IMPACTS OF RING ROAD ON STREET FRONTAGE AND PEDESTRIAN ACCESSIBILITY: THE CASE OF BOLE SUB-CITY, ADDIS ABABA.

Henok Ayalew Abebe

A Thesis submitted to The Department of Urban Planning and Design
School of Civil Engineering and Architecture

Presented in Partial Fulfillment of the Requirement for the Degree of Master's in Urban Planning and Design

Office of Graduate Studies
Adama Science and Technology University

Adama, Ethiopia

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Advisor Dr. Yared Girma

A Thesis Submitted to the Department of Architecture and urban planning and design School of Civil Engineering and Architecture

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DECLARATION

I hereby declare that this Master Thesis entitled "**Impact of ring road on street frontage and pedestrian accessibility in the case of Bole sub-city, Addis Ababa**" 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 accordingly acknowledged through citation.

_____	_____	_____
Name of student	Signature	Date

RECOMMENDATION

I, the Advisor of this thesis, hereby certify that I have read the revised version of the thesis entitled "**Impact of Ring Road on street frontage and pedestrian accessibility in the Case of bole subcity, Addis Ababa**." prepared under my guidance by Henok Ayalew Abebe and submitted in partial fulfillment of the requirements for the degree of Masters of Science in Urban Planning and Design. Therefore, I recommend the submission of the revised version of the thesis to the department following the applicable procedures.

Yared Girma (Ph.D.) _____ _____

Major Advisor/Supervisor Signature Date

APPROVAL OF BOARD OF EXAMINER

I, the advisor of the thesis entitled "**Impact of ring road on street frontage and pedestrian accessibility in the case of Bole sub city, Addis Ababa**" and developed by **Henok Ayalew**, hereby certify that the recommendation and suggestions made by the board of examiners are appropriately incorporated into the final version of the thesis.

Major Advisor	Signature	Date

We, the undersigned, members of the Board of Examiner of the thesis open defense by **Henok Ayalew** have read and evaluated the thesis/dissertation paper entitled "**Impact of ring road on street frontage and pedestrian accessibility in the case of Addis Ababa bole sub city"** and examined the candidate during the open defense. This is, therefore, to certify that the thesis is accepted for partial fulfillment of the requirement of the degree of Master of Science in Urban Planning and Design.

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

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LIST OF ACRONYMS AND ABBREVIATIONS

ARTA----------Addis Ababa Road Transport Authority

AI----------Adobe illustrator

ASTU ----------Adama science and technology university

AUTOCAD----------Computer Aided design

GIS----------Geographic Information System

LOS----------Level of Service

PF----------Pedestrians flow

PFR----------Pedestrians flow Rate

PLOS----------Pedestrians' Level of Service

PWI----------Pedestrian walkability index

We---------- Effective width

ABSTRACT

The rapid pace of urbanization is having a significant impact on the environment, economy, and land. In order to mitigate these impacts, it is important to understand better how urban spatial development and road construction interact. The development of the Bole Sub City Ring Road could considerably affect local social and economic links and pedestrian circulation. Hence, this research aims to assess the impact of the Bole Sub City Ring Road's design on the street frontage and pedestrian accessibility. In order to achieve the intended objectives, quantitative and qualitative research approaches were employed in this study. A population of 321 people was surveyed using purposive sampling to gather information about the barriers to pedestrian accessibility and perceptions of built environment infrastructure in the study area. The study also employed observation and a case study approach to gather data on how urban economy interacts with ring road pedestrian crossing and how built environment infrastructure is perceived. The findings indicated that approximately 48.4% of the Bole sub-city ring road's total area had dead-end street frontage, contributing less to the road's economic function and creating safety and security issues. The inadequate building-street interaction caused by the blind street frontages reduces street activity. The ring road has impacted pedestrian accessibility in the case study locations, with a walkability index value of 0.38, indicating insufficient facilities for pedestrians in the neighborhood. The underutilized street frontages must therefore be activated by using Plug-in urban design, which is an appropriate method for pre-existing communities and urban contexts to create livable streets and apply appropriate design and management solutions. Additionally, a streetscape design that emphasizes a more human-friendly environment was created to address the numerous issues discovered during this study.

Keywords: Ring Road, frontage, Street, Streetscape, Pedestrians, walkability, Plug-in urban design

CHAPTER ONE
INTRODUCTION

In addition to accommodating the significant growth, streets must meet the needs of all users. All streets should be constructed considering the convenience, affordability, safety, accessibility, and mobility of all users. Streets benefit a city's social, economic, and environmental health (Kuma & Juan, 2016). To ensure the long-term vitality of the urban environment, urban street spatial planning should be maximized.

Bole is one of the busiest and most densely populated sub-cities in Addis Ababa and is home to the city's main airport. The construction of the ring road in Bole has had significant implications for urban planning and development in the area. The study aims to assess the pedestrian friendliness and overall streetscape quality of Ethiopia's Bole sub-city ring road, which is the primary connection between the main airport and various sub-cities. The road's importance as the first impression for foreign visitors and as a crucial urban artery makes it essential to modernize and enhance its quality to support all regional activities.

1.1 Background of the Study

The construction of transportation infrastructure, such as highways and main roads, can create barriers that limit the mobility of pedestrians and cyclists in urban areas and negatively impact their access to essential services and amenities. This can result in social exclusion, reduced physical activity, and increased health inequalities. According to a study by Laverty et al. (2021), such barriers can disproportionately affect marginalized and low-income communities, highlighting the need for equitable and inclusive urban planning that prioritizes active transportation and enhances the walkability and bike-ability of cities.

Streets are the most numerous and widely dispersed urban public spaces. They are the sites of much of a city's activity. Streetscapes, or the three-dimensional built environments surrounding them, are indisputable components of urban livability (Harvey, 2014). Cities comprise 20-30% of streets (Stavroulaki & Meta, 2020). The design of streets and their surrounding streetscapes impacts whether they are simply conduits for accessing distributed features of a livable community or livable spaces in and of themselves (Campoli, 2012). Because streets are such an important part of everyday life and are the most common public spaces in the developed world, it is obvious that the characteristics of street design influence their aesthetic appeal and, as a result, livability for a wide range of users (Andrew, 2019).

In the 1960s, the construction of large metropolitan centers began to include ring roads as standard infrastructure. Their greatest influence on the urban spatial organization is radial growth patterns and placing commercial, residential, and industrial activities close to highway interchanges. The growth of peripheral centers, which benefit from better accessibility brought about by ring road construction, is frequently related to the declining vibrancy of central areas. Ring roads are refocusing urban growth by rearranging the way that cities are accessible. The structure of urban highways needed to be revised due to urban area growth, traffic, and the importance of inter-urban movements growing (Rodrigue, J.-P. (2020).

The relationship between urban spatial development and road construction has to be better understood. Most studies deal with these two elements independently. The problem of how larger road constructions affect traffic moves is regularly on engineers' minds. Their concern for developing road networks that can accommodate expected traffic flows as well as origin and destination traffic flow models is shown in their interest in this matter. However, architects and urban planners are frequently preoccupied with solving the legal issue of executing different functions needed in urban settings. They concentrate mostly on the built environment's urban blocks between streets and roads (Van Nes, 2021).

In order to address the severe traffic issues in urban centers, many politicians and planners still believe that a ring road is the best option. This issue might be resolved in certain towns by a ring road. In some cases, its adoption might have unexpected repercussions on town centers' business activity and social life. The alternative highlights how critical it is to thoroughly understand how ring roads influence the spatial and socioeconomic features of built environments. (Friedmann & Alonso, 2004).

In developed countries, the main challenge regarding street quality involves constant maintenance and repair of aging infrastructure, along with addressing factors such as land use, zoning regulations, and building design that impact street quality. Pedestrian accessibility is also an issue, particularly in urban areas with traffic congestion and limited sidewalk space. In developing countries, street quality challenges are more fundamental, as many areas lack basic infrastructure like sidewalks, street lights, and crosswalks, and streets are often designed primarily for motor vehicles. This leads to unsafe conditions for those without cars, with pedestrian fatalities making up over 40% of road traffic deaths in low- and middle-income countries. (Zahra, 2015)

As part of the city's commitment to implementing the city plan and fostering surrounding growth, the Addis Ababa Ring Road Project was started in 1998. (Addis et al. ,2002).

The Addis Ababa Ring Road has several uses, including fostering peripheral development, providing an alternate route for clogged roadways, lowering travel times and costs, highlighting the city's scenic beauty, and preventing heavy trucks from traveling from the city's five outlying areas to the city center. The Ring Road is also intended to move traffic from the city center, which currently uses a network of city streets, to the Ring Road. These goals seek to enhance mobility and transportation in the city while encouraging sustainable growth and minimizing the detrimental effects of excessive traffic on the city center. However, the Ring Road's development has created several issues with regard to active street frontage and pedestrian accessibility.

1.2 Statement of the Problem

Transport infrastructure like highways, railways, and main roads can improve motorized transportation at regional and interurban levels. However, they can also create obstacles that make it difficult for pedestrians and cyclists to travel locally. These barriers can result in detours, reduced social interactions, limited access to services and employment, and decreased attractiveness of Frontage. (Van Eldijk et al., 2022)

A good streetscape is a safeguard and a requirement for a thriving environment. To accomplish this, a deeper comprehension of urban spatial development and road building is required. However, in the study region, where walking is widely practiced, the problem of walkability and street quality must be addressed. This is also related to the city government's decision to design the ring road without seeking community involvement.

The large number of pedestrians in Addis Ababa—half of all trips within the city are on foot, and there are only 66 vehicles per 1,000 people—means that pedestrian needs should have been a major consideration in the design of the city road (World Bank and UNECA, 2002). However, the approach of building several pedestrian bridges to supposedly address punctual connection issues reflects a primarily technical design attitude that views pedestrians as abstract numbers rather than actors who behave under their human, economic, and social needs. The layout and design of these pedestrian "supplements," which are solely based on the functionalistic paradigm of safely and "rationally" crossing a street from point 1 to point 2, clearly illustrate this attitude.

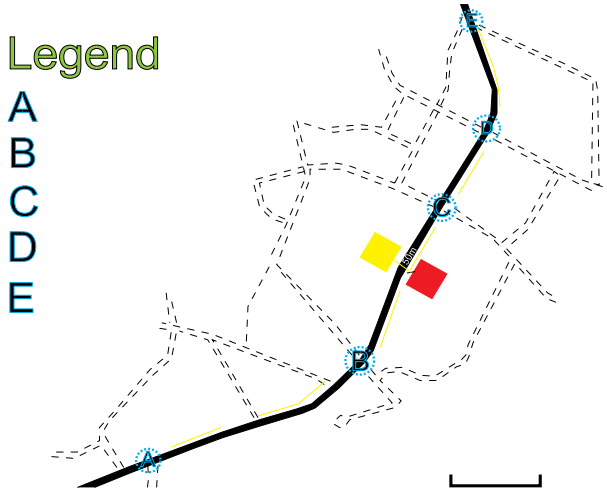


Figure 1.1 Picture showing crossing a street from one side to the other side

This lack of consideration for pedestrians has resulted in accidents, with a report by the Addis Ababa City Administration Road Traffic Management Agency, stating that there were 202 accidents on the Ring Road in 2022, with a majority of them (78) occurring in the Bole subcity. The report attributes the accidents to pedestrians attempting to cross the Ring Road by jumping over the fenced ring road, which is illegal and dangerous. The high number of accidents highlights the need for improved pedestrian safety measures and a more holistic approach to transportation planning in Addis Ababa.

Figure 1.2 Picture showing Multiple peoples jumping over the median grills

Various urban street frontage elements' physical quality, connectedness, and impact on consumers' livability perceptions have received little to no scientific attention. The study by Anciaes et al. (2017) highlights the need for measures to improve street connectivity and mitigate the negative impacts of ring roads on pedestrian movement and connectivity. However, further research is needed to explore ring roads' social and economic impacts using

users' perceptions of urban areas and identify the most effective strategies for improving pedestrian accessibility in areas affected by ring roads.

Since this issue is not given deserving attention in our country, such studies that give information about its impact and management are important. Even though the activities regarding improving street quality and walkability are becoming practical in some developing countries, many countries need this understanding and regulation to be part of their urban planning practice.

1.3 Objectives

1.3.1 Genera objective

The study's general objective is to assess the impact of the ring road on the street frontage and pedestrian accessibility in the Bole sub-city.

1.3.2 Specific objectives

- To examine the existing street frontage condition of the Bole sub-city ring road.
- To investigate the push and pull impact of the Bole sub-city ring road on socioeconomic and environment.
- To assess the effect of ring roads on pedestrian accessibility in the Bole sub-city.

1.4. Research Questions

1. What is the existing street frontage condition of the Bole sub-city ring road?
2. What is the push and pull impact of the Bole sub-city ring road on socio-economic and environment?
3. How do ring roads affect pedestrian accessibility in the Bole sub-city?

1.5 Significance of the Study

The government can develop the best ideas for installing ring roads inside cities that do not impede the growth of the surrounding neighborhoods based on the results of this study. The study identifies the best course of action for the case area residents to adapt to the current socioeconomic situation.

Additionally, to save time, money, and energy, it will be used as a reference for other researchers who wish to research related issues. Additionally, it will add to the scant literature already available on the effects of ring road construction on street frontage development in developing countries.

1.6 Scope of the Study

1.6.1 Spatial scope

The Special scope of this study is to investigate the influence of the Bole sub-city ring road on the street frontage and pedestrian accessibility from Megenagna square to Mamo (7 km length and 40m width) with uneven pavement width (varying from 1.6 - 2.5m) on both sides of the street. The research looked at both the left and right sides of the Bole sub-city ring road street. The study's population consists of Bole sub-city ring road street users.

The study was carried out on the Bole sub-city ring road because highly influenced pedestrian walkability and street quality are located in the study area, the absence of many street crossings exposes it to many risks, the area requires heavy maintenance, and has an inadequate width from both sides for future growth.

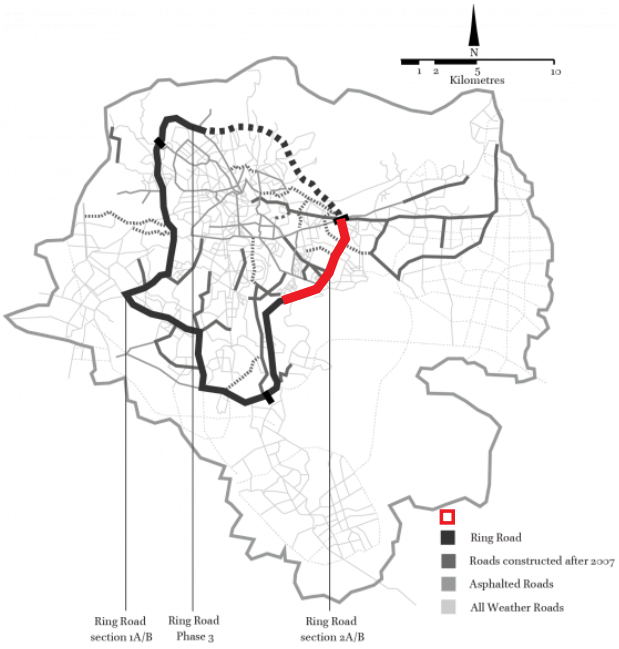


Figure 1.3 Location map of the study area

1.6.2 The thematic scope

Thematically the study focused on the effects of ring roads on the street frontage and walkability of the pedestrian in bole sub-city by investigating the factors for causing dead street frontage and obstructing pedestrian's experience of walking habits, pedestrian behaviors, and perceptions about the sidewalk facilities, performance, infrastructures, amenities, and safety of the pedestrian walkways along the study route. Furthermore, the study assessed the mitigation system between the ring road, street frontage, and a walkable environment and developed strategies that enhance the street frontage study area.

1.7 Limitation of the study

The primary constraint of the study was the need for a reference document concerning the interaction between urban spatial development and road construction within the Ethiopian context. Conducting site surveys and obtaining responses from participants proved to be challenging. During the data collection, measuring sidewalks and counting pedestrians proved difficult due to the prevailing political climate in Addis Ababa, which involved the demolition of houses. Additionally, people needed to be more open to engaging in conversation on the subject matter. These issues inevitably impacted the data collection and analysis processes to some extent.

1.8 Organization of the Research

The research is organized into five chapters. Each chapter examines the content and data of the study. The main chapter in the research is further described as follows.

Chapter One: The study's overall idea, research problems, objectives, questions, significance, scope, description of the study area, and research limitations are all stated in the introduction, which also serves as an illustration of the thesis.

Chapter Two: Literature Review is a chapter that discusses key terms related to street and walkability. The border area of the research was examined, evaluated, and stated from different literature in a literature review. It contains an Introduction, basic conceptual definitions, and theoretical and empirical views of the research area were referred to carefully.

Chapter Three: Material and Methods discusses the method and materials used for this specific research. It explains the research approach, research design, methods, methods for data collection, types and sources of data, and finally, data analysis and presentation methods discussed.

Chapter Four: Result and Discussion is a chapter that presents the conclusions from the qualitative and quantitative data. Field observation and case studies are used to get irrational quantitative data. The qualitative data are analyzed based on a questionnaire survey, field observation notes, and written documents. This chapter presents and interprets the organized data.

Chapter Five: Conclusion and Recommendation is the section where the results are discussed more meaningfully by comparing each result with the international guideline. The chapter concludes with the results and discussion as well as recommendations for further studies are also given.

CHAPTER TWO

LITERATURE REVIEW

2.1 Ring roads

2.1.1 The Rationale of a Ring Road

Ring roads started to gain popularity in new, large urban centers in the 1960s. By promoting radial development patterns and placing commercial, residential, and industrial activities close to highway interchanges, they primarily impact the spatial organization of urban areas. The waning vitality of central areas is typically associated with the rise of peripheral centers, which profit from increased accessibility brought about by the construction of ring highways. Ring roads consequently modify the accessible pattern of metropolitan areas, which reroutes urban growth. Due to the expansion of urban areas, traffic congestion, and the requirement for inter-urban transportation, the present design of urban roadways needed to be revised. (Rodrigue, 2020).

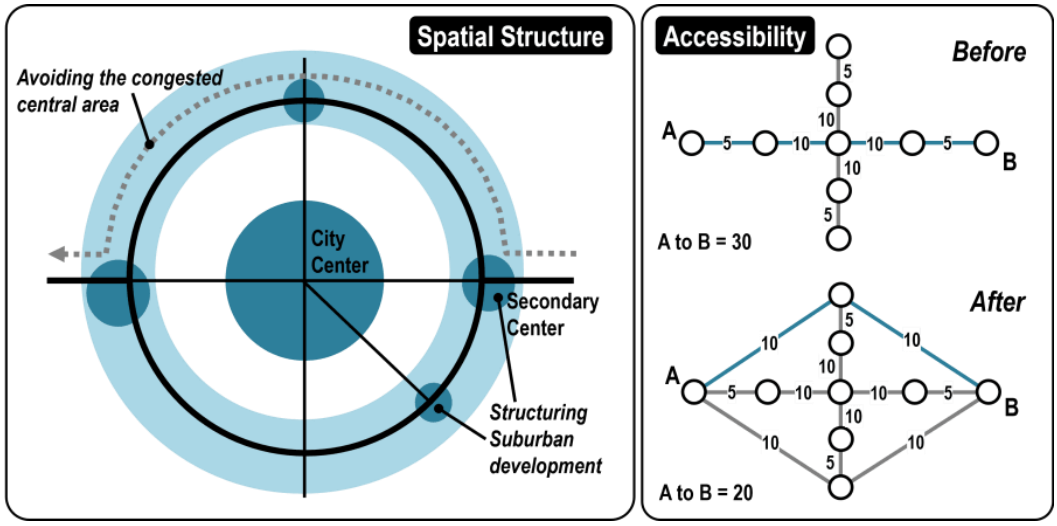


Figure 2.1 The Rationale of a Ring Road

Major cities have erected a number of ring roads around them, which have since become an essential component of their spatial architecture. The multicentric character of many cities has been formed by urban development clusters, with highway interchanges in suburban regions serving as significant examples. What might be referred to as peri-urban areas have been generated by the extension (and over-extension) of metropolitan districts. The phrase "edge cities" has been used to describe a collection of urban development taking place in suburban settings, even though they are positioned far from the urban core and the suburbs

and are nonetheless accessible by reasonable commutes. Travelling from point A to point B would take 30 minutes before the building of a ring road, as demonstrated in the fictitious example above, with the major causes of delays being having to pass through the central region (e.g., limited roads, traffic, speed limits, traffic lights, etc.). As soon as a ring road is built, travel times between points A and B are lowered to 20 minutes, regardless of how far apart they are. This is because congested areas are avoided. Additionally, because ring roads are typically limited-access highways, they can reduce the amount of time it takes to cross a metropolitan region by allowing for speedier traffic. (Rodrigue, 2020).

Ring roads are a common type of urban transportation infrastructure that aims to reduce traffic congestion by providing an alternate route for through traffic that bypasses the city center. ring roads are widely adopted in cities all around the world and have been shown to be effective in reducing congestion and improving travel times. However, the construction of these roads can also lead to negative impacts such as increased air and noise pollution and the displacement of communities. Therefore, it is essential to carefully consider the potential benefits and drawbacks of ring road development(Deakin, Robbins, 2017).

Increased connectivity and accessibility are two advantages of ring road construction that may result in economic growth and better quality of life for locals. ring roads can connect outlying regions of a city to its commercial core, enhancing access to employment and other possibilities. Additionally, ring roads can increase connectedness throughout the city, facilitating citizens' access to various locations. Both social welfare and economic progress may benefit from this (Ramanayya, T.V., & Reddy, 2015).

However, the development of ring roads may also be detrimental to the ecology and general welfare. ring roads can worsen noise and air pollution, especially in neighborhoods close to the road. The health and wellbeing of those who live close to the road may suffer as a result. Furthermore, the building of ring roads might result in the uprooting of communities, especially when the route is built through a heavily populated area. Loss of social networks and community cohesion are only two examples of the detrimental social effects this may have (Gao, J., & Regan, 2016).

It is crucial to carefully plan and construct the road to minimize its negative effects on the environment and society in order to counteract the negative effects of ring road development. including green infrastructure into ring road designs can improve stormwater management and biodiversity while reducing air and noise pollution. Participating in the planning process

and engaging the community can also help to ensure that the needs and worries of the community are taken into account (Zhang, X., & Chen, Y., 2021).

The efficiency of ring road development's implementation and management is also crucial to its success. Effective management measures, can help to ensure that the road is used effectively and safely, lowering the likelihood of accidents and congestion. The road can be built on schedule and within budget with effective implementation, minimizing the negative effects on nearby people and the environment (Zhang, X., Chen, H., & Wang, Y., 2019).

2.2 Street Frontage

Street frontage formed by building facades with their configuration of doors, windows, and the connection between private and public activities as a corollary of the land uses. In Grogol residential area, where the houses are owned by middle to upper class people, the building are more or less designed with functional and aesthetic consideration and using good material quality. But that doesn’t guarantee the good quality of the street frontage. The quality of street frontage is determined by a combination of functional variety, good design, and transparency. In the middle to upper-class residential areas of Grogol and the planned part of Manggarai, houses are well-designed with yards and fences, but lack transparency due to high fences for security reasons. However, some houses along the main street in Grogol that have been converted into commercial spaces have more transparent frontages. In contrast, the street frontage in the squatter part is not aesthetically pleasing but has a great scale of transparency and variety, with a strong connection between private and public spaces. The commercial street in Manggarai has a less intimate transparency due to its commercial intentions(Gehl & Soholt, 2002).

Figure 2.2 Street frontage at Grogol. Residential street (left), commercial street (right)

Figure 2.3 Street frontage at Manggarai. Planned Residential Street (left), Squatters streets (middle) and commercial (right)

2.2.1 Active Street Frontages

Carmona et al. distinguish between the public realm's physical and social components in their book Public Places, Urban Spaces. They view the physical public sphere as a collection of observable traits. These qualities may take the form of distinct, easily recognizable objects, such a bench or a street lamp. They might also be more conceptual, such walking routes and links. Furthermore, these features could be privately owned, like a building facade, or they could belong to the public, like a pavement. The ability of these interrelated qualities to create a setting that facilitates and promotes social activities and events determines the success of the physical public realm.(Carmona et al., 2004).

