are the major challenges that the Authority faces in promoting and implementing integrated urban mobility in Ahero Town?

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……
……

Are there any plans or strategies in place to address gaps and challenges in achieving integrated urban mobility in Ahero Town?

……
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Kenya Rural Roads Authority (KeRRA)

You are kindly requested to answer all questions in the interview guide, the information provided shall be treated with strict confidentiality and only used for academic purposes.

I. General Information

1. Name of the respondent……...
2. Position of the respondent……
3. Gender……..
4. Level of Education……...
5. Number of years in the current position……..
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II. Roads Authority

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How has the Authority ensured the effectiveness of these initiatives or projects towards the improvement of mobility in Ahero Town?

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Does the Authority engage with the local community within Ahero Town? If yes, how?

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In your opinion, what role does community participation play in promoting and achieving integrated urban mobility in Ahero Town?

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What climate-resilient transport infrastructure mechanisms does the Authority use in Ahero Town and its environs given the flooding situation within the area?

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How does the Authority ensure the sustainability of its integrated urban mobility projects and initiatives in Ahero Town?

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What are the major challenges that the Authority faces in promoting and implementing integrated urban mobility in Ahero Town?

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Are there any plans or strategies in place to address gaps and challenges in achieving integrated urban mobility in Ahero Town?

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County Government of Kisumu
Department of Physical Planning, Lands & Urban Development

You are kindly requested to answer all questions in the interview guide the information provided shall be treated with strict confidentiality and only used for academic purposes.

I. General Information

1. Name of the respondent……...
2. Position of the respondent……
3. Gender……...
4. Level of Education……...
5. No. of years in current position……
6. Email address……...

II. Department of Physical Planning, Lands and Urban Development.

What road(s) infrastructure activities does your department have in Ahero Town (Current and Planned)

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What role does the department play in promoting sustainable transportation in Ahero Town, such as walking, cycling, and public transport?

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How does the department collaborate with other government agencies and stakeholders to ensure that transport infrastructure and services in Ahero Town are safe, efficient, and accessible to all residents, particularly those from low-income communities?

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What policies and regulations have the Urban Planning Department implemented to promote integrated urban mobility in Ahero Town, and how have these policies been enforced?

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How does the Urban Planning Department work with transport service providers, such as public transport operators and taxi companies, to ensure that services are of high quality and meet the needs of residents?

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What measures has the Urban Planning Department taken to ensure that urban development in Ahero Town is sustainable and inclusive, with a focus on promoting sustainable mobility?

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What challenges does the Urban Planning Department face in implementing integrated urban mobility in Ahero Town, and how is the department addressing those challenges?

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County Government of Kisumu
Department of Public Works, Roads & Transport

You are kindly requested to answer all questions in the interview guide. The information you provide shall be treated with strict confidentiality and only used for academic purposes.

1. **General Information**
    1. Name of the respondent……...
    2. Position of the respondent……
    3. Gender……..
    4. Level of Education……...
    5. Number of years in current position……
    6. Email address……...
2. **Department of Public Works, Roads & Transport.**

What road(s) infrastructure activities does your department have in Ahero Town (Current and Planned)

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What role does your department play in promoting sustainable transportation in Ahero Town, such as walking, cycling, and public transport?

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How does your department collaborate with other government agencies and stakeholders to ensure that transport infrastructure and services in Ahero Town are safe, efficient, and accessible to all residents, particularly those from low-income communities?

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What policies and regulations have your department implemented to promote integrated urban mobility in Ahero Town, and how have these policies been enforced?

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How does your department work with transport service providers, such as public transport operators and taxi companies, to ensure that services are of high quality and meet the needs of residents?

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What measures has your department taken to ensure that urban development in Ahero Town is sustainable and inclusive, with a focus on promoting sustainable mobility?

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What challenges does your department face in implementing integrated urban mobility in Ahero Town, and how is the department addressing those challenges?

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Ahero Traffic Police Department:

You are kindly requested to answer all questions in the interview guide, the information provided shall be treated with strict confidentiality and only used for academic purposes.

I. General Information

1. Name of the respondent……..
2. Position of the respondent……...
3. Gender…….
4. Level of Education……..
5. No. of years in current position……...
6. Email address…….....

II. Traffic Police Department Ahero Headquarters

What role does the traffic police department play in promoting sustainable transportation in Ahero Town, such as walking, cycling, and public transport?

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How does the traffic police department enforce traffic regulations and ensure the safety of all road users, including pedestrians, cyclists, and motorists?

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What measures has the traffic police department taken to address traffic congestion and reduce the number of accidents on the roads within Ahero Town?

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According to police records how many cases of traffic accidents occur within Ahero Town involving;

Type	2020	2021	2022
Cyclists			
Pedestrians			
Motorized vehicles (PSVs and private vehicles)			
Boda-Boda			
Tuk-Tuk			

In the last three years, how do you rate the occurrence of accidents within Ahero Town?

☐ Low ☐ Very high

☐ High

Is there a particular group with a high prevalence of accidents?

