Assessment of Pedestrian Walkability in the Central Business District of Adama City

By Derege Negash Weldesenbet

A Thesis Submitted to the department of Urban Planning and Design College of Civil Engineering and Architecture Presented in Partial Fulfillment of the Requirements for the Degree of Master's in Urban Planning and Design

Office of Graduate Studies
Adama Science and Technology University

November, 2024
Adama, Ethiopia

Assessment of Pedestrian Walkability in the Centeral Business District of Adama City

By Derege Negash Weldesenbet

Advisor Belay Zeleke(PhD)

A Thesis Submitted to the department of Urban Planning and Design College of Civil Engineering and Architecture Presented in Partial Fulfillment of the Requirements for the Degree of Master's in Urban Planning and Design

Office of Graduate Studies
Adama Science and Technology University

November , 2024
Adama, Ethiopia

Declaration

I hereby declare that this Master Thesis entitled “Assessment of Pedestrian Walkability in the Centeral Business District of Adama City” is my original work. That is, it has not been submitted for the award of any academic degree, diploma or certificate in any other university. All sources of materials that are used for this thesis have been duly acknowledged through citation.

Derege Negash Weldesenbet	_____	_____
Name of the student	Signature	Date

Recommendation of Advisors

I/we, the advisor(s) of this thesis, hereby certify that I/we have read the revised version of the thesis entitled "Assessment of Pedestrian Walkability in the Centeral Business District of Adama City" prepared under my/our guidance by Derege Negash Weldesenbet Submitted in partial fulfillment of the requirements for the degree of Mater's of Science in Urban Planning and Design. Therefore, I/we recommend the submission of revised version of the thesis to the department following the applicable procedures.

Belay Zeleke(PhD) Advisor	Signature	Date
Co-advisor/Co-supervisor	Signature	Date

Approval of M.Sc. Thesis

I/we, the advisors of the thesis entitled "Assessment of Pedestrian Walkability in the Centeral Business District of Adama City" and developed by Derege Negash Weldesenbet hereby certify that the recommendation and suggestions made by the board of examiners are appropriately incorporated into the final version of the thesis.

Advisor Belay Zelek (PhD) Signature _____ Date_____-

Co_Advisor Signature_____ Date_____

We, the undersigned, members of the Board of Examiners of the thesis by Derege Negash Weldesenbet have read and evaluated the thesis entitled "Assessment of Pedestrian Walkability in the Centeral Business District of Adama City" and examined the candidate during open defense. This is, therefore, to certify that the thesis is accepted for partial fulfillment of the requirement of the degree of Master of Science in Urban Planning and Design

_____	_____	_____
Chairperson	Signature	Date
_____	_____	_____
Internal Examiner	Signature	Date
_____	_____	_____
External Examiner	Signature	Date

Final approval and acceptance of the thesis is contingent upon submission of its final copy to the Office of Postgraduate Studies (OPGS) through the Department Graduate Council (DGC) and School Graduate Committee (SGC).

Department Head Signature_____Date_____

School Dean Signature_____Date_____

Office of Postgraduate student Dean Signature_____Date_____

ACKNOWLEDGEMENT

Words cannot express my gratitude to Belay Zeleke(PhD) and chair of my committee for his invaluable patience and feedback. I also could not have undertaken this journey without my defense committee, who generously provide knowledge and expertise. Additionally, this endeavor would not have been possible without the generous support from Oromia Urban Planning Institute.

I am also grateful to my classmates especially my Office mates, for their editing help,and moral support. Thanks should also go to the librarian, IT assistant, and data collectors, who impacted and inspired me.

Lastly I would be remiss in not mentioning my family, especially my wife w/o Mame Alamrew and my children Ruhama Derege and Israel Derege. Their belief in me has kept my sprit and motivation high during this process. Would also like to thank Girmma Adama Pension workers for all the entertainment and emotional Support.

Table of contents

Contents **page**

List of Tables

Tables page

Liste of Figure

Figure **Page**

Acronyms

ADA: American Disability Act

ASHTO: Association of State Highway and Transportation Officials

CBD: Central Business Distinct

GWI: Global Walkability Index

ITDP: The Institute for Transportation and Development Policy

LOS: Level of Service

MUDH: Ministry of Urban Development and Housing

NACTO: National Association of City Transportation Officials

PLOS: Pedestrian Level of Service

POD: Pedestrian Oriented Development

ROW: Right of Way

WMTs: Walkability Measurement Tools

WHO: World Health Organization

Abstract

Urban transformation is accelerated by streets, balancing personal mobility and economic access. since 75 percent of the world's population is predicted to live in cities by 2050. Dense cities with multimodal transportation networks offer equal opportunities, sustainable growth, and high quality of life, replacing auto-centric, low-density development patterns.This Research examines the walkability of pedestrian walkways in Adama City. It emphasizes the importance of walkability for urban populations, particularly in developing countries where many people rely on walking as their primary mode of transportation. The primery objective of the study to Assess levels of walkability using the Global Walkability Index (GWI) and identify the need for improved pedestrian facilities. Methodology; Uses a mixed methods approach and combines qualitative and quantitative data through surveys and pedestrian infrastructure assessments. Results; The study shows that pedestrian walkways in Adama City are generally unsafe and inconvenient. The main problems include: High number of pedestrian fatalities due to traffic accidents, Poor infrastructure, many sidewalks are blocked or in poor condition, inadequate amenities and facilities for disabled people and lack of adequate crossings and security measures. Safety: A significant proportion of traffic accidents involve pedestrians, suggesting the need for better traffic management and pedestrian protection laws. Convenient and Attractiveness; Many walkways are not well maintained, lack cleanliness and adequate facilities, making them unattractive to users. Policy support: The study shows insufficient funding and resources for pedestrian planning despite existing urban planning guidelines Safety Recommendations the study showed that high traffic volumes, poor road conditions and inadequate crossing options lead to pedestrian safety concerns. This highlights the need for improved safety measures and a link between pedestrian density and accidents. To resolve these issues, those Stakeholders should take action. Applying safety laws and regulations reduces pedestrian fatalities, maximizes the number of intersections, increases intersection safety through spot and traffic management, reduces crime by maximizing the streetlight network, provides short training, and improves the quality of driver behavior improved. The study found that many sidewalks were poorly maintained and had problems such as cracks, uneven surfaces and obstacles that hindered pedestrian movement. The lack of amenities such as benches, lighting and shade further detracted from the hiking experience. Those involved should have taken action to address these issues. Maintain and clean walkways. Improve the quality of infrastructure facilities for the blind and disabled. Install facilities in the right place. Illuminate permanent and temporary obstacles on sidewalks. Further recommendations on key policy measures support the study, which encourages the provision of policy support for pedestrians. The supply of pavements in the study area is very low and does not meet the demand of the area. Those involved should have taken action to address these issues.

Key words; Global walkability Index, Safety, security, comfort, and Convenien

CHAPTER ONE

1. Introduction

1.1. Background of the study

Urban transformation is accelerated by streets. Urban roads must balance the demands for increasing personal mobility and access to the urban economy, since 75 percent of the world's population is predicted to live in cities by 2050. Dense cities with robust multimodal transportation networks are best suited to provide equal economic opportunity, sustainable growth, and high quality of life, where the auto-centric, low-density development patterns of the 20th century failed. Today's city people need and demand walkable, bikeable, and transit-oriented neighborhoods (Initiative, 2016)

In urban regions of developing countries, where high rates of urban growth, large poor populations, and high densities overcome, walking is the only option available for a major part of the population. Many people are poor who often do not have other alternatives. Which means they can't afford any alternative; therefore, the. The condition of the pedestrian environment is essential to enable walkers to meet their day-to-day needs. (Wuhong Wang, 2014).

Litman (2004) states that the advantages of walking can be examined from three different angles: social, economic, and environmental. . From the economic perspective, walking can improve accessibilities especially for the non-drivers, hence reducing transportation cost. In term of social benefits, walking can increase neighborhood interaction and community cohesion. It also improves the opportunity to preserve cultural resources and safeguard the aesthetic of an area. Likewise, walking can be beneficial to the environment by reducing the use of land for roads and parking facilities and reducing energy consumption and pollutions (Raja Noriza Raja Ariffina, 2013).

Town planning definition of what a pedestrian is has a strong influence on how they are when planning and designing infrastructure and the urban environment. Pedestrians are an integral aspect of all road environments, and both urban and rural areas should take note

of their presence. Compared to rural pedestrians, urban pedestrians have a greater influence on roadway design features due to their greater prevalence. It is frequently very difficult to make adequate provisions for pedestrians due to the demands of vehicular traffic in congested areas. Nevertheless, measures need to be taken because pedestrians are essential to our cities, particularly in the downtown and other shopping districts (AASHTO, 2004).

Most people in developing countries will live in cities within a generation, and the number of urban residents in these countries will double, to a total of over 2 billion people. With massive population growth and low incomes, cities are booming. Increasing rates of rapid growth in urban density and high poverty among the population stimulate high demand for high-quality pedestrian environments (Wuhong Wang, 2014).

People have space to move within the public right-of-way that is kept apart from moving cars thanks to pedestrian walkways and walkways, also known as pedestrian lanes.They also provide areas where children can play, run, skate and ride bikes. In addition to improving pedestrian mobility and facilitating access for all types of pedestrian movements, e.g. For example, to and from home, to work, in parks, schools, shopping centers, public transport stops, etc., pedestrian paths are associated with a significant reduction in collisions involving pedestrian motor vehicles. All newly constructed and remodeled buildings should have sidewalks, and streets without pedestrian walkways should be retrofitted where possible (Foundation, 2019).

The study makes use of a mixed model that is parallel converging, in which qualitative and quantitative data are gathered concurrently and examined independently. In a mixed research approach, both qualitative and quantitative research approaches will be used, as well as a descriptive research approach, depending on the nature of the study. Additionally, it offers a detailed understanding of the circumstances through data collection tools from the Pedestrian Survey, Public Agency Survey, and Physical Infrastructure Survey. In which information and data are critically examined and analyzed in light of existing knowledge Describe walkability problems regarding with pedestrian Safety, Security, Convenient and policy support of provision of walk way and also identify the Cause and factors of walkability dilapidation and recommend solution for flourishing walkability so as to insure sustainability.

1.2. Statement of the Problem

In many developing cities, a large portion of residents rely on walking as their primary mode of transportation. For example, walking constitutes over half of all trips taken in Ethiopian cities. Despite this significant volume, the amount of road space allocated for pedestrians does not match their usage. Only about 25% of streets in Ethiopian cities, including Adama City, have sufficient and properly maintained pedestrian walkways.

Adama City aims to be a hub for political, social, cultural, and economic activities, situated where various marketing, transportation, conference, and leisure facilities intersect. This prime location generates significant pedestrian traffic in the central business district, demanding a walkable environment to accommodate daily activities.

On the contrary , the path is often congested, uneven, narrow or non-existent, posing a danger to other road users and making it impassable. This suggests that pedestrian traffic is not taken into account in the planning, design, construction and maintenance of roads.

The study determines that there is a lack of comprehensive research that specifically focuses on walkability in the central business district of Adama City use GWI extrnded Survey materials.

In addition researches and evaluating pedestrian walkability of CBD in Adama City need for local studies, a deeper understanding of the causes of walkability problems, qualitative insights from users, an examination of policy implications, and longitudinal analysis are important .

The ultimate goal of this paper is to use the insights from each of the three research questions to develop a set of recommendations for planners and infrastructure delivery professionals on ways to potentially improve the implementation of walkability of CBD in the city to provide built environment.

1.3. The Objective of the Study

1.3.1. General Objective of the study

To assess pedestrian walkability ofAdama City(CBD) using Global Walkability Index (GWI)

3.2.2. The Specific Objective of the study

1. To evaluate the Safety and Security of Adama city pedestrian walkway
2. To assess the Convenient and attractiveness of Adama city pedestrian walkways
3. To analyze the major Policies Supports on Adama city pedestrian walkways provision and management.

1.4. Research Questions

The study focuses on the following research questions

1. How do existing walkways provide pedestrian environments that are safe and secure?
2. To what extant walkways have Convenient and Attractive?
3. How does the police support the provision and management of pedestrian routes?

1.5. Significance of the Study

The study's findings will be highly advantageous for the reasons listed below, as the analysis will assist decision-makers in making better choices regarding the future of pedestrian pathways. The researcher then learns how the pedestrian path users perceive the situation.By understanding the diverse perspectives of pedestrians, the findings will enable planners to identify specific areas that require improvement or redesign. Furthermore, by integrating user feedback into the planning process, authorities can enhance safety features, optimize pathway layouts, and promote accessibility for all individuals, including those with disabilities.

Additionally, the research can highlight the preferences of different user groups, such as commuters, recreational walkers, and cyclists, allowing for a more tailored approach to pathway development. This holistic understanding fosters a collaborative environment

where the needs of the community are prioritized, ultimately leading to increased pedestrian traffic and promoting a healthier, more active lifestyle.

Moreover, the study will provide valuable data on peak usage times and behavioral patterns, equipping decision-makers with the necessary insights to implement effective policies and allocate resources efficiently. In this way, the analysis not only addresses current gaps but also future-proofs pedestrian infrastructure against the anticipated growth in urban populations and shifts in transportation trends.

In summary, these findings will serve as a critical foundation for developing pedestrian pathways that are not only functional but also enhance the overall quality of urban life, thereby encouraging a shift towards more sustainable modes of transportation

1.6. Delimitation/Scope

The research examines critical aspects of walkability, including convenience, safety, security, and the level of policy support for the pedestrian environment.

The spatial scope is the central business district of Adama City. The study area in the city is 1409 ha or 10.66% of the city's total area of 13211.15 ha. This includes industrial areas, commercial areas, hotels, jetties, financial institutions and bus terminals. The city revision of the structural plan(2022), traffic planning, study report, main report, summer report Mainsion Traffic volume in the three zones of the city is walking > 5000 feet per day or 417 feet per hour in the central business district; 2500 ped/day at medium level; and 500ped/day at the periphery.and due to this demand, the city is also a tourist-oriented city, which requires an environmentally friendly pedestrian path that serves both the residence and guests

1.7. Organizations of the Thesis

The thesis generally consists of Five chapters, starting with the introduction (explaining the background of the problem, Finding the purpose and objectives) and ending with the analysis, results and discussion. Chapter two literature reviews topic area. In the third chapter, the physical principles and the background of the area of study are explained in detail. This chapter also presents the research design, the methodology and the methods followed, as well as the background of the implemented data. A brief description of the data and datasets used as input for analysis is also provided. Chapter four analyzes and discusses the practical solutions to the problem to achieve the purpose and objectives set out in chapter one. Chapter five the last chapter contains the conclusion and recommendation given to the study based on the findings.

CHAPTER TWO

2. Literature Review

2.1. Introduction

This section of the study provides an explanation of key terms and concepts that are frequently used in the research, including walkability, safety, comfort, and pedestrian theories, so that readers can understand the various explanations under various circumstances. A variety of techniques have been employed in earlier research to examine the factors influencing a pedestrian's experience when evaluating their walking ability. The Global Walkability Index toolkit, which was created for the World Bank's expanded survey materials, served as the foundation for the methodology utilized in this work to analyze walkability (Krambeck H. , 2006) Therefore, some of the methods used in practice and related to this study are explained in order to obtain a selection method suitable for this specific study context.

2.2. Pedestrian Transportation

Pedestrians must be taken into account in any street environment, which is why their presence in rural and urban areas is becoming increasingly important, although the design of urban areas remains challenging due to the growing demand for motorized transport. But because pedestrians are so important, safety measures must be taken. (AASHTO, 2004)

Reduced vehicle traffic is reflected in an increase in pedestrian traffic, which can have a big effect on the environment. Walking reduces the number of cars on the road, which lessens the impact on the environment and traffic jams (South worth, 2005). And pedestrian transportation also offers numerous benefits, such as reduced public externalities, lower user costs, more efficient land use and improved public health, improved community quality of life and stimulated economic growth. All of these advantages must be taken into account when making urban planning decisions. There are three perspectives to examine the benefits of walking (Litman, 2004) .

2.3. Walkability

Walking has always been the most basic movement that every person can perform independently. It is also one of the most widespread and popular forms of training. Hiking is incredibly common and widely practiced because it is affordable and accessible to all. Although it is a very basic activity, walking can be divided into two categories: walking as a leisure activity and walking as a means of transportation. The built environment influences both types of walking. When deciding between different types of physical activity, walking should be viewed as safe, enjoyable, and practical. (Choi, 2012).

Since the 1990s, as technology has become more and more ingrained in our daily lives, our routines have evolved and altered in tandem. The two most noteworthy outcomes of this development and integration are the adjustments we made to our transportation and telecommunications systems. Our walking habits began to shift primarily as a result of more people using cars. Furthermore, cities have a tendency to expand toward the suburbs, especially as a result of capitalism. In addition, traffic congestion is one of the main issues that modern communities face. (Abley, 2011) In addition to traffic and transportation-related proposals to solve the traffic congestion problem, increasing the density of neighborhoods is another proposal that can shorten transportation routes, increase the number of walking movements, and minimize overall motor vehicle consumption (Choi, 2012).Urban design experts proposed a solution that brings the starting point and destination of travel close together in order to increase accessibility in urban life while simultaneously decreasing the need for travel (Jia, Fantta, and Mercado., 2022)

2.4 Walkability Theory

According to Theory of Walkability, a walk needs to be interesting, safe, practical, and comfortable in order to be successful. None of these qualities by itself is adequate; all of them are necessary. When something is useful, it indicates that most things in daily life are easily accessible and arranged so that walking is beneficial. "Safe" refers to a road's construction, which offers pedestrians an opportunity to defend themselves against automobile accidents. It's more difficult to satisfy your need to feel safe than it is to simply be safe.

Comfortable refers to how urban streets are changed from wide open areas that normally do not draw pedestrians into "outdoor living rooms" by buildings and landscaping. And "Interesting" means that there are lots of human traces and distinctive buildings with welcoming facades lining the sidewalks. A walkable city is more than just a lovely, satisfied concept. Instead, it is a straightforward, workable solution to a wide range of intricate issues that our society faces and that regularly jeopardize the sustainability of the environment, public health, and economic competitiveness of our country. (Speck, 2012)

In the built environment, walking is the most fundamental human activity that liberates and equalizes everyone. The concept of walkability is defined by examining it from different angles. Although walkability is being researched in many areas, there is a lack of a precise definition and set of standards. Walkability has been assessed since the 1990s using printed walkability measurement tools (WMTs) and later web-based WMTs. WMTs are typically used in the literature as a tool to assess the level of walking ability of the selected patient. Nevertheless, few researchers have made efforts to understand and investigate the processes underlying these WMTs (PAYKOÇ, 2019).

2.5. Walkability index

There is a connection between people's physical activity and the urban environment in which they live. It studies the physical activity of citizens in the different structures of the city. There are many factors that influence citizens' physical activity (Burian, 2012)

Essentially, there are three general techniques for evaluating the performance of the built environment (Sweet, 2012) the first technique is verification, which is applied to existing situations and may include audit and rating and other assessment tools. Options will be developed and how well the proposed options will improve the quality of walkability will be assessed. The second method is testing, which can be applied to existing and planned designs. It identifies deficiencies based on recognized standards and can suggest solutions. It is ideal for qualitative and quantitative identification of maintenance problems and simple corrective actions. The third and final method is assessment, which can be defined as a tool for assessing the walkability of an environment or facility. It can be used for

existing or proposed designs and allows a practitioner to quantitatively compare different walking environments (PAYKOÇ, 2019)

The walkability index can be helpful in the urban planning phase. A high value of the walkability index means that a certain layout of the city promotes people's physical activity. The low value of the walkability index means that people use cars very frequently in everyday life, which leads to a minimum of physical activity. Calculating the walkability index is possible both for the existing structure of the city and for any proposed city plan. It is therefore a good opportunity for urban planners to evaluate the proposed urban plan from the perspective of its influence on people's physical activities. Urban planners can increase citizens' daily physical activities through good street layout and wide land use diversity (Burian, 2012).

Calculating the walkability index is particularly useful for urban planners in the design phase of a new city plan. An innovative approach (walkability index) can be used for more precise urban planning. With this program you can automatically recalculate the walkability index for a new version of the city map. Finally, it is possible to track the influence of the different versions of the city plan on the value of the walkability index. The goal of urban planning is certainly to create a better urban environment for healthy people (Burian, 2012).

2.6. The Global Walkability Index

Holly Virginia Krambeck's(2006) paper "The Global Walkability Index" describes an extensive investigation meant to evaluate and enhance pedestrian environments in cities, especially in developing nations

The Global Walkability Index (GWI) is a comprehensive study aimed at assessing and improving pedestrian environments in cities, particularly in developing regions. The GWI ranks cities globally based on safety, security, and convenience of pedestrian environments. The index aims to generate awareness and provide actionable insights for city planners, particularly in developing countries where pedestrian conditions vary significantly.

The Tool is particularly useful for developing countries as it provides a standardized way to assess and compare pedestrian infrastructure across different cities, helping identify

areas needing improvement. It raises awareness among city planners and policymakers about the importance of walkability and pedestrian safety, often overlooked in urban planning. The index offers data that can inform investment decisions and urban development strategies, ensuring resources are allocated effectively.

The Global Walkability Index (GWI) Extended Survey Materials are designed to complement the main walkability index by providing a more detailed and nuanced understanding of pedestrian environments. These materials typically include survey templates, field observation tools, public agency surveys, community feedback mechanisms, and data aggregation methods.

Benefits of using Extended Survey Materials include comprehensive understanding, enhanced engagement, and informed decision-making. By utilizing the GWI, cities in developing countries can make informed decisions to create safer, more accessible, and pedestrian-friendly environments.

2.7. Empirical Walkability Researches Review

2.7.1. Introduction

Walkability is increasingly recognized as a critical factor in urban planning, influencing not only pedestrian safety and comfort, but also public health and environmental sustainability (Pragia Minhas and Arunava Poddar, 2017). This recent studies conducted in various locations, including the Lovely Professional University LPU (hatdanai Luadsakul,Vatanavongs Ratanvaraha and Graduate Students, 2013) in India (Pragia Minhas and Arunava Poddar, 2017), neighborhoods in Amman Jordan (https://www.cnu.org, 2019), Slamet Riyadi Street in Surakarta Indonesia (NN Hayati,G Sulistyaningtyas,Daud Nawir and S Z Ishak, 2024), and urban areas in Addis Ababa (Jia, Fantta, and Mercado., 2022) using various methodologies including the Global Walkability Index (GWI). The results highlight the complexity of walkability assessments and the urgent need for targeted improvements to pedestrian infrastructure.

2.7.2. Researches Review

The first study he synthesis was conducted at Lovely Professional University (LPU), located in Phagwara, Punjab, India. It is considered India's largest single-campus private university (Pragia Minhas and Arunava Poddar, 2017). The research was carried out by Pragia Minhas, who is pursuing traffic and transportation engineering, and Arunava Poddar, assistant professor in the civil engineering department at Lovely Professional University.

According to Pragia Minhas and Arunava Poddar, 2017 Studied, The study used the Global Walkability Index (GWI) method to assess the walkability of Lovely Professional University. This method focuses on evaluating various factors that impact walkability, including pedestrian amenities, safety, and accessibility. The GWI provides a score that categorizes areas based on their walkability and helps identify strengths and weaknesses of pedestrian infrastructure.

The result of the Global Walkability Index (GWI) assessment for Lovely Professional University (LPU) was an average score of 55.64 on a 100-point scale. This value shows that there are some places on LPU that are walkable, but many everyday commutes still require a bike, car, or public transportation. The results suggest that while walkability is at a satisfactory level, there are significant opportunities for improvement, particularly in traffic management and pedestrian facilities.

The results of the Lovely Professional University (LPU) walkability study include: Satisfactory walkability: The overall average score of 55.64 indicates that the walkability of the campus is close to satisfactory, indicating that some stores and facilities the case is within walking distance, but many everyday routes still require other means of transportation. Areas of concern: Key issues identified include: lack of traffic dividers lack of pedestrian-friendly crossings lack of ramps for barrier-free access, incomplete continuity of sidewalks. The User satisfaction: Students, the primary users of the campus, reported that pedestrian facilities were lacking in several respects, highlighting the need for improvements. And also .Gender comparison: Female pedestrians reported similar levels of satisfaction to male pedestrians, with the exception of the obstacle-free width of the sidewalk. And other Public authority: The survey found that rules for the safe and

comfortable movement of pedestrians are being enforced, but these measures prove inadequate.

Recommendations for improvement: The study suggests that immediate attention is needed, to improve pedestrian infrastructure, including: improving the design structure of sidewalks. Increasing the width of sidewalks where possible providing more parking spaces. And addressing areas known as; “black spots” for pedestrian safety.

The limitations of the Global Walkability Index (GWI) method identified in the study include: Design factors not taken into account: The GWI method does not take into account certain design aspects such as the height of the walkways and the availability of walkways on the corresponding side of the roadway . And Equal weighting: The method gives equal weight to both footpath availability and pedestrian perception ratings, which can result in a more subjective and qualitative assessment .And other also Evaluation of specific parameters: It is difficult to determine which specific parameters need to be improved, such as safety , infrastructure for the disabled, comfort, Convenient and amenities, Focus on infrastructure: The method focuses primarily on physical infrastructure and does not adequately address the social and behavioral aspects of pedestrian traffic .Limitations of the survey: The assessment of pedestrian facilities is based on surveys, which may be influenced by respondents' opinions and may not fully capture the actual conditions of all users finally generalization of Results: Results may not be universally applicable to all areas or contexts as they are based on specific conditions at LPU and may not reflect walkability issues at other sites. These limitations suggest that while the GWI method provides valuable insight into walkability, there is a need for a more comprehensive approach that incorporates additional factors and considerations.