More demands are placed on the public realm as cities and towns grow, and the link between it and other structures is crucial for achieving high amenity, community safety, and aesthetic appeal. Buildings should have a "active frontage" to the public realm, pedestrian activity needs to be important and safe, and streets and pathways should also be attractive in order to maximize these attributes. In order to promote the public realm, streets and public spaces should be constructed with the ideas of mixed use, permeability of blocks and neighborhoods, and active frontages at the ground level. The most active street fronts are those that are near busy pedestrian areas and non-residential uses such shops, studios, offices, cafes, recreation places, and promenade options. Active street fronts are those that interact with the street and the people who use it. This can be done by having a ground floor use that is open to the public, like a shop, or by having doors and windows that look out into the street. Making frontages "active" enhances the public realm's interest, life, and vigor((Firm) & Partnership, 2004).

When it comes to creating an engaging and vibrant street scene, narrow frontage buildings with frequent doors and windows and articulated facades can make a big difference. These features give the street a vertical rhythm and break up the monotony of blank walls. Projections like bays and porches can add depth to the facade and create a welcoming vibe.

Lively interior uses that are visible from the outside or spill out onto the street also contribute to a dynamic street scene, encouraging pedestrian activity and creating a sense of community. By incorporating these design elements into urban planning, cities can create streetscapes that are more engaging and attractive to both residents and visitors.

Source-Urban Design Compendium volume-1, 2000.

Figure 2.4 Quincy Market, Boston, USA: an illustration of a 100% active location

2.2.2 Inactive Street Frontages

The pace of pedestrian traffic can range from leisurely strolling to hurried, determined halfjogging. Some hallways are just intended for movement, with no inviting stores, building uses or pavement activities to entice us to stop and stay for a while. Window displays, unique stores, sidewalk cafes, courtyards and street vendors make some places more interesting. These streets are essentially linear plazas that serve as destinations in and of themselves, as locations to visit, hang out, and engage in urban life. On certain instances, a corridor is transformed into an urban chamber, a space for being and belonging in addition to circulation. The rhythm and pulse of the town are influenced by user demographics, foot traffic volume, direction, and pace, vehicular use profile, and storefront activation, all of which are cyclical in nature. Of course, eviscerating the finer grain of older city networks in favor of building massive structures benefits the public coffers. The megastructure reduces the amount of public street.(Matthew & Steve, 2007).

Additionally, because private roadways make up the megastructure's circulation, the policing function might be privatized. The extent to which a city's streets and public spaces are accessible to all residents and may be used freely and safely is one indicator of a civilized society. But cities with vast single-use blocks that break the intricate network of public pathways; a coarse-grained metropolis that is dying at night; a terrifying environment for inhabitants who are not shielded by the solace of a fast-moving car (Nasution & Zahrah, 2012).

Figure 2.5 Inactive Street: no feeling of place, no connection to its environment, no quality, with streets made exclusively for cars.

2.3 Major Causes of blind street frontages

The first criterion looks at whether the street has a mix of compatible land uses that might complement one another, address local residents' needs, and draw tourists. According to his findings, Columbia Street and its neighboring streets' institutional, residential, and office uses all provide a customer base for the street's retail businesses, though many of these businesses may not be particularly well-liked by the general public.

The second criterion in this group investigates whether interactions and consequent activity are facilitated by small, continuous street frontages with numerous doors. The final criterion that Jennifer investigates during his study is whether street frontages could become lifeless as a result of distributed activities occurring at various levels as opposed to just one level.(Natland, 2007)

2.4 The need for activating blind street frontages

Building facades should be planned so that they extend out into the street and provide an "active" frontage onto public space, enhancing the public realm's interest and vitality. The more doors and windows that open onto public space, the better, as they hint at a human presence. The interface must allow 'private' interior activities to coexist practically with 'public' outside activities. Views into buildings pique the interest of onlookers, while views that output 'eyes on the street' improve safety. A good measure of the potential for street life is the number of doors or entrances that are directly visible from public space and generate activity. Continuous commercial or retail land uses that have access to the sidewalk offer lively, pedestrian-focused street frontages. By promoting pedestrian activity, it promotes public safety and passive surveillance, increases the amenity of the public domain, and can

also help to sustain the economic viability of the street where this provision will apply. Activity hubs are typically created along streets or at points of high pedestrian activity. By offering a distinct street address, direct access from the street, and a direct view over the street, residential structures can also draw attention to themselves. (Davies, 2017)

It is important for streets to have a feeling of place, which is mostly achieved through regional distinctiveness and thoughtful design. Additionally, they offer easy access to the structures and areas that surround them. Therefore, the majority of highways in urban areas can be categorised as streets. People who regularly interact with one another build their communities and foster a sense of pride in their local environments. Furthermore, residents of high-quality environments are more likely to feel a sense of responsibility for upholding the standard of their neighborhood's streets and public spaces. Since streets make up the majority of the public realm, they have a substantial impact on the built environment's quality and are essential to the development of sustainable, inclusive, mixed-use communities.(Cliff, 2003)

A street frontage is considered active if it has a wide variety of uses, few passives and no blind facades, more than 25 doors and windows per 100 meters, high-quality construction materials, and intricate detailing. As a result, active frontage promotes a "human scale" and fine pedestrian grain, adds interest, life, and vitality to the public realm, which calls for amenities like street furniture, banners, art, street trees, and special paving, as well as wayfinding signage, historical elements, and cultural references, to foster a "sense of place". (Davies, 2017)

Quality is in large part a result of the urban structure's wonderful paths' variation and almost maze-like layout. Public safety in streets is somewhat influenced by how heavily people utilize them and how much activity they create. Streets are safer when they have a lot of traffic and when no one in the nearby buildings pays them any attention. 'Self-policing' is how Jane Jacobs described crowded streets during the day and at night. The pattern of land usage is varied throughout Tavira's old town. Even though the town still has a sizable residential population keeping it alive, even residential streets are lined with various stores, pubs, restaurants, and tiny offices. This particular pattern has only been interrupted in locations that underwent redevelopment in the latter half of the 20th century, sometimes in large-scale administrative or commercial centers(Mertens & Moughtin, 2007).

2.5 Techniques for turning on the frontages of blind streets

One strategy for reviving the cores of cities has been to entice back those suburbanites who despise and fear the city by constructing solitary, sterile fortresses. Whyte rejects this approach, saying, "If these folks despise the city, let them stay away. Building inferior suburban retail centers won't attract people back to the city's downtown; instead, we must capitalize on the city's advantages by providing a highly urban experience with chaotic, congested, and active streets(Whyte, 2012).

Whyte believes that legislation against blank walls is important, despite the fact that he thinks it is unfortunate that it has come to this. New York City, which, like Montreal, has a long history of street life, has used zoning laws to mandate that, starting in a 1971 bylaw, 100 percent of the frontages of buildings on specific streets have small shops with entrances directly to the street and with see-through windows, and that the width of entrances to buildings must be strictly limited. Whyte conducted pedestrian counts on hundreds of pavements across North America and came to the conclusion that St Catherne St is one of the continent's healthiest streets due to the amount of activity there. He anticipates the "revenge of the street," the day when regular, healthy streets with pavements lined with bustling shops will reclaim the upper hand and the street will once again play its vital function as the city's river of life.

These are common aspects of the contemporary planning trends described in the Miami 21 zoning code that make the blind street frontages lively and economically efficient. The following are some of the methods used in this code:

Transforming Blank Walls

These ideas suggest that an inactive street can be made dynamic and walkable by removing massive blank walls and bringing buildings closer to the sidewalk with frequent entrances and busy sidewalk businesses. The presence of more windows and doors can increase safety by increasing the number of "eyes on the street." Increased landscaping and tree cover improve this pedestrian area's use and benefit the environment.

Before **After**

Figure 2.6 Transformed Street frontage by removing large blank walls

Source: The Miami 21 Zoning Code, for the city of Miami in the state of Florida, USA.

Externalizing Development

Bright neighborhood streets can transform self-contained, inward-looking private undertakings into useful elements. -Planned public open space and the addition of landscaping provide a pedestrian-friendly environment.

Figure 2.7 Activated blank wall by turning the development out ward

Source: The Miami 21 Zoning Code, for the city of Miami in the state of Florida, USA. Mixed-use neighborhood centers allow for the connection of neighborhood center nodes via transit, increase employment prospects, and provide neighborhood services within easy walking distance of residents. You'll see that there is now both residential and business space on the ground floor of the property. (Retail stores).

Mixed-Use Corridors

Jobs, neighborhood amenities, live-work possibilities, and transit opportunities are all close by in mixed-use neighborhood corridors with medium densities. In this illustration, the transportation corridor transitions from merely serving as a route to a destination to serving as a destination unto itself. Large, blank walls are replaced with buildings that offer pedestrian-oriented frontages creating mixed- use streets.

Improving architectural detail and constructing on a human scale creates a welcoming environment for people and develops neighborhood identity. Landscaping and planned public open space are added to create a pedestrian-friendly environment. The addition of alternate modes of transportation and fresh, diverse housing options are made possible by transportation corridors

Figure 2.8 Dead Street frontages replaced with mixed- use active streets.

Source: The Miami 21 Zoning Code, for the city of Miami in the state of Florida, USA.

Improved Streetscapes and Building Frontages

Wide walkways, parallel parking, and planting are examples of public improvements that can help create tidy streetscapes. Building frontages play a crucial role in designing a cityscape that is friendly to pedestrians. In this example, not only are there street improvements on the public realm such as trees and wider sidewalks, but there are also private improvements such as wings. The pedestrian is made comfortable by all of these. These businesses are able to expand the number of their customers thanks to the installation of parking places along the road.

Figure 2.9 Activating dead street frontage by improving streetscapes

Plug-in urban design

Refers to the plugging in of new infrastructure elements in to existing built up areas in order to bind them in to a unit and boast their amenity level and thus competitive advantages. It is the design where the design goal is to create the infrastructure so that subsequent developments can ‘plug in’ to it or a new element of infrastructure is plugged into the existing urban fabric to enhance a location’s amenity level as a catalyst for development.

Alternatively, it can mean the design and construction of the infrastructure of a development site to bind it in to a unit and as an incentive for individual owner builders or property developers to invest in new buildings.

2.6 Pedestrian accessibility

2.6.1 Pedestrian

The Oxford English Dictionary published in 2006 states a pedestrian is someone who travels on foot or in a wheelchair for a variety of reasons, including social contact, shopping, leisure, recreation, exercise, and protest. Anyone using their feet or a vehicle pushed by human power is considered to be a pedestrian. A person who is unable to move around as a pedestrian but has utilized a self-propelled wheelchair, an inoperative tricycle, or a motorized quad bike is referred to as a pedestrian. A pedestrian is a person who chooses to travel on foot rather than by automobile. In contrast to automobiles, public transportation, or bicycles, pedestrian behavior is specifically specified (Dunmore & Fleischer, 2008).

2.6.2 pedestrian accessibility

The degree to which individuals may readily and securely walk to various locations within a city is referred to as pedestrian accessibility. According to Cervero and Kockelman (1997), pedestrian accessibility is a crucial idea in urban design because it affects how much people move around, interact with one another, and engage in economic activity. Regarding pedestrian accessibility, there are a number of theories and ideas that are pertinent to urban planning and design.

The idea of walkability is one of the fundamental ideas in pedestrian accessibility. The term "walkability" describes how pedestrian-friendly a neighborhood or city is, including amenities like sidewalks, crosswalks, and pedestrian-friendly crossings. Ewing and Cervero (2010) claim that walkability influences social contact, economic activity, and physical activity and is a key factor in determining physical activity.

The level of walkability refers to how well the built environment supports and promotes walking by assuring pedestrian comfort and safety, swiftly and affordably connecting people to a variety of destinations, and offering visual interest on trips throughout the network. The Wisconsin Pedestrian Policy Plan 2020 provides a clear definition of a walkable neighborhood: "Walkable communities are the ultimate goal of every project to promote pedestrian traffic. If a neighborhood has been purposefully designed, constructed, or otherwise altered to facilitate walking, it is said to be walkable. Walking is considered a

common mode of transportation in extremely walkable communities, and it doesn't divert or impede automobile traffic. The idea of walkability may be crucial to sustainable urban planning (Southworth M. (2005)).

Table 2.1: Walkability Assessment Indicators

Indicators	**Elements to access**
Connectivity	• Block size • Number of pedestrian connections in the region • Density of path crossings • Path distance to various destinations
Linkage to other modes	a connection to another means of transport to improve connectivity inside the city,
Land use patterns /Different Activities in the area/	The area's land use patterns in relation to the environment
Safety	Facilities along the pedestrian paths to ensure that the neighborhood's residents can walk there safely • Lighting • Conflict with automobile traffic
Path Quality	• Walking environment with barriers, pavement, etc. • Shading/Natural Sunlight • Pedestrian Path Width • Lighting • Continuity
Path Context	Physical features and aesthetic appeal along the pedestrian path for pedestrian entertainment Street design with trees and landscaping street front interaction the sights and lighting Interaction with vehicles for air pollution and noise

2.7 Factors Influencing Pedestrian Accessibility

2.7.1 Built Environment Characteristics

Determined by the built environment, pedestrian accessibility is a critical factor. Highdensity development, integrated roadway networks, diverse land use, and high-quality pedestrian infrastructure are all essential components of a walkable environment (Ewing &

Cervero, 2010). By allowing people to reach many locations within a short walking distance, mixed land use encourages walkability. On the other hand, interconnected roadway networks help pedestrians navigate in an effective, direct manner (Frank et al., 2005).

2.7.2 Demographic and social factors

Age, gender, wealth, and physical ability are additional socioeconomic and demographic variables that affect pedestrian accessibility (Clifton et al., 2007). For instance, physical impediments or a lack of proper infrastructure may make it more difficult for older persons and people with disabilities to utilize pedestrian facilities (Iwarsson & Sthl, 2003**).** Additionally, due to insufficient investment in pedestrian infrastructure in their neighborhoods, lower-income groups may have limited accessibility for pedestrians (Talen, 2018).

2.8 Measuring Pedestrian Accessibility

Walking Indexes

To measure pedestrian accessibility, a number of walkability indices have been established, including Walk Score **(**Carr et al., 2010). To give a composite assessment of the built environment's support for walking, walkability indices often combine measurements of land use mix, street connectivity, and residential density (Frank et al., 2010). The association between walkability and other outcomes, including physical activity, preferred mode of transportation, and environmental sustainability, has been evaluated using these indices (Riggs et al., 2020).

2.9 Interventions to Improve Pedestrian Accessibility

2.9.1 The pedestrian network

The pedestrian network, which refers to the connected system of sidewalks, walkways, and other pedestrian infrastructure that enables people to walk to various locations in a city, is a crucial element of pedestrian accessibility. The degree of pedestrian activity and accessibility in a city may be significantly impacted by the quality and connection of the pedestrian network (Gehl & Soholt, 2002).

2.9.2 Complete streets

Complete streets are those that have been planned to be safe and easily accessible for all users, including drivers, bikes, and pedestrians. communities with high levels of pedestrian activity may be made safer and more livable by planning roadways with the needs of all users

in mind. Complete streets highlight the significance of creating roadways that are accessible to all users, priorities safety, and are environmentally friendly (National Complete roadways Coalition (2016)).

2.10 Empirical Literature Review

This literature review examines at empirical data on how ring roads affect street frontage and pedestrian accessibility based entirely on phenomena that have been observed and measured in the field and in response to research questions that have been posed. These studies have helped to clarify the general relationship between ring roads, street frontage, and pedestrian accessibility.

2.10.1 Case Study: Urban Form and Pedestrian Accessibility in London

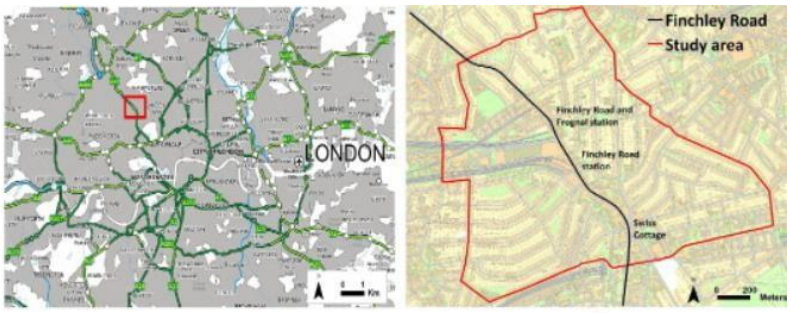


Figure 2.10 Finchley Road location within London (a) and boundaries of case study area (b).

Anciaes, Jones, and Mindell (2017) conducted a study on street connectivity in London, examining the impact of ring roads on pedestrian accessibility. The study used data from the London Walking and Cycling Activity Study, which collected data on the walking and cycling behavior of over 7,000 London residents. The study analyzed the relationship between street connectivity and pedestrian accessibility, using measures such as the number of street intersections and the density of street networks.

The study by Anciaes et al. (2017) found that ring roads had a significant impact on street frontage in London. The study found that areas near ring roads tended to have lower levels of street connectivity, as the physical barriers created by the ring roads limited pedestrian movement and connectivity. This can result in a loss of local character and a reduction in the sense of place in these areas.

Figure 2.11 Aspects of Finchley Road: a) Lack of formal crossings, b) Barriers preventing pedestrians crossing, c) Swiss Cottage junction.

The impact of ring roads on street frontage can also affect the vitality of local businesses. The study by Anciaes et al. (2017) found that areas with higher levels of street connectivity tended to have more vibrant street frontages, with a higher density of shops, cafes, and other businesses. This suggests that the construction of ring roads can have a significant impact on the distribution of economic activity within a city.

The impact of ring roads on pedestrian accessibility was a key focus of the study by Anciaes et al. (2017). The study found that areas near ring roads tended to have lower levels of pedestrian accessibility, due to the physical barriers created by the roads. This can make it more difficult or dangerous for pedestrians to cross the road, and can limit opportunities for walking and cycling in these areas.

The study also found that areas with higher levels of street connectivity tended to have higher levels of pedestrian accessibility. This suggests that the design of street networks can have a significant impact on pedestrian accessibility, and that measures to improve street connectivity, such as reducing the number of one-way streets and increasing the number of street intersections, can help to improve pedestrian accessibility in urban areas.

Figure 2.12 Space syntax analysis (local scale).

Conclusion:

The study by Anciaes et al. (2017) provides empirical evidence on the impact of ring roads on street frontage and pedestrian accessibility in London. The study found that ring roads can create physical barriers that limit pedestrian access and connectivity, which can negatively impact the health and well-being of urban residents. The study also found that areas with higher levels of street connectivity tended to have more vibrant street frontages and higher levels of pedestrian accessibility, suggesting that improving street connectivity can help mitigate the negative impacts of ring roads on the urban environment.

2.11 Summary and Gaps of the Literature

The study found that ring roads can create physical barriers that limit pedestrian access and connectivity, which can negatively impact the health and well-being of urban residents. The study also found that areas with higher levels of street connectivity tended to have more vibrant street frontages and higher levels of pedestrian accessibility, suggesting that improving street connectivity can help mitigate the negative impacts of ring roads on the urban environment.

However, there are some areas for improvement in the literature on this topic. While the study by Anciaes et al. (2017) provides significant empirical evidence on the impact of ring roads on pedestrian accessibility, there is a need for further research to explore the social and economic impacts of ring roads on urban areas. For example, further research could examine the impact of ring roads on local businesses and the distribution of economic activity within a city.

In conclusion, the literature on the impact of ring roads on street frontage and pedestrian accessibility provides essential insights into the impacts of ring roads on the urban environment. The empirical literature review highlights the need for measures to improve street connectivity and mitigate the negative impacts of ring roads on pedestrian movement and connectivity. However, further research is needed to explore ring roads' social and economic impacts on urban areas and identify the most effective strategies for improving pedestrian accessibility in areas affected by ring roads.

CHAPTER THREE
MATERIALS AND METHODS

This chapter provides an in-depth discussion of the research region and the various categories of data necessary for the study. It also covers the sampling techniques, procedures, and tools used to collect data types. Additionally, the chapter analyzes and describes the techniques used to analyze the generated data, intending to address the research questions and achieve the study's objectives.

3.1 Description of the study area

Bole sub-city is the study area's precise location concerning Addis Abeba. Bole is one of Addis Ababa's 11 sub-cities. The bole sub-city's coordinates are 9.0183° N and 38.8029° E. The case study area's ring road is 7 kilometers long and 56.25 hectares in total area.

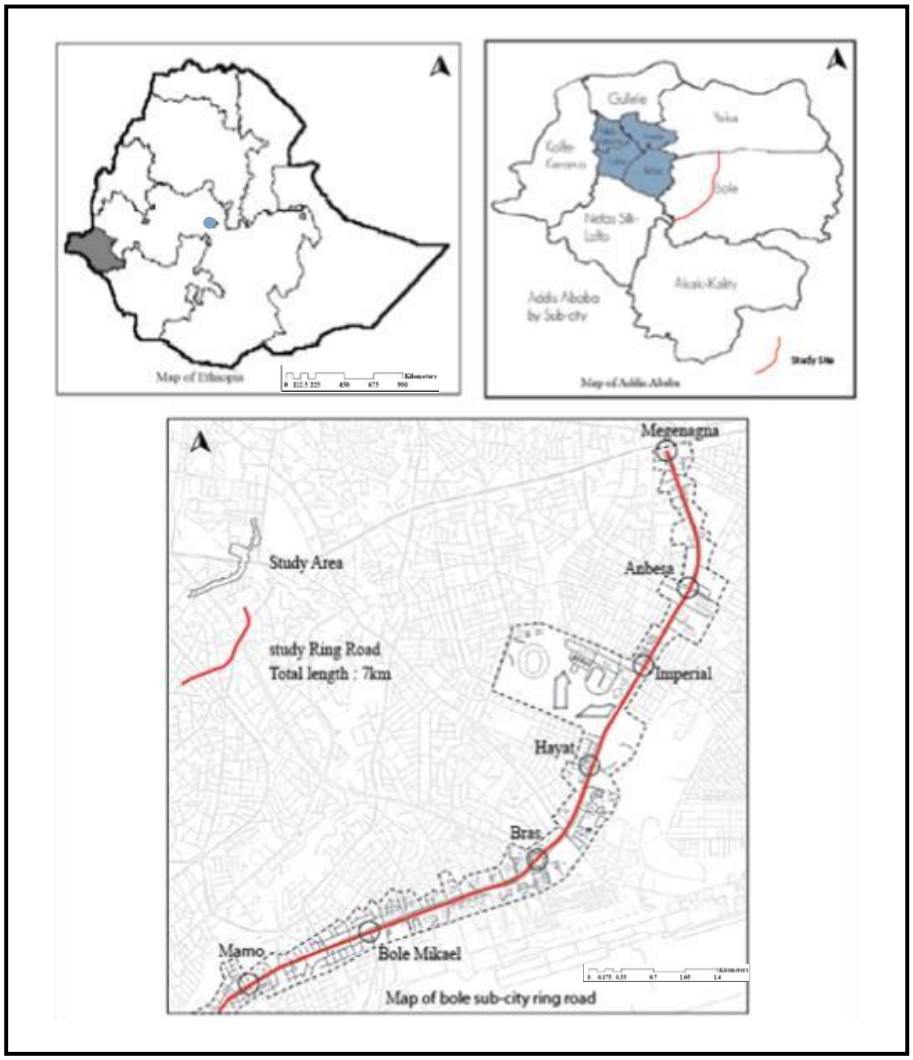


Figure 3.1 Location map of the study area

3.2 Criteria for selecting the study area

The study defined criteria and concepts and numerous selection criteria based on walkability and street quality variables to choose the study region. Based on traffic, pedestrian activity, street frontage, and the city's physical characteristics, the route from Megenagna Round to Mamo was selected. Based on these selection criteria, observations were made. This observation looks at the street's physical characteristics, including its breadth, the amenities on the sidewalks, how people travel through it, where they cross, and how it looks. Another factor is that Bole is one of the busiest and most densely populated sub-cities in Addis Ababa and is home to the city's main airport.

