Challenges For Urban Transport And Looking Forward For NMT In The Case Of Addis Ababa, Nifas Silk Lafto Sub-City

Betelhem Abnet Assefa

A Master's Thesis Submitted to the Department of Architecture

School of Civil Engineering and Architecture

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

Office of Graduate Studies

Adama Science and Technology University

Adama, Ethiopia

Apr; 2023

Challenges for urban transport and looking forward for NMT in the case of Addis Ababa, Nifas Silk Lafto Sub-city

Betelhem Abnet Assefa

Advisor: Prof. Samson Kassahun

A Thesis Submitted to the Department of Architecture

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

Office of Graduate Studies

Adama Science and Technology University

Adama, Ethiopia

Apr; 2023

APPROVE OF BOARD OF EXAMINERS

I, the advisor of the thesis entitled “Challenges for urban transport and looking forward for NMT in the case of Addis Ababa, Nifas Silk Lafto Sub-city” and developed by Betelhem Abnet Assefa, hereby certify that the recommendation and suggestions made by the board of examiners are appropriately incorporated into the final version of the thesis.

Prof. Samson Kassahun ---------- ----------

Major Advisor Signature Date

We, the undersigned, members of the Board of Examiners of the thesis by Betelhem Abnet Assefa have read and evaluated the thesis entitled “Challenges for urban transport and looking forward for NMT in the case of Addis Ababa, Nifas Silk Lafto Sub-city” and examined the candidate during the open defense. This is, therefore, to certify that the thesis is accepted for partial fulfillment of the requirement of the degree of Master of Science in Urban Planning and Design.

---------- ---------- ----------

Chairperson Signature Date

---------- ---------- ----------

Internal Examiner Signature Date

---------- ---------- ----------

Eternal Examiner Signature Date

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

_____ _____ _____

Chairperson Signature Date

_____ _____ _____

Internal Examiner Signature Date

_____ _____ _____

External Examiner Signature Date

DECLARATION

I hereby declare that this MSc Thesis entitled “Challenges for urban transport and looking forward for NMT in the case of Addis Ababa, Nifas Silk Lafto Sub-city” is my original work. That is, it has not been submitted for the award of any academic degree, diploma, or certificate in any other university. All sources of materials that are used for this thesis have been duly acknowledged through citation.

Betelhem Abnet Assefa ---------- ----------

Name of the Student Signature Date

RECOMMENDATION

I, the advisor of this thesis, hereby certify that I have read the revised version of the thesis entitled "Challenges for urban transport and looking forward for NMT in the case of Addis Ababa, Nifas Silk Lafto Sub-city" prepared under my guidance by **Betelhem Abnet Assefa** submitted in partial fulfillment of the requirements for the degree of Masters of Science in "**Urban Planning and Design"**. Therefore, I recommend the submission of the revised version of the thesis to the department following the applicable procedures.

Prof. Samson Kassahun	----------	----------
Major Advisor	Signature	Date

Acknowledgment

First and foremost, I want to express my heartfelt gratitude to the almighty God, who provides me with strength and knowledge at every stage of my life and throughout the whole research time. Next, I'd like to express my gratitude to my adviser, Professor Samson Kassahun, for his divine advice, academic guidance, suggestions, and never-ending feedback. His genuine manner motivates me to finish my academics. Finally, I would like to thank my family members for their encouragement and support during my education and research periods.

Acronyms

AATDP - Addis Ababa transport development plan

CPI - Centre for Public Impact

EV - Electronic vehicle

ITDP - Institute for transportation and development policy

LOS - Level of service

MOT – Ministry of transport

NMT - Non-motorized transport

OCASI - Ontario council of Agencies serving immigrants

PMV - Personal motor vehicles

UN - United Nation

VKT - Vehicle kilometers traveled

Abstract

Transport is key to the growth of the community because it connects inhabitants to schools, markets, housing, recreation, health care, and other vital services. Nowadays, developing nations rely far more on automobiles than industrialized countries. And, as the use of motorized transport grows in developing nations, there are social, economic, and environmental issues that must be addressed. Access to a safe, efficient, and sustainable transportation system is a challenge in Addis Ababa. The study area is located on Woreda two (from Jomo one to Mekenisa road). The distance between Jomo 1 and Mekenisa is 4.1 kilometers. The site contains four nodes: Jomo1, Mikael, Germen Square, and Mekenisa. The primary goal of this research is to investigate the challenges of sustainable urban transport in Addis Ababa city administration, Nefas Silk Lafto sub-city, woreda 2, from Mekenisa to Jemo road, and to develop an alternative solution for sustainable urban transport by using various methods, approaches, and techniques. based on road users' comments, the research of problems for sustainable urban transportation suggests that this road is challenging and requires a solution to establish a sustainable urban transportation system in the study region. To provide an economically, ecologically, and socially sustainable transportation system, an appropriate combination of public transit, motorized autos, and non-motorize transport must be used. The study area faces a lot of challenges like, there high traffic congestion, inadequate mode of transportation especially non-motorized transport system, and also several transport challenges are observed from Mekenisa road to Jemo road. the research identify the challenges by using various methods for sustainable urban transport based on road users' responses reveals that this road is difficult and requires a solution to develop a sustainable urban transportation system in the study area. And NMT offers various advantages in terms of reducing urban transportation challenges.

Keywords: Urban Addis Ababa, motorized transport, non-motorized transport, sustainable transport system, and transport, transportation.

Table of content

List of tables

List of figures

CHAPTER – ONE

Introduction

The challenges for urban transport are unpleasant and perverse. As society becomes wealthier, schooling or healthcare advances, but transportation issues will deteriorate (Pojani & Stead, 2015). Transport is critical to the community's growth because it connects residents to schooling, markets, housing, leisure, health care, and other essential resources. Improved mobility for the poor and disadvantaged communities, especially in developing-world cities, is one of the most significant prerequisites for achieving the Millennium Development Goals (Pardo et al., 2014).

Currently, many urban places like Addis Ababa are being more car-centric and less sustainable (Pojani & Stead, 2015). Today, most cities' transportation systems are no longer viable owing to a shortage of natural resources such as oil reserves, increasing the number of deaths and injuries caused by motor vehicle accidents and traffic congestion (Yazid et al., 2011).

According to the Ministry of Transport report in 2011 Considering Addis Ababa's rapid growth and the need for the transportation sector to perform its necessary role, the government has spent heavily on road construction in order to expand the road network and create a good transport system (Ministry of transport, 2011). But there are still challenges in order to creating a sustainable urban transport system in most parts of Addis Ababa city.

Sustainability is a system study that focuses on how environmental, economic, social, and cultural systems interact to mutual advantage at different spatial scales of operation (Yazid et al., 2011). A sustainable transportation system to make effective use of limited resources. This may be achieved by supporting non-motorized modes of transportation as well as fuel-efficient and environmentally friendly autos (United Nations, 2012).

In this research, it is planned to identify the problems for sustainable urban transportation as well as the benefits of NMT in order to alleviate urban transportation challenges. After identifying the issues and exploring the significance of NMT, it would be interpreted in light of the community's environmental, economic, and social challenges. This study is being carried out since no previous research has been undertaken on the chosen topic and region.

1.1 Background

Transport is an essential component that may play a major part in every society's economic and social growth. The main mode of transportation in Ethiopia is road transport, which has several challenges and is characterized by a relatively low degree of reliability. As a result, the available modes of transportation are extremely restricted and unappealing to users (Admasu, 2019). The period of the walking-horsecar era (1800-1890) was distinguished by the lack of urban mass transit, with individuals having access to destinations that could be reached (walked) in under 45 minutes (4 to 6 km). The horse car made its debut, paving the way for the creation of the first urban transit lines (Peter, 1986).

Urban transport refers to the movement of people and products inside metropolitan areas utilizing technology such as buses and railways. Globalization, urbanization, fiscal decentralization, and economic development have all contributed to the difficulties of urban transportation in metropolitan regions (Msigwa, 2013). Road transport is categorized into two main sub-categories: motorized and non-motorized modes. Pedestrians, animal- or human-pulled or driven carts, wheelbarrows, bicycles and tricycles, draught animals (horses, donkeys, camels, mules, elephants, etc.), and other hand-drawn vehicles are included in the non-motorized category (Aklilu, 2006).

Access to a safe, efficient, and sustainable transport systems is an issue for Addis Ababa city. Congestion is becoming a typical occurrence in numerous regions of the city as a result of a lack of constant concerted efforts by diverse stakeholders. The city's infrastructure is woefully inadequate to meet the city's growing travel demand (Weheyaga, 2019). While the route from Mekenisa to Jemo has good infrastructure, there is still considerable traffic congestion and other obstacles related to sustainable urban transportation concerns. These challenges are the main reason for the researcher to select the research area.

The Sustainable Cities Institute (SCI) identified five fundamental sustainability transportation principles: accessibility, affordability, connectivity, a comprehensive transportation strategy, land use planning, and environmental impact planning (Nottingham Trent, 2021).

The notable challenges for urban transport that Addis Ababa is currently facing include, long commuting, traffic congestion and parking difficulties, the inadequacy of public transport, difficulties for NMT, loss of public space, accident and safety, environmental and energy effects, land use, and the delivery of freight are the main issues facing urban transport (Msigwa, 2013).

To eliminate "transportation gaps," the transportation system must be connected and balanced. Gabriel Bouladon established the notion of a "transportation gap." Bouladon defined intrinsic service capability and contrasted it with demand. There are places where people travel but that are either too far away to walk or too close to drive to. In such instances, other modes of transportation should be made available, allowing the user to avoid either of the extreme modes of mobility-walking or driving (UN, 2012).

1.2 Statement of the problem

In urban transportation, both developed and developing countries face significant challenges. Nowadays, the urban community makes use of a wide range of urban transportation options. Motorized transportation is the most well-known, and more people utilize it than NMT. As a result, the community faces a variety of transportation challenges. The challenges of urban transportation have an impact on the day-to-day activities of the community and it has social, environmental, and economic impacts.

AATDP reports in 2020 Addis Ababa city's most serious transportation concerns are that due to lack of public transportation people have limited access to jobs, education, health care, and other services. Inadequate traffic signals, road signs, and markings, along with non - functional and inefficient aspects of existing ones, and no designated bus lanes or facilities for NMT, such as walking and bicycle infrastructure. Addis Ababa faces a number of urban transportation issues as a result of the current urban economic situation and the infrastructure of the private and public sectors in the transportation system. The most significant transportation difficulties arise when urban transportation networks are unable to appropriately meet the needs of urban mobility (Rodrigue, 2017).

There will not be a sustainable city if there are obstacles to urban transportation. If these issues are not addressed, there will be no accessibility or mobility in the city. Furthermore, the problems will have an economic, social, and environmental impact on the society. When there is

a problem with urban transportation, the community is more likely to have difficulties in their everyday activities. Addressing this problem will have a practical benefit for Addis Ababa city.

The purpose of this study is to examine the present challenges for sustainable urban transportation in Addis Ababa, Nefassilk Lafto Sub City Woreda 2. And to explore the significance of NMT for addressing the challenges for sustainable urban transportation in Addis Ababa Nefas silk Lafto Sub City woreda 2. The challenges for sustainable urban transportation will be identified by using qualitative methods and the researcher will collect data through surveys and interviews. Finally, the research will identify the challenges and potential alternatives by using different statistical analysis.

1.3 Research objective

1.3.1 General objective of the research

The main objective of this research is to identify the challenges for sustainable urban transport in Addis Ababa city administration, Nefas Silk Lafto sub-city, woreda 2 from Mekenisa to Jemo road.

1.3.2 Specific objective of the research

The specific objectives for this research are;

- To evaluate current transport system of the study area.
- To identify the major challenges for sustainable urban transport in the study area
- To explore other options of transport system in order to reduce the challenges for sustainable urban transport in the study area.
- To create awareness creation for the NMT.

1.4 Research questions

The research question of the thesis includes the challenges for sustainable urban transport and reducing the challenges by using further discussion and recommendations to address the challenges associated with the sustainability pillars. The following are research questions of the thesis:

- What are the evaluations of the study area's current transportation system?
- What are the challenges for sustainable urban transport in the study area?
- What is the importance of NMT in order to reduce the challenges for sustainable urban transport in the study area?

- How to create awareness creation for NMT?

1.5 Significance of the study

Based on problem identification and analysis by the researcher, the study would give thorough information on the urban transportation challenges that Addis Ababa is now facing. When the analysis is complete, it will identify the existing local research on the study title and allow other researchers to investigate further based on the current disparity, which is used to address urban transportation issues as well as future ideas or methods for improving urban transportation systems. In general, it would give a comprehensive understanding of the challenges for sustainable urban transportation as well as solutions to reduce the challenges for sustainable urban transport in Addis Ababa's Nefas Silk Lafto Sub-city.

1.6 Scope of the study

The purpose of this research is to identify current challenges and how to minimize them by expanding the promotion of NMT in Addis Ababa's Nefas Silk Lafto sub-city from Mekenisa to Jemo road. By using various methods, approaches, and techniques, the researcher will find out the potential solutions for the challenges.

Three months are allotted to complete the study. During this time, the researcher attempts to complete data collecting, data analysis, and the overall thesis report.

Site description

The site is in Addis Ababa, which is located at 9°1′48″N latitude and 38°44′24″E longitude. The city is located in the center of the country, at an elevation varying from 2,100 meters in the south at Akaki to 3,000 meters in the north at Entoto Hill (Socio-Economic Profile of Addis Ababa, 2012). The city has eleven sub cities, but the site is specified in one of them, Nefas Silk Lafto sub city woreda 2, which runs from Jomo 1 to Mekenisa. The distance between Jomo 1 and Mekenisa is 4.1 kilometers. The site contains four nodes: Jomo1, Mikael, Germen Square, and Mekenisa.

Figure 1 Location of the site

Source : (Jomo 1 Bus Station Google Maps, 2022)

1.7 Limitation of the study

The research would not be carried out without a challenge. There are various challenges for the research like finance, the Covid -19 diseases, the given time for the completion of the study and the current political situation of the country are the limitation for this study. During data collection period the researcher had difficulty to collect data from some respondents due to their low literacy level, which made it difficult for them to understand the questions, the nature of their work, which compels them to be either late for work or exhausted from work, as well as the long distance they commute to and from work.

