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Challenges of Pedestrian Movement in Addis Ababa: The Case of Bole Sub-City

By:
Melisew Andarge

**A Thesis Submitted to the School of Graduate Studies of Addis Ababa University,
Ethiopian Institute of Architecture, Building Construction and City Development, in
Partial Fulfillment of the Requirements of the Award of Master of Science Degree in
Urban Design and Development.**

Advisor: Birhanu Girma (PhD)

**January, 2025
Addis Ababa, Ethiopia**

Declaration

I, Melisew Andarge, declare that the thesis work entitled “**Challenges of Pedestrian Movement in Addis Ababa: The Case of Bole Sub-City**” is my own original work and it has not been submitted any other University/Institutions and all the sources of materials used for this thesis work from other sources have been properly acknowledged and cited following the scientific guidelines of the University.

By:

Melisew Andarge

Signature_____

Date_____

Approval

As a member of the Examiners board of the final master's thesis open defense of Melisew Andarge, we have read and evaluated the thesis prepared by Melisew Andarge entitled "**Challenges of Pedestrian Movement in Addis Ababa: The Case of Bole Sub-City**" and recommended to Ethiopian Institute of Architecture, Building Construction and City Development, Addis Ababa University to accept the Thesis for the Fulfillment of Requirements for the award of Degree of Master of Science in Urban Design and Development.

Board of Examiners

<u>Birhanu Girma (PhD)</u>	_____	_____
Advisor	Signature	Date
<u>Dr. Bedane Shata</u>	_____	_____
External Examiner	Signature	Date
<u>Dr. Asfaw Mohamed</u>	_____	_____
Internal Examiner	Signature	Date
<u>Dr. Abunu Arega</u>	_____	_____
Chair Person	Signature	Date
<u>Dr. Dagnachew Adugna</u>	_____	_____
Graduate Program Director	Signature	Date

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Abstract

Walking is being promoted as either a main mode of transportation or as a part of multimodal mobility. Despite the advantage of walking mode of transport, there is no standard pedestrian facility not only in quality but also in the capacity. Thus, pedestrian accidents are a serious and growing problem in the world, especially in the cities of low-income and middle-income countries. To answer all the research questions, a 1 to 5 Likert scale, correlation and multiple linear regression models were used. Moreover, primary and secondary data were collected using research tools and collected data was analyzed using (SPSS) version 20. Results showed that the presence of rubbish dumped on pedestrian walkways, temporary garbage storage on pedestrian walkways and unlimited excavation and construction materials dumped on pedestrian walkway were the major challenges in pedestrian side walk. Besides, design of pedestrian facilities can lead to endless problems and can discourage the pedestrians due to a feeling of unselfishness, unprotected, or uncomfortable conditions. Thus, it is recommended that while planning urban road facilities, pedestrian crossings should be given due importance and placed accordingly so that its impact does not affect the traffic flow to a higher level.

Keywords: *Bole Sub-city, Pedestrian, Roadside Vendors, Obstruction, Street Parking*

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List of Acronyms

AACRA : Addis Ababa City Roads Authority

EPCC : Ethiopian Population Census Commission

PLOS: Pedestrian Level of Service

TPB : Theory of Planned Behavior

WHO: World Health Organization

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the Study

Globally, pedestrians constitute a greater number of all road deaths, and in some developing countries, especially in Ethiopia, this proportion is high. Inadequate pedestrian workability infrastructures cause more people injuries in traffic-related crashes while walking and some of whom become permanently disabled. These incidents cause much suffering and grief as well as economic hardship for families and loved ones. In Addis Ababa, walking constitutes major transportation modes. Even though pedestrians are legitimate roadway users, they are frequently overlooked in the quest to walk over main carriageway. Small effort towards accessibility makes a big difference in people's life (Yetnebersh, 2014). Creating improved safety and access for pedestrians requires providing safe places for people to walk, as well as implementing traffic control and design measures, which allow for safer street crossings and attractive sidewalk spaces (Shay & Iacono, 2010).

Walking is the best mode of transport to maintain good health, reducing traffic congestion and zero emission system, the frequency and severity of the accident is high. According to the Global status report on road safety 2018, launched by world health organization (WHO, 2018) pedestrians are being the most vulnerable road users in Africa. Most citizens of developing country used walking because it is mostly available with no-cost. In Addis-Ababa, 55% trip makers used walking as a daily mode of transport (AATMA, 2019). However, lack of available walking space and unprotected available walking space are the main problem and determinant of Addis Ababa walking environment. Due to this reason, pedestrians are the most affected road users with more than 86% of fatalities (AATMA, 2019).

Thus, by recognizing the advantage of walking as a mode of transport, Addis-Ababa city are currently constructing and upgrading pedestrian facility in different sub city but not consider the perception and attitude of pedestrians as per their socioeconomic characteristics and external factor. The challenges faced by pedestrians in Bole Sub-city are not limited to physical infrastructure and traffic issues; they also extend to social and accessibility concerns. Persons with disabilities, the elderly, and those with mobility impairments often face significant barriers in navigating the sub-city's pedestrian environment. The lack of accessible infrastructure, such as ramps, tactile paving, and audible signals, further marginalizes these

vulnerable groups and restricts their ability to move freely and independently. And also rapid urbanization has put immense pressure on the city's transportation infrastructure, particularly for pedestrian movement. Many areas within Addis Ababa lack proper pedestrian facilities, such as well-designed sidewalks, crosswalks, and pedestrian bridges. Additionally, the encroachment of street vendors, parked vehicles, and other obstacles has further reduced the available space for pedestrians, forcing them to share the road with vehicular traffic. Hence, the sub-city's growth has outpaced the development of pedestrian infrastructure, leading to severe challenges for pedestrian movement and safety (AATMA, 2019).

Addressing the problems of pedestrian movement in Bole Sub-city is crucial for promoting sustainable urban development, improving accessibility, and enhancing the overall livability of the area. By understanding the root causes and extent of these problems, this study aims to identify major challenges of pedestrian movement for stakeholders involved in transportation and infrastructure development in Addis Ababa.

1.2. Statement of the Problem

Bole Sub-city, a rapidly growing and densely populated area of Addis Ababa, is grappling with severe challenges related to pedestrian movement and safety. Despite being a major commercial and residential hub, the sub-city's infrastructure development has struggled to keep pace with its rapid urbanization, resulting in a pedestrian environment that is increasingly hostile, unsafe, and unsustainable. One of the most glaring problems is the lack of adequate pedestrian facilities, such as well-designed sidewalks, crosswalks and pedestrian bridges. Existing sidewalks, where present, are often narrow, poorly maintained, and frequently obstructed by street vendors, parked vehicles, or construction materials. This lack of dedicated pedestrian spaces forces pedestrians to share the road with vehicular traffic, exposing them to a heightened risk of accidents and injuries(AATMA, 2019).

Furthermore, more often, pedestrian crashes are one of the major road safety problems in the world, especially developing countries, representing about 40 percent of the total fatal crashes in low income countries and many pedestrian crashes in these countries occur at unsignalized intersections (Tulu et al., 2015). Thus, most countries in Africa have insufficient policies and strategies to protect vulnerable road users. As a result some studies depicted that the African Region has the highest proportion of pedestrian and cyclist deaths at 43 percent of all road traffic deaths. As Ethiopia is one of the developing countries, pedestrians account for 55% of fatal crashes per annum (WHO, 2009). But, however, the problems of pedestrian

movement in Bole Sub-city have far-reaching consequences that extend beyond the immediate safety concerns. They contribute to a lower quality of life for residents, discourage active transportation modes such as walking and cycling, and hinder the sustainable development of the sub-city. Businesses and economic activities may also be negatively impacted due to reduced foot traffic and accessibility issues (AATMA, 2019).

Addressing these multifaceted challenges and gaps require comprehensive understanding of the root causes and the development of holistic solutions that prioritize pedestrian safety, accessibility and the overall livability of the urban environment. By identifying and addressing the major challenges of pedestrian movement in Bole Sub-city, this study aimed to contribute to the ongoing efforts towards creating a more sustainable, inclusive, and pedestrian-friendly urban landscape in Addis Ababa.

1.3. Objective of the Study

1.3.1. General Objective of the Study

The general objective of this study is to assess the major problems hindering pedestrian movement in Bole Sub-city, Addis Ababa and propose viable solutions to address these challenges.

1.3.2. Specific Objectives of the Study

- To assess the major pedestrian movement challenges in Bole Sub-city.
- To identify strategies that can be implemented to improve pedestrian movement, accessibility and safety in Bole Sub-city.
- To evaluate the societal impacts of poor pedestrian infrastructure and accessibility in Bole Sub-city.

1.4. Research Questions

To realize the purpose of this study and to give appropriate answer for the issues raised in the statement of the problem section, the research addressed the following specific research questions.

1. What are the major pedestrian movement challenges in Bole Sub-city be addressed through a collaborative and participatory approach?
2. What strategies can be implemented to improve pedestrian movement, accessibility and safety in Bole Sub-city?

3. What are the societal impacts of poor pedestrian infrastructure and accessibility in Bole Sub-city?

1.5. Significance of the Study

This study holds significant importance and potential impact in various realms, as it addresses a critical aspect of urban sustainability and livability – pedestrian movement and accessibility. By comprehensively assessing the major problems hindering pedestrian movement in Bole Sub-city, the research aims to contribute to the ongoing efforts towards creating a more pedestrian-friendly and inclusive urban environment within Addis Ababa. From a policy perspective, the findings and recommendations emerging from this study can inform evidence-based decision-making processes for urban planners, policymakers, and transportation authorities. The insights gained will aid in the formulation of pedestrian-centric policies, regulations, and guidelines that prioritize pedestrian safety, accessibility, and mobility. This can lead to the development of more robust pedestrian infrastructure standards, traffic management strategies, and enforcement measures tailored to the specific needs of Bole Sub-city.

Moreover, the study's emphasis on stakeholder engagement and capturing diverse perspectives can foster a collaborative and participatory approach to urban planning and development. By involving residents, business owners, community groups, and other stakeholders, the research can contribute to a shared understanding of the pedestrian movement challenges and promote a sense of ownership and accountability in implementing solutions.

Furthermore, the research findings can contribute to the broader discourse on sustainable urban development and the creation of livable cities. By highlighting the importance of pedestrian-friendly infrastructure and policies, the study can serve as a catalyst for broader conversations and initiatives aimed at promoting sustainable transportation modes, reducing environmental impacts, and enhancing the overall quality of life in urban areas. Finally, the study's potential to draw upon best practices and successful case studies from other cities or countries can provide valuable insights and lessons for replication or adaptation within the context of Bole Sub-city and Addis Ababa. This cross-pollination of knowledge and experiences can accelerate the implementation of effective solutions and foster a culture of continuous learning and improvement in addressing pedestrian movement challenges. To

create safe, sustainable and smart city, pedestrian walking facility is the number one to be provided as urban infrastructure which consider all of the above influential factors.

1.6. Scope of the Study

This study is limited Assessment of the major challenges of pedestrian movement in Addis Ababa: The case of Bole sub-city. It was one of the most densely populated and rapidly developing areas within Addis Ababa, the capital city of Ethiopia. There was a methodological scope which could be based on descriptive research design approach & used purposive sampling technique. The geographical boundaries of the research were confined to the administrative limits of Bole Sub-city, which encompassed a diverse range of urban environments, including residential neighborhoods, commercial districts, transportation hubs, and public spaces. Additionally, due to time constraints the study would be conducted by using cross sectional survey design from January – July, 2024. Within this defined area, the study aimed to comprehensively investigate the various challenges faced by pedestrians in their daily movements. This included examining the physical infrastructure aspects, such as the availability, condition, and design of sidewalks, crosswalks, pedestrian bridges, and other pedestrian facilities. The research assessed the adequacy of these infrastructure elements in meeting the needs and safety requirements of pedestrians, including those with disabilities, the elderly, and children. Furthermore, the study investigated the broader impacts of poor pedestrian infrastructure and accessibility, such as the economic implications for businesses, the effects on public health and quality of life, and the social implications for vulnerable groups like persons with disabilities and the elderly.

1.7. Limitation of the Study

Despite the research report might provide important insights and understandings of the major challenges of pedestrian movement in Addis Ababa, particularly in Bole sub-city, it was not without some critical limitations. The major limitations of the current study is time and financial, difficulty to access full documents of pedestrian movement challenges for the study area and lack of willingness from the side of respondents to fill the distributed questionnaires on time.

1.8. Definition of Key Terms

1. Pedestrian: The term “pedestrian” refers to people travelling outside of a motorized vehicle but who are not pedal cyclists. Pedestrians, quite naturally, are made up of all ages and abilities of people (e.g., children, older adults, persons with disabilities, persons with visual or hearing challenges, as well as those using assistive devices, skateboards, long boards, rollerblades and Segway’s (CCMTA, 2013). MUTCD also defined pedestrian as “a person on foot, in a wheelchair, on skates, or on a skateboard (FHA, 2009).

2. Pedestrian Facilities: a general term denoting improvements and provisions made to accommodate or encourage walking (FHA, 2009). Another literature stated that pedestrian facilities consist of sidewalks, curb ramps, marked crosswalks, transit stop treatments, roadway lighting improvements, and street furniture (Alluri et al., 2013).

1.9. Organization of the Study

The study included five chapters. The first chapter is introductory part which consisted of background of the study, statement of the problem, objectives of the study, significance of the study, scope of the study, limitation, operational definitions and organization of the study. The second chapter contained literature review, in this section, theoretical, conceptual, and empirical finding of previous studies related to the topic was reviewed. The third chapter included the research design & methodology; sources of data, sampling design, method of data analysis tools were included under this section. The fourth chapter dealt with data analysis and discussion. Finally, the fifth chapter dealt with conclusion, recommendations and suggestions for future research study.

CHAPTER TWO

2. REVIEW OF RELATED LITERATURE

2.1. Theoretical Review

2.1.1. Concepts of Pedestrian

Walking is considered to be one of the most important non-motorized modes of transport (Jabbari et al., 2022). Pedestrian mobility, or the act of traveling on foot, is indeed the oldest form of mobility. Before the invention of wheeled vehicles, animals for transportation, or even boats, humans had to rely solely on their own two feet to get from one place to another. As civilizations began to evolve, pedestrian mobility remained an important mode of transportation. Ancient Greeks, Persians, and Romans, built networks of roads and footpaths to facilitate travel by foot, and even today, some of these ancient routes are still in use (Amato, 2004; Hodza & Butler, 2022). In many parts of the world, a pedestrian network continued to be an essential means of transportation. The primary function of the pedestrian network is to provide mobility for pedestrians, allowing them to travel from one location to another on foot. The pedestrian network in Iranian cities worked as a city skeleton and there were main urban elements and activities included the bazaar complex, school, and neighborhood centers (Farkisch et al., 2015; Jabbari et al., 2021). The concept of the pedestrian network originated in 1797 when the French army occupied Venice and attempted to build a structure to connect the island groups by waterways (Vivo, 2016). They worked to transform the amphibious city into a homogeneous pedestrian network by creating canals, building bridges, and creating paths. De Vivo (2016) believes that walking was a daily habit and formed the pedestrian network in sixteenth-century Venice.

Hence, walking is the most basic, active and inclusive of all modes of transport. Aside from delivering economic benefits such as vehicle or public transport cost savings, time saving and transport externality reduction, it also increases personal mobility options (Litman, 2003). The pedestrian walkway network links smoothly, without interruptions and hazards, with other transit modes such as bus and minimizing automobile dependence. Path system supports walking for utilitarian purposes such as shopping or the journey to work, as well as for pleasure, recreation, and health (Southworth, 2005). In addition, it supports equitable access to opportunities, particularly to most vulnerable transport users in our society such as women, children, person with disability and the elderly. However, walking has continued to be undervalued in current transportation planning and policy development (Litman, 2003),

especially in a number of developing cities. Therefore, walking is the easiest and most affordable way to improve physical activity and promote healthier lifestyles.

2.1.2. Pedestrian Needs

As stated by Mateo-Babiano (2016), when deciding pedestrians on a walking route tends to choose a route based on a number of influencing factors and found such factor is their socio-demographic characteristics and includes their age, income level, and gender. Additionally, the purpose and frequency of their walk trip, essentially their travel characteristics may also influence their decision to take on a particular route. In his study, (Mateo-Babiano, 2016) identified two groups, socio demographic and travel characteristics, are fixed variables, thus, cannot be changed and the third group of variables, which refers to the attributes of the external walking environment, can be changed. By considering these environmental attributes and the extent to which these attributes satisfy their needs as pedestrians, they then assess the positive or negative aspects of the route and pedestrians will then decide to walk or not to walk within the walking environment.

1. A person with disability

A 2007 Ethiopian Population and Housing Census defines a disabled person as a person who is unable to carry out or limited in carrying out activities that others can do due to congenital or long term physical/mental disabilities. In general, (Ethiopian Population Census Commission, 2007) define a person as disabled if due to physical or mental injuries could not fully perform activities that other healthy person could do. The 2007 EPCC(Page 59 – 61) classifies the person's disability in the following types.

2. **Blind:** Persons who totally lost their vision.

3. **Seeing difficulty:** Persons with seeing difficulty are those who cannot count fingers of hands at a distance of two meters or those who cannot identify the individual standing four meters away from them. Persons who lost one of their eyes and became unable to fully see due to the problem in one eye affecting the other were considered as persons with seeing difficulty. Moreover, persons who were unable to do their work without the help of others because of weakness in seeing were considered as persons who have seeing difficulty.

4. **Deaf:** Persons who were not able to hear from both ears but can speak. Hearing difficulty: Persons who have totally lost hearing in one ear and partially hear by one or those who were able to hear partially by both ears.
5. **Disability in Hands:** Nonfunctional upper limbs, Loss of one hand or both hands, paralysis of one hand or both hands or any other disability in one hand or both hands were taken as disability in hands.
6. **Disability in Legs:** Nonfunctional lower limbs, Loss of one leg or both legs, paralysis of one leg or both legs, or any other disability in one leg or both legs.
7. **Physical Organs Movement Difficulty:** Any other specific physical organ movement difficulties (such as difficulties in seating, keeping balance, severe shaking and coordinated organs' movement).
8. **Dumb:** Persons who were not able to speak at all but can hear.
9. **Speaking difficulty:** Persons who were not able to speak as a healthy person could speak or persons whose speech could not be understood clearly to others.
10. **Deaf mute:** Persons who were not able to speak and hear at all.
11. **Mental retardation:** Mentally disabled persons having difficulties in learning. A person whose social interaction is below expected and backward having low capacity of understanding, training with difficulties in helping themselves.
12. **Mental Problem:** Persons with mental illness due to unknown causes were not considered as disabled as long as they are treated and healed.

2.1.3. Pedestrian activities

According to Muraleetharan and Hagiwara (2005), it is necessary to quantify how well roadways accommodate pedestrian travel, and a measure of walking conditions would greatly aid in roadway cross-section design and would help in evaluating and prioritizing the needs for sidewalk retrofit on existing roadway.

2.1.3.1. Pedestrian environment

2.1.3.1.1. Theories of Pedestrian Behavior and Route Choice

1. Theory of Planned Behavior (TPB): Ajzen(1991), is a widely used theory in social psychology that explains human behavior through three key factors: attitudes, subjective norms, and perceived behavioral control. In the context of pedestrian behavior, the theory suggests that an individual's intention to walk and their route choice are influenced by their

attitudes towards walking (e.g., perceived benefits, convenience, enjoyment), subjective norms (e.g., social pressures, societal expectations), and perceived behavioral control (e.g., perceived ease or difficulty of walking, availability of infrastructure). The TPB has been applied in various studies to understand and predict pedestrian behavior, and it can inform interventions to encourage more walking.

2. Utility Maximization Theory: This theory, rooted in economics and decision theory, assumes that individuals make choices that maximize their perceived utility or satisfaction. In the context of pedestrian route choice, utility maximization theory suggests that pedestrians select routes that optimize certain factors, such as minimizing travel time, distance, or effort, and maximizing safety, comfort, and environmental quality (Bovy & Stern, 1990). Utility functions can be developed to model pedestrian preferences and trade-offs between different route attributes, providing insights for urban planning and infrastructure design.

3. Pedestrian Route Choice Models: Building upon utility maximization theory, various models have been developed to predict pedestrian route choices based on various factors. For example, the shortest path model assumes that pedestrians choose the shortest route, while the least effort model considers factors such as slope, surface quality, and obstacles (Hoogendoorn & Bovy, 2004). Other models incorporate safety considerations, environmental preferences, and cognitive factors like familiarity and way finding (Verlander & Heydecker, 1997). These models can be used to simulate pedestrian movements, assess the performance of pedestrian networks, and inform design decisions.

4. Space Syntax Theory: Developed by Bill Hillier and Julienne Hanson (1984), space syntax theory analyzes the spatial configuration of urban environments and its influence on pedestrian movement patterns. It emphasizes the importance of connectivity, integration, and visibility in shaping pedestrian behavior. Space syntax measures, such as connectivity and integration, quantify the ease of movement and accessibility within urban spaces, providing insights into how the spatial layout can facilitate or hinder pedestrian flows. This theory has been widely applied in urban design and planning to create more pedestrian-friendly environments.