3.3 Background of the study area

The growth trends of Addis Ababa have been closely linked to the development of the ring road. The ring road has promoted decentralization and dispersal of economic activities away from the city center, leading to new economic centers and neighborhoods along the ring road corridor. Additionally, the improved accessibility provided by the ring road has facilitated the expansion of the city's-built environment, leading to rapid population growth and urbanization. (Addis et al. ,2002).

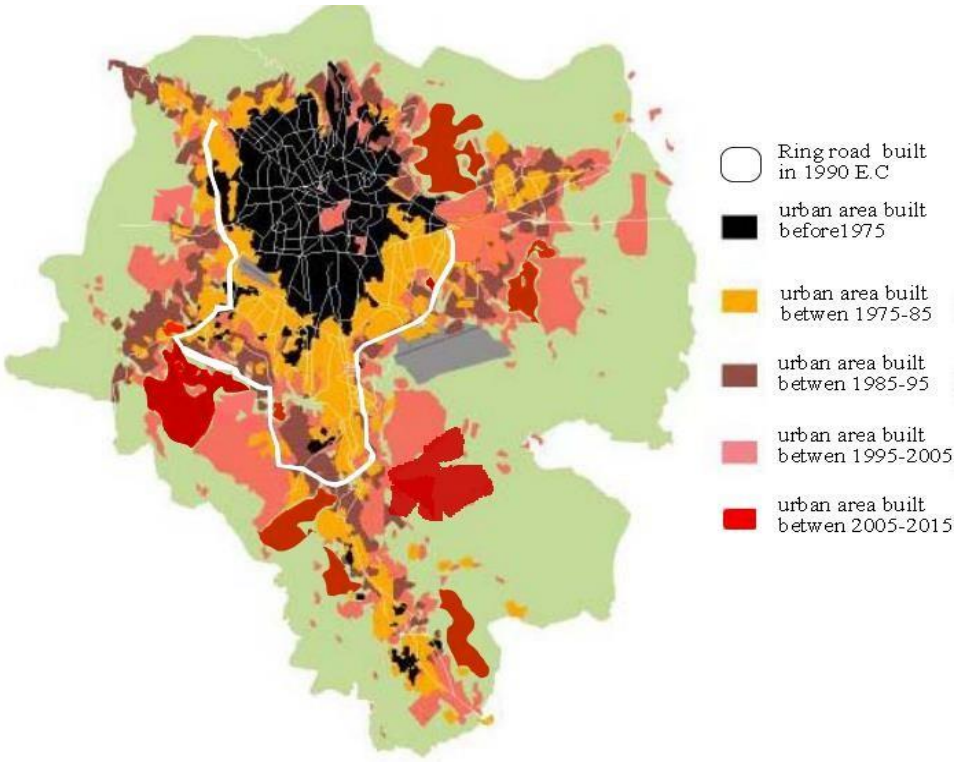


Figure 3.2 Growth trends of Addis Ababa between 1975 and 2015

Source: Revised Addis Ababa Master Plan Executive Summary.2015

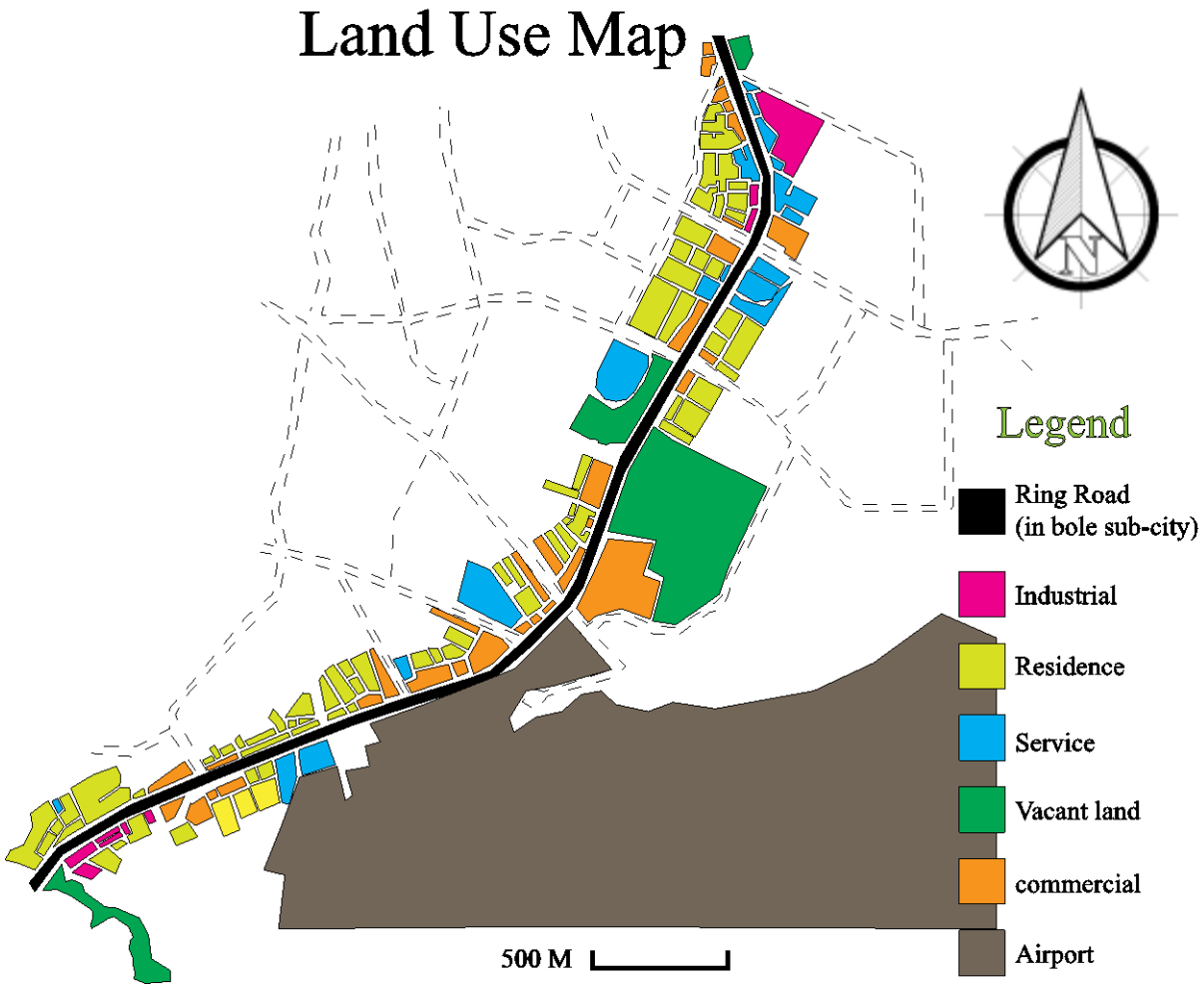


Figure 3.3 Existing land use map of the study area.

The portion of the ring road that passes through the Bole sub-city is a circular road that runs around the perimeter of the sub-city and intersects with several major streets and roads. The length of this portion of the ring road is estimated to be around 5-7 kilometers, but this may vary depending on the exact route and configuration of the road.

3.4 Research Design

According to Yu (2009), a research design is the "procedure for gathering, analyzing, interpreting and reporting data in research studies." It is the overarching strategy for linking the conceptual research concerns with the relevant (and achievable) inquiry. In other words, the study design determines how the specific data will be collected, how it will be gathered and analyzed, and how it will be used to answer the research question (Wilkerson, 2014). In order to completely investigate the situations, a descriptive research design was used in the study.

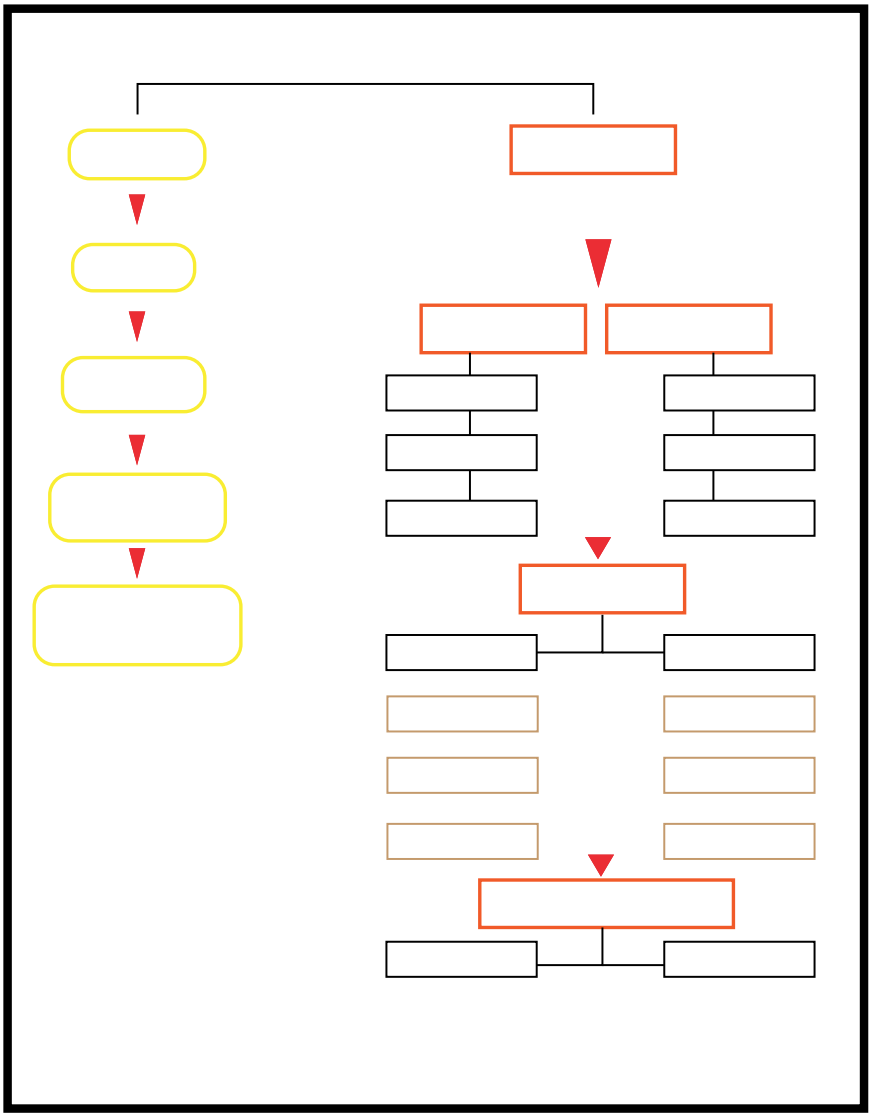


Figure 3.4 methodological design (Source: Own design, 2023)

3.5 Study approaches

This research adopted a deductive research approach. The deductive approach means reasoning from the general to the specific. The study generates general information on specific information. The researcher used this method, allowing them to collect qualitative and quantitative data. A qualitative method is essential for gathering respondents' opinions and experiences about pedestrian facilities and related challenges. On the other hand, the quantitative approach is crucial for getting numerical data from questionnaires so that the study can gather statistics through extensive surveys.

3.6 Research method

Quantitative and qualitative research approaches were required to meet the study's aims. A qualitative method was used to investigate the quality and condition of the street frontage that is already available, and a quantitative approach was implied to determine how well these facilities meet the demand for pedestrian's friendly environment. For this study, primary data sources were used to gather information. Peak pedestrian volume from the research region was used to calculate the number of services provided by existing pedestrian facilities, their extent relative to demand, and their conditions as observed and recorded through field surveys.

3.6.1 The Existing Street frontage condition.

Site observation method

Direct and controlled observation using photography and a checklist (See Appendix D) was the main data collection method for the first objective. The initial data collection approach was a direct and controlled observation by taking site photos and filling prepared checklists to assess the physical qualities and characters of the Ring Road streets from Megenagna to Mamo. The existing streetscape appearance was evaluated Using a checklist. The checklists were prepared based on general street frontage elements, urban utilities, and urban street transport amenities.

The checklists were used on April 4,5, and 6 observation dates for three consecutive days. Depending on those approaches, the current physical character of the streets was documented. This method was applied and used in this research to deeply understand the extent of urban physical changes or observed situations occurring in the selected street and the existing condition of the streetscape.

3.6.2 Impact on socio-economic and environmental conditions.

Sampling

The target population for this specific objective is the tenants and owners of commercial buildings on the ring road corridor. In this study, 50 tenants and 30 owners were interviewed judgmentally. This was significant because tenants and owners of commercial buildings are the main actors in business activity undergone in the ring road corridor and helped to understand their perspective towards the existing condition of the streetscape.

Data Type and Sources primary and secondary data have both been gathered by the researcher. Questionnaires for a sampled population of Bole sub-city ring road users, interviews for tenants' and owners' firsthand accounts, and in-person and telephone interviews with urban planners, academics, and property owners were used to gather primary data.

The location characteristics of the respondent are situated in Bole, between St. Michael and Bole Bras, a distance of 2 kilometers that may be covered on foot in 29 minutes. The locational characters of respondents are divided into three categories: between 100 and 300 meters, between 300 and 500 meters, and between 500 and midway between two corresponding pedestrian crossings. This classification method is applied subjectively in any case. The researcher has represented the scales below for easier comprehension and more straightforward analysis. The first scale corresponds to the neighborhood of pedestrian crossing, the second to a distance of about 400 meters, and the third to a distance roughly corresponding to the distance between pedestrian crossings.

Books, journals, prior study materials, and websites have all been employed as secondary sources of information in this case. Interviewing renters, owners, or property managers based on their willingness to provide information, conducting on-site surveys, and taking relevant measures, such as the distance from the ring road crossing, the rent value, and other features of the urban space units, have been collected directly.

Case studies

Two particular buildings were chosen as a case study for examining the push and pull effects of ring road construction corridors on tenants and business activity since data indicated that they could represent the remaining structures well. This method can give a thorough picture of how ring road construction would affect local businesses and tenants.

These two structures were chosen based on many factors (see Appendix 3), including how close they were to the ring road and whether they were used for business or residential purposes. These criteria were chosen to ensure the buildings picked were typical of the other properties in the region and could offer information about how the ring road construction will affect tenants and commercial activities.

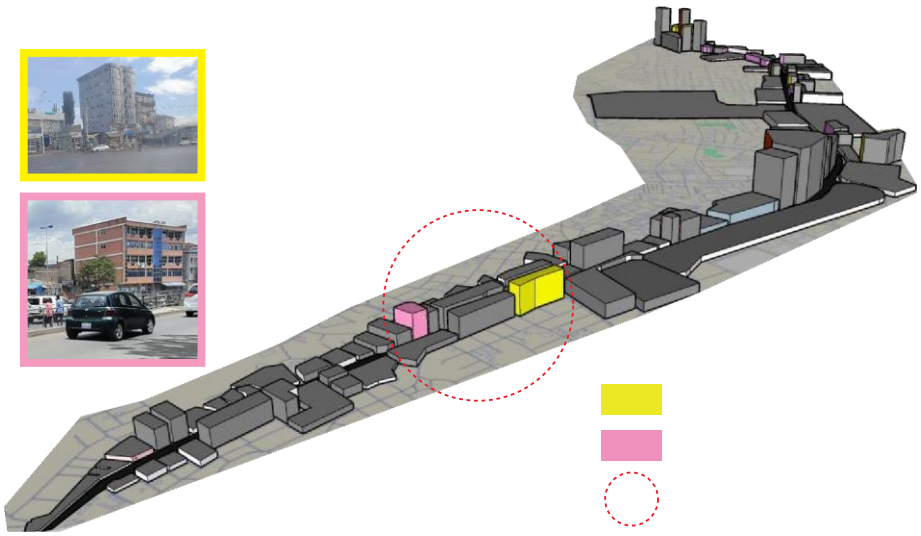


Figure 3.5 Location of selected Building

3.6.3 Effect of ring road on pedestrian accessibility on bole sub city.

A questionnaire survey has been used to achieve the study's third objective. Three hundred eighty-four questionnaires were printed and deployed using 5 data collectors for 384 questionnaire respondents, and 321 respondents only willingly answered the question. In this process, pedestrians were respondents for the questionnaires because they are direct and dayto-day relations with the streets. They are highly exposed and face problems because of unconventional streets and streetscapes in the Bole sub-city. Walking speed, traffic congestion, connectivity, accessibility, and safety due to the ring road barriers are the main concerns of questionnaires for pedestrians. The series of questionnaires was made to understand better the current problems pedestrians face and what they want to see on the Bole sub-city ring road street in the future.

Space syntax analysis

Space syntax network analysis of choice (betweenness) at 400-meter search radius showing bole sub-city Ring Road Street connectivity using manual space syntax analysis method.

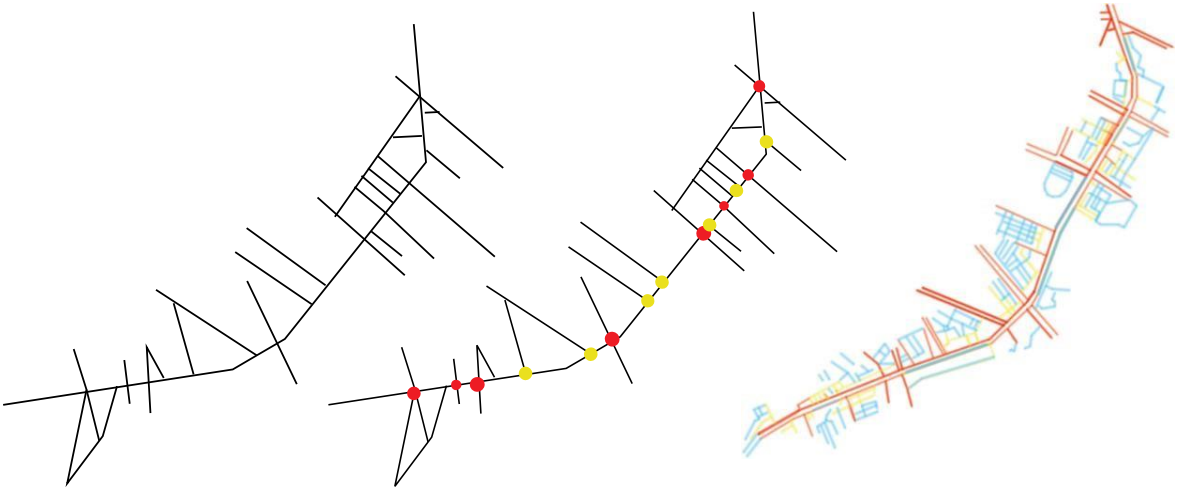


Figure 3.6 space syntax analyses to show street connectivity of study area (local scale). a) axial line b) axial point c) street connectivity

Manual counts for pedestrian

Manual counts were carried out based on pedestrians per hour to measure the pedestrian flow. This is where pedestrians were counted manually along the sidewalks using a tally marking sheet. Manual counting of pedestrians was done at 15-minute intervals because the pedestrian account is effective if it is taken between 10-15 minutes using cordon count. The observation site was carefully chosen to ensure the prevailing demand was observed. The merits of this approach are that it is flexible and simple to carry out. Pedestrians counted within the selected sites based on pedestrian activity from the street in 2 different sites at a 1.3 km average distance with a range of 500-600m.

Pedestrian level of service analysis method

The Highway Capacity Manual (HCM) is used in this study to determine the level of service the sidewalks provide. As a major component of the pedestrian facilities, the level of service was used in this study to assess the current state of the sidewalk. This method was chosen because it takes less time to obtain and is easy to implement and apply in the whole town. It helped in measuring the physical characteristics of the existing condition of the pedestrian sidewalk due to the existing pedestrian obstruction around the study area.

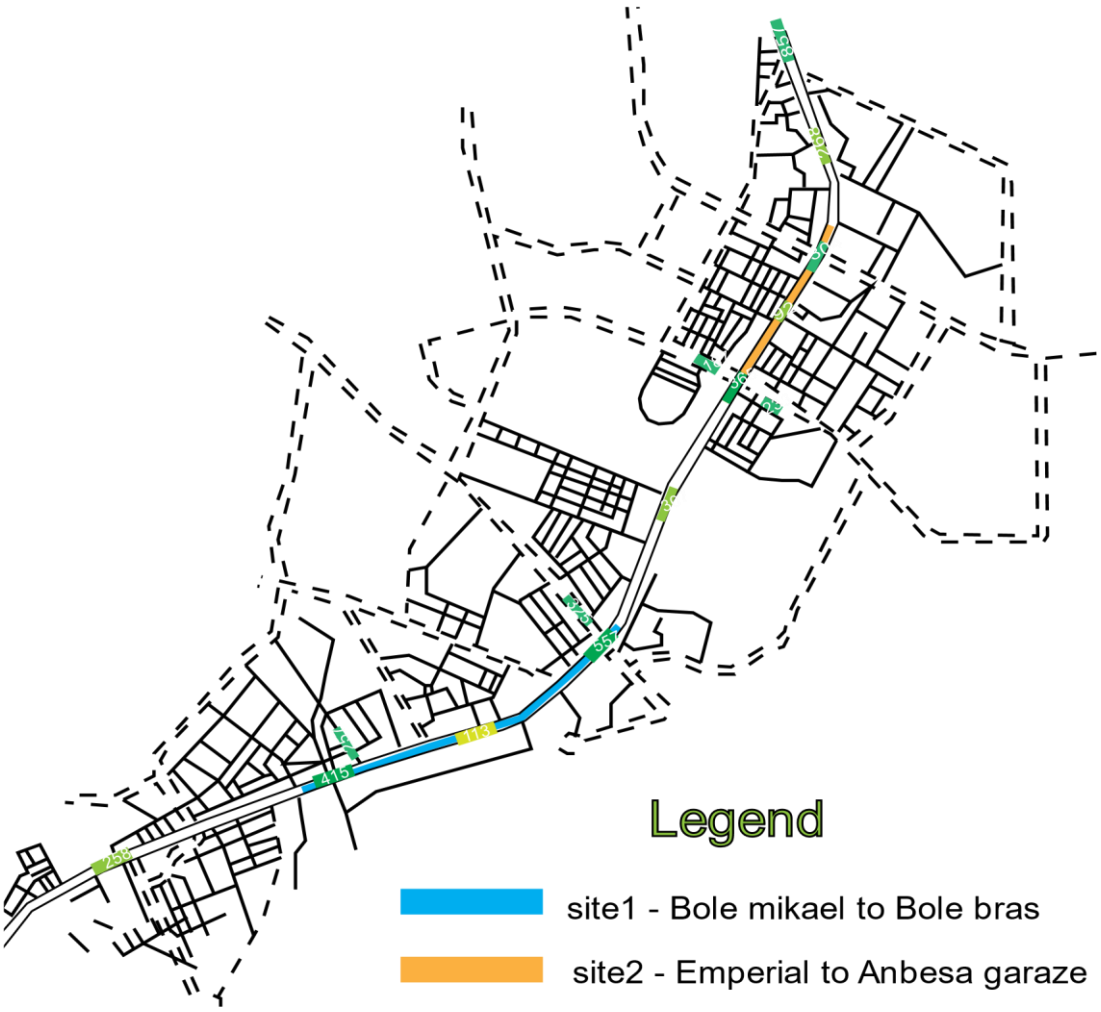


Figure 3.7 Site selected for PLOS

Pedestrian level of service calculation for the study area

Table 3.1 Steps to calculate PLOS

Steps to calculate the pedestrian level of service for the sidewalk in the study area
Step1: identification of sidewalk based on land use type Step 2: measurement of sidewalk width Step 3: Estimation of the effective walkway width of the facility Step 4: observe pedestrian flow(p/min) Step 5: Estimation of maximum or peak flow rate p//m/min Step 6: determination of PLOS

Table 3.2 Criteria for the pedestrian level of service determination

LOS	Space (m^2/ped.)	Flow Rate (ped/min/m)	Speed (m/s)	Volume (v)/Capacity (c) ratio
A	≥6.0	≤7	≥1.32	<0.21
B	3.7-6.0	7-23	1.27-1.32	0.21-0.31
C	2.2-3.7	23-33	1.21-1.27	0.31-0.44
D	1.4-2.2	33-50	1.14-1.21	0.44-0.65
E	0.6-1.4	50-81	0.76-1.14	0.65-1.00
F	≤0.6	variable	≤0.76	variable

The formula used to calculate the pedestrian level of service (PLOS)

We = Wt - SAD (approximate preempted width) …… Calculation 1

PF = No pedestrian/ min…… Calculation 2

PFR = Ped flow/We…… Calculation 3

Where; -

We = Effective width of walkway

PF = Pedestrian Flow (per/min)

Wt = total width of walkway

PFR = Pedestrian Flow Rate (ped/m/min)

SAD = shy away from distance (approximate preempted width).