1.8 Organization of the research

The research would be organized into five sections. The background of the study, the statement of the problem, the research questions, the General Objective, Specific Objectives, the Significance of the Study, the Scope of the Study, the Limitations of the Study, and the Organization of the Study are all included in Chapter One. The second chapter would feature a review of the extant literature on the challenges for sustainable urban transportation by researchers who have studied the subject. The research methodology would be covered in Chapter Three, which is divided into the following sections: research design and methodology, description of the study area, research, target population, sampling strategy, data collection tools and techniques, validity and reliability, and ethical considerations in the research. The fourth chapter would go through data analysis, presentation, and interpretation. The fifth chapter would provide a summary and discussion of the findings, as well as conclusions and recommendations.

CHAPTER - TWO

Literature review

2.1 Introduction

In this chapter, the researcher would address the major challenges for sustainable urban transport in developing countries and how they are challenging the urban environment. It would also briefly explain each major challenge of sustainable urban transport. This chapter would outline different methodologies that have been used on various projects, including their explanations, disputes, and their opinions.

2.2 Definition of terms

Urban transport

People's access to education, markets, work, entertainment, health care, and other important services is made possible by transportation. Improved mobility for the poor and disadvantaged people, particularly in developing global cities (Pardo et al., 2014). Transportation is a catalyst for economic and social growth and for environmental sustainability and economic stability, renewable transport is very important (Takiguchi & Mizuno, 2013).

Sustainability

In 1983, the United Nations nominated former Norwegian Prime Minister Gro Harlem Brundtland to oversee the new World Commission on Environment and Development.

Economic progress at the expense of environmental health and social fairness did not appear to lead to long-term success. It was evident that the world needed to find a method to balance environmental sustainability and economic growth (Mollenkamp, 2021).

According to Brundtland's report in 1987 sustainability, it is: "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (Kuhlman & Farrington, 2010).

Several sustainable development goals and objectives, particularly those linked to food security, health, energy, economic growth, infrastructure, and cities and human settlements, have been integrated into sustainable transportation (UN HABITAT,2021).

Traffic Level of Service

LOS is a useful strategy for designing and managing junction signal timing and crossing facilities. It has various quantifiable properties, and one of the most crucial elements that warrants additional investigation is the delay. A word used to qualitatively define the operational characteristics of a roadway based on factors such as speed, travel time, maneuverability, delay, and safety is called the LOS A facility's level of service is assigned a letter from A to F, with A denoting the best operational circumstances and F denoting the worst.

2.3 Theoretical literature review

2.3.1 sustainable urban transport

A sustainable transportation system should guarantee that scarce resources are used efficiently. This may be accomplished by increasing the use of NMT and promoting fuel-efficient and green automobiles (United Nations, 2012). There is now a better grasp of the need to create more sustainable urban transportation and land-use systems, as well as the policies that are required to do so. The European Conference of Transport Ministers, on the other hand, has noted institutional, acceptability, financial, information, regulatory, and process challenges to their implementation (May 2008). The transportation system is made more efficient for both the suppliers and the customers by encouraging public transit and non-motorized mobility (United Nations, 2012).

2.3.1.1 Elements of sustainable urban transport

Elements of sustainable urban transportation are components that help to build sustainable urban transportation by relying on the sustainability pillars. The following components are major elements of sustainable urban transport.

Fuel economy

The community can achieve the same distance while emitting fewer emissions by increasing fuel economy. This is accomplished by making engines more efficient, cars lighter, and body shapes more aerodynamic (Wilson, 2013).

Occupancy

Occupancy means decreasing carbon emissions by taking buses instead of Bajaj or small-sized vehicles. If there is a high occupancy rate, carbon emissions will be reduced (word press, 2013).

Electrification or solar-based technologies

Electrifying the transportation system provides a number of advantages, including increased fuel portfolio diversity, reduced dependency on fossil fuels, lower total cost of ownership, and greater pricing stability. Furthermore, it supports national security, energy independence, and a cleaner environment (Narayan, 2018). Solar-based technologies are important technologies that reduce carbon emissions by using natural resources (Affenzeller, et al., 2017).

Cycle based (pedal power)

Bikes have clear speed and distance constraints, but they are hard to surpass in terms of carbon emissions for short excursions in regions with strong infrastructure. They also work well with public transportation, such as intercity trains (Wilson, 2013).

Urbanization

Urbanization refers to the process by which people migrate from rural to urban regions, as well as the "gradual growth in the proportion of people living in urban areas" and the methods in which each culture adapts to the change (Paul & Comfort, 2018). Each of the first four aspects listed above relates to reducing transportation's carbon intensity. However, emissions are a result of both how and how far we travel. The tendency toward urbanization is one element that addresses both of these challenges (Wilson, 2013).

2.3.1.2 Principles of sustainable urban transport

There are various principles of sustainable urban transport such as Car Free Developments, Developing Transit-Oriented Developments (TODs), Promoting Clean Vehicles (EV), Promoting Pedestrians and Cyclists, Optimization of Road networks, Developing Public Spaces in City Centers, Parking Management for Sustainable Transportation, Traffic Calming, managing to park, communicating solutions, and Implementing transit improvements (United Nation, 2015).

2.3.1.3 Benefit of sustainable urban transport

The concept of sustainable transportation is critical for maintaining a clean, healthy, and high-quality environment. To address present and future demands, the idea also emphasizes human life and the environment. Today, major city transportation systems have a bad reputation due to

traffic congestion, accidents, a lack of access to public transportation, and carbon emissions to the atmosphere of space, which contribute to environmental pollution and an imbalance in terms of quality of life in general mobility. Along with the intriguing notion of providing sustainable transportation services to clients at a reasonable price (Mat & Ismailb, 2011).

Pedestrians, bikers, and cycle rickshaw riders produce little air pollution, no greenhouse emissions, and very little noise pollution. Decreasing emissions and noise pollution are crucial for slowing global warming, reducing asthma and other upper respiratory and cardiovascular problems, and improving sleep (Hook, 2005).

2.3.1.4 Challenges for sustainable urban transport

The challenges for sustainable urban transport are occurring when the transport systems cannot adequately satisfy the requirements of urban mobility. Urban areas are areas with a high degree of economic activity accumulation and concentration. Infrastructures, such as transportation networks, sustain complex spatial structures (Rodrigue, 2017). The challenges of urban transportation include road congestion, parking issues, collisions, and emissions. Vehicles are crawling on the roads in some major cities, particularly during morning and evening rush hours. In our different urban centers, this equates to a daily lack of time and resources (Solanke, 2013). Congestion is one of the most common transportation issues in major metropolitan areas. While congestion can occur in any city, it is more common above a population of about 1 million people (Rodrigue, 2017).

The challenges of urban transport are unpleasant and perverse. As society becomes wealthier, schooling or healthcare advances, but transportation issues deteriorate. Congestion has been the dominant characteristic of many cities all over the world. Transportation is, however, critical to a metropolitan future that is more prosperous and humane (Pojani & Stead, 2015).

Due to the increasing population increase in cities caused by the use of personal vehicles in recent decades, the influence of public transit and the spaces associated with them has attracted more attention to inner-city transportation systems (Majedi et al., 2012)

Michael Thomson's famous book Great Cities and Their Traffic (1977) gives a valuable explanation of how most people are unsatisfied with their cities' transportation systems. The seven major challenges for sustainable urban transport in developing countries and are: Traffic

movement and congestion, public transport crowding, Off-peak inadequacy of public transport, Difficulties for Pedestrians, Parking Difficulties, Environmental impact, and Atmospheric Pollution (Raghav, 2020).

1. Traffic movement and congestion

Because congestion is frequently the result of specific circumstances such as a shortage of parking or badly coordinated traffic lights, identifying the underlying source of congestion is a strategic challenge for urban planning (Rodrigue, 2017). To minimize traffic congestion, numerous regulations have been introduced, including improved public transportation, vehicle and motorcycle restrictions on certain highways, and an even-odd license plate policy (Ilahi et al., 2019).

2. Public Transport Crowding

As the population of various cities throughout the world grows, so does the ability of public transportation networks to offer mobility to people. Expansion of public transportation capacity is frequently a lengthy process, and growing travel demand usually results in increased congestion in vehicles and terminals (Lindholm, 2013). There are three techniques for reducing the impact of public transport crowding they are: By providing exclusive lanes for public transport; using regulations and traffic engineering to control traffic and by using innovative ideas to reduce traffic impacts on public transport (Andrew, 2017).

3. Off-peak Inadequacy of Public Transport

Many public transportation networks, or sections of them, are either over or underutilized because demand for public transportation fluctuates. Congestion causes pain for consumers during peak hours as the system deals with a brief rise in demand. This presents the difficulty of providing enough transport infrastructure and service levels. Peak capacity design leaves the system underutilized during off-peak hours, whereas average capacity planning causes congestion during peak hours (Rodrigue, 2017).

4. Difficulties for Pedestrians

Pedestrians are the most common type of traffic accident victim. Attempts to improve their safety have often focused on restricting mobility on foot rather than addressing the cause of the

problem for example traffic speed and volume (Raghav, 2020). To reduce pedestrian difficulties improved pedestrian walkways are required. There should be no physical barriers or buildings on the walkaways that might impede people's movement, especially older residents who need to walk to their homes. Lamp poles and bus stop signs are not permitted on these walkways (Salihahsally, 2019).

5. Parking Difficulties

Vehicles spend a lot of time in parking lots in the CBD, which has raised the need for land consumption. Even when parking facilities are available, the demand for parking is quite high due to increased motorization (Msigwa, 2013). The parking difficulties include; Inadequate pricing methods, confusing parking policies, Difficulties with parking regulation and pricing, Lack of sufficient parking at the event site Economic, environmental and astatic impacts of parking facilities, Parking spaces that are an inconvenience to nearby residents and businesses, and Low parking turnover rate (Banerjee & Associets, 2003)

6. Environmental impact

There is a push to “decarbonize” urban transportation networks, especially with the spread of alternative energy sources such as electric automobiles (Rodrigue, 2017). There are five major environmental impacts of sustainable urban transport challenges and they are; Energy Consumption in Transport and Environmental Pollution, Air Pollution, Noise Pollution, Land Consumption, Landscape Damage, and Ecological Degradation (Raghav, 2020).

7. Atmospheric Pollution

Transportation is a key source of global pollution, which causes the greenhouse effect. While the United Nations Framework Convention on Climate Change legally classifies six gases as greenhouse gases, only three are particularly problematic for the transportation sector: carbon dioxide, methane, and nitrous oxide (Gorham, 2002).

2.3.2 Non-Motorized Transportation (NMT)

NMT is critical for sustainable living, as sustainable transportation has the characteristics of being safe, comfortable, and efficient in terms of economic and energy usage, as well as minimizing environmental degradation (Mat & Ismailb, 2011). As part of sustainable transportation, NMT aspires to provide a clean, healthy, and safe environment for citizens. These

means of transportation not only have a minimal carbon footprint, but also reduce urban traffic congestion and pollution levels. NMT also has higher space penetration (access to tighter spaces such as conservation lanes and alleyways), delivers door-to-door service, and enables last-mile connection (Anantharamakrishnan, et al. 2021). NMT encompasses all modes of transportation that do not rely on an engine or motor for propulsion. Walking and cycling are examples, as are small-wheeled mobility (skates, skateboards, push scooters, and hand carts) and wheelchairs. These kinds of transportation can serve as both a mode of recreation and a mode of transportation (Mat & Ismailb, 2011).

Investing in high-quality NMT facilities is expected to yield a number of advantages, including improved pedestrian convenience, a reduction in traffic-related fatalities and injuries, improved economic vitality, cost savings for the government, improved public health, greater social cohesion, enhanced public security, foreign exchange savings due to reduced fuel use and vehicle imports, and reduced emissions of local air pollution and greenhouse gases (Ministry of transport,2020).

Despite the benefits of NMT, the majority of transportation policies are focused on motorized transportation and the construction of related infrastructure. Furthermore, as per capita income continues to rise across the globe, individuals are beginning to place a higher value on time and comfort, resulting in a shift to speedier forms of transportation (Anantharamakrishnan, et al. 2021). NMT is important not only for people's transportation but also for cargo transit in cities. Handcarts are used to move items to and from markets in many African communities. This might be done by the vendor or a small-scale entrepreneur as a service to the client (Hook, 2005).

2.3.2.1 Benefits of NMT

NMT trips provide numerous advantages for both the individuals who take them and society as a whole. The advantages of taking the NMT range from less environmental impact to improved human health. As a form of transportation, NMT provides a variety of advantages to both individuals and society. The primary benefit is improved road safety for both NMT and MT users. It's worth noting that enhancing the quality of NMT excursions is especially vital for meeting the demands of the more socioeconomically vulnerable members of society who rely on them to meet their travel needs (Kamundu, 2020).

2.3.2.2 NMT strategy in Ethiopia

Ethiopia's transport ministry has identified some major aims and targets for the next ten years focused on increasing NMT in Ethiopia. The primary goal of this strategy is to alleviate Ethiopia's current transportation issues.

Goal	Contributing Actions	10-year targets
- Increased use of walking, cycling, and public transportation as modes of transportation	- Funding for high-quality walking and cycling paths -Improved public transportation last-mile connection	- Public transportation and paratransit account for 80% of all motorized trips. - NMT's modal share of trips stays at or above 60%. - Women account for half of all bikers.
- Personal motor vehicle usage is being reduced (PMV)	- Controlling/managing private car use - Increased appeal of sustainable means of transportation	- PMVs' vehicle kilometers traveled (VKT) do not exceed 2020 norms.
- Improved road safety	- NMT features include safe crossings, enhanced junctions, and dedicated facilities.	- Fatalities of pedestrians and cyclists are reduced by 80 percent below 2019 levels
- Improved air quality	- Increased investment in high-quality walking and cycling infrastructure - Measures in place to limit the use of private vehicles	- WHO ambient air quality standards are reached 350 days per year - Greenhouse gas emissions are in line with Ethiopia's Nationally Determined Contribution.