5. Affordance Theory: Based on the work of Gibson (1979), affordance theory suggests that the environment provides opportunities for action (affordances) that influence human behavior. In the context of pedestrian behavior, affordances can refer to the perceived walkability, accessibility, and way finding cues in the built environment (Heft, 2010). For example, the presence of sidewalks, crosswalks, and pedestrian-friendly infrastructure affords or encourages walking, while barriers or obstructions may

discourage it. Affordance theory highlights the importance of designing environments that support and invite pedestrian activity.

2.1.3.1.2. Theories of Perception and Preferences Related to Walking Environments

1. **Prospect-Refuge Theory:** Developed by Jay Appleton (1975), the prospect-refuge theory proposes that people have an innate preference for environments that provide a balance between prospect (the ability to see and observe) and refuge (a feeling of safety and shelter). In the context of walking environments, this theory suggests that pedestrians prefer spaces that offer good visibility and a sense of enclosure or protection. For example, pedestrians may be drawn to walkways that offer views of the surroundings (prospect) while providing a sense of enclosure from trees or buildings (refuge). The theory has been applied in urban design to create pedestrian-friendly streetscapes and public spaces.
2. **Attention Restoration Theory (ART)** is Proposed by Rachel and Stephen Kaplan (1989), ART suggests that exposure to natural environments can aid in restoring directed attention and reducing mental fatigue. According to this theory, natural settings with elements like vegetation, water features, and Park-like settings provide opportunities for effortless attention and cognitive restoration. In the context of walking environments, ART suggests that incorporating natural elements and green spaces can make walking more enjoyable, restorative, and mentally rejuvenating, potentially influencing pedestrians' preferences and willingness to walk.
3. **Image ability and Legibility Theories:** Introduced by Kevin Lynch (1960) in his seminal work "The Image of the City," image ability theory emphasizes the importance of creating memorable and easily identifiable urban environments. Legibility theory, closely related, focuses on the ease of understanding and navigating urban spaces. These theories suggest that pedestrians prefer walking environments that are visually distinct, coherent, and easy to comprehend, with clear landmarks, paths, and way finding cues. Pedestrians' perceptions, way finding abilities, and overall walking experience are influenced by the image ability and legibility of the built environment.
4. **Environmental Preference Models:** Various models have been developed to predict and understand individuals' preferences for different environmental settings based on factors such as complexity, coherence, and familiarity (Kaplan & Kaplan, 1989; Stamps, 2000). For example, the Kaplan's' preference model suggests that people prefer environments that are coherent and legible (making sense), but also provide complexity and mystery

(inviting exploration). In the context of walking environments, these models can inform the design of pedestrian spaces that are aesthetically appealing, engaging, and encourage exploration and discovery.

5. **Aesthetic and Experiential Theories:** These theories explore the role of aesthetic qualities, sensory experiences, and emotional responses in shaping pedestrians' perceptions and preferences for walking environments (Nasar, 1998; Porteous, 1996). For example, factors such as architectural styles, public art, street furniture, and the presence of historic or cultural elements can influence pedestrians' aesthetic appreciation and emotional connections to walking environments. Additionally, sensory experiences like sound, smell, and tactile sensations can shape the overall walking experience and influence pedestrians' preferences and behavior.

2.1.3.1.3. Theories of Environmental Stressors (Noise, Air Pollution) and Their Impacts

1. **Environmental Stress Theory:** Developed by Stokols (1976), environmental stress theory suggests that environmental stressors, such as noise and air pollution, can have negative impacts on human health, well-being, and behavior. According to this theory, prolonged exposure to environmental stressors can lead to physiological and psychological stress responses, including anxiety, fatigue, and impaired cognitive function. In the context of pedestrian movement, environmental stressors like traffic noise and poor air quality can discourage walking, reduce physical activity levels, and negatively impact the overall walking experience.
2. **Noise Pollution Theories:** These theories examine the specific effects of noise pollution on human health, cognitive performance, and behavior. For instance, the non-auditory effects of noise theory (Stansfeld & Matheson, 2003) suggests that noise exposure can cause physiological stress responses, such as increased blood pressure and hormonal changes, even when the noise is not consciously perceived. Additionally, the attention model of noise (Öhrström et al., 2006) proposes that noise can interfere with cognitive processes, such as attention and memory, potentially impacting pedestrians' way finding abilities and decision-making.
3. **Air Pollution Theories:** These theories explore the impacts of air pollution on human health, respiratory function, and cognitive abilities. For example, research has shown that exposure to particulate matter and other air pollutants can contribute to respiratory diseases, cardiovascular problems, and neurological effects (Kampa & Castanas, 2008; Calderón-Garcidueñas et al., 2015). In the context of pedestrian movement, poor air

quality can discourage outdoor activities; reduce physical activity levels, and negatively impact pedestrians' comfort and willingness to engage in walking, especially for vulnerable populations like children and the elderly.

4. **Environmental Justice Theory:** This theory highlights the disproportionate exposure of marginalized communities to environmental stressors, such as noise and air pollution, and the associated health and quality-of-life impacts (Bullard, 1990; Holifield, 2001). Environmental justice research has shown that low-income and minority communities often bear a disproportionate burden of environmental hazards, including traffic-related pollution and noise, which can exacerbate existing health disparities and limit opportunities for active transportation like walking.
5. **Psychological Distance Theory:** Developed by Trope and Liberman (2010), psychological distance theory suggests that individuals may perceive and respond differently to environmental stressors based on their psychological distance or closeness to the source. For example, individuals may perceive air pollution or noise as more threatening and impactful when it is geographically or psychologically closer to them. This theory

2.1.3.2. Accessibility of pedestrian facilities

As stated by Litman (2017), Accessibility refers to people's ability to reach goods, services and activities, which is the ultimate goal of most transportation activities. Many factors affect accessibility, including physical movement, the quality and affordability of transportation options, transportation system connectivity, mobility substitutes, and land use patterns."

In recent time, the quality of life and well-being has been increased from time to time, due to this reason the paradigm of the transportation sector has been changing from a car-oriented transportation system to an eco-friendly, pedestrian- or all people-oriented urban space mode of transportation (Campisi et al., 2021 and Hine, 1996). Walking is the most basic means of transportation for all human's type based on their active body movement and is the basis of all activities such as commuting, going to school, work, religious institute, recreational area, and leisure place. In terms of transportation, walking itself is also a form of travel, and it serves as a link between various long travel transportation modes, e.g., buses, railway, taxiway, and subways.

In addition, many studies by Khan & Tiwari, 2007, Bivina et al., 2018, Adkins, et al., 2012, and Larouche et al., 2014, claim that walking provides various functions other than

transportation modes. For instance, the study conducted in America in state of Oh and Seo argue that the concept of walking in urban design has expanded continuously with the times from the primary means of transportation.

Specifically, the perspective of understanding walking has been expanded as a means of experience and recognition of urban space, a means of leisure, performing social functions, and a monitoring function of public space. KOTI was also emphasizing the eco-friendliness of walking because it relies on human power and has little impact on the environment. In addition, the literature insists that walking plays a role in bringing novelty and vitality to life in outdoor spaces, going beyond transportation. It contributes to revitalizing the economy of a city or community, promotes social exchange and local economic activities, connects transportation modes, guarantees accessibility, and improves human health. As pedestrians, everyone contributes to ensuring equality in their community and enhancing safety and security.

Different countries and municipal cities are conducted different movement and proclamation to enhance pedestrian movement in urban areas. For instance, in case of South Korea, the recent enactments, such as the Mobility Convenience Promotion Act for the Transportation Vulnerable in 2006 and the Sustainable Transportation and Logistics Development Act in 2009, laid the institutional foundation to vitalize pedestrian transportation that is a non-motorized, carbon-free transportation mode to reduce congestion and greenhouse gas emissions. Furthermore, since the enactment of the Act on Pedestrian Safety and Convenience Promotion in 2015, interest in securing pedestrian rights and the pedestrian environment have increased significantly. Along with the pedestrian-oriented policy paradigm shift, research to evaluate and analyze pedestrian satisfaction has actively been conducted at different time in different place.

According to several researches conducted by different money school arches factors of the walking environment that affect pedestrian satisfaction are identified as safety, security, scenery, comfort, and convenience (Asadi-Shekari et al., 2013, Kadali & Vedagiri, 2015, Campisi, et al., 2021, Holland, & Hill, 2007 and Mōri & Tsukaguchi, 1987). A case study conducted as investigating the pedestrian satisfaction of traditional markets in Korea classified the influential factors into safety of traveling street, comfort of walking surface, convenience of the place from different area, and interest of individual who are using the street. Besides safety, convenience, and comfort, other studies suggested street environments,

e.g., air quality, noise, natural shade, planting, or street continuity and visibility as evaluation or design elements as conducted by many other studies.

Based on the common workability metrics and attributes from the literature and consideration of the built environment of urban design of the country, this study categorizes factors affecting pedestrian satisfaction into safety, convenience, and comfort to examine differences in satisfaction by land use and street type. Safety implies that the presence of sidewalks, illegal parking, perceived safety level from traffic accidents, illegally placed objects and vehicle travel speed. In case of Convenience: sufficiency of pedestrian guidance facilities, sidewalk material (pavement condition), sidewalk slope, easiness to access public transportation facilities are the main factor to take in to consideration. Comfort is another issue which takes in to account the factors such as pedestrian volume, the sufficiency of green space, cleanliness, noise level. Comfort and convenience in most studies are correlated with traffic security directly or indirectly.

2.1.3.3. Pedestrian encroachment into the main carriage way

Due to pressure on the narrow pedestrian spaces, people tend to walk on the carriageway and cross the road at any point as well and these limits the vehicular smooth flow and at the same time pose great danger to the pedestrians. The risk of pedestrian injury is high when pedestrians share the road with vehicles travelling at fast speeds. Increased vehicle speeds are associated with increased injury severity and death for pedestrians and cyclists (Segni, 2013).

2.1.3.4. Pedestrian Safety and Risk factors for pedestrian traffic injury

The World Health Organization (2013) identified some of the key factors that influence the risk of pedestrian traffic injury as speed, alcohol, lack of pedestrian facilities, weather conditions, and inadequate visibility of pedestrians and inadequate enforcement of traffic laws. These factors align well with the focus areas of a safe systems approach. Based on observation of the road environment in the country, it would be safe to conclude that speeding, absence of median and pedestrian refuge island, walking along roadway, illegal crossing and narrow roadway width might have significantly contributed to the increase in pedestrian risks to crashes (Segni, 2015).

According to Redi (2015), from the Traffic Police Commission, the number of road crash fatalities in respect of road users, sex, and age group in Ethiopia during 2009-2013 showed that the age groups 18 - 30 are the most vulnerable and further, pedestrians are the most vulnerable. Among pedestrians, males are the most vulnerable. In addition, (Redi, 2015)

identified that the main cause of pedestrian crash was the absence of adequate and appropriate parking space, pedestrian pathways and the available pedestrian walkways are very narrow, very rough and do not respect the universal accessibility standards, aggravates the problems and enforce the pedestrians to encroach to the main carriageways.

2.1.3.4.1. Identification of Pedestrian Crash Hot Spots and Risk Factors

Imagine a city where pedestrians navigate the streets with a sense of unease, their safety compromised by the constant threat of vehicular collisions. In such an environment, identifying pedestrian crash hot spots and understanding the underlying risk factors becomes a crucial endeavor, one that demands a multifaceted approach and a deep commitment to promoting pedestrian safety. At the heart of this effort lays the analysis of comprehensive crash data. Every pedestrian-vehicle collision, no matter how minor, is meticulously documented and mapped, revealing patterns and clusters that might otherwise go unnoticed. Powerful Geographic Information Systems (GIS) and spatial analysis tools transform this data into vivid visual representations, highlighting the areas where pedestrians are most vulnerable (Segni , 2015).

.But mere data alone is not enough. Network screening methods, such as the Empirical Bayes (EB) approach or the Potential for Pedestrian Improvement (PedPPI) method, are employed to systematically analyze and prioritize locations for safety improvements. These methods go beyond simply counting crashes, incorporating exposure measures and historical trends to identify the area's most in need of intervention. Advanced statistical models, like negative binomial regression or geographically weighted regression, take the analysis a step further by identifying the specific risk factors associated with pedestrian crashes. Variables such as roadway characteristics, traffic volumes, land use patterns, and socioeconomic factors are meticulously studied, revealing the intricate web of influences that contribute to pedestrian safety risks (Litman , 2017).

Yet, for all the power of data and statistical analysis, there is no substitute for the lived experiences of the community itself. Engaging with local residents through surveys, public meetings, or crowd sourcing platforms provides invaluable insights into perceived safety concerns and potential hot spots from the pedestrian's perspective. Their voices, often overlooked, become a vital component in the effort to create a truly pedestrian-friendly environment. Finally, on-site audits and assessments of pedestrian facilities and infrastructure offer a tangible, first-hand evaluation of potential risk factors. From inadequate lighting and

poor visibility to deficient pedestrian crossing facilities and a lack of pedestrian amenities, these audits leave no stone unturned in identifying the areas where pedestrians face the greatest challenges. By employing this multifaceted approach, cities can pinpoint the area's most in need of intervention and target resources effectively, ultimately creating a safer and more welcoming environment for pedestrians of all ages and abilities (Segni, 2015).

2.1.3.4.2. Evaluation of Pedestrian-Vehicle Conflict Areas

In the urban landscape, where pedestrians and vehicles coexist, conflict is an ever-present risk. Pedestrian-vehicle conflict areas are the battlegrounds where these two modes of transportation intersect, and the potential for collisions looms large. Evaluating and understanding these conflict zones is a critical step towards mitigating risks and ensuring the safety of all road users. One of the most powerful tools in this endeavor is conflict analysis and observation studies. Trained observers, armed with keen eyes and meticulous attention to detail, take to the streets, carefully documenting pedestrian and vehicle movements, near-misses, and evasive maneuvers. Every interaction, every close call, is meticulously recorded, providing a rich tapestry of data that can reveal patterns and potential conflict zones.

But it's not just about observing the present; understanding pedestrian crossing behavior is keying to predicting and preventing future conflicts. Detailed studies delve into the nuances of gap acceptance, pedestrian compliance with signals, and vehicle yielding behavior, uncovering the complex interplay of factors that contribute to conflicts between these two modes of transportation. In the realm of modern technology, simulation models offer a powerful tool for evaluating pedestrian-vehicle conflicts without the risks inherent in real-world observations. Microscopic simulation software allows researchers to model pedestrian and traffic interactions under various scenarios and conditions, providing a safe and controlled environment for testing potential countermeasures before implementation (Segni, 2013).

Surrogate safety measures, such as time-to-collision (TTC) or post-encroachment time (PET), provide a proactive approach to identifying potential conflict areas. By quantifying the severity of pedestrian-vehicle conflicts without relying solely on crash data, these measures offer a glimpse into the future, allowing for preemptive action to mitigate risks. And when all else fails, a comprehensive road safety audit can shed light on even the most elusive conflict areas. Multidisciplinary teams of experts conduct systematic evaluations of existing infrastructure, traffic operations, and user behavior, leaving no stone unturned in their quest

to identify deficiencies and recommend improvements. By employing these various methods, cities can gain a deep understanding of the specific locations and conditions that pose risks to pedestrians. Armed with this knowledge, targeted interventions can be developed, from improved pedestrian crossings and traffic calming measures to educational campaigns aimed at promoting safer behavior for all road users. In the ongoing battle for pedestrian safety, evaluating and addressing pedestrian-vehicle conflict areas is a crucial front line, one that demands vigilance, data-driven decision-making, and a unwavering commitment to creating a truly pedestrian-friendly environment(Lakshmi, 2016).

2.1.3.4.3. Traffic Exposure, Speed and Other Safety Determinants

In the realm of pedestrian safety, a multitude of factors converge to create a complex tapestry of risk and vulnerability. While infrastructure and conflict areas play a significant role, it is the broader determinants – traffic exposure, vehicle speeds, and a myriad of other influences – that truly shape the pedestrian experience and determine the likelihood of a safe journey. Consider, first, the impact of traffic exposure. In areas where pedestrian volumes and vehicle traffic converge, the risk of conflict and collision is amplified. Each step taken, every crossing attempted, becomes a delicate dance between vulnerability and vehicular might. Quantifying this exposure through pedestrian counts, traffic volumes, and crossing data is a crucial first step in understanding the true nature of the risk. Yet, even in the absence of high traffic volumes, the specter of vehicle speed looms large. A single moment of inattention, a split-second lapse in judgment, can have catastrophic consequences when combined with the kinetic energy of a vehicle traveling at excessive speeds. Higher speeds not only increase the risk of collisions but also the severity of injuries sustained by pedestrians, transforming what could have been a mere brush with danger into a life-altering tragedy (Peden et al., 2004).

Pedestrian visibility and conspicuity play a pivotal role in this equation, as the ability of drivers to detect and respond to pedestrians can mean the difference between a near-miss and a collision. Lighting conditions, weather, pedestrian clothing, and visual obstructions can all conspire to obscure the presence of those on foot, creating a dangerous disconnect between driver perception and reality. The very infrastructure intended to protect pedestrians can itself become a source of risk when roadway design and pedestrian facilities fall short of best practices. Inadequate sidewalks, poorly designed crosswalks, and intersections that prioritize vehicular flow over pedestrian safety create an environment that is inherently hostile to those on foot. And yet, for all the physical and environmental factors at play, it is the human element – the behaviors, decision-making processes, and actions of both pedestrians and

drivers – that can be the most unpredictable and potentially dangerous variable in the equation (Redi, 2015).

Addressing these multifaceted determinants of pedestrian safety requires a holistic approach that integrates infrastructure improvements, traffic management strategies, educational campaigns, and enforcement efforts. Only by acknowledging and mitigating the complex interplay of factors that influence pedestrian safety can cities truly create environments that are safe, welcoming, and conducive to active transportation and vibrant street life. It is a daunting task, but one that is essential for the well-being of our urban communities. For in a world where pedestrians and vehicles coexist, the pursuit of safety must be a never-ending journey, a commitment to continuously identifying and addressing the risks that threaten our most vulnerable road users.

2.1.3.5. Lack of pedestrian facilities and lack of perfect land-use planning

According to Zegeer(2012), pedestrian risk increases when roadway design and land-use planning fail to plan for and provide facilities such as sidewalks, or adequate consideration of pedestrian access at intersections. Additionally, infrastructure facilities and traffic control mechanisms that separate pedestrians from motor vehicles and enable pedestrians to cross roads safely are important mechanisms to ensure pedestrian safety, complementing vehicle speed and road system management. Beyond design elements of the roadway itself, the design and use of the broader land for commercial, industrial, recreational, transport, conservation, agricultural, or a mix of purposes, can contribute to the occurrence of pedestrian injuries and fatalities (Peden et al., 2004 and Elvik et.al., 2009). They also stated that the extent to which land-use planning provides facilities and services to ensure continuous, safe pedestrian access constitutes a major influence on pedestrian traffic risk. WHO stated that the land-use planning factors that affect pedestrian traffic risk include Population density (McLean , 1972), Land-use mix (Buehler , 2011, Dumbaugh and Li, 2011) and City structure (Mohan, 2008).

2.1.3.6. Pedestrian level of service (PLOS)

Level of Service (LOS) in transportation engineering is a term used which describes existing operating conditions (or suitability) for a mode of travel in a transportation system. Calculation of PLOS is more complex, which represents the operating condition of pedestrian facility and level of comfort pedestrians experience in using these facilities (Singh , 2011). PLoS models could also be used to support the development of pedestrian facility

improvements. Roadway designers can use the PLoS model to test alternative intersection designs by iteratively changing the independent variables to find the best combination of factors to achieve the desired LoS.

The most common approach for assessing the quality and serviceability of pedestrian facilities is the estimation of PLoS and its estimation helps in roadways design and prioritizes the needs for sidewalk retrofit on existing roadway (Singh , 2011). Assessing the walking conditions are the fundamental components to know how well roadways accommodate pedestrian travel or how they are pedestrian friendly or how safe is crossing the road (Singh , 2011). (Singh , 2011), confirmed that the estimated PLoS varies significantly depending on the selected method, as some take into consideration mainly qualitative parameters where others use only quantitative ones. However, the results obtained by pedestrian satisfaction rating were found very close to the results obtained by using the proposed methodology and for the construction of new sidewalks and maintenance of existing sidewalks, the estimation of PLoS is needed, for which there is no proper methodology.