Table 3.3 Pedestrian LOS Grade Scale

LOS grade	**Range of score**
A	132 or higher
B	101 to 131
C	69 to 100
D	37 to 68
E	36 or lower
F	Depends on walkway conditions

Source:(Gallin, 2001).

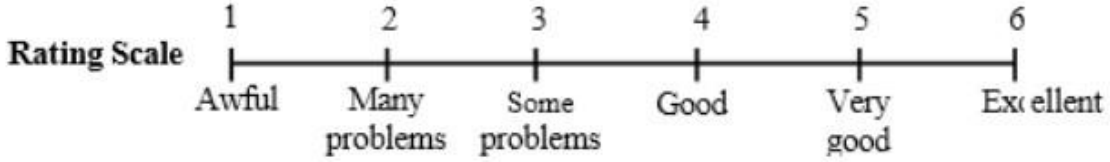
Pedestrian walkability index Analysis

50 pedestrians were surveyed as part of this study to gather data on the facilities available to them. In six areas, 50 interviews were conducted.

(PWI) PWI = ((∑ (Facility rating × length of the stretch × pedestrians count×10))/ Number of stretches)/1000 Where,

PWI= Pedestrian walkability index Facility rating= the ratings provided by the pedestrians in the field walkability survey.

Length of stretch= field data obtained, several stretches= the stretches selected for the study. The Pedestrian and Bicycle Safety Team's walkability checklist is used to implement the sidewalks' walkability. The scale for rating the characteristics is as follows:



Only 10 crucial characteristics were taken into account for the field walkability survey based on the literature analysis and the opinions of the experts. The factors that are chosen will give a general assessment of the pedestrian environment in the chosen area.

The parameters which are considered:

Footpath width, Footpath surface, Continuity, Footpath encroachment, Obstructions, Cleanliness and maintenance of footpath, Comfort and walking environment, Crossing facilities, Lighting facilities along the footpath, Pedestrian count

The material used to achieve the third objective for the study area

Materials used during the survey include an A4-sized printed questionnaire, a cell phone, an audio recorder, and notebooks. SPSS software and Microsoft Excel were used to analyze the valid questionnaires after they were collected.

3.7 Study Population

Communities in the Bole sub-city that use the ring road make up the study's target population. Therefore, in the instance of the bole Sub-city, a sample has been taken from the ring road users, who are currently unknown and have been utilized to research the influence of the ring road on urban mobility and active street development in the Bole sub-city.

3.7.1 Sample size determination

Despite the unknown population, the study conducted an on-site questionnaire survey of pedestrians. As a result, the study used a purposive sample strategy to select convenient and easily reachable subjects. Since the population size for street surveys is unknown, the sample size was determined using Cochran's formula (1963).

Where; no = sample size $n = \frac{z^2pq}{e^2}$

Z = confidence level at 95% (standard value is 1.96)

P = the estimated proportion of an attribute that is presented in a population with 50% q = 1-p, e = designed level of precision with + 5%

n= (1.96) * x (0.5) (0.5) n = 384

(0.05) *

As a result, the study purposefully sampled 384 people from a population of individuals who were convenient and willing to fill out a questionnaire.

Additionally, Semi-structured interviews were used in this study, allowing for direct interaction between tenants, owners of buildings along the street, and the researcher. In this study, 50 tenants and 30 owners were interviewed judgmentally. This was significant because tenants and owners were also a part of the street and streetscape and had a better understanding of the existing condition of the streetscape and its relation with economic activity.

3.8 Data analysis and interpretation

3.8.1 Qualitative data analysis techniques

To better comprehend the respondent's subjective experiences, the data analysis process involved carefully gathering and organizing the interview transcripts, completed questionnaires, field notes, and other material gathered. Narrative analysis has been used to organize and present qualitative data from various sources, such as interviews of respondents, observations from the field, or surveys. Content analysis is usually used to analyze responses from interviewees. This analysis particularly focused on the second objective. It focuses on using the stories and experiences shared by people to answer the research questions.

3.8.2 Quantitative data analysis techniques

The data like measurements, statics, and numerical data collected through census, questionnaires, and surveys have been analyzed through descriptive analysis quantitatively using SPSS and Excel software to analyze and describe the data, maps, diagrams, charts, graphs, text, figures, and tables. The data was analyzed using various programs, including Word and Excel, descriptively and statistically, including frequencies and percentages. Data were processed and presented at the end.

3.9 Validity and Reliability of the Data

The questionnaire was filled out by the researcher and five other data collectors rather than the respondents themselves to ensure the knowledge's validity and reliability. The study's findings would reflect the specific situation of the road and walkways along the study routes because it was performed using various ideas from the interviews and field observations. As a result, the study's findings would be reliable and valid.

3.10 Ethical considerations

Various methodologies will be used in this study to consider ethical issues. Data collectors will first explain the study's purpose to the participants, and their desire to participate is the only criterion for participation. Participants may be informed that they can stop participating or skip questions even after the interview or questionnaire has begun. Using aliases or encrypting the questionnaires will ensure confidentiality.

3.11 Summary of methods

Table 3.4 Summary of methods.

Specific objective	Source of data used	Collection method	Instrument used	Analysis method and software
To examine the existing street frontage condition of Bole sub-city ring road.	City structural plan, Secondary data	Municipality and the existing situation in the area	Observation method	Measuring tape Samsung M13 for photo capturing	Qualitative data analysis techniques GIS and AutoCAD2007, Microsoft Word 2016 and Excel 2016, Illustrator
To investigate push and pull impact of the Bole sub-city ring road on socio-economic and environment.	The existing situation in the study area. Responses of the residents based on the prepared interview question.	Purposively Sampled interview respondent Which are 50 tenants and 30 owners.	Case study and Interview	A4 Paper, Mobile, Notebook, Measuring tape	
To assess the effect of ring roads on pedestrian accessibility in the Bole subcity.	Responses of questionnaire survey	Sampled population 321 respondents which are willingly responded from the total of 384 sample.	questionnaire	Microsoft Word 2016 and Excel 2016	

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

This chapter was organized according to the objectives and research questions, as well as the methods and approaches used to attain the specific goals specified in the preceding chapters.

4.1 Demographic characteristics of respondents

Table 4.1 below shows the total number of participants or respondents found on the streets during data collection between Megenagna to Mamo, including pedestrians, vehicular drivers, and professionals. Of the 384 participants, 206 (64.2%) men and 115 (34.8%) women willingly answered the questionnaire; there are 321 respondents.

Table 4.1 Respondents' sex categories.

Sex of respondents			
	Frequency	Percent	Vali l Percent
Male	206	64.2%	64.2%
Female	115	35.8%	35.8%
Total	**321**	**100%**	**100%**

(Source: Field Survey data,2023)

Table 4.2 displays the respondents' age groups. Of all respondents, 14.6% were under the age of 25, 26.8% were between the ages of 25 and 35, 29.2% were between the ages of 35 and 45, 22.1% were between the ages of 45 and 55, and 7.3% were 65 or over. The outcome demonstrates unequivocally that cultures regularly use the street from adolescence through middle life.

Table 4.2 Age groups of the respondents

Age of respondent			
	ıcy	Percent	V
15-25		Percent	
25-35	47	14.6	14.6
	86	26.8	26.8

Age group	35-45	94	29.2	29.2
	45-55	71	22.1	22.1
	>65	23	7.3	7.3
	Total	321	100	100

(Source: Field Survey data,2023)

Table 4.3 shows the sex-specific walking patterns of pedestrians. Male pedestrians had a high percentage of walking experiences, with 64.2% of men and 35.8% of women respondents being pedestrians. 64.2% of the respondents were men, 54.9% commuted by walking frequently, 23.3% by walking occasionally, 14% Sometimes, and 2.9% Rarely, in that order. Accordingly, among 35.8% of the female respondents, 58.2% commute by walking frequently, 19.1% by walking occasionally, 9.5% by walking seldom, and 4.3% by walking rarely.

Table 4.3 pedestrian walking behavior

		Frequency				
		Frequently	Occasionally	Sometimes	Rarely	Total
Sex	Male	113	48	29	6	206
		54.9%	23.3%	14%	2.9%	64.2%
	Female	67	22	11	5	115
		58.2%	19.1%	9.5%	4.3%	35.8%
		180	70	40	11	321

(Source: Field Survey data,2023)

4.2 Existing Situational Analysis of the bole sub city ring road street frontage

4.2.1 Spatial Analysis

According to the structure plan created by the Urban Plan & Information Institute in April 2019, a substantial amount of land is covered by the development of the Bole Sub City Road, with the road network accounting for roughly 21.8% of the total road coverage, the road network's coverage in this area is good compared to the standard of 25%. In June 2019, the city center's Land Use map was proposed. The illustration below demonstrates the need for mixed use development along the ring road corridor leading to it.

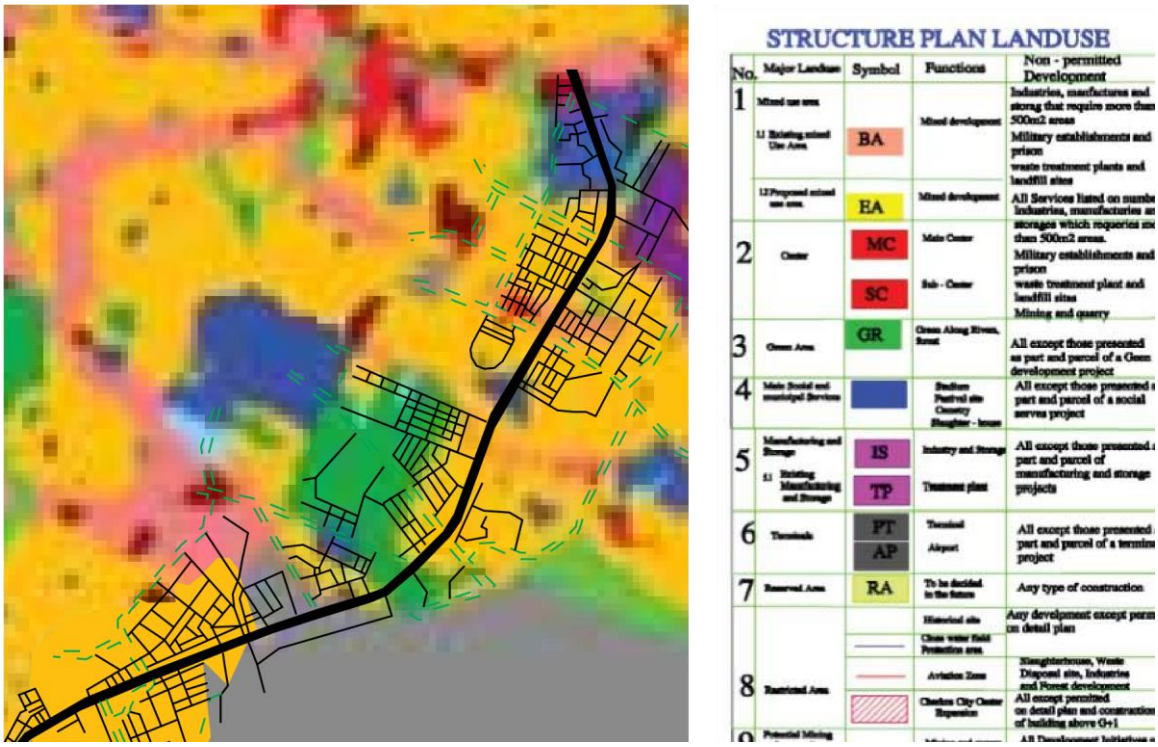


Figure 4.1 land use map of the study area

Source: Addis Ababa City Planning Project office, 2019

However, the actual situation on the ground from the observation demonstrates that neither the sub-areas nor the corridors are developed under the proposal of the local development plan, as shown in Figure 4.2 below.

During the site survey conducted in Bole sub-city's Ring Road Street, it was observed that the existing land use needed to align with the intended land use for several reasons. The presence of the ring road had led to changes in land use patterns, as new businesses and industries were not attracted to the area due to the lack of accessibility and mobility. The community had also built according to their preferences to adopt the effect of the road imposed on them rather than the government's structure plan, which further complicated the existing land use pattern. In this particular study, GIS software analysis was conducted in the Bole sub-city's Ring Road line to calculate changes in land use areas over time. The analysis revealed that 25% of the mixed-use allocated area had been converted into residential use, while 17% of the commercial area had also been transformed into residential use. This change in land use has significant implications for the community surrounding the Ring Road line, as it can impact the availability and accessibility of commercial and mixeduse spaces.

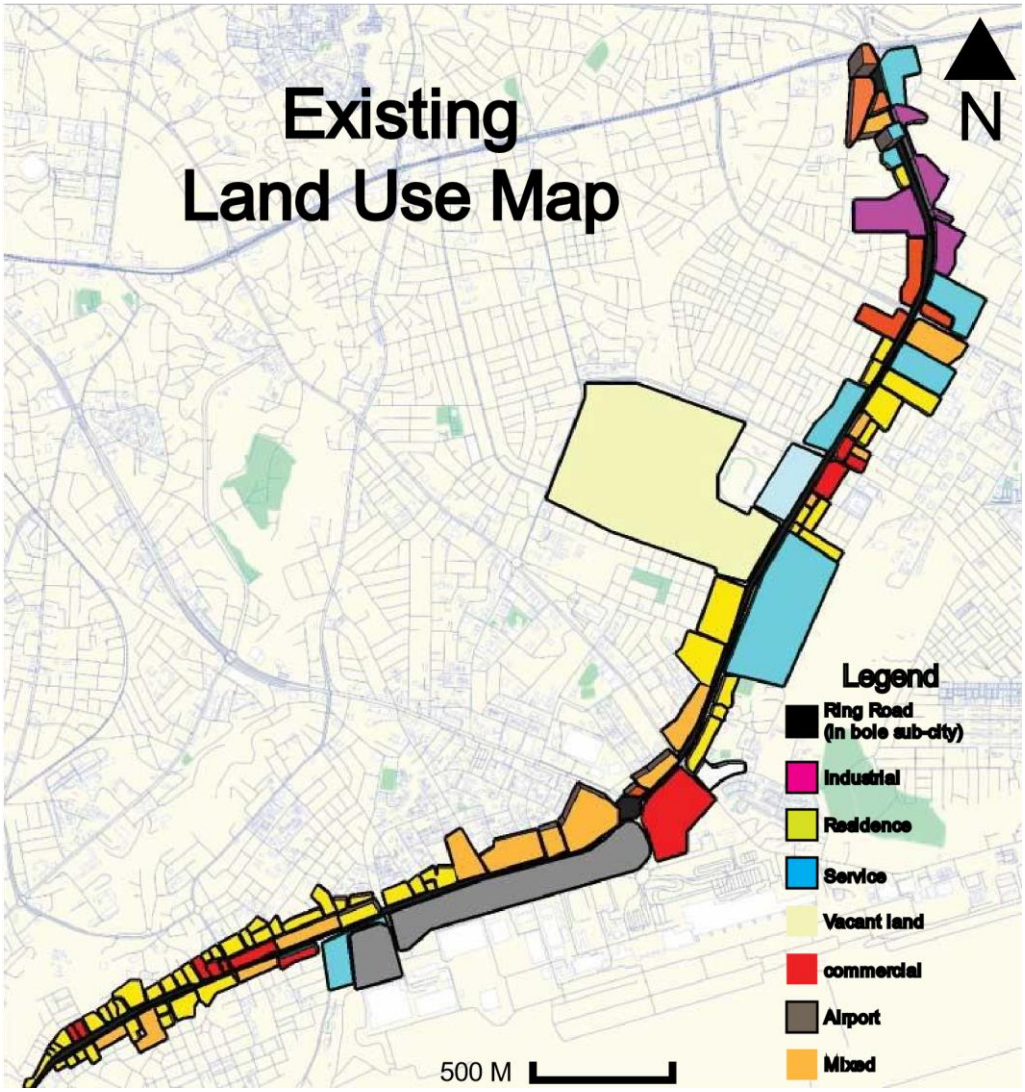


Figure 4.2 Existing land use of the study area.

On the map below, from direct site observation, plots that are on the main thoroughfares are categorized under active street frontage and blank street frontage based on the standard found in the literature, which is if a plot with a 100-meter length does not have an opening more than 25 is categorized under blank and vise-versa. So, by using measuring tape and counting the openings, the following map was produced, which classified the site plots. You can see the empty walls that line the main thoroughfares and the empty street frontages that make up Addis Ababa's Bole sub-city ring road corridor.

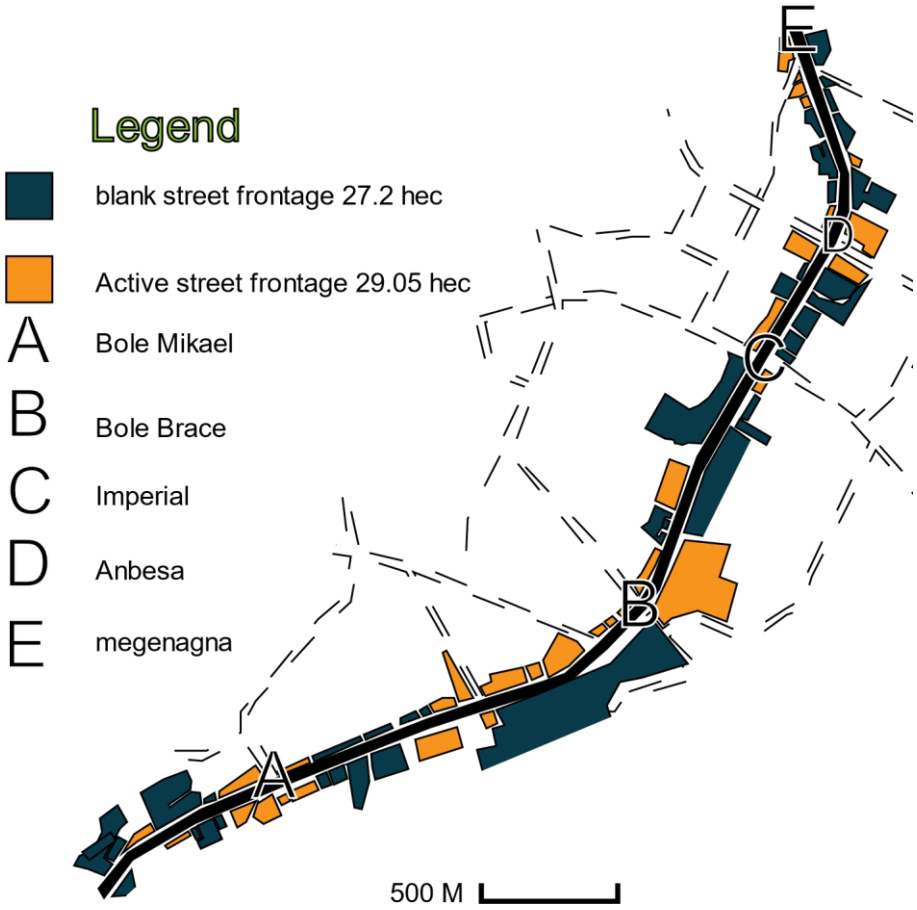


Figure 4.3 street frontage analysis map.

From the direct observation of the site, Plots that are not orange in color display all of the dead street frontage plots that do not have openings as the standard says, which is more than 25 door or window openings in a length of 100m.temporary construction safety walls that have been in place for longer than two years are classified as dead frontages and mapped with different colors based on their current function.

As a result, the above map shows that various functions are identified and hatched with orange colors. It also shows that many government and administrative buildings, or megastructures, are concentrated or clustered in the study area.

Additionally, there are places like stadiums, factories, small-scale businesses, inaccessible parks, and land uses that are incompatible that contribute to the development of bare walls and empty street frontages. Additionally, the corridor contains much empty land in various locations. However, because most of the cleared areas in the outer city have not yet been built, they are not adhering to the necessary development program. Instead, it is discovered that most of them have been enclosed with ad hoc structures for many years. Due to the underutilization of the unoccupied property, they also contribute to the lifeless street

frontage, pollution from individuals discarding their waste outside the fence, and overall huge economic loss. The table below lists the main land use categories for these existing dead wall structures and underutilized unoccupied, built-up areas of the study area.

Table 4.4 Major land use categories of dead street frontages in the bole sub city ring road street

№	Land Use Class	Total area in Hectare	Percentage from the Total (%)
1	Administration	8.84	32.5%
2	Social services (*)	3.1	11.4%
3	Residence (*)	1.45	5.3%
4	Bank & Insurance (Business)	0.33	1.2%
5	Industry & Storage (*)	6.48	23.8 %
6	Recreation & Open Space	1.51	1.3%
7	Transport Services (**)	1.34	5.5%
8	Infill Area (***)	1.55	5.7%
	Total	27.2	100
*	Places with blank wall frontage		
**	garages, fuel stations & bus stations		
***	Underutilized & vacant lands		

Source (own field survey, 2023)

Table 4.4 shows that, of the 56.25 hectares total area of the Bole sub-city ring road street, 48.4% or around 27.2 hectares of land is unusable due to dead street frontage. Industry & Storage, Open Space sectors control 23.4% of the dead wall. In comparison, social service and administrative sectors possess the remaining 43.9%, comprising abandoned private and kebele homes and demolished intervention sites that have not been developed in three to four years.

Figure 4.4 blanck street frontage from different place in the case study area

Figure 4.5 Active Street frontage from different place in the case study area

Source: (Own field survey, 2023)

4.2.2 Existing Street valuation

Based on secondary data from the structure plan created by the Urban Plan & Information Institute in April 2019 and a direct site survey, the Bole sub-city ring road is evaluated using streetscape elements, material, hierarchy, and Utilities and services standards. The research region has various streets, categorized as sub-arterial, collector, and local streets in the legend parts. With heavy traffic movement and density, the street hierarchy lacked accessibility and was poorly connected.

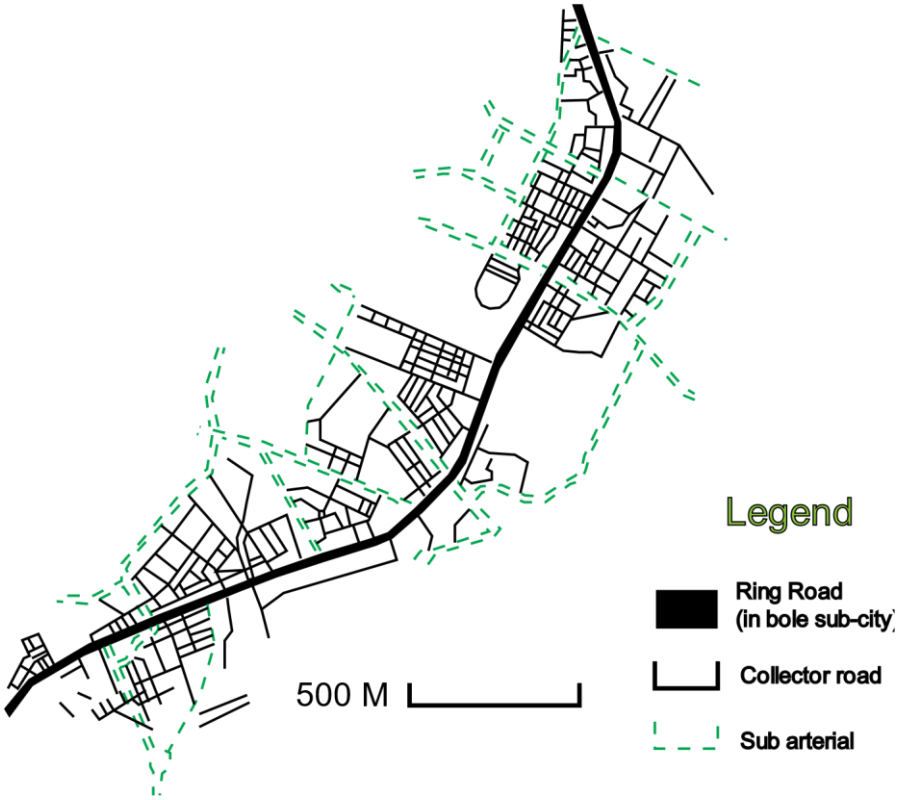


Figure 4.6 Road hierarchy Map of selected street

Table 4.5 below explains the finding that all streetscape components on this roadway have been found to fall short of various standards. Some of the themes examined in this street are only present in reputable settings. There are 257 streetlights on both sides of the walkways. However, they are completely inoperable. Additionally, there are seven traffic signals, 40 traffic signs, and 89 different kinds of trash cans in the roadway. The location lacks bicycle facilities, public art, street furniture, and restrooms for the general public. This finding reveals that no appropriate streetscape components, street utilities, or street services are on the street from Mamo to Megenagna Bus Stop. Table 4.5 Observation of streetscape elements

	Count	Standard		
Streetscape Elements	Total number on the site	Above standard	Below standard	Remark
Street lights,	257	-	x	12 m high & 50-65 m apart
Trash cans	89	-	x	Not on use
Public art	-	-	-	No available
Public toilets	0	-	-	Not available
Traffic signs and signals,	47	-	x	Some of which are damaged
Street trees and other	-	-	x	Block pedestrian walk way

street furniture	15	-	x	old
Bicycle facilities	0	-	-	Not available
Street crossing	6	-	x	Not inclusive

Source: (Own field survey, 2023)

Table 4.6 below provides. According to the observation, walkways, and pavements are 22.5 meters wide, 70% constructed of earthy material, and have a variety of obstacles. While ditches are formed of masonry but are subterranean and corroded, pedestrian walkways are in poor shape and have deteriorated. Frontage cafes are hardly ever present, and there are no accessible routes. The findings show that the area's street utilities might not be as good as they could be, with few pedestrian-friendly services and a lack of easily accessible infrastructure.