Table 1 Ten-year goals for an improved NMT environment in Ethiopian cities and rural centers. Source: (MOT, 2020)

And the Ministry of Transportation had set different implementation objectives for cities based on their population size; in this case, the researcher chose the implementation target for cities with populations of 50,000 or more.

2.3.2.3 NMT FACILITIES ON THE SIDEWALK

There is sometimes not enough space along sidewalks to modify NMT installations. When there isn't enough space, the recognized and suggested minimum widths are shown in the following Figure can be used. The following can be used as absolute minimum widths (not recommended):

- A sidewalk with 1.2 meters for pedestrians;

- 1.5 meters for bicycles divided by a painted line;

- 2 meters for pedestrians and cyclists with no separation between modes; and

- 1.5 meters for pedestrians exclusively (Kamundu, 2020)

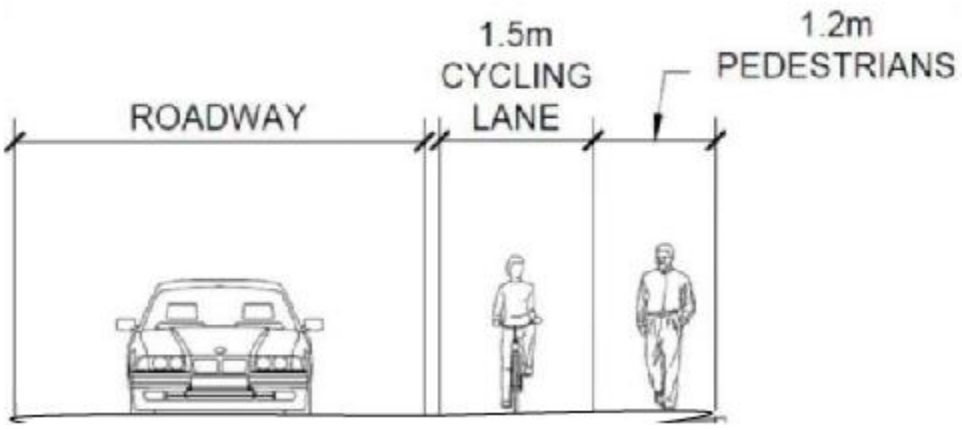

Figure 2 Minimum Street standard for NMT transport

Source: (Kamundu, 2020)

2.3.2.4 Design Principles for NMT Facilities

Desire lines	volume		Dimensions		Design requirements
	High	Low	walkway	Cycleway	
Follow direct lines	No mixing of NMT	Mixing of NMT possible	1200mm to 2500mm	1500mm to 2500mm	- Levelling of NMT facilities always - Walkway and cycleway can be placed next to each other to minimize earthwork
Bridges and tunnels need to be placed strategically	No mixing of NMT	Mixing of NMT possible	1500mm to 1800mm	1500mm to 1800mm	- Barriers between MT and NMT - Wheelchairs and prams passing space
Facilitate NMT at intersections or create crossing infrastructure	No mixing of NMT	No mixing of NMT	1500mm to 1800mm	1500mm to 1800mm	- Partial separation of cycling via kerb or color - Appropriate drop kerbs at all crossing facilities - Marked separation of cycling - Cycleway width can be less for short Distances - Appropriate drop kerbs at all crossing facilities

Traffic calming might be required	No mixing of NMT	No mixing of NMT	1800mm/ preferably more	N/A Cyclists in roadway	- All UD users are accommodated in the walkway - Appropriate drop kerbs at intersections and traffic calming

Table 2 design principles for NMT facilities

Source: (Vanderschuren et al., 2014)

2.4 Empharical literature review

In a 2011 journal study, Rahman and Chin assess sustainable urban transportation and the balanced score card in the context of Singapore. Singapore's urban transportation system is now an excellent model for other emerging and industrialized countries. These writers use various sustainability perspectives, themes, and indicators to evaluate the present sustainable urban transportation in Singapore. It's a valuable learning experience to apply their sustainability perspectives to a better urban transportation system.

There are four key sustainable perspectives for developing sustainable urban transportation (Rahman & Chin, 2011).

Customer perspectives

Environmental preservation, user happiness, and social coherence are two of the most essential sustainability themes in this approach. The influence on the global environment, the impact on local air pollution, noise control, sustainable waste management, and sustainable energy usage are all indicators of environmental protection. Accessibility, connection, travel time, affordability, level of service and comfort, and user happiness and coherence are some of the sustainability indicators. Enhancing safety, social equality, and cohesion, as well as increasing security and employment (Rahman & Chin, 2011).

Internal process

NO	Sustainability themes	Sustainability indicators
1.	**Institutional Efficiency**	- Institutional coverage and capacity - Integration and efficiency of institutions
2.	**Built Environment and Land-use**	- Land-use and transport integration - Management and quality of transport infrastructure - Management of parking facilities
3.	**Management of Transport Modes**	- Promotion of public transport - Control over private vehicles Facilitation of NMT - Integration among passenger modes - Efficiency of commercial goods transport - Promotion of green vehicles - Promotion of car sharing practices
4.	**Deployment of Smart Technologies**	- Vehicle emission standard - Fuel standard - Electronic fare collection - Electronic road pricing - Smart infrastructure technologies - Smart vehicle technologies - Advanced traveler information - Congestion and incident management

Table 3 sustainability themes and indicators for an internal process perspective

Source: (Rahman & Chin, 2011)

Financial perspectives

Revenue and Economic Enhancement, as well as good cost management, are two sustainability themes from a financial standpoint. Revenue enhancement and management of mobility and travel demand are two significant sustainable indicators of revenue and economic enhancement. Efforts to extend the use of petroleum-based fuels are merely postponing the inevitable, and it is

legitimate to question whether they are worthwhile. And switching from petroleum to another technique is a significant contribution to lowering financial costs (Biack, 1996).

Learning and growth

This perspective will create a clear and greater gap between the community, which is very good for our country Ethiopia because the community is not aware of the need to participate in such activities and there is no education about how the community uses the road system or the factors that contribute to every urban transportation challenge.

User behavior, feedback and adaptation, and research and innovation are two crucial elements for learning and growth, according to the Rahman & Chin jornal study. User behavior includes awareness and education, skill development and training, legislation and enforcement, public engagement, leadership, and political dynamics, as well as adaptation to changing demographics and expectations. New inventions and practices, as well as research and development, are two indicators in research and innovation (Rahman & Chin, 2011).

2.4.1 Samples of other countries' experiences (case study summary)

In Arcadis' 2017 Sustainable Cities Mobility Index, Hong Kong was named the best city in the world for sustainable transportation. The study looked over 100 large cities across 23 different parameters to determine a rough rating of their transportation systems' mobility and sustainability. Hong Kong is in the lead because of its well-connected and modern transportation system, which handles an amazing 12.6 million passenger travels each day. It is also inexpensive by worldwide standards, accounting for 90% of all daily travels in the Asian megacity, the highest percentage of any city on the planet. Seoul and Singapore, two additional Asian cities, are also in the top ten. The latter did well overall, but its urban mobility score dropped due to its lack of bike infrastructure.

Walking is the most popular method of transportation in Africa, with pedestrians accounting for half of all daily journeys in Sub-Saharan Africa, yet even the most basic NMT infrastructure is lacking. Cycling is less common in most African cities, but it is becoming more evident in medium-sized cities (SSATP, 2005). Despite its enormous benefits, NMT continues to receive little attention in policy creation and implementation. The bulk of the urban poor live on the outskirts of most cities, and they account for the majority of NMT users. However, the distances they travel are not necessarily suitable for walking or cycling, posing personal and traffic safety issues. They must drive large distances at a considerable expense to get to work, hospitals,

recreation centers, and schools, and they rely on public transportation and walking or cycling (NMT) to get around (Kamundu, 2020).

2.6 Research Gap for the reviewed literature

During the literature review, the researcher notices several gaps. The first is that there is no clear explanation for the fourth pillar of sustainability, which many scholars have discarded and others are employing for other studies. And Agenda 21 indicates that there is no clear conceptual framework for the fourth pillar of sustainability. As a result, if there is no clear conceptual foundation for the fourth pillar of sustainability, it is preferable to eliminate it. The second gap among researchers is that most researchers utilized conventional techniques and analyses in this modernist era, which may be incompatible with the present challenges that urban regions are facing, therefore as a researcher, it is important to move with the flow and work wisely.

In addition, there is no clear information on transport strategy or other actions in the 2020 transportation minister report. The researcher notices several discrepancies between the 2020 and 2019 reports and attempts to compile the information in accordance with current practices as well as the stated goals and strategies. And some of the text is just duplicated, with no attempt to update it to reflect the present transportation system. The ten-year target is mentioned in both the 2019 and 2020 reports; however, the substance is extremely identical and repeated. The ministry of transportation should develop several effective techniques based on diverse city experiences.

CHAPTER - THREE

Materials and methods

3.1 Introduction

The approach and philosophy that would be used for the desired research effort will be presented in this section. These include the overall research design strategy, data kinds and sources, data gathering techniques, data processing, and presentation.

3.2 Research philosophy

The research philosophy for the study is Interpretivism. The main reason for selecting Interpretivism philosophy is the behavior of the study which is used in explanatory and descriptive research to identify the challenges in detail.

3.3 Research approach

The researcher employed an inductive research technique in this study because it uses research questions to narrow the scope of the study. An inductive approach focuses on discovering new phenomena or looking at previously studied phenomena from fresh angles. While the research uses both data analysis techniques, the majority of the time is focused on qualitative data analysis, and inductive procedures are typically associated with qualitative research.

3.4 Research strategy

3.4.1 Survey

Surveying is essential for data collection that can be standardized using the questionnaire and easily compiled. It is also a cost-effective choice for the researcher. The survey technique is preferable for data collecting to achieve a high response rate. In the instance of this thesis, the researcher plans to distribute questionnaires to clients and then conduct a survey as a consequence.

3.4.2 Grounded Theory approach

The other strategy for this research is the Grounded theory approach. It is a set of precise, systematic principles and methods for collecting data and doing inductive analysis to produce a theory. These principles also aid in the explanation and description of theoretical concepts and social phenomena to build a new theory. Because grounded theory is a systematic approach that

develops knowledge and a theory, it has a general benefit for this research. Some of the advantages are: More efficient, less-time consuming, wider availability, cost-effective, less intrusive, more stable, and having precise details.

3.5 Time horizon

The researcher employs a cross-sectional time horizon strategy that is confined to a single time period. The advantage of cross-sectional time frames is that they allow the researcher to compare many variables at the same time.

3.6 Research method

The researcher used researcher used both qualitative and quantitative data collection methods for both the objectives.

3.7 Method of data collection

Depending on the previous research questions, a mixed-methods approach is required to collect both quantitative and qualitative data for this thesis. Content Analysis and Narrative Analysis are two of the most common approaches.

Qualitative data

The qualitative data analysis approach yields words, photos, maps, descriptions, and observations as data. This form of analysis refers to the techniques and processes that are used to analyze data in order to give some level of comprehension, explanation, or interpretation in the study. Methods such as surveys, observations, research samples, and secondary data collection are qualitative data.

Quantitative data

Data produced by quantitative data analysis methods include the the study of the number of respondents filling out questionnaires, sample size estimates, and so on.

3.8 Type and sources of data

In this research, the researcher used both primary and secondary data collection methods.

3.8.1 Primary data resource

The researcher identified the challenges by observing the existing challenges that the site is currently facing, after generating a checklist the researcher evaluated the transport system, and

make a note to identify the challenges. Interviews are the base for this research; knowing people's ideas and problems helped the researcher to identify potential solutions to the challenges for sustainable urban transportation.

In this study, the researcher used questioner method and it was prepared to collect information based on respondents' travel time, the kind of transport they use, and the major challenges that they face. The answered question helped the researcher for the study. Questioner were given to passengers, drivers, and other transportation experts. The questionnaire includes both open ended and close ended question to get accurate data but 80% of the question is close ended and it is used for the respondents to answer fast and not make them bored and the 20% of the question was open ended question it is because to get a different perspective from the respondents.

The researcher used primary data because the information gathered is specific to the situation and is valuable; the obtained data is of high quality and usable, and it might lead to the discovery of further data and information while it is being gathered. There were also several complexities involved in the collecting of primary data, such as deciding how, when, what, and why to gather.

The interviews and questioner would conduct in various ways for different groups. such as; Passengers, traffic, Drivers, Transport offices, and non-motorized users.

3.8.2 Secondary data source

The data for this study was collected through a semi-structured interview and review of documents. Analysis of documents involves public records, newspapers, news articles, and transportation-related publications. Multiple channels will be used to find relevant literature regarding the challenges for sustainable urban transport planning and the solutions for the challenges of urban transport and sustainability. Searches might carry out in academic databases for this research, research publications, and publications. It also includes the following instruments; literature review, case studies, research documents, and other related books. The researcher’s reason to use secondary data is that it will guide the research process and it is readily available. Secondary data collection is often inexpensive.

3.7 sampling techniques and sampling methods

3.7.1 Sampling methods

The researcher used different sampling methods to collect data, for the questioner's survey the research used non-probability sampling method with a purposive sampling method that was

backed by quota sampling, the researcher picked the best-fit participants for the systematic inquiry. It also saved the researcher time and allowed the researcher to collect qualitative responses, which leads to better insights and more precise research results. Because the researcher collected information from the best-fit participants, the results are relevant to the research context.