2.1.3.6.1. Pedestrian level of service for sidewalks

Broad sidewalks can accommodate pedestrians of all abilities, whereas narrow sidewalks are insufficient to accommodate more passing pedestrians and they tend to step into roadway where they conflict with drivers or cyclists (Lakshmi, 2016). When pedestrians occupy the track of motorized vehicles as no separate grades are provided, such movement leads to traffic congestion as well as the safety factor of pedestrian is at risk. Increase the level of service by developing the quality of roads for vehicles is not possible due to heterogeneity of traffic (Jena, 2014) and inadequate width of sidewalks leads to sharing the limited space of the roads. The studies by (Lakshmi, 2016) on pedestrian safety at sidewalks shows that there is a great risk for pedestrian for sidewalks not maintained properly and encroached by vendors affecting pedestrians walking on roadway with safety issues.

Furthermore Lakshmi (2016), found that the pedestrian volume and flow characteristics significantly affect the service level at sidewalks and he concluded that pedestrian gender, age groups, and platoon size are the main factors for defining the safety-based service level at pedestrian facilities. Accordingly, he found that female pedestrians were more careful than male pedestrians and larger group sizes reduce the service level of bidirectional pedestrian flow and he have also identified that pedestrians with baggage, mobile usage, behavior and the bidirectional pedestrian flow affect the pedestrian level of service at pedestrian facilities.

2.1.3.6.2. Pedestrian level of service at crossings

The first attempt on LOS study was made by Lautso and Murole (1974), to find out the influence of environmental factors on pedestrian facilities. Their research was a milestone in pedestrian LOS research, and it was further expanded by later researchers to accommodate many important factors into the computation of pedestrian LOS. Sarkar (1993) proposed a qualitative method to compute pedestrian LOS based on six factors: safety, security, convenience and comfort, continuity, system coherence, and attractiveness. Qualitative attributes of pedestrian environments are described, but not quantified, in Sarkar's work. Since it is a qualitative method, the measurement of each factor is not easy in reality and also most of the factors are linked with each other. Later Khisty developed a quantitative method to determine the pedestrian LOS based on almost same criteria proposed by (Khisty, 1994). Although Khisty (1994), method provides a quantitative measure of pedestrian LOS on a point scale, the results from this scale is not easy to interpret. A fundamental question remains as whether these scaling systems really address the pedestrian facilities, i.e. do pedestrians agree with these scaling systems (Miller et al., 2000), and they proposed a scale method for pedestrian LOS assessment.

2.1.3.6.3. Factors affecting PLoS at Intersections

According to Muraleetharan et al., (2005), PLOS model for crosswalk provides a measure of a crosswalk's performance with respect to pedestrians' safety and comfort. Using the value of PLOS at crosswalk, roadway designers can determine how well a particular intersection accommodates pedestrian travel. PLOS measures can provide an easy understanding about the condition of a crosswalk. Such a measure would help in evaluating and prioritizing the needs for pedestrians on existing intersections. PLoS at crosswalk can be used to develop a minimum LoS standard, which could prescribe the minimum acceptable LoS for the adequate accommodation of pedestrians. Crosswalks at urban intersections should be targeted to maintain a minimum PLoS in order to provide a minimum level of accommodation for pedestrians.

According to Muraleetharan and Hagiwara (2005), it is important that the right factors should be included in the design process. They established the factors by referring previous research works. The factors such as space at corners, crossing facilities, turning vehicles, delay at signals, and pedestrian-bicycle interaction were identified as the factors affecting crosswalk PLoS. The space at corner includes both hold area and circulation area. (HCM, 2010) describes circulation area and temporary holding area as two main parts of pedestrian areas at

street corners. Circulation area is necessary for moving pedestrians, and hold area is necessary to accommodate waiting pedestrians. Based on this description, space at corner was classified into three levels as both circulation area and hold area are large enough to accommodate the people, only the hold area is wide enough to accommodate the people, and both areas are too small and not enough to accommodate the people. (Muraleetharan and Hagiwara, 2005), stated that using the value of overall PLoS, people can understand how well a particular street accommodates pedestrian travel.

2.1.3.7. Transport infrastructure

Alongside the design of the vehicle, inadequate road infrastructure design causes major structural barriers to the mobility of persons with disabilities. People with physical disabilities are deprived of access to bus stations because of the need to negotiate steps and stairs, due to lack of adequate seating and waiting areas, as well as their inability to use banking facilities in the streets for lack of appropriate space for the movement of wheelchairs (Uganda, 2016).

2.1.3.8. Problems of parking

According to (Kim, 2014), undesignated parking of vehicles along the road is the cause of congestion in the road. Undesignated parking hampers both pedestrians and other motorized vehicular movements and accessibility in general. Parking at road junction breaks the continuity of the pedestrian movements along the road making them use the carriageway and this too limits the free flow of vehicles.

Addis Ababa City Administration had formulated a strategy to develop parking lots throughout the city to solve the parking space shortages and the administration would construct parking facilities within a short period of time. However, due to unknown reasons, the city is still going without sufficient parking spaces. Parking places remain a serious problem adversely affecting drivers, pedestrians and the business community (Capital magazine in February, 2012). According to the city administration plan, the road from Meskel Square to Megenagna and from Meskel Square to Bole International Airport are priority areas that need immediate parking lots as there is a large concentration of vehicles in these areas that lack sufficient parking facilities compared to the traffic flow.

According to Capital magazine news in 2012, the city has planned to demolish selected residential houses located behind the two roads mentioned above to make them available for parking and green spaces. Although the idea is noble, it needs stakeholders' participation,

before commencement of implementation for effective and efficient utilization of the facilities that would involve huge costs. The existing parking service is inadequate and suffers from structural problems, mainly street parking. Consequently, lack of sufficient parking places has contributed to inefficient utilization of the road network, safety hazards and congestion problems. Thus, parking remains one of the critical issues that need to be urgently addressed through optimum transport planning of the city.

The number of paid parking places on Addis Ababa streets increased from 19 in 2003 to 72 in 2008, E.C. (2010/11-2015/16 G.C.) Management of parking spaces is left to registered parking operators' associations. Parking related jobs increased from 207 in 2003 E.C (2010/11 G.C.) to 1,244 in 2008 E.C. (2015/16 G.C.) In addition to this, the yearly revenue generated from the service increased from Birr 2.1 million to Birr 8.3 million during that period. However, on-street parking has resulted in negative impact on efficient utilization of road network capacity, contributing to congestion. Thus, the practice needs modernization in respect of providing appropriate parking spaces, fare charges and collection, avoiding congestion. (Website: <http://www.addisababaonline.com/parking>).

Addis Ababa city is located at the center of the country and is among the most important commercial city with a highly concentrated population in Ethiopia. Recently, study shows that the morphology (form) of the city has changed very rapidly beyond the ability of the city administration to recover its original status. For example, the constructions of different activities attract more people with a private vehicle who often visit the areas for leisure, employment and other services. On the contrary, parking space is not enough to accommodate the number of clients visiting the areas. Parking challenges occurring in Capital city will continue to be the major problem due poor parking policies, poor planning of the city, population growth, increase of car to mention in a few (Bundara, 2010).

- 1. Rapid Urbanization:** The population in Addis Ababa has been changing very rapidly at a rate of 2.1% per year (Central Statistical Agency, 2010). For example, according to the Addis Ababa Transport Branch Office 2003 – 2007 E.C. (2010/11 - 2014/2015 G.C.), the strategic plan shows that, human settlement and population in Addis Ababa would be 4.5 million in 2012 E.C. (2019/2020). This increase does not correspond to the capacity of the Municipality for providing a reliable service such as parking facilities which has a tendency to reduce the traffic congestion and smoothen the travel time in the city. The increase in population also will continue to exert

pressure on parking spaces and other social and economic services unless deliberate efforts are made to address the problems, particularly in the cases of poor parking facilities, management and policy development.

The urban growth in terms of population increase and the spatial expansion of the urban centers which come along with both increasing car ownership and demand for movement for employment purpose, leisure, education and other urban activities (Osoba, 2012). Subsequently, some cities cannot cope with the explosive growth in the number of people due to urban activities especially at the urban centers. The situation is getting worse with the growing number of visitors and patrons due to urban revitalization, suburban development, and the increasing trend of mobility which make parking situation more challenging. Therefore, parking is increasingly giving attention as an important aspect of transportation planning (Jeffrey, 2007).

2. **Increased number of Cars:** According to the data from the Federal Transport Authority, 2016, out of the total number of vehicles in the country about 70% is estimated to be concentrated in Addis Ababa. With continuous growth in the number of vehicles, the demand for parking space is increasing year by year. At present, the growth of economy has led to growth in the number of vehicles in Ethiopia in general and in Addis Ababa in particular (Table 2.1. below shows increased number of vehicles from 2004 E.C to 2008 E.C. (2011/12 to 2015/16 G.C.)
3. **Inadequacy of parking spaces:** Roadside and illegal parking are common phenomenon in Addis Ababa especially in the central business district (CBD), this is due to the limited spaces for parking. As stated by Kiunsi (2011), the on-street parking narrows the road, causes unnecessary congestion and accidents. Shoup (2005b) conducted a study in 11 international cities. The study found that on averages 30% of traffic is cruising looking for parking spaces with the average search time being 8.1 minutes. A research organized by the RAC Foundation (2004) found that 48% of respondents acknowledged that they park illegally. Residential areas in parts of many cities are overwhelmed with parking cars (Balcombe and York, 1993) that there are no informal safe crossing points for children.

Parking policy should not be developed in isolation but as part of local and regional spatial and transportation planning processes (Marsden and May, 2005). Double parking along street narrow roads caused traffic congestion. This is due to the non-availability of off-street parking facilities along the transportation routes coupled with inadequate traffic management (Asiyanbola and Akinpelu, 2012).

4. **Demand for right of way:** Streets in Addis Ababa are used in different ways but mostly for movements / mobility (cars, passenger vehicles, pedestrians and motorcyclists), exchange (social interaction and street vending) and storage (parking). Many streets in the CBD (central business district) area, does not freely allow right of way to accommodate all the functions. It is clear that spaces dedicated to parking are unavailable to get service from different shops and offices.
5. **Pedestrian safety and comfort:** On some streets, illegal parking in the CBD hinders the movements of vehicles and walkway which is important for pedestrian comfort and safety. Poor parking on the walkway on pedestrian crossings forces pedestrians into the roadway and affects visibility. This does not attract people to use non-motorized facilities to travel in the city of Addis Ababa.
6. **Traffic Congestion:** The Addis Ababa city street network has a finite capacity, poor parking planning and the inadequacy of the policy developed to coordinate the decision on roadway capacity. If no new roadway capacity is planned in the CBD, it will be ultimately futile to the construction of more parking facilities for all daily commuters to the CBD. This lack of parking facilities would only add to existing congestion and undermine the ridership.

2.1.3.9. Commercial Activities

The encroachment of commercial activities for instance on-street sellers and commercial goods arranged or displayed along the shops fronts' narrows down the space for pedestrians. The impacts of these are seen when pedestrians use the limited space hence congestion and they spill over to the carriageway. Others avoid using the road section which causes them use more time walking to their desired destination. In addition, these commercial activities are not provided with loading and unloading zones; hence, when undertaking this activity, the vehicles are parked on the road which prevents smooth vehicular flow while the goods on the other side blocks the pedestrian movements slowing down other activities along the road (Kim, 2014). Most street vending occupies busy streets, pavements or other public spaces; these activities are often considered to be illegal. This status makes traders victims of harassment and threats from police and other government authorities (Solomon et al., 2009).

2.1.3.10. Inadequate enforcement of laws

The multi-disciplinary nature of road safety requires that there is strong collaboration across many boundaries of responsibility, both within local authorities and with outside organizations. Each of the professional disciplines involved in engineering, education and

enforcement should work together. The prime responsibility for promoting co-operation rests with the local highway authority, to establish organizational arrangements and to ensure co-ordination between the various services involved in the road safety strategy. Internally, this involves accident investigation, road safety engineering and road safety education staff. Externally, it involves with local education authorities, teachers and the police and voluntary workers have an important part to play (Teklu, 2012).

2.1.3.11. Walking speeds and Distance

(Autumn, 2013), studied that the ability for pedestrians to select their own walking paces and speeds is a qualitative measure of convenience. Accordingly, he found that the walking time and walking speed are the main factors that influence the distance that pedestrians can comfortably travel. Autumn (2013), also found that pedestrian speeds and pace vary according to the time of day and the trip purpose and he summarized that the morning rush hour is the fastest time of the day in terms of pedestrian speed and people walk progressively slower as the day wears on; however, the evening rush hour is also fast, but more sociable. (Autumn, 2013), also proved that crowding has an adverse effect on the ability of a pedestrian to choose their own locomotion speed “As volume and density increase, pedestrian speed declines. As density increases and pedestrian space decreases, the degree of mobility afforded to the individual pedestrian declines, as does the average speed of the pedestrian stream.”

2.1.3.12. Countermeasures to Improve Pedestrian Safety

There exists a long and growing list of pedestrian fatality and injury countermeasures. This section will show some major examples of proven and emerging practices. A study published in the American Journal of Public Health found that one of the general engineering principles for better protecting pedestrians involves separation of pedestrians from vehicles through space and time (Retting, R.A., Ferguson, S.A., & McCartt, Anne T, 2003). Countermeasures that separate pedestrians from vehicles, through space or time, or provide other engineering/traffic control safety benefits to pedestrians.

Engineering countermeasures for pedestrians can be classified into broad categories; separation of pedestrians from vehicles through space or time, reducing or eliminating concurrent movements of vehicles and people, reducing crossing distances, increasing the visibility of pedestrians including through better lighting, alerting drivers to the location of crosswalks and reducing vehicle speeds. If a countermeasure can address one of these key

areas it will have good chance of playing a positive role in pedestrian safety (Canadian Council of Motor Transport Administrators (CCMTA, 2013). At the same time, other measures also exist to support pedestrian safety and these can perform this role in many different ways. One example is through the use of measures that provide good access to safe crossings like the simple use of curb cuts and tactile markings for people who use wheelchairs and people who are visually impaired [Ibid.].

2.1.3.12.1. Crosswalk Design

Crosswalk design is a critical component of pedestrian safety. One of the primary goals of crosswalk design is to provide safe places for pedestrians to cross while enabling drivers and pedestrians to make safer decisions while minimizing the likelihood of a crash. Crosswalks are also used by forward-thinking jurisdictions to signal greater priority to pedestrian travel. The design of a crosswalk should consider all possible users and take an inclusionary approach. Curb cuts make crosswalks accessible to pedestrians using wheelchairs, scooters, strollers and other walking devices. Furthermore, the alignment of curb cuts with crosswalks enables the pedestrian to face the crosswalk, which is an important signal to approaching drivers [Ibid.].

2.1.3.12.2. Intersection Channelization

Intersection channelization is the use of raised islands located in an intersection to obstruct specific traffic movements and physically direct traffic through an intersection. A literature stated that intersection channelization can improve pedestrian crossing safety by reducing crossing distances and providing refuge areas. As a result, it may reduce vehicle pedestrian conflict (Canadian Council of Motor Transport Administrators (CCMTA), 2013).

2.1.3.12.3. Raised Median

A raised median through an intersection is an elevated median located on the centerline of a two-way roadway through an intersection. The purpose of a raised median through an intersection is to obstruct motor vehicle short-cutting and reduce the crossing distance for pedestrians. It can create a refuge for pedestrians, enabling them to cross one direction of travel at a time, thereby reducing waiting times for gaps when crossing the roadway.

2.1.3.12.4. Sidewalk Design

As defined by the Geometric Design Guide for Canadian Roads, a sidewalk is “a travelled way intended for pedestrian use, following an alignment generally parallel to that of the adjacent roadway” [29]. Sidewalks provide pedestrians with a means of travelling within the

public right-of-way but separate from vehicles on the road. Research has shown that separating pedestrians from the roadway reduces pedestrian trauma from motor vehicles. Generally, the further that sidewalks are separated from the roadway the better the safety benefits for pedestrians. The US DoT, in their Toolbox of Countermeasures, for pedestrian crashes, has recognized the safety benefits of sidewalks and concluded they provide an 88 percent reduction in pedestrian collisions (U.S. Department of Transportation Federal Highway Administration: FHWA-SA-014, 2008). A US cross-sectional study of urban streets with and without sidewalks found that pedestrian collisions were more than two times as likely to occur at locations without sidewalks based on equal exposure (Knoblauch et al., 1987).

The width of a sidewalk depends on the volume and type of road users. Since pedestrians may desire opportunities to pass stopped or slower moving pedestrians and sometimes walk in pairs, it is desirable to have a clear sidewalk width of 1.8 m; however 1.5 m is the minimum design width. Each additional lane of pedestrian travel requires a minimum of approximately 0.7 m of clear sidewalk width (Transportation Association of Canada, 1999). This width is free from any obstructions such as lighting poles, fire hydrants, traffic signs, etc.

In commercial areas where there is a higher volume of pedestrians, sidewalk widths are usually 2.4m. At bus stops, there should be sufficient space to accommodate waiting passengers and also those pedestrians wanting to walk past. This is typically 3.0 m of width [Ibid.]. A special consideration should be given to areas where there are hospitals and assisted care homes, as persons who use wheelchairs need a wider sidewalk. Persons who use wheelchairs need about 1.2 m of clear sidewalk width for unimpeded travel; therefore, typically 2.0 m is used for the full sidewalk width [Ibid.].

2.1.3.13. Attitudes and level of Satisfaction of pedestrian

Essentially, researchers have developed three approaches to assessing pedestrian level of service. The first method takes into account pedestrian traffic and sidewalk geometry. The second type is based on the road environment's quality. The final method considers both traffic flow operations and road physical characteristic. The assessing parameters for pedestrian level of service are pedestrian flow operation, sidewalk geometry, space occupancy, and sidewalk capacity. As a result, these methods continue to ignore pedestrians. (Dandan et al., 2007) created a method for calculating pedestrian LOS based on pedestrian

perceptions. The respondents were divided into three groups based on their age, gender, and walking ability. After that, a questionnaire survey was carried out. We used a stepwise regression model to make a model. The model included a number of variables, including bicycle volume and pedestrian volume, vehicle volume, driveway access per meter, and sidewalk distance to car lanes, Rahaman et al. (2005) attempted to investigate the qualitative level of pedestrian comfort in Dhaka by providing six broad categories of roadside walking environments in terms of safety, security, and convenience and comfort, walkway continuity, system coherence, and attractiveness by some specialized services. Some qualitative data had been gathered through an observation survey whereas the responses of the walker were recorded using a questionnaire survey.

In modern world, the quality of life and well-beingness has been increased from time to time; the paradigm of the transportation sector has been changing from a car-oriented transportation system to an eco-friendly, pedestrian- or people-oriented urban space by keeping the availability of walking facility as it is. Walking is the most basic means of transportation for humans and is the basis of all activities such as commuting, going to school, work, and leisure. In terms of transportation, walking itself is also a form of travel, and it serves as a link between various transportation modes such as buses and subways. In addition, many studies claim that walking provides various functions other than transportation modes. For instance, Oh and Seo (Oh & Seo, 2015)] have found that the concept of walking in urban design has expanded continuously with the times from the primary means of transportation.

At microscopic level, the perspective of understanding walking has been expanded as a means of experience and recognition of urban space, a means of leisure, performing social functions, and a monitoring function of public (Oh & Seo, 2015). It also emphasizes the Eco friendliness of walking because it relies on human power and has little impact on the environment. It contributes to revitalizing the economy of a city or community, promotes social exchange and local economic activities, and connects different transport activity.

Sarkar (2003) presented some theoretical guidelines for qualitatively assessing the levels of comfort provided along walkways in major activity centers. The method was created by combining environmental psychology, landscape architecture, and urban planning. The method included two separate evaluations: service level, which provides standards for overall desirable and undesirable comfort conditions at the macro level, and comfort level, which

provides standards for overall desirable and undesirable comfort conditions at the micro level. The quality level examines the finer details of pedestrian comfort at the micro level. Physical, physiological, and psychological comfort were used to determine the service level and quality level. The requirements for comfort varied depending on cultural and geological factors. Based on the pedestrian-oriented policy paradigm shift, research to evaluate and analyze pedestrian satisfaction has actively been conducting. According to Ji and Gu(2011), the factors of the walking environment that affect pedestrian satisfaction are identified as safety, security, scenery, comfort, and convenience.

A case study investigating the pedestrian satisfaction of traditional markets in Korea classified the influential factors into safety, comfort, convenience, and interest (Chung, 2012). Besides safety, convenience, and comfort, other studies suggested street environments for instance, air quality, noise, natural shade ,planting, or street continuity and visibility as evaluation or design elements (Chung, 2012). This study categorizes factors affecting pedestrian satisfaction into safety, convenience, security and comfort to examine differences in satisfaction by land use and street type. Safety is the presence of sidewalks associated with illegal parking, perceived safety level from traffic accidents, illegally placed objects and vehicle travel speed(Chung, 2012, Khisty, 1994 and Sahani & Bhuyan, 2020). Convenience is another requirement of pedestrian facility which implies sufficiency of pedestrian guidance facilities, sidewalk material (pavement condition), sidewalk slope, easiness to access public transportation facilities, (Chung, 2012, Campisi et al., 2021 and Oh & Seo, 2015). Comfort: is the critical requirement of pedestrian facility that must bring for pedestrian, in terms of pedestrian volume, the sufficiency of green space, cleanliness, noise level(Chung, 2012).