Table 4.6 Utilities and services running for pedestrian activities

Check List for street Utilities	Physical quality/size	Materials	remark
Sidewalks/footpaths	2m- 2.5 m	70 % is Earthy martial	Have different obstacles
Pedestrian Pavements	poor	terrazzo, Earth material, stone	deteriorated
Ditches (M)	-	Masonry	Underground and Damaged ditches
Disability ways	-	-	Not available
Frontage cafes	_	_	Almost Not available

Source: (Own field survey, 2023)

The researcher used 3D modeling to analyze building heights on the Bole sub-city's Ring Road to comprehend the height variations produced along the street. The research showed a strong correlation between building height and pedestrian mobility, as higher buildings were more frequently found near pedestrian crossings, as shown in Figure 4.7 below. For instance, Megenagna and Bole Bras had high-rise buildings with more than six floors, while Bole Mikael and Imperial had mid-rise buildings with four to six floors, and other sites in the study area had low-rise buildings.

4.2.3 Perception of safety analysis by pedestrians

The ring road completely blocks the neighborhood thoroughfare, leaving little room for foot traffic. As a result, foot traffic has shifted to the available road crossings, resulting in pandemonium and creating an environment that encourages criminal activity and accidents.

Table 4.7 pedestrian Safety analysis

Pedestrians Accident types		
	Frequency	Percent
While jumping over a fence hit by car	44	34.4%
While waiting for a taxi next to a sidewalk	14	11%
While walking along the roadway	12	9.3%
Colliding with non-motorized vehicles	7	5.5%
Being hit by a moving vehicle	36	28.2%
Due to issues with the bridge design	9	7%
Others	6	4.6%
Total	**128**	**100.0**

(Source: Field Survey data,2023)

An analysis of pedestrians' perceptions of safety is shown in Table 4.7 The safety requirements are evaluated based on the types of accidents, the accessibility of buffers, and the lack of crossings. According to the observational survey, no crossing spots or buffers exist in the research zone. Due to them, walkers are less secure and are more susceptible to accidents of all types. 44 (34.4%) of the 128 accidents in the area were caused by individuals leaping over fences and being struck by vehicles. Shows that there is no pedestrian crossing; thus, people must scale the barrier to get across the circular road

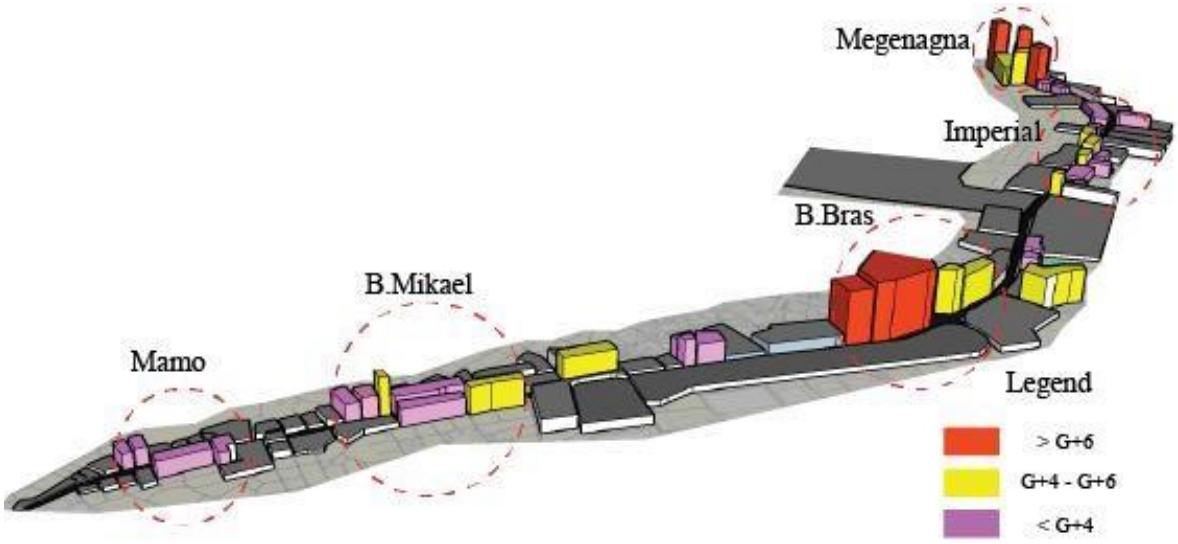


Figure 4.7 Building Hight Map of selected street

Source: (Own field survey, 2023)

The fact that higher buildings were found close to pedestrian crossings, as observed by the researcher, further emphasizes the significance of considering pedestrian mobility in urban planning and development.

The observation that taller buildings were located near pedestrian crossings underscores the importance of prioritizing pedestrian infrastructure in urban planning and development to ensure that the built environment is safe and accessible for all.

4.2.4 Crossing the road

Although the distance of the ring road was only 50 meters, it was discovered during the site survey that individuals were traveling an average of 1 kilometer to get commodities on the opposite side of the ring road. People had to go further to their destinations since pedestrians needed safe access points to cross the ring road. People were compelled to cross the busy road in potentially hazardous ways, which caused discomfort for the locals and posed safety risks. Therefore, it is crucial to prioritize the construction of pedestrian-friendly infrastructure in the study area to increase accessibility and encourage everyone's safe mobility.

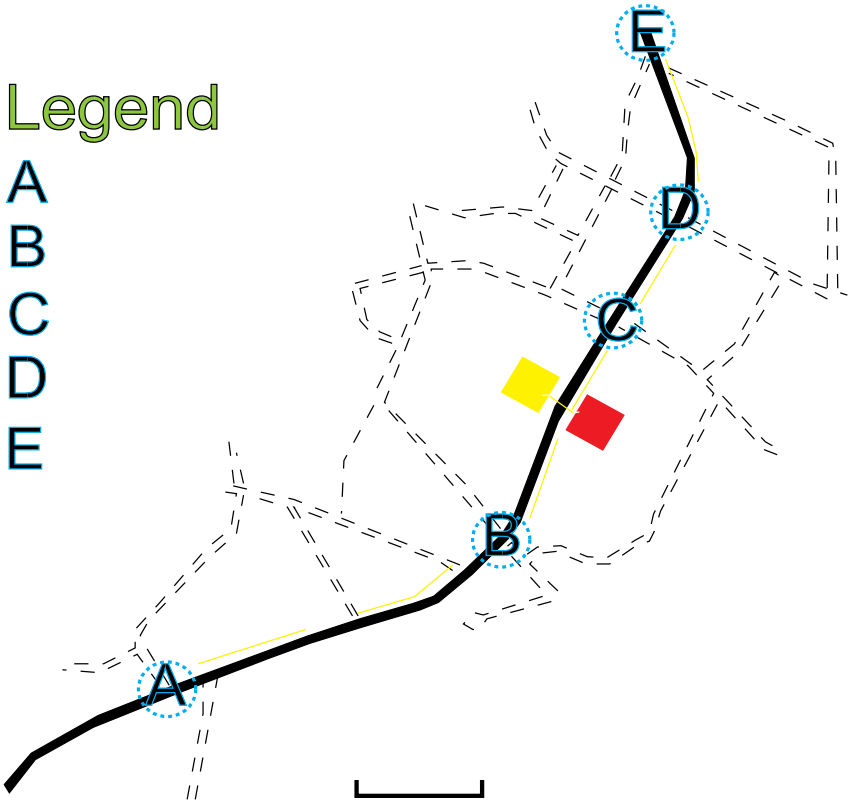


Figure 4.8 map of pedestrian crossing points

The study's findings suggest Bole Sub City Ring Road is a boundary between distinct neighborhoods. The maps of pedestrian flow from the video study (Figure. 4.17) reveal a notable difference in the volume of people using the pavement on the two sides of the road. The number of pedestrians on the west side may be up to three times larger than on the east. Given that it is reasonable to assume that in large retail districts without a road barrier effect, pedestrians would use both sides of the street equally, this may indicate that the street is not permeable to pedestrians. There are more businesses and retailers on the west side of the street.

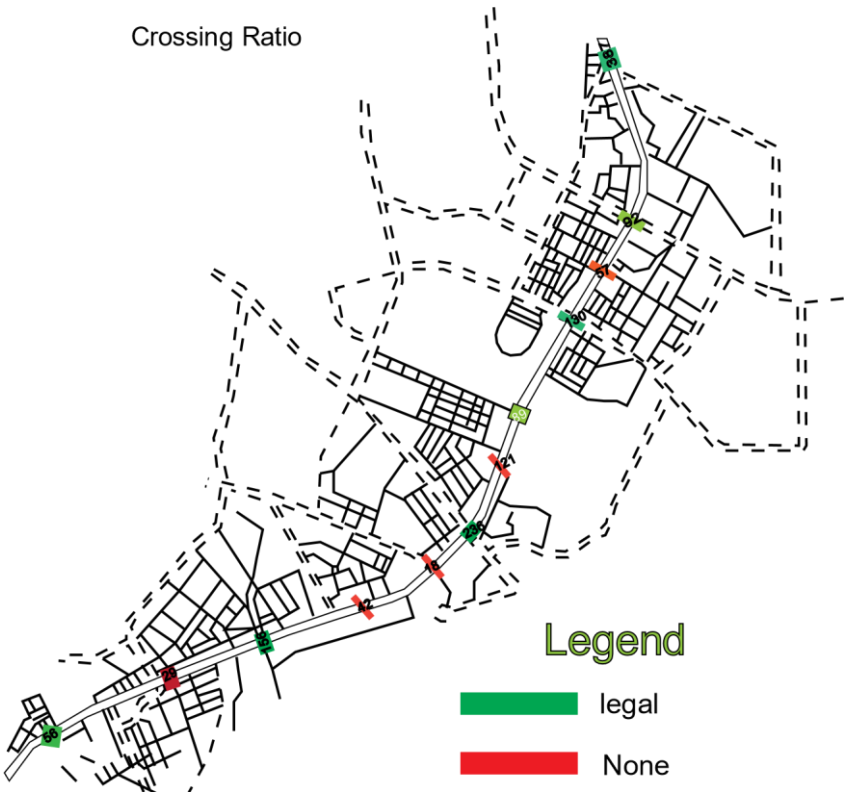


Figure 4.9 Map of crossing ratio

Bole Ring Road's role as a psychological barrier dividing various populations is also supported by evidence. This may reflect the Ring Road's function as a line separating various real estate markets. Nearly half of the pedestrians who cross legally do so by climbing over the ring road fence illegally, as seen in the table below, which summarizes this information.

Table 4.8 pedestrians crossing point

№	Name of a place	Average pedestrian crossing the road per 15 minutes	Percent (%)
1	Legal crossing point	164	69.8%
2	Illegal crossing point	71	30.2%
	Total	235	100%

(Source: Field Survey data,2023)

4.2.5 Walking obstruction.

According to pedestrian perception and observation data, the two greatest pedestrian hindrances in the area are street crossing and illegal parking.

Figure 4.10 lack of street crossing and unlawful parking

Table 4.9 Perception of a walking obstruction by pedestrians

		Frequency			Total
		Illegal parking			
Street crossing	Trees and poles walking	180	104	37	
321	obstruction	56%	32.4%	11.6%	100%

(Source: Field Survey data,2023)

Table 4.9 displays the viewpoints of pedestrians regarding a walking obstruction. Of the 321 respondents, 56 % identified insufficient roadway crossings, 32.4 % illegal parking, 11.6% incorrectly built poles and trees, and improper parking as the primary pedestrian barriers.

4.3 Discussion of the Existing Situational Analysis of the Bole sub-city Ring Road Street frontage

This study assessed the quality of street and pedestrian facilities within the Bole Sub City Ring Road area by employing an observation checklist and questionnaires. The study used criteria to determine the quality of a street frontage, which includes a mix of compatible land use, interaction, and consequent activity aided by multiple doors. The study found that the existing situational study of the Bole Sub City Ring Road Street frontage revealed significant development limits, with lifeless street frontages, unoccupied land underutilization, and environmental concerns. Blank walls on megastructure buildings, such as government offices and social services, contributed greatly to the dead street frontage, resulting in a lack of vibrancy and livability and a major economic loss.

The study also revealed that approximately 48.4% of the Bole Sub City Ring Road's total area had dead-end street frontage, contributing less to the road's economic function and creating safety and security issues. The inadequate building-street interaction caused by the blind street frontages also reduced street activity. These findings highlight the significant implications for the community surrounding the Ring Road line due to changes in land use, which can impact the availability and accessibility of commercial and mixed-use spaces.

The Bole Sub City Ring Road Street has lost its connection with society due to a lack of pedestrian crossings, convenient pavements, and bicycling facilities. (Liu-Ambrose, 2006) has reported that if the surface of the walkways is not well maintained if the effectiveness of the walkway width is not continuous and if the walkways are filled with waste and hindrances, pedestrians do not feel comfortable walking.

The ring road completely blocks the neighborhood thoroughfare, leaving little room for foot traffic. As a result, foot traffic has shifted to the available road crossings, resulting in pandemonium and creating an environment that encourages criminal activity and accidents. According to (Rehan, 2013) livability emphasizes on the convenience of the residents, welcoming characteristics of streetscapes, a reliable and most importantly, an enjoyable walk on the streets. In general, the study's findings suggest Bole Sub City Ring Road is a barrier between distinct neighborhoods

The study emphasizes the importance of interventions to bring life back to abandoned streets, such as activating blank walls and finding solutions for them. The study also highlights the need for physical and social connections between the streetscape and surrounding areas, including public transportation, walking, and bicycling. The study concludes that improving the streetscape will enhance the livability and vibrancy of the area and improve the economic function of the Ring Road line.

4.4 Socio-economic and environmental impact of bole sub city ring road

4.4.1 Economic Impact

This section provides the economic impact of bole sub-city Ring Road crossing points in connection with the total Ring Road system. It depends on the data from the interview, questionnaire questions, and personal observation of the Ring Road system. This section includes the economic impact of the Bole sub-city Ring Road.

I. Locational Characteristics of Respondents

According to Table (4.10) below, from the owner's perspective, 43.33%, 23.33%, and 33.33% are situated close to the pedestrian crossing, at a distance of about 400 meters, and in the middle of two pedestrian crossings, respectively; however, their preferred locations are 83.33%, 13.33%, and 3.33%, which are situated close to the pedestrian crossing, at a distance of about 400 meters, and between crossings. From the tenants' perspective, 50%, 28%, and 22% of the respondents are situated close to the corridor, at a distance of about 400 meters, and in the middle of two consecutive pedestrian crossings, respectively. Even if there are more tenants in the middle of two consecutive pedestrian crossings, this location differs from what they prefer. According to data gathered from tenant respondents, 92% of tenants like to be close to a pedestrian crossing.

Table 4.10 Respondents' current location and preferred location

	Owner		Tenants	
location with respect pedestrian crossing	Frequency	Percentage	Frequency	Percentage
Close to pedestrian crossing way	13	43.33%	25	50%
Around 400 meters	7	23.33%	14	28%
At mid distance between pedestrian crossing	10	33.33%	11	22%
Total	30	100%	50	100%
Location choice Close to pedestrian crossing	25	83.33%	46	92%
Around 400 meters	4	13.33%	3	6%

At Mid distance between pedestrian crossing	1	3.33%	1	2%
Total	30	100%	50	100%

Source: own survey, 2023

Because of the accessibility issue, owners and tenants prefer to be close to the pedestrian crossing. Customers can easily enter the commercial building close to the pedestrian crossing. Since there are no other crossings besides the pedestrian bridge, the region next to the pedestrian crossing is much busier than the area at a distance. Tenants want rental space near the pedestrian crossing because of this. The building's vacancy rate decreased near the pedestrian crossing during the same period.

It may be inferred from the respondents' preferences for the location that the proximity to a pedestrian crossing, business activity, and property occupancy are all directly associated. In a nutshell, buildings next to pedestrian crossings are more occupied than structures farther away. Furthermore, construction close to the pedestrian crossing is preferable to construction far from the pedestrian crossing. Therefore, in terms of occupancy conditions, a building close to the corridor is more valuable than a structure far from the pedestrian crossing.

II. Tenant attraction and eviction

The question of tenant displacement was put to the building's owners. Additionally, the renters were questioned regarding their desire to remain in the existing residential or business premises. The following table provides a summary of the statistical outcome:

Table 4.11 Tenant displacement

Question	Owner				Tenant			
Is there tenant displacement?	Yes		NO		Yes		No	
And are you willing to stay?								
Location of respondent	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Very close to pedestrian crossing	1	3.33%	12	40%	21	42%	4	8%
Around 100 meter	6	20%	1	3.33%	9	10%	5	18%

Around the mid-distance between two pedestrian crossing	10	33.33%			3	6%	8	16%
Total	17	56.67%	13	43.33	29	58%	21	42%

Source: own survey, 2023

According to owner perception, as shown in Table (4.11) above, 56.67% have claimed that tenants are being evicted from their buildings. From this, 56.67% of tenant eviction, 20%, and 33.33% are tenants distant from the pedestrian crossing. Due to noise, buildings that house hotels and bedrooms do not want to be near a pedestrian crossing. Of the overall 42% of tenants unwilling to remain in their existing apartment, 34% are away from a pedestrian crossing. However, 58% of tenants are eager to stay in their current office space, and most are near a pedestrian crossing. Overall, tenants far from a pedestrian crossing do not want to remain in the present space; nevertheless, tenants close to a pedestrian crossing want to remain in the current commercial space. A building far from a pedestrian crossing has a high rate of evictions; in contrast, a building close to a pedestrian crossing has a low rate of evictions. The tenants are relocated from the region in the middle of two successive pedestrian crossings to the area surrounding the pedestrian crossing. Finding a suitable location for their business is the main factor driving tenant eviction into a pedestrian crossing. The fenced ring road system severely impacts the businesses in the middle of the space between the two pedestrian crossings.

III. Pedestrian crossing and economic activity

Respondents were questioned whether they believed commercial buildings near pedestrian crossings were more suited for businesses than those farther away. The following table illustrates their beliefs:

Table 4.12 pedestrian crossing for business sustainability

Near to pedestrian crossing is more suitable for business	Strongly agree		Agree		I don ‘t agrees		I have no idea	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%

Owner	22	73.33%	6	20%	0	0	2	6.67%
Tenants	37	74%	8	16%	1	2%	4	8%
Total	59	73.75%	14	17.5%	1	1.25%	6	7.5%

Source: own survey, 2023

Information on the connection between commercial activity and pedestrian crossing is given in Table (4.12) above. The survey table shows that 73.75% of respondents think commercial space near pedestrian crossing is ideal. Furthermore, 17.5% of respondents agree that the pedestrian crossing area is appropriate for businesses; however, 1.25% and 7.5% of respondents disagree and have no opinion, respectively. The pedestrian crossing area is quite active, according to the survey table and information from the interview. It is, therefore, ideal for the majority of business activities. Business activity decreases as one moves from the pedestrian crossing to the middle space between two pedestrian crossings.

One of the reasons that tenants prefer to rent close to the pedestrian crossing is that there are no pedestrian crossings between the two locations. (Yigzaw et al. 2009) finding that the companies with the closest location to crossing points and pedestrian crossings had superior performance lends credence to this. Additionally, due to the ring road's construction, businesses must be more satisfied with the parking spaces, crossing points, and pedestrian facilities. The planner asserts that a pedestrian crossing establishes a node and a core business distribution. The people, economy, and transit breaks are all concentrated in one region. Because the pedestrian crossing is the only means for a pedestrian to access the goods and services on the other side, the bus and taxi stops are close to the pedestrian crossing. As a result, businesses are drawn to the pedestrian crossing from far areas of the pedestrian crossing, the commercial spaces nearby are occupied to capacity, and the building far from the pedestrian crossing is left empty.

IV. pedestrian crossing as a source of the problem and its effect

The pedestrian crossing is the source of various issues such as noise, congestion, pollution, garbage, and rubbery. The lack of car and pedestrian crossings in Addis Ababa's fenced ring road system impedes unrestricted pedestrian crossing between the opposite sides of the Ring Road. 30 property owners/managers/ and 50 tenants were polled on their observations of difficulties around the pedestrian crossing and their consideration as a concern. At the same time, owners were asked about the impact of the problem on their house worth regarding occupancy level. Tenants were also asked about the impact of the problems on their business.

The table below displays respondents' perception of an issue and its influence on their property worth and business.

Table 4.13 pedestrian crossing issues and their effects on property value and business.

Problems	Consideration as a difficulty				The current state of the impact on property value and business					
	Yes		No		Positive		Negative		No impact	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Robbery & security problem	17	21.3%	63	78.7%			1	1.3%	79	98.7%
Noise	55	68.8%	25	31.2%			10	12.5%	70	87.5%
Traffic congestion	58	72.5%	22	27.5%			25	31.3%	55	68.7%
Air pollution	56	70%	24	30%			2	2.5%	78	97.5%
Source of waste	63	78.8%	17	21.2%			3	3.8%	77	96.2%
Absence of crossing	29	36.3%	51	63.7%			2	2.5%	78	97.5%

As the table above 4.13 reveals, 72.5% of respondents said there is a Traffic congestion problem around pedestrian crossings. Based on the response of most of the respondents, there is a significant difference from other areas related to Traffic congestion.

The other major problem that can be considered a problem around the pedestrian crossing is noise. According to the survey, 68.8% of the respondents have observed noise problems

around the crossing. Nonetheless, 31.2% of the respondents have not considered noise a problem. Although theoretically, in much of the literature, one of the major problems around pedestrian crossing is noise, 31.2 % of respondents did not consider noise a problem.

V. Case studies

Two comparative case studies were conducted based on two construction descriptions of the pedestrian crossing. The Dadhii Mall building and Menker Mall building. Dadhii Mall is near a pedestrian crossing in these two instances. However, Menker Mall is far from a pedestrian crossing. This helps in demonstrating the effect of the fenced ring road and the pedestrian crossing on the building's occupancy level and the local economy.

These two cases have provided a thorough understanding of how fenced ring road lines affect commercial buildings, notably in terms of occupancy and vacancy levels and tenant turnover. A commercial building's degree of vacancy and occupancy directly indicates its worth. A tenant of a commercial space also stays with the company. Buildings next to good commercial sectors are more frequently inhabited than those found in troubled locations.