3.7.2 Sample size

The sample size for the study was determined by using a unknown population sample size calculation (Cochran formula). Therefore, the sample size of the population is 384 in total which is come from the following Cochran formula.

$$\text{Necessary sample size (n)} = \frac{Z^2Pq}{e^2}$$

q = 1-p	**1-0.5=0.5**
Percentage of population (P)	**50% (0.5)**
Confidential level (%)	**95%**
Margin of error (D)	**5%**
Z – score	**1.96**
Sample size (n)	**384**

Table 4 Sample size

3.7.2 Sampling techniques

Because the target populations in this research comprised passengers, drivers, NMT users, traffic, and transport office, the researcher intended to employ purposive sample approaches. First, the researcher divided the population number into strata or identified the different groups of the population from the sample size. such as; Passengers, traffic, Drivers, Transport offices, and non-motorized users. Third, the researcher calculated a quota for each stratum: quota means the number of cases that should be included in each stratum. It depends on the make-up of each stratum within the sample population size.

No	Stratum	Percentage	Sample size
1	Passengers	68%	260
2	Drivers (Motorized)	20%	76
3	Non-motorized users	10%	38
4	Transport office	1%	3
5	Traffic	1%	3

Table 5 sampling methods

After getting the questionnaire data the researcher used descriptive type of statics to convert difficult-to-understand numerical findings from each stratum data collection into bite-sized explanations. The data was collected by using well-structured questionnaires that are given utilizing self-filling by the researcher or face-to-face questioning with sample family members in chosen passengers, NMT users, drivers, transport offices, and traffic. The questionnaire was written in English and then translated into the local language (Amharic) because the majority sample size did not speak English and understand the language. Finally, the researcher assessed and cross-check the responses after they have been collected from those subjects by using different instruments.

3.8 Data Analysis and presentation

Qualitative data analysis

Notes, video, audio recordings, photographs, and text documents were evaluated in this study. To define the qualitative data form, a qualitative technique was used. Data should have been presented using tables, maps, graphs, and charts. SPSS software was mostly utilized for this purpose; however, Excel was also used to examine the data.

Quantitative data analysis

The quantitative data gathered through observation and measurement of the existing site circumstance was numerically analyzed. The outcome was analyzed and described using descriptive statistics such as frequency and percentage. Photographs and figures would be included in the research to corroborate and verify the current situation on the ground. Presentation approaches will include relevant computer applications such as SPSS, Illustrator, Excel, PowerPoint, and others, as well as adequate verbal descriptions.

Site classification

Because the site is long to examine the challenges one by one, road categorization is necessary to facilitate data collection on this route.

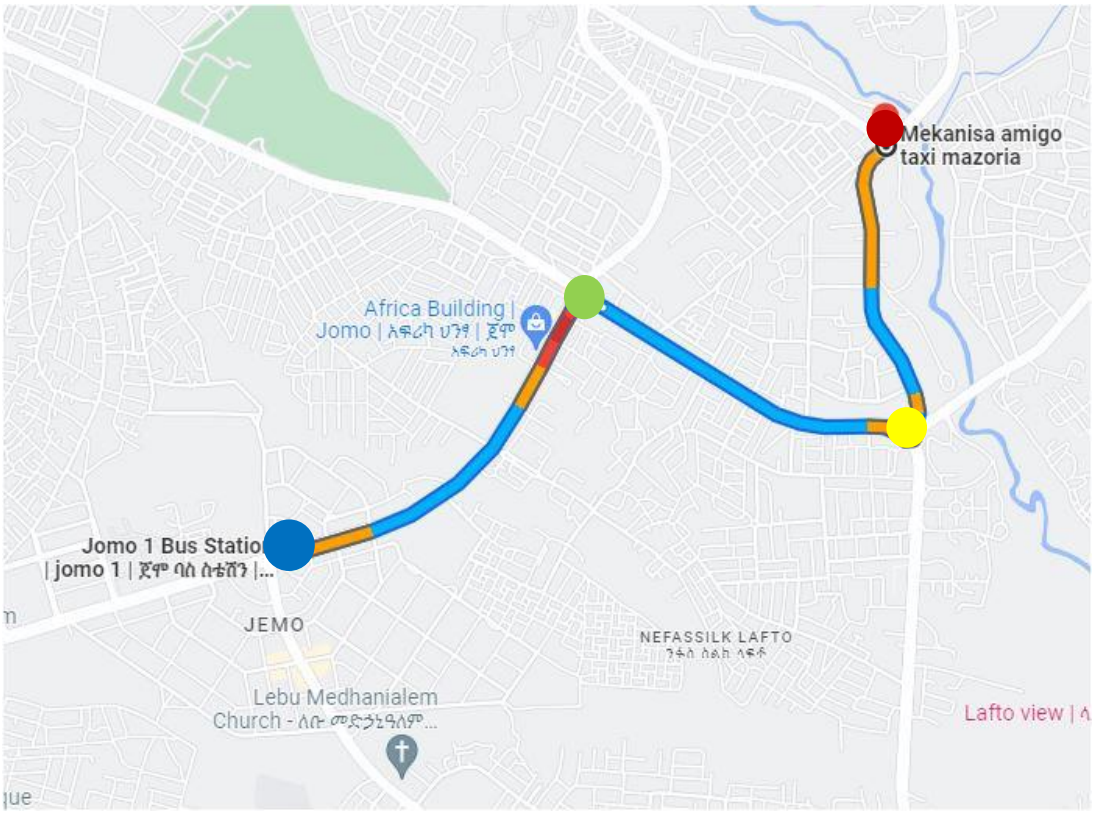

Figure 3 Street classification

Source : (Jomo 1 Bus Station Google Maps, 2022)

- Node 1 Jomo1,
- Node two Mekael,
- Node three Germen square, and
- Node four Mekenisa

CHAPTER – FOUR

Result and Discussion

4.1 Introduction

This section contains the outcomes for the objectives that the researcher wants to examine by using various data gathering methods, as well as the discussion and organize the discussion based the result.

4.1.1 Background of a sample population

Age	Gender			
	Male	Female	Total	%
15 - 29	107	29	136	35.78
30 - 44	100	95	195	51.32
45 - 59	25	21	46	12.11
60 – 70	3	0	3	0.79
Total	235	145	380	100

Table 6 Age and gender of the sample population

Source: (Researcher survey result, 2022)

Table 7 shows a total sample population of 380 participants that were surveyed. Males are 61.8 percent (235 responses) of the population, while females are 38.15 percent (145 respondents). This survey included respondents of all ages. According to table 7, more than half of the population (51.32 percent) was between the ages of 30 and 49, and the sample included elderly people beyond the age of 60, resulting in a huge age difference. This survey includes three

respondents (0.79 percent) who are elderly and 136 respondents (35.78 percent) who are young between the ages of 15 and 29. The following bar chart shows the sample population gender and their age group.

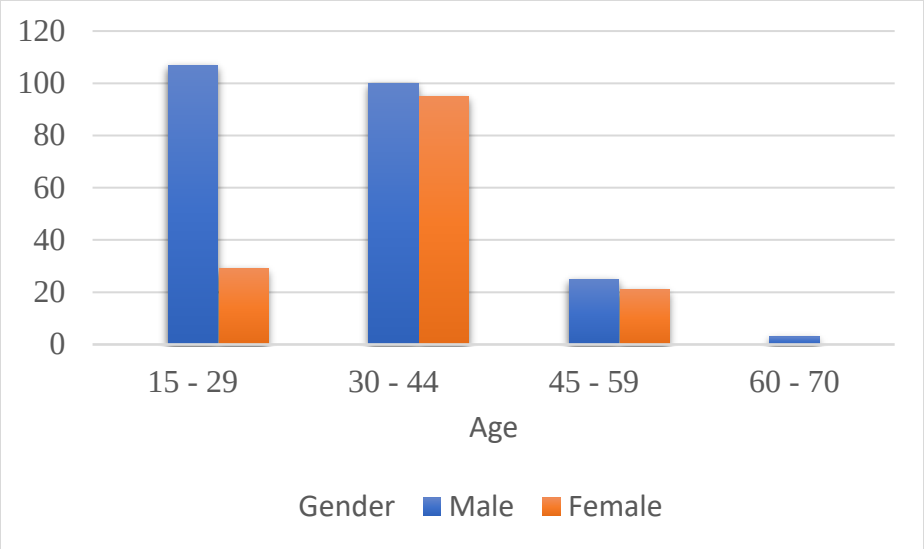

Figure 4 Gender and age category for the sample population

Source: (Researcher survey result, 2022)

4.1.2 Sample population mode of transportation on Jomo to Mekenisa road

Mode of transport	Frequency	Percent
Bus and Taxi	139	36.6
Bus	75	19.7
Taxi	27	7.1
Service	43	11.3
Car	42	11.1
Bicycle	10	2.6
Walk	43	11.3
Electric Scooter	1	0.3
Total	380	100.0

Table 7 Sample population mode of transport

Source: (Researcher survey result, 2022)

The sample population's mode of transportation is shown in Table 8. In this table, the researcher finds that 36.6 percent of the sample population uses buses and taxis, with just 19.7 percent of

public transport users present on the site (75 respondents). Taxi users represent for 7.1 percent (27 respondents). Service buses are used by 11.3 percent (43.3 respondents) for daily activities. Automobile owners were included in the study to discover additional issues, and car users are 11.1 percent of those who participated on the survey (42 respondents). There are non-motorized users at the site; bicycles are used by 26% of the sample population (10 respondents), and walking is used by 11.3 percent of the sample population (43 respondents). Another non-motorized mode of transportation is the electric scooter, which received 0.3 percent, or 1 participant. The following bar chart, or figure 8, illustrates these findings.

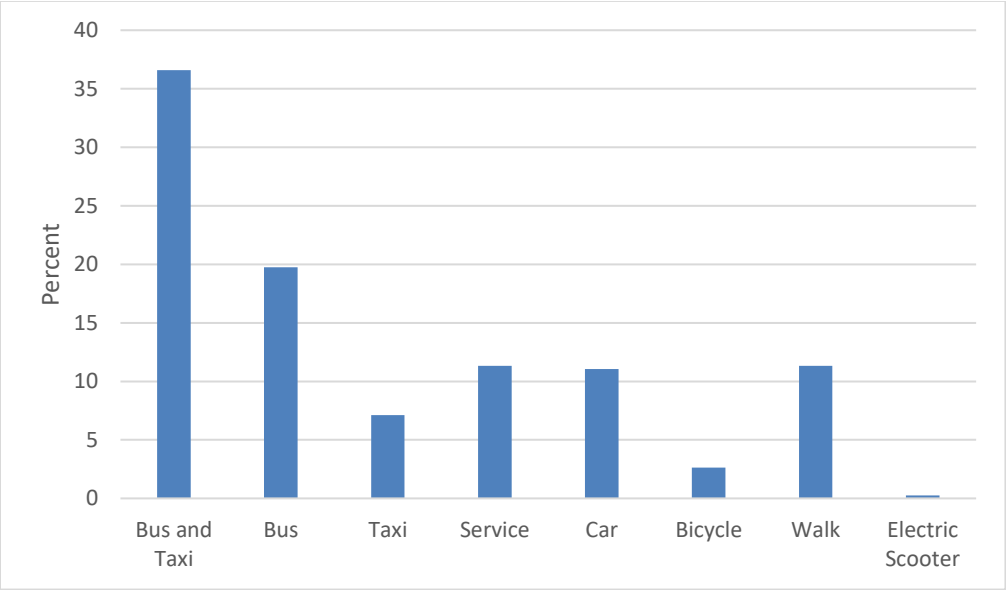

Figure 5 Sample population mode of transport

Source: (Researcher survey result, 2022)

4.2 Challenges for sustainable urban transportation

The site analysis result and the sample population questioner response will be used to determine the objective one result.

4.2.1 Site Analysis Result

During the site observation period, the researcher observed a variety of issues with the current transportation system, such as considerable traffic congestion, a lack of adequate public transportation, noise and air pollution, a scarcity of parking spaces, a lack of proper infrastructure, a lack of NMT infrastructure such as bicycle lanes and pedestrian, unfinished

roads, and automobile dependency. Crawling vehicles can be seen on the roadways at each node, particularly during peak hours in the morning and evening. This translates to a loss of time and energy for the community on a daily basis.

Figure 6 Congestion in the study area

Source: (Researcher survey result, 2022)

The above figure9 illustrates the current congestion problem situation on the site. The site encounters this issue at peak hours, particularly in the morning and at evining. The researcher observes this challenge based on three main periods: in the morning, after lunch, and at evining. And the researcher discovered that the route is congested in the morning and evening

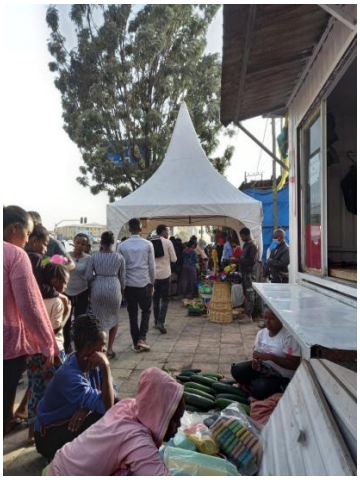

Figure 7 Informal trade on the site

Source: (Researcher survey result, 2022)

In Addis Ababa, informal trade is growing, and this site is an illustration of this. During the observation time, the researcher observed numerous informal markets on walkways and on the road. It makes the urban transportation difficult for the community. Nowadays, ease of

movement is critical in order to establish sustainable urban transportation system. This path is designed for pedestrians, but the informal market cannot accommodate them, as seen in Figure 10, and the pedestrian is heavily crowded with informal markets.

Figure 8 Inadequate pedestrian

Source: (Researcher survey result, 2022)

Based on the site analysis, the researcher observed inadequate pedestrian, it makes it difficult to walk and travel from one place to another, providing yet another obstacle and it is another obstacle for sustainable urban transportation and it is challenged for people with disabilities. Figure 11 illustrates the site's poor pedestrian spaces.

Figure 9 Unsafe for people with disabilities

Source: (Researcher survey result, 2022)

Figure 12 shows unsafe pedestrian for people with disabilities because, as the above analysis result shows, the pedestrians and the unfinished roads are challenged to move so it will be more challenging for people with disabilities.