Using trip quality as a basis, Jaskiewicz (2000) suggested a method for evaluating pedestrian level of service. Measurements of the pleasantness, safety, and functionality of nine different pedestrian system evaluations were made. The nine metrics are: enclosure/definition, complexity of path networks, building articulations, intricate space design, transparency, buffers, shading, trees, overhangs/awnings/various roof lines, and physical elements/conditions. These precautions were each developed based on a combination of safety concerns, volume and capacity considerations, and qualitative design elements. The study's findings showed that pedestrian level of service along with more conventional variables like volume and capacity, appraisal should take into account some qualitative aspects of the road environment. In addition to volume and capacity considerations, it is

crucial to pay more attention to pedestrian comfort and safety in order to make walking a more appealing means of transportation.

Inside the SARTRE-4 European survey on road users' attitudes, perceptions and behavior, a dedicated questionnaire was addressed to pedestrians from nineteen countries. The statistical analysis that followed (Papadimitriou, 2013) discovered seven elements of pedestrian attitudes and behavior (formed on the basis of fifty four form elements), namely: satisfaction with pedestrian environment, attitudes towards penalties, attitudes towards electronic in-vehicle devices, attitudes towards speed limitations and surveillance, pedestrian behavior and distraction, attitudes towards pedestrian safety design, annoyance with alternative road users and lack of accessibility. Moreover, pedestrians were clustered in 3 groups: positive attitudes and positive behavior, negative attitudes and negative behavior, and mixed attitudes and positive behavior, with vital variation over gender, age groups and countries. Although, the study has not considered all type of socio-demographic characteristics and physical distraction elements of pedestrian walkway are not included that may not be the objective.

(Granié, 2013) developed and tested a form for the self-reporting behavior of pedestrians. Out of forty-seven components tested, twenty were found to be most vital for assessing pedestrian behavior, inside four elements, namely: "transgression", "lapses", "aggressive behavior" and "positive behavior" "conditions or facility design factors.

The physical condition of the elements as walking environments and how pleased individuals are with their walking experiences when using them are two factors that contribute to pedestrian happiness (Sahani and Bhuyan, 2020). Using such physical criteria or facility design factors, multiple studies have assessed the walkability of various cities throughout the world (Bernhoft & Carstensen, 2008).

Walkability, according to Blečić et al., (2020), assesses how well-suited an urban setting is to incorporate pedestrian walkways or features that by nature make walking practical, secure, pleasant, and desirable, which is characterized by geographical and socioeconomic inequality, demonstrates the necessity of include walkability as a vital component. Walking enhances urban accessibility and travel equity because it is socially equitable, or available to most people without hindrance.

According to Distefano et al., (2021), elderly or handicapped persons prioritize certain elements of walking environments according to their physical capabilities. The authors suggest a new walkability measure based on thermal comfort. Having a quick journey time, a

barrier-free environment that can be navigated on foot, safety, pedestrian infrastructure, and upmarket and pleasant strolling settings are some other definitions offered by Forsyth and Southworth for walkability.

The presence and continuity of sidewalks, accessibility of facilities to people with different abilities, directness of pedestrian paths, connections to frequent transit services, ease and safety of crossings, visual interest, and perceived or actual walkability are just a few of the aspects of walkability that share commonalities across the literature (Sahani & Bhuyan, 2020). On the other hand, some research (Blec̃ić et al., 2020) concentrated on the satisfaction that is the perceived degree of service to the criteria of walkability.

Kim et al., (2014) estimated the effects of environmental factors on the level of satisfaction of utilitarian and recreational walkers, in Seoul, Korea. However, the pedestrian survey includes only one question addressing overall pedestrian satisfaction. In order to sufficiently examine pedestrian satisfaction, various aspects of satisfaction, for example, comfort, safety, ease and aesthetics of walking should be determined. The results call on researchers to investigate a comprehensive set of psychological and environmental factors, in order to understand the various aspects of pedestrian satisfaction. (Kim et al., 2014) measured the pedestrian level of service within roadside walking environments and investigated major factors affecting the pedestrian level of service by conducting a pedestrian intercept survey. The model developed in the paper has a limitation that it is only applicable to the assessment of the pedestrian LOSs at low pedestrian volumes.

(S. Marisamynathan & P., 2019) have examined pedestrian perception-based level of service at signalized intersections crosswalk in India. This study has identified several factors which significantly affect pedestrians' perception of safety, convenience, and efficiency while crossing signalized intersections. (Mateo & Babiano, 2016) have also examined pedestrians' needs for walking environment in Manila, Philippines via face-to-face questionnaire survey and analyzed using Analytic Hierarchy Process (AHP). Based on the survey, the most important priority needs hierarchy for pedestrians is protection, ease, equitable access, mobility, identity, and enjoyment. (Hidayat et al., 2011) presented an alternative model for evaluating the pedestrian level of service at the sidewalk with street vendor activities in Bangkok and Jakarta. Factor analysis is used to summarize pedestrian perceptions into several important variables. Regression models were estimated with pedestrian traffic data to find the level of service. These studies show that pedestrian flow volume and behaviors are

influenced by the accessibility to public transportation, land-use patterns and walking environments (e.g., road width, obstacles, and crosswalk). Some other studies are interested in pedestrian's level of service and safety (Lee, 2012). Workability is one of the popular issues in health and welfare which estimates pedestrian's mental condition affected by walking conditions of pedestrian facilities and amenities.

The efficacy of current studies to capture all facets of a facility evaluation process has been a source of worry for a number of review papers and reports. The sidewalk environment, pedestrian characteristics, and flow characteristics are three components that Bloomberg and Burden (2006) have described. The sidewalk environment component is related to the actual, constructed walking environment, the pedestrian characteristics are related to the specific socioeconomic data, behavior, physical capability, and their expectation (users' perception), and the flow characteristics are related to the specifics of the pedestrian and vehicular traffic flow. Given the three main constructs and how they relate to one another was closely adapted from Bloomberg and Burden (2006). The appraisal of amenities has not, according to Singh and Jain (2011), been inclusive in terms of the complete "walking environment."

2.2. Empirical Review

The environment for pedestrians often presents the first hurdle / obstruction to take a trip. The combination of design and construction practices, defective or inadequate, and the adequacy of facilities management, and natural features of the terrain, the absence of sidewalks and paved adequately maintain sidewalks limited of mobility of people with various disabilities (AASHTO, 2004). Uneven surfaces, garbage dump which lead to increased vulnerability to infection and on street illegal business activities force people to use the main road. Kerbs are often difficult to negotiate for people with mobility devices. Pedestrians of every age travel erratically, deciding to walk on pavements they feel comfortable on or attracted by. When they do not feel at ease, they detour from the current route towards a more comfortable one.

(Litman T., 2017) Stated that an improved pedestrian safety and a safer walk able environment will help the community in improving the accessibility for drivers and thus the cost of transportation will sharply reduce. (Litman T., 2017) further stated that the parking efficiency in the area would be greatly enhanced and improvement in aesthetics, reduction in land needed for road construction and reduce the level of pollution.

(Segni G. T., 2015) stated that most of the time, everywhere in Ethiopia, pedestrians walk along the roadway and cross roads illegally because the road is fully or partially access

controlled. For instance, pedestrians use the same roadway space in many places in the country and they walk shoulder to shoulder with motorized traffic in most parts of Addis Ababa, particularly in areas such as; Merkato, Shiromeda, Kasanchis, Megenagna, Mexico, Saris, Kera, Arat Kilo, Ayertena, etc. (Segni G. T., 2015) were also identified that the roads in these areas are either narrow without provision of footpaths or insufficient footpath capacity compared to the demand of pedestrians. (WHO, 2013a), confirmed that about 84% of the road network in developing countries, including Ethiopia, are constructed without pedestrian footpaths.

Rastogi et al., (2014) presented the level of service criteria under two conditions, one for pedestrian movements along the carriageway on or at its side and other for the movement on a pedestrian facility. The level of service criteria was developed using two different approaches and the two data sets. One approach is based on the rate of change of curvature of the pedestrian flow-area module curve and another is based on speed ratio-density plot. It is observed that the pedestrian space criterion is more uniform and stable than the pedestrian flow criterion in defining the level of service of a facility (R. Rastogi, S. Chandra, & M. Mohan, 2014).

B. R. Kadali& P. Vedagiri, (2015) suggested evaluating the level of service provided by such crossing facilities in relation to various land use types when there is mixed traffic. Data on pedestrian perceptions of line of sight (LOS) were gathered for various land uses, including commercial, residential, and retail. The NLOGIT software package was used to construct the ordered probit (OP) model, with the number of cars encountered, the difficulty of the road crossing, and safety being the three main considerations elements including land-use type, roadway layout, and pedestrian-specific variables like gender and age (B. R. Kadali& P. Vedagiri, 2015)

2.2.1. Factors Influencing Pedestrian Mobility and Accessibility

2.2.1.1. Physical Barriers and Obstructions to Pedestrian flow

Imagine a bustling city street, where pedestrians of all ages and abilities navigate the urban landscape. However, their journey is often hindered by a multitude of physical barriers and obstructions that disrupt the flow of pedestrian movement. One of the most significant challenges is the lack of continuous and well-maintained sidewalks. Uneven surfaces, cracked pavement, and narrow pathways can pose a tripping hazard, especially for those using mobility aids or pushing strollers. Additionally, the absence of pedestrian crossings or

poorly designed crosswalks forces pedestrians to navigate busy intersections with little regard for their safety. Traffic-related barriers further exacerbate the situation. High-volume and high-speed vehicular traffic creates an intimidating and dangerous environment for pedestrians. The lack of adequate buffer zones between pedestrians and vehicles heightens the sense of vulnerability, deterring many from choosing to walk (Zegeer C V., 2012).

Environmental barriers, such as steep slopes or changes in elevation without ramps or alternative routes, can make certain areas virtually inaccessible for individuals with mobility impairments. Inadequate lighting or visibility issues at night can also discourage pedestrian activity due to safety concerns. Temporary obstructions, such as construction sites, parked vehicles blocking sidewalks, or accumulated litter and debris, present unexpected obstacles that force pedestrians to navigate around them, often into the path of vehicular traffic. These obstructions can be particularly challenging for those with visual impairments or mobility limitations. Land use patterns and urban form can also create barriers to pedestrian flow. Fragmented land use patterns with large blocks and limited pedestrian permeability discourage walking by creating circuitous routes and increasing travel distances. The prevalence of pedestrian-unfriendly land uses, such as industrial areas or large parking lots, further contributes to an uninviting and hostile environment for pedestrians. Overcoming these physical barriers and obstructions requires a concerted effort from urban planners, policymakers, and community stakeholders. Investing in infrastructure improvements, enforcing regulations, and promoting pedestrian-friendly design can create a more accessible and inclusive urban environment for all (Redi, K., 2015).

2.2.1.2. Connectivity, Directness and Integration of Pedestrian Networks

Imagine a city where pedestrian networks are seamlessly woven into the urban fabric, providing efficient and convenient routes for residents to navigate their daily lives on foot. This vision of a well-connected and integrated pedestrian network is crucial for promoting pedestrian mobility and accessibility. At the heart of this concept is the idea of connectivity – the degree, to which pedestrian pathways are interconnected, allowing for multiple route choices and minimizing detours. Frequent intersections and pedestrian cut-through create a web of pedestrian routes that cater to the diverse needs and destinations of the community. Equally important is the directness of these routes. Pedestrians value efficiency and convenience, and routes that provide the most direct path between origins and destinations

are more likely to be utilized. Unnecessary detours or circuitous routes not only increase travel times but can also discourage pedestrian activity altogether (Jena, 2014).

Integrating pedestrian networks with other transportation modes is also crucial for promoting multi-modal mobility. Seamless connections between pedestrian facilities, public transit stations, and cycling infrastructure allow for seamless transitions between modes, reducing the need for private vehicle ownership and promoting sustainable transportation choices. Beyond connectivity and directness, the integration of pedestrian networks with the surrounding urban fabric is essential. Pedestrian routes should permeate through different land uses and neighborhoods, creating a sense of permeability and accessibility. This integration fosters a pedestrian-friendly environment where walking is not only a practical choice but also a pleasurable experience. A hierarchical structure within the pedestrian network can further enhance its functionality. Local neighborhood pathways, major pedestrian corridors, and regional trails can be differentiated based on their intended function and user volumes, creating a logical and intuitive system for pedestrians to navigate (Segni G. T., 2015).

Finally, the incorporation of clear way finding and legibility elements ensures that pedestrians can easily orient themselves and navigate the network. Signage, landmarks, and visual cues aid in way finding, reducing confusion and enhancing the overall user experience. By prioritizing connectivity, directness, and integration in the design and development of pedestrian networks, cities can create environments that encourage walking, promote sustainable transportation, and foster a sense of community and belonging among residents.

2.2.1.3. Accessibility for Special Needs Populations (Disabled, Elderly, Children)

In a truly inclusive and equitable city, pedestrian mobility and accessibility are not luxuries reserved for a select few but a fundamental right for all residents, regardless of their age, ability, or circumstance. Consider the challenges faced by individuals with disabilities as they navigate the urban landscape. Simple tasks like crossing the street or entering a building can become daunting obstacles when pedestrian infrastructure lacks accessibility features. The provision of ramps, tactile paving, and curb cuts can mean the difference between independence and isolation for those using wheelchairs or those with visual impairments. Ensuring adequate crossing times and refuges at intersections are also crucial for accommodating slower walking speeds and mobility limitations. Integrating audible and

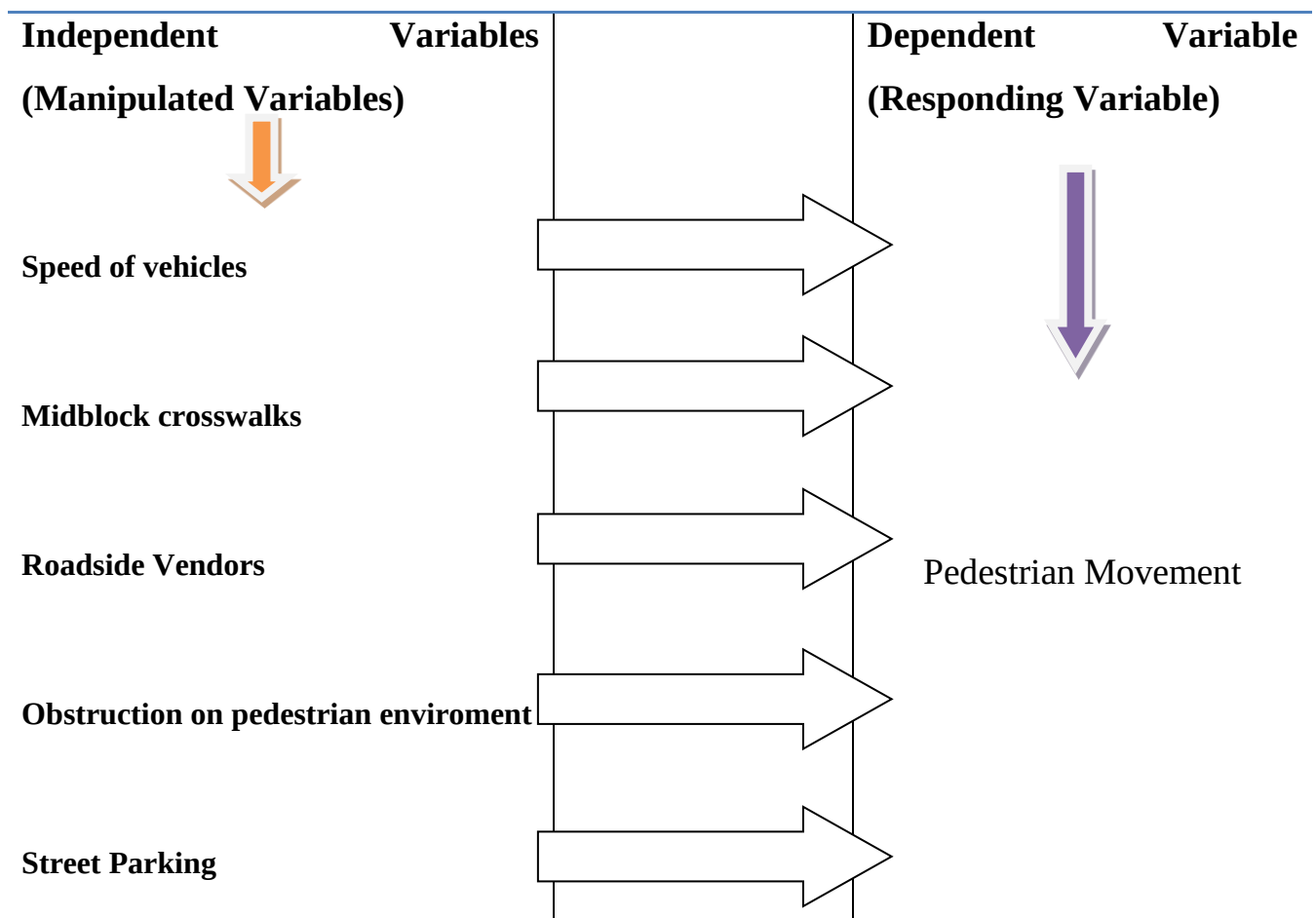
tactile cues for navigation and way finding can further empower these individuals to navigate their environment with confidence and ease (Kim, 2014).

For the elderly population, the challenges of pedestrian mobility and accessibility may be more subtle but no less significant. Well-maintained and level surfaces free of trip hazards can prevent falls and injuries, while adequate seating and resting areas along pedestrian routes can provide much-needed respite for those with limited endurance. Prioritizing pedestrian safety and traffic calming measures in areas with high elderly populations can also contribute to a sense of security and encourage more active lifestyles among this vulnerable group. Children and families represent another special needs population with unique requirements for pedestrian accessibility. Safe and accessible routes to schools, parks, and other destinations frequented by children are paramount. Traffic calming measures and pedestrian safety features in residential areas and near schools can provide parents with peace of mind, promoting healthy and active lifestyles for their children.

Incorporating age-appropriate signage, way finding, and educational resources can also foster a sense of independence and confidence among young pedestrians, empowering them to navigate their communities safely and responsibly. Ultimately, addressing the needs of these special populations requires the adoption of universal design principles that accommodate the widest range of abilities and ages. By integrating inclusive design features that benefit all pedestrians, cities can create truly accessible and equitable environments. Collaboration with disability advocacy groups, community organizations, and active involvement of these special needs populations in the planning and design process is essential. Through education, awareness, and a commitment to inclusivity, cities can break down barriers and foster a culture of pedestrian mobility and accessibility for all (Redi, 2015).

2.3. Conceptual Framework of the study

A conceptual frame was constructed based on the research objectives & research questions. It indicated the relationships between independent & dependent variables & these variables determine the pedestrian movement. Speed of vehicles, midblock crosswalks, Roadside Vendors, Obstruction on pedestrian environment & Street Parking were considered as independent variables whereas pedestrian movement was dependent variable.



Source: Constructed & Developed by the Researcher of this paper, (2024).

CHAPTER THREE

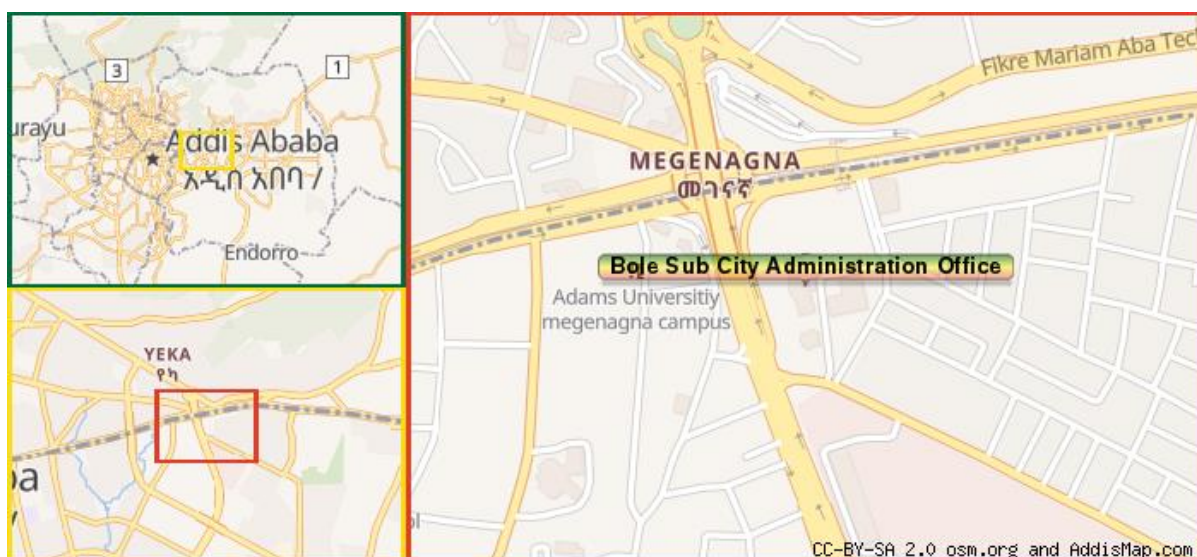
RESEARCH METHODOLOGY

3. Introduction

Research methodology was a way to systematically solve the research problem. It might be understood as a science of studying how research was done scientifically and included various steps that were generally adopted by a researcher in studying his research problem along with the logic behind them (Kothari, 2004). This chapter discussed how to do the study with appropriate methods, which comprised the research technique, method, sampling design, sources of data, how to gather data from the target population, investigate and present the analyzed data, so that enabled the researcher to address the research objectives.