Case 1: Dadhii mall

Figure 4.11 Dadhii building St. Michel, bole

Dadhii Mall is in Addis Ababa, mainly in the Bole Mikael neighborhood near St. Michael Cathedral. It is situated extremely close to the St. Michael pedestrian crossing in terms of pedestrian crossing. It was built after the ring road's construction had started. It is a 55-room, six-story structure with offices, banks, clinics, and beauty parlors. This building was entirely occupied at the time the inquiry was conducted. The manager claims there needs to be more turnover among the tenants, although other tenants from nearby buildings request rooms for rent in the building's core area. However, the building is already occupied to capacity and

requires extra room. There are no price increases and tenants are reliable. The cost of renting varies depending on the floor of the building. A room is more expensive on the first floor than it is upwards. The rent is cheaper upstairs than it is on the bottom floor. The building's 100% occupancy results from the fact that tenants are drawn to it because it is close to pedestrian crossings.

Because pedestrian crossing is the only way to cross the ring road line, tenants want to locate their businesses nearby. As a result, customers are reluctant to travel far inside the central crossing area. Passengers board and disembark at crossings, which is why the sections along the pedestrian crossing are busier than the mid regions of the two stations. Pedestrian crossing often helps this property by lowering vacancy rates and tenant turnover. However, noise near the building's hallways does not affect the property value or the occupancy rate.

Case 2: Menker mall

Figure 4.12 Menker city mall, St. Michael, bole

Menker Mall is found In the Bole neighborhood of Addis Abeba, specifically close to St. Michael church. It is situated halfway between Bole Bridge and St. Michael Pedestrian crossing in terms of pedestrian crossing. It was built after the ring road's construction. It is a four-story structure with 35 rooms in total. Only 21 out of the 35 rooms are substantially occupied. It takes up 65% of the space in the room. However, 14 rooms are empty.

The manager claims that five residents in this building applied to vacate the property while reviewing these facts. This suggests that, compared to buildings close to the pedestrian crossing, this building has a high level of vacant space and a high level of tenant turnover. Tenants demand more accessible and suitable locations for their clients and require busy

spaces for those enterprises. Tenants are forced to do business and operate close to buildings with pedestrian crossings. Due to the lack of crossings between two pedestrian crossings, the main effect of this issue is that the fenced ring road line damages commercial property, especially structures far from the pedestrian crossing. The tenant's situation changes depending on the manager. They departed the building after making an effort for a few months. Few rooms were vacant, and there were fewer turnovers before the ring road was built; these numbers occasionally went up due to the lack of a pedestrian cross. On the other hand, the tenants claimed that their company was hurt.

They contend that their placement away from the node and the lack of crossings have harmed commerce. In general, occupancy/vacancy levels and tenant turnover are impacted by the lack of crossings on ring road lines and the distance of the buildings from the route. As a building becomes farther away from a pedestrian crossing, its vacant occupancy rate and tenant turnover rise. Similarly, properties far from the pedestrian crossing have higher vacancy rates and tenant turnover due to the need for close crossings on ring road lines.

From the two situations mentioned above, it can be concluded that. In contrast, Menker City Mall is more unoccupied and has tenants who are unstable and have more turnover. The Dadhii building near Pedestrian Crossing is fully occupied, has stable tenants, and experiences very little tenant turnover. It is not just a matter of the distance from the corridor, say the building managers. The absence of crossing between stations has a far bigger influence than this finding. Therefore, even if two buildings are situated in the same neighborhood, the building close to the pedestrian crossing may be worth more than the structure far from the pedestrian crossing.

4.4.2 Social Impact

I. People’s Daily Activities and their Social Interaction condition

People have always traveled to a location with a purpose, such as going to work, shopping, relaxing, and meeting others. As a result, social contact between people has steadily expanded in areas with various economic activities. The availability of shops, cafes, hotels, restaurants, recreation centers, and other different services; the qualities of street escape and public realm, i.e., street form, shape, hierarchy, linkage, street light, furniture as well as open spaces, playgrounds, greenery areas, parking are the reasons why residents were asked about their preferences and frequent visits to some of the places and streets that exist in the corridor.

Table 4.14 Mostly visited and favored places in the bole sub city Addis Ababa

№	Name of a place	№ of people frequently visit	Percent (%)
1	Bole brace	125	38.9
2	Bole Mikael	97	30.2
3	imperial	48	14.9
4	mamo	13	4
5	Anbesa	15	4.6
6	Hayat	23	7.4
(*)	The % is taken № of people from the total sample 321; not exclusive to each other		

According to the above table, Bole Bras is frequented by 38.9% of respondents, followed by Bole Mikael by 30.2% of respondents. They like and frequent these places since they can easily walk to most of the required goods and services. They purchase items, get to know and socialize with new people, talk business, and have fun together. On the other hand, the Mamo and Anbesa corridors are less popular and regularly used by pedestrians because there are fewer economic enterprises there, leading to poor social contact between people. This demonstrates that locations like bole bras and Bole Mikael, with a variety of commercial establishments, such as stores, theatres, restaurants, cafes, and other mixed-use services on the ground floor, as well as recreation and boulevard opportunities, support the busiest pedestrian areas and the most active street fronts, which in turn can improve neighborhood safety and urban quality.

Figure 4.13 human activity and social interaction

Source: (Own field survey, 2023)

II. Psychological Impact

The table below illustrates some of the psychological effects of the deserted street frontages along the bole sub-city ring road corridor.

Table 4.15 psychological effects on the people walking along the corridor's blank walls.

Individual feeling	№ of respondents	Percent (%)
good	-	-
bad	243	75.7
Neutral	78	24.3
Total	321	100

Source: (Own field survey, 2023)

As seen in the above table, no one feels happy as they pass by the side of lifeless street frontages, and 75.7% of the sample's pedestrians feel negative. Only 24.3% feel neutral or unaffected. In response, the respondents stated that most blank walls in government structures, social service facilities, banks, and retail establishments along the corridor have no connection with the pedestrians using the pathways. As a result, they often see various issues, particularly at midday and at night, such as drug addiction, theft, alcoholism, streets, homelessness, and other crimes, on the side of blank walls. Since people do not always feel safe from crime when they walk along dead wall streets, pedestrians, especially women, suggest that a solution be found for these blank walls or that they should be activated to breathe life into the deserted streets. The following figure 4.14 compares the frontages of active and inactive streets in the Bole sub-city ring road corridor at noon.

Figure 4.14 Bole Mikael left has a busy street frontage while bole Mamo right is deserted.

Source (Own field survey, 2023)

Figure 4.15 Homelessness in the hallway on the right, combined with street crime, drug and alcohol abuse along a deserted street frontage.

Source (Own field survey,2023)

4.4.3 Environmental Impact

I. Micro Climatic Condition

The microclimate of a place greatly impacts how well the locals can live. People who live in appropriate climates are healthy, while those who live in polluted settings risk developing health issues. The lack of open spaces and green areas, gas emissions from automobiles and industries, the repulsive smell of polluted rivers, and trash dumped on the street and walkways of abandoned street frontages and vacant lands all contribute to Addis Ababa's high level of pollution, according to ORRAMP, 2002.

In the case study region of the Bole sub-city, dead street frontages are a major source of environmental pollution because people dispose of their rubbish outside of them. During the data collection and field survey, it was discovered that certain government buildings and social service organizations plant grass in their compound and construct attractive landscape designs, improving the surrounding area's view. The image below illustrates a green space within a compound that creates a pleasant microclimate and offers a clear view of the outside world.

Figure 4.16 Green spots in the skylight The Ethiopian hotel creates a nice view of the outside on the left and the empty airport terminal wall on the right.

Source (Own field survey,2023)

II. Pollution

Residents with high-quality environments are more likely to feel a sense of responsibility for and a stake in upholding the standard of their neighborhood's streets and public areas. Since people are usually nearby, most avoid throwing trash or urinating on busy street corners. Some individuals, however, lack a sense of ownership and defecate and dispose of trash near the bare walls of deserted street frontages. Residents in the surrounding area may have pollution issues, as the photo illustrates in the Mamo area. The tables below list the major issues homeowners close to blank walls in the case study region are experiencing in descending order of importance.

Table 4.16 Major issues with blank walls in order of importance

Problems	№ of respondents	Percent (%)
Sense of place issue,	79	24.6
Lack of security and safety	63	19.6
Poor odor from people urinating and disposing their rubbish on the white walls.	57	17.8
Darkness and subpar visuals	94	29.2
Others detail	28	8.8
Total	321	100

Source (field survey,2023)

According to the above table, out of all the households surveyed, specifically, those living close to a dead wall, 17.8% experience pollution issues or bad odors as a result of people urinating or disposing of waste on the dead street frontage, 19.6% experience a lack of safety and security, 29.2% experience darkness and poor visual quality, 24.6% experience a sense of place issue, and 10% experience other issues.

This demonstrates that: - pollution issues or a bad odor, a lack of safety and security, darkness and poor visual quality, the issue of a sense of place, and other problems related to these issues in priority order are the main issues they face in their daily lives as a result of the presence of blank walls in their neighborhood. Therefore, they argue that an intervention is needed at these abandoned street frontages to address the serious environmental issues alongside others and raise the economic value of these kinds of mega-structure buildings.

Figure 4.17 Clean, lively street frontage at Bole and solid trash disposed of alongside lifeless street frontage at Hayat

4.5 Discussion of the Socio-economic and environmental impact of bole sub city ring road

This study highlights the importance of pedestrian crossings in the Bole sub-city ring road area and its direct impact on business activity and property occupancy levels. The study found that tenant displacement is high in the midpoint of two consecutive pedestrian crossings, while tenant displacement from near pedestrian crossings is relatively low. Most buildings along pedestrian crossings are fully occupied, with 43.33% of owners located near pedestrian crossings and 50% ensuring no tenant turnover, maintaining high occupancy levels. Tenant respondents revealed that 92% prefer to be near pedestrian crossings, with 73.75% strongly agreeing that buildings near pedestrian crossings are better for economic activity.

However, the fenced ring road restricts unrestricted movement from one side to the other, significantly impacting business activity, building vacancy levels, and eventually leading to dead areas. Barrier-free walkways and walker's friendly walkways can allow pedestrians a high level of comfort which in turn facilitate for an active business interaction (Zupan, 2000). Pedestrian crossings are also characterized by noise, traffic congestion, pollution, garbage, theft, and robbery, affecting building business and occupancy levels. While robbery, theft, pollution, and trash have no significant impact, 31.25% and 12.5% of respondents recognized

traffic congestion and noise as detrimental to business and vacancy levels. The study emphasizes the importance of pedestrian-friendly infrastructure, including street lighting, traffic control devices, pedestrian crossings, and buffers, to reduce traffic accidents and improve the livability and vibrancy of the area.

The study also highlights the significance of building location, with those near pedestrian crossings being more occupied. This statement is cross-checked using two case study buildings, which found that buildings close to pedestrian crossings are worth more than those far from pedestrian crossings. Additionally, locations like Bole Bras and Bole Mikael, with various commercial establishments and mixed-use services on the ground floor, support the busiest pedestrian areas and active street fronts, improving neighborhood safety and urban quality.

However, the study identified the issue of blank walls in government structures, social service facilities, banks, and retail establishments along the corridor, which have no connection with pedestrians using the pathways and often result in various issues such as drug addiction, theft, homelessness, and other crimes. The study emphasizes the need for interventions such as activating blank walls and finding solutions to bring life back to abandoned streets. Furthermore, the study highlights that dead street frontages are significant sources of environmental pollution and respiratory illness, with people disposing of waste in this area. The study concludes that improving pedestrian crossings and building frontage will enhance the livability and vibrancy of the area and improve the economic function of the Ring Road line.

4.6 Effect of ring road on pedestrian accessibility on bole sub city.

4.6.1 Street connectivity

The space syntax analyses showed that the Bole sub-city Ring Road is structurally important for vehicular traffic accessibility. However, the road needs to facilitate pedestrian activity in the local area. The street network sections that comprise Bole sub-city Ring Road are not important in terms of local connectivity (measured at a network distance of around 400m, approximating a 5min walk) and were, therefore, most likely do not attract the most pedestrian demand for street activity and movement through the area (Figure 4.18).

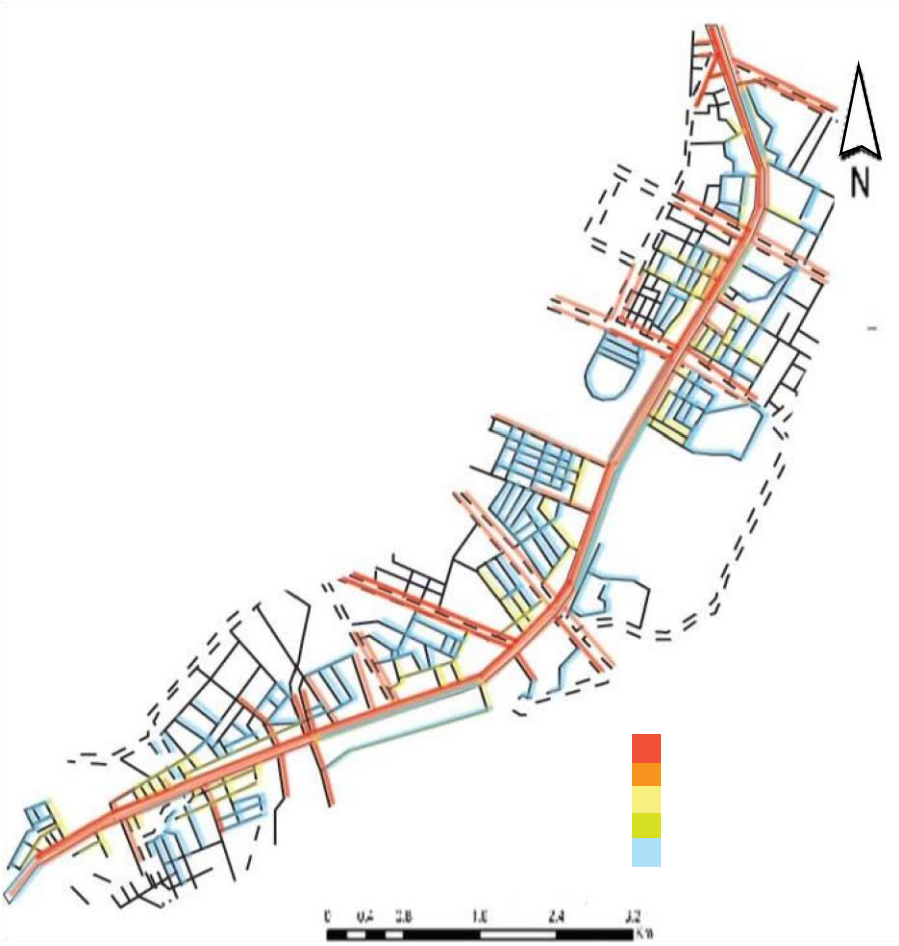


Figure 4.18 space syntax analyses to show Street integration Map of Bole sub-City Ring Road

Regarding global integration, the streets in red here reflect the dual graph's most central nodes, while the streets in blue represent its least central nodes. Since the street network segments that make up the Bole sub-city ring road are not particularly important for ensuring local connectivity (measured at a network distance of about 400 m, or roughly a 5-minute walk), they most likely do not draw the greatest number of pedestrians interested in a street activity and movement through the area.

Table 4.17 Street connectivity.

Questions	Percentage of satisfaction with the network's pedestrian situation					Total
	Very satisfied	Satisfied	Average	Unsatisfied	Very unsatisfied	
	12	13	112	139	45	321
Connection to the						

	surrounding area	3.8%	4%	34.9%	43.3%	14%	100%
Pedestrian Connectivity	Circulations or crossings for pedestrians that connect the neighborhood	1	7	33	152	128	321
		0.3%,	2.2%,	10.3%,	47.3%	39.9%	100%
	facilities in the surrounding area?	0	26	50	151	84	321
		0%,	8%,	15.6%,	47.2%,	26.2%	100%
	Which pedestrian route would you like to link the area with the neighborhood?	The street/ rout/ that is not in the ring road line = 15%					
		The street/ rout/ that is in the ring road line = 85 **%**					

Source: (Field Survey data,2023)

The pavement connection along both sides of the Bole sub-city ring road Street is shown in Table 4.17. As a result, less than 15% of the sidewalk on the Street is connected from both sides, which indicates that the connection between the ring road and the local roads has been lost and could be better for pedestrians.

Due to a lack of safe pedestrian routes, crossings, and amenities, the current situation is unacceptable and causes many accidents and injuries. A lack of adequate infrastructure and facilities to access vital services like stores, hospitals, and schools has adversely affected the quality of life for pedestrians.

4.6.2 Street walkability

The information gathered and reviewed with the use of the several research strands show how challenging it is for pedestrians to cross Ring Road. Tyagi, S. K., & Soni, S. K. (2014). Street audits have revealed that the crossing is not physically feasible due to the presence of guard rails and barriers along the section with the biggest pedestrian traffic. Because there aren't enough signalized crossings, people must wait a long time up to two minutes to cross at the ones that are currently in place.

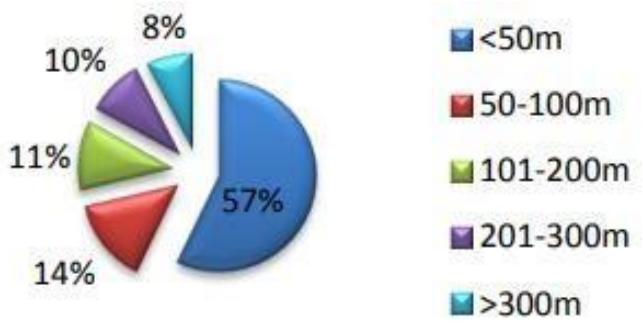


Figure 4.19 Willingness to walk to cross the street

Figure 4.19 demonstrates that over 57% of the pedestrians surveyed are prepared to go as little as 50 meters to reach a pedestrian crossing. But after that, the data dramatically decreases, showing that there must be road crossings that are no more than 200 meters apart.

Table 4.18 pedestrians crossing availability and time for crossing

Questions		Lack of crossing sites	several crossing points	Total
	crossing sites	295	26	321
		91.2%	8.8%	100%
Crossing		enough	Not enough	
Ratio	Time to cross the legal crossing point	250	71	321
		71.6%	28.4%	100%

(Source: Field Survey data,2023)

91.2% of survey participants reported a lack of crossing locations as a problem they encountered when attempting to navigate their neighborhood, and 28.4% claimed that signalized crossings did not provide them adequate time to cross. The mapping of crossing locations (Fig 4.8) demonstrates the absence of official crossing stations over a significant stretch of Bole Ring Road. The majority of formal crossing points have a low Pedestrian Environment Review System score due to delays (signal timings for controlled crossings, lack of gaps for uncontrolled crossings), poor legibility (especially in complex crossings), and gradient (in both existing underpasses, which have steps but neither ramps nor lifts).

Table 4.19 pedestrians crossing Frequency

Questions	Frequency			
	Daily	2/3 time a week	3/4 time a month	Total
How much do you cross the road?	115	151	55	321
	35.8%	47%	17.2%	100%

(Source: Field Survey data,2023)

The study found that just 35.8% of participants crossed Bole Ring Road regularly, a low number considering that the road serves as the primary thoroughfare for a densely populated area. Only once per two to three months is the most often participants (1.27%) cross the roadway. It's possible that the Bole Ring Road's heavy motorized traffic prevents people from using it as often as they should.

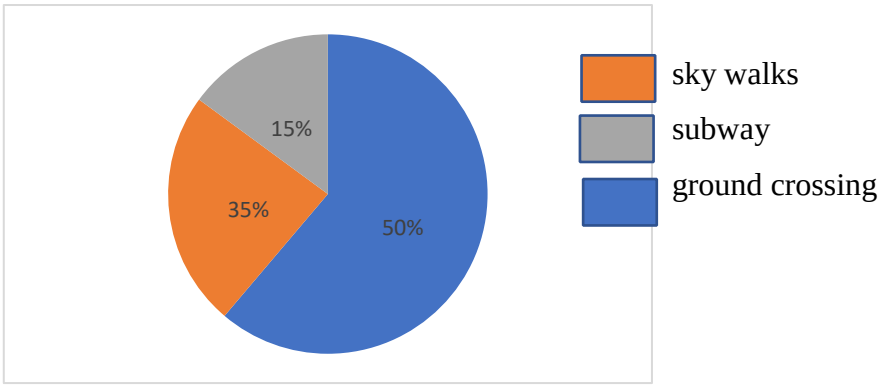


Figure 4.20 preferred mode of crossing

In response to a question regarding how they like to cross the street, pedestrians are shown in Figure 4.20 15% of participants said they would rather cross the street on a pedestrian subway. Skywalk was selected by 35% of the populace. And 50% of people preferred crossing the street at ground level when walking.

4.6.3 Pedestrian volume analysis

The number of pedestrians in the research region is shown in Figure 4.21 Given its large and extensive crossing lines, Megenagna had the highest number of pedestrian movements (764) in the graph above. Bole Bras 557, Bole Mikael 415, Bole Imperial 365, Bole Anbesa 304, Bole Hayat 287, and Bole Mamo 251 were among the pedestrians counted at different locations. They were tallied for 15 minutes in descending order.

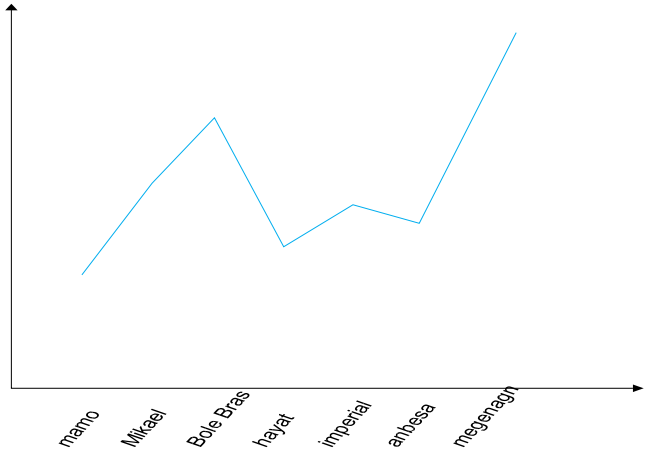


Figure 4.21 Pedestrian volume analysis per 10 minutes

A study conducted in the city of Singapore by researchers from the National University of Singapore. Demonstrating the importance of pedestrian volume analysis in informing urban design and planning decisions and highlights the potential benefits of using data-driven approaches to urban design. (Wong, Y. D., Tan, G. L., & Tan, C. K., 2015)

4.6.4 Existing pedestrian sidewalk evaluation based on PLOS.

4.6.4.1 Pedestrian count result for site one

Table 4.20 Pedestrian count for 15 minutes during peak hour

Place	Random count in 15 min			Effective width(m)
	Morning	Night	Average	
Bole Bras	627	603	615	1.6m
Mid	101	125	113	1.8m
Bole Mikael	896	818	857	1.6m

(Source: Field Survey data,2023)

Table 4.20 above displays the results of the 15-minute pedestrian count at Site 1 at three different locations, two at pedestrian crossings and the third midway between the two points. Average pedestrian counts include 615 at B. Bras, 113 at mid-distance, and 857 at Bole Mikael. Based on this finding, the analysis concluded that B. Mikael and Bole Bras had the highest pedestrian activity. The sidewalk at site one of the selections is 2.4 m wide overall, but we must remove obstructions like hawkers, curbs, trash cans, and poles in the middle of the sidewalk, then the effective sidewalk width becomes 1.8 meter wide at the mid distance and 1.6 meter wide at bole Mikael and bras. This shows how the pavements are becoming

smaller and more congested with obstructions. The same result was obtained from the study by Habtegebriel, M. (2018). in the article "Pedestrian Level of Service in the Central Business District of Addis Ababa, Ethiopia", which discusses pedestrian volume and sidewalk obstructions in the city of Addis Ababa.

Table 4.21 Result of the pedestrian flow at the first location

Places	Bole Bras	**Mid**	Bole Mikael
PF =No pedestrian/ min	PF = No pedestrian/ min 615 ped /15 min 41 ped/min	PF=No pedestrian/ min 113ped /15 min **7.5** ped/min	PF = No pedestrian/ min 857 ped /15 min 57.1 ped/min

(Source: Field Survey data,2023)

By dividing the average number of persons by the time it took them to cross the pavements in three different locations, Table 4.21 above displays the pedestrian flow result. Every 15 minutes, were 58,8,41 pedestrians at Bole Mikael, mid-distance, and Bole bras respectively. There was a lot of foot traffic at Bole Mikael and Bole Bras. The result is necessary to determine the pedestrian flow rate.