Figure 10 Automobile dependency

Source: (Researcher survey result, 2022)

Nowadays, the majority of society depends on automobiles for both long and short distances. And this has an impact on the community and the transportation system. On this site, as shown in Figure 13, there are numerous automobiles on the road. It indicates that the community's preferred mode of transportation is motorized transport over nonmotorized transport. This is the most challenging task for sustainable urban transportation since motorized transportation has effects on both present and future generations due to carbon emissions into space, which contribute to pollution and an imbalance in terms of mobility quality in general.

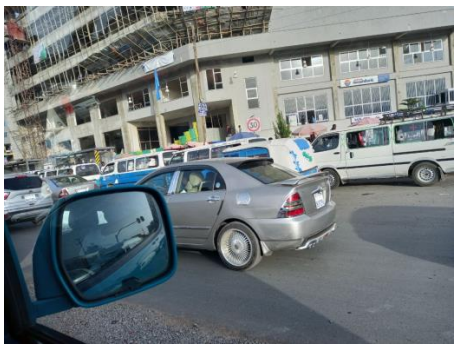

Figure 11 Parking difficulty

Source: (Researcher survey result, 2022)

parking difficulty is also the site's weekness. As shown in Figure 14, there is a parking difficulty on the site. The vehicles are not parked in their designated location since there is no parking space on or off the road.

Figure 12 Lack of cycle lane

Source: (Researcher survey result, 2022)

There is no bicycle lane on the route from Jomo to Mekenisa Road, which is a difficulty for bicycle riders. As illustrated in Figure 15, the cycles are waiting for the automobile to move, which is still a challenge for urban transportation systems.

Figure 13 Lack of public transport

Source: (Researcher survey result, 2022)

Unless there is public transportation such as buses and services on the site, the community still has difficulty traveling elsewhere, implying that the present public transportation is not commensurate to the population. The above diagram shows long commuting time peoples are

waiting the bus for more than 30 minute to travel for a single trip which is a challenge for sustainable urban transport which are waited for the public transport.

4.2.2 Challenges for sustainable urban transport result

4.2.2.1 Determine whether the site faces challenges for sustainable urban transportation or not.

In this section, the researcher determines whether or not there is a challenge for sustainable urban transportation. This allows the researcher to determine whether or not the place has urban transportation problems. The table below shows how many people in the sample said there is an urban transport challenge in the site.

	Frequency	Percent
Yes	348	91.57
No	32	8.43
Total	380	100.0

Table 8 challenge presence test

Source: (Researcher survey result, 2022)

Site classification	There is a Challenge on the site		Total
	Yes	No	
Node 1 (Jomo 1)	174	7	181
Node 2 (Mekael)	65	3	68
Node 3 (Germen square)	21	12	33
Node 4 (Mekenisa)	88	10	98
Total	348	32	380

Table 9 challenge presenceanalysis for each node

Source: (Researcher survey result, 2022)

The above result indicates that the site has difficulty with sustainable urban transportation. As indicated by the researcher in the sample selection section, the researcher separates the site into four node types and distributes the questioner to each node depending on this categorization.

Challenges that matter more to sample populationfor each node

In this section, the researcher places the results of each challenge on each node of the site. The researcher collects data from the sample population that said there is a challenge for sustainable

urban transportation in the site, which is 91.57 percent (348 respondents), based on the above challenge presence test, and the following data were collected from 348 respondents.

Site classification	There is a Challenge on the site	
	Yes	**No**
Node 1 (Jomo 1)	77.33%	22.67%
Node 2 (Mekael)	71.28%	28.71%
Node 3 (Germen square)	41.26%	58%
Node 4 (Mekenisa)	64.01%	35.98%

Table 10 challenge presence percentage for each node

Source: (Researcher survey result, 2022)

The following chart is a summary of the chalanges for sustainable urban transportation based on the results: which node is most challenged?

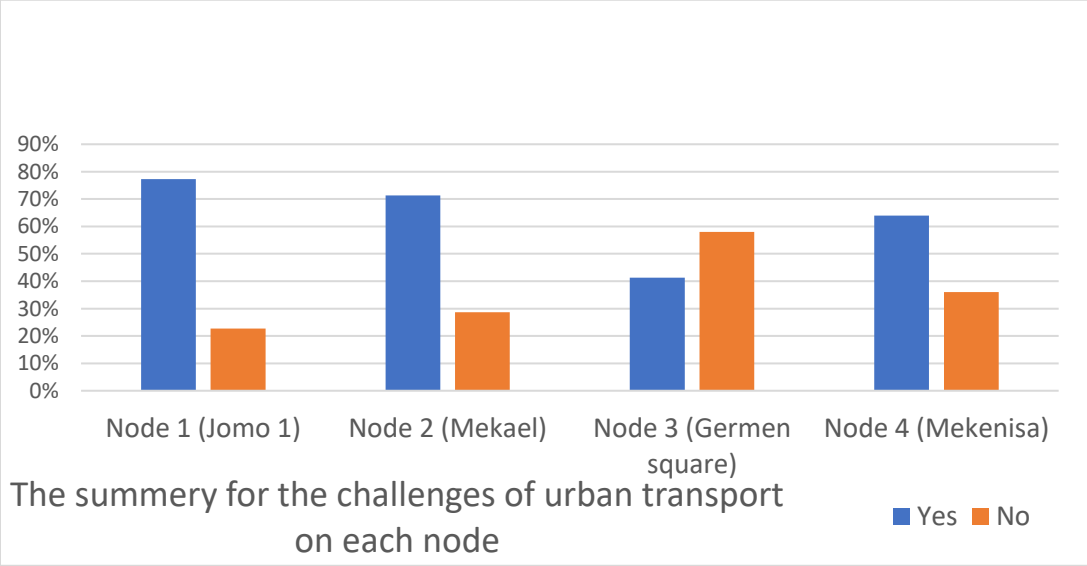

Figure 14 summery for the challenges of urban transport on each node

Source: (Researcher survey result, 2022)

Congestion

Congestion is one of the urban transportation challenges that impacts sustainable urban transportation.The table below illustrates the congestion that exists in each node of the site.

Site classification	There is a Congestion on the site		Total
	Yes	**No**	
Node 1 (Jomo 1)	161	13	174
Node 2 (Mekael)	47	18	65
Node 3 (Germen square)	13	8	21
Node 4 (Mekenisa)	60	28	88
Total	281	67	348

Table 11 Congestion presence analysis for each node

Source: (Researcher survey result, 2022)

The pie chart below generalizes the result of the congestion existence, indicating that 81 percent (281 respondents) said there is a congestion challenge on the road and 19 percent (67 respondents) did not agree for the congestion issue.

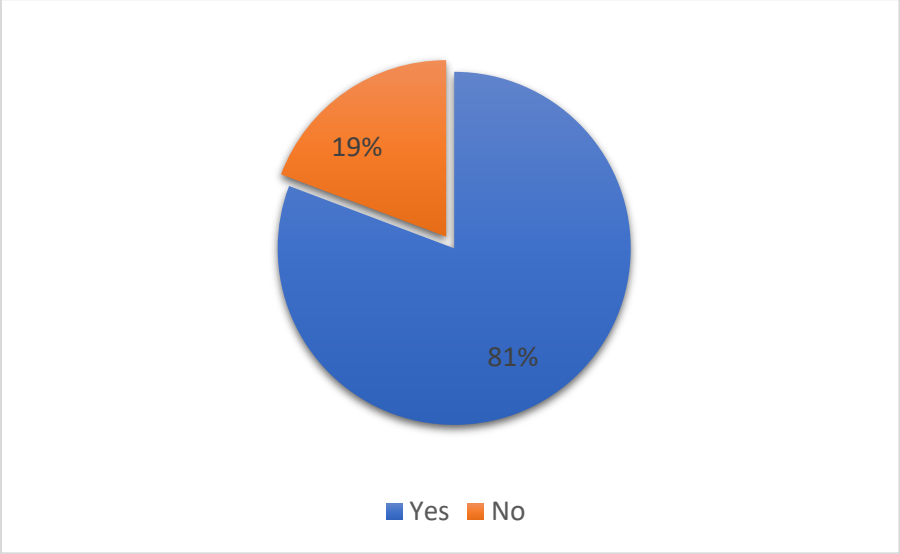

Figure 15 congestion existence result

Source: (Researcher survey result, 2022)

Parking difficulties

If there is a car, there must be a spot for it to be parked. Currently, this is a difficulty for the transportation system on the site, and the table below demonstrates the existing parking challenges on each node of the site.

Site classification	There is a parking difficultyon the road		Total
	Yes	**No**	
Node 1 (Jomo 1)	147	27	174
Node 2 (Mekael)	55	10	65
Node 3 (Germen square)	15	6	21
Node 4 (Mekenisa)	67	21	88
Total	284	64	348

Table 12 parking difficulty analysis for each node

Source: (Researcher survey result, 2022)

The pie chart below summarizes the results of the parking difficulties questionnaire, showing that 82 percent (284 respondents) believe there are parking problems on the road, while 18 percent (64 respondents) disagree.

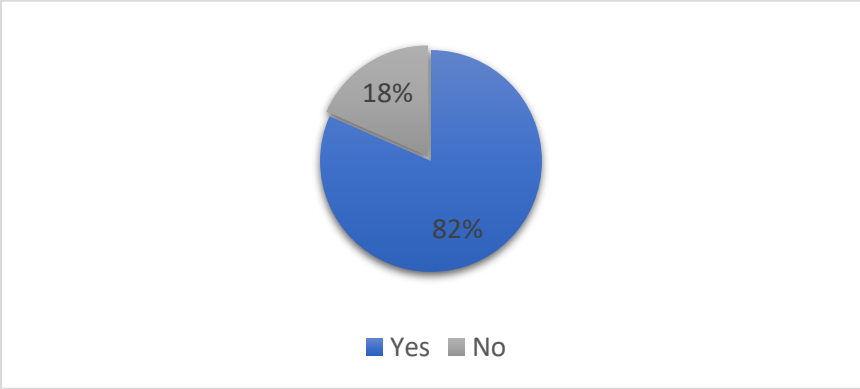

Figure 16 Parking difficulties result

Source: (Researcher survey result, 2022)

Inadequate bike lane

Despite the fact that bicycle usage in Ethiopia is low, there is no bicycle lane for cyclists on this site.This is yet another challenge for sustainable urban transportation, as seen in the table below, which shows how many people in the sample population are challenged by the bike lane and how many of them disagree.

Site classification	There is Inadequate bike lane		Total
	Yes	**No**	
Node 1 (Jomo 1)	116	58	174
Node 2 (Mekael)	47	18	65
Node 3 (Germen square)	14	7	21
Node 4 (Mekenisa)	70	18	88
Total	247	101	348

Table 13 Inadequate bike lane analysis for each node

Source: (Researcher survey result, 2022)

The following pie chart illustrates the inadequacy of bike line on the overall site by using percentage. 71 percent of the population agreed with the inadequacy of bike lane are a challenge for sustainable urban transport and 29 percent of the sample size did not notice this as a challenge.

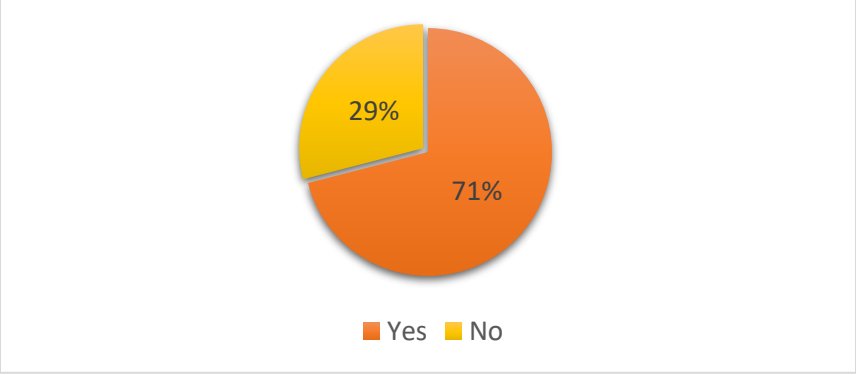

Figure 17 In adequacy of bicycle lane result

Source: (Researcher survey result, 2022)

Inadequate pedestrian

The pedestrian site is inadequate for a variety of reasons, including an incomplete walkway, an informal market, a lack of maintenance, a car wash, the development of buildings, and a lack of well-paved path. The table below indicates how many people in the sample population agree that there is inadequacy of pedestrians on the site and how many disagree for each node.

Site classification	There is Inadequate pedestrian on the site		Total
	Yes	**No**	
Node 1 (Jomo 1)	163	11	174
Node 2 (Mekael)	61	4	65
Node 3 (Germen square)	12	9	21
Node 4 (Mekenisa)	65	23	88
Total	301	47	348

Table 14 Inadequate pedestrian analysis for each node

Source: (Researcher survey result, 2022)

The findings of the inadequate pedestrian survey are shown in the pie chart below, which shows that 86 percent (301 respondents) feel there are inadequate pedestrians for road users, while 14 percent (47 respondents) disagree.

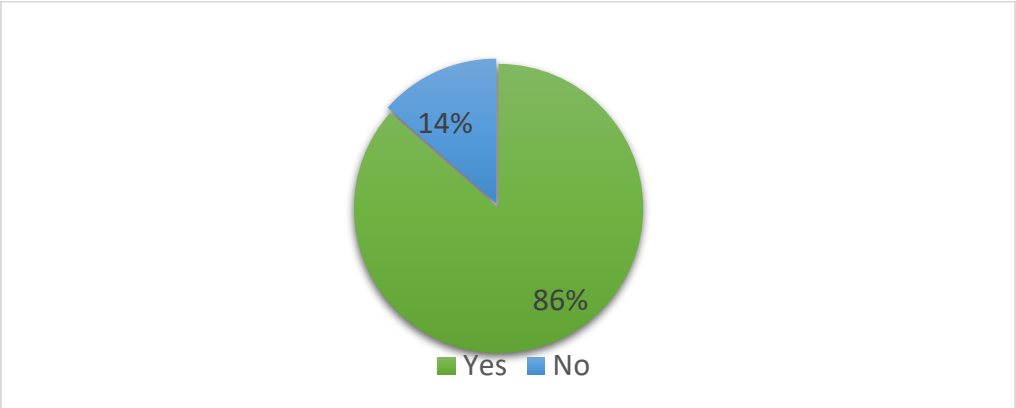

Figure 18 Inadequate pedestrian result

Source: (Researcher survey result, 2022)

Lack of public transport

The community still has difficulty getting around until public transportation, such as buses and services, is available on site, implying that present public transportation is insufficient for the population. Based on the responses for each node on the site, the following table will demonstrate this challenge.