The Second review study was conducted in Amman, Jordan, and specifically examined walkability in different neighborhoods (https://www.cnu.org, 2019). Eleven locations were selected for the study, representing different city typologies and areas along the planned Bus Rapid Transit (BRT) line.

Volunteers on site assessed pedestrian conditions using the Global Walkability Index (https://www.cnu.org, 2019).

The team consisted of ten local volunteers, mostly architecture students, who were trained in the use of the audit. The volunteers were bilingual and spoke Arabic and English. The

study was submitted for consideration at the 2019 Congress of New Urbanism, but the author's exact name was redacted from the document (https://www.cnu.org, 2019).

The research used a qualitative and quantitative methodology to assess walkability (https://www.cnu.org, 2019). Key methods included: .Global Walkability Index: Volunteers used this index to assess pedestrian conditions in different neighborhoods. It includes criteria such as road connectivity, pedestrian facilities and safety, Field Assessments: Volunteers conducted on-site physical examinations to collect data on walkability factors, including sidewalk conditions, crosswalk availability, and overall pedestrian infrastructure, Photography and documentation: Visual documentation was likely used to complement the results and provide a clearer picture of walkability conditions and challenges. And Data Analysis: After collecting data through audits, the team likely analyzed it to quantify the walkability score (https://www.cnu.org, 2019).

The results of assessing walkability using the Global Walkability Index (GWI) showed the following: Highest and lowest scores: Jabal Al-Luweibdeh neighborhood scored the highest with an index of 71and indicating that it is the most was the best walkable area that was evaluated. In contrast, the Nordbahnh of district achieved the worst score with an index of 49.6.2. Overall score: All other study areas achieved values between 55 and 65.3.

Strengths and Weaknesses: The GWI enabled a multidimensional comparison between neighborhoods and uncovered specific strengths and weaknesses in ensuring walkability. For example, while Luweibdeh performed well overall, it scored lower in pedestrian facilities and disabled-accessible infrastructure compared to other areas. And Comparative Analysis: The results showed that Amman is relatively walkable compared to other Asian cities of similar size, although This does not reach the level of highly walkable cities such as Hong Kong or Manila.

Recommendations for improvement: The results highlighted areas where improvements could be made, e.g. The study found that while Amman has room to improve walkability, it has a solid foundation on which to build pedestrian-oriented development can be. Amman walkability assessment results derived from the Global Walkability Index (GWI) (https://www.cnu.org, 2019).

Limitations of walkability assessment in Amman, as explained in the document, include:. Subjectivity of the GWI: The Global Walkability Index relies on local volunteers for

assessment, which introduces a degree of subjectivity. This means that the results reflect the reviewers' perceptions rather than an objective measure of walkability, Cultural sensitivity: While the GWI allows for international comparisons, the subjective nature of the assessment can make these comparisons difficult. Different cultural contexts can influence how walkability is perceived and evaluated, Data Availability: The study faced challenges related to the availability of comprehensive data for certain analyses, particularly for geospatial analysis and other walkability metrics that require detailed urban planning data, Limited scope: The assessment focused on only eleven neighborhoods, which may not fully reflect the diverse urban fabric of Amman. This limited scope could affect the generalizability of the results to the entire city, Temporal context: The audits were conducted at specific times on weekdays, which may not capture differences in pedestrian activity and conditions at different times or days and the last Regulatory Challenges: Sidewalk maintenance is the responsibility of property owners, and sidewalk width and flatness regulations are often ignored, resulting in inconsistent pedestrian infrastructure that may not be fully captured in assessment.

The third focus article Studied was on the analysis of walkability index and pedestrian amenities in Slamet Riyadi Street in Surakarta, Indonesia (NN Hayati,G Sulistyaningtyas,Daud Nawir and S Z Ishak, 2024). The study titled “Analysis of Walkability Index and Handling of Pedestrian Facilities in Slamet Riyadi Street, Surakarta” was conducted by Dwiky Erlangga, Dewi Handayani, and Syafi'i from the Postgraduate Department of Civil Engineering at Sebelas Maret University, Indonesia (N N Hayati,G Sulistyaningtyas,Daud Nawir and S Z Ishak, 2024).

The methodology used in the study “Analysis of Walkability Index and Management of Pedestrian Facilities of Slamet Riyadi Street, Surakarta” included quantitative analysis techniques including: Field investigations: Data were collected from observations and measurements of pedestrian facilities and conditions along Slamet Riyadi Street, Walkability Index Assessment: Researchers calculated a walkability index based on factors such as sidewalk width, pavement quality, safety features, and accessibility, Data Analysis: The data collected was analyzed to determine the overall walkability of the street and identify opportunities for improvement in pedestrian amenities This comprehensive approach allowed researchers to effectively assess pedestrian comfort and safety (N N Hayati,G Sulistyaningtyas,Daud Nawir and S Z Ishak, 2024).

The results of the study showed a significant difference between the two assessment methods for assessing walkability: 1.Global Walkability Index (GWI): The GWI achieved a score of 56.2, indicating that the pedestrian walkways were in a “fairly walkable” condition, so several facilities could be reached on foot (N N Hayati,G Sulistyaningtyas,Daud Nawir and S Z Ishak, 2024).

The results of the study “Analysis of Walkability Index and Handling of Pedestrian Facilities of Slamet Riyadi Street, Surakarta” included the following key points: Comparison of assessment methods: There was a very significant difference between the Global Walkability Index (GWI). And the assessment methods SE PUPR 02/SE/M/2018. The GWI scored 56.2 while the SE PUPR scored 49.4, indicating that the GWI valuation was more favorable, Condition of pedestrian paths: The average walkability score of 56.2 from the GWI indicated that the pedestrian paths were well walkable, while the SE PUPR value of 49.4 indicated a less walkable condition limited facilities, Issues Identified: The analysis highlighted several issues affecting pedestrian comfort and safety, including: Conflicts on pedestrian walkways, Behavior of motor vehicle drivers at intersections, Safety concerns related to crime, Inadequate facilities for people with disabilities, Maintenance and cleanliness problems, and Presence of pedestrian obstacles (N N Hayati,G Sulistyaningtyas,Daud Nawir and S Z Ishak, 2024).

Recommendations for improvement: The study provided recommendations for dealing with pedestrian facilities based on user perceptions and evaluation results and focused on: Improvement of safety features and infrastructure, Improvement the behavior of motor vehicle drivers at intersections, increasing the availability of complete facilities and ensuring accessibility for people with disabilities, Addressing maintenance and cleanliness problems along pedestrian paths (N N Hayati,G Sulistyaningtyas,Daud Nawir and S Z Ishak, 2024).

These findings The study “Analysis of Walkability Index and Handling of Pedestrian Facilities of Slamet Riyadi Street, Surakarta” may have several limitations, although specific limitations are not explicitly stated in the document. Based on typical research limitations, the following limitations can be derived: Geographical focus: The study is limited to Slamet Riyadi Street in Surakarta, which may not be representative of other urban areas in Indonesia or other contexts, limiting the generalizability of the results, Sample Size: While the study involved surveying 30 people per segment in 9 segments,

the total sample size of 270 can still be considered small for a comprehensive statistical analysis, potentially affecting the reliability of the results, Subjectivity in perception assessment : Using the Likert scale to assess pedestrian perception can introduce subjectivity as individual experiences and opinions can vary widely, Temporal factors: The assessment may not take into account differences in pedestrian behavior and conditions at different times of the day or year that could influence walking ability, Limited variables: The study focused on specific variables from the Global Walkability Index and the SE PUPR criteria, which may not include all factors affecting walking ability, such as: socio-economic conditions or cultural aspects and Potential bias in data collection: The data collection process may be subject to biases such as: Observer bias (N N Hayati,G Sulistyaningtyas,Daud Nawir and S Z Ishak, 2024).

The Fourth study was conducted in Nakhon Ratchasima Province, Thailand, specifically in two areas: the monument of Thao Suranaree and the area in front of Rajabhat University Nakhon Ratchasima. The study was conducted by Chatdanai Luadsakul, a graduate student, and Vatanavongs Ratanvaraha, an associate professor at Suranaree University of Technology (hatdanai Luadsakul,Vatanavongs Ratanvaraha and Graduate Students, 2013).

The study used the following methods: Data collection: A survey research method was used which included two parts: Part1: An infrastructure survey involving volunteers to collect data on road and path conditions and other pedestrian facilities. Part 2: A pedestrian survey in which 400 pedestrians were surveyed with revealed preference (RP) questions related to their walking behavior 1 km². along the main road corridor Study area: The area in front of Nakhon Ratchasima Rajabhat University, also 1 km² in size. along the main road corridor, Evaluation of walkability index: The walkability index was evaluated based on 9 parameters, including factors such as traffic conflict on the sidewalk, safety from crime, safety when crossing, behavior of motorists, amenities, infrastructure for the disabled, maintenance and cleanliness. Disability and availability of intersections, Weighting parameters: In the study, various parameters were weighted according to their importance, following the guidelines of the Clean (hatdanai Luadsakul,Vatanavongs Ratanvaraha and Graduate Students, 2013).

The results of the study can be summarized as follows: Comparison of walkability index: Study area 1 (Monument of Thao Suranaree) had a higher walkability index value (2.76) than study area 2 (Nakhon Ratchasima Rajabhat University), which achieved 2.45. This

indicates that the monument area is more walkable than the university area.2.Parameter analysis: The analysis of various parameters revealed that study area 1 outperformed study area 2 in most categories, especially in “walkway modal conflict” (3, 47 vs. 2.46) and “safety from crime” (2.98 vs. 2.90). This suggests that the infrastructure and safety measures in Study Area 1 are more suitable for pedestrians.3. Pedestrian perception:A significant proportion of pedestrians (50%) perceived the walking comfort in their area as “okay”, while 23% rated it as “Good-Very good”. This indicates a generally positive perception of walkability by users, although there is room for improvement, Distance to intersections: In Study Area 1, 60% of respondents reported walking no more than 300 meters to get one Street to cross, indicating relatively accessible intersections. In contrast, 71% of respondents in Study Area 2 reported walking more than 300 meters to cross, suggesting less convenient crossing options.5. Overall implications: The study highlights the importance of urban planning and infrastructure in promoting walkability. The results suggest that better land use planning and pathway planning can encourage more people (hatdanai Luadsakul,Vatanavongs Ratanvaraha and Graduate Students, 2013).

The study identified several limitations, including:Sample size: The study's sample size of 400 pedestrians may not be sufficient to represent the entire population of Nakhon Ratchasima Municipality, potentially affecting the generalizability of the results. Focus on Specific Areas: The research was limited to two specific areas (the Thao Suranaree monument and the area in front of Nakhon Ratchasima Rajabhat University), which may not capture the walkability conditions of other areas within the municipality or province. Subjectivity in Perceptions: The pedestrian survey relied on self-reported perceptions of walking comfort and safety, which may be subjective and may not accurately reflect actual conditions,Exclusion of pedestrian counting: The study did not include any step of pedestrian counting (the number of people),Cultural and contextual differences: The study recognizes that different cultural lifestyles and laws in Thailand may influence the applicability of the standard walkability index, suggesting that the assessment method may need to be tailored to local contexts. And the last Potential Bias in Responses: Respondents may have given biased answers based on their experiences or expectations, especially if they had long-distance travel or if they were influenced by the presence of researchers during the survey (hatdanai Luadsakul,Vatanavongs Ratanvaraha and Graduate Students, 2013).

The fifth Study paper was Addis Ababa Sidewalk Safety and Improvement Study was conducted in Addis Ababa,and focused on sidewalk conditions and pedestrian safety along a selected study area of 5.4 km along the Light Rail Transit (LRT) Line A corridor (Jia, Fantta, and Mercado., 2022) . The study specifically analyzed three main station areas: Meskel Square, St. Urael Station and Megenagna Station (Jia, Fantta, and Mercado., 2022).

Accourding to Jia,e.alt saied 2022 The "Addis Ababa Sidewalk Safety and Improvement Study" was prepared by a team led by Wenyu Jia (Sr. Urban Transport Specialist) and Bezawit Tesfaye Fantta (Transport Specialist) at the World Bank. The report was prepared as part of the Ethiopia Transport Systems Improvement Project (TRANSIP) and involved collaboration with various stakeholders, including government officials and experts from various Addis Ababa scrotal Bureaus.

The study used a comprehensive data collection and analysis methodology that included the following phases: Stakeholder engagement: A stakeholder engagement plan was developed to ensure participation and feedback from various stakeholders throughout the study. This also included virtual workshops due to COVID-19 restrictions,Definition of the study area: The study focused on a 5.4 km section along the Light Rail Transit (LRT) Line A corridor and specifically analyzed three main station areas: Meskel Square, St. Urael Station, and Megenagna Station, Data collection methodology: Urban Inventory: A digital-based field survey was conducted using dereferenced technology to assess the current condition of the pavement. This involved identifying and classifying elements into five categories: city life, pavement condition, urban elements, pedestrian crossings and safety. User surveys: Questionnaires were distributed to users in the study area to collect information on socio demographic characteristics, walking activities and user perceptions related to sidewalk conditions. and Walkability analysis: The collected data was analyzed using a geographic information system (GIS) to create a global walkability index, which quantified walkability based on various indicators related to urban inventory elements.Gap Analysis: A gap analysis was conducted to identify the differences between the current sidewalk conditions and the desired improvements, leading to the formulation of improvement strategies.

The results of the Addis Ababa Sidewalk Safety and Improvement Study highlighted several key findings regarding sidewalk conditions and pedestrian safety: Sidewalk

conditions: A significant portion of the sidewalk network (67%) falls within levels C and D of the Global Walkability Index, which stands out indicates inadequate and unsafe conditions. Specifically, 39% of the network is classified as Level D, meaning it is either non-existent or unusable. Many sidewalks are narrow, uneven, blocked, or nonexistent, making them a safety hazard for pedestrians. Common problems include inadequate crossings, missing sidewalk sections and poor accessibility for vulnerable users, User perception: User surveys confirmed the results of the urban inventory. A majority of respondents reported that sidewalks were inaccessible (75%), unsafe in terms of quality of infrastructure (66%) and unsafe in terms of traffic load (63%). Many users (70%) reported that sidewalks were blocked by obstacles, street vendors, parked vehicles, or other obstacles, and 63% reported a lack of adequate crossing points, Walkability Results: The analysis found that 85% of buildings in the study area are unattractive to pedestrians or have no connection to sidewalks. A significant value Numerous walkways lack adequate maintenance, with 50% of the walkway rated as poor to very poor and 54% of the network not having a tactile walkway for visually impaired users. Recommendations: The study suggested various improvement strategies should implement.

The results of the “Addis Ababa Sidewalk Safety and Improvement Study” can be summarized as follows: Quality of sidewalks: Global Walkability Index: 67% of the sidewalk network falls below levels C and D, indicating poor and unsafe conditions. Specifically, 39% of the network is classified as Level D, meaning it is either non-existent or unusable,Width of walkways: While 39% of the network has a width of more than 2.5 meters, 26% lack any walkways at all, requiring urgent attention poor infrastructure quality unsafe. Disabilities: 70% of users reported that sidewalks are blocked by street vendors, parked vehicles or other obstacles. This leads to unsafe walking conditions. Crossing conditions: Inadequate crossings: 79% of the network has inadequate crossings, resulting in pedestrian crossings and unsafe pedestrian behavior Accessibility for vulnerable users: 65% of crossings are inaccessible to people with reduced mobility (PRM).).Urban environment: Permeable frontages: Only 15% of the network has high permeability, meaning that most buildings do not accommodate pedestrians or provide access to sidewalk activities. Bus stops: There are hardly enough bus stops, what public transport hinders usage and last-mile connectivity, Safety Concerns: Pedestrian Deaths: Study shows pedestrians are at higher risk of road accidents, with nearly 500 fatalities.

The report “Addis Ababa Sidewalk Safety and Improvement Study” describes the current condition and challenges of sidewalks in Addis Ababa, with a focus on pedestrian safety and accessibility. Here are the key limitations identified in the report: Limitations Inadequate infrastructure: Many sidewalks are narrow, uneven or obstructed, creating unsafe conditions for pedestrians, High pedestrian fatalities: The city has a disproportionately high rate of pedestrian fatalities primarily due to inadequate traffic safety measures, Insufficient data: Previous studies have not adequately addressed sidewalk conditions or pedestrian experiences, resulting in a lack of comprehensive Data leads, Maintenance Issues: Walkways often suffer from poor maintenance as undergrowth, rubble, etc. Vendor encroachments block pathways and other Limited crossings: There are not enough pedestrian crossings, which encourage street crossings and increase the risk of accidents.

2.7.3. Research Gaps

he research gaps can be stated as follows in relation to the pedestrian accessibility literature review.

2.7.3.1.Insufficient Localized Studies

While there is a wealth of literature worldwide on walkability in various urban contexts, there is a distinct lack of localized studies that focus specifically on Adama City or similar cities in developing countries. Most existing research tends to focus on metropolitan areas in developed countries, which may not accurately reflect the unique challenges and conditions faced by cities like Adama. This gap indicates the need for studies that consider local socioeconomic, cultural, and environmental factors that influence pedestrian behavior and infrastructure.

2.7.3.2.Limited Focus on Mixed-Methods Approaches

Many walkability studies primarily use quantitative methods such as surveys and statistical analysis to assess infrastructure and safety. However, there is a gap in the literature regarding the integration of qualitative methods that capture the lived experiences and perceptions of pedestrians. Understanding how users interact with their environment and their subjective experiences can give you a more comprehensive view of walkability issues. This gap suggests that future research should employ mixed methods approaches to enrich the collected data.

2.7.3.3.Underexplored Factors Influencing Walkability

Literature often highlights physical infrastructure and security as major factors affecting walkability. However, there is a gap in researching other influencing factors such as social dynamics, community engagement and cultural attitudes towards walking. Research that examines how these factors interact with physical conditions could lead to a more holistic understanding of walking ability and lead to more effective interventions.

2.7.3.4.Impact of Policy and Governance on Walkability

While some studies address the role of urban planning policies in shaping pedestrian environments, there is a lack of comprehensive analyzes that directly link policy frameworks to walkability outcomes. The literature often fails to address how governance structures, funding mechanisms and policy support (or lack thereof) impact the development and maintenance of pedestrian infrastructure. This gap highlights the need for research that critically examines the relationship between policy decisions and walkability.

2.7.3.5.Longitudinal Studies and Temporal Changes

Most existing research provides a snapshot of walkability conditions at a given point in time. There is a gap in longitudinal studies that track changes in pedestrian infrastructure, user behavior, and safety over time. Understanding how walkability evolves in response to urban development, policy changes, and community initiatives is critical to assessing the long-term effectiveness of interventions and planning future improvements.

In summary, the literature review highlights several research gaps in the field of pedestrian walkability, particularly in relation to local studies, the integration of qualitative methods, the examination of various influencing factors, the impact of policy and governance, and the need for longitudinal analyses. Addressing these gaps in future research can significantly improve the understanding of pedestrian environments and contribute to more effective urban planning and design strategies.

2.8. Important factors affecting safety, comfort and Convenient.

According to a study, the following factors can be considered general affecting factors to the pedestrian users on crossings, vehicular bridges, vehicular roadways, and sidewalks: inadequate visibility, illegal crossings, pedestrian fatigue, drunk driving and walking, institutional capacity, walking along the roadway, socio-economic factors, poor transport and land use planning, population growth, lack of road safety education, high annual growth in motorization, the proportion of two- and three-wheelers in the traffic mix, and poor enforcement of traffic regulation (Roberts, 2008).

The quality of the walking environment, sidewalk capacity, and the pedestrian's perception of safety, comfort, and Convenient are the three measures that describe the roadside pedestrian environment, according to Dan Burden, a prominent national advocate for more walkable societies and transportation systems. Burden states that many factors that affect a pedestrian's feeling of safety, comfort, and Convenient are present in the sidewalk environment (Briceño-Garmendia, 2010).

According to a study, street vendors frequently occupy space within the sidewalk width, reducing the overall width because they impede pedestrian traffic and because their particular activities take place on the sidewalk, which creates a lane for activities by both buyers and vendors in front of the vendors and is common in developing nations (Choi, 2012).

Urban planning and architecture have a major influence on the design of urban environments. A well-planned urban fabric prevents the emergence of a sense of threat, strengthens a person's sense of place and promotes the development of social bonds. One of the most basic human needs is a feeling of security. The most important concrete means of meeting this need is the design of safe architectural environments. Safety must be a priority when constructing urban public spaces and designing architectural structures. t (Paszkowski, Z.W,Kołowiecka,S.Kuśmierek.A., 2021).

The walkability research conducted at LPU in Amman, Surakarta and Addis Ababa highlights the critical role of pedestrian infrastructure in urban environments. While the GWI and other methodologies provide valuable insights, there is clearly a need for a more

integrated approach that incorporates local contexts, user experiences and standardized evaluation criteria. Addressing the identified vulnerabilities and implementing targeted recommendations can significantly improve pedestrian safety and the overall quality of life in the city, ultimately promoting healthier and more sustainable communities. Future research should focus on developing comprehensive methods that consider a broader range of factors that influence walkability to ensure that urban areas can effectively meet the needs of their pedestrian populations.

2.9. Policy Support.

Policy, guide and manual are important tools for planning, implementing and monitoring any project. International and national documents are also available for the implementation of an accessible street.The Global Street Design Guide establishes a new global standard for urban street design. The urban street design guidelines shift the focus from the traditional perspective of vehicle movement and safety to access, safety and mobility for all users, environmental quality, economic benefit and place improvement, public health and overall quality of life, recognizing that cities are places for people. Experts from global cities took part (NACTO, 2016).

Funded by Bloomberg Philanthropies, it will train practitioners, motivate leaders and support communities to realize the full potential of their public spaces. The guide helps cities realize the potential of streets as safe, accessible and financially viable places by viewing them as public spaces that integrate different uses and functions. More people should be able to utilize urban streets than they currently do. They must be built to support the many issues that cities will encounter in the years to come, supporting the objectives and desired results for Public Health and Safety, Quality of Life, Environmental Sustainability, Economic Sustainability, and Social Equity at the city-wide level (NACTO, 2016).

Ethiopian policymakers are therefore in a unique position to advance national policies for sustainable urban mobility. Other cities can learn from Addis Ababa’s challenges and successes. Elsewhere and on a different scale, the strong mandate and capabilities of the Addis Ababa Road and Transport Bureau should be emulated. To support this capacity building, a national program with measurable goals would be crucial. All cities face serious threats from misalignment of land use plans, enforcement and mobility policies.

Policies and institutional coordination can continue to be put in place to prevent, or at least reduce, secondary cities from being exposed to the same levels of pollution and traffic as the capital, Addis. In addition to improving peak-time capacity in key corridors (whether road or rail), strengthening the contractual framework and financial stability of the various public and private public transport providers is crucial. It is recommended that policies and action plans include non-motorized transport and technological innovations such as information technology and new energies (MoT, 2020).

The goal of the Ethiopian City Street Design Manual project is to create thorough and detailed street design guidelines for Ethiopian urban centers that will make it easier to create attractive, secure, livable, and well-served streets and, in turn, help the government implement its policies and plans (MUDH, Street Design Standards for Urban Ethiopia, 2017).

CHAPTER THREE

3. Method and Materials

3.1.Introduction

Research is defined as a systematic investigation aimed at learning more about a specific phenomenon. The type of knowledge gained from research varies depending on its objectives. Some research aims to make systematic and standardized comparisons, while others focus on conducting in-depth analyses of phenomena or circumstances. This chapter seeks to clarify the research method employed for this study. It will discuss various aspects, including the sources and types of data to be used, the study area, the selection of informants, and the research design. Additionally, the chapter will present the data collection techniques and the methods of data analysis that will be utilized.

3.1. Description of study area

3.1.1. Climate and Rainfall

Adama Average monthly temperatures and weather, sunny and cloudy days. Annual rainfall and snowfall in Adama 2015–2021. Average monthly temperatures (day and night), average annual precipitation (rain and snow) and days with wet weather per month in Adama. Warm, sunny months for a trip to Adama. In general, the city enjoys favorable climatic conditions due to its geographical location, surrounded by plateaus with moderate temperatures and rainfall conducive to life. Precipitation falls mainly during the summer season. This season sees abundant and heavy rainfall every year. In a report on the social economy of Adama City for the last five consecutive years, the maximum average and minimum average annual temperature in 2020/21 and 2021/22 were 29.4°C and 15.8°C respectively. Likewise, the maximum annual total rainfall and the minimum annual total rainfall were 934.8 mm and 736.5 mm, respectively.

3.1.2. Population and Population Density

According to the last three consecutive censuses in the country, Adama Town recorded a large increase in population. At the first Ethiopian population and housing census, held in May 1984, Adama had a population of 77,237. The second population and housing census in 1994 showed that Adama had a total population of 127,842, of which 61,965 were men and 65,877 were women. According to the third Ethiopian population and housing census conducted in 2007 (the most recent year for which data is available), there were 220,212 people living in Adama, of which 108,872 were men and 111,341 were women. On this basis, the projected population of Adama town including the four sub-urban ganda under the municipality in 2018/19 (2011 E.C.) was 433,046, of which 216,046 were male and 217,000

were femaleWith an area of 35.1164 square kilometers, Adama has a population density of 2002,794; all are city dwellers. A total of 60,174 households were counted in this city, which corresponds to an average of 3.66 people per household and 59,431 residential units. The pattern of spatial population distribution shows differences between different districts. Population density varies from area to area. The central districts have a high population density compared to the urban expansion areas. The urban kebele with the largest population in the study area is Dadacha Arara (04), while Daka Adi is the urban kebele with the smallest population and Goro Kebele is the second largest kebele.