3.1. Description of the study Area

This study was focused on the assessment of the major problems of pedestrian movement in Addis Ababa: The case of Bole sub-city and limited only on Bole sub-city. Bole Sub-City was one of the eleven Sub-Cities of Addis Ababa, the capital of Ethiopia with a total population of 328,900 of which 161,458 are male and 167,442 female. The Sub-city covered a total of 122.08 Km² (CSA, 2007) and consisted 11 Woredas. The district was located in the south-eastern suburb of the city. It borders with the districts of Yeka, Kirkos, Nifas Silk-Lafto and AkakyKaliti. Taking all the above facts about the city and study area in to consideration, the researcher was interested to contribute her share for the city's growth by conducting research. The sub-city was responsible for the administrative and political activities.



Source: Ethio-GIS, 2014.

3.2. Features of selected Area

The selected area in this study is Goro area (street) &Megenagnaarea (street). Each area has its own distinct features such as land use and pedestrian walking type. For more detail, it is shown in table below as follows.

Table 3. 1: Features of selected area

Area/Location	Street Name	Land Use	Side Walk	Street Market
GORO	Goro Street	Commercial	Not Separated	Yes
MEGENAGNA	Megenagna Street	Commercial	Not Separated	Yes



Figure 3. 1: Goro Walkway indicator



Figure 3. 2: Megenagna Walkway Indicator.

3.3. Research Design

This paper followed the descriptive research design by using cross sectional survey strategy. The reason why this study selected descriptive type of research design was to identify and clearly describe the Major Challenges of Pedestrian Movement in Addis Ababa: The Case of Bole Sub-City. The choice of cross sectional design was allowed researcher to collect data from participants in more economical way (Mugenda, 2003).

3.4. Research Approach

The methodology conducted in this study was statistical analysis; the data were used to show the present pedestrian level of services of the road segments in Bole sub-city, Addis Ababa. A research instrument for this study was designed for quantitative methods. Besides, it tested and quantified data from the questionnaires brought the research questions and literatures review together. Moreover, this study was employed survey research strategy & consequently it was employed quantitative research approach to deal with sample of population to study its characteristics.

3.5. Sampling technique and procedure

3.5.1. Target Population

According to Amin (2005), a target population was the population to which the researcher ultimately wanted to generalize the results. The research was covered pedestrian users such as

pedestrian road movement on the selected segments with the number of people with disabilities needs special built up environment.

3.5.2. Sampling Technique

The sampling technique that employed for this study was non-probability sampling since the respondents didn't have an equal chance of being selected. In this regard, some literatures also reinforced the reason and advantages of purposive sampling, in such a way that “purposive sampling was a useful sampling method which allowed a researcher to get information from a sample of the population that one thinks knows most about the subject matter,” (Walliman, 2005). Thus, the method of sampling was based on the areas where pedestrian movement was reasonably complicated. These are the market area, commercial area, education area and residential area roadway segments in Bole sub-city. To use this technique researcher was selected cases that researcher thinks that was best achieve research objectives of the study (Saunders, Lewis & Thornhill, 2009).

3.5.3. Sample Size

Sample size is a representative sample of the target population & the sample size for this study is determined by using the formula developed by (Cochran, 1963, p. 75) & Israel, 1992). The sample size is affected by variability of population, degree of precision and population size. The sample size required for questionnaire should have always greater than direct field data because the reliability and accuracy is lower than observational and field measurement data. Sample size from the respondents is calculated as follows:

$$N_0 = Z_{\alpha/2}^2 * p * (1-p) / MOE^2$$

$$N_0 = (1.96)^2 (0.5) (0.5) / (0.05)^2$$

$$N_0 = 3.8416 * 0.25 / 0.0025$$

$$N_0 = 0.9604 / 0.0025$$

$$N_0 = 384.16$$

$$N_0 = 384$$

$Z_{\alpha/2}$ is the critical value of the Normal distribution at $\alpha/2$ (for a confidence level of 95%, α is 0.05 and the critical value is 1.96) when the population is large and unknown. The value for Z is found in statistical tables which contain the area under the normal curve.

MOE is the margin of error

P is the sample proportion and

N_0 is the sample size assumed

3.6. Types of data

The types of data for this study were both primary and secondary data. The primary data for this study was collected through questionnaires, field investigation (actual field observations), and pedestrian count (volume) data. Whereas, secondary data were collected from the secondary sources such as different reports, literatures, working papers, articles and published and unpublished researches which conducted in the same area was relevant sources to secondary data.

3.7. Data collection Methods

The primary instrument for data collection in this research was designed through structured questionnaires. In the questionnaires, the researcher was provided a list of answers for respondents from which to choose and respondents only needed to choose the answer/s given in the questionnaires and it was required less time to complete. Questionnaires were enabled this study to more easily to identify and describe the major problems of pedestrian movement.

3.8. Methods of Data Analysis

After all required data were collected, coded, screened and processed, data analyses were made by using descriptive(case reports and case series, cross sectional study) and inferential statistics. The data collected via a questionnaire was analyzed quantitatively using (SPSS Vs 20.0) and was presented in the form of a table.

3.8.1. Descriptive Statistics

Descriptive statistics has been implanted to analyze data that related to demographic profile of respondents, major problems of pedestrian movement, and effects of pedestrian movement and descriptive statistics for Likert scale items. To analyze these; table, percentage, mean and standard deviation were used.

3.8.2. Inferential statistics

3.8.2.1. Correlation Analysis

According to Phyllis and his associates (2007:18-55), inferences have a very important in management research. This was because conclusions were normally established on the bases of results. Such generalizations were therefore, be made for the population from the samples.

They speculated that the Pearson Product Moment Correlation Coefficient was a widely used statistical method for obtaining an index of the relationships between two variables when the relationships between the variables were linear and when the two variables correlations were continuous. To determine whether a statistically significant relationship exists independent and dependent variables and the Product Moment Correlation Coefficient was used. In this study Pearson's Product Moment Correlation Coefficient was used to determine the relationships between explanatory variables and dependent variables in a study area.

3.8.2.2. Regression analysis

Regression analysis was used to test the significance contribution of each independent variable to the dependent variable time overruns. This statistical technique was helped researcher to explain whether the variation time overruns could be accounted for by explanatory variables. Multiple regressions were a flexible method of data analysis that might be appropriate whenever a quantitative variable (the dependent) was to be examined in relationship to any other factors (Cohen, West & Aiken, 2003). The regression model was adopted from Kihanya, 2013.

Equation for the research was depicted as follows,

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

Where Y= dependent variable (pedestrian movement)

X_{1-n} = independent variable

X_1 = Speed of vehicles (SV)

X_2 = Midblock crosswalks (MBCW)

X_3 = Roadside vendors on pedestrian sidewalk (RSVPS)

X_4 = Obstruction on pedestrian sidewalk (OPSW)

X_5 = Street Parking (SP)

B_0 = Constant, β_{1-n} , the coefficient or change included in Y by each X.

ε = error term

3.9. Reliability & Validity of Research Questionnaires.

The reliability test was an essential instrument to measure the degree of consistency of an attribute which will be supposed to measure. As stated by Mahon & Yarcheski (2002) the less variation of the instruments produces in repeated measurements of an attribute the higher its reliability. Reliability could be equated with the stability, consistency or dependability of a measuring tool.

The validity test was an important term in research that refers to the conceptual & scientific soundness of a research study. Its primary purpose was to increase the accuracy & usefulness of the findings by eliminating or controlling as many confounding variables as possible, which was allowed for greater confidence in the findings of a given study (Marczyk et al., 2005). It is measured the internal consistency of the items in a scale. A computed alpha coefficient ranged between 0 to 1 (0 denoting no internal consistency & 1 denoting perfect internal consistency) & the higher values reflect the higher degree of internal consistency. To sum up, coefficient alpha was one name for the Cronbach alpha reliability estimate. Cronbach alpha is the most commonly analysis, reported reliability test for multiple questions and measure internal consistency.

Table 3. 2: Cronbach's alpha value evaluation.

Cronbach's alpha	Internal Consistency
$\alpha \geq 0.9$	Excellent(High Stakes testing)
$0.7 \leq \alpha < 0.9$	Good(Low-Stakes testing)
$0.6 \leq \alpha < 0.7$	Acceptable
$0.5 \leq \alpha < 0.6$	Bad
$\alpha < 0.5$	Unacceptable

Source: George, D., & Mallery, P., (2003).

Table 3. 3: Cronbach’s Alpha for each variable of the questionnaires.

No.	Variables	Number of items under each variables	Cronbach’s Alpha	Remark
1.	Speed of vehicles(SV)	4	0.973	Excellent
2.	Midblock crosswalks(MBCW)	4	0.884	Good
3.	Roadside vendors on pedestrian sidewalk(RSVPS)	2	0.971	Excellent
4.	Obstruction on pedestrian side walk (OPSW)	3	0.983	Excellent
5	Street Parking (SP)	3	0.946	Excellent
Total Reliability of items		16	0.952	Excellent

Source: Survey SPSS Result, (2024).

The Cronbach’s coefficient alpha was calculated for each field of the questionnaire. The table 3.2 above showed the values of Cronbach’s Alpha for each field of the questionnaire and the entire questionnaire. For the fields, values of Cronbach's Alpha ranged from 0.884 and 0.983. This range was considered high as the result ensures the reliability of each field of the questionnaire. Cronbach's Alpha equals 0.952 for the entire questionnaire which indicated excellent reliability of the entire questionnaire. Therefore, based on the test, the results for the items were reliable and acceptable.

3.10. Ethical issues

The researcher enumerated on how privacy and confidentiality concerned were approached and was sensitive to not only how information was protected from unauthorized access, but also if and how participants were going to be notified of any unforeseen findings from the research that they were not meant to know. To give clarity of the idea all the necessary information regarding ethical issues in seeking consent, avoiding deception, maintaining confidentiality, respecting the privacy, and protecting the anonymity of all respondents were stated on the questionnaire.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4. Introduction

This chapter contained summaries of the data collected, analyzed & the findings on the major challenges of pedestrian movement in Addis Ababa in the case of Bole sub-city. In order to make all the collected data suitable for the analysis, all questionnaires were screened to be completed. But, all returned incomplete questionnaires were therefore considered as errors & has to be removed from the surveyed data. That means, out of 384 distributed questionnaires, sixty (60) of them was incomplete. Thus, a total of 324 complete questionnaires were used for this research in order to be analyzed. Furthermore, descriptive & analytical methods were implanted to analyze Likert scale items & variables of major challenges of pedestrian movement via observation by walking along the foot path & document reviews.

4.1. Response rate of Questionnaires

Table 4. 1: Response Rate of Respondents

Respondents	Questionnaires					
Bole sub-city area Residents	Distributed		Returned		Unreturned	
	Frequency	%	Frequency	%	Frequency	%
	384	100	324	84	60	16

Source: Surveyed Data, (2024).

Regarding the response rate of respondents as shown in table 4.1 above, 384 questionnaires were distributed & 334 were filled properly & returned with the rate of 84%. Based on this, i.e. 324 (84%), the next analysis was conducted. This response rate is excellent and confirms to Mugenda (2003), stipulation that a response rate of 50% is adequate for analysis and reporting; a rate of 60% is good and a response rate of 70% and over is excellent.

4.2. Descriptive Analysis

4.2.1. Socio-Demographic characteristics of Respondents

This descriptive analysis was used to look at the data collected and to describe data captured through the questionnaires. It was used to describe the demographic factors for more clarification. It was mainly important to make some general observations about the data gathered for general or demographic questions. The demographic factors used in this research

were gender, age, educational qualification and occupation of respondents in Bole sub-city administration.

Table 4. 2: Demographic Characteristics of Respondents, N=324

Demographic characteristics of respondents	Category	Frequency	Percent's (%)
Gender	Male	206	64
	Female	118	36
	Total	324	100
Age	<20	-	-
	20-30	84	26
	31-40	165	51
	41-50	75	23
	51-60	-	-
	Total	324	100
Educational qualification	Primary education	-	-
	Secondary education	19	6
	Certificate	22	7
	Diploma	60	19
	Degree	183	56
	Master's Degree & Above	40	12
	Total	324	100
Occupation	University/College Students	11	3
	Not employed	21	7
	NGO's employee	42	13
	Government employee	178	55
	Self-employee	72	22
	Total	324	100

Source: Own Survey, 2024.

As far as the table 4.2 above was concerned, 64% of the respondents of the Bole sub-city residents were males while the remaining 36 % of the respondents were females. Hence, the demographic details of the main survey sample indicated that the majority of the respondents were males. From this, we can infer that female participation of the Bole sub-city was low relative to male. According to age wise sample population largely dominated by age group of 31-40 years (51%) followed by the group comprising the age group of 20-30 years (26%) & 41-50 years (23%) of the sample population respectively. This displayed that most of the sample population were below the age of 45 years & thus they were under the parts of the youngest age categories. Educationally, first Degree, Diploma, Master's Degree, certificate secondary education took 56%, 19%, 12%, 7%&6% of the sample population respectively. Based on this, education played an important role in influencing human action, the impulse & motives that sustain & regulate all mental activity & behaviour of individuals (Bytqi, 2008). And occupationally, except twenty one (21) unemployed individuals, majority of the respondents were under the category of the government employees (178, 55%), self-employed (72, 22%), University / college students (11, 3%) & NGO's employee (42, 13%). Hence, majority of the sample study were government employees & self-employed business owners.

4.2.2. Factors that Challenges a pedestrian movement

In order to understand the major challenges of pedestrian movement at Bole sub-city, pedestrians were asked to give their level of agreement to statements with regard to the given variables. Pedestrians rating in five points of Likert scale were then analysed with descriptive statistics of mean and standard deviation. Hence, the mean indicates to what extent the sample group on average agrees or disagree with the different statements. According to Marczyk, Dematteo and Festinger (2005), the lower the mean, the more the respondents disagree with the statements. The higher the mean, the more the respondents agree with the statement. According to Zaidatoland Bagheri(2009)cited in (Wogari, 2016) the mean score below 3.39 is considered as low; the mean score from 3.40 up to 3.79 is considered as moderate and mean score above 3.8 is considered as high ass hown below. In this section, the analysis results were presented in subsequent tables each dealt with the speed of vehicles, mid blocks of cross walks, roadside venders, obstruction on pedestrian movement & street parking in terms of pedestrians' point of view.

4.2.2.1. Speed of Vehicles

Pedestrians are one of the prime road users on urban roads and also vulnerable at unprotected mid-block locations under heterogeneous traffic. Hence, Pedestrians are the inseparable part of transportations system in cities. Vehicular speed has an inverse effect on pedestrian movements. Furthermore, the idea that the faster a striking vehicle is traveling, the more damage is done to a struck pedestrian, has been documented in a number of studies. Pasanen (1992), for example, concluded from three studies relating collision speeds and pedestrian injury severity that about 5 percent of pedestrians would die when struck by a vehicle traveling 20 mph, about 40 percent for vehicles traveling 30 mph, about 80 percent for vehicles traveling 40 mph, and nearly 100 percent for speeds over 50 mph. In the absence of sidewalk (specifically on urban roads) forces the pedestrians to share the right-of-way with fast-moving vehicles and it causes a reduction of 7.23 km/h in average speed on urban roads (Bassani, Dalmazzo and Marinelli, 2013). And also Advani and Nisha (2013) and Adinarayana and Anil (2017) observed that lower speed on urban streets is associated with the high volume of pedestrians walking along the carriage way.

Table 4. 3: Variables related to Speed of Vehicles indicators

No.	Speed of Vehicle Variables	N	Mean	Std. Deviation
1.	Motorist yielding behavior speed is influenced by the location of the pedestrian safety.	324	4.79	0.879
2.	There is an impact of motorist behavior on pedestrian safety.	324	4.37	0.985
3.	There is unsafe behaviors of the vehicle drivers on pedestrians due to poor judgments of the speed of approaching vehicles.	324	4.65	0.914
4.	There are factors that influencing pedestrians' decisions to accept or reject gaps in traffic for crossing considering pedestrian characteristics.	324	4.42	0.965
	Average/mean	324	4.56	0.936
	Valid N (list wise)	324		

Source: Survey SPSS output, (2024)

As revealed on table 4.3 above, the mean ranges from 4.17 – 4.59 with the SD of 0.879 – 0.985. From this the researcher assured that the speed of vehicle with respect to pedestrian movement was found to be a common challenge with a mean score of 4.34 which was the highest agreement responded from pedestrians. This means that Bole sub-city has practiced the highest practicing vehicular speed as suggested by Zaidation and Bagheri (2009). From the analysis, it can be concluded that inaccurate estimation of vehicle speed may lead to more dangerous street-crossing decisions, thus it is important to explore the ability of pedestrians to accurately estimate vehicle speed while crossing streets. But, this was more or less emphasized by Pasanen (1993) and Anderson et al. (1997) examined specific crashes and both determined that reducing vehicle speeds would have reduced pedestrian injuries in two ways: by eliminating some crashes altogether, and by reducing injury severities in the others.

4.2.2.2. Midblock of crosswalks

Mid-block crossings are located and placed according to a number of factors, including roadway width, traffic volume, traffic speed and type, desire lines for pedestrian movement, and adjacent land use. However, in order to measure pedestrian level of service for mid-block crossing, blocks may be defined in one of two ways. A block may be narrowly seen as the roadway section between two consecutive intersections, regardless of whether they are signalized or not. This view is in line with the traditional definition of a street block. Alternatively, a block may be broadly seen as the roadway section between two consecutive signalized intersections. This view is in line with what constitutes a highway segment for multi modal quality of service analysis by McLeod, (1999). But, safety has not been used as a measure of effectiveness for pedestrian mid-block street crossing, perceived safety and comfort is used by some (Landis et al., 1999) as a measure of effectiveness for pedestrians walking along roadway segments.



Figure 4. 1: Pedestrian Mid-block Crosswalks indicator.

Key:

The marking of the crossing is visible for all road user, guardrails leading pedestrian to safe crossing areas & create convenience for pedestrian since they think it is safe to cross & the driver can observe the marking since it is visible.

Table 4. 4: Variables related to mid-block of crosswalks indicators

No.	Midblock of crosswalks Variables	Std.		
		N	Mean	Deviation
1.	There is Mid-block crosswalks in places of Bole sub-city that provide pedestrians with safe crossing along roadways.	324	3.34	0.638
2.	There is Mid-block crossings that allow pedestrians a formally designated place to cross a street in Bole sub-city when intersections are spaced too far apart to be convenient.	324	3.21	0.798
3.	The Bole sub-city has a complete Pedestrian network, publicly accessible walkways where all destinations are connected to each other and protected from vehicle traffic.	324	3.29	0.724
4.	There are crossings in Bole sub-city walkways that are spaced at more frequent intervals in busy commercial areas.	324	3.19	0.817
	Average/mean	324	3.26	0.745
	Valid N (list wise)	324		

Source: Survey SPSS output, (2024)

As the survey results have shown on table 4.4 above, the mean ranges from 3.19 - 3.34 with the SD of 0.638 – 0.817. From this the researcher guaranteed that the mid-block of crosswalks with respect to pedestrian sidewalk was found to be a common challenge with a mean score of 3.26 which was the lowest agreement responded from pedestrians & implied no Mid-block crosswalks facilities were found in Bole sub-city in general & thus would increase the pedestrian risk at crossing. But, however, crossing area facilities has a significant influence on pedestrian safety as pedestrians and drivers react differently under different situations. According to Ghee et al (1998), drivers are more likely to give way to pedestrians at formal crossings. But, in Bole sub-city, during the field investigation, lack of leading pedestrians to crossing areas & no leveled cross walked around crossing area were observed. Thus, pedestrians were restricted by physical boundaries around them, visibility and other

crossing area facilities. But, however, when crosswalk markings or controls are used, more pedestrians significantly use the crossings than at other unsanctioned locations.

4.2.2.3. Road-side Venders on pedestrian sidewalk

Street vending is an essential part of the urban informal economy in developing countries. The presence of roadside vendors can have an impact on pedestrian safety. Studies have shown that factors such as the location and width of the vending stall, width of the walkway, pedestrian flow, and the presence of a customer interacting with a vendor can affect the average pedestrian density. Additionally, the number of parking, pedestrian crossing and violations' volume, traffic speed variation, and the number of intersecting side roads are significant risk factors related to pedestrian crash risk. Therefore, it is important to assess and mitigate the influence of road-side activities on pedestrian safety to achieve safer walking environments (M.Sarasalome, 2014: Refereed Journal).