- ☐ 14yrs and below
- ☐ 15-20
- ☐ 21-30
- ☐ 31-40
- ☐ 41-50
- ☐ Above 50

Which gender is the most prevalent in accidents

- ☐ Male
- ☐ Female

What time and day of the week are the accidents most prevalent?

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What measures has the traffic police department taken to address traffic congestion and reduce the number of accidents on the roads in Ahero Town?

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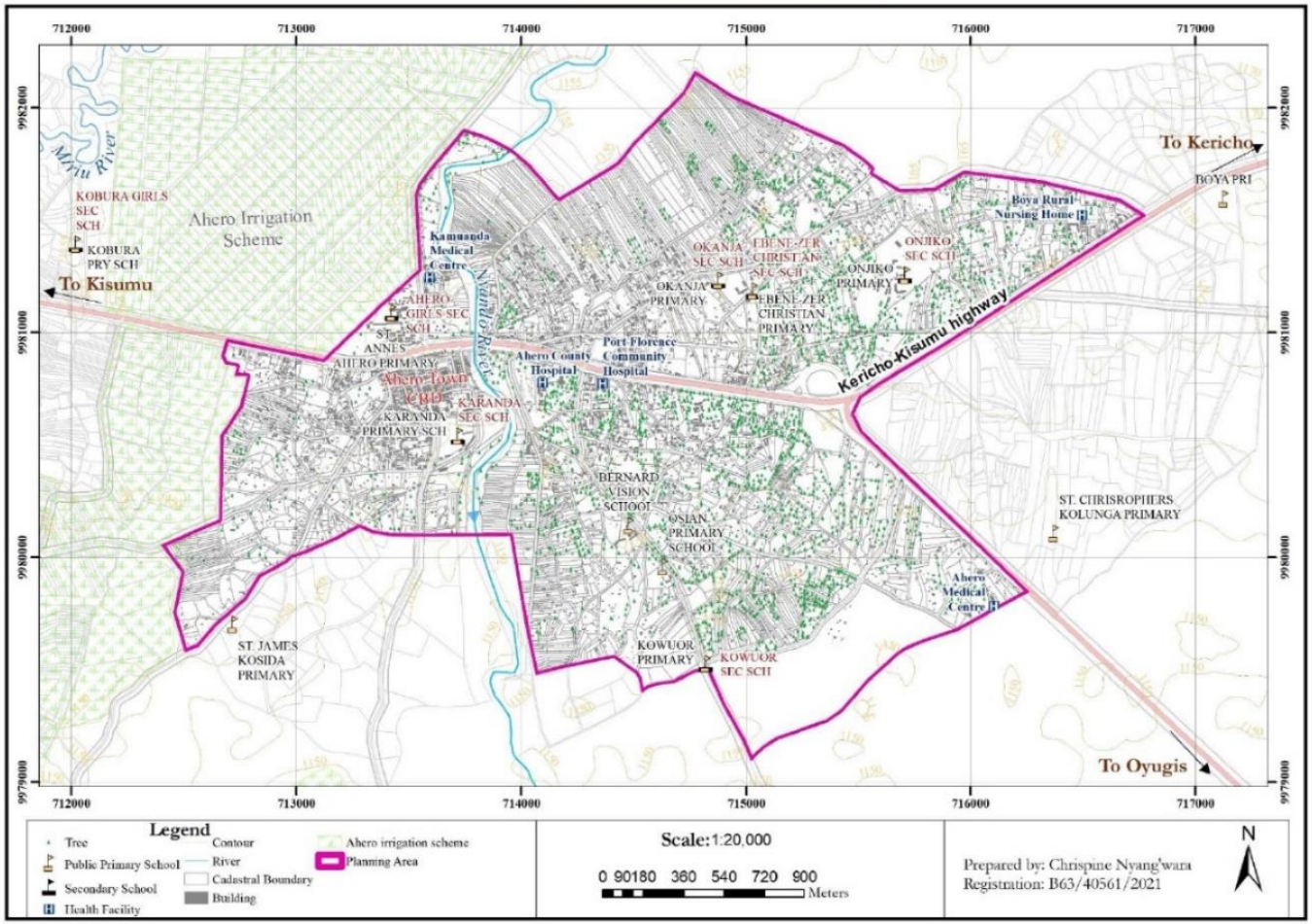
Are there particular spots where accidents are most prevalent? (Indicate on the attached base map)



If yes, what causes the accidents?

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Why the spots?

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What measures has the traffic police department taken to address and reduce the number of accidents on the roads in Ahero Town?

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National Transport and Safety Authority (NTSA)

You are kindly requested to answer all questions in the interview guide the information provided shall be treated with strict confidentiality and only used for academic purposes.

I. General Information

1. Name of the respondent…….
2. Position of the respondent…….
3. Gender……...
4. Level of Education……
5. No. of years in current position…….
6. Email address……

II. National Transport and Safety Authority

What is the trend in terms of road accidents between the years 2020 and 2023 along the Kisumu-Kericho Highway, on the stretch within Ahero Town? Please provide statistics.

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What are some of the major causes of roads accident within Ahero Town?

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To what extent is the inspection of motor vehicles instrumental in the reduction of road accidents within Ahero Town? Explain.