3.1.3. Economic source

The city serves as an administrative, industrial, commercial, conference and weekend recreation center. The city has 370 manufacturing industries, 6,808 wholesale and retail businesses, 4,981 service industries, 8 gas stations and 73 workshops. The financial institutions include one state-owned and 13 private banks as well as three microfinance organizations. The employment rate is 58.2% for both genders, 66.8% for men and 49.8% for women, while the unemployment rate is 21.4% for both genders, 16% for men and 28.4% for women. The city of Adama has great potential for industry, agro-processing and recreational areas. The tourism and business sector is growing with modern hotels for tourists and conferences. In addition, modern shopping centers and supermarkets as well

as the entertainment sector are on the rise. Over 4,000 investors have invested a total of 6.01 billion Birr in almost 13,000 hectares of land, creating employment opportunities for 36,813 people. The city's youth are the main factor in the city's dramatic transformation and since 2003 the city administration has been involving them through various initiatives, for example in the areas of agriculture, house building, animal fattening, trade, industry and the service sector.

3.3. Pedestrian volume population

In Adama city, walking and non-motorized transport appear to play an important role, similar to other regions where non-motorized transport accounts for a large proportion of trips. However, the modal share of NMT is at or above 60%, it is important to revisit this specific number as the overall context may be different in different areas of Ethiopia (ITDP, https://unhabitat.org/, 2020). The city revision of the structural plan(2022), traffic planning, study report, main report, summer report Mainsion Traffic volume in the three zones of the city is walking > 5000 feet per day or 417 feet per hour in the central business district; 2500 ped/day at medium level; and 500ped/day at the periphery.

3.4. Pedestrian survey

The Pedestrian Survey is intended to help us gather information about walkability that cannot be obtained through physical infrastructure surveys or public agency surveys, such as: E.g., night light conditions, purposes of walks, etc. To avoid complications in translating printed surveys and illiteracy, these surveys must be conducted orally. The surveys are carried out directly with the target group - hikers - by carrying out sample interviews at selected locations (Krambeck H. , 2006).

By using Purposive sampling stands out as a deliberate choice of participants or data points, guided by the researcher's informed judgment. This technique is handmade to the unique needs of the study, ensuring that the sample embodies the characteristics essential for in-depth analysis (Singh and Masuku, 2014).

The surveyed population can include: pedestrians, vendors, local traders, traffic police, office workers, maintenance workers, etc. Surveys can be conducted on the street, in

offices and shops, (Krambeck H. , 2006). It is very important that the pedestrian survey questions relate to the streets examined in the physical infrastructure survey.

According to various scholars, the issue of sampling in qualitative research is quite delicate as there are no clear guidelines or standards on what can be considered as the correct number of samples. Most scholars agree that any sample of 15 to 50 participants is sufficient (Charmaz, 2006),and (Mason,2010) suggesting that "25 participants is sufficient for smaller projects".

As mentioned above, 8 selected sample areas are selected using spatial random sampling; And 25 pedestrians select each area around selected streets using the targeted sampling method. The main sample 25*8=200 is the entire pedestrian sample, which occupies the total area of the randomly selected spatial areas.

3.5. Physical infrastructure survey

As Krambeck.H. wrote (2006) The physical infrastructure survey shall be used to collect raw data on the availability and quality of pedestrian infrastructure. The survey may be filled out by hand. In some developing cities, no such master list of street names exists for all or most major and minor roads. In terms of drawing a city boundary, we shall consider developed Areas contiguous to the city center.

Because of budget constraint using targeted Sampling methods the researcher selects two street segments within each survey area, he has eight sample areas the sum of sample segment become sixteen, ensuring that street sample features a variety of widths and uses.

3.6. Time of Day

In addition to location aspects, aspects of the time of day must also be taken into account. For example, a street that appears very safe at 9:00 a.m. may appear much less safe at 9:00 p.m. Or a sidewalk that appears perfectly walkable on a Sunday afternoon may not be walkable during rush hour on Monday. Under ideal conditions, all areas studied would be visited at least twice - during peak and off-peak hours (note that specific peak times of the day will vary from city to city). However, if limited resources prove that multiple visits are not feasible, conducting surveys in my study contact only during local peak hours may be an option (Krambeck H. , 2006).

3.7. Study area Selection Method

Like Dr. Shyma Prasad wrote: "The central business district (CBD) is the center of a city and is characterized by large retail and financial districts, government buildings and maximum accessibility." It serves as the commercial and civic center of the city. Typically it is located in the city center, which is the easiest to reach from all parts of the city in terms of major road and rail routes. It also serves as a main hub for pedestrian and vehicular traffic. It is truly the center of the city with the highest concentration of tallest buildings, the highest land value and the highest concentration of commercial, retail and office space. Murphy and Vance also came to the conclusion that the CBD limit is dynamic and constantly changing and is not a fixed limit. Its edges were observed to either expand or contract, leading to the identification of zones of shedding and assimilation. This is the transformation process that every CBD goes through. In addition, each city has its own growth circumstances and historical background. Therefore, local factors are important in defining the boundaries of CBD. Physical obstacles can occasionally occur, e.g. G. Wetlands, a river or lake, or cultural features, e.g. G. Railway lines and cemeteries pose a challenge to the horizontal growth of the CBD. Therefore, no method can be applied to every city on earth."

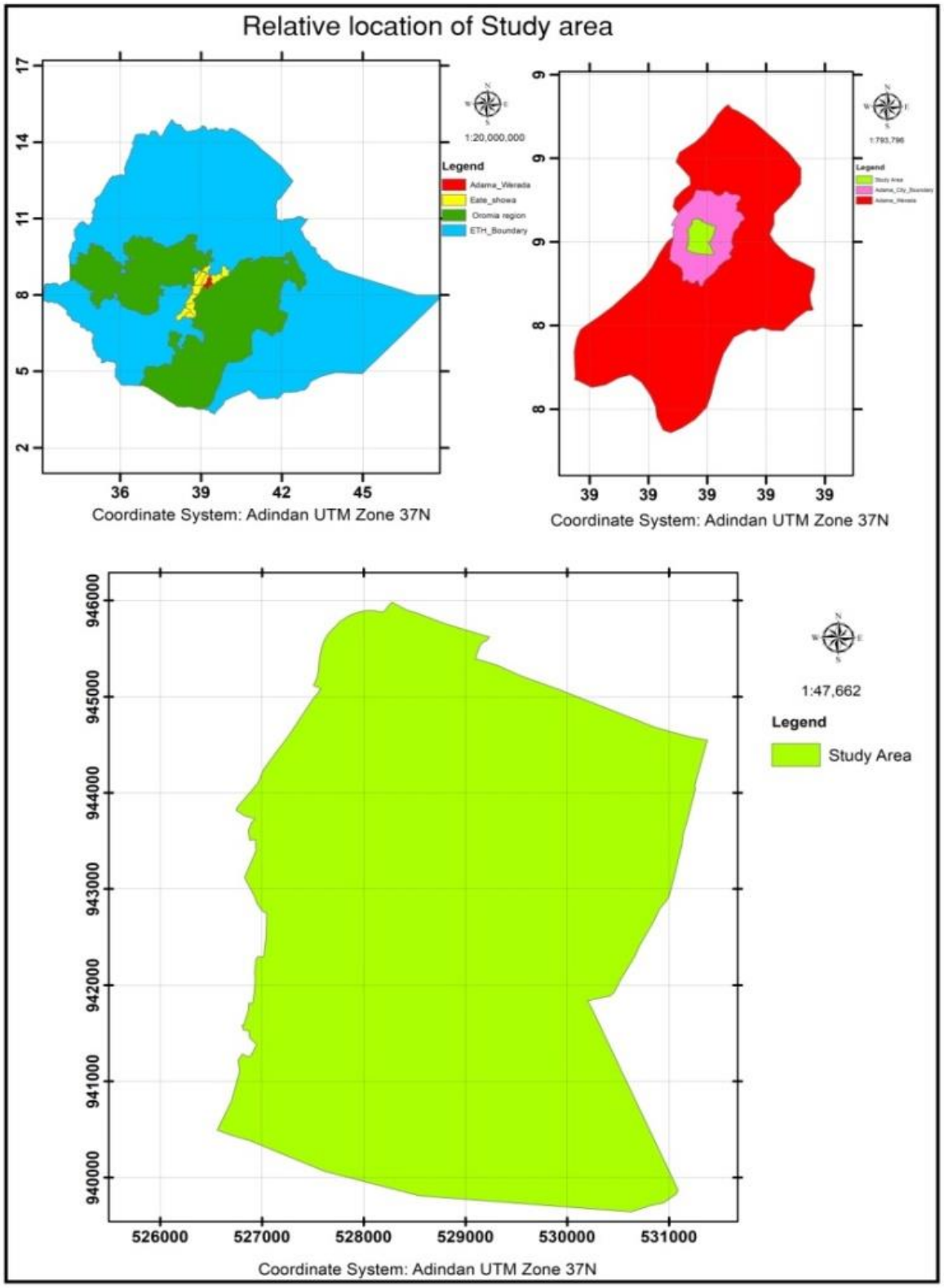


Figure 3.1 Relative location of study Area
source Ethio_GIS(February 2023)

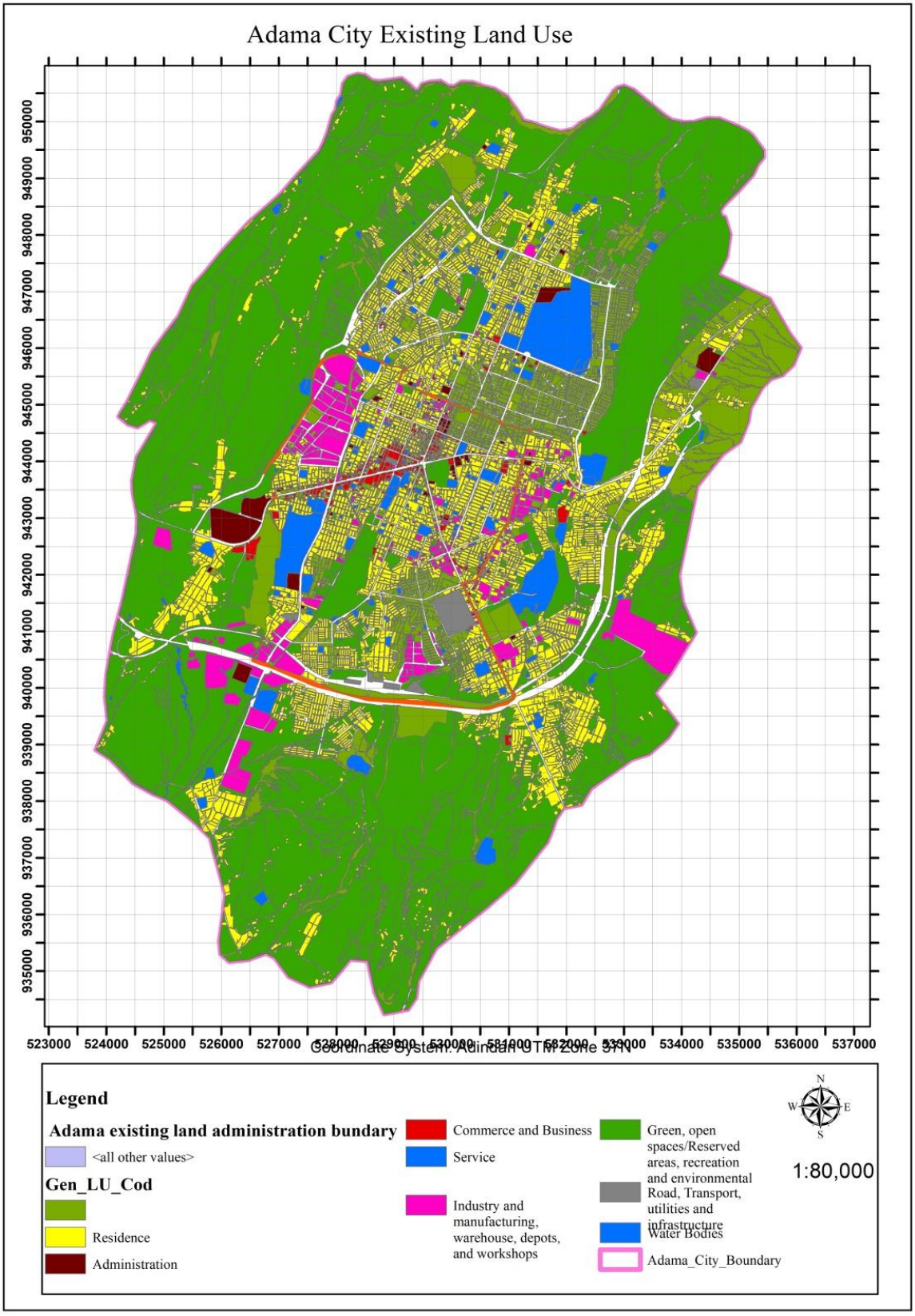


Figure 3.2 Adama City Existing Land Use
source the Oromia Urban planning Institute(2019

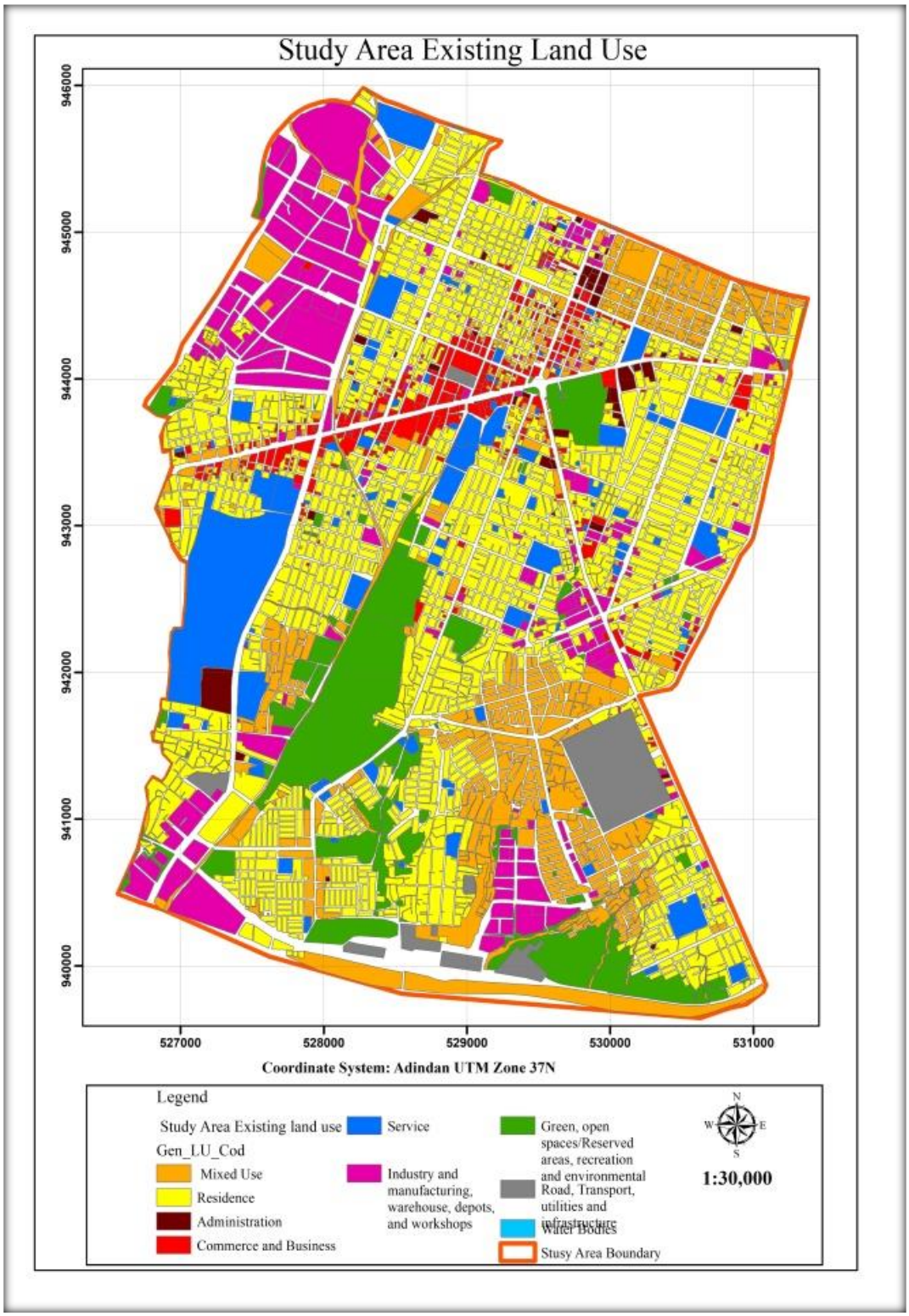


Figure 3.3.Selection of specific study area based on determined criteria
Source Structure plan of Adama city computed by Oromia planning institute 2019

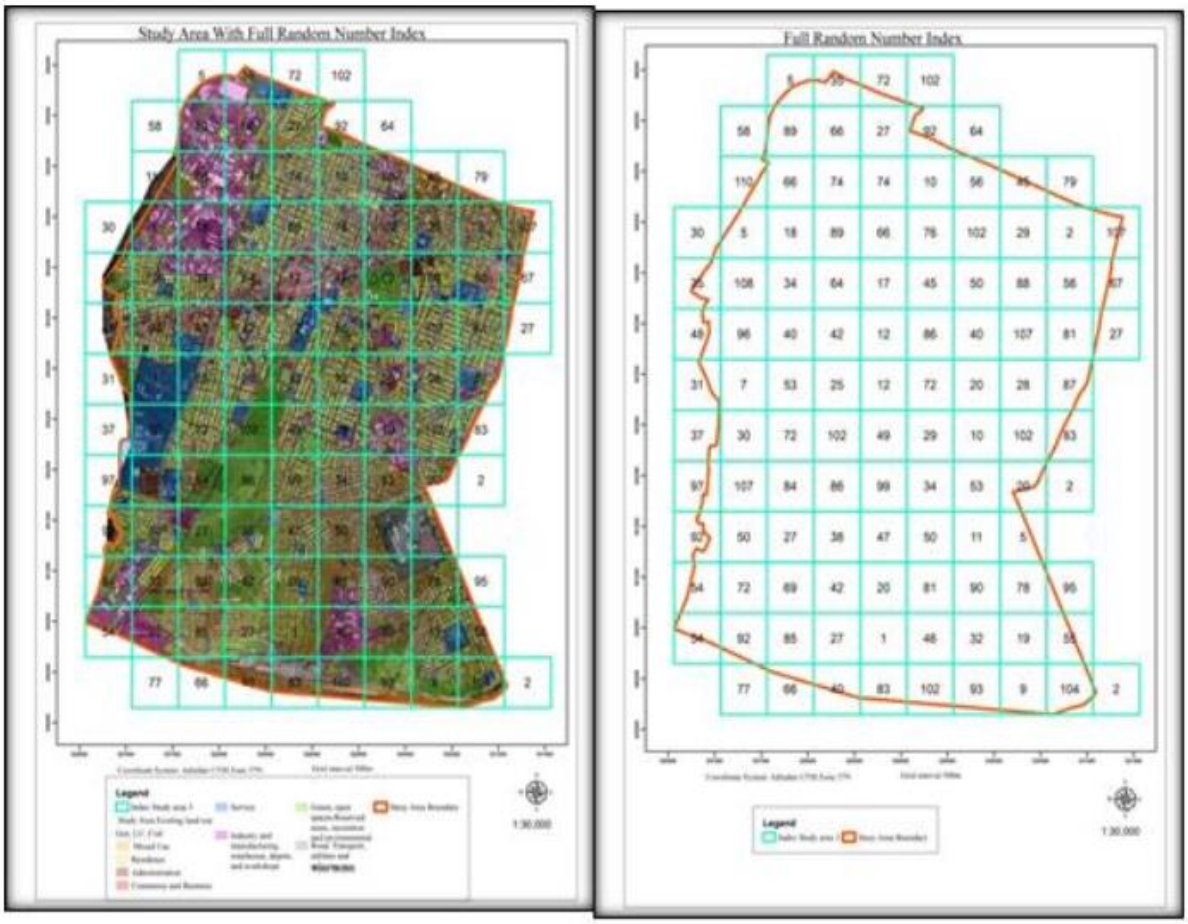


Figure3.4 Selection of specific study area 500 meter by 500 meter grid on top of delineated study area map

Source Structure plan of Adama city computed by Oromia planning institute 2019

Place a 500 x 500 meter grid on the map of the demarcated study area. Map and grid scales must be consistent throughout the study area. Unsuitable for conducting surveys (e.g. lakes, parks, private property, etc.). Generate a random number table. He generated numbers along a normal distribution of 1-110 (there are 110 unblocked squares on the map). Transfer randomly generated numbers from the table to the card as shown in the diagram.

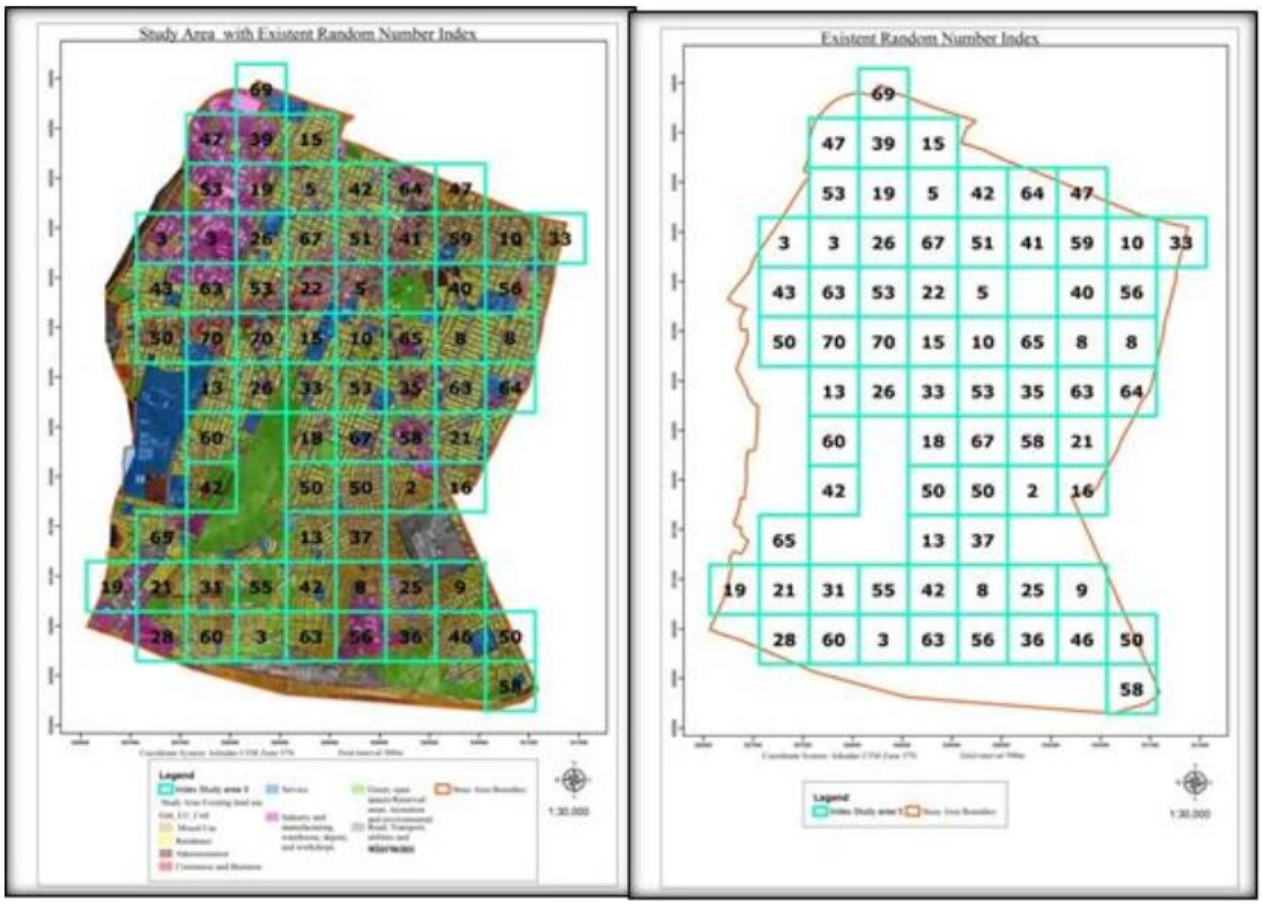


Figure 3.5. Selection of specific study area extract for conducting surveys (e.g., lakes, parks, private property, etc.)

Source Structure plan of Adama city computed by Oromia planning institute 2019

To ensure the index is fair, it is randomly selected. He used the random number table he created earlier. Starting from the left, when a number from the table appears on our card, the corresponding square is selected (see diagram).