Site classification	There is Lack of public transport on the site		Total
	Yes	**No**	
Node 1 (Jomo 1)	99	75	174
Node 2 (Mekael)	42	23	65
Node 3 (Germen square)	4	17	21
Node 4 (Mekenisa)	52	36	88
Total	197	151	348

Table 15 Lack of public transport analysis for each node

Source: (Researcher survey result, 2022)

The pie chart below shows how many people in each sample are impacted by public transportation. According to the findings, 57 percent of the sample population agrees that there is a shortage of public transportation on the site, while 43 percent disagree.

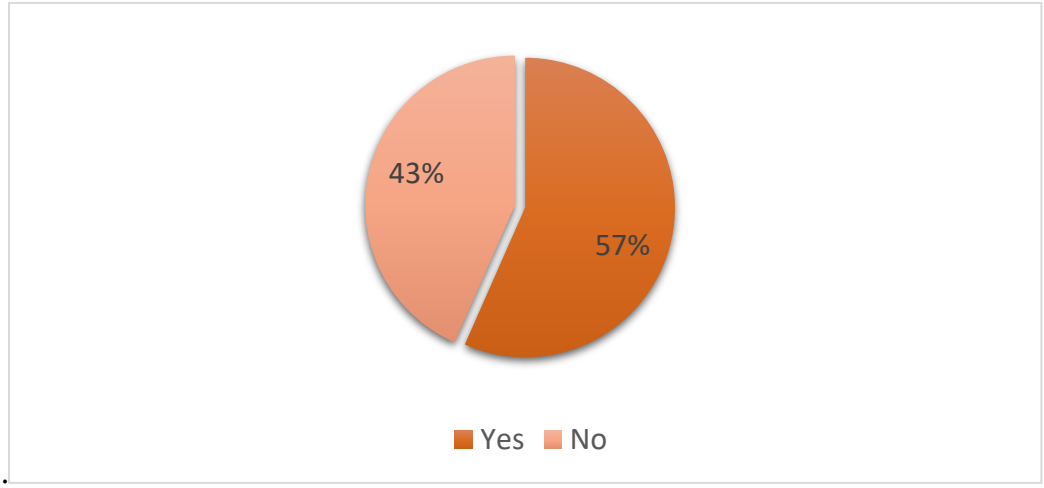

Figure 19 Lack of public transport result

Source: (Researcher survey result, 2022)

Lack of proper infrastructure

As seen in the table below, the site lacks sufficient infrastructure, and the majority of respondents are aware of this issue as follows.

Site classification	There is Lack of proper infrastructure on the site		Total
	Yes	**No**	
Node 1 (Jomo 1)	148	26	174
Node 2 (Mekael)	59	6	65
Node 3 (Germen square)	3	18	21
Node 4 (Mekenisa)	57	31	88
Total	267	81	348

Table 16 Lack of proper infrastructure analysis for each node

Source: (Researcher survey result, 2022)

Figure 23 shows how the sample population is affected by a lack of proper infrastructure. According to the responses, 77 percent of the sample population believes there is a lack of proper infrastructure on the site, which makes it difficult to create a sustainable urban transportation system, while the remaining sample population disagrees.

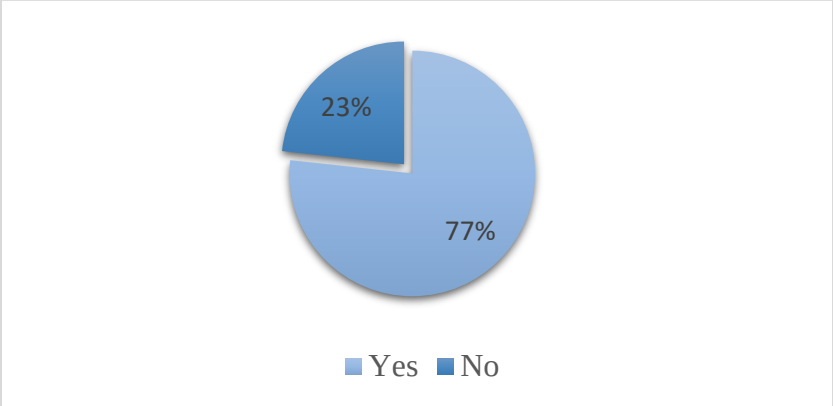

Figure 20 Lack of proper infrastructure result

Source: (Researcher survey result, 2022)

Automobile dependency

Table 18 shows if automobile dependency is a barrier for sustainable urban transportation, and the researcher categorized the replies for each site node.

Site classification	There is a Challenge on the site		Total
	Yes	**No**	
Node 1 (Jomo 1)	87	87	174
Node 2 (Mekael)	22	43	65
Node 3 (Germen square)	9	12	21
Node 4 (Mekenisa)	36	52	88
Total	154	194	348

Table 17 dependency analysis for each node

Source: (Researcher survey result, 2022)

The following pie chart shows how the sample population is affected by automobile dependency. According to the responses, 56 percent of the sample population believes that automobile dependency makes it difficult to develop a sustainable urban transportation system, while the remaining sample population disagrees.

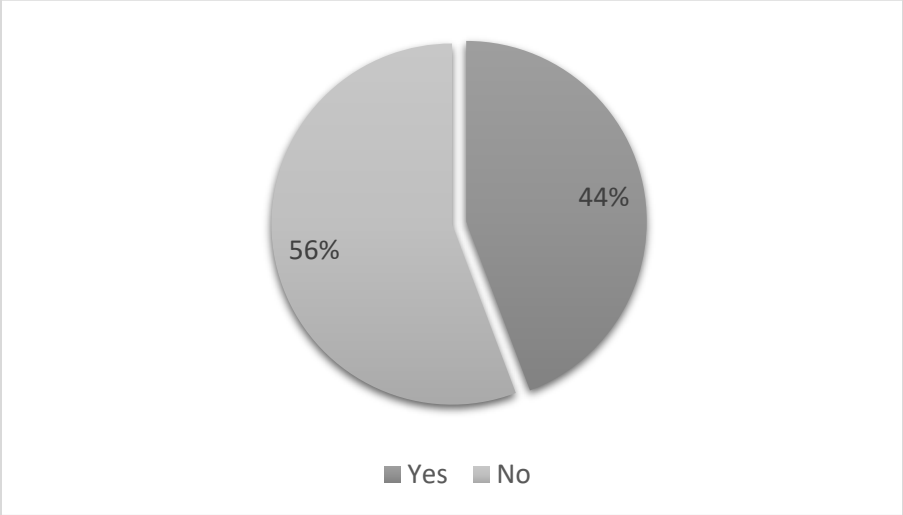

Figure 21 Automobile dependency result

Source: (Researcher survey result, 2022)

Unsafe road and pedestrian for people with disabilities

Unsafe roads and pedestrians for persons with disabilities were noticed on the locations, therefore the researcher asked respondents whether unsafe roads and pedestrians are a challenge for sustainable urban transportation, and then the researcher analyzed the results as follows:

Site classification	There is Unsafe Road and pedestrian for people with disabilities on the site		Total
	Yes	**No**	
Node 1 (Jomo 1)	131	43	174
Node 2 (Mekael)	30	35	65
Node 3 (Germen square)	4	17	21
Node 4 (Mekenisa)	42	46	88
Total	207	141	348

Table 18 Unsafe Road analysis for each node

Source: (Researcher survey result, 2022)

Figure 25 shows how many people in the sample population are affected by an unsafe road. According to the results, 59% of the sample population feels that the location has dangerous roads for people with disabilities, making it impossible to develop a sustainable urban transportation system, while 41% of the sample population disagrees.

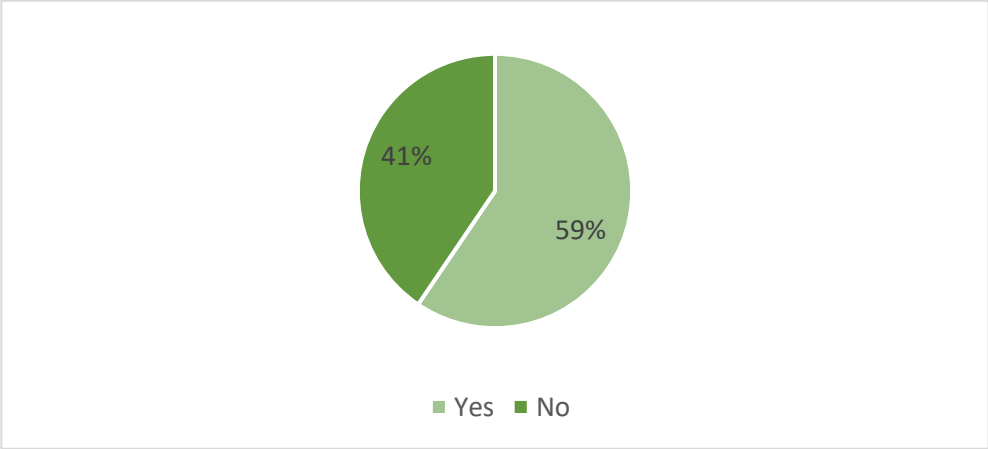

Figure 22 Unsafe Road result

Source: (Researcher survey result, 2022)

Informal market

Informal markets are common on the site, and the researcher asks questions as to whether or not informal markets pose a challenge to sustainable urban transportation. The researcher then analyzes the acquired data on table19.

Site classification	There is Informal market on the site		Total
	Yes	**No**	
Node 1 (Jomo 1)	159	15	174
Node 2 (Mekael)	54	11	65
Node 3 (Germen square)	4	17	21
Node 4 (Mekenisa)	58	30	88
Total	275	73	348

Table 19 Informal market analysis for each node

Source: (Researcher survey result, 2022)

The effect of informal markets on urban transportation is illustrated in the pie chart below, which reveals that 79 percent (271 respondents) believe informal markets provide a significant challenge to the urban transportation system, while 21 percent (73 respondents) disagree.

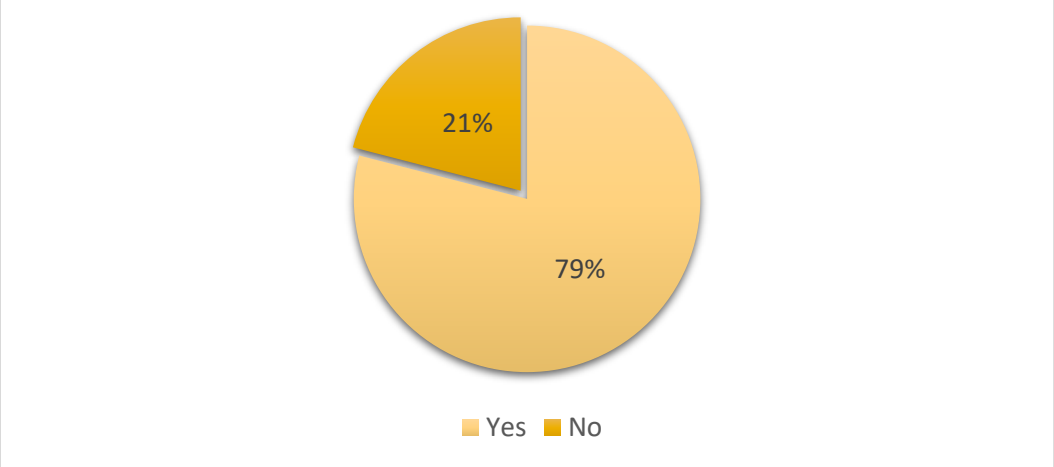

Figure 23 Informal market result

Source: (Researcher survey result, 2022)

4.2.3 Discussion

The majority of the population in the study region travels by bus and taxi on a daily basis. This demonstrates that the community is more dependent on using motorized transportation. The researcher observes challenges for sustainable urban transportation throughout the site investigation and questioning. The researcher then identifies the difficulties based on the site analysis and questioner results. During the identification process, the researcher observed several urban transportation challenges, including significant traffic congestion, a lack of adequate public transportation, air and noise pollution, a scarcity of parking spaces, a lack of proper infrastructure, a lack of NMT infrastructure, unfinished roads, and automobile dependency.

According to the stated difficulties, 86 percent of the sample population believes that insufficient pedestrians are a major issue in the research region. There aren't enough pedestrians in the research region. The second biggest challenge for the sample population is parking challenges, which are reported by 82 percent of the people in the research region. while the majority of the sample population disagreed with the parking situation. The third major challenge of the sample population is congestion, which is acknowledged by 81% of the sample population in the research region. While the majority of the sample group disagreed with this challenge, and public saying there is a lack of public transportation in the study area and 43 percent saying there is adequate public transportation in the study area.

4.3 Importance of NMT

Walking and cycling have several benefits, ranging from personal advantages such as enhanced health, safety, and cost savings to public advantages such as improved air quality, increased productivity, and space savings. From this view point, the researcher gathers information on how many people in the sample population utilize NMT for distances of 500 meters or more and what benefits does this provide for sustainable urban transportation and put the result as follows.

4.3.1 Profile on Sample population use of NMT

How many samples of population use NMT in the study area?

The table and the pie chart below illustrate how many people in the sample population take NMT to go more than 500 meters. Out of 380 respondents, 85 percent (323 respondents) use nonmotorized transport to travel more than 500 meters, while 15 percent (57 respondents) do not.

This is due to the researcher includes car owners in the sample population selection, which was 42, but there were some Bajaj drivers who did not use motorized transport.