Figure 4. 2: Road-side venders on Goro sidewalk.

Table 4. 5: Variables related to Road-side Vendors on pedestrian sidewalk

No.	Road-side Vendors on pedestrian sidewalk Variables	N	Mean	Std. Deviation
1.	There are temporary roadside vendors on Bole sub-city walkside.	324	4.99	0.898
2.	There are permanent roadside vendors on Bole sub-city pedestrian movement.	324	4.38	0.928
	Average/mean	324	4.69	0.913
	Valid N (list wise)	324		

Source: Survey SPSS output, (2024)

As displayed on table 4.5 above, the mean ranges from 4.38 – 4.99 with the SD of 0.898 – 0.928. From this the researcher assured that the roadside vendors with respect to a side walk as found to be a major challenge with a mean score of 4.69 which was the highest agreement responded from pedestrian of Bole sub-city. According to (Kimathi, 2004), Vendors/vendors are someone who promote or exchanges goods or services for money on roads, pedestrian walkway and obstructs the pedestrian movement on pedestrian environment. Furthermore, from the field observations and field survey, the major problems associated with pedestrians were the ever-increasing number of road-side vendors operating on sidewalks and on the streets. Consequently, there is intense struggle for space between the traders and the pedestrians are therefore, forced to walk on the streets, resulting in conflict of vehicular and pedestrian traffic. At Goro area, there were a high number of pedestrian congestions where there is also public transport terminal; Sheger bus, Anbessa bus and taxi stations. The numbers of road- side vendors were large and make walking very complex.

4.2.2.4. Obstructions on pedestrian sidewalk

The pedestrians forced to use the carriageway in either of the two cases; one the pedestrian facility is fully encroached and another in the absence of a pedestrian facility. It encroached the facilities studied is a measure of the number of obstructions per kilometer on the path being assessed. Assessment of this factor is essential to determine the access available to people with disabilities. Obstructions tend to influence pedestrian movement and reduce the effective walkway width. The study done by the Addis Ababa city Transport Planning and Management Office (2016), defines the effective walkway width as the difference between potential walkway width and total walkway width. The effective walkway widths were

reduced by different obstructions like; rubbish deposition, on street parking, on street vendor's activities, vegetables grown on pedestrian walkways, poor drainage facilities and improperly placed roadside infrastructures. Therefore, the assessment of obstructions is essential to determine the access available to pedestrians. In a residential area, parking lot and illegal construction materials are challenging the pedestrians on a sidewalk as an obstruction, and it needs to consider by neighbor authorities to maintain and to take legal actions for further user safety.



Figure 4. 3: Sidewalk obstructions around Goro, CMC.

Table 4. 6: Variables related to Obstructions on pedestrian sidewalk indicators

No.	Obstructions on pedestrian sidewalk Variables	N	Mean	Std. Deviation
1.	Littering on pedestrian walkway (by individual).	324	4.78	0.846
2.	Putting partial garbage storage on pedestrian walkway by Government employees.	324	4.63	0.983
3.	Unlimited Digging sidewalks and putting building tools for various reasons put up.	324	4.99	0.739
	Average/mean	324	4.80	0.856
	Valid N (list wise)	324		

Source: Survey SPSS output, (2024)

As revealed on Table 4.6 above, the mean ranges from 4.63 – 4.99 with the SD of 0.739 – 0.983. From this the researcher identified that obstructions on pedestrian with respect to a side walk as found to be a major challenge with a mean score of 4.80 which was the strongest

agreement indicated from pedestrian dwellers of Bole sub-city. Therefore, the assessment of obstructions is essential to determine the access available to pedestrians. Thus, the current walkways in Bole sub-city entirely encroach especially in market and commercial areas by illegal construction materials. These segments are not comfortable in general, and it is right to say no walkway in Bole sub-city market areas and shopping areas because the behaviour of vendors in the sub-city always seen by using only on the sidewalk even where the space available. But filling a sidewalk with obstructions can be highly detrimental to pedestrians trying to use the sidewalk for its intended purpose. Accordingly, the field survey outcomes showed that the presence of rubbish dumped on pedestrian walkways by (individuals), temporary garbage storage on pedestrian walkways by government employees and unlimited excavation and construction materials dumped on pedestrian walkway were taken into the major challenges in pedestrian side walk.

4.2.2.5. Street Parking

On-street parking is a common form of parking, known for its efficiency in terms of land use and convenience to motorists as it allows them to park their vehicles nearer to their destinations. On-street parking has some benefits as well as drawbacks which also keep varying depending upon circumstances. Today, urban transport planners are facing difficulties and want to know where and when on-street parking should be allowed confirming that benefits are outweighing its drawbacks. Again, if it is allowed, query comes whether it should be a parallel parking or angled. Before allowing or restricting on street parking, one should need to delve into different corollaries of it (Biswas et al., 2017). In many urban areas, the illegal parking is also the common problem which is hazardous to traffic safety& pedestrian movement. Also, haphazard parking due to lack of parking space marks leads to inefficient utilization of the parking lot area& impacts those of pedestrians.



Figure 4. 4: Street parking indicator

Table 4. 7: Variables related to Street Parking on pedestrian indicators

No.	Street Parking Variables	N	Mean	Std. Deviation
1.	There is parking on the sidewalk of Bole sub-city.	324	4.48	0.798
2.	On the pedestrian walkway, there is abandoned old car left.	324	4.23	0.893
3.	Due to street parking on some road segment there is no footpath pedestrian walk way in Bole sub-city at all.	324	4.89	0.683
	Average/mean	324	4.53	0.792
	Valid N (list wise)	324		

Source: Survey SPSS output, (2024)

As indicated on Table 4.7 above, the mean ranges from 4.23 – 4.89 with the SD of 0.683 – 0.893. From this the researcher deduced that street parking with respect to pedestrian side walk was found to be a common challenge with a mean score of 4.53 which was the greatest agreement resulted from pedestrian respondents of Bole sub-city residents. In addition, according to (Byrd and Sisiopiku, 2006) the traffic simulation results showed that on-street parking resulted in a 32% increase in average delay time and a 24% reduction in speed. But, however, the impact of on-street parking on traffic performance can be significant and might lead to various problems for urban areas particularly on pedestrian side walk. Even though,

some pedestrian walkways were paved with cobblestones, the presence of old vehicles left on pedestrian walkway environment obstructs the movement of pedestrians permanently. In summary, in Bole Sub-city, Megenagna area, temporary on street parking is legally allowed although this action adversely impact pedestrian movements.

4.2.3. Evaluation of the status of Pedestrians' Perception

Pedestrians themselves are the most appropriate group to identify treatments that create a safe and desirable environment for them and options that increase their likelihood to use of the walker at designated facilities correctly. A distribution questionnaire was undertaken to assess the pedestrians' perception of the conditions of pedestrian facilities. The perception rating categories include "Yes" or "No" which expresses the issue in percent.

Table 4. 8: Pedestrians' Perceptions about the conditions of pedestrian facilities

Variables		N	Yes (%)	No (%)	Not sure (%)
1	Decisions about how to allocate and design street space have a tremendous impact on quality of life. Does our street design ensure safety for all users, particularly pedestrians and cyclists, and facilitate efficient use of road space?	324	72 (22%)	252 (78%)	-
2	Do our Streets near churches, mosques, schools, universities, colleges, hospitals, administration offices, banks, and other destinations attracting large numbers of people have adequate space for pedestrian movement and interaction?	324	83 (26%)	241 (74%)	-
3	Walking is a key to urban life because it is a healthy and pollution-free form of mobility and recreation. Do you think Addis Ababa has complete, safe, and publicly accessible pedestrian networks?	324	52 (16%)	272 (84%)	-
4	Walking is a dominant mode in Ethiopian cities, and public transport trips also start and end on foot. As a healthy and pollution-free form of mobility and recreation, walking is a key to urban life. Do you	324	68 (21%)	256 (79%)	-

	think the sub-city has a complete pedestrian network, publicly accessible walkways where all destinations are connected to each other and protected from vehicle traffic?				
5	Good footpaths promote safe and comfortable pedestrian mobility. Do you think the sub-city has walkways which are accessible to all users, regardless of age, gender, or special needs?	324	43 (13%)	281 (87%)	-
6	In Ethiopia context, do you think there are crossings that are spaced at more frequent intervals in busy commercial areas?	324	63 (20%)	261 (80%)	-
7	In Ethiopia context, do you think there are sufficient and convenient pedestrian footbridges or tunnels in the city?	324	76 (24%)	248 (76%)	-
8	Well-designed bus stops offer a comfortable, weather-protected waiting area for public transport passengers while leaving clear space for pedestrian movement behind the shelter. Do you think the city's bus stops are determined considering the land use, street network and existing passenger behavior?	324	69 (21%)	255 (79%)	-
9	Well-designed street lighting enables motor vehicle drivers, cyclists, and pedestrians to move safely and comfortably by reducing the risk of traffic crashes and improving personal safety. Do you think such infrastructures are provided at convenient places on the walkways?	324	73 (22%)	251 (78%)	-
10	Valuable street space should be used for wider walkways, trees, cycle tracks, cycle parking, vending, and social gathering space rather than parking. Do you agree that on-street parking should be allowed on streets where all the other requirements for public transport and non-motorized travel have been met?	324	85 (26%)	249 (74%)	-

Source: Own Survey, 2024.

As displayed on table 4.8 above, 78% of the respondents replied that street design of Bole sub-city didn't ensure safety for all users particularly for pedestrians and cyclists and facilitate efficient use of road space. Hence, decisions about how to allocate and design street space have a tremendous impact on quality of life & urban streets have multiple users including pedestrians, cyclists & motorists. And also, effective urban street design ensures safety for all, particularly pedestrians and cyclists, and facilitates efficient use of road space.

As 74% of the respondents replied, there is no adequate space for pedestrian movement and interaction especially for streets near churches, mosques, schools, universities, colleges, hospitals, administration offices & banks in Bole sub-city. But, however, public spaces must be designed to be flexible and adaptable, allowing for temporary or permanent transformations to accommodate a variety of uses & events. Hence, by integrating the principles of public space theory, cities must create pedestrian-friendly environments that encourage social interaction, foster community identity, and contribute to the overall livability and vibrancy of urban areas.

84%&79% of the respondents indicated that Addis Ababa, particularly Bole sub-city has no complete, safe and publicly accessible pedestrian networks& walkways where all destinations are connected to each other and protected from vehicle traffic respectively. Thus, Bole sub-city was a challenging place for pedestrians so far. Sidewalks are narrow, uneven, or obstructed—if they exist at all and drivers often fail to yield to pedestrians. This state of affairs is not just inconvenient, it's dangerous. Thus, the city's Road Safety Strategy identified those pedestrians as the most at-risk to die particularly in the situation of not enough side-walk.

87% of the pedestrians responded that the Bole sub-city has no walkways which are accessible to all users, regardless of age, gender, or special needs. But, addressing the needs of these special populations requires the adoption of universal design principles that accommodate the widest range of abilities and ages. Thus, by integrating inclusive design features that benefit all pedestrians, the sub-city must create truly accessible and equitable environments. Moreover, through education, awareness, and a commitment to inclusivity, the sub-city must break down barriers and foster a culture of pedestrian mobility and accessibility for all. By employing this multifaceted approach, the sub-city must pinpoint the area's most in need of intervention and target resources effectively, ultimately creating a safer and more welcoming environment for pedestrians of all ages and abilities.

80% & 76% of the respondents identified that there are no crossings that are spaced at more frequent intervals in busy commercial areas & sufficient and convenient pedestrian footbridges or tunnels in the sub-city respectively. But, to make streets passable and safe for people, the sub-city should put pedestrians first by improving existing crosswalks and intersections and building footbridge-to-pass. Thus, crossings must be made convenient, safe, and direct for pedestrians, cyclists, and others to actually use and benefit from their protection. The sub-City streets must have frequent crossings for pedestrians that are clearly marked, timed for diversity of users and at the same level as adjoining footpaths or sidewalks.

As the pedestrian respondents responded that, 79% & 78% of the city's bus stops are not determined considering the land use, street network and existing passenger behavior & no well-designed street lighting was provided at convenient places on the walkway. This was because of inadequacy and lack of proper maintenance of the transport infrastructural facilities and other activities within the sub-city area was found. And also, 74% of the respondents disagreed that on-street parking should be allowed on streets of pedestrians.

4.3. Results of Inferential Statistics

In this section; the results of inferential statistics were presented. For the purpose of assessing the objective of the study, Pearson product moment correlation coefficient and regression analysis were computed.

4.3.1. Pearson's Product Moment Correlation Coefficient

Correlation analysis is primarily concerned with finding out whether a significant relationship exists between two variables (Field, 2005). It is used to describe the strength and direction of the linear relationship between two variables. Pearson correlation (commonly called Pearson Correlation Coefficient) is used for the study to investigate a relationship between performance appraisal and employees' job satisfaction. The value of Pearson product-moment correlation coefficient (r) normally varies between -1 to +1. The sign indicates whether there is a positive correlation (as one variable increase, other also increase) or negative correlation (as one variable increase, other decrease). According to Field (2005), a coefficient (r) of +1 indicates a perfect positive relationship while -1 indicates a negative relationship. Breaking down the strength of the relationship, values of $r = \pm 0.1$ to ± 0.29 represent a weak relationship while $r = \pm 0.3$ to ± 0.49 represent a medium relationship while $r = \pm 0.5$ to ± 1.0 indicate a strong relationship. Thus, Pearson's product moment correlation coefficient was computed to identify whether there is significant relationship between

independent variables i.e., Speed of vehicles, Midblock crosswalks, Roadside Vendors on pedestrian side-walk, Obstruction on pedestrian side-walk, Street Parking & with the response variable (Pedestrian movement). Moreover, regarding to relationship between the two variables, table 4.9 below briefly indicated that figures with symbol (**) displayed each of the variables significantly correlated at significance level of $p < 0.01$.

Table 4. 9: Relationship between independent variables and Dependent variables, N=324

Variables		Pedestrian movement
Speed of vehicles	Pearson correlation	0.968**
	P – value	0.000
	N	324
Midblock crosswalks	Pearson correlation	0.799**
	P – value	0.000
	N	324
Roadside Vendors on pedestrian side-walk	Pearson correlation	0.983**
	P – value	0.000
	N	324
Obstruction on pedestrian side-walk	Pearson correlation	0.991**
	P – value	0.000
	N	237
Street Parking	Pearson correlation	0.898**
	P – value	0.000
	N	324

Source: Survey SPSS Output, (2024).

** Correlation is significant at the 0.01 level (2- tailed).

*Correlation is significant at the 0.05 level (2- tailed).

According to the Pearson correlation result the association of independent variables with pedestrian movement presented on the above table 4.9, the result of level of obstruction on pedestrian side-walk & roadside vendors on pedestrian side-walk with pedestrian movement correlation coefficient were 0.991 & 0.983 respectively, these explained that there were the 1st & 2nd strong positive relationship between the variable. Speed of vehicles & street

parking correlation coefficient were 0.968 & 0.898, these results indicated that there were the 3rd & 4th strong positive relationship between the variable but it was less relationship as compared to the level of obstruction on pedestrian side-walk & roadside vendors on pedestrian side-walk. But, however, the midblock crosswalk and pedestrian movement correlation coefficient was 0.799; this explained that there was also strong positive relationship between the variable but the strength of correlation was less than the above four independent variables (i.e. Obstruction on pedestrian side-walk, Roadside vendors on pedestrian side-walk, Speed of vehicles & Street Parking). Based on our finding, it was pertinent to conclude that those of all independent variables have more power to make to determine degree of relationships with that of dependent variable (Pedestrian movement).

4.3.2. Multiple Linear Regression Analysis

According to Marczyk, et al. (2005), linear regression is a method of estimating or predicting a value on some dependent variables given the values of one or more independent variables. Like correlations, statistical regression examines the association or relationship between variables. Unlike with correlations, however, the primary purpose of regression is prediction. Multiple regressions were a correlation between the observed values of Y, the values of y predicted by multiple regression models. Therefore, large values of the multiple regressions represent a large correlation between the predicted and observed values of the outcome. Adjusted R^2 is used to measure the percentage of variance in the dependent variable explained by the independent variables. From the multiple regression equation, the standard regression coefficient (beta weight) is determined to compare the effect of each independent variable that had on the variability of the overall pedestrian movement.

For the purpose of determining the extent to which the independent variables explain the variance in the dependent variable; Regression analysis was used. The results of regression analysis were shown here under.

Table 4. 10: Model Summary

Summary of model	R	R Square	Adjusted R square	Std. error of estimation		Sig.
	.906 ^a	.822	.812	.216		0.000
Coefficients	Model	Un standardized coefficients		Standardized coefficients	t	Sig.
	Independent variables	B	Std. error	Beta		
	Constant	0.750	0.182		4.115	.000**
	Speed of vehicles (X ₁)	0.286	0.044	0.388	6.664	.000**
	Midblock crosswalks (X ₂)	0.212	0.038	0.295	5.604	.000**
	Roadside Vendors on pedestrian side-walk (X ₃)	0.122	0.035	0.180	3.464	.001**
	Obstruction on pedestrian side-walk (X ₄)	0.120	0.031	0.184	3.812	.000**
	Street Parking(X ₅)					

Source: Survey SPSS Output, (2024).

Table 4.10 above showed the estimates of the multiple linear regressions of pedestrian movement against its selected variables for 324 respondents (samples). It indicated that the correlation between the calculated value of pedestrian movement and the independent variables such as level of speed of vehicles, midblock crosswalks, roadside vendors on pedestrian side-walk, obstruction on pedestrian side-walk & street parking were 0.906^a as

shown in the above table. Additionally, R square value is 0.822 and adjusted R square value is 0.812. Therefore, this indicated that 81.2 percent of the variation of pedestrian movement can be explained by explanatory variables those included in this study while remaining 18.8 percent of variance of pedestrian movement was explained by other variables that were not included in this study.

B column (un standardized coefficients) was the coefficients of explanatory variables in regression equation as shown here below:-

$$\text{Dependent variable (Pedestrian movement)} = 0.750 + 0.286X_1 + 0.212X_2 + 0.122X_3 + 0.120X_4 + 0.182X_5$$

Where:

X_1 = Speed of vehicles (SV)

X_2 = Midblock crosswalks (MBCW)

X_3 = Roadside Vendors (RSV)

X_4 = Obstruction on pedestrian environment (OPE)

X_5 = Street Parking (SP)

The information shown in the above table indicated that; all explanatory variables incorporated in this study were significantly explained at the 95 % level of confidence to the deviation of the response variable. Standardized coefficients showed the contribution of explanatory variables to response variable (Pedestrian movement). The numeric value of beta is the amount the response variable raises at the time explanatory variables rises by one unit of its measurement. Finally, the above table indicated that all selected explanatory variables were significant for the study.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5. Introduction

The concluding chapter of this study accounted for the research conclusions, recommendations & limitations that future researchers could direct their investigations. Furthermore, conclusions were deduced from the findings that were discussed in the earlier chapter. Finally, based on the overall conclusions & recommendations, limitations were provided for future researchers interested in the area of major challenges of pedestrian movement in Addis Ababa, particularly in Bole sub-city.

5.1. Conclusion

The main objective of the study was to examine the major challenges of pedestrian movement in Addis Ababa, particularly in Bole sub-city. To achieve the aforementioned objective of the study, the researcher used quantitative research approach & a descriptive research design. To select a representative sample population of the study participants, a non-probability sampling technique of purposive sampling was used and self-administered questionnaires were carefully developed from previous related studies and evenly distributed during the study period. Based on the findings, the following conclusions were drawn:

- ❖ Pedestrian is one of the important component in urban transportation system and also vulnerable at unprotected mid-block locations under mixed traffic conditions. At unprotected mid-block locations, some of the vehicles may yield to pedestrians who are already at crosswalk location. However, some of the pedestrians are using forced gaps to cross the road. Hence, while pedestrians use the mid-block crosswalk with forced gaps, which decreases the vehicular flow characteristics.
- ❖ Poor design of pedestrian facilities can lead to endless problems and can discourage the pedestrians due to a feeling of unselfishness, unprotected, or uncomfortable. So, the needs of the pedestrian should be considered in the design of urban environments and transportation facilities.
- ❖ In most cases, the presence of sidewalk vendor along with pedestrian flow had caused pedestrians change path and reduce walking speed. However, the effect size varies depending on width of vending stall and pedestrian volume. Understanding pedestrian

walking behavior in the presence of sidewalk vendors could be an essential input for better street design that accommodates the diverse needs of the sub-city.