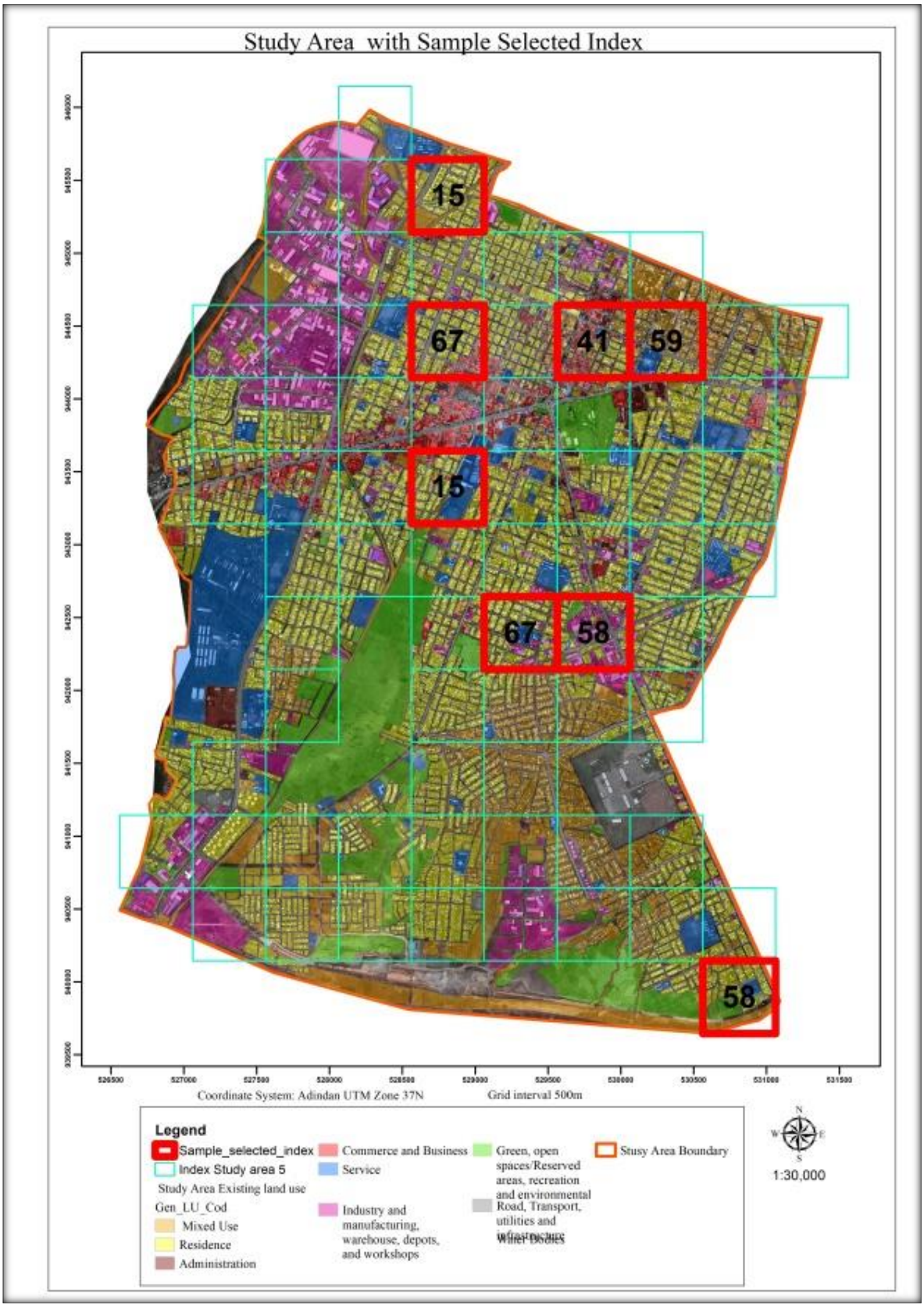


Figure 3.6 Study area and Select Sample index

Source Structure plan of Adama city computed by Oromia planning institute 2019

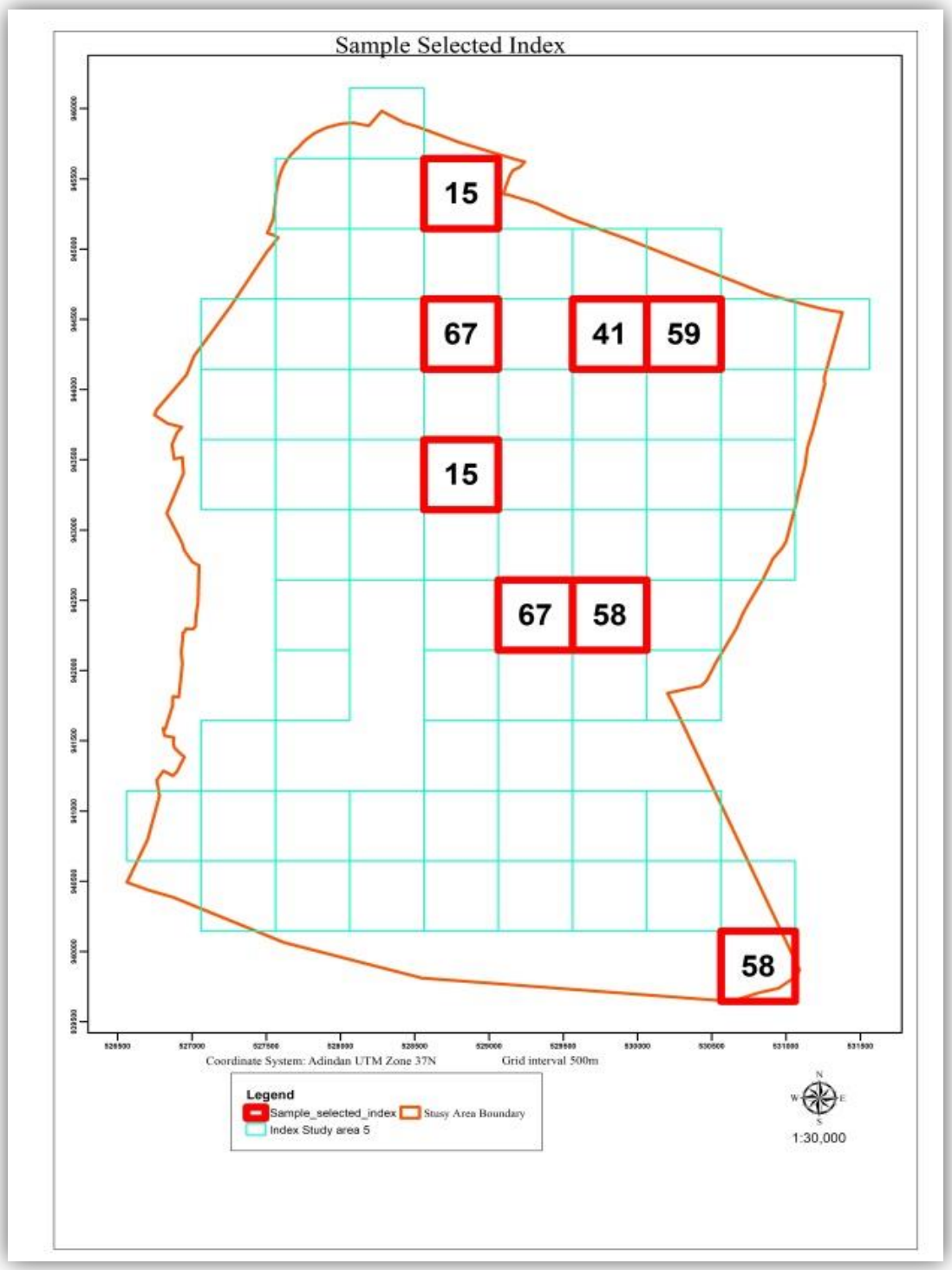


Figure3. 7 Select Sample index

Source Structure plan of Adama city computed by Oromia planning institute 2019

Table 3.1 Random Number Select from 70 index and Survey area local mane

Random Number Select from 70 blocks		
NO	Random Sampling	Spatial Random selected Survey areas local mane
1	15	Around Goroo high School
2	67	Around Ts Maryam church
3	41	Around Mebrat hayl Square
4	59	Around Oda Health Center
5	15	Around Refit valley University
6	67	Around Adama Boset Primary School
7	58	Around Catholic Eye Clinic
8	58	AroundBoku Ts Michiel Church

Organized by the author (February 2023)

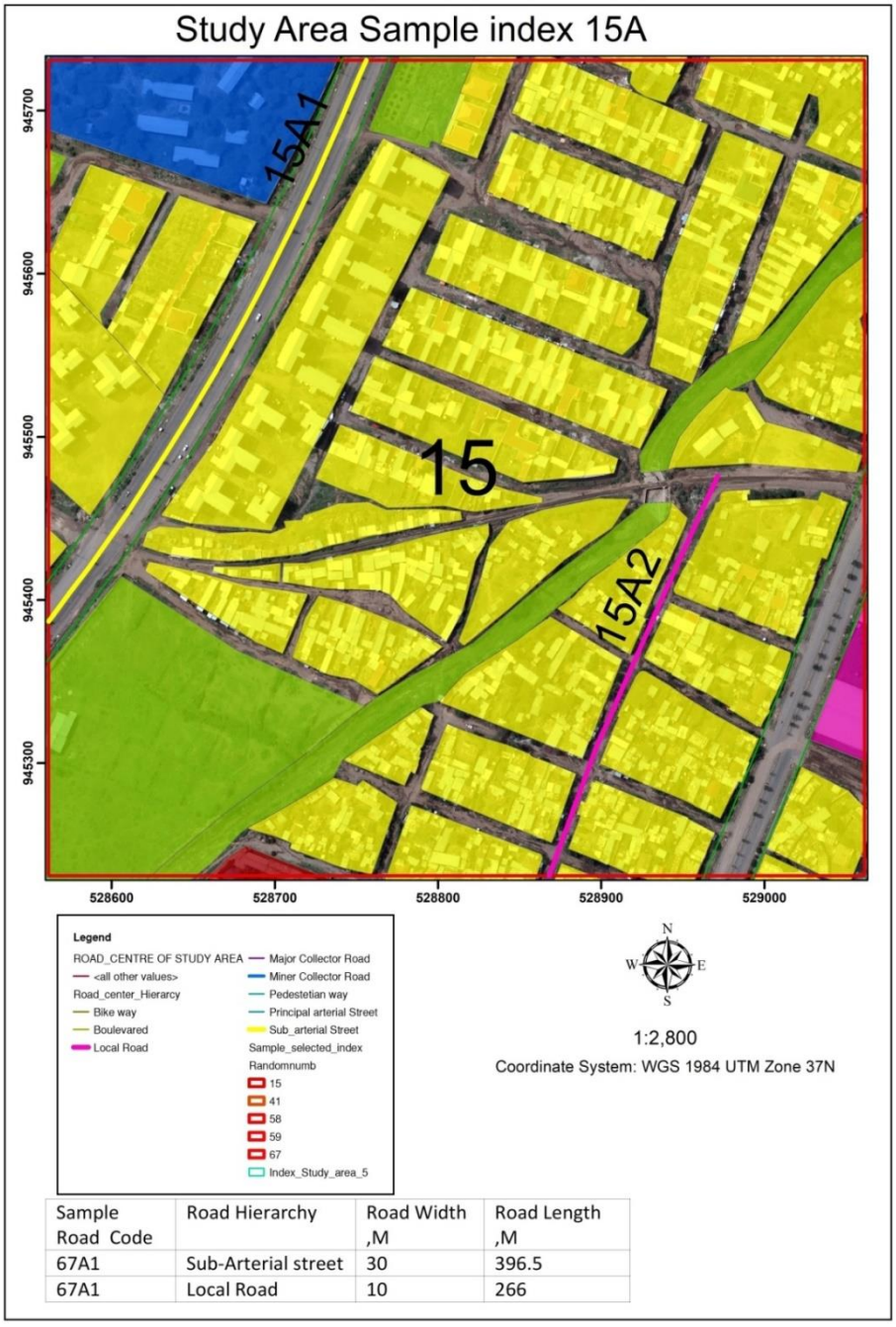
3.7.1. Spatial Random Sample

In surveys, econometricians typically prefer to use random sampling to avoid as much bias as possible. While the previously described methods have their merits, none contain a random component that would lend credibility to the survey results. One way to incorporate randomness into the selection of the study area would be to obtain a random spatial sample. This method was originally proposed by Judy Baker, an economist at the World Bank (Krambeck H. , 2006).

3.7.2. Survey Area

It is important that selected study areas within CBDs provide comparable results, and it is important that the areas studied are representative of a large cross-section of the cities' diverse neighborhoods and districts. It is quite difficult to determine a method for selecting the study area that meets the criteria. Taking this problem into account, he decided to use spatial random sampling from eight different survey methods (Krambeck H. , 2006). This mean total area select in every select has one sample area has 25ha land this also main 25*8=200ha of land will cover the spatial random select sample (Krambeck H. , 2006).

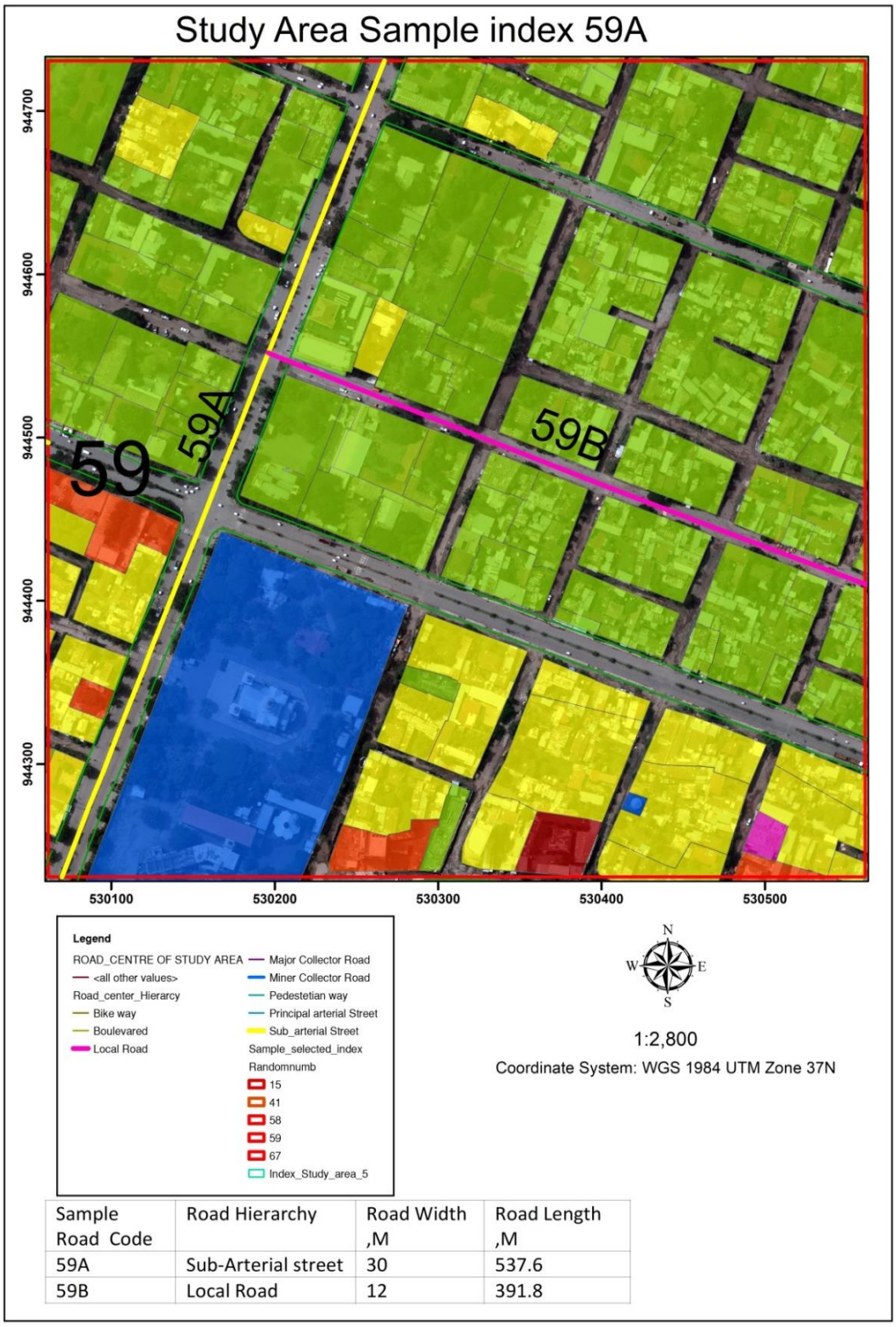
Index Survey Areas map and Infrustructure Suevey sreets



Sample Road Code	Road Hierarchy	Road Width ,M	Road Length ,M
67A1	Sub-Arterial street	30	396.5
67A1	Local Road	10	266

Figure 3.8. Select Sample index Study area and Raod Segment 15A
Source Structure plan of Adama city computed by Oromia planning institute 2019

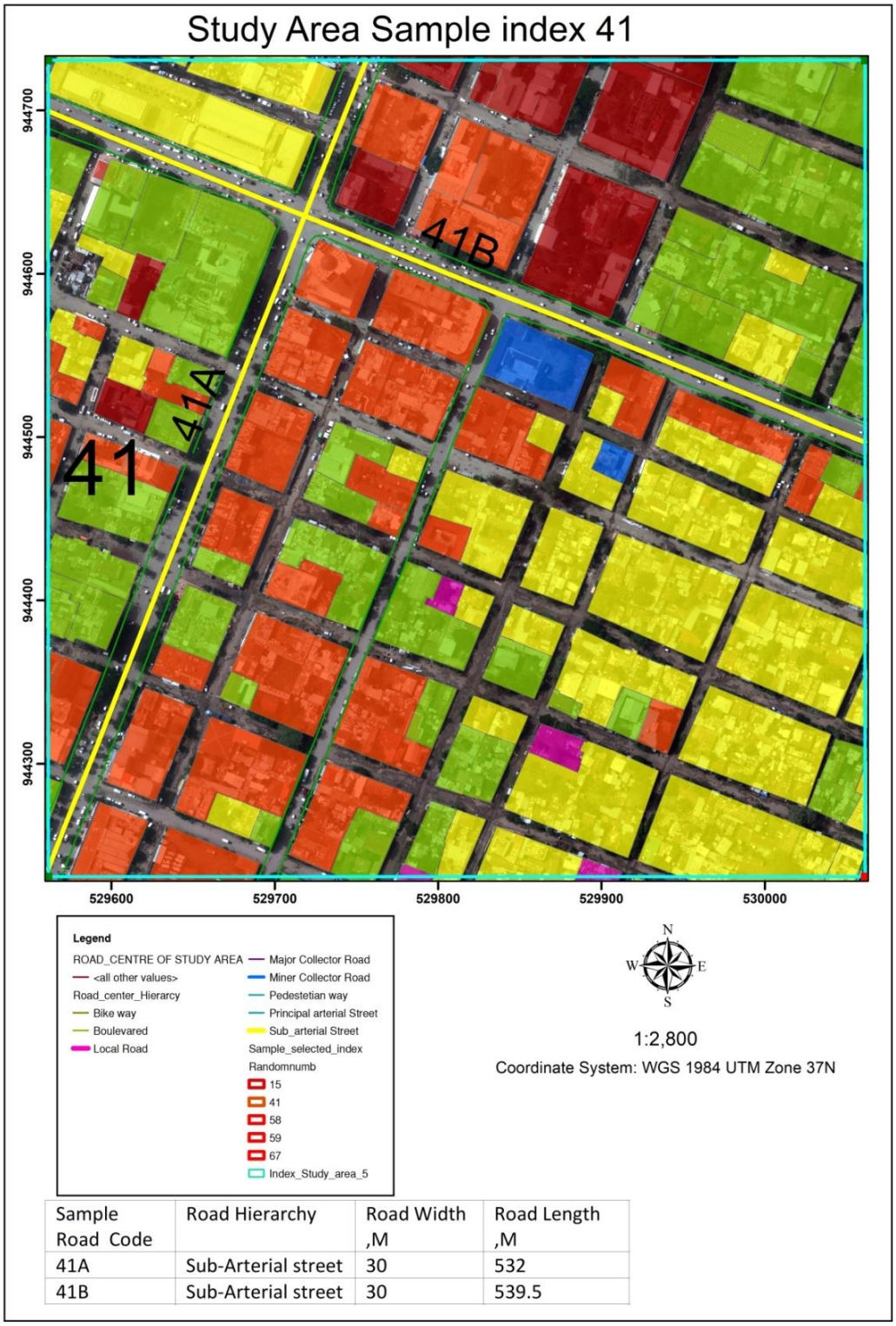
(Around Goroo high School



Sample Road Code	Road Hierarchy	Road Width ,M	Road Length ,M
59A	Sub-Arterial street	30	537.6
59B	Local Road	12	391.8

Figure 3.9.Select Sample index Study area and Raod Segment 59A
Source Structure plan of Adama city computed by Oromia planning institute 2019

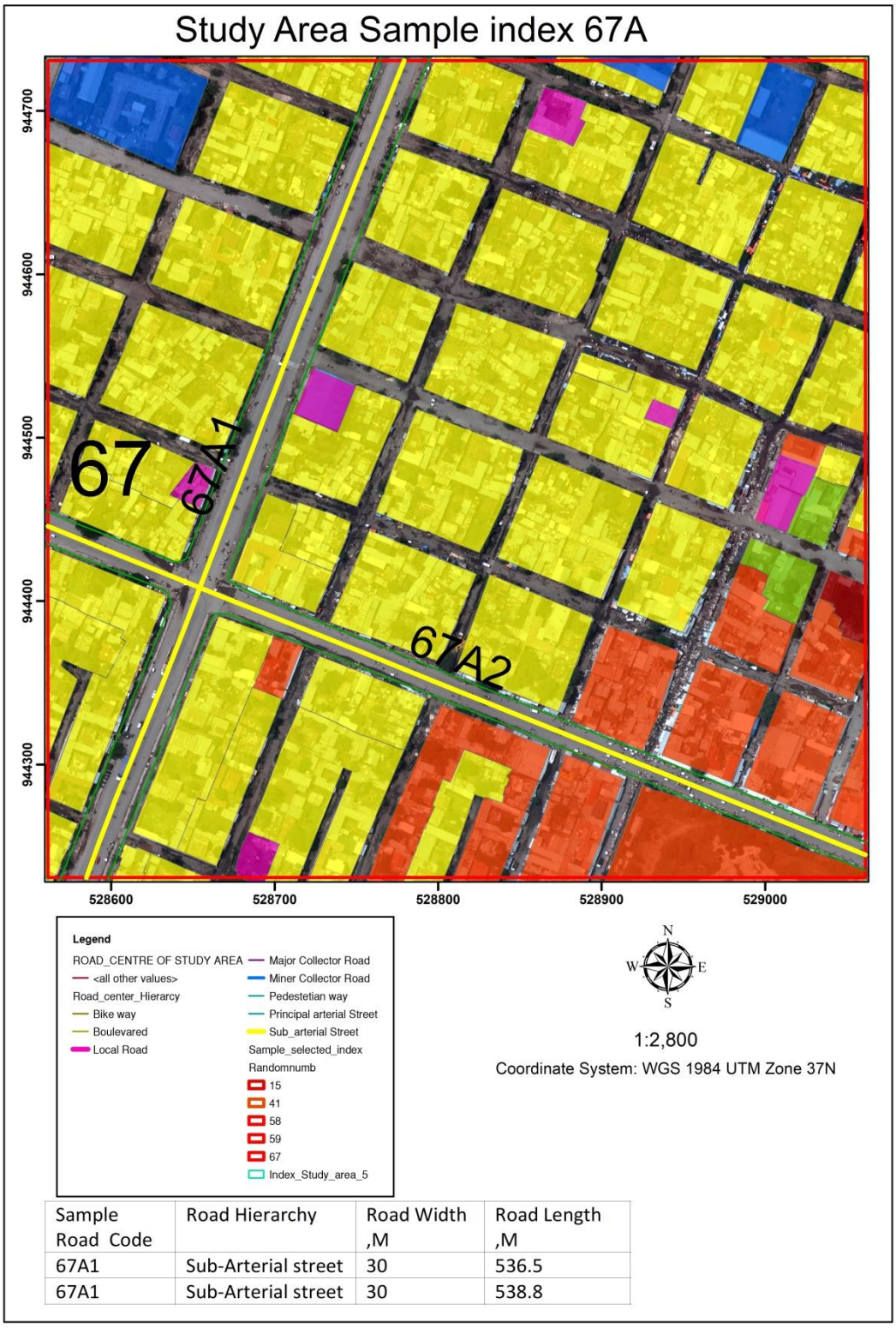
(Around Ts Maryam church)



Sample Road Code	Road Hierarchy	Road Width ,M	Road Length ,M
41A	Sub-Arterial street	30	532
41B	Sub-Arterial street	30	539.5

Figure 3.10.Select Sample index Study area and Raod Segment 41
Source Structure plan of Adama city computed by Oromia planning institute 2019