Table 4.22 Flow of pedestrians

Places	Bole Bras	**Mid**	Bole Mikael
PFR = Pedestrian flow/ Width	PF = pedestrian flow/ Width	Pedestrian flow/ Width	Pedestrian flow/ Width
	41 ped/1.6m	7.5 ped/ 1.8m	57.1 ped/min / 1.6m
	25.6 ped/m/min	4.1 ped/m/min	35.7 ped/m/min

(Source: Field Survey data,2023)

The result for the pedestrian flow rate was shown in Table 4.22 above by dividing the pedestrian flow by the effective width of the pavement. For Bole Bras, mid-distance, and Bole Mikael, respectively, the pedestrian flow rates are 25.6, 4.1, and 35.7 ped/m/min. The pedestrian level of service for the site can be divided into the following categories based on the stated pedestrian flow rates: **Bole Bras:** level of service (LOS) C category, where the pedestrian flow rate of 25.6 ped/m/min. **Mid-distance:** 4.1 ped/m/min pedestrian flow rate

is within LOS A. **Bole Mikael:** 35.7 ped/m/min pedestrian flow rate is within the LOS D range.

An active street typically receives a B or C on the PLOS scale, indicating that it provides acceptable, convenience, and safety for pedestrians but may have space for improvement. But bole Mikael and the mid distance area POLS value are different from these values which indicates there should be some improvement needed. This would be demonstrated by wellkept pavements, adequate lighting, safe crossings, and other amenities that make walking a pleasurable and enjoyable experience. It is common for a busy street to have a decent volume of automobile traffic traveling at normal speeds, providing for safe and pleasant pedestrian movement adjacent to driving cars.

A study by Ewing, R., & Clements, R. (2013) found that the majority of streets in downtown Charlottesville received a grade of B or C on the PLOS scale, indicating that they provided acceptable comfort, convenience, and safety for pedestrians but had room for improvement. The streets that received the highest scores were characterized by well-kept pavements, adequate lighting, safe and marked crossings, and other amenities that made walking a pleasurable and enjoyable experience.

Bole Mikael and Bole Bras are, therefore, moderately active sites according to the PLOS test results, but the street in the middle of them is not likely due to the lack of a pedestrian crossing on the ring road.

4.6.4.2 Pedestrian count result for site Two

The findings of the 15-minute pedestrian count at Site 2 at three different locations, two of which are situated at pedestrian crossings, are displayed in Table 4.23 below. The third location is situated in the middle of the two points. At Imperial, there are typically 365 pedestrians, 92 at Mid-Distance, and 304 at Anbesa Garaz. The investigation came to the conclusion that Anbesa Garaz and Imperial had the most pedestrian activity based on this finding. The sidewalk at site one of the selections is 2.4 m wide overall, but we must remove obstructions like hawkers, curbs, trash cans and poles that are in the middle of the sidewalk then the effective sidewalk width become 1.6 m wide.

Table 4.23 Pedestrian count for 15 minutes during peak hour

Place	Random count in 15 min	Effective width(m)

	Morning	Night	Average	
Imperial	327	403	365	1.6m
Mid	98	86	92	1.6m
Anbesa Garaz	300	308	304	1.6m

(Source: Field Survey data,2023)

By dividing the average number of persons by the time it took them to cross the pavements in three different locations, Table 4.24 below displays the pedestrian flow result. There were 25, 7, and 21 pedestrians at imperial, mid distance, and Anbesa Garaz, respectively, every 15 minutes. There was a lot of foot traffic at Imperial and Anbesa Garaz. The result is necessary to determine the pedestrian flow rate.

Table 4.24 Pedestrian flow result for the first site

Places	**Imperial**	**Mid**	**Anbesa garaz**
PF =No pedestrian/ min	PF = No pedestrian/ min 365 ped /15 min 24.3ped/min	PF=No pedestrian/ min 92ped /15 min **6.1** ped/min	PF = No pedestrian/ min 304 ped /15 min 20.2 ped/min

(Source: Field Survey data,2023)

The result for the pedestrian flow rate was shown in Table 4.25 below by dividing the pedestrian flow by the effective width of the pavement. Imperial, mid distance, and Anbesa garaz had pedestrian flow rates of 15.2, 3.8, and 12.6 ped/m/min, respectively.

Table 4.25 Pedestrian flow

Places	**Imperial**	**Mid**	**Anbesa garaz**
PFR = Pedestrian flow/ Width	PF = pedestrian flow/ Width 24.3ped/1.6m 15.2 ped/m/min	Pedestrian flow/ Width 6.1ped/ 1.6m 3.8ped/m/min	Pedestrian flow/ Width 20.2 ped/min / 1.6m 12.6 ped/m/min

(Source: Field Survey data,2023)

The pedestrian level of service for the site can be divided into the following categories based on the stated pedestrian flow rates: Imperial: which has 15.2 ped/m/min pedestrian flow rate falls under the Level of Service (LOS) B category, Anbesa garaz: The pedestrian flow rate

of 12.6 ped/m/min falls within the range of LOS B, Mid-distance: whereas the pedestrian flow rate of 3.8 ped/m/min is within LOS A's range.

An active street typically receives a B or C on the PLOS scale, indicating that it provides acceptable comfort, convenience, and safety for pedestrians but may have space for improvement. This would be demonstrated by features such as well-kept pavements, adequate lighting, safe crossings, and other amenities that make walking a pleasurable and enjoyable experience. It's common for a busy street to have a decent volume of automobile traffic travelling at normal speeds, providing for safe and pleasant pedestrian movement adjacent to driving cars.

According to the PLOS test results, Imperial and Anbesa Garaz are therefore rather dynamic sites, however the street in the middle of them is not very lively because there is no pedestrian crossing on the ring road.

4.6.5 Pedestrian Walkability index analysis

There are five spans separating each section. Ten pedestrians each stretch was interviewed using the proforma and asked to list their preferences.

The areas are numbered as below: Area 1: Mamo, Area 2: Bole Mikael, Area 3: Bole Bras, Area 4: Hayat, Area 5: Imperial, Area 6: Anbesa

Analyses of average facility ratings and field walkability

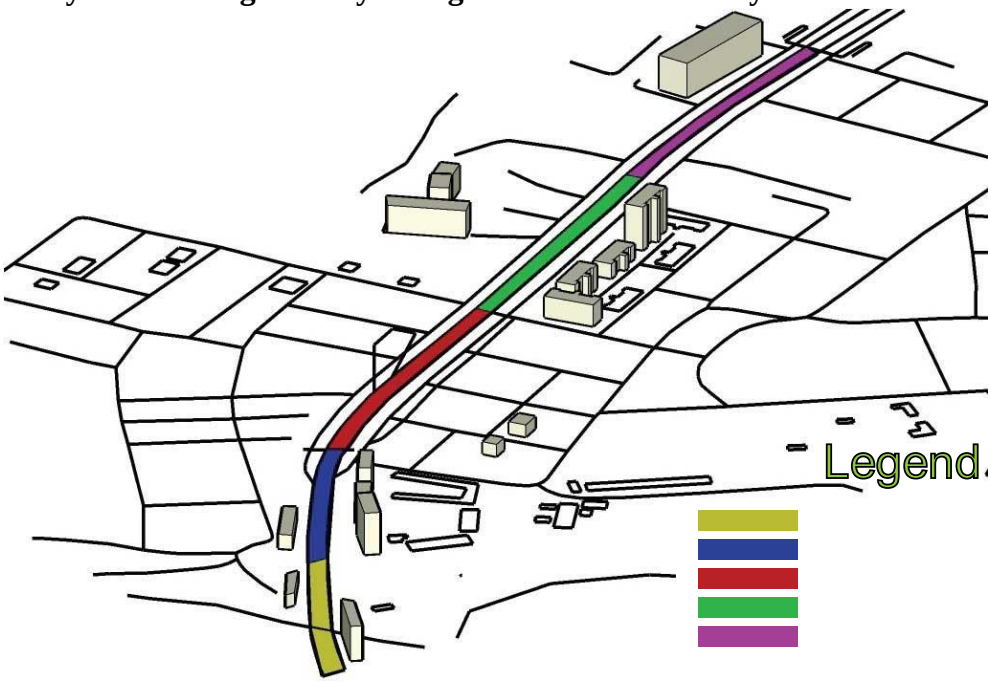


Figure 4.22 PWI Analysis Area one / Mamo

Table 4.26 Proforma for field walkability survey

Stretch 1, Area 1: Peak hour: yes no
Length of the stretch: 0.1km, width:2.5m

S. No.	Parameters considered	Number of pedestrians									Average Facility Rate	
		1	2	3	4	5	6	7	8	9 10		
1	Footpath surface	2	2	2	2	2	3	2	3	2	3	2
2	Footpath width	3	3	3	2	3	3	3	3	3	3	3
3	Continuity	4	3	4	5	4	4	4	4	4	4	5
4	Footpath width encroachment	3	3	3	2	2	3	3	2	3	2	
5	Obstructions	3	3	3	4	3	4	3	3	3	3	
6	Cleanliness and maintenance	2	2	2	2	2	2	2	2	2	2	
7	Comfort and walking environment	2	2	2	2	2	2	2	3	3	2	
8	Lighting facilities along footpath	3	2	3	3	2	3	2	3	3	3	
9	Crossing facilities	2	1	2	2	2	2	2	2	2	1	3

The Pedestrian provided ratings in table 4.26 for the following factors: footpath surface, footpath width, continuity, footpath width encroachment, obstructions, cleanliness and maintenance, comfort and walking environment, lighting facilities along footpath, and crossing facilities along one stretch. Analogously, divide the rating by 10 members, averaging each stretch's parameter.

Table 4.27 PWI Analysis of Area one / Mamo

PWI= ((∑ (facility rating× Length× Ped count×10))/Number of stretches)/1000

S. No	Parameters considered	Number of Stretches 1	2	3	4	5	PWI	PWI for the study area
1	Footpath Surface	2	4	40.4	3	4		
2	Footpath width	3	3	5	4	4	0.4184	
3	Continuity	4	5	4	5	4	0.4948	
4	Footpath width encroachment	3	3	3	4	3	0.3536	
5	Obstructions	3	3	3	4	3	0.3536	
6	cleanliness and maintenance	2	3	3	3	3	0.316	
7	Comfort and walking environment	2	3	3	3	3	0.316	
8	Lighting facilities on the footpath	3	2	3	3	4	0.326	
9	Crossing facilities	2	1	2	2	2	0.1924	
10	Pedestrian count	88	150	106	100	112	**Average** 0.324 =0.32349	

We can see that the obtained PWI values for Mamo sites are 0.324 in Table 4.27 According to the PWI values, the obtained PWI values are less than 0.4, making it possible to assign a low grade to the places' pedestrian facilities. Additionally, pedestrian Crossing facilities have the lowest PWI in the study area out of all the parameters taken into account, so special attention needs to be paid to them.

Table 4.28 PWI for Bole sub-city ring road street line

S. No.	Areas	PWI for the study area
1	Mamo	0.324

2	Bole Mikael	0.410
3	Bole Bras	0.532
4	Hayat	0.353
5	Imperial	0.364
6	Anbesa Garaz	0.310
	Average	0.38

From table 4.28 above the walkability index value of 0.38 indicates that there is a lack of pedestrian amenities in the area and that pedestrians are at significant risk, as shown by the number of accidents involving pedestrians. Bole Mikael and Bole Bras are the only two of the six locations to have PWI ratings between 0.4 and 0.6 that are considered fair. This is because they have better pedestrian crossing facilities than the other regions; the other five do not. The studies on walkability will aid city planners in comprehending the value of walkability and how it can be utilized to enhance PWI to guarantee safety.

4.6.6 Pedestrian perception on the sidewalk to be improved

The ideas made by pedestrians for upgrading the pavements are shown in Figure 4.23. 34.8% of women and 65.2% of men who responded agreed that the street should be improved. Pavement padding (6.5%), tree planting (9.6%), pavement expansion (16.2%), street lighting (9%), and adding street furniture (16%) are among the categories of proposals that garnered a lot of support from people of both sexes. Bicycle lanes (13.7%), green infrastructure (6.0%), more crossings (16.2%), and modified crossing bridges (15.8%) were the top ideas offered by pedestrians for pavement upgrades.

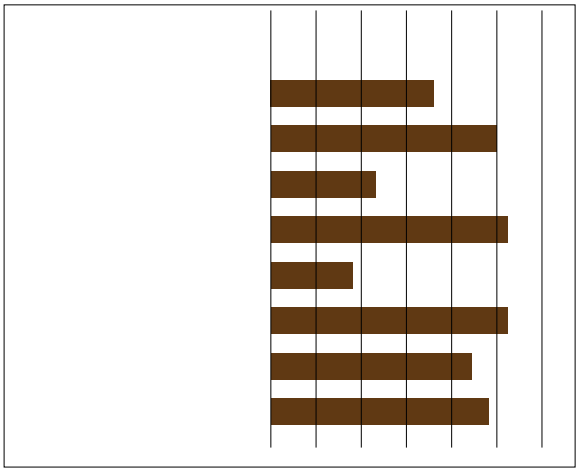


Figure 4.23 pedestrian recommendations

4.7 Discussion of the Effect of ring road on pedestrian accessibility on bole sub city.

This study aimed to evaluate pedestrian accessibility in the Bole Sub City Ring Road area using a questionnaire. Street connectivity analysis revealed that the area is not essential for local connectivity and does not draw many pedestrians. This is due to its physical disconnection from its surroundings, which needs pedestrian crossings, convenient sidewalks, and bicycling facilities. The absence of safe pedestrian routes, crossings, and amenities is unacceptable and leads to many accidents and injuries. Additionally, a lack of adequate infrastructure and facilities to access essential services like stores, hospitals, and schools adversely affects pedestrians' quality of life.

The PLOS and walkability index results from the two sites clearly show that the current sidewalks in Bole Mikael are insufficient to accommodate all users. Moreover, the middistance PLOS value seems good, but it is only because no pedestrian crossings are available in the area. The PLOS D, C and A results from both sites are very low, indicating poor pedestrian conditions. The walkability index analysis results demonstrate that the realm is hazardous for walking, as the value of 0.38 is below the acceptable quality level. This finding suggests a lack of pedestrian amenities in the area, and pedestrians are at significant risk, as evidenced by the number of accidents involving them.

Among the six locations studied, only Bole Mikael and Bole Bras received PWI ratings between 0.4 and 0.6, which are considered fair. This is because they have better pedestrian crossing facilities than the other regions, which lack such amenities. The studies on walkability help city planners understand the value of walkability and how it can enhance PWI to ensure safety for pedestrians.

CHAPTER FIVE

CONCLUSION, RECOMMENDATION AND PROPOSAL

5.1 Conclusion

This research analyzed the Bole sub-city Ring Road's special, economic, social, and environmental aspects. It provided a comprehensive evaluation of the issues associated with the influence of the ring road on the street frontage and pedestrian accessibility.

The current state of the Bole sub-city ring road shows that almost half of the built-up area, 48.4%, along the street frontage is blank and not contributing to the city's growth. This is because the ring road blocks pedestrian access and covers a large area with mega-structure buildings such as offices for the government, social services, banks, insurance companies, businesses, and stores, among others, with blank walls. These walls line the main ring road streets, eliminating street life in the study area and creating empty, lifeless streets. Despite the high land value in the studied region, it needs to be more effectively utilized, and residents of the city experience social, psychological, and environmental challenges due to the empty walls.

The pedestrian level of service (LOS) of the site resulted in D (36 ped/m/min), C (26 ped/m/min), and A (5 ped/m/min) LOS, respectively, indicating that pedestrian density is directly related to the presence of a pedestrian crossing. Areas with pedestrian crossings, like Bole Mikael (36 ped/m/min LOS D) and Bole Bras (26 ped/m/min LOS C), have more pedestrian activity and support business activity. However, in areas located at a mid-distance from two crossing points, the pedestrian flow is too low (5 ped/m/min LOS A) compared to other places, which has impacted the business activity of the site and resulted in tenant evictions due to a loss of income. Consequently, the site has become where most crimes are committed, and waste is disposed of, obstructing pedestrian movement and making people feel unsafe while walking in this area. An analysis of the walkability index shows a value of 0.38, indicating a lack of pedestrian amenities in the area and significant risk to pedestrians.

Improving the Bole sub-city ring road is crucial to address these problems by enabling the street frontage to develop into a thriving commercial sector and promoting a walking culture by establishing busy pedestrian spaces.

5.2 Recommendation

5.2.1 Overall recommendation

The research's conclusions suggest that the current Bole Sub City Ring Road has several issues. By making streets more accessible, safer, and attractive, well-planned and complete streets symbolize an urban growth and improvement strategy.

1. Instead of constructing a roadway designed for cars, which increases the number of vehicles on the road and causes other forms of urban pollution, the emphasis should be building a more human-friendly environment.
2. The government can raise public awareness about maintaining the quality of local streets and public spaces through public meetings and the media. This can help people feel a sense of ownership and community. It is also important to consider current streets as potential locations for the city's development and expansion.
3. Community involvement during the planning, design, and implementation is critical for a successful program.
4. It is essential to add more street crossings when designing and building a ring road street so that study area residents can travel freely between either side of the road.
5. Mixed-use lives/work settlements should be promoted since they are more practical, adaptable, and straightforward. Additionally, it might make the roadway busy all day and night.
6. Rather than entirely demolishing the existing structures and erecting a new one, it is possible to rebuild the existing infrastructures directly associated with the street, such as street utilities, streetlights, and ditches, with a low or minimal cost. Plug-in urban design is one method for converting existing blank-wall buildings into living streets.
7. For further study, 's street frontage net model, which uses a convolutional neural network (CNN) that can successfully evaluate the quality of street frontage as active or blank, could be used, which can minimize the cost and time of data collection and the data collection would become more efficient in casting out an image classification problem.
8. Statistical analysis with both Housing price/land value and difference in scenic ness can be done for further research.

5.2.2 Design recommendations

Depending on the result and discussion the following Design recommendation was made. the development of the design is based on the existing design and structural plan of Bole sub-city.

Design of basic streetscape elements

Sidewalks: Use materials and pavements that are permeable or semi-permeable to enhance the amount of groundwater. Utilizing locally developed, environmentally friendly paving materials can lessen life cycle effects on the environment. Streets and pavements need to be kept apart using a green buffer as a mechanism, and pavements need to serve more purposes than only as walking lanes.

Street furniture: In order to produce street furniture that is both aesthetically pleasing and functionally dynamic, placement and arrangement must be carefully planned and matched. On the sidewalks as well as in the street, trash cans and the proper street signage must be placed wherever they are required.

Trees and landscaping: Understanding and placing where different types and shapes of trees are used in their respective areas.

Bicycle services: When planning and designing the street provision of well-defined bicycle way along with its amenities like bicycle parking, well defined by attractive color. The width of the bicycle lane must not be less than 1.5 meters in total.

Crosswalks: Establish a crosswalk that is easily seen and close to pedestrian access points. It was using the proper color and pattern for the zebra crossings, installing digital waiting and crossing equipment that will speed things up and motivate people to use the crosswalks, and ensuring that all people can use the crossings.