- ❖ The study results show that the pedestrian walking paths being in very bad conditions and some road segments has no footpaths; the conditions of available walking paths were poorly maintained, there were severe walkways damaged by erosions and closed by obstructions. Most of the Bole Sub-city core streets do not have adequate pedestrian access, despite the fact that walking takes the lion share of passenger movements.
- ❖ Pedestrians are encouraged to walk when there are nice walkway connections between attractive places like parks, shopping centers, transit bus stops and other public service centers. However, the study result showed that there exists a very poor pedestrian walkway network at Goro and Megenagna area.
- ❖ There are no designated places for street traders and so they use spaces, which are meant for other purposes. This results in contestations and conflicts with urban authorities. There were also intense struggle for space between the traders and the pedestrians are forced to walk on the streets, resulting in conflict of vehicular and pedestrian traffic. At Goro area, it was observed that there were a high number of pedestrian congestions where there is also public transportation terminal for Sheger and Anbessa bus and taxi stations and the number of street vendors were large making walking very difficult
- ❖ Obstructions tend to influence pedestrian movement and reduce the effective walkway width. Therefore, the assessment of obstructions is essential to determine the access available to pedestrians. Thus, the current walkways in Bole sub-city entirely encroach especially in Market and Commercial areas by vendors, utility poles, parking carts and illegal construction materials. These segments are not comfortable in general, and it is right to say no walkway in Bole sub-city market and shopping areas because the behavior of vendors in the sub-city always seen by using only on the sidewalk even where the space available.
- ❖ It can be summarized that the major problems of the current on-street parking facilities in Bole sub-city were: lack of sufficient parking spaces, lack of sufficient off-street parking leading to street parking, blocking of personal business centers by parking in front of their shops and offices; and risk of insecurity and theft of vehicle parts while parking, double parking on prohibited spaces due to lack of proper parking places results in road congestions, accidents during maneuvers of car. In conclusion, the existing parking places in the study area are not adequate to accommodate the existing demand leading to resource wastage and traffic congestion.

5.2. Recommendations

Based on the findings of the study and conclusions, the following recommendations are forwarded for possible use by pertinent policy makers:

- ❖ In most cases, drivers used on-street parking because of lack of sufficient off-street parking spaces. Therefore, to reduce street parking problems, construction of off-street parking in different zones of the sub-city should be encouraged and information regarding parking availability and fees should be provided to parking facility onlookers through signs, brochures and maps, websites to minimize loss of resources in respect of time, energy and fuel while looking for parking places.
- ❖ This research tried to aware the transportation planners and nearby authorities on the existing problems related to the safety of pedestrians in Bole sub-city. Hopefully, this study contributes much in enhancing the safety of pedestrians by identifying the affecting factors studied through the investigation of existing problems in the areas of pedestrians and indicated that improving the road infrastructure can increase walking and decrease fatalities in the sub-city. Pedestrian facilities like crosswalks, sidewalks, Curb ramps and the like should be well designed and maintained to be useful for both encouraging people to walk and improve pedestrian safety along specific routes.
- ❖ Thus, it is recommended that while planning urban road facilities, pedestrian crossings should be given due importance and placed accordingly so that its impact does not affect the traffic flow to a higher level there by reducing the speed of traffic flow.

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SCHOOL OF POST GRADUATE STUDIES

Appendix A: Self-Report Questionnaires

Dear Respondents,

I am pleased to inform you that I am a graduate student at Addis Ababa University pursuing a Master of Science Degree in Urban Design and Development. As partial fulfillment of my Master's Degree, I am conducting a research to assess the major challenges of pedestrian movement in Addis Ababa: The case of Bole sub-city.

Please note that any information you give will be treated with utmost confidentiality & at no instance will it be used for any other purpose other than for the intended objectives of this study. Your assistance will be highly appreciated. I look forward to your prompt responses.

Yours Faithfully,

Melisew Andarge

PART- I: Demographic information

- PART II: Factors that Challenges a pedestrian movement practices in Bole Sub-city Residents.**

Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
SD	D	N	A	SA
1	2	3	4	5

Variables	Statements /questions	Scale / Value					
		5	4	3	2	1	Remarks
Speed of Vehicles	Motorist yielding behavior speed is influenced by the location of the pedestrian safety.						
	There is an impact of motorist behavior on pedestrian safety.						
	There is unsafe behaviors of the vehicle drivers on pedestrians due to poor judgments of the speed of approaching vehicles.						
	There are factors that influencing pedestrians' decisions to accept or reject gaps in traffic for crossing considering pedestrian characteristics.						
Midblock cross walks.	There is Mid-block crosswalks in places of bole sub-city that provide pedestrians with safe crossing along roadways.						
	There is Mid-block crossings that allow pedestrians a formally designated place to cross a street in Bole sub-city when intersections are spaced too far apart to be convenient.						
	The Bole sub-city has a complete Pedestrian network, publicly accessible walkways where all destinations are connected to each other and protected from vehicle traffic.						

	There are crossings in Bole sub-city walkways that are spaced at more frequent intervals in busy commercial areas.						
Roadside Vendors	There is temporary roadside vendors on Bole sub-city pedestrian movement.						
	There is permanent roadside vendors on Bole sub-city pedestrian movement.						
Obstruction on pedestrian environment	Littering on pedestrian walkway (by individual).						
	Putting partial garbage storage on pedestrian walkway by Government employees.						
	Unlimited Digging sidewalks and putting building tools for various reasons put up.						
Street Parking	There is parking on the sidewalk of Bole sub-city.						
	On the pedestrian walkway, there is abandoned old car left .						
	Due to street parking on some road segment there is no footpath pedestrian walk way in Bole sub-city at all.						

PART III: - Questions are prepared to evaluate the status of the pedestrian walk way practices in Bole sub-city.

1. Decisions about how to allocate and design street space have a tremendous impact on quality of life. Does our street design ensure safety for all users, particularly pedestrians and cyclists, and facilitate efficient use of road space?
Yes ☐ No ☐ Not sure ☐
2. Dose our Streets near churches, mosques, schools, universities, colleges, hospitals, administration offices, banks, and other destinations attracting large numbers of people have adequate space for pedestrian movement and interaction?
Yes ☐ No ☐ Not sure ☐
3. Walking is a key to urban life because it is a healthy and pollution-free form of mobility and recreation. Do you think Addis Ababa has complete, safe, and publicly accessible pedestrian networks?
Yes ☐ No ☐ Not sure ☐
4. Walking is a dominant mode in Ethiopian cities, and public transport trips also start and end on foot. As a healthy and pollution-free form of mobility and recreation, walking is a key to urban life. Do you think the city has a complete Pedestrian network, publicly accessible walkways where all destinations are connected to each other and protected from vehicle traffic?
Yes ☐ No ☐ Not sure ☐
5. Good footpaths promote safe and comfortable pedestrian mobility. Do you think the city has walkways which are accessible to all users, regardless of age, gender, or special needs?
Yes ☐ No ☐ Not sure ☐
6. In Ethiopia context, do you think there are crossings that are spaced at more frequent intervals in busy commercial areas?
Yes ☐ No ☐ Not sure ☐
7. In Ethiopia context, do you think there are sufficient and convenient pedestrian footbridges or tunnels in the city?
Yes ☐ No ☐ Not sure ☐

8. Well-designed bus stops offer a comfortable, weather-protected waiting area for public transport passengers while leaving clear space for pedestrian movement behind the shelter. Do you think the city's bus stops are determined considering the land use, street network, and existing passenger behavior?

Yes ☐ No ☐ Not sure ☐

9. Well-designed street lighting enables motor vehicle drivers, cyclists, and pedestrians to move safely and comfortably by reducing the risk of traffic crashes and improving personal safety. Do you think such infrastructures are provided at convenient places on the walkways?

Yes ☐ No ☐ Not sure ☐

10. Valuable street space should be used for wider walkways, trees, cycle tracks, cycle parking, vending, and social gathering space rather than parking. Do you agree that on-street parking should be allowed on streets where all the other requirements for public transport and non-motorized travel have been met?

Yes ☐ No ☐ Not sure ☐

Thank you very much for your kind cooperation and assistance!!!

Publishable Article

Identifying the key challenges that affect pedestrian movement in Bole Sub city of Addis Ababa City Administration, Ethiopia.

Melisew Andarge^{a}, Birhanu Girma^b*

^{a} Ethiopian Institute of Architecture, Building Construction and City Development (EiABC), Addis Ababa University,*

Email:melisew@yahoo.com

^b Ethiopian Institute of Architecture, Building Construction and City Development (EiABC), Addis Ababa University

P.O. Box 518, Addis Ababa, Ethiopia,

E-mail: mesi.bire@gmail.com

Abstract

Despite the advantage of walking mode of transport, there are no standard pedestrian facilities not only in quality but also in capacity. Thus, pedestrian accidents are a serious and growing problem in the world, especially in the cities of low-income and middle-income countries. The aim of this study was to identify the key challenges that affect pedestrian movement in Bole Sub city of Addis Ababa City Administration, Ethiopia. Five points of Likert scale and descriptive statistics were used to answer research questions. Results indicate the key challenges affecting pedestrian movement are speed of vehicles, midblock of crosswalks, roadside vendors, obstruction on pedestrian movement & street parking. Lastly, while planning urban road facilities, pedestrian crossings should be given due importance and placed accordingly so that its impact does not affect the traffic flow to a higher level there by reducing the speed of traffic flow.

Keywords: *Bole Sub-city, Pedestrian, Roadside Vendors, Obstruction, Street Parking*

1. Introduction

Pedestrians account for a higher percentage of all traffic fatalities worldwide, and this percentage is particularly high in developing nations like Ethiopia. More persons are hurt when walking in traffic-related accidents due to inadequate pedestrian workability infrastructures, and some of them suffer lasting disabilities as a result. Families and loved ones suffer financially as well as emotionally from these occurrences. Walking is one of the main forms of transportation in Addis Ababa. Despite being valid users of the road, pedestrians are usually disregarded in the rush to cross the main thoroughfare. "A small amount of accessibility work has a significant impact on people's lives" (Yetnebersh, 2014). Creating improved safety and access for pedestrians requires providing safe places for people to walk, as well as implementing traffic control and design measures, which allow for safer street crossings and attractive sidewalk spaces (Litman, 2017).

Therefore, in recognition of the benefits of walking as a form of transportation, Addis Ababa is currently building and improving pedestrian facilities in various sub-cities, but it does not take into account how walkers perceive and behave in relation to their socioeconomic features and outside factors. Bole Sub-city pedestrians encounter a variety of difficulties, including social and accessibility issues in addition to problems with the physical infrastructure and traffic. When negotiating the pedestrian environment of the sub-city, people with disabilities, the elderly, and those with mobility limitations frequently encounter major obstacles. The lack of accessible infrastructure, such as ramps, tactile paving, and auditory signaling, further marginalizes these vulnerable populations and hinders their capacity to move freely and independently.

Moreover also rapid urbanization has put immense pressure on the city's transportation infrastructure, particularly for pedestrian movement. Many areas within Addis Ababa lack proper pedestrian facilities, such as well-designed sidewalks, crosswalks, and pedestrian bridges. Additionally, the encroachment of street vendors, parked vehicles, and other obstacles has further reduced the available space for pedestrians, forcing them to share the road with vehicular traffic. Hence, the sub-city's growth has outpaced the development of pedestrian infrastructure, leading to severe challenges for pedestrian movement and safety (ECPCC, 2007).

Furthermore, more often, pedestrian crashes are one of the major road safety problems in the world, especially developing countries, representing about 40% of total fatal crashes in low income countries and many pedestrian crashes in these countries occur at un-signalized intersections (Tulu et al., 2015). Thus, most countries in Africa have insufficient policies and strategies to protect vulnerable road users. As a result some studies depicted that the African Region has the highest proportion of pedestrian and cyclist deaths at 43% of all road traffic deaths. As Ethiopia is one of the developing countries, pedestrians account for 55% of fatal crashes per annum (WHO, 2009).

But, however, the problems of pedestrian movement in Bole Sub-city have far-reaching consequences that extend beyond the immediate safety concerns. They contribute to a lower quality of life for residents, discourage active transportation modes (such as walking and cycling), and hinder the sustainable development of the sub-city. Businesses and economic activities may also be negatively impacted due to reduced foot traffic and accessibility issues (EPCC, 2007).

The study area, a highly populated and quickly expanding part of Addis Ababa, is facing significant obstacles with regard to pedestrian safety and mobility. The sub-city's infrastructure has not kept up with its rapid urbanization, despite being a significant commercial and residential center. As a result, the pedestrian environment has become more hostile, unsafe, and unsustainable. The absence of proper pedestrian amenities, such as thoughtfully planned sidewalks, crosswalks, and pedestrian bridges, is among the most obvious issues. Existing sidewalks, where present, are often tiny, badly maintained, and frequently obstructed by street vendors, parked vehicles, or building debris. Because there aren't enough designated areas for pedestrians, they must share the road with cars, which puts them at higher risk of collisions and injury (EPCC, 2007).

Lastly, in order to support sustainable urban development, increase accessibility, and improve the area's general livability, it is imperative that the issues with pedestrian circulation. Hence, accordingly, this study intends to identify the key challenges that affect pedestrian movement in Bole Sub city of Addis Ababa City Administration.

2. Literature Review

2.1. Concepts of Pedestrian

One of the most significant non-motorized forms of transportation is walking (Jabbari et al., 2022). The earliest type of mobility is, in fact, pedestrian mobility, or walking. Humans had to use their own two feet to move from one place to another before the development of wheeled vehicles, animals for transportation, or even boats. As societies started to change, walking remained a crucial form of transportation. To make walking easier, the ancient Greeks, Persians, and Romans constructed networks of roads and walkways; some of these historic pathways are still in use today (Mohan, 2008; Khisty, 1994). In many parts of the world, a pedestrian network continued to be an essential means of transportation. The primary function of the pedestrian network is to provide mobility for pedestrians, allowing them to travel from one location to another on foot.

The bazaar complex, school, and neighborhood centers were among the primary urban elements and activities that comprised the pedestrian network, which served as the city's skeleton in Iranian cities (Buehler, 2011; Jabbari, Fonseca & Ramos, 2021). When the French army invaded Venice in 1797 and tried to construct a system to link the island groups by canals, the idea for the pedestrian network was born (Vivo, 2016). They constructed canals, bridges, and pathways in an effort to turn the amphibious metropolis into a uniform pedestrian network. According to De Vivo (2016), the pedestrian network in sixteenth-century Venice was shaped by the daily practice of walking.

2.2. Pedestrian Needs

According to Mateo-Babiano (2016), pedestrians typically base their walking route choice on a variety of influencing factors, including their socio demographic traits, which include gender, age, and economic level. In addition, their decision to choose a specific route may also be influenced by the goal and frequency of their walk trips—basically, their travel characteristics. According to Mateo-Babiano (2016), two of the variables in his study—socio demographic and travel characteristics—are fixed and hence unchangeable, whereas the third category of variables—the features of the outside walking environment—can be altered. After evaluating the good and negative features of the route, walkers will determine whether or not to stroll within the

walking environment based on these environmental attributes and how well they meet their needs as pedestrians.

2.3. Theories of Pedestrian Behavior and Route Choice

Theory of Planned Behavior (TPB): The TPB (Elvik.R, 2009) is a widely used theory in social psychology that explains human behavior through three key factors: attitudes, subjective norms, and perceived behavioral control. In the context of pedestrian behavior, the theory suggests that an individual's intention to walk and their route choice are influenced by their attitudes towards walking (e.g., perceived benefits, convenience, enjoyment), subjective norms (e.g., social pressures, societal expectations), and perceived behavioral control (e.g., perceived ease or difficulty of walking, availability of infrastructure). The TPB has been applied in various studies to understand and predict pedestrian behavior, and it can inform interventions to encourage more walking.

2.3.1. Utility Maximization Theory

This theory, rooted in economics and decision theory, assumes that individuals make choices that maximize their perceived utility or satisfaction. In the context of pedestrian route choice, utility maximization theory suggests that pedestrians select routes that optimize certain factors, such as minimizing travel time, distance, or effort, and maximizing safety, comfort, and environmental quality (Forkisch, H,2015). Utility functions can be developed to model pedestrian preferences and trade-offs between different route attributes, providing insights for urban planning and infrastructure design.

2.3.2. Pedestrian Route Choice Models

Building upon utility maximization theory, various models have been developed to predict pedestrian route choices based on various factors. For example, the shortest path model assumes that pedestrians choose the shortest route, while the least effort model considers factors such as slope, surface quality, and obstacles (John, 2000). Other models incorporate safety considerations, environmental preferences, and cognitive factors like familiarity and wayfinding (HCM, 2010). These models can be used to simulate pedestrian movements, assess the performance of pedestrian networks, and inform design decisions.

2.4. Factors Influencing Pedestrian Mobility and Accessibility

2.4.1. Physical Barriers and Obstructions to Pedestrian flow

Imagine a bustling city street, where pedestrians of all ages and abilities navigate the urban landscape. However, their journey is often hindered by a multitude of physical barriers and obstructions that disrupt the flow of pedestrian movement. One of the most significant challenges is the lack of continuous and well-maintained sidewalks. Uneven surfaces, cracked pavement, and narrow pathways can pose a tripping hazard, especially for those using mobility aids or pushing strollers. Additionally, the absence of pedestrian crossings or poorly designed crosswalks forces pedestrians to navigate busy intersections with little regard for their safety. Traffic-related barriers further exacerbate the situation. High-volume and high-speed vehicular traffic creates an intimidating and dangerous environment for pedestrians. The lack of adequate buffer zones between pedestrians and vehicles heightens the sense of vulnerability, deterring many from choosing to walk (Zegeer C V., 2012).

Environmental barriers, such as steep slopes or changes in elevation without ramps or alternative routes, can make certain areas virtually inaccessible for individuals with mobility impairments. Inadequate lighting or visibility issues at night can also discourage pedestrian activity due to safety concerns. Temporary obstructions, such as construction sites, parked vehicles blocking sidewalks, or accumulated litter and debris, present unexpected obstacles that force pedestrians to navigate around them, often into the path of vehicular traffic. These obstructions can be particularly challenging for those with visual impairments or mobility limitations. Land use patterns and urban form can also create barriers to pedestrian flow. Fragmented land use patterns with large blocks and limited pedestrian permeability discourage walking by creating circuitous routes and increasing travel distances. The prevalence of pedestrian-unfriendly land uses, such as industrial areas or large parking lots, further contributes to an uninviting and hostile environment for pedestrians. Overcoming these physical barriers and obstructions requires a concerted effort from urban planners, policymakers, and community stakeholders. Investing in infrastructure improvements, enforcing regulations, and promoting pedestrian-friendly design can create a more accessible and inclusive urban environment for all (Redi, K., 2015).

2.4.2. Connectivity, Directness and Integration of Pedestrian Networks

Imagine a city where pedestrian networks are seamlessly woven into the urban fabric, providing efficient and convenient routes for residents to navigate their daily lives on foot. This vision of a well-connected and integrated pedestrian network is crucial for promoting pedestrian mobility and accessibility. At the heart of this concept is the idea of connectivity – the degree, to which pedestrian pathways are interconnected, allowing for multiple route choices and minimizing detours. Frequent intersections and pedestrian cut-through create a web of pedestrian routes that cater to the diverse needs and a destination of the community. Equally important is the directness of these routes. Pedestrians value efficiency and convenience, and routes that provide the most direct path between origins and destinations are more likely to be utilized. Unnecessary detours or circuitous routes not only increase travel times but can also discourage pedestrian activity altogether (Jena, 2014).

2.5. Accessibility for Special Needs Populations (Disabled, Elderly, Children)

In a truly inclusive and equitable city, pedestrian mobility and accessibility are not luxuries reserved for a select few but a fundamental right for all residents, regardless of their age, ability, or circumstance. Consider the challenges faced by individuals with disabilities as they navigate the urban landscape. Simple tasks like crossing the street or entering a building can become daunting obstacles when pedestrian infrastructure lacks accessibility features. The provision of ramps, tactile paving, and curb cuts can mean the difference between independence and isolation for those using wheelchairs or those with visual impairments. Ensuring adequate crossing times and refuges at intersections are also crucial for accommodating slower walking speeds and mobility limitations. Integrating audible and tactile cues for navigation and way finding can further empower these individuals to navigate their environment with confidence and ease (Kim, 2014).

For the elderly population, the challenges of pedestrian mobility and accessibility may be more subtle but no less significant. Well-maintained and level surfaces free of trip hazards can prevent falls and injuries, while adequate seating and resting areas along pedestrian routes can provide much-needed respite for those with limited endurance. Prioritizing pedestrian safety and traffic calming measures in areas with high elderly populations can also contribute to a sense of security

and encourage more active lifestyles among this vulnerable group. Children and families represent another special needs population with unique requirements for pedestrian accessibility. Safe and accessible routes to schools, parks, and other destinations frequented by children are paramount. Traffic calming measures and pedestrian safety features in residential areas and near schools can provide parents with peace of mind, promoting healthy and active lifestyles for their children.