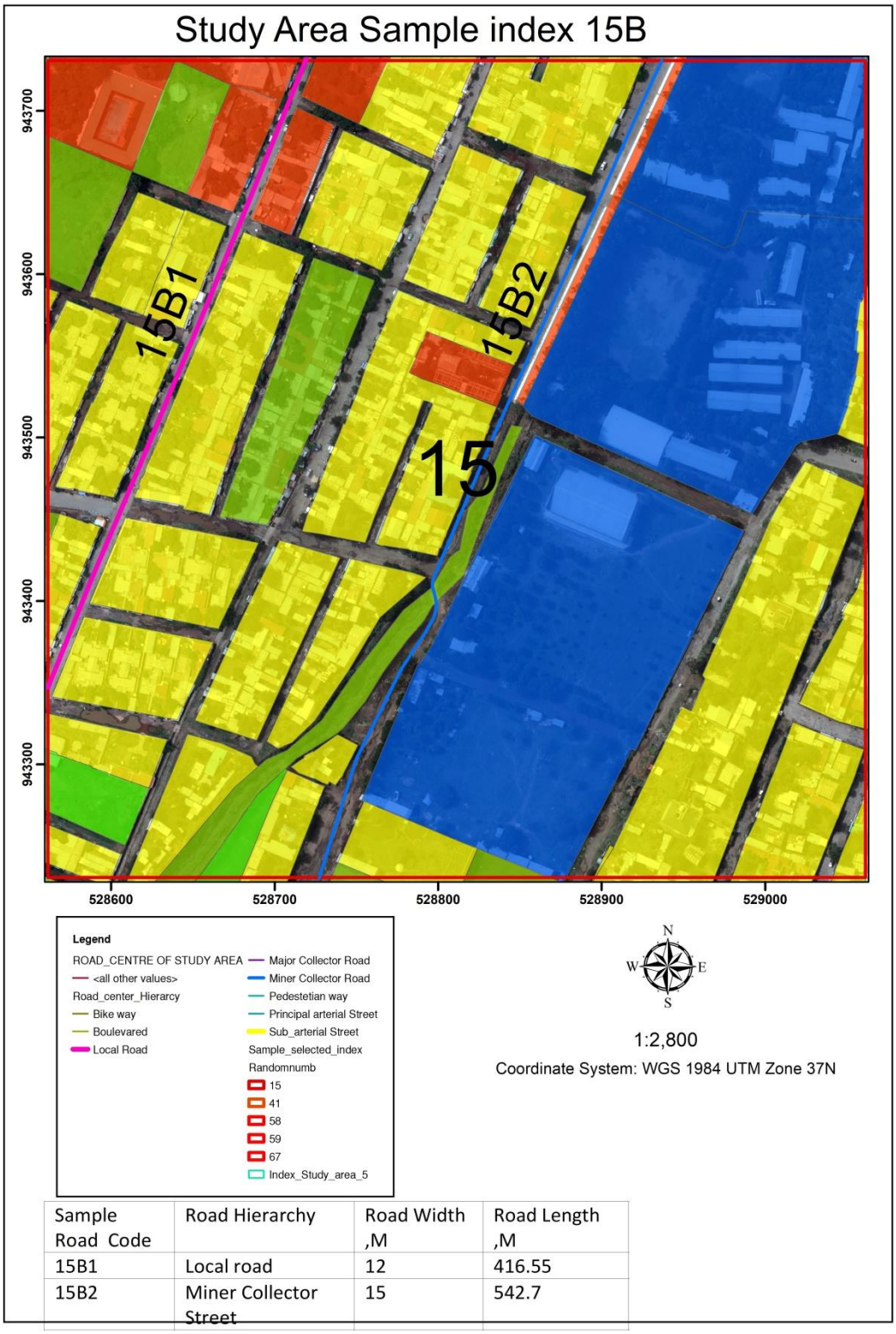
(Around Mebrat hayl Square)



Sample Road Code	Road Hierarchy	Road Width ,M	Road Length ,M
67A1	Sub-Arterial street	30	536.5
67A1	Sub-Arterial street	30	538.8

Figure 3.11.Select Sample index Study area and Raod Segment 67A
Source Structure plan of Adama city computed by Oromia planning institute 2019

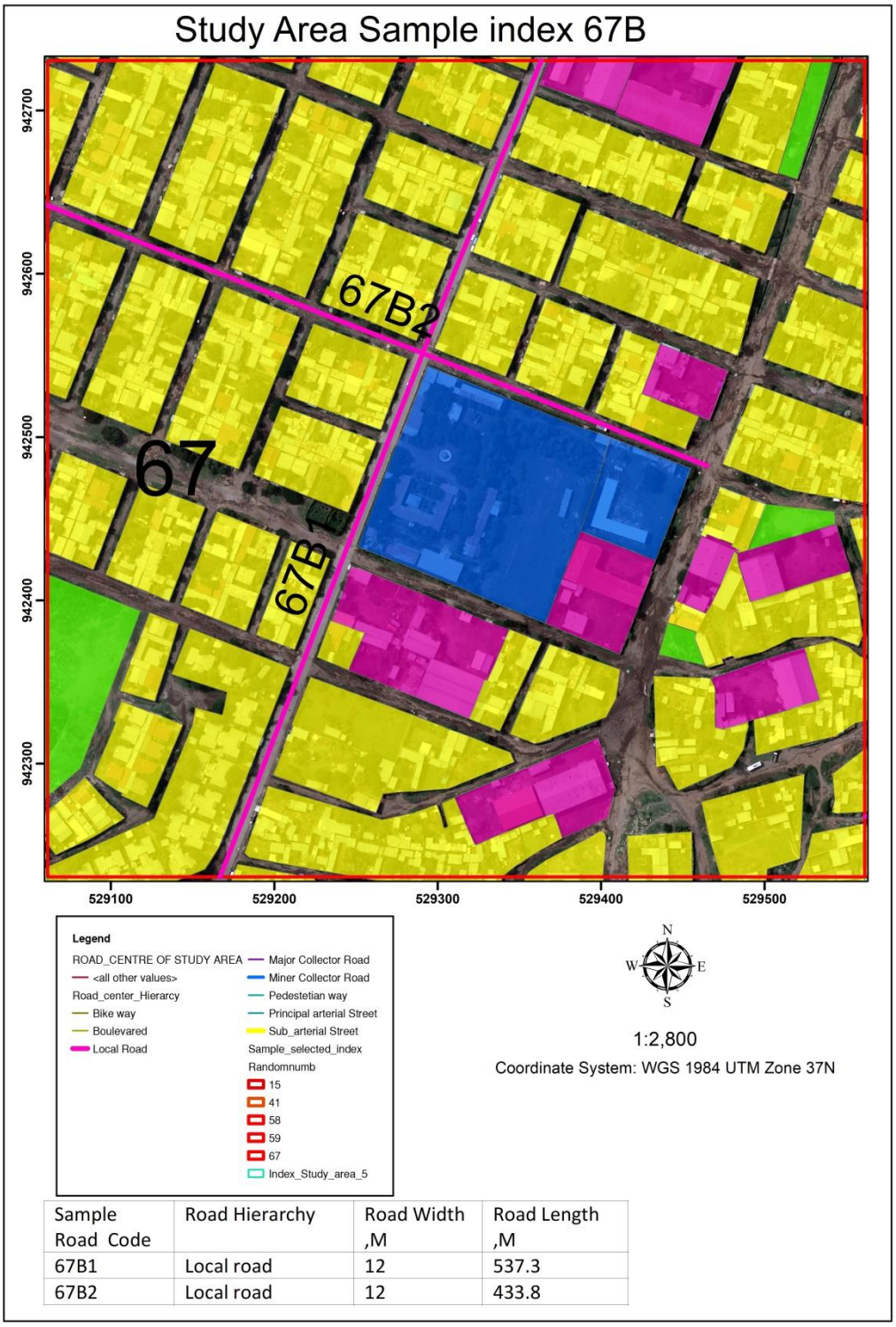
(Around Oda Health Center)



Sample Road Code	Road Hierarchy	Road Width ,M	Road Length ,M
15B1	Local road	12	416.55
15B2	Miner Collector Street	15	542.7

Figure 3.12.Select Sample index Study area and Raod Segment 15B
Source Structure plan of Adama city computed by Oromia planning institute 2019

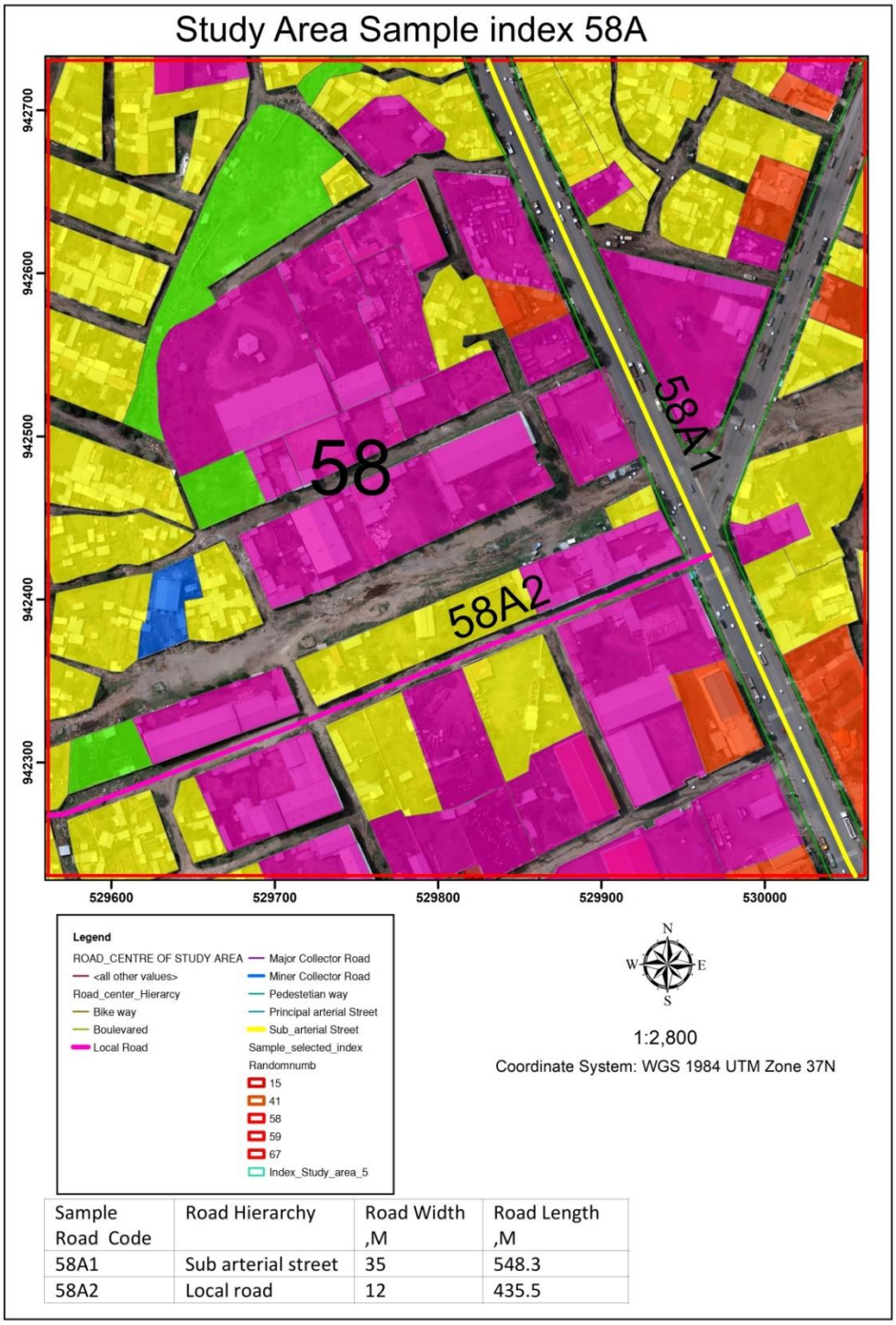
(Around Refit valley University)



Sample Road Code	Road Hierarchy	Road Width ,M	Road Length ,M
67B1	Local road	12	537.3
67B2	Local road	12	433.8

Figure 3.13.Select Sample index Study area and Raod Segment 67B
Source Structure plan of Adama city computed by Oromia planning institute 2019

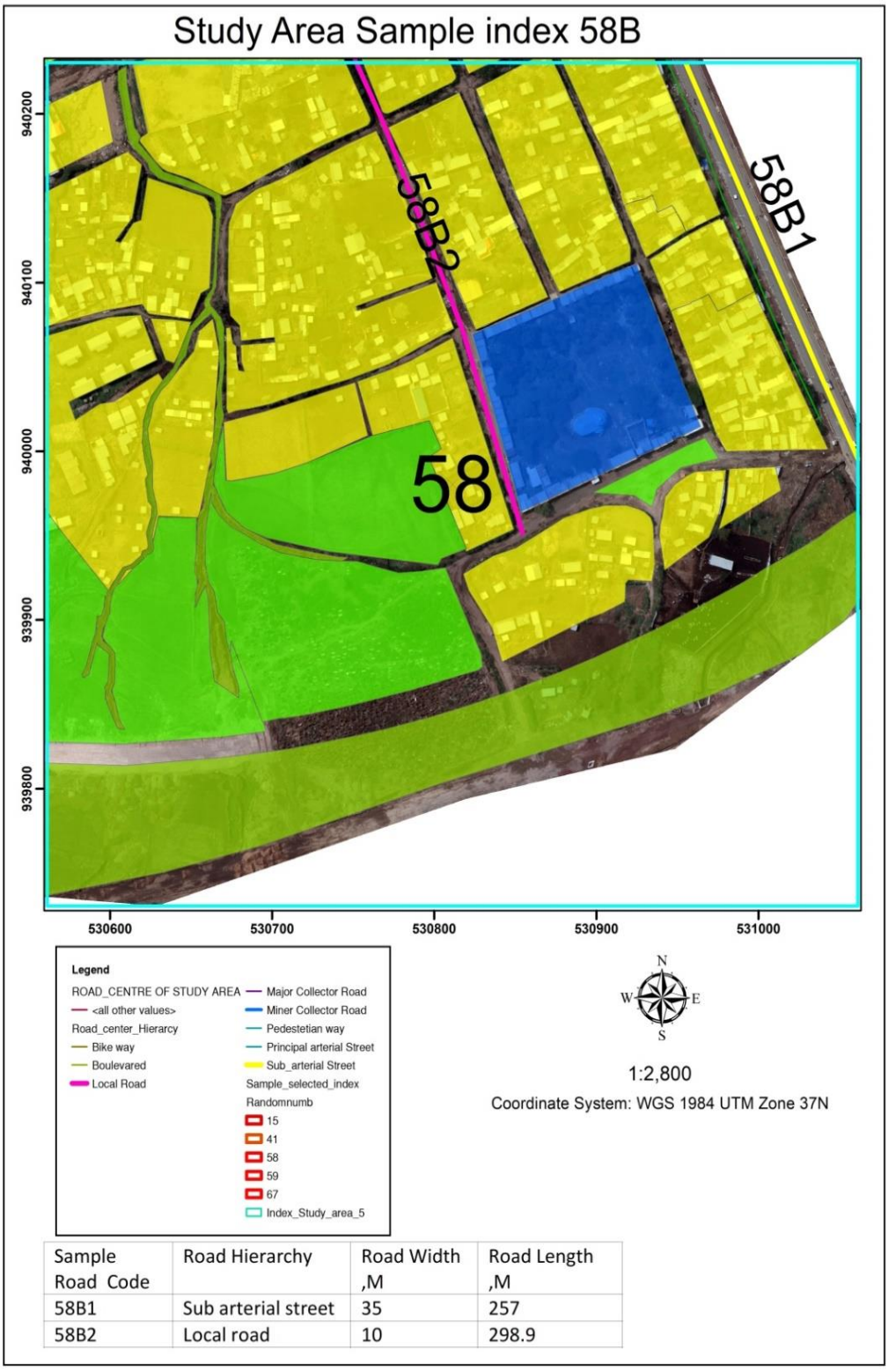
(Around Adama Boset Primary School)



Sample Road Code	Road Hierarchy	Road Width ,M	Road Length ,M
58A1	Sub arterial street	35	548.3
58A2	Local road	12	435.5

Figure 3.14.Select Sample index Study area and Raod Segment 58A
Source Structure plan of Adama city computed by Oromia planning institute 2019

(Around Catholic Eye Clinic)



Sample Road Code	Road Hierarchy	Road Width ,M	Road Length ,M
58B1	Sub arterial street	35	257
58B2	Local road	10	298.9

Figure 3.15.Select Sample index Study area and Raod Segment 58B
Source Structure plan of Adama city computed by Oromia planning institute 2019

(Around Boku Ts Michiel Church)

3.8. Research Method

The methodology was based on quantitative and qualitative data and reflected either supply-side factors (e.g. infrastructure provision) or demand-side concerns (e.g. pedestrian surveys). It is used in this study to calculate the Walkability Index and is based on the Global Walkability Index toolkit developed for the World Bank. Expanded GWI survey materials: that would allow the City to identify suggestions and recommendations for specific infrastructure and policy needs (Krambeck H. V., The Global Walkability Index, 2006).In mixed methods research, he uses both qualitative and quantitative methods for data collection and analysis to answer questions. The GWI Enhanced Surveys are a simple tool that allows cities to collect quantitative and qualitative data on the condition of existing pedestrian infrastructure, resident feedback on relevant pressing concerns, and a clear assessment of existing institutional capacity and policies to ensure safer and more convenient walking Pedestrian environments can be collected (Krambeck, Holly Virginia, 2006).

3.9. Research Approach

This study employs a combination of qualitative and quantitative research methods since it is helpful to gather the best results from each method. Since both approaches can be given the nature of the study and the descriptive research approach. To capture respondents' interests, viewpoints, and attitudes regarding walkability, a qualitative technique is employed. The physical infrastructure survey results are given a numerical description. Take into consideration cause and effect when deFinding independent(Componet) and dependent variables. An independent variable is the one you think is the cause, and a dependent variable is the main effect. This is how the table displays components and variables. A few lines are all that are included in the trial. Components are dependent variables and variables are independent variables (Krambeck, Holly Virginia, 2006).

Table 3.2 Global Walkability Index Summaries of Components and Variables (Krambeck, Holly Virginia, 2006)

Component	Variable
Safety and Security	1 Proportion of road accidents that resulted in pedestrian fatalities (most recent year avail.) 2 Walking path modal conflict 3 Crossing safety 4 Perception of security from crime 5 Quality of driver behavior
Convenient and Attractiveness	6 Maintenance and cleanliness of walking paths 7 Existence and quality of facilities for blind and disabled persons 8 Amenities (e.g., coverage, benches, public toilets) 9 Permanent and temporary obstacles on walking paths 10 Availability of crossings along major roads
Policy Support	11 Funding and resources devoted to pedestrian planning 12 Presence of relevant urban design guidelines 13 Existence and enforcement of relevant pedestrian safety laws and regulations 14 Degree of public outreach for pedestrian and driving safety and etiquette

Source the global walkability index research (Krambeck, Holly Virginia, 2006)

3.10. Research Design

The research uses a mixed design. Convergent parallel: Quantitative and qualitative data are collected simultaneously and analyzed separately. After both analyzes are completed, compare the mining results to draw general conclusions. The study identifies the causes and effects of why the situations occur. The aim is to identify the causes and effects of the occurrence of situations through analysis and critical evaluation of information and data in relation to existing facts. Following this, a descriptive method is planned to describe and provide the extent and extent of walkability and associated problems. This made it clear to see “what is” and to what extent on the real ground. In addition, it provides a detailed understanding of the situation through a physical infrastructure survey, a public survey and a pedestrian survey data collection tool. (Krambeck H. , 2006).

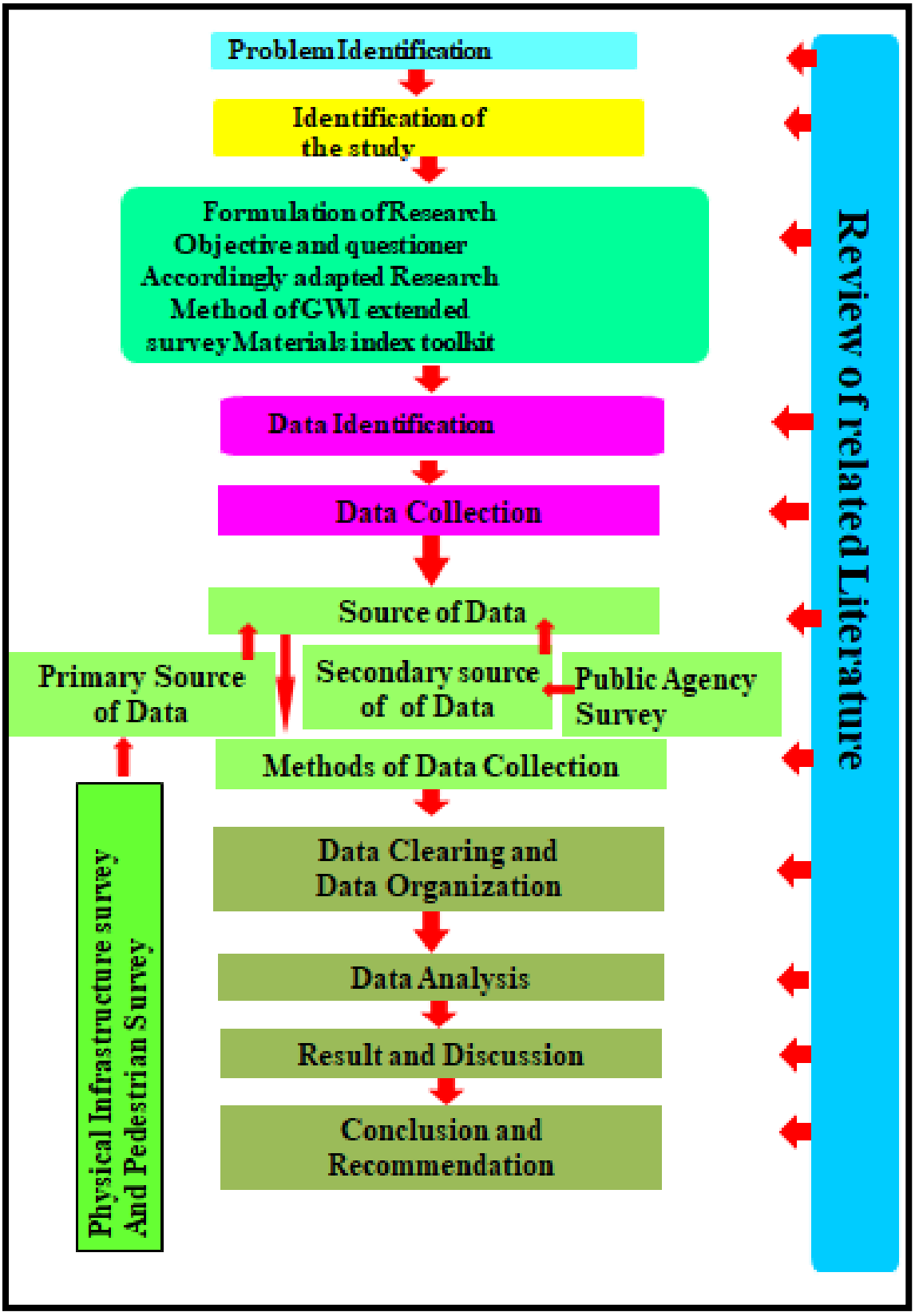


Figure 3.16: Research design outline
Organized by the author (February 2023)

3.10. Method of Data Collection

3.10.1. Data Type and Sources

The data sources of the study are both primary and secondary data. The primary data is a physical infrastructure survey, a pedestrian survey and observations. The secondary data are policy and strategy documents for public administration offices. The data collection methods had to be kept simple for practical implementation purposes, but their simplicity results in a less robust index, reducing its usefulness as a tool for investment and as a tool for policy reform. (Krambeck H. , 2006).

3.10.2.. Data collection tools

The methodology used in this work was adopted, with some modifications, from the Global Walkability Index Toolkit developed for the World Bank Extended Survey Materials (Krambeck H. , 2006). The Global Walkability a set of Extended Survey Materials, An index was developed that would allow cities to identify specific infrastructure and policy needs in addition to deriving the simple index ranking. The enhanced surveys are a simple tool that allows cities to collect quantitative and qualitative data on the condition of existing pedestrian infrastructure, resident feedback on relevant pressing concerns, and a clear assessment of existing institutional capacity and policies to ensure safe and convenient pedestrian environments (Krambeck H. , 2006).

3.10.2.1. Pedestrian survey questioner.

The Pedestrian Survey is intended to help us gather information about walkability that cannot be obtained through physical infrastructure surveys or public agency surveys, such as: E.g., night light conditions, purposes of walks, etc. To avoid complications in translating printed surveys and illiteracy, these surveys must be conducted orally. The surveys are carried out directly with the target group hikers by carrying out sample interviews at selected locations (Krambeck H. , 2006).

3.10.2.2 Physical infrastructure survey.

The physical infrastructure survey is intended to collect raw data on the availability and quality of pedestrian infrastructure. The Checklist can be completed by hand (one Checklist sheet per street). Regardless of the collection method, we assume that all data will eventually be entered into the provided Excel spreadsheet (Krambeck H. , 2006).

3.10.2.3. Public agency survey

Surveying public agencies is intended to help us gather information about walkability that is not available through physical infrastructure surveys or interviews with pedestrians, such as: Pedestrian fatality statistics and institutional capacity for pedestrian planning. The survey includes three different types of agencies (in some cities, these may overlap) (Krambeck H. , 2006).