	Frequency	Percent
Yes	323	85
No	57	15
Total	380	100.0

Table 20 NMT user result

Source: (Researcher survey result, 2022)

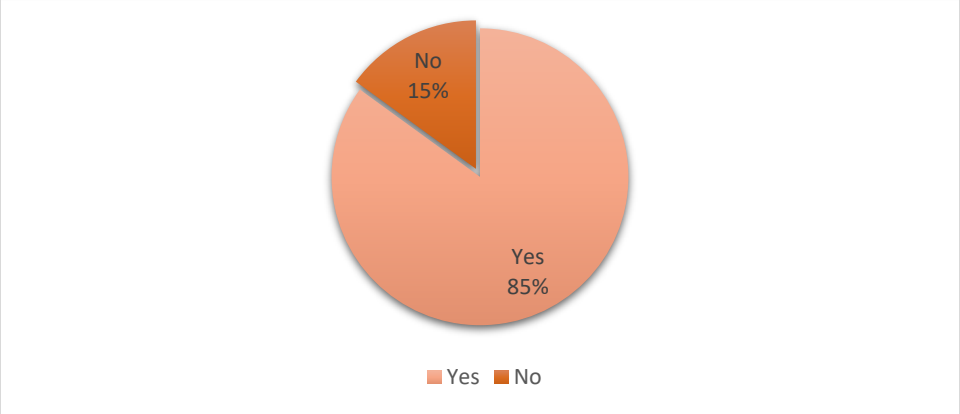

Figure 24 NMT user analysis result

Source: (Researcher survey result, 2022)

What kind of non-motorize transport they use?

The majority of respondents prefer to walk rather than ride a bike or other NMT type. The most common NMT type is seen in the graph below. And the following analysis is solely for the 323 respondents who used NMT in the previous question.

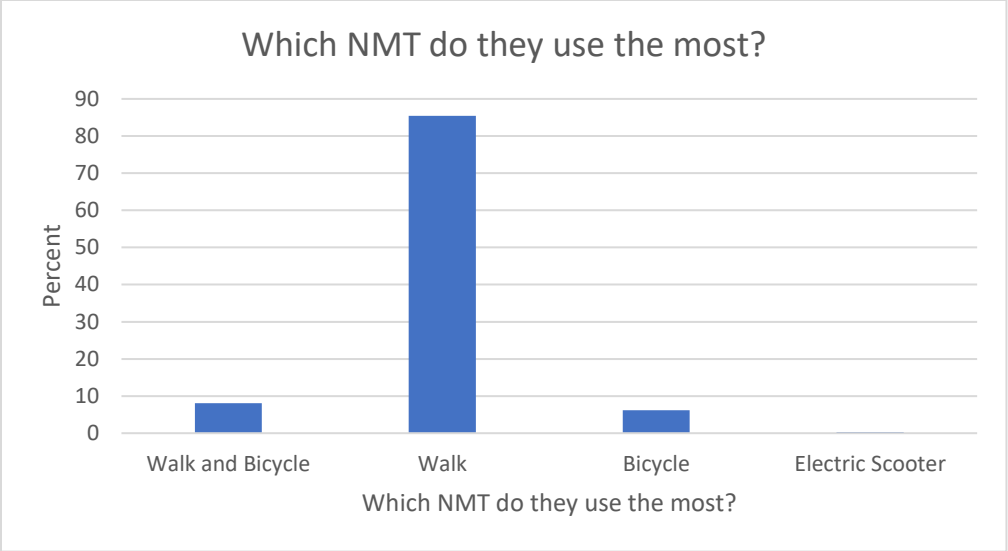

Figure 25 The kind of NMT used by the sample population

Source: (Researcher survey result, 2022)

How often do they use NMT?

As seen above, the responder type of NMT is displayed, and the following chart illustrates the frequency of time that they use this mode of transportation.

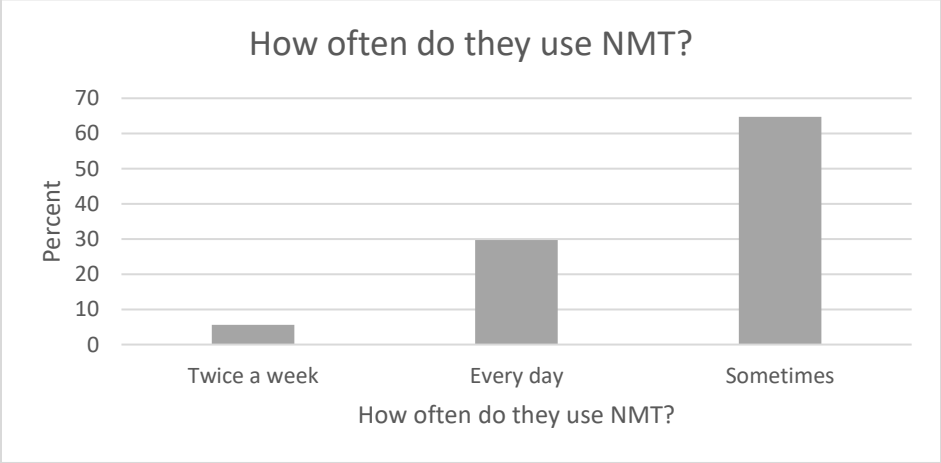

Figure 26 How often do they use NMT

Source: (Researcher survey result, 2022)

Which NMT transport method is frequently used by the users?

The table below displays the most common mode of transportation used by the sample population. Walking is the most common mode of transportation utilized on a daily basis, followed by cycling. The majority of responders use NMT only sometimes.

		Which NMT do they use the most?				Total
		Walk and Bicycle	Walk	Bicycle	Electric Scooter	
How often do they use NMT?	Twice a week	0	18	0	0	18
	Every day	4	74	18	0	96
	Sometimes	22	184	2	1	209
Total		26	276	20	1	323

Table 21 How often and Which NMT do they use the most analysis result

Source: (Researcher survey result, 2022)

The chart below simplifies the previous results about how often and which NMT do the sample population use and makes the result easier to understand.

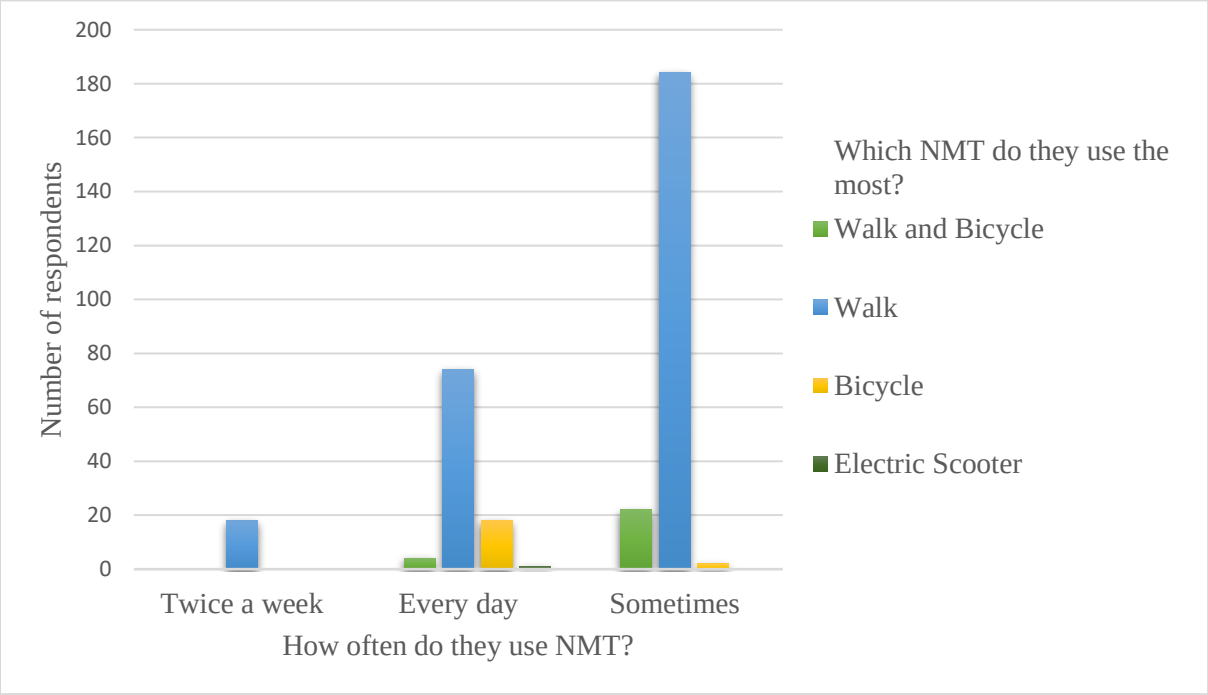

Figure 27 How often and Which NMT do they use the most analysis result.

Source: (Researcher survey result, 2022)

4.3.2 Issues and benefits of non-motorized transport.

The researcher obtains the following data from the data collecting results concerning did NMT have benefits in order to alleviate the existing transportation difficulty in the study are obtained from this questioner.

	Frequency	Percent
Yes	**313**	**82.4**
No	**67**	**17.6**
Total	**380**	**100.0**

Table 22 NMT benefits in order to alleviate the existing transportation difficulty result

Source: (Researcher survey result, 2022)

According to the above table, 82 percent of the sample population believes that expanding NMT offers multiple benefits for urban transportation and it can reduce the challenges for sustainable urban transport, however 17 percent (or 67 respondents) disagree.

Using NMT has numerous benefits for society and cities. These advantages will help to mitigate the challenges for sustainable urban transportation. There are various benefits of NMT they are: reduce air pollution, space utilization, cost saving, help other mode of transport, health benefit (physical exercise), increase social interaction, low traffic accident. The researcher organized the benefits according to sustainability pillars as follows.

Social benefits

Health benefit (physical exercise)

According to World Health Organization research, physical inactivity is one of the main causes of death (2011). The usage of NMT on a daily basis is one strategy to increase physical activity. However, in affluent countries, the use of NMT has reduced significantly during the last few decades. Around 60% of adults worldwide are inactive, leading to obesity and other disorders (Mansoor et al., 2021).Physical activity can lower the risk of heart and circulation illness by up to 35% and the chance of dying prematurely by up to 30%, according to research (OCASI, 2021).NMT increases health advantages. People will use their legs to move when they wish to go somewhere. They will use their legs to move the bike when riding it and it can be physical

activity for to burn as many calories as possible. This benefit is very essential for sustainable urban transport.

Accessible for all and increase social interaction

Because the bicycle is a low-cost mode of transportation, it has the potential to promote fairness and improved accessibility for persons who cannot afford public transit or the purchase of a motor car. NMT improves social interaction for the community and fosters social activities in the community through various means of communication.

Economic benefits

According to the ITDP report (2018), Well-designed streets reduce the use of motor vehicles and the associated expenses of traffic congestion; increase retail sales and business transactions; raise property values; provide a less expensive alternative to road building and maintenance, and reduce family transportation costs.

Cost saving

Walking is always the cheapest means of transportation for distances of less than 1km, cycling is cheaper than public transportation, and driving is ten times more expensive than all of these choices. The bigger the cost saved, the greater the distance cycled (Phayane, et al., 2014). The cost of motorized transport is very high due to the expensive motors type.

Help other mode of transport

If planned properly, cycling and pedestrian networks can act as a feeder to public transport. (CPI, 2022). The expansion of NMT is very helpful to other modes of transport, as the researcher observe some transportation challenges in the study area it will help to reduce congestion and long commuting time for buses and taxis.

Low traffic accident

According to the researcher's observations, there are many vehicles around the site, and it is known that the more vehicles that are alive, the more accidents that will occur, but if there are NMT in the site, the accident will be reduced, which is a very important benefit in order to reduce the challenges for sustainable urban transportation.

Environmental benefits

Reduce air pollution

One of the major sources of greenhouse gas emissions and air pollution is road transportation. Although many other energy sectors contribute to greenhouse gas emissions, transportation

emissions are fast increasing and are anticipated to increase by 80 percent between 2007 and 2030, especially in developing countries (Mansoor et al., 2021).Switching from motorized to nonmotorized forms of transportation can lower tailpipe emissions and local air pollution. Motor vehicle pollution contains hazardous substances such as particulate matter, nitrogen oxide, and Sulphur dioxide, which contribute to local air pollution (ITDP, 2020).More NMT in the urban area means less motorized transportation, and less motorized transportation means fewer gas emissions from automobiles.

Space utilization

Bicycles take up less space than other modes of transportation. Bicycles offer a space-saving benefit in developed cities with limited parking since providing bicycle parking takes up less room than parking for an average-sized motor car. Figure 32 shows the space required to transport the same number of persons by various means of transportation in comparison to a bicycle. It demonstrates that the bicycle is a better means of transportation over shorter distances (Phayane, et al., 2014).

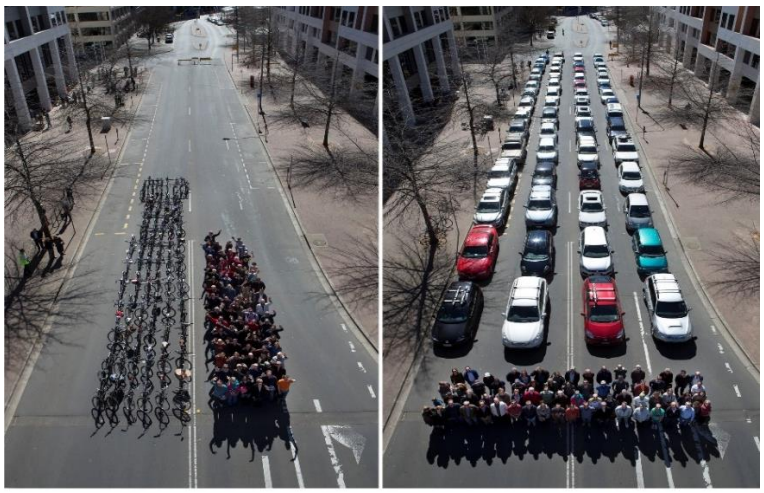

Figure 28 Benefit of NMT for space utilization

Source: (Schauer, 2015)

4.3.3 how can non-motorized transport help in sustainable urban transport planning

A sustainable transportation system should make effective use of limited resources. This may be done by boosting the usage of NMT and encouraging fuel-efficient and environmentally friendly vehicles (United Nations, 2012). Sustainable urban transport planning includes ten major principles, and NMT is one of these principles. This means that NMT is has a great role in order to reduce the challenges for sustainable urban transport.