3. Methodology

3.1. Introduction

Research methodology was a way to systematically solve the research problem. It might be understood as a science of studying how research was done scientifically and included various steps that were generally adopted by a researcher in studying his research problem along with the logic behind them (Kothari, 2004). This chapter discussed how to do the study with appropriate methods, which comprised the research technique, method, sampling design, sources of data, how to gather data from the target population, investigate and present the analyzed data, so that enabled the researcher to address the research objectives.

3.2. Description of the study Area

This study was focused on the assessment of the major problems of pedestrian movement in Addis Ababa: The case of Bole sub-city and limited only on Bole sub-city. Bole Sub-City was one of the eleven Sub-Cities of Addis Ababa, the capital of Ethiopia with a total population of 328,900 of which 161,458 are male and 167,442 female. The Sub-city covered a total of 122.08 Km² (CSA, 2007) and consisted 11 Wereda's. The district was located in the south-eastern suburb of the city. It borders with the districts of Yeka, Kirkos, Nifas Silk-Lafto and Akaky Kaliti. Taking all the above facts about the city and study area in to consideration, the researcher was interested to contribute her share for the city's growth by conducting research. The sub-city was responsible for the administrative and political activities.

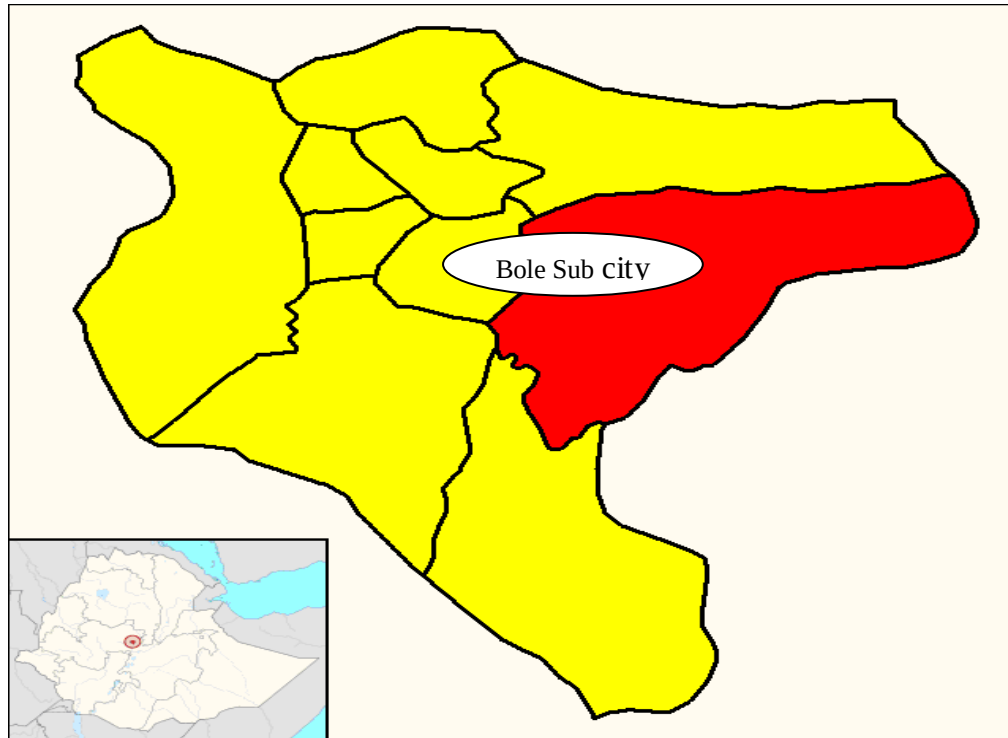


Figure 1: Map of the study area (shown in red color)

Source: Own work, 2025

3.2.1. Selected area

Based on the existing and manifestation of the challenges, Goro & Megenagna Area Street were selected purposively. Each area has its own distinct features such as land use and pedestrian walking type.

3.3. Research Design

This article followed the descriptive research design by using cross sectional survey strategy. The reason why this study selected descriptive type of research design was to identify and clearly describe the Major Challenges of Pedestrian Movement in Addis Ababa: The Case of Bole Sub-City. The choice of cross sectional design was allowed researcher to collect data from participants in more economical way (Mugenda, 2003).

3.4. Research Approach

The methodology conducted in this study was statistical analysis; the data were used to show the present pedestrian level of services of the road segments in Bole sub-city, Addis Ababa. A research instrument for this study was designed for quantitative methods. Besides, it tested and quantified data from the questionnaires brought the research questions and literatures review together. Moreover, this study was employed survey research strategy & consequently it was employed quantitative research approach to deal with sample of population to study its characteristics

3.5. Sampling technique and procedure

3.5.1. Target Population

According to Amin (2005), a target population was the population to which the researcher ultimately wanted to generalize the results. The research was covered pedestrian users such as pedestrian road movement on the selected segments with the number of people with disabilities needs special built up environment.

3.5.2. Sampling Technique

The sampling technique that employed for this study was non-probability sampling since the respondents didn't have an equal chance of being selected. In this regard, some literatures also reinforced the reason and advantages of purposive sampling, in such a way that “purposive sampling was a useful sampling method which allowed a researcher to get information from a sample of the population that one thinks knows most about the subject matter,” (Walliman, 2005). Thus, the method of sampling was based on the areas where pedestrian movement was reasonably complicated. These are the market area, commercial area, education area and residential area roadway segments in Bole sub-city. To use this technique researcher was selected cases that researcher thinks that was best achieve research objectives of the study (Saunders, Lewis & Thornhill, 2009).

3.5.3. Sample Size

Sample size is a representative sample of the target population & the sample size for this study is determined by using the formula developed by (Cochran, 1963, p. 75) .The sample size is

affected by variability of population, degree of precision and population size. The sample size required for questionnaire should have always greater than direct field data because the reliability and accuracy is lower than observational and field measurement data. Sample size from the respondents is calculated as follows:

$$N_0 = Z_{\alpha/2}^2 * p * (1-p) / MOE^2$$

$$N_0 = (1.96)^2 (0.5) (0.5) / (0.05)^2$$

$$N_0 = 3.8416 * 0.25 / 0.0025$$

$$N_0 = 0.9604 / 0.0025$$

$$N_0 = 384$$

$Z_{\alpha/2}$ is the critical value of the Normal distribution at $\alpha/2$ (for a confidence level of 95%, α is 0.05 and the critical value is 1.96) when the population is large and unknown. The value for Z is found in statistical tables which contain the area under the normal curve. MOE is the margin of error P is the sample proportion and N_0 is the sample size assumed.

3.6. Types of data

The types of data for this study were both primary and secondary data. The primary data for this study was collected through questionnaires, field investigation (actual field observations), and pedestrian count (volume) data. Whereas, secondary data were collected from the secondary sources such as different reports, literatures, working papers, articles and published and unpublished researches which conducted in the same area was relevant sources to secondary data.

3.7. Data collection Methods

The primary instrument for data collection in this research was designed through structured questionnaires. In the questionnaires, the researcher was provided a list of answers for respondents from which to choose and respondents only needed to choose the answer/s given in the questionnaires and it was required less time to complete. Questionnaires were enabled this study to more easily to identify and describe the major problems of pedestrian movement.

3.8. Methods of Data Analysis

After all required data were collected, coded, screened and processed, data analyses were made by using descriptive(case reports and case series, cross sectional study) and inferential statistics. The data collected via a questionnaire was analyzed quantitatively using (SPSS Vs 20.0) and was presented in the form of a table.

3.9. Specific Method

In order to understand the major challenges of pedestrian movement at Bole sub-city, pedestrians were asked to give their level of agreement to statements with regard to the given variables. Pedestrians rating in five points of Likert scale were then analyzed with descriptive statistics of mean and standard deviation. Hence, the mean indicates to what extent the sample group on average agrees or disagree with the different statements. According to Marczyk, Dematteo and Festinger (2005), the lower the mean, the more the respondents disagree with the statements. The higher the mean, the more the respondents agree with the statement. According to Zaidatol and Bagheri (2009) the mean score below 3.39 is considered as low; the mean score from 3.40 up to 3.79 is considered as moderate and mean score above 3.8 is considered as high.

3.10. Reliability & Validity

3.10.1. Reliability

The reliability test was an essential instrument to measure the degree of consistency of an attribute which will be supposed to measure. As stated by Mahon (2008) the less variation of the instruments produces in repeated measurements of an attribute the higher its reliability. Reliability could be equated with the stability, consistency or dependability of a measuring tool.

3.10.2. Validity

The validity test was an important term in research that refers to the conceptual & scientific soundness of a research study. Its primary purpose was to increase the accuracy & usefulness of the findings by eliminating or controlling as many confounding variables as possible, which was allowed for greater confidence in the findings of a given study (Marczyk et al., 2005). It is measured the internal consistency of the items in a scale. A computed alpha coefficient ranged between 0 to 1 (0 denoting no internal consistency & 1 denoting perfect internal consistency) & the higher values reflect the higher degree of internal consistency

3.11. Ethical issues

The researcher enumerated on how privacy and confidentiality concerned were approached and was sensitive to not only how information was protected from unauthorized access, but also if and how participants were going to be notified of any unforeseen findings from the research that they were not meant to know. To give clarity of the idea all the necessary information regarding ethical issues in seeking consent, avoiding deception, maintaining confidentiality, respecting the privacy, and protecting the anonymity of all respondents were stated on the questionnaire.

4. Results

4.1. Introduction

This chapter contained summaries of the data collected, analyzed & the findings on the major challenges of pedestrian movement in Addis Ababa in the case of Bole sub-city. In order to make all the collected data suitable for the analysis, all questionnaires were screened to be completed. But, all returned incomplete questionnaires were therefore considered as errors & has to be removed from the surveyed data. That means, out of 384 distributed questionnaires, sixty (60) of them was incomplete. Thus, a total of 324 complete questionnaires were used for this article in order to be analyzed. Furthermore, descriptive & analytical methods were implanted to analyze Likert scale items & variables of major challenges of pedestrian movement via observation by walking along the foot path & document reviews.

4.2. Response rate of Questionnaires

Table1:- Response rate of respondents

Respondents	Questionnaires					
	Distributed		Returned		Unreturned	
Bole Sub city residents	Frequency	%	Frequency	%	Frequency	%
	384	100	324	84	60	16

Source: Surveyed data, 2024

Regarding the response rate of respondents as shown in table 4.1 above, 384 questionnaires were distributed & 334 were filled properly & returned with the rate of 84%. Based on this, i.e. 324 (84%), the next analysis was conducted. This response rate is excellent and confirms to Mugenda

(2003), stipulation that a response rate of 50% is adequate for analysis and reporting; a rate of 60% is good and a response rate of 70% and over is excellent.

4.3. Factors that Challenges a pedestrian movement practices

In order to identify the major challenges of pedestrian movement at study area, pedestrians were asked to give their level of agreement to statements with regard to the given variables. Pedestrians rating in five points of Likert scale were then analyzed with descriptive statistics of mean and standard deviation. Hence, the mean indicates to what extent the sample group on average agrees or disagree with the different statements According to Marczyk, Dematteo and Festinger (2005), the lower the mean, the more the respondents disagree with the statements.

The higher the mean, the more the respondents agree with the statement. According to Zaidatol and Bagheri (2009) cited in (Wogari, 2016) the mean score below 3.39 is considered as low; the mean score from 3.40 up to 3.79 is considered as moderate and mean score above 3.8 is considered as high. Therefore based on data obtained from respondents the challenges that affects pedestrians movement are speed of vehicles, midblock of crosswalks, roadside vendors, obstruction on pedestrian movement & street parking as presented each of them in the following tables.

4.3.1. Speed of Vehicles

Table 2: Variables related to speed of vehicles

Speed of Vehicles	N	Mean	Std.
Motorist yielding behavior	324	4.79	0.879
Impact of motorist behavior on pedestrian safety.	324	4.37	0.985
Unsafe behaviors of the vehicle drivers	324	4.65	0.914
Pedestrians' decisions to accept or reject gaps in traffic for crossing	324	4.42	0.965
Average mean	324	4.56	0.936

Source: Survey SPSS output, 2024

As revealed on table 2 above, the mean ranges from 4.17 –4.59 with the SD of 0.879 –0.985. From this the researcher assured that the speed of vehicle with respect to pedestrian movement was found to be a common challenge with a mean score of 4.34 which was the highest agreement responded from pedestrians. This means that Bole sub-city has practiced the highest practicing

vehicular speed. From the analysis, it can be concluded that inaccurate estimation of vehicle speed may lead to more dangerous street-crossing decisions, thus it is important to explore the ability of pedestrians to accurately estimate vehicle speed while crossing streets.

4.3.2. Midblock of crosswalks

Table 3: Variables related to midblock of crosswalks

Midblock of crosswalks	N	Mean	Std.
Crosswalks that provide pedestrians with safe crossing	324	3.34	0.638
Crossings that allow pedestrians a formally designated place	324	3.21	0.798
Walkways where all destinations are connected to each	324	3.29	0.724
walkways that are spaced at more frequent intervals	324	3.19	0.817
Average/mean	324	3.26	0.745

Source: Survey SPSS output, 2024

As the survey results have shown on table 3 above, the mean ranges from 3.19 - 3.34 with the SD of 0.638 –0.817. From this the researcher guaranteed that the mid-block of crosswalks with respect to pedestrian sidewalk was found to be a common challenge with a mean score of 3.26 which was the lowest agreement responded from pedestrians & implied no Mid-block crosswalks facilities were found in the sub-city in general & thus would increase the pedestrian risk at crossing. But, however, crossing area facilities has a significant influence on pedestrian safety as pedestrians and drivers react differently under different situations. Besides during the field investigation, lack of leading pedestrians to crossing areas & no leveled cross walked around crossing area were observed. Thus, pedestrians were restricted by physical boundaries around them. But, however, when crosswalk markings or controls are used, more pedestrians significantly use the crossings than at other unsanctioned locations.

4.3.3. Street parking

Table 4: Variables related to Street Parking

Street Parking Variables	N	Mean	Std.
There is parking on the sidewalk	324	448	0.798
On the pedestrian walkway, there is abandoned old car left	324	423	0.893
there is no footpath pedestrian walk way	324	489	0.683
Average/mean	324	453	0.792

Source: Survey SPSS output, 2024

As indicated on table 4 above, the mean ranges from 4.23 –4.89 with the SD of 0.683 –0.893. From this the researcher deduced that street parking with respect to pedestrian sidewalk was found to be a common challenge with a mean score of 4.53 which was the greatest agreement resulted from pedestrian respondents of Bole sub-city residents. But, however, the impact of on-street parking on traffic performance can be significant and might lead to various problems for urban areas particularly on pedestrian side walk. Even though, some pedestrian walkways were paved with cobblestones, the presence of old vehicles left on pedestrian walkway environment obstructs the movement of pedestrians permanently. In summary, in Bole Sub-city, Megenagna area, temporary on street parking is legally allowed although this action adversely impact pedestrian movements.

4.3.4. Obstructions on pedestrian sidewalk

Table 5: Variables related to obstructions on pedestrian sidewalk

Obstructions on pedestrian sidewalk	N	Mean	Std.
Littering on pedestrian walkway	324	4.78	0.846
Putting partial garbage storage on pedestrian walkway	324	4.63	0.983
Unlimited Digging sidewalks and putting building tools	324	4.99	0.739
Average/mean	324	4.80	0.856

Source: Survey SPSS output, 2024

As revealed on table 4.6 above, the mean ranges from 4.63 –4.99 with the SD of 0.739 –0.983. From this the researcher identified that obstructions on pedestrian with respect to aside walk as found to be a major challenge with a mean score of 4.80 which was the strongest agreement indicated from pedestrian dwellers. Therefore, the assessment of obstructions is essential to determine the access available to pedestrians. Thus, the current walkways in Bole sub-city entirely encroach especially in market and commercial areas by illegal construction materials. These segments are not comfortable in general, and it is right to say no walkway in Bole sub-city market areas and shopping areas because the behaviour of vendors in the sub-city always seen by using only on the sidewalk even where the space available. But filling a sidewalk with obstructions can be highly detrimental to pedestrian trying to use the sidewalk for its intended purpose. Accordingly, the field survey outcome showed that the presence of rubbish dumped on

pedestrian walkways by (individuals), temporary garbage storage on pedestrian walkways by government employees and unlimited excavation and construction materials dumped on pedestrian walkway were taken into the major challenges in pedestrian side walk.

4.3.5. Road-side Venders on pedestrian sidewalk

Table 6: Variables related to Road-side Venders

Road-side Venders on pedestrian sidewalk	N	Mean	Std.
Temporary roadside vendors	324	4.99	0.898
Permanent roadside vendors	324	4.38	0.928
Average/mean	324	4.69	0.913

Source: Survey SPSS output, 2024

As displayed on table 4.5 above, the mean ranges from 4.38 –4.99 with the SD of 0.898 –0.928. From this the researcher assured that the roadside venders with respect to a side walk as found to be a major challenge with a mean score of 4.69 which was the highest agreement responded from pedestrian of Bole sub-city. Furthermore, from the field observations and field survey, the major problems associated with pedestrians were the ever-increasing number of road-side vendors operating on sidewalks and on the streets. Consequently, there is intense struggle for space between the traders and the pedestrians are therefore, forced to walk on the streets, resulting in conflict of vehicular and pedestrian traffic. At Goro area, there were a high number of pedestrian congestions where there is also public transport terminal; Sheger bus, Anbessa bus and taxi stations. The numbers of road-side vendors were large and make walking very complex.

5. Discussion

The pedestrians forced to use the carriageway in either of the two cases; one the pedestrian facility is fully encroached and another in the absence of a pedestrian facility. It encroached the facilities studied is a measure of the number of obstructions per kilometer on the path being assessed. Assessment of this factor is essential to determine the access available to people with disabilities. Obstructions tend to influence pedestrian movement and reduce the effective walkway width. The study done by the Addis Ababa city Transport Planning and Management Office (2016), and the result of this article define the effective walkway width as the difference between potential walkway width and total walkway width. The effective walkway widths were reduced by different obstructions like; rubbish deposition, on street parking, on street vendor's

activities, vegetables grown on pedestrian walkways, poor drainage facilities and improperly placed roadside infrastructures. Therefore, the assessment of obstructions is essential to determine the access available to pedestrians. In a residential area, parking lot and illegal construction materials are challenging the pedestrians on a sidewalk as an obstruction, and it needs to consider by neighbor authorities to maintain and to take legal actions for further user safety. According to (WHO,2009) and the result of this study the traffic simulation results showed that on-street parking resulted in a 32% increase in average delay time and a 24% reduction in speed.

6. Conclusion

The main objective of the study was to examine the major challenges of pedestrian movement in Addis Ababa, particularly in Bole sub-city. To achieve the aforementioned objective of the study, the researcher used quantitative research approach & a descriptive research design. To select a representative sample population of the study participants, a non-probability sampling technique of purposive sampling was used and self-administered questionnaires were carefully developed from previous related studies and evenly distributed during the study period.

Pedestrian is one of the important component in urban transportation system and also vulnerable at unprotected mid-block locations under mixed traffic conditions. At unprotected mid-block locations, some of the vehicles may yield to pedestrians who are already at crosswalk location. However, some of the pedestrians are using forced gaps to cross the road. Hence, while pedestrians use the mid-block crosswalk with forced gaps, which decreases the vehicular flow characteristics. Besides poor design of pedestrian facilities can lead to endless problems and can discourage the pedestrians due to a feeling of unselfishness, unprotected, or uncomfortable. So, the needs of the pedestrian should be considered in the design of urban environments and transportation facilities.

The study results show that the pedestrian walking paths being in very bad conditions and some road segments has no footpaths; the conditions of available walking paths were poorly maintained, there were severe walkways damaged by erosions and closed by obstructions. Most of the Bole Sub-city core streets do not have adequate pedestrian access, despite the fact that walking takes the lion share of passenger movements. And pedestrians are encouraged to walk

when there are nice walkway connections between attractive places like parks, shopping centers, transit bus stops and other public service centers. However, the study result showed that there exists a very poor pedestrian walkway network at Goro and Megenagna area.

In general major problems of the current on-street parking facilities in Bole sub-city were: lack of sufficient parking spaces, lack of sufficient off-street parking leading to street parking, blocking of personal business centers by parking in front of their shops and offices; and risk of insecurity and theft of vehicle parts while parking, double parking on prohibited spaces due to lack of proper parking places results in road congestions, accidents during maneuvers of car. In conclusion, the existing parking places in the study area are not adequate to accommodate the existing demand leading to resource wastage and traffic congestion.

7. Recommendations

The following points are recommended for local stakeholders:

1. Pedestrian facilities like crosswalks, sidewalks, Curb ramps and the like should be well designed and maintained to be useful for both encouraging people to walk and improve pedestrian safety along specific routes.
2. Construction of off-street parking in different zones of the sub-city should be encouraged and information regarding parking availability information has to be provided to the public.
3. While planning urban road facilities, pedestrian crossings should be given due importance and placed accordingly so that its impact does not affect the traffic flow to a higher level there by reducing the speed of traffic flow

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