I. . Agency responsible for transportation planning
II. . Agency responsible for city planning
III. . Agency responsible for traffic safet

3.11. Data analysis and interpretation

Data from both primary and secondary sources is analyzed and provided in the form of reports, physical infrastructure survey and pedestrian survey areas. the data is classified, processed and analyzed accordingly; while the rest is always saved for future reference during study. The qualitative data reflecting the respondents' opinions and suggestions are summarized in the text. Quantitative data is analyzed for its link in describing the variables and presented in tables, graphs, charts and maps: primarily to complement the qualitative description. Computer software such as Excel, SPSS, Auto-CAD and Arc GIS are used for analysis.

3.12. Ethical Considerations.

The nature, aim and objectives of the research are explained to the respondents and they are given the opportunity to ask questions related to the research. Confidentiality is ensured by not including the respondent's informal name in the questionnaires. The researcher will consider the following when conducting the research. The researcher respects the culture, values and views of residents and other peoples while collecting information relevant to the study. The researcher will also acknowledge the work of others that he or she considers useful to the research. In addition, the researcher tries to avoid personnel bias and stick to expertise and on-site reality.

CHAPTER FOUR

4 Results and Discussion

4.1. Introduction

This chapter triangulates the results of the study as much as possible to verify the validity of the data and provide an in-depth understanding of the issues examined. Analyzing the data collected based on the stated research objectives and producing findings that answer the research questions of the study were discussed. The data collected from various sources using different types of data collection techniques were discussed. The study results of the physical infrastructure survey, pedestrian survey interview and public authority survey were analyzed. The analysis mainly focuses on evaluating security, evaluating Convenient and attractiveness, and predicting key political support. The analyzes of the data are presented in tabular form and in figures or pictorial representation. This chapter contains the researcher's original work or contribution. In the discussion section interpret the results in detail. The purpose of the discussion is to highlight the significance of the study and describe the limitations of the study and its implications. In addition, the results of the study were generally described using appropriate presentation tools such as descriptive statistics (tables and figures). Finally, the chapter analyzes the recommended possible suggestions for assessing pedestrian walkability in the study area

4.2. General discussion of the area of study

4.2.1. Physical Survey area selected by random Spatial Selection

4.2.1.1. Time of Day

Location considerations also include time of day considerations (note that specific peak times of the day may vary from city to city). However, if limited resources prove that multiple visits are not feasible, then conducting surveys in my study contact only during local peak hours may be an option (Krambeck H. , 2006). The researcher analyzes all time and budget constraints and decides to conduct the survey between 6:00 and 9:00 local.AM time. Even when the survey was conducted during the local rush hour, as shown in Table 4.1, twelve main streets were full of pedestrians and four main streets were less than rush hour.

Table 4.1 Crosstabs Roads vs. Peak travel time

Crosstabs Roads vs. Peak travel time				
		Peak travel time		Total
		Non-peak	Peak	
survey Road	Road _15A1	-	1	1
	Road _15B1	-	1	1
	Road _15B2	-	1	1
	Road _41A	-	1	1
	Road _41B	-	1	1
	Road _58A1	-	1	1
	Road _58A2	-	1	1
	Road _58B1	-	1	1
	Road _58B2	1	-	1
	Road _59A	-	1	1
	Road _67A1	-	1	1
	Road _67A2	-	1	1
	Road _67B2	1	-	1
	Road_15A2	1	-	1
	Road_59B	-	1	1
	Road_67B1	1	-	1
Total		4	12	16

Source: Compiled from physical infrastructure survey (road, waling path, amenities) checklist Organized by the author (February 2023)

4.2.1.2. Surrounding land use

The GWI methodology use spatial random sample to select the study survey area (Krambeck H. , 2006). Using this methods and extract eight sample survey area those have 8*25ha =200ha. The extract sample road cover every sample survey area select two road total 7.79 ha, Coble surface cover 2.63 Km or 33.75%, Gravel surface cover 0.73 Km or 9.37% and Asphalt Surface cover 4.43Km or 56.37%. These selecting Starch road only asphalt cover has separated walkway the rest coble and gravel cover road have no separated walkway. Also shown below on table 4.1 land use cover and Figure 4.1-4.8 of ROW selected road thoes nine Starch road cover with Commercial/Retail, throes two Starch road cover with Medium-Income Residential, and throes five Starch road cover with Low-income residential.

Table 4.2.Crosstabs of surrounding land use vs. Peak travel time

Crosstabs Surrounding land use vs. Peak travel time				
		Peak travel time		Total
		Non-peak	Peak	
Surrounding land use (check all that are the most prevalent)	Commercial/Retail	0	9	9
	Medium-Income Residential	0	2	2
	Low-income residential	4	1	5
Total		4	12	16

Source: Compiled from physical infrastructure survey (road, waling path, amenities) checklist. Organized by the author (February 2023)

4.2.2. Public Agency Survey

Information about walkability, such as pedestrian fatality statistics and institutional capacity for pedestrian planning, that cannot be obtained through physical infrastructure surveys or interviews with pedestrians, is collected using the public agency survey. The researcher had conducted a survey in the municipal transportation planning department of the community; The city planning team and he received enough information.

The City's Transport planning Office has non-motorized planning program the department organized by 87 permanent workers with the proportion of 30 females workers and 57 male workers. As developing County City office budget Sufficient only to meet very few program goals; But in all this the city had Structural plan; development of very aspect regulate by the plan also it had Road network plan incorporate pedestrian walkway.

Transport planning Office had annual report 2021/2022 on the proportion of all trips (to work, shopping, school, etc.) Automobile had .02% share, Motorized two-wheeler had 1.70 % share, Public min bus had 13.62 % share, Bicycle had 0.81 % share, Walking had 81.62 % share, hours cart had 2.23 % share.

4.2.3. Pedestrian Survey

4.2.3.1. Informants by Sex

Analyzing the status of gender type helps to understand how much both male and female individuals are clearly participated in this particular research paper. Hence based on the collected data with the prepared questionnaire, out of 200 individuals, 56.5 % were male and 43.5 % were female for the case of the Spatial random survey study area which was selected stretch road. The number of females is lower than that of male at that peak time.

Table 4.3.Pedestrian Survey Gender Proportion

Frequency of Pedestrian Survey Gender Proportion				
		Frequency	Percent	Cumulative Percent
Gender	Female	87	43.5	43.5
	Male	113	56.5	100.0
	Total	200	100.0	

Source: Compiled from Pedestrian Survey Questioner Organized by the author (February 2023)

4.2.3.2. People with Disability

Analyzing the status of disability helps to understand proportion of people with Disability teak to account in very public concern.as shown in table 4.3 out of 200 samples 3 of them ware with Disability.

Table 4.4. People with Disability Proportions

Frequency of People with Disability Proportions					
		Frequency	Percent	Valid Percent	Cumulative Percent
Disabled	Yes	3	1.5	1.5	1.5
	No	197	98.5	98.5	100.0
	Total	200	100.0	100.0	

Source: Compiled from Pedestrian Survey Questioner Organized by the author (February 2023)

4.2.3.3. Children living with Informants at present

Analyzing the Informants living small children at present with helps to understand proportion of people with children in road user teak to account in very public concern.as shown in table 4.4 out of 200 samples 43 of them ware living with children Informants at present.

Table 4.5 Frequency of Have small children living with Informants at present

Frequency of Have small children living with Informants at present				
		Frequency	Percent	Cumulative Percent
children (living with Informants at present)	Yes	43	21.5	21.5
	No	157	78.5	100.0
	Total	200	100.0	

Source: Compiled from Pedestrian Survey Questioner Organized by the author (February 2023)

4.2.3.4. Informants by Age

The study involved individuals with various ages particularly starting from those who were able to commute from and to home while travelling to their respective destinations, which were of course either work place or service areas or both. Thus regarding the informant's age of the surveyed questionnaire, the following Table 4.5 shows the age of each individuals within group 10-19 had proportion of 35%, 20-39 had proportion 49.5% and 40-59 had proportion of 15%.

Table 4.6 Frequency of Informants Age by group

Frequency of Informants Age by group					
		Frequency	Percent	Valid Percent	Cumulative Percent
group	10-19	71	35.5	35.5	35.5
	20-39	99	49.5	49.5	85.0
	40-59	30	15.0	15.0	100.0
	Total	200	100.0	100.0	

Source: Compiled from Pedestrian Survey Questioner Organized by the author (February 2023)

4.2.3.5. Income Level of Informants

From the collected data using the questionnaire survey Females Low income 63 Medium 24 and Male Low income 75 Medium 37 high income 1 Table 4.6 shows the income status of the Informants

Table 4.7. Crosstabs Gender vs. Income Level

Crosstabs Gender Vs. Income Level					
		Low.	medium	high	
Gender	Female	63	24	0	87
	Male	75	37	1	113
Total		138	61	1	200

Source: Compiled from Pedestrian Survey Questioner Organized by the author (February 2023)

4.2.3.6. Walking Profile

The Informants walking time per day and walking time to work each day analyze informants Time spend per day walking 31-60 minutes have maximum which is 139 out of this minutes 0-15 spent walking to work as shown in table 4.6 this direct quality of Walkway permeable and assessable to minimize time spent on road .

Table 4.8 Crosstabs Time spend per day walking Vs. Time spend walking to work each day (minutes)

Crosstabs Time spend per day walking Vs. Time spend walking to work each day (minutes)					
		Time spend per day walking (minutes)			Total
		16-30	31-60	60 and above	
Time spend walking to work each day	0-15	19	139	6	164
	16-30	-	8	19	27
	31-60	-	-	9	9
Total		19	147	34	200

Source: Compiled from Pedestrian Survey Questioner Organized by the author (February 2023

4.3. To evaluate the Safety and Security of Adama city pedestrian walkway.

The evolution of safety and Security is done by analyzing the following five variables quantitative or qualitative data from data collected by physical survey checklist, pedestrian interviews questioner, and observation collected photos.

I. Proportion of road accidents that resulted in pedestrian fatalities
II. Walking path modal conflict
III. Crossing safety
IV. Perception of security from crime
V. Quality of motorist behavior.

4.3.1. Road accidents that resulted in pedestrian fatalities.

The World Health Organization (WHO) estimates that there are 27,326 road deaths in Ethiopia, or 27 deaths per 100,000 inhabitants. Poor road design, driver negligence and vehicle technical problems are the main causes of accidents. The most vulnerable road users, such as cyclists and pedestrians, bear the greatest burden in terms of fatalities and injuries. Most road deaths in Ethiopia, or 37% of all deaths, are caused by pedestrians (MoT, 2020). Adama City's 2021/2022 Annual Report revealed that; “Road accidents are the leading cause of death for young people worldwide, particularly between the ages of 15 and 29. Year on year, the average number of road accidents in Ethiopia has increased, with Oromia Regional State responsible for these accidents." Majority of fatalities." "The 2013 Oromia Police Commission report shows that Adama City is a significant contributor to the suffering caused by road accidents in the Oromia region. For example, in 2012, the Oromia region was responsible for 1050 road accidents, with Adama City responsible for 313 (29.8%) of these accidents. Furthermore, the report stated that Adama City is the most vulnerable city and accounts for a significant share of the suffering caused by road accidents in the Oromia Region. Therefore, traffic accidents are a problem throughout Ethiopia and especially in Adama City.” Therefore, the distributions of traffic accidents have proven to be more serious.

4.3.2. Walking path modal conflict

Walking path modal conflict this parameter indicates the conflict that pedestrians encounter when crossing the road or walking along the roadway or walkway (Abley, 2011)

As shown in Table 4.6 Crosstabs People walking in the street (not on a walking path) and. Peak travel time out of 16 road sections 12 roads are peak time 94.44% of people in five-minute walking mixing with another transport mode which shows a more severe mobility trend. Also Table 4.7 Crosstabs Pedestrian congestion and. Conflicts between pedestrians and other modes indicate out of 16 road sections 9 road section roads are served top half full Pedestrian congestion under conditions of Significant conflict, walking possible, but dangerous shows sever trained. In addition, Table 4.8 Frequency Safety to walk in this area 40% moving dangerous 51 % moving unsure this date also declare safety under demand. A closer look at Figure 4.1 collecting the study area this line and magnified tables analysis output truth and shows study areas risky pedestrian movement; that indicate not Safe meantime of assessing walkability.

Table 4.9 Crosstabs People walking in street (not on walking path) and. Peak travel time

People walking in street (not on walking path) Vs. Peak travel time						
		Peak travel time		Total	Total People walk peak/nonpeak	%
		Non-peak	Peak			
People walking in street (not on walking path)	4	1	-	1	27	5.56
	6	1	-	1		
	8	1	-	1		
	9	1	-	1		
	23	-	1	1	459	94.44
	25	-	1	1		
	30	-	1	1		
	31	-	1	1		
	32	-	1	1		
	34	-	1	1		
	35	-	1	1		
	43	-	1	1		
	44	-	1	1		
	45	-	1	1		
	53	-	1	1		
	64	-	1	1		
Total		4	12	16	486	

Source: Compiled from physical infrastructure survey (road, waling path, amenities) checklist. Organized by the author (February 2023)

Table 4.10 Crosstabs Pedestrian congestion Vs. Conflicts between pedestrians and other modes

Pedestrian congestion Vs. Conflicts between pedestrians and other modes (bicycles, etc.)				
		Conflicts between pedestrians and other modes (bicycles, etc.)		Total
		Significant conflict, walking possible, but dangerous	Some conflict -- walking is possible, but dangerous	
Pedestrian congestion (1-5 point scale -- see guide)	non-empty	0	2	2
	half-full	1	2	3
	Top half full	9	2	11
Total		10	6	16

Source: Compiled from physical infrastructure survey (road, waling path, amenities) checklist Organized by the author (February 2023)

Table 4.11 Frequency Safety to walk in this area

Frequency Safety to walk in this area					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Dangerous	80	40.0	40.0	40.0
	unsure	102	51.0	51.0	91.0
	Safe	18	9.0	9.0	100.0
	Total	200	100.0	100.0	

Source: Compiled from Pedestrian Survey Questioner Organized by the author (February 2023)

Source field survey(febroury 2023)

Figure4.17 walking path modal conflict source the researcher

4.3.3. Crossing safety

Road crossing movement should consider all road user people that mean children, elders, people with disabilities, and people with children. But as shown in Table 4.9 Crosstabs Survey Road and Road Crossing Safety from traffic accident; out of 12 roads which have crossing zebras 8 roads are dangerous Safety from traffic accidents and the rest 4 roads are unsure Also Table 4.10 Crosstabs Road Safety from a traffic accident and Traffic Management that shows the traffic police manage traffic movement under this situation out of 12 roads 7 roads under Road Safety dangerous from a traffic accident in addition closer look at figure 4.2 crossing safety some crossing point have no crossing zebra in another way even if crossing point shaded the people not use it. The table and figure analysis shows in the study area road Crossing is not safe during the research time. Table 4.9 Crosstabs Survey Road vs. Road Crossing Safety from traffic accident

Table 4.12.Survey Road vs. Road Crossing Safety from traffic accident

Survey Road vs. Road Crossing Safety from traffic accident				
Survey Road		Safety from traffic accident		Total
		dangerous	Unsure	
Road Code	Road _15A1	2	-	2
	Road _41A1	3	-	3
	Road _41A2	3	-	3
	Road _58A1	-	1	1
	Road _58B1	-	1	1
	Road _67A2	-	1	1
	Road_67A1		1	1
Total		8	4	12

Source: Compiled from physical infrastructure survey (road, waling path, amenities) checklist Organized by the author (February 2023)

.

Table 4.13 Crosstabs Road Safety from traffic accident and Traffic Management

Road Safety from traffic accident Vs. Traffic Management				
		Traffic Management		Total
		Traffic police	None	
Road Safety from traffic accident	dangerous	7	1	8
	Unsure	2	2	4
Total		9	3	12

Source: Compiled from physical infrastructure survey (road, waling path, amenities) checklist Organized by the author (February 2023)

.

Source field survey(febroury 2023)

Figure 4.18 crossing safety

4.3.4. Perception of security from crime

Infrastructure reducing crime such as Street lights Shown in Table 4.11 Crosstabs roads and street lights out of 16 road segments only 8 road segments have Street lights this shows the rest 8 road fall under crime suspension. And other Table 4.12 Crosstabs Survey Road and. Road Security from crime out of 8 segments road there is 12 road crossing point 9 are dangerous Security from crime and the rest are unsure.in addition, other Table 4.13 Respondent Frequency of Security to walk in this area Shows the frequency respondent of dangerous 37% and the frequency of unsure 52.5%. A closer look at Figure 4.3 Perception of security from crime the figure shows the absence of Street light provision. The table and figure analysis shows the study areas were not secure during research time.

Table 4.14 Crosstabs Roads and Street lights

Roads and Street lights (total number on one side)						
		Street lights (total number on one side)				Total
		8	9	11	12	
Survey Roads	Road _15A1	-	1	-	-	1
	Road _41A	-	-	1	-	1
	Road _41B	-	-	-	1	1
	Road _58A1	-	-	1	-	1
	Road _58B1	1	-	-	-	1
	Road _59A	-	-	-	1	1
	Road _67A1	-	-	1	-	1
	Road _67A2	-	-	1	-	1
Total		1	1	4	2	8

Source: Compiled from physical infrastructure survey (road, waling path, amenities) checklist Organized by the author (February 2023)

Table 4.15 Crosstabs Survey Road and. Road Security from crime

Survey Road Vs. Road Security from crime				
Survey Road		Security from crime		Total
		dangerous	Unsure	
Road Code road crossing piont	Road _15A1	1	1	2
	Road _41A1	3	-	3
	Road _41A2	2	-	2
	Road _58A1	1	-	1
	Road _58B1	1	-	1
	Road _67A2	-	1	1
	Road_41A2	1	-	1
	Road_67A1	-	1	1
Total		9	3	12

Source: Compiled from physical infrastructure survey (road, waling path, amenities) checklist Organized by the author (February 2023)

Table 4.16 Respondent Frequency of Security to walk in this area

Security to walk in this area					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	very dangerous	1	.5	.5	.5
	Dangerous	74	37.0	37.0	37.5
	Unsure	105	52.5	52.5	90.0
	Safe	20	10.0	10.0	100.0
	Total	200	100.0	100.0	

Source: Compiled from Pedestrian Survey Questioner Organized by the author (February 2023)

Source field survey(febroury 2023)

Figure 4.19 Perception of security from crime

4.3.5. Quality of Driver behavior

The motorist behavior has higher shear of traffic mobility safe. Shown in Table 4.14 Respondent Frequency of Motorists Failing to yield to people crossing the street Motorists Fail to yield the respondent respond rarely 53%, sometimes respond 46.5% and often respond 0.5%; sometimes respondents 46.5% indicate motorist behavior uncomfortable to secure safety. In addition on Table 4.15 Respondent Frequency of Motorists Driving too Fast shows that the respondent responds rarely 53%, sometimes respond 46.5% and often respond 0.5%; sometimes respondent 46.5% indicate motorist behavior rough to secure safety. The two-table analysis indicates that bad motorist behavior highly influences the study areas making it unsafe in the meantime of research.

Table 4.17 Respondent Frequency of Motorists Fail to yield to people crossing the street

Motorists Fail to yield to people crossing the street					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Rarely	106	53.0	53.0	53.0
	Sometimes	93	46.5	46.5	99.5
	Often	1	.5	.5	100.0
	Total	200	100.0	100.0	

Source: Compiled from Pedestrian Survey Questioner Organized by the author (February 2023)

Table 4.18 Respondent Frequency of Motorists Drive too fast

Motorists Drive too fast					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Rarely	106	53.0	53.0	53.0
	Sometimes	93	46.5	46.5	99.5
	Often	1	.5	.5	100.0
	Total	200	100.0	100.0	

Source: Compiled from Pedestrian Survey Questioner Organized by the author (February 2023)

4.4. To assess the Convenient and attractiveness of Adama city pedestrian walkways.

Similar to how Convenient and attractiveness are evaluated, quantitative or qualitative data from physical survey checklists, pedestrian interviews, public agency questionnaires, and observation-collected photographs are used to analyze the following five variables.

I. Maintenance and cleanliness of walking paths
II. Existence and quality of facilities for blind and disabled persons
III. Amenities
IV. Permanent and temporary obstacles on walking paths
V. Availability of crossings along major roads

4.4.1. Maintenance and cleanliness of walking paths

Walkway is one and important public space in sustainable environment in case of this study area shown Table 4.16 Respondent Frequency of Convenient of walk paths in Survey area 27.5%,53.5%and 19% bad, fair and good respectively. The first two Choice indicate the study area is not Convenient residence also Table 4.17 Crosstabs Road Code and Cleanliness shows 8 road segments,7 road segments and 1 road segment which is Minor obstacle; degrades environment, Rubbish makes walking difficult; degrades environment and Rubbish makes walking impossible, ruins environment consecutively. As shownTable 4,18 study area 50% road segments not Convenient a closer look at Figure 4.4. Maintenance and cleanliness walkway not maintain and clear and occupied by Contraction left material. All table and figure analysis shows study area walkway path is not Convenient in the meantime of the research

Table 4.19 Respondent Frequency of Convenient of walk paths in Survey area

Convenient of walk paths in Survey area					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	bad	55	27.5	27.5	27.5
	fair	107	53.5	53.5	81.0
	Good	38	19.0	19.0	100.0
	Total	200	100.0	100.0	

Source: Compiled from Pedestrian Survey Questioner Organized by the author (February 2023)

Table 4.20 Crosstabs Road Code and Cleanliness

Road Code		Cleanliness			Total
		Rubbish makes walking impossible, ruins environment	Rubbish makes walking difficult; degrades environment	Minor obstacle; degrades environment	
Roads	Road _15A1	-	-	1	1
	Road _15B1	-	-	1	1
	Road _15B2	-	-	1	1
	Road _41A	-	-	1	1
	Road _41B	-	-	1	1
	Road _58A1		1		1
	Road _58A2	1	-	-	1
	Road _58B1	-	1	-	1
	Road _58B2	-	1	-	1
	Road _59A	-	-	1	1
	Road _67A1	-	1	-	1
	Road _67A2	-	1	-	1
	Road _67B2	-	1	-	1
	Road_15A2	-	-	1	1
	Road_59B	-	-	1	1
	Road_67B1	-	1	-	1
Total		1	7	8	16

Source: Compiled from physical infrastructure survey (road, waling path, amenities) checklist Organized by the author (February 2023)

Table 4.21 Crosstabs Roads and Maintenance and Pavement Quality

Roads Vs. Maintenance and Pavement Quality						
Count						
Survey Road		Maintenance and Pavement Quality				Total
		Separate paving for walking path not present	Paving is mostly dirt, covered with mud, poor condition	some paving, party smooth, poor condition	Paved and walk able, not well maintained	
Roads Code	Road _15A1	-	-	1	--	1
	Road _15B1	1	-	-	-	1
	Road _15B2	1	-	-	-	1
	Road _41A	-	-	1	-	1
	Road _41B	-	-	1	-	1
	Road _58A1	-	-	-	-	1
	Road _58A2	1	-	-	-	1
	Road _58B1	1	-	-	-	1
	Road _58B2	1	-	-	-	1
	Road _59A	-	-	-	1	1
	Road _67A1	-	-	1	--	1
	Road _67A2	-	-	1	--	1
	Road _67B2	-	1	-	-	1
	Road_15A2	1	-	-	-	1
	Road_59B	1	-	-	-	1
	Road_67B1	1	-	-	-	1
Total		8	2	5	1	16

Source: Compiled from physical infrastructure survey (road, waling path, amenities) checklist Organized by the author (February 2023)

Table 4.22 Crosstabs Roads and road Width

Roads and Width (most commonly occurring) in meters								
		Width (most commonly occurring) in meters						Total
		2.10	2.40	3.10	3.20	3.50	4.00	4.30
Roads	Road _15A1	-	1	-	-	-	-	-	1
	Road _41A	-	-	1	-	-	-	-	1
	Road _41B	-	-	-	-	-	-	1	1
	Road _58A1	-	-	-	-	-	-	-	1
	Road _58B1	-	-	-	-	1	-	-	1
	Road _59A	-	-	-	1	-	-	-	1
	Road _67A1	-	-	-	-	-	1	-	1
	Road _67A2	1	-	-	-	-	-	-	1
Total		1	1	1	1	1	2	1	8

Source: Compiled from physical infrastructure survey (road, waling path, amenities) checklist Organized by the author (February 2023)

Source field survey(febroury 2023)

Figure.4.20. Maintenance and cleanliness

4.4.2. Existence and quality of facilities for blind and disabled persons

Public infrastructure provides for all without segregation of people with disability but in the Study area As shown in Table 4.20 Crosstabs Roads and Infrastructure for disabled 50% of road segments No infrastructure for disabled persons available 43.75% Limited infrastructure available, not in usable condition and 6.25 % Infrastructure present in good condition but in poorly placed closer look at figure 4.5 the Pavements not good condition for people with blindness and also Figure.4.6. Open ditches beside the sidewalk path vulnerable for the accident. In the end, the above analysis shows there are no suitable walkways for blind and disabled persons in the study area during the period of research.