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In what ways do roadblock checks by NTSA enforcement officers and traffic police contribute to the reduction of road accidents within Ahero Town?

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In terms of enforcement, what are some of the measures that NTSA has put in place to improve the operations of the public transport system in Ahero Town?

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Do the enforcements help to deter the violation of road safety rules and regulations? Explain.

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What are some of the measures you would recommend to enhance road safety and reduce road accidents, especially along the Kisumu-Kericho Highway within Ahero Town?

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Appendix II: Observation Checklist

S/No.	ELEMENTS OF OBSERVATION	OBSERVATION
	Infrastructure	
1.	Is there adequate infrastructure in place for different modes of transportation, such as bike lanes, sidewalks, and public transit stops?	
2.	Are the roads and pathways well-maintained and free of obstructions that could impede mobility?	
3.	Are there any areas where infrastructure is lacking or needs improvement?	
	Safety	
1.	Are there safety measures in place for pedestrians, cyclists, and public transit users, such as crosswalks, traffic signals, and bike lanes?	
2.	Are there any areas of the city that are particularly unsafe for certain modes of transportation?	
3.	Are there any safety hazards that need to be addressed?	
	Accessibility	
1.	Are there transportation options available that are accessible to individuals with disabilities or limited mobility?	
2.	Are public transit stops and stations easily accessible, and are there accommodations in place for individuals with disabilities?	
3.	Are there any areas of the city that are particularly difficult to access using public transit or other modes of transportation?	
	Efficiency	
1.	How efficiently do different modes of transportation operate in the city, in terms of travel time, frequency, and reliability?	
2.	Are there any bottlenecks or areas of congestion that impede mobility and need to be addressed?	
3.	Are there any areas of the city that could benefit from expanded or improved transportation options?	
	Sustainability	
1.	Are there sustainable transportation options available, such as bike-sharing programs, electric scooters, or public transit that runs on renewable energy?	
2.	Are these options widely used, and are there opportunities to expand their availability and use?	
3.	Are there any barriers to promoting sustainable transportation in the town?	

Appendix III: Traffic Count

Date		**Cordon Point Name:**	
Road/Street		**Cordon Point Coordinates**	**Latitude:**
Traffic Flow Direction			**Longitude:**

Modes	**Tally**			**Notes**
	06:00Hrs – 09:00Hrs	**12:00Hrs – 14:00Hrs**	**17:00Hrs – 18:00Hrs**	
Cyclists				
Motorcyclists				
Private Cars				
Vans				
Light goods vehicles				
Heavy goods vehicles				
Matatus				
Large bus – public/private transport				

Appendix IV: Department of Urban & Regional Planning, University Research Permit

University of Nairobi
Department of Urban and Regional Planning
Faculty of the Built Environment and Design
P.O. Box 30197, 00100 GPO Nairobi, Kenya
e-mail:durp@uonbi.ac.ke

4TH MAY, 2023

TO WHOM IT MAY CONCERN,

RE: MASTER OF ARTS IN PLANNING – CHRISPINE NYANG'WARA

This is to confirm that Chrispine is an M.A student in the Department of Urban & Regional Planning, University of Nairobi.

As part of the Master of Arts in Planning programme, the students are required to acquire training in data collection, analysis and report writing .

This is to request you to allow Chrispine to access your Institution/neighbourhood in order to collect data for his Thesis titled "***Intergrated mobility for sustainable Urban Development in Ahero Town: Opportunities and Constraints., Ahero Town***"

Any assistance accorded to him will be highly appreciated.

University Of Nairobi
Faculty of Built Environment & Design
Department Of Urban And Regional Planning
CHAIRMAN
P.O. Box 30197 - 00100 Nairobi

DR. FRIDAH W. MUGO
CHAIR - DEPARTMENT OF URBAN & REGIONAL PLANNING

Appendix V: County Government of Kisumu, Research Permit from County Commissioner

OFFICE OF THE PRESIDENT

MINISTRY OF INTERIOR AND NATIONAL ADMINISTRATION

STATE DEPARMENT FOR INTERNAL SECURITY AND NATIONAL ADMINISTRATION

Telephone: Kisumu 2022219/Fax: 2022219
Email: ckisumucounty@gmail.com

COUNTY COMMISSIONER
KISUMU COUNTY
P.O. BOX 1912-40100
KISUMU

Ref: CC/KC/RES/1/3/VOL.V/51

13th June, 2023

DEPUTY COUNTY COMMISSIONER
NYANDO

RE: RESEARCH AUTHORIZATION – CHRISPINE NYANG'WARA

The above named is an M.A student in the Department of Urban & Regional Planning, University of Nairobi.

He has been authorized to do a research on ***"Integrated Mobility for Sustainable Urban Development in Ahero Town: Opportunities and Constraints, Ahero Town".***

The research period ends on Friday 16th June 2023.

Kindly accord him the necessary assistance he may need.

R. NYAKWARA
For: COUNTY COMMISSIONER
KISUMU COUNTY

Copy: Chrispine Nyang'wara
University of Nairobi