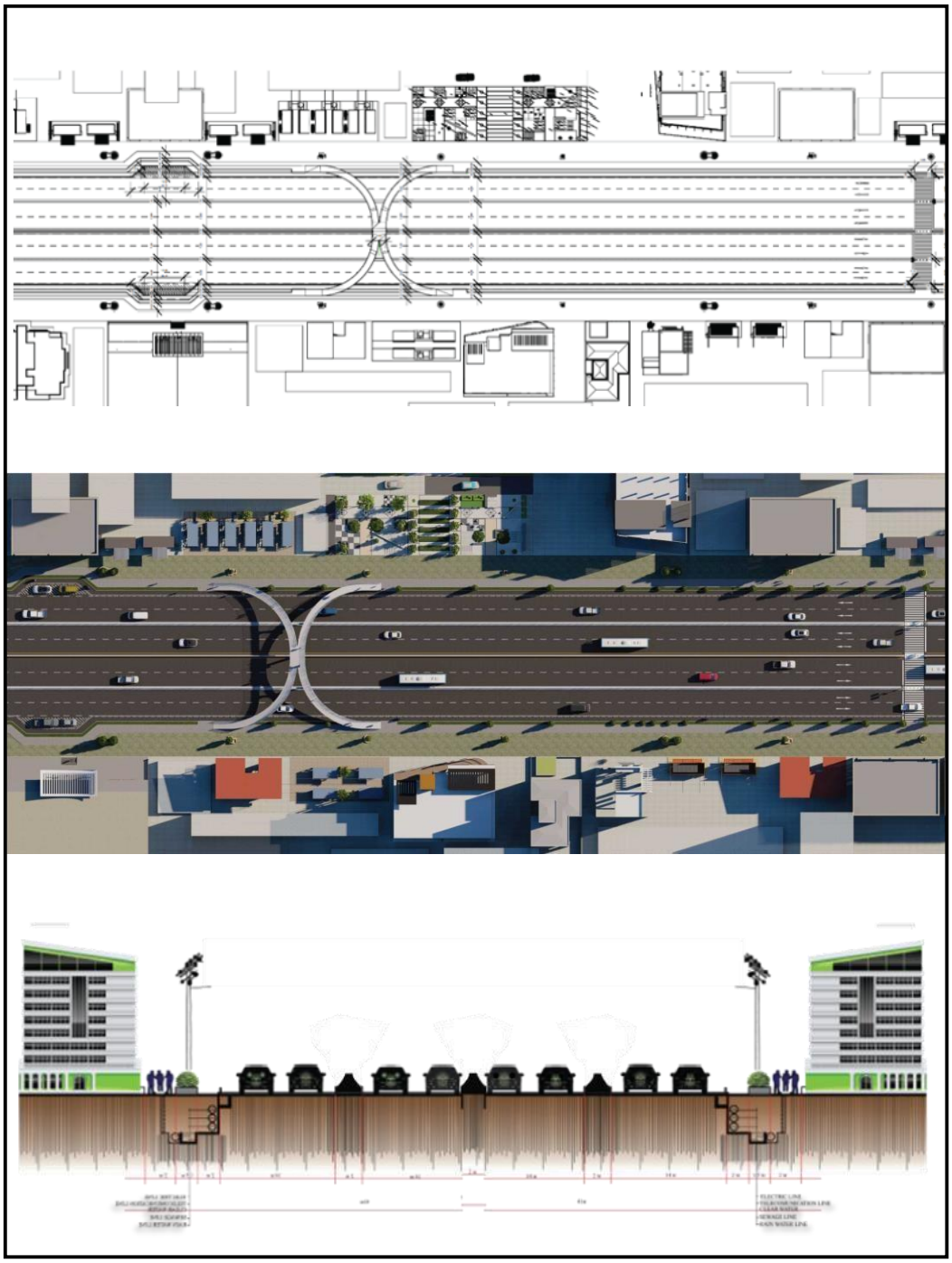


Figure 5.1 Proposed Street Design plan and Section

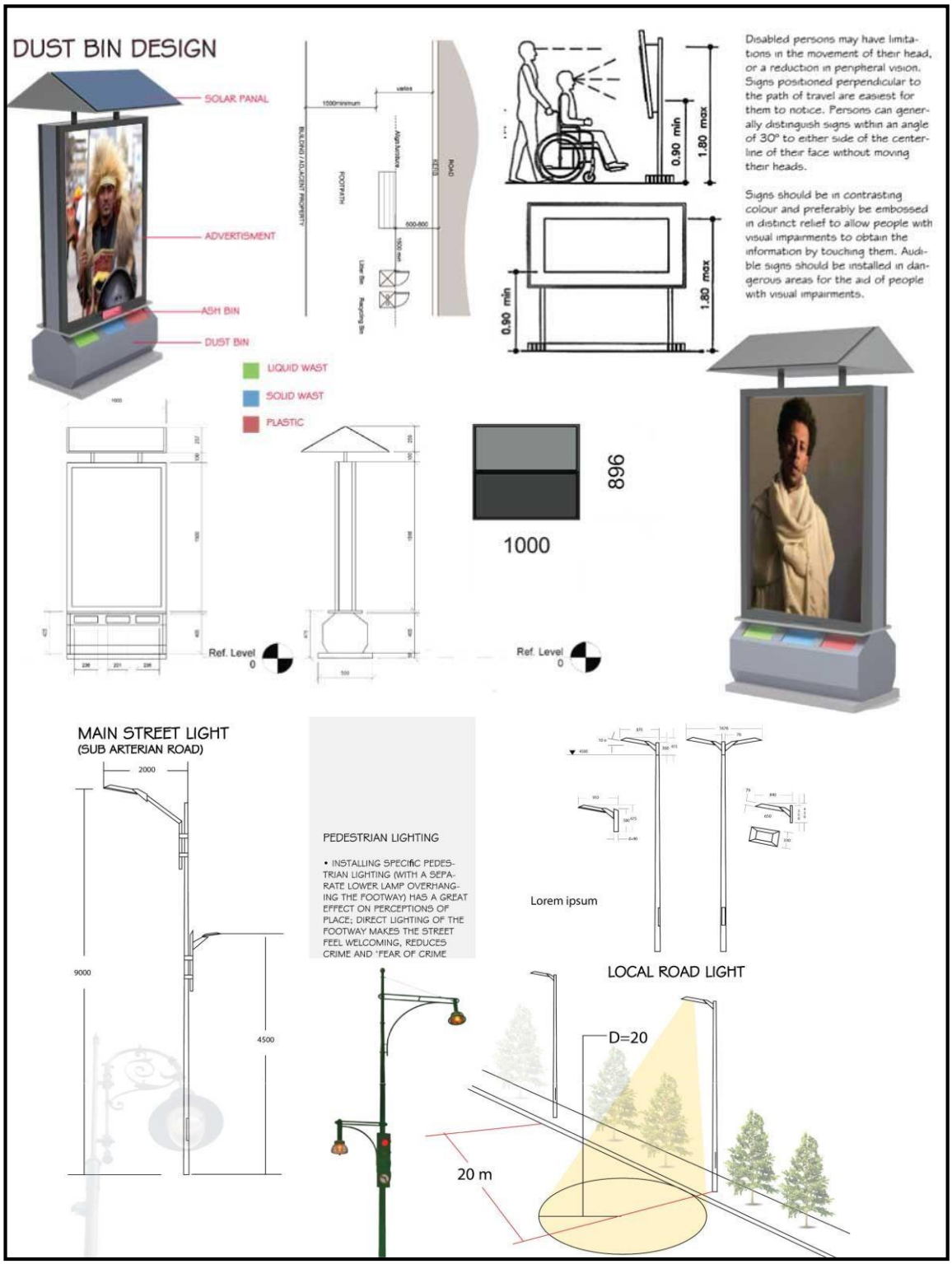


Figure 5.2 Proposed Dust bin design and street light

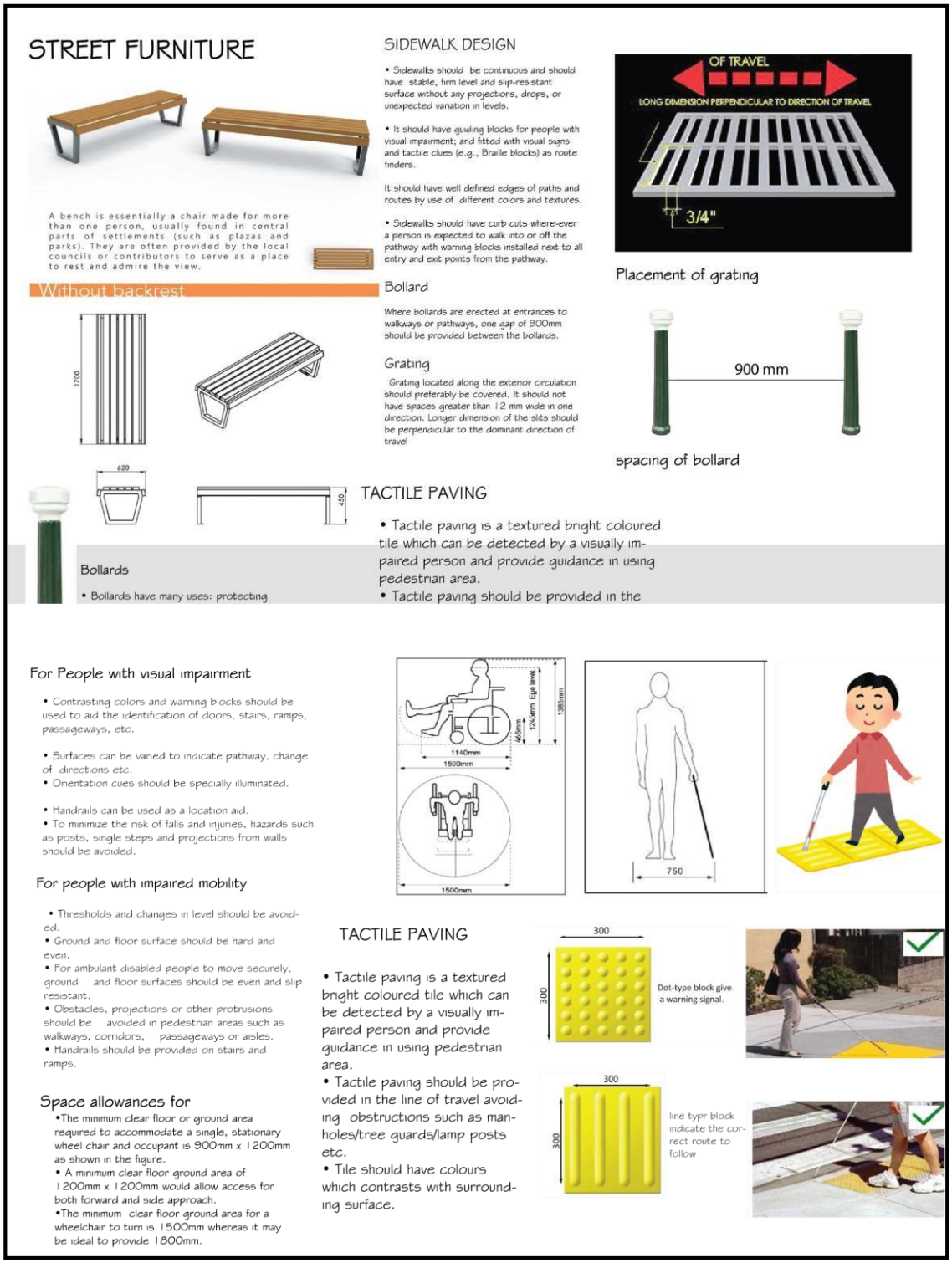


Figure 5.3 Proposed Street furniture and tactile paving

Figure 5.4 Proposed on site car parking design

Figure 5.5 Proposed plug-in shop design

Figure 5.6 Traffic light and ground pedestrian crossing

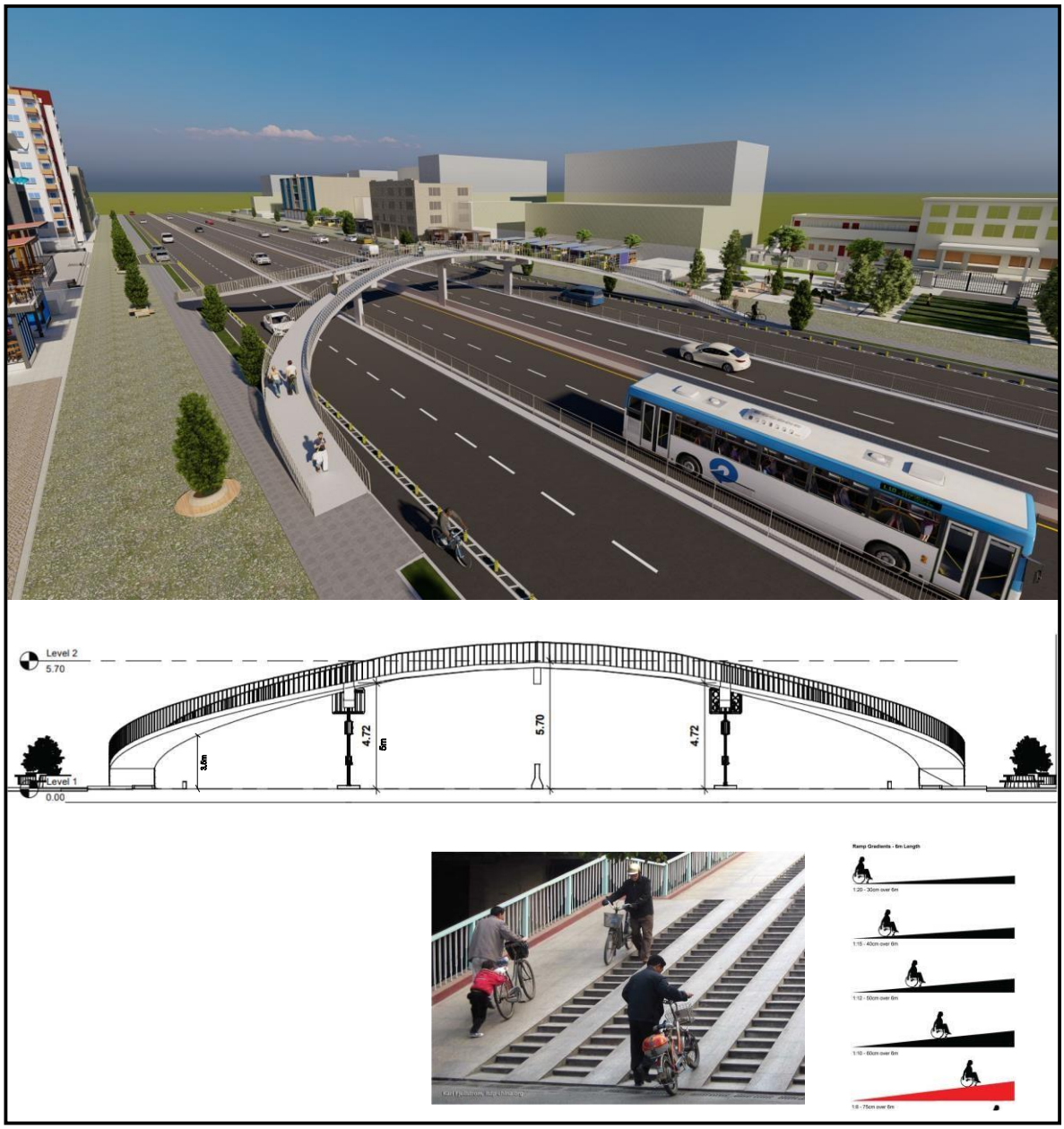


Figure 5.7 Proposed inclusive pedestrian and bicycle over pass design

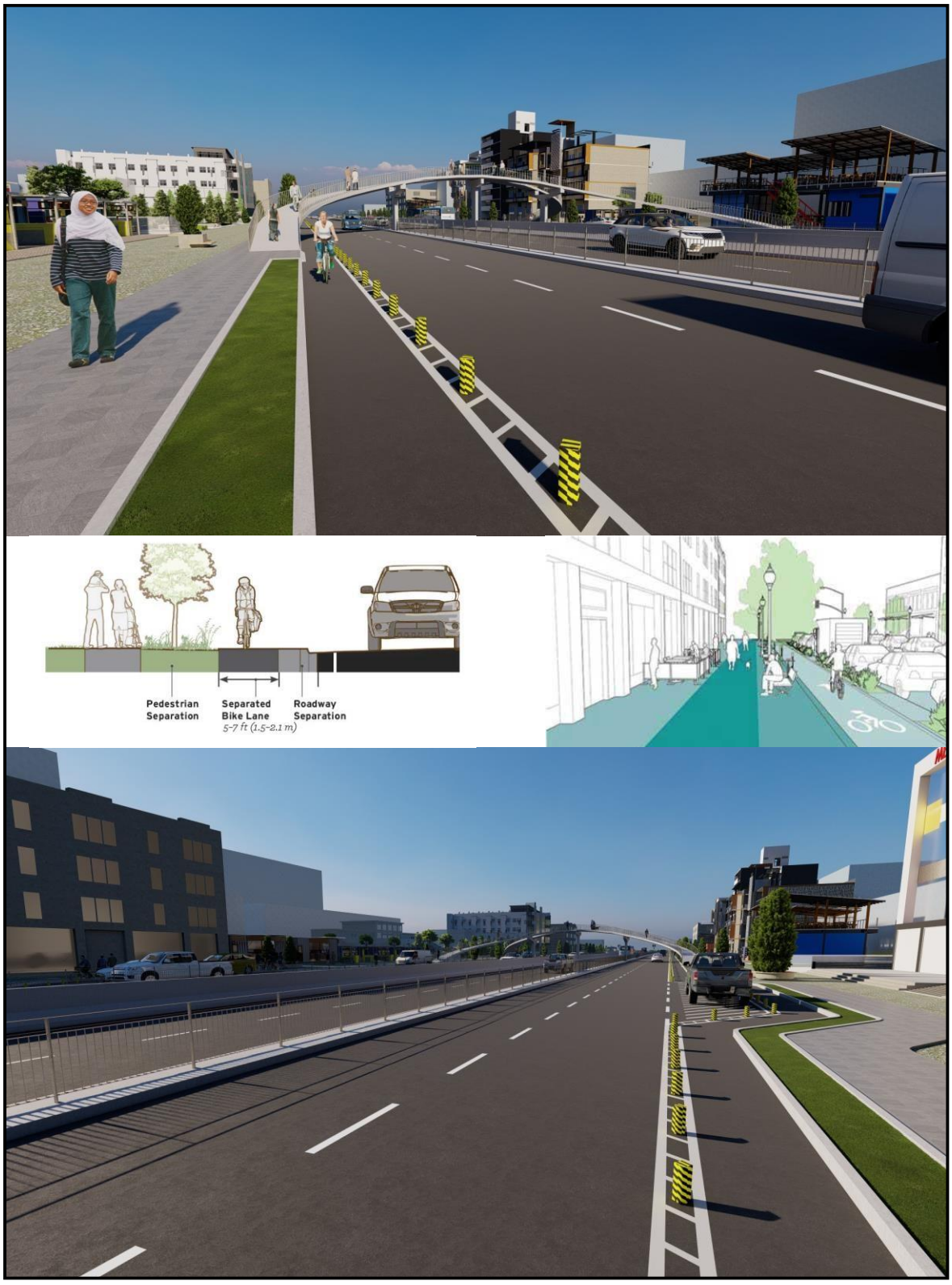


Figure 5.8 Proposed Bicycle Lane, pedestrian walk way and building frontage design

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APPENDIX

Appendix A- Questionaries and Interview questions

Adama science and technology university

school of civil engineering and architecture

Department of urban planning and design MSc program

Interview questions

Interview Questions for tenants

Dear respondents, you are kindly requested to answer this questionnaire which is used for the fulfillment of my degree in urban planning and design in ASTU. The title of the study is impact of ring road on the development of a vibrant street frontage and pedestrian accessibility in Addis Ababa bole sub city thank you in advance for your cooperation.

Questionnaire For tenant of commercial place

I. General characteristics of respondents

1. Sex

   A. Male B. female

2. Age

   A. Below 25 B 25-30 C. 31-35 D. 36-40 E. above 40.

II. The main idea of Interview questions

3. The current function of your house?

   A. Shop B. café and restaurant C. living D specify if other_____

4. If you want to rent a property, do you want to prefer to rent near to ring road crossing? A Yes B. No

5. If your answer is yes or no, why? _____

6. If you have the choice to get rented property with the same desirability and the same rent price, which is Your preferred area? A. Bole Mikael B. Mamo C.Anbesa garaz D.Hayat
7. Location of your business is found from pedestrian crossing way
   A. between 0 meters and 300 meters
   B. between 300 meters and 500 meters
   C. between 500 meters to the mid-distance between two pedestrian crossing ways
8. If you want to rent other commercial space, where do you prefer from pedestrian crossing way?
   A. between 0 meters and 300 meters
   B. between 300 meters and 500 meters
   C. between 500 meters to the mid-distance between two crossings
9. Do you want to stay on your current commercial space?
   A. Yes B. No
10. Do you believe that fenced ring road has a negative effect on commercial property value and business activity.
    A. Strongly Agree B. Agree C. Dis Agree D. I have no idea
11. Do you think that the distance between pedestrian crossing and your shop affect your business? A. Only positive
    B. Only negative
    C. Both positive and negative
    D. No impact
12. When do you want to rent commercial property, which characteristic is your best Preference? If you consider the following characteristics? Please put tick mark your consideration?

SN.	Yes	No
a. Age of the building		
b. Near to Taxi station		
c. The floor level of space		
d. Near to corner of any road		
e. Near to pedestrian crossing		

f. Near to ring road line		
g. Activeness of the location		
h. Area of space		

13.Do you observe the following problems around crossing

Possible problem	Yes	No
Noise		
Robbery		
Congestion		
Social disintegration		
Pollution from car		
Waste		

14.What is the negative impact that your business is near to pedestrian crossing?

15.What is the positive impact positive impact on your business?

16.Which one is greater (negative or positive)

Interview Questions for Property owners/managers

Dear respondents, you are kindly requested to fill this questionnaire which is used for the fulfillment of ma degree in urban planning and design in ASTU. The title of the study is — impact of ring road on the development of a vibrant street frontage and pedestrian accessibility in Addis Ababa bole sub city thank you in advance for your cooperation.

The main idea of a questions

1 . Building level: G+_____

Location of your building

A. mamo B. bole Mikael C. bras D. Hayat E. Imperial F. Anbesa 2

When your building is constructed?

A. Before the introduction of ring road system B.

After the introduction of ring road system

3 Where do you guess Location of your building from pedestrian crossing ways

A. Between 0 meter and 300 meters

B. Between 300 meter and 500 meters

C. Between 500 meter and the mid-distance between two pedestrian crossing ways

4 If you want to build your building as new, which location do you prefer with respect to pedestrian crossing ways? A. Between 0 meter and 300 meters

B. Between 300 meter and 500 meters

C. Between 500 meter and the mid-distance between two pedestrian crossing ways

5 Do you prefer your commercial building is very close to pedestrian crossing ways

A. Yes B. No

6 What is the advantage that your building is very close to pedestrian crossing ways?

Is there tenant displacement from your building? A.

Yes B. No

7 If your answer to question 9 is yes what is the reason for displacement?

A. Unaffordable rental price increment

B. Unsuitability location for their business due to absence of pedestrian cross

C. If any other, specify_____

8 Dou you believe that commercial property near pedestrian crossing ways is important for business activity.

A. Strongly Agree B. Agree C. Dis Agree D. I have no idea

9 How do you recognize the relationships between distance from pedestrian crossing and business?

A. Direct relationships B. inverse relationships C. no relationships D. I do not recognize

10 What kind of use is suitable near to pedestrian crossing?

A. Office B. shops c. store D. restaurant and café F. hotel, G. if any other, Specify_____

11 Do you believe that fenced ring road line has a negative impact on your property value such as /rent and occupancy?

A. Strongly agree B. agree C disagree D. I have no idea

12 Do you think that pedestrian crossing ways distance from your building has a positive or negative impact on your building occupancy level?

A. Only positive

B. Only negative

C. Both positive and negative

D. I do not know

13 What is the negative impact that your property is near to pedestrian crossing?

14 What is the positive impact on your property?

15 How do you evaluate the occupancy level of building close pedestrian crossing and far pedestrian crossing?

A. occupancy near crossing increase

B. occupancy near crossing decreases

16 Do you think that constructing a pedestrian cross between the consecutive station might resolve vacancy problem properties found in the mid of two crossings?

A. Yes B. No

17 Do you believe that constructing a pedestrian cross makes active dead areas due to fenced ring road line?

A. yes B. no

18 Are you volunteered to participate in solution mechanisms? A. Yes B. No

19 If you answer is yes, do you participate in terms of money?

A. Yes B. No

20 If you are not willing to participate in terms of money, what will be your involvement?

_____

_____.

21 What is your recommendation for all problems related to ring road system with respect to your property value (rent, sale, occupancy level)

_____

Questionnaires for bole sub city ring road street users

Dear respondents, you are kindly requested to fill this questionnaire which is used for the fulfillment of ma degree in urban planning and design in ASTU. The title of the study is ― impact of ring road on the development of a vibrant street frontage and pedestrian accessibility in Addis Ababa bole sub city thank you in advance for your cooperation. General characteristics of respondents

I. Sex

B. Male B. female

II. Age

A. 15 - 25 B 25-35 C. 35-45 D. 45-55 E. above 55.

III. How often do you use the road?

A. Frequently B. Occasionally C. Sometimes D. Rarely

1. Which place do you prefer the most to visit?
   a. Bole Bras b. Bole Mikael c. Imperial d. Mamo e. Hayat
2. Which way do you Prefer to cross the ring Road if Available?
   a. Tunnel b. Over pass c. Ground crossing d. Unsure/No opinion
3. In your opinion, has the construction of the ring road made it easier or more difficult for pedestrians to access amenities and services in Bole sub-city? a. Easier
   b. More difficult
   c. No significant changed. Unsure/No opinion
4. What do you feel walking on the street of bole sub-city ring road?
   a. good b. Normal c. Bad d. Unsure/No opinion
5. How has the construction of the ring road impacted the walkability of Bole sub-city for pedestrians?
   a. Improved walkability
   b. Decreased walkability
   c. No significant change in walkability
   d. Unsure/No opinion
6. What is the most walking Obstruction in Bole sub-city ring road?
   a. Car parking
   b. Street trees
   c. Unsure/No opinion
7. How much distance are you Willingness to walk to cross the street?
   a. < 50 m b. 50-100 c. 101 – 200 d. 201- 300
8. Have any businesses or services in Bole sub-city been negatively impacted by changes to pedestrian accessibility resulting from the construction of the ring road?
   a. Yes, significantly
   b. Yes, somewhat
   c. No, not at all
   d. Unsure/No opinion
9. Do you think pedestrian crossing provided are enough in bole sub-city ring road?
   a. Lack of crossing b. Normal c. Sufficient crossing d. Unsure/No opinion
10. In your opinion, what measures could be taken to improve pedestrian accessibility in Bole sub-city following the construction of the ring road? a. Improved sidewalk infrastructure
    b. Enhanced pedestrian crossings and signage

c. Increased public transportation options

d. Other (please specify)

e. No opinion/Unsure

APPENDIX B – Criteria and elements used in selecting study site

Selection Criteria	**Elements**
Urban character	Urban typology: Path, corridor, frontage, connectivity
Walkability effect	Pedestrian crossing, bicycle lane, disability inclusiveness
Utility and infrastructure	Street side Spatial element: lighting, dust bin, walk ways, Street trees

APPENDIX C – Street frontage evaluation criteria

Street frontage quality	Mix of compatible land use
	connectivity
	opening
	walkability

APPENDIX D – Site observation checklists

Site Observation checklist	Availability		
Check List for Streetscape Elements	Available on selected site	Less available	Not available at all
Street lights,			
Trash cans			

Public art			
Pedestrians crossing point			
Traffic signs and signals,			
Street trees and other horticultural elements,			
General public furniture,			
Bicycle facilities (bikeway, racks)			
Check List for street Utilities and services running for pedestrian activities			
sidewalks/footpaths			
Pedestrian Pavements			
Ditches (M)			
Crossings			
Disability ways			

APPENDIX E – Pedestrians counting table

Bole Mikael		**Mid Distance**		**Bole Bras**		**Imperial**		**Mid Distance**		**Anbesa Garaze**	
Mor.	Night	Mor.	Night	Mor.	Night	Mor.	Night	Mor.	Night	Mor.	Night

APPENDIX F – Pedestrians counting table

Case study checklists for property manager/property owners

1. Has any shift occurred from one pedestrian crossing to another nearby or vice versa?
2. The effect on commercial property owners' income. (If it is determined that the property is either close or distant from the pedestrian crossing)
3. If there are frequent vacancies?
4. Why did tenants have to move? If there are, why did renters move to other locations and a pedestrian crossing?
5. Where do tenants commute from, and where do they enter houses near pedestrian crossings?
6. How has the Ring Road affected your building's overall occupancy and property rental value?
7. What is the cause of this effect?