Table 4.23 Crosstabs Roads and Infrastructure for disabled

Roads Vs. Infrastructure for disabled (ramps, blind paths, etc.)					
Count					
Survey Road		Infrastructure for disabled (ramps, blind paths, etc.)			Total
		No infrastructure for disabled persons available	Limited infrastructure available, not in usable condition	Infrastructure present in good condition but in poorly placed	
Roads Code	Road _15A1	-	1	-	1
	Road _15B1	1	-	-	1
	Road _15B2	1	-	-	1
	Road _41A	-	1	-	1
	Road _41B	-	1	-	1
	Road _58A1	-	1	-	1
	Road _58A2	1	-	-	1
	Road _58B1	-	1	-	1
	Road _58B2	1	-	-	1
	Road _59A	-	-	1	1
	Road _67A1	-	1	-	1
	Road _67A2	-	1	-	1
	Road _67B2	1	-	-	1
	Road_15A2	1	-	-	1
	Road_59B	1	-	-	1
	Road_67B1	1	-	-	1
Total		8	7	1	16

Source: Compiled from physical infrastructure survey (road, waling path, amenities) checklist Organized by the author (February 2023)

Source field survey(febroury 2023)

Figure.4.21 quality of facilities for blind and disabled persons

Source field survey(febroury 2023)

Figure.4.22. Open ditches

4.4.3. Amenities

Amenities are public space furniture as shown in Table 4.22 Crosstabs Roads and. Trees out of 16 roads segments study only the 5 road segments have three cover and Table 4.23 Crosstabs Roads and List available amenities shows in study areas only bins install 10 road segment the rest even not have bins. And also Figure.4.7 Amenities; shows not having public space benches, covers and the like. this Amenities analysis table and the figure show the absence of amenities install in the study area in the meantime of research.

Table 4.24 Crosstabs Roads and. Trees

Roads Vs. Trees (total number on one side)							
Survey Road		Trees (total number on one side)					Total
		76	77	80	112	120	
Roads Code	Road _41A	1	-	-	-	-	1
	Road _41B	-	-	1	-	-	1
	Road _59A	-	1	-	-	-	1
	Road _67A1	-	-	-	-	1	1
	Road _67A2	-	-	-	1	-	1
Total		1	1	1	1	1	5

Source: Compiled from physical infrastructure survey (road, waling path, amenities) checklist Organized by the author (February 2023)

Table 4.25 Crosstabs Roads and. Coverage type

Crosstabs Roads and. Coverage type				
Survey Road		Coverage type (check all that apply)		Total
		Trees	None	
Roads Code	Road _15A1	-	1	1
	Road _15B1	-	1	1
	Road _15B2	-	1	1
	Road _41A	1	-	1
	Road _41B	1	-	1
	Road _58A1	-	1	1
	Road _58A2	-	1	1
	Road _58B1	-	1	1
	Road _58B2	-	1	1
	Road _59A	1	-	1
	Road _67A1	1	-	1
	Road _67A2	1	-	1
	Road _67B2	-	1	1
	Road_15A2	-	1	1
	Road_59B	-	1	1
	Road_67B1	-	1	1
Total		5	11	16

Source: Compiled from physical infrastructure survey (road, waling path, amenities) checklist Organized by the author (February 2023)

Table 4.26 Crosstabs Roads and List available amenities

Roads and List available amenities (e.g., rubbish bins, benches, toilets, etc.)				
Survey Road		List available amenities (e.g., rubbish bins, benches, toilets, etc.)		Total
		none	Bins	
Roads Code	Road _15A1	0	1	1
	Road _15B1	1	0	1
	Road _15B2	1	0	1
	Road _41A	0	1	1
	Road _41B	0	1	1
	Road _58A1	0	1	1
	Road _58A2	1	0	1
	Road _58B1	0	1	1
	Road _58B2	1	0	1
	Road _59A	0	1	1
	Road _67A1	0	1	1
	Road _67A2	0	1	1
	Road _67B2	1	0	1
	Road_15A2	0	1	1
	Road_59B	0	1	1
	Road_67B1	1	0	1
Total		6	10	16

Source: Compiled from physical infrastructure survey (road, waling path, amenities) checklist Organized by the author (February 2023)

Source field survey(febroury 2023)

Figure.4.23. Amenities source the researcher

4.4.4. Permanent and temporary obstacles on walking paths.

Obstructions Permanent and temporary make the walking path difficult. As shown in Table 4.24 respondent Frequency indicates of walking paths in this area are blocked with obstructions. 27.5%, 22%, 50.5,% rarely, Sometimes, and Often respectively this indicates 50% of the walking path are covered with obstructions and other figure shows 4.8 shows temporary Obstacle and Figure 4.9 permanent obstacle, in general, the analysis shows obstacles cover walking paths of the study area the study areas road segments not Convenient for path users in the meantime of the research.

Table 4.27 Frequency of walking paths in this area Blocked with obstructions

walking paths in this area Blocked with obstructions (e.g., poles, parked cars)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Rarely	55	27.5	27.5	27.5
	Sometimes	44	22.0	22.0	49.5
	Often	101	50.5	50.5	100.0
	Total	200	100.0	100.0	

Source: Compiled from Pedestrian Survey Questioner Organized by the author (February 2023)

Table 4.28 Frequency Degree do obstructions

Degree of obstructions				
		Frequency	Percent	Cumulative Percent
Roads Code	Pedestrians are very inConvenientd	11	68.8	68.8
	Pedestrians are very mildy inConvenientd	3	18.8	87.5
	Minor inConvenient, but obstruction may be welcome	2	12.5	100.0
	Total	16	100.0	

Source: Compiled from physical infrastructure survey (road, waling path, amenities) checklist Organized by the author (February 2023)

Table 4.29 Crosstabs Obstructions and Pedestrian congestion

Obstructions Vs. Pedestrian congestion					
		Pedestrian congestion (1-5 point scale -- see guide)			Total
		non-empty	half-full	Top half full	
To what degree do obstructions	Pedestrians are very inConvenientd	0	2	9	11
	Pedestrians are very mildy inConvenientd	0	1	2	3
	Minor inConvenient, but obstruction may be welcome	2	0	0	2
Total		2	3	11	16

Source: Compiled from physical infrastructure survey (road, waling path, amenities) checklist Organized by the author (February 2023)

Table 4.30 Crosstabs Degree of obstructions Vs. Open sewers

Degree of obstructions Vs. Open sewers				
		Open sewers		Total
		Yes	No	
To what degree do obstructions	Pedestrians are very inConvenientd	7	4	11
	Pedestrians are very mildy inConvenientd	2	1	3
	Minor inConvenient, but obstruction may be welcome	1	1	2
Total		10	6	16

Source: Compiled from physical infrastructure survey (road, waling path, amenities) checklist Organized by the author (February 2023)

Source field survey(febroury 2023)

Figure.4.24. temporary obstacles

Source field survey(febroury 2023)

Figure.4.25 Permanent obstacles

4.4.5. Availability of crossings along major roads

Roads crossing along major roads are important for Convenient. In this research area in Table 4.28 out of 16 road segments 12 zebra crossings were spotted and in Table 4.29 respondent Frequency shows 47%, 50%, and 2.5% Rarely, Sometimes and Often respectively responded far out of way just to cross the street. That analysis shows crossings spotted fewer distributions and figure 4.10 show impropriety utilizing crossings spotted. Summing up the two analyses shows fewer crossings spot and this led to the study area not being convenient for path users in the meantime of the research. Table 4.28 Crosstabs Survey Road and Type Road Crossing.

Table 4.31 Survey Road Vs. Type Road Crossing

Survey Road Vs. Type Road Crossing			
Survey Road		Type crossing	Total
		Zebra/other marking	
Road Code	Road _15A1	2	2
	Road _41A1	3	3
	Road _41A2	3	3
	Road _58A1	1	1
	Road _58B1	1	1
	Road _67A2	1	1
	Road_67A1	1	1
Total		12	12

Source: Compiled from physical infrastructure survey (road, waling path, amenities) checklist Organized by the author (February 2023)

Table 4.32 Frequency Survey Road and Type Road Crossing

Far out of way just to cross the street					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Rarely	94	47.0	47.0	47.0
	Sometimes	101	50.5	50.5	97.5
	Often	5	2.5	2.5	100.0
	Total	200	100.0	100.0	

Source: Compiled from Pedestrian Survey Questioner Organized by the author (February 2023)

Source field survey(febroury 2023)

Figure.4.26 crossings along major roads

4.5. To foresee the major Policy Support on Adama city pedestrian walkways provision.

The major Policy Supports are evaluated, quantitative or qualitative data from public agency questionnaires and observation-collected photographs are used to analyze the following four variables.

I. Funding and resources devoted to pedestrian planning
II. Presence of relevant urban design guidelines
III. Existence and enforcement of relevant pedestrian safety laws and regulations
IV. Degree of public outreach for pedestrian and driving safety and etiquette

4.5.1. Funding and resources devoted to pedestrian planning

Policy support can be measure the extent to which the municipal government is in favor of expanding services and infrastructure for pedestrians (Krambeck H. , 2006).

Adama City Municipal have full structured Transport Office Directorate team direct alien with Federal MoT by implementing envision of “The mission of the transport policy is to benefit our society equally and create linkage and economic integration among people; support and speed up the economic development; attain accessible, integrated, efficient, effective, reliable and transparent system that takes paying ability into account and supported by Information technology. The policy also strives to realize a safe transport infrastructure provision and effective transport service provisions.”

The Adama City Transport office NMT Directorate team monitors the pedestrian's mobility; using the annual regular budget and the UIDP fund, the Municipal Infrastructure Provision Directorate Done Sidewalk construction, maintenance and cleaning, Street lighting networking and administration, Pedestrian amenities setting and Tree planting but supply Budget and infrastructures demand budget not balanced in the interim of this research done.

4.5.2. Presence of relevant urban design guidelines

Adama City Municipal has many working manuals National and Regional level develops and implement for the benefit to insure Sustainable development. Among the manuals

- Ethiopia Non-Motorized Transport Strategy 2020-2029
- National Urban Development Spatial plan Urban design Manual
- Model Urban block Standard
- National Transport Policy.
- Street Design Standards for Urban Ethiopia
- Road Safety Manual for Africa
- Ministry of transport Indoors Global Street Design Guide

The city Structure plan Adama Smart city Project, Local Development plan (LDP) have done According to the above manuals but on analysis above 4.3.2.1.Maintenance and cleanliness of walking paths variable walkway have not networked implement throughout the city done according to manuals.in the period in-between of the research done.

4.5.3. Existence and enforcement of relevant pedestrian safety laws and regulations

This enforcement tool has National level Design by National Road Traffic Safety Council of Ethiopia; The Council of Ministers Regulation (No. 205/201l) .The highest levels of desired outcomes are the final safety outcomes, which fall into three main categories. They accurately reflect Ethiopians' experiences with road safety. Fewer fatalities, fewer serious injuries, and lower social costs associated with road trauma (https://www.ssatp.org).

On the ground condition the Existence and enforcement of relevant pedestrian safety laws and regulations not solve fully problems pending the Research finalized

4.5.4. Degree of public outreach for pedestrian and driving safety and etiquette

The Traffic Safety and Law Enforcement office respond Confirming that every weekend Sunday mooring public outreach for Teaching the public about the rules of the road, teaching them how to drive and walk safely, and emphasizing the need to look out for one another.

The office use different public outreach teaching methods such like bummers, flyer, songs and sport festival related to traffic safety road but; as shown figure 4.11 public road safety rule implementation is not enough mature as safe themselves from traffic accident; until this research ended.

Source field survey(febroury 2023)

Figure4.19 shows understanding level of safely road use

4.6. Findings

According to the literature review, it is preferable to examine the Walkability condition before deciding on the research questions' findings. it is fundamental to see the following explanations from the contextual back ground of the thesis how it is approached. The GWI extended Survey Materials that were utilized; this material, which is recommended for cities in developing countries, assesses walkability by looking at safety, security, Convenient, and attractiveness, as well as policy sport, in order to continue squeezing input for policymakers and shareholders of walkway infrastructure developer. (Krambeck, Holly Virginia, 2006) .He will attempt to answer the research questions presented in the first chapter in this section. But the fourth research question is answered in the recommendation and implication chapter.

How many walkways have Safe and Secure pedestrian environments?

What extant walkways have Convenient and Attractive?

What are the majors Policies Support rendering pedestrian walkways provision?

What are the possible suggestions to create sustainable pedestrian walkability for Adama city?

4.6.1 How many walkways have Safe and Secure pedestrian environments?

In the above result Analysis part safety and security components of the five variables analyzed are the Proportion of road accidents that resulted in pedestrian fatalities; High Accident Rate: Adama City contributes significantly to the total road accidents in the Oromia region and was responsible for almost 30% of accidents in 2012. Vulnerability: The city is considered particularly vulnerable to these accidents, suggesting underlying issues such as infrastructure, driver behavior or traffic management. Safety concerns: The data suggests that Adama City is not a particularly safe place for pedestrians and drivers, which may be affecting economic activity and quality of life.

Walking path modal conflict; Peak travel time of 16 road sections is 12 roads in rush hour. 94.44% of people in the five-minute walk mix with another mode of transportation, showing a stronger mobility trend, other modes of transportation indicate that out of 16

road sections, 9 road sections are served in the first place half full pedestrian traffic jam under significant conflict conditions, walking possible , but dangerous shows strict training and safety when walking in this area 40% movement dangerous 51% movement unsafe This date also declares safety under demand, moreover analysis output truth and shows study areas with risky pedestrian movement; which indicate that it is not safe.

Crossing safety; Out of 12 roads where there are crossing zebras, 8 roads are dangerous. Safety from traffic accidents and the remaining 4 roads are unsafe. Traffic management shows that the traffic police are managing the traffic flow in this situation. Out of 12 roads, 7 roads are dangerous.

Perception of security from crime; 12 road crossing points 9 are dangerous. Safety from crime, the rest is uncertain. In addition, the frequency with which respondents say they are dangerous, 37%, and the frequency with which they are unsafe, 52.5%, shows the perception of safety from crime. The illustration shows the absence of street lights. and Quality of motorist behavior; People crossing the street. Drivers who don't give in. The respondent rarely answers 53%, sometimes 46.5%, and drivers who drive too fast shows that the respondent rarely answers 53%, sometimes 46.5%.In general, the analysis of the variables indicates that there are no safe and secure pedestrian environments in meantime of this research.

4.6.2.What extant walkways have Convenient and Attractive?

In the above result Analysis, part Convenient and Attractive components of the five variables analyzed are Maintenance and cleanliness of walking paths; Comfortable sidewalks in the study area: 27.5%, 53.5%, and 19% poor, fair, and good, respectively. Road cleanliness shows 8 road sections, 7 road sections and 1 road section presenting a minor obstacle; deteriorates the environment, garbage makes walking difficult; degrades the environment and garbage makes walking impossible, continually ruining the environment; Study area 50% road sections not comfortable.Existence and quality of facilities for blind and disabled persons; Infrastructure for the disabled 50% of road sections No infrastructure for the disabled available 43.75% Limited infrastructure available, not in usable condition and 6.25% Infrastructure available in good condition but poorly located Amenities; Trees from 16 road segments studied have only the 5 road segments with three covers and the list of available facilities shows that in the study areas only garbage containers are installed, 10 road segments, the rest even have no garbage

containers. Permanent and temporary obstacles on walking paths and Availability of crossings along major roads; Walkways in this area are blocked by obstacles. 27.5%, 22%, 50.5%, rarely, sometimes and often. This indicates that 50% of the walkway is covered with obstacles. In general, the analysis shows that obstacles obscure the sidewalks of the study area and the road sections of the study area are not suitable for the path. Users have conducted the research in the meantime and 12 zebra crossings were spotted out of 16 road sections As we see above overall the analysis of the variables indicates that the study area roads have less Convenient and Attractive pedestrian environments in the meantime of this research.

4.6.3 What are the majors Policies Support rendering pedestrian walkways provision?

In the above result Analysis part Policies Support components of the four variables analyzed are Funding and resources devoted to pedestrian planning; The Directorate of Urban Infrastructure Provision has completed the construction, maintenance and cleaning of sidewalks, networking and managing street lighting, establishing pedestrian facilities and planting trees, but the budget and demand for infrastructure are not in the meantime balanced. Presence of relevant urban design guidelines; Adama City Municipal has numerous work manuals developed and implemented at national and regional levels to ensure sustainable development. Among the manuals:Ethiopia's Non-Motorized Transport Strategy 2020-2029, National Urban Development Spatial Plan Urban Design Manual, Model City Block Standard, National Transport Policy, Road Design Standards for Urban Ethiopia, Road Safety Manual for Africa and Ministry of Interior Transport Global Road Design Guide.

Existence and enforcement of relevant pedestrian safety laws and regulations, and Degree of public outreach for pedestrian and driving safety and etiquette; This enforcement tool was designed by the National Road Safety Council of Ethiopia at the national level. The Council of Ministers Regulation (No. 205/201l). The highest levels of desired outcomes are the final security outcomes, which fall into three main categories. They accurately reflect Ethiopians' experiences with road safety. Fewer deaths, fewer serious injuries and lower social costs associated with traffic accidents (https://www.ssatp.org). Provided that the existence and enforcement of relevant pedestrian protection laws and regulations will not fully resolve the issues until the research is completed.

The Department of Traffic Safety and Law Enforcement confirms that a public outreach event is held every weekend on Sundays to educate the public about traffic rules, teach them how to drive and walk safely, and emphasize the need to look out for each other. The use of the office Various teaching methods for public relations such as Bummers, flyers, songs and sports festivals related to road safety As we see above overall the analysis of the variables indicates that the study area Policies Support rendering pedestrian walkways provision has very less supply not balance as demand of the study area in the meantime of this research.

4.7 Dicussion

This section describes how the methodology, results, and compilation of this paper's findings set it apart from previous related research or projects .The results and findings of the Adama City Central Business District Walkability Study provide a comprehensive overview of the current state of pedestrian infrastructure and identify key areas for improvement. The analysis is based on various data collection methods, including physical surveys, pedestrian surveys and government assessments. Here you will find a detailed discussion of the results and findings.

Compare the results and findings of the study with the context of the overall research. Volunteers on site assessed pedestrian conditions using the Global Walkability Index (https://www.cnu.org, 2019).

The research used a qualitative and quantitative methodology to assess walkability (https://www.cnu.org, 2019). Key methods included: .Global Walkability Index: Volunteers used this index to assess pedestrian conditions in different neighborhoods. It includes criteria such as road connectivity, pedestrian facilities and safety, Field Assessments: Volunteers conducted on-site physical examinations to collect data on walkability factors, including sidewalk conditions, crosswalk availability, and overall pedestrian infrastructure, Photography and documentation: Visual documentation was likely used to complement the results and provide a clearer picture of walkability conditions and challenges. And Data Analysis: After collecting data through audits, the team likely analyzed it to quantify the walkability score (https://www.cnu.org, 2019).

The results of assessing walkability using the Global Walkability Index (GWI) showed the following: Highest and lowest scores: Jabal Al-Luweibdeh neighborhood scored the highest with an index of 71and indicating that it is the most was the best walkable area that was evaluated. In contrast, the Nordbahnh of district achieved the worst score with an index of 49.6.2. Overall score.

In this also study evaluated the walkability index based on several parameters, including traffic conflicts, safety from crime, safety when crossing and the availability of pedestrian facilities. The results indicate that Adama City's overall walkability index for CBD was below desired levels, indicating significant room for improvement. Certain areas within the study area were rated as more walkable, while others, particularly those with

inadequate infrastructure and security measures, were rated worse. This disparity highlights the need for targeted interventions in less walkable areas to improve pedestrian safety and comfort

A key result of the study was pedestrians' perception of safety. The analysis found that many pedestrians felt unsafe due to high traffic volumes, poor road conditions and inadequate crossing options. The study quantified the proportion of traffic accidents involving pedestrians and highlighted the urgent need for improved safety measures. The results showed that areas with higher pedestrian traffic also had more accidents, suggesting a link between pedestrian density and safety risks.

Another important result was the quality of pedestrian infrastructure. The study found that many sidewalks were poorly maintained and had problems such as cracks, uneven surfaces and obstacles that hindered pedestrian movement. The lack of amenities such as benches, lighting and shade further detracted from the hiking experience. The results highlighted the importance of regular maintenance and the need for urban planners to prioritize pedestrian-friendly designs in new developments. The study found that improving the physical environment could encourage more residents to walk, promote healthier lifestyles and reduce traffic congestion

The pedestrian survey provided insights into public perception and behavior regarding walking in the central business district of Adama City. Many respondents expressed a preference for walking, but cited safety concerns and poor infrastructure as deterrents. The study highlighted that improving walkability could lead to increased pedestrian traffic, which in turn could lead to a more vibrant urban environment.

The limitation of this research was that only use the extended survey Toolkit of Global Walkability Index and assess walkability, For further implementation of sustainable walkways, He did not quantify the walkability score or compare one city's walkability to another city using the Global Walkability Index toolkit. Further studies are required for this.

In summary, the study on walkability in the central business district of Adam City revealed important insights into the current state of pedestrian infrastructure, safety concerns and public perception. The results highlight the importance of prioritizing walkability in urban planning to create safer, more accessible and amusing environments for pedestrians. By addressing the identified issues and implementing the recommended strategies, Adama City can improve its walkability and ultimately contribute to a healthier and more sustainable urban community.

CHAPTER FIVE

5.1 Conclusion and Recommendation

5.1.1. Conclusion

This paper presents the results of the pedestrian walkability assessment in Adama City, with a focus on the importance of safe and accessible sidewalks for urban populations, particularly in developing countries. The aim of the study is to assess the walkability of pedestrian paths using the Global Walkability Index (GWI) and to identify necessary improvements to pedestrian facilities.

Methodology a mixed methods approach was used, combining qualitative and quantitative data from pedestrian surveys, government surveys and physical infrastructure assessments. The GWI was used to assess various factors that impact walkability, including safety, Convenient, and political support. Data collection included assessment of pedestrian fatalities, infrastructure quality, and user perceptions to uncover critical gaps in the existing pedestrian environment.

Results; The study shows that pedestrian walkways in Adama City are generally unsafe and inconvenient. The main problems include: High number of pedestrian fatalities due to traffic accidents, Poor infrastructure, many sidewalks are blocked or in poor condition, inadequate amenities and facilities for disabled people and lack of adequate crossings and security measures. Safety: A significant proportion of traffic accidents involve pedestrians, suggesting the need for better traffic management and pedestrian protection laws. Convenient and Attractiveness; Many walkways are not well maintained, lack cleanliness and adequate facilities, making them unattractive to users. Policy support: The study shows insufficient funding and resources for pedestrian planning despite existing urban planning guidelines.

Finding; Traffic accidents cause high pedestrian fatalities, with 37% of fatalities involving pedestrians. Most routes are unsafe, with inadequate crossings and poor visibility. Convenient and accessibility are lacking, with only 12 road sections out of 16 road sections having sufficient crossing options. Policy support has enough manual, document and existing urban design guidelines but inadequate funded for infrastructure development; for this cease not being effectively implemented.

The implementing pedestrian safety laws and regulations can reduce pedestrian fatalities, increase crossing safety, maximize the number of crossing spots and traffic management, deter crime, maintain clean and well-maintained walking paths, improve the quality of infrastructure facilities for the blind and disabled, install amenities in strategic locations, illuminate both temporary and permanent obstacles on walking paths, increase funding and resources dedicated to pedestrian planning, utilize urban design guidelines to implement walkways, and more, Expand the extent of public education strategies and the hours and days that focus on driving and pedestrian safety and manners.

Limitations in the Assessment of Pedestrian Walkability in the Centeral Business District of Adama City highlight several factors that may affect the comprehensiveness and applicability of the findings. Data availability, Sample Subjectivity in Qualitative Data, Temporal Constraints, and Resource Limitations for Policy Implementation: These limitations suggest that while the assessment provides valuable insights into the current state of pedestrian walkability in Adama City, further research and ongoing evaluation are necessary to develop effective, long-term solutions. Addressing these limitations can enhance future studies and contribute to more robust urban planning efforts.

The conclusion of the Adama City Walkability Assessment highlights several key findings and recommendations. The study shows that current pedestrian infrastructure is inadequate and creates significant safety risks and inConvenient for users.

5.1.2. Recommendations

Beyond assessing and evaluating the pedestrian walkability, the aim of this study is also to make suggestions to create sustainable pedestrian walkability and to protect or enhance their positive attributes.

Recommendations towards the Safety and Security

The study shown that high traffic volumes, poor road conditions, and inadequate crossing options lead to pedestrian safety concerns, highlighting the need for improved safety measures and a link between pedestrian density and accidents.To solve those problems stakeholders should have done.

- Using Safety laws and regulations reduce pedestrian fatalities.
- Maximizing the number of crossing Spot and traffic management increase Crossing safety.
- Maximizing street light network decries crime.
- Giving short training and increasing quality of driver behavior.

Recommendations towards the Convenient and attractiveness.

The study found that many sidewalks were poorly maintained and had problems such as cracks, uneven surfaces and obstacles that hindered pedestrian movement. The lack of amenities such as benches, lighting and shade further detracted from the walking experience. Stakeholders ought to have taken action to address those issues.

- Maintain and clean walking paths
- Increase the quality of infrastructure facilities for blind and disabled persons
- Install Amenities in the right place
- Illuminate Permanent and temporary obstacles on walking paths

Recommendations towards the major Policies Supports.

The study found the study area Policies Support rendering pedestrian walkways provision has very less supply not balance as demand of area. Stakeholders should to have taken action to speak those issues.

- Increase the supply Fund and resources devoted to pedestrian planning
- Utilize urban design guidelines implementing walkway
- Implement pedestrian safety laws and regulations to maximize safety and security.
- Increase the degree of public outreach methods and time and day for pedestrian and driving safety and etiquette

REFERENCE

AASHTO. (2004).

https://Www.Cnu.Org. (2019). Retrieved Jun 14, 2024

Https://En.Wikipedia.Org/Wiki/Talk:Ethnic_Federalism. (2022, March). Retrieved From Wikipedia.

Abley, T. S. (2011). Predicting Walkability. Auckland: Ipenz Transportation Group Conference.

Afifah, S. N. (2019). Walkability Assessment Tool For A Developing Country. *Materials Science And Engineering*, 527.

Briceño-Garmendia, V. F. (2010). Africa's Infrastructure. *The World Bank.*

Burian, J. (2012). *Advances In Spatial Planning.* Croatia: Intech.

Choi, E. (2012). *Walkability As An Urban Design Problem.* Stockholm.

Consulting, J. M. (2020, 27 January). *How Are Today's Biggest Tech Trens Affecting Our Human Rights?* Retrieved From Www.Jmccie.Com.

Cpemd. (2007). *Streetscape Design Guide Line.* Tshwane.

El-Sayad. (2012). Streetscape Design Process In Constraint Environments. *Spaces And Flows: An International Conference On Urban And Extraurban Studies*, 22.

Foundation, W. (2019, Jun). *Urban Mobility Indicators For Walking And Public Transport*. Retrieved From Www.Uitp.Org.

Group, T. W. (2022). *Addis Ababa Sidewalk Safety And Improvement Study.* Washington Dc: The World Bank.

Gwilliam, K. (2002). *Cities On The Move : A World Bank Urban Transport Strategy Review.* Washington, Dc: World Bank.

Harun. (2017). Developing A Framework For Streetscape Design To Promote Walkability In Malaysian Campus. *Journal Of Computational And Theoretical Nanoscience* , 6.

https://Www.Ssatp.Org. (N.D.). *Https://Www.Ssatp.Org*. Retrieved Jun 17, 2023, From Https://Www.Ssatp.Org.

Initiative, G. D. (2016). *Global Street Design Guide.* Los Angeles: Island Press.

ITDP. (2023, 12). *Https://Africa.Itdp.Org/Publication/Ethiopia-Urban-Street-Design-Manual/*. Retrieved 9 13, 2024

James Leather, H. F. (2011). *Walkability And Pedestrian Facilities In Asian Cities.* Metro Manila,: Adb Sustainable Development Working Paper Series.

Jia, Fantta, And Mercado. (2022). *Addis Ababa Sidewalk Safety And Improvement Study.* Washington Dc: The World Bank.

Krambeck, H. (2006). *The Global Walkability Index,Talk The Walk And Walk The Talk.* Washington Dc: Massachusetts Institute Of Technology.

Krambeck, H. V. (2006). *The Global Walkability Index.* Massachusetts: Massachusetts Institute Of Technology.

Kylmicka, K. B. (2006). Multiculturalism And The Welfere State:Recognition And Redistribution Is Contemporary Democracies. *Journal Of Social Policy*.

Lewis, D. G. (2017). *Road Environment Safety.*

Litman, T. A. (2004). Economic Value Of Walkability. *Victoria Transport Policy Institute.* Canada.

Lo, R. H. (2009). Walkability: What Is It. *Journal Of Urbanism*, 145.

Marti, D. A. (2013, Murch). *Design Manual For Urban Roads And Streets*.

Mot. (2020). *National Transport Policy.* Addis Ababa: Addis Ababa.

Moussa. (2021). An Investigation Into The Causes Of Pedestrians' Walking Difficulties In Cairo Street. *Civil Engineering And Architecture*, 15.

MUDH. (2017). *Street Design Standards For Urban Ethiopia.* Addis Ababa: Federal Democratic Republic Of Ethiopia Ministry Of Urban Development And Housing.

Muhammad Sofwan And Mira Hafizhah Tanjung. (2020). Evaluation Study Of Walkability Index In Central Business District(Cbd) Area, Pekanbaru City, Indonesia. *Geoscience*, 155-163.

N N Hayati,G Sulistyaningtyas,Daud Nawir And S Z Ishak. (2024). *Https://Iopscience.Iop.Org/Article*. Retrieved 9 15, 2024, From Https://Iopscience.Iop.Org/Article: 10.1088/1755-1315/1294/1/012002

Nacto. (2016). *Global Street Design Guide.* Los Angeles: Island Press.

National Association Of City Transportation Officials, G. D. (2020). *Designing Streets For Kids.* Los Angeles: Island Press.

Nhtsa. (2017). *Automated Driving Systems* .

Nzta. (2009). *Design, Pedestrian Planning And Guide.* Nz Transport Agency .

Past Perfect. (N.D.). Retrieved From Www.Englishclub.Com.

Paszkowski, Z.W,Kołowiecka,S.Kuśmierek.A. (2021). *Urban Security - As Part Of The 'Smart Cities' Strategy.* Qatar: Isocarp.

Paul Collier, E. G. (2022). City That Work. *International Groth Center*, 2.

Paykoç, E. (2019). *Analysis Of Walkability Measurement Tools (Wmts).* İzmir.

Pragia Minhas And Arunava Poddar. (2017, July 07). *Https://Www.Gtkp.Com*. Retrieved 9 15, 2024

Pragia Minhas, A. P. (2017). Walkability Index By Global Walkability Index Method. *International Research Journal Of Engineering And Technology*, 2957.

Retrieved From Www.Learnemglish.British Council.Org.

Raja Noriza Raja Ariffina, R. K. (2013). Perceptions Of The Urban Walking Environments. *Sciencedirect*, 590.

Raminder Kaur, M. J. (2022). Enhancingwalkability In Brick & Mortar Retail Markets: Case Study Of Chaura Bazar, Ludhiana. *Civil Engineering And Architecture*, 447.

Rehan. (2012). Sustainable Streetscape As An Effective Tool In Sustainable Urban Design. *Hbrc Journal*, 14.

Rindone, C. (2022,, 12 17). *Corrado Rindone*. Retrieved Dec 17, 2022, From Info13070351: Https://Www.Mdpi.Com/Journal/Information

Roberts, B. M. (2008). *Walk Urban.* Washington, D.C.: The World Bank Group.

Santos, P. M. (2019). *He 8 Principles Of,Sidewalkst.* (Ics).

Pervasive Computing . Retrieved From Www.Techtarget.Com.

Shelly Permata Sari, ,. H. (2020). Walkability Of Sidewalk In Commercial Corridors. *International Journal Of Scientific & Technology Research*, 1367.

Singh And Masuku. (2014, November 11). *Https://Ijecm.Co.Uk*. Retrieved 9 24, 2024, From Https://Ijecm.Co.Uk: Issn 2348-0386

Singh, S. (2021). The Concept Of Walkability As An Alternative Form Of Sustainable Urban Mobility Planning (Sump). *International Journal Of Science And Research*, 1050.

South Worth, M. (2005). Designing The Walkable City. *Journal Of Urban Planning And Development*, 246.

Speck, J. (2012). *Walkability City.* New York: Farrar,Staus And Grioux.

Suurmann, T. A. (2020). Personalizing Human-Agent Interaction Through Cognitive Models. *Frontiers In Psychology*, 12.

Sweet, R. W. (2012). Integrating Walkability Into Planning Practice. *Trt 2322*, 20-30.

Wuhong Wang, 1. H. (2014). Advances In Mobility Theories, Methodologies, And Applications. *Hindawi Publishing Corporation*, 2.

APPENDEX

Submit by Email

GLOBAL WALKABILITY INDEX

PHYSICAL INFRASTRUCTURE SURVEY (roads, walking paths, amenities)

Part I: Survey Area

1) Survey area # _____

2) Date (dd/mm/yyyy) _____

3) Time
- ○ 6:00 - 9:00
- ○ 9:01 - 12:00
- ○ 12:01 - 15:00
- ○ 15:01 - 18:00
- ○ 18:01 - 21:00

4) Peak travel time?
- ○ Non-Peak
- ○ Peak

5) Road name (or other identifier) (mark on map) _____

6) Surrounding land use (check all that are the **most** prevelant)
- ☐ Commercial / Retail
- ☐ Industrial
- ☐ Political / Cultural
- ☐ High Income Residential
- ☐ Medium-Income Residential
- ☐ Low-Income Resudenrtial
- ☐ "Slum" / Informal Settlement
- ☐ Other _____

Part II: Road

7) Length (meters) _____

8) Average traffic speed
- ○ 0 - 10 km / hour (gridlock)
- ○ 10 - 30 km / hour (very slow moving traffic)
- ○ 30 - 70 km / hour (traffic moving at reasonable speed)
- ○ 70 - 120 km / hour (fast moving traffic)
- ○ 120 + km / hour (very fast moving traffic)

9) Number of driving lanes  _____

Number of parking lanes _____

Number of bicycle / motorcycle lanes _____

Number of median strips _____

10) People walking in street (not on walking path) -- 5 minute count _____ (mark location on map)

Part III: Walking Path

11) Width (most commonly occuring) in meters _____

12) People walking on walking path -- 5 minute count _____ (mark location on map)

13) Trees (total number on one side) _____

14) Street lights (total number on one side) _____

15) Cleanliness 
- ○ 1 -- Rubbish makes walking impossible; ruins enivronment
- ○ 2 -- Rubbish makes walking difficult; degrades environment
- ○ 3 -- Minor obstacle; degrades environment
- ○ 4 -- Degardes quality of environment, but not obstacle
- ○ 5 -- Walking path is clean

16) Maintenance and Pavement Quality 

- ○ 1 -- Separate paving for walking path not present
- ○ 2 -- Paving is mostly dirt, covered with mud; poor condition
- ○ 3 -- Some paving; partly smooth; poor condition
- ○ 4 -- Paved and walkable; not well maintained
- ○ 5 -- Smooth walking surface; well maintained

17) Infrastructure for disabled (ramps, blind paths, etc.)

- ○ 1 -- No infrastructure for disabled persons available
- ○ 2 -- Limited infrastructure available, not in usable condition
- ○ 3 -- Infrastructure present but in poor condition
- ○ 4 -- Infrastructure present, in good cond., but poorly placed
- ○ 5 -- Infrastructure is present, in good condition, well placed

18) Coverage type (check all that apply)

- ☐ Temporary awning Proportion of road (%) _____
- ☐ Permenant awning Proportion of road (%) _____
- ☐ Arcade Proportion of road (%) _____
- ☐ Trees Proportion of road (%) _____
- ☐ None

19) Road length without sidewalk

Length (meters) _____

○ One side ○ Both sides

20) To what degree do obstructions (items that make effective walking path width less than 1 meter wide) affect overall walkabiility of road? List types of obstructions (e.g., parked cars). 

- ○ 1-- Walking is compoletely impossible
- ○ 2 -- Pedestrians are very inconveninced
- ○ 3 -- Pedestrians are mildy inconvenienced
- ○ 4 -- Minor inconvenience, but obstruction may be welcome
- ○ 5 -- Pedestrian environment is enhanced by obstructions
- ○ There are no obstructions

_____

_____

_____

Part IV: Amenities and Environment

21) Conflicts between pedestrians and other modes (bicycles, etc.) 

- ○ 1 -- Significant conflict; walking is impossible
- ○ 2 -- Significant conflict; walking possible, but dangerous
- ○ 3 -- Some conflict -- walking is possible, but not convenient
- ○ 4 -- Minimal conflict, mostly btw. pedestrians and bicycles
- ○ 5 -- No conflict between pedestrians and other modes

22) Pedestrian congestion (1-5 point scale -- see guide) ○ 1 (empty) ○ 2 ○ 3 ○ 4 ○ 5 (gridlock)

23) Pedestrian signage (crossings, maps, directions) 1-5 point scale. ○ 1 (none) ○ 2 ○ 3 ○ 4 ○ 5 (ample)

24) List available amenities (e.g., rubbish bins, benches, toilets, etc.)  _____

25) Open sewers? ○ Yes ○ No

GLOBAL WALKABILITY INDEX

PHYSICAL INFRASTRUCTURE SURVEY (crossings)

a) Survey area # _____

b) Date (dd/mm/yyyy) _____

c) Time ○ 6:00 - 9:00 ○ 9:01 - 12:00 ○ 12:01 - 15:00 ○ 15:01 - 18:00 ○ 18:01 - 21:00

d) Peak travel time? ○ Peak ○ Non-Peak

---

1) **Crossing ID #** _____

2) Type (s) ☐ Zebra / other marking ☐ Overpass ☐ Subway ☐ No marking

3) Location ○ Road intersection ○ Non-Intersection

4) Avg. Traffic Speed ○ 0 - 10 km / hr ○ 10 -30 km / hr ○ 30 - 70 km / hr ○ 70-120 km / hr ○ 120 + km

5) Number of lanes to cross (across widest road segment) _____

6) Average time spent waiting to cross the street (across widest road segment) ○ 0 - 1 min. ○ 1 - 2 min. ○ 2 - 3 min. ○ 3+ min.

7) Average time given to cross the street (across widest road segment) ○ 0 - 1 min. ○ 1 - 2 min. ○ 2 - 3 min. ○ 3+ min.

8) Time is sufficient for **X** to cross -- check all that apply. ☐ Typical healthy adult ☐ Person with small children ☐ Disabled/eldrely person ☐ No one

9) Safety from traffic accident ○ 1 -- Very dangerous ○ 2 -- Dangerous ○ 3 -- Unsure ○ 4 -- Safe ○ 5 -- Very safe

10) Security from crime ○ 1 -- Very dangerous ○ 2 -- Dangerous ○ 3 -- Unsure ○ 4 -- Safe ○ 5 -- Very safe

11) Traffic Management ○ Regular Traffic Signal ○ Pedestrian Phase SIgnal ○ Traffic Police ○ None

GLOBAL WALKABILITY INDEX

1) **Crossing ID #** _____

2) Type (s) ☐ Zebra / other marking ☐ Overpass ☐ Subway ☐ No marking

3) Location ○ Road intersection ○ Non-Intersection

4) Avg. Traffic Speed ○ 0 - 10 km / hr ○ 10 -30 km / hr ○ 30 - 70 km / hr ○ 70-120 km / hr

5) Number of lanes to cross (across widest road segment) _____

6) Average time spent waiting to cross the street (across widest road segment) ○ 0 - 1 min. ○ 1 - 2 min. ○ 2 - 3 min. ○ 3+ min.

7) Average time given to cross the street (across widest road segment) ○ 0 - 1 min. ○ 1 - 2 min. ○ 2 - 3 min. ○ 3+ min.

8) Time is sufficient for **X** to cross -- check all that apply. ☐ Typical healthy adult ☐ Person with small children ☐ Disabled/eldrely person ☐ No one

9) Safety from traffic accident ○ 1 -- Very dangerous ○ 2 -- Dangerous ○ 3 -- Unsure ○ 4 -- Safe ○ 5 -- Very safe

10) Security from crime ○ 1 -- Very dangerous ○ 2 -- Dangerous ○ 3 -- Unsure ○ 4 -- Safe ○ 5 -- Very safe

11) Traffic Management ○ Regular Traffic Signal ○ Pedestrian Phase Signal ○ Traffic Police ○ None

---

1) **Crossing ID #** _____

2) Type (s) ☐ Zebra / other marking ☐ Overpass ☐ Subway ☐ No marking

3) Location ○ Road intersection ○ Non-Intersection

4) Avg. Traffic Speed ○ 0 - 10 km / hr ○ 10 -30 km / hr ○ 30 - 70 km / hr ○ 70-120 km / hr

5) Number of lanes to cross (across widest road segment) _____

6) Average time spent waiting to cross the street (across widest road segment) ○ 0 - 1 min. ○ 1 - 2 min. ○ 2 - 3 min. ○ 3+ min.

7) Average time given to cross the street (across widest road segment) ○ 0 - 1 min. ○ 1 - 2 min. ○ 2 - 3 min. ○ 3+ min.

8) Time is sufficient for **X** to cross -- check all that apply. ☐ Typical healthy adult ☐ Person with small children ☐ Disabled/eldrely person ☐ No one

9) Safety from traffic accident ○ 1 -- Very dangerous ○ 2 -- Dangerous ○ 3 -- Unsure ○ 4 -- Safe ○ 5 -- Very safe

10) Security from crime ○ 1 -- Very dangerous ○ 2 -- Dangerous ○ 3 -- Unsure ○ 4 -- Safe ○ 5 -- Very safe

11) Traffic Management ○ Regular Traffic Signal ○ Pedestrian Phase Signal ○ Traffic Police ○ None

GLOBAL WALKABILITY INDEX

1) **Crossing ID #** _____

2) Type (s) ☐ Zebra / other marking ☐ Overpass ☐ Subway ☐ No marking

3) Location ○ Road intersection ○ Non-Intersection

4) Avg. Traffic Speed ○ 0 - 10 km / hr ○ 10 -30 km / hr ○ 30 - 70 km / hr ○ 70-120 km / hr

5) Number of lanes to cross (across widest road segment) _____

6) Average time spent waiting to cross the street (across widest road segment) ○ 0 - 1 min. ○ 1 - 2 min. ○ 2 - 3 min. ○ 3+ min.

7) Average time given to cross the street (across widest road segment) ○ 0 - 1 min. ○ 1 - 2 min. ○ 2 - 3 min. ○ 3+ min.

8) Time is sufficient for **X** to cross -- check all that apply. ☐ Typical healthy adult ☐ Person with small children ☐ Disabled/eldrely person ☐ No one

9) Safety from traffic accident ○ 1 -- Very dangerous ○ 2 -- Dangerous ○ 3 -- Unsure ○ 4 -- Safe ○ 5 -- Very safe

10) Security from crime ○ 1 -- Very dangerous ○ 2 -- Dangerous ○ 3 -- Unsure ○ 4 -- Safe ○ 5 -- Very safe

11) Traffic Management ○ Regular Traffic Signal ○ Pedestrian Phase Signal ○ Traffic Police ○ None

---

1) **Crossing ID #** _____

2) Type (s) ☐ Zebra / other marking ☐ Overpass ☐ Subway ☐ No marking

3) Location ○ Road intersection ○ Non-Intersection

4) Avg. Traffic Speed ○ 0 - 10 km / hr ○ 10 -30 km / hr ○ 30 - 70 km / hr ○ 70-120 km / hr

5) Number of lanes to cross (across widest road segment) _____

6) Average time spent waiting to cross the street (across widest road segment) ○ 0 - 1 min. ○ 1 - 2 min. ○ 2 - 3 min. ○ 3+ min.

7) Average time given to cross the street (across widest road segment) ○ 0 - 1 min. ○ 1 - 2 min. ○ 2 - 3 min. ○ 3+ min.

8) Time is sufficient for **X** to cross -- check all that apply. ☐ Typical healthy adult ☐ Person with small children ☐ Disabled/eldrely person ☐ No one

9) Safety from traffic accident ○ 1 -- Very dangerous ○ 2 -- Dangerous ○ 3 -- Unsure ○ 4 -- Safe ○ 5 -- Very safe

10) Security from crime ○ 1 -- Very dangerous ○ 2 -- Dangerous ○ 3 -- Unsure ○ 4 -- Safe ○ 5 -- Very safe

11) Traffic Management ○ Regular Traffic Signal ○ Pedestrian Phase Signal ○ Traffic Police ○ None

GLOBAL WALKABILITY INDEX

PUBLIC AGENCY SURVEY

Submit by Email

Part I: Agency Responsible for Transportation Planning

1a) Is there a specific non-motorized planning program / department?

- ○ Yes
- ○ No

1b) If there is a specific non-motorized planning program / department / point person , then please provide a brief description. Include activities and number of full and part time staff.

*2) If there is a specific non-motorized planning program / department, please rate program funding.

- ○ Enough to sustain high-quality progr am in long-term
- ○ Sufficient for short term, but not the long term
- ○ Neutral
- ○ Sufficient only to meet very few program goals
- ○ Totally insufficient

*3) Are pedestrian networks included in the city master plan or transportation plan?

- ○ Yes
- ○ No

4a) Please state the proportion of all trips (to work, shopping, school, etc.) that are made via:

Automobile	____ %	Year(s): ____
Motorized two-wheeler	____ %	
Rail-based public transit	____ %	
Public bus	____ %	
Informal transit	____ %	
Bicycle	____ %	
Walking	____ %	
Other	____ %	

4b) How were above proportions derived (rough estimates based on visual observations, traffic counts, surveys, etc.)?

Part II: Agency Responsible for City Planning

1) Please check the pedestrian-related urban design guidelines that are already well-established. Feel free to add any relevant guidelines that are not included in the list.

- ☐ Sidewalk pavement type
- ☐ Placement of benches and similar amenities on walk paths
- ☐ Sidewalk widths
- ☐ Design for disabled persons
- ☐ Other _____
- ☐ Other _____
- ☐ Other _____

2) Please check the building front guidelines that are already well-established. Feel free to add any relevant guidelines that are not included in the list.

- ☐ Strict build-to lines
- ☐ Arcade / sidewalk coverage requirements
- ☐ Other _____
- ☐ Other _____

3) Which public agency/agencies are responsible for:

Licensing of street activities (e.g., vending, busking) _____

Sidewalk construction _____

Sidewalk infrstructure maintenance _____

Sidewalk cleaning _____

Street lighting _____

Pedestrian amenities (e.g., benches) _____

Tree planting _____

Road safety _____

Pedestrian network planning _____

Obstructions / publi c space policy _____

4) Please rate the relative importance of the provision of pedestrian infrastructure and services in your agency.

- ◯ Very important -- walking is a high priority
- ◯ Somewhat important
- ◯ Neutral
- ◯ Somewhat unimportant
- ◯ Not important -- walkability is almost never ocnsidered

5) On a city map, please indicate concentrations of employment, low income residences, and high income residences. Please describe the connections between these areas, noting any particular barriers such as highways with few crossings

Part III: Agency Responsible for Traffic Safety and Law Enforcement

1) Does the agency maintain data on pedestrian fatalities and injuries? If so, please attach.

- ☐ Yes
- ☐ No

2) Is there a law or regulation for any of the following items? If so, is the law or reguulation enfoced? Feel free to add any relevant laws or regulations that are not included in this list.

Is there a law or regulation for:	Enforced? Usually	Sometimes	Rarely
☐ Jaywalking	☐	☐	☐
☐ Vendors on sidewalks	☐	☐	☐
☐ Parking on sidewalks	☐	☐	☐
☐ Driving / riding on sidewalks	☐	☐	☐
☐ Drunk driving	☐	☐	☐
☐ Other _____	☐	☐	☐
☐ Other _____	☐	☐	☐
☐ Other _____	☐	☐	☐

3) Have there been public outreach efforts (by this or other agency) to educate pedestrians or drivers on road and pedestrian safety? If so, please describe.

- ☐ Yes
- ☐ No

4) Does the department maintain location data for pedestrain fatalities / road accidens? If so, please describe and attach for most recent year available.

- ☐ Yes
- ☐ No

*5) Does the department maintain location data for street crimes (coule the agency, for example, pinpoint specific high crime locations on a map based on data inputs)?

- ☐ Yes
- ☐ No

Date _____ Time _____ Initials _____ Survey Location ID# _____

GLOBAL WALKABILITY INDEX

PEDESTRIAN SURVEY

Submit by Ema

Part I: Respondent Description

Answer the first three questions using visual inspection:

1) Gender: ○ Female ○ Male

2) Disabled: ○ Yes ○ No

3) Have small children (living wiht you at present) ○ Yes ○ No

Ask the respondent the following questions (may ask these questions last):

4) Age ○ 10 - 19 ○ 20 - 39 ○ 40-59 ○ 60+

5) Income Level (do you earn significantly less or more than local median?) ○ Low ○ Medium ○ High

6) Neighborhood where home is located (currently): _____

7) Do you own (in this city): ☐ Bicycle ☐ Motor two-wheeler ☐ Car

Part II: Walking Profile

8) How much time do you spend per day walking (minutes)? ○ 0 - 15 ○ 16 - 30 ○ 31 - 60 ○ 60+

9) How long, on average do you spend walking to work each day? ○ 0 - 15 ○ 16 - 30 ○ 31 - 60 ○ 60+ ○

10) How long does it take you to take transit to work (total trip) ? ○ 0 - 15 ○ 16 - 30 ○ 31 - 60 ○ 60+ ○

11) How long does it take to walk to nearest transit stop from home ? ○ 0 - 15 ○ 16 - 30 ○ 31 - 60 ○ 60+ ○

12) List top three places you usually walk to: _____ _____ _____

Part III: Convenience

Show respondent map with 0.5 km radius drawn around survey point. The following questions refer to this area:

13) On a scale of 1-5, how convenient are walk paths in this area (1= very bad)? ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

14) Are walking paths in this area:

	Rarely	Sometimes	Often
a)	☐	☐	☐ Blocked with obstructions (e.g., poles, parked cars)
b)	☐	☐	☐ Congested with non-pedestrian traffic (e.g., bicycles)
c)	☐	☐	☐ Adequate for blind or disabled people
d)	☐	☐	☐ Poorly lit at night
e)	☐	☐	☐ Covered with litter
f)	☐	☐	☐ Uneven and hard to walk on

15) Do you have to walk very far out of your way just to cross the str eet: ○ Rarely ○ Sometimes ○ Often

Part IV: Safety and Security

Show respondent map with 0.5 km radius drawn around survey point. The following questions refer to this area:

16) On a scale of 1-5, how **safe** is it to walk in this area? (1 = dangerous) ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

17) On a scale of 1-5, how **secure** is it to walk in this area? (1 = dangerous) ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

18) Do motorists in this area:

	Rarely	Sometimes	Often
a)	☐	☐	☐ Fail to yield to people crossing the street
b)	☐	☐	☐ Drive too fast
c)	☐	☐	☐ Drive through red traffic lights and stop signs

19) List three things the city should do to improve walkability _____ _____ _____