Planning dense and human scale cities, developing transit-oriented cities, managing parking, encouraging walking and cycling, controlling vehicle-use, implementing transit improvements, promoting clean vehicles, approaching the challenges comprehensively, communicating solutions, and optimizing the road network and its use are all included in principles of sustainable urban transport (SUTP, 2022).

From the Ethiopian road authority office, the researcher got some information about the relation of the urban transport plan and NMT and it is summarized as follows.

The development of road infrastructure and amenities is important to accelerate the urban environment's social and economic growth. Infrastructural development projects will help to create a suitable environment to access a larger and quicker community's needs. In addition to this, it ensures the development of road infrastructure for the community. The Addis Ababa City Road Authority has created and is currently developing enormous roads that are upgrading the city in addition to boosting its growth.

This authority office has paid particular attention in the previous three years to bringing the NMT and car-based package. Road construction is progressing well across the city to lower traffic congestion and accident. It is essential to build road infrastructure specifically to non-motorized transportation in order to enhance the benefits of non-motorized transportation. It has also been attempted to construct broad highways with bicycle lanes and pedestrian crossings. From the recent attempt Hachalu Road and Wolo sefer road building are an excellent example for the NMT and MT, as seen in the image below.

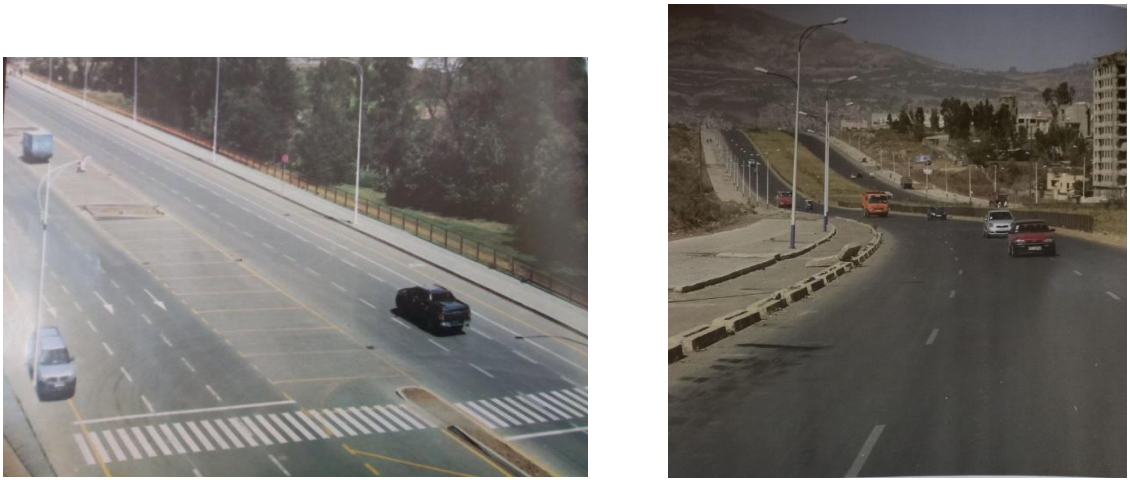

Figure 29 Examples of a new inclusive road in Addis Ababa

Source: (AACRA, 2014)

4.3.4 How NMT reduce the challenges for sustainable urban transport

NMT provides various advantages for urban transportation and will promote sustainable urban transportation. The use and mechanism by which NMT ensures sustainable urban transportation planning are represented in the figure 34 below.

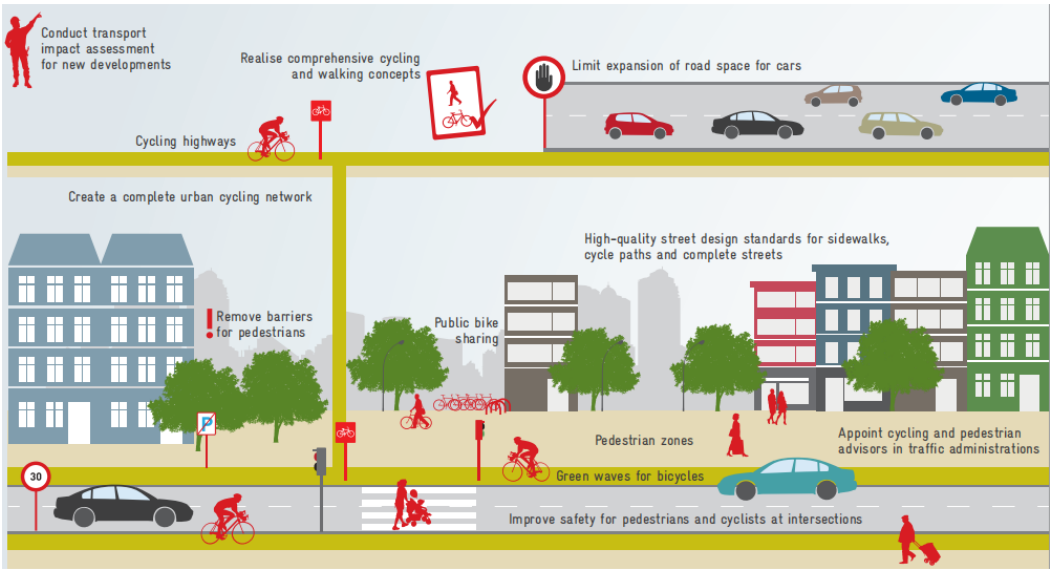

Figure 30 Benefit of NMT for space utilization

Source: (Schauer, 2015)

4.3.5 Discussion

From the 3 key informant interviews, the first key informant interviewed person was Mr.Mulugeta, who believes that NMT may assist the present transportation system and will be effective in reducing current transportation difficulties. When the researcher asks how NMT might be a solution to the current problem, he says that if NMT is expanded, there will be less congestion and longer commute times. And he was unaware of any new design or plan in the research area. While one of the key informants agreed with Mr.Mulugeta, she is aware of a new planning for the study area that is about the new design or plan in the study area, which began two years ago but has not yet been completed, and if the new BRT road is completed, it may reduce the challenges, according to one of the key informants, Mrs. Yetenayet. Finally, the third key informant was a file finisher, and his answer differed from the two respondents, and the researcher don't think his answer was reliable, therefore the answers were canceled.

NMT is a mode of transportation that can help cities to reduce traffic congestion and pollution. NMT is powered by human or animal energy. As a result, boosting the use of non-motorized

modes including public transportation is essential for sustainability. Pollution: These modalities are non-polluting and environmentally beneficial by nature (Kumar, 2015). NMT provides social, environmental, and economic benefits for society; these benefits will be useful in minimizing urban challenges for sustainable urban transportation. The researcher selects the primary benefits of NMT among the several benefits that will assure sustainable urban transportation practices as well. The environmental advantage of NMT is that it minimizes the amount of energy they consume and space utilization for the urban environment. This implies the vehicles emit less pollution and are more efficient than motorized transportation as well as they manage the spaces in the urban roads. The social benefit includes reduce the amount of time people spends on the road (long commuting hour), ensures the health benefit (physical exercise), and Safety. Because of their intrinsic moderate speeds, NMT is a perfectly safe method. Congestion and narrow roads are common on the study area. However, there were few accidents involving pedestrians, and bicycles that resulted in death or serious injury. The problem has been arisen because of motorized vehicles for movement or parking is encroaching upon roadways reserved for NMT. The economic benefits of NMT are affordability, help other mode of transport, minimize traffic accident cost and cost minimization for the society.

Major finding

From the result of questionnaire, 91.5 percent of the sample population agreed there is a challenge for sustainable urban transport in the study area. Several urban transportation issues were raised during the discussion, including significant traffic congestion, a lack of suitable public transportation, air and noise pollution, a lack of parking spaces, a lack of proper infrastructure, a lack of NMT infrastructure, incomplete roads, and reliance on automobiles.

According to 313 respondents (or 82 percent of the sample population), whereas 17 percent (or 67 respondents) disagreed. Expanding NMT has various benefits for urban transportation and can minimize the problems of sustainable urban transportation. One of the key informants believes that if NMT is expanded, there will be less congestion and longer commute times. According to other key informants, if a new BRT road is completed, it may reduce the challenges. From the literature, the researcher finds that NMT helps urban transportation in terms of social, environmental, and economic advantages; these benefits will be effective in reducing urban difficulties for long-term urban transportation.

CHAPTER - FIVE

Conclusion and Recommendation

5.1 Conclusion

The purpose of this study was to identify challenges for sustainable urban transport on the Jomo-Mekenisa route and to explore the importance of NMT in reducing the challenges for sustainable urban transport in the study area. In chapter four, various types of survey data were collected and analyzed to undertake this study. The following conclusion is derived from the results.

The road from Jomo to Mekenisa is hampered by several transportation challenges that do not contribute to the city's sustainable urban transportation system. Significant traffic congestion, a lack of suitable public transportation, air and noise pollution, a lack of parking spaces, a lack of proper infrastructure, a lack of NMT infrastructure, incomplete roads, and reliance on automobiles are seen in the study area, and these challenges will not create a sustainable urban transport system. These challenges make the communities' daily bias in their economic, social, and environmental lifestyle very difficult, and sustainable urban transport is not present if those challenges are seen because sustainable urban transport ensures the community's social, environmental, and economic aspects.

There are ten important sustainable urban transportation principles that will help to reduce the challenges, such as Car Free Developments, developing transit-oriented developments, promoting clean vehicles, encouraging pedestrians and cyclists, optimizing road networks, developing public spaces in city centers, parking management for sustainable transportation, traffic calming, managing parking, communicating solutions, and implementing transit improvements. Based on the ten principles, the researcher seeks to see if NMT is beneficial for reducing the challenges for sustainable challenges, and the researcher obtained important data from site analysis, questionnaires, key informant interviews, and various literatures. Many people stated that NMT is very important for reducing the current challenges in the study area, and it has economic, social, and environmental benefits for the community.

In general, the research of challenges for sustainable urban transport based on road users' responses reveals that this road is difficult and requires a solution to develop a sustainable urban transportation system in the study area. And NMT offers various advantages in terms of reducing urban transportation challenges.

5.2 Recommendation

Based on the knowledge gathered from the literature, the results of the challenges for sustainable urban transportation, and the advantage of NMT in reducing the obstacles for sustainable urban transportation in the case of the Jomo-Mekenisa route, the recommendations are given.

- Road capacity for private motorized transportation should be reduced in city centers that are easily accessible by public transportation. Instead, current road capacity should be devoted to on-ground public transportation options, bicycles, and expanded pedestrian zones.
- The road must be maintained, and unfinished roads and pedestrians must be completed within the time frame specified in order to guarantee the safety of individuals with disabilities.
- Public transportation should be easily accessible for both people with disabilities and forabled.
- For disabled people, the urban transport system must be accessible.
- Cycling and walking should be encouraged by providing appropriate and safe infrastructure, particularly for short trips.
- For longer trips, cycling and walking should be encouraged in conjunction with public transportation.
- Electric scooters should be used in metropolitan areas to minimize the cost and time spent traveling by public transportation.
- The government should punish informal traders on the road and on pedestrians, and the government must develop a legal provision for informal dealers on the road.
- The city must minimize its reliance on automobiles and instead adopt NMT and electricity transit options to create sustainable urban transport.
- Media and conferences at all levels should create awareness about building sustainable urban transportation, teaching the community about the benefits of NMT, and persuading the community to utilize NMT instead of MT.
- There must be an optimal combination of public transit, motorized cars, and NMT to ensure an economically, environmentally, and socially sustainable transportation system.

Reference

Admasu, F. (2019).Reliablity assissment of the transport system, *Addis Ababa case study. 49*(4), 27–36. https://doi.org/10.2478/jok-2019-0073

Affenzeller, J., Beaumel, L., Bergstein, M., Coppin, O., Faye, I., Hildermeier, J., . . . Scott, D. (2017). *Electrification of the Transport System.* European Commission.

Aftabuzzaman, M., & Mazloumi, E. (2011). Achieving sustainable urban transport mobility in post peak oil era. *Transport Policy*, *18*(5), 695–702. https://doi.org/10.1016/j.tranpol.2011 .01 .004

Aklilu, T. (2020). The role of transport sector in Ethiopia's economic development. *Addis Ababa, Hilton hotel*. https://eea-et.org/sites/default/files/publications/Economic%20Focus%20%20 Vol%209%20 No%204_0.pdf

Andrew, N. (2017). *Reduce Traffic Congestion. In Crowd Sourced Transport*. https://crowd sourced-transport.com/working-pages/improve-public-transport/reduce-traffic-congestion/%0Ahttp://crowdsourced-transport.com/working-pages/improve-public-transport/reduce-traffic-congestion/

Ariffin, R. N. R., & Zahari, R. K. (2013). Towards a Sustainable Urban Transport System in the Klang Valley, Malaysia: *The Key Challenges. Procedia - Social and Behavioral Sciences,85*, 638–645. https://doi.org/10.1016/j.sbspro.2013.08.391

Asaduryan, A. (2020, 0 0). StackPath. StackPath; www.yescycling.com. https://www.yescycling.com/cycling-vs-walking/

Banerjee & Associets. (2003). An over view of common parking issues, parking management options, and creative solutions prepared for: *an over view of common parking issues*.

Biack, W. R. (1996). Sustainable transportation: a US perspective. 6923(96).

CPI. (2022, 0 0). TransMilenio: renewing Bogotá’s transport system. Centre For Public Impact (CPI); www.centreforpublicimpact.org. https://www.centreforpublicimpact.org/case-study/transmilenio

Dimitriou, H. T., & Gakenheimer, R. (2011). Urban transport in the developing world: A handbook of policy and practice. In Urban Transport in the Developing World: A Handbook of Policy and Practice (pp. 1–636). https://doi.org/10.4337/9781849808392

Goldman, T., & Gorham, R. (2006). Sustainable urban transport: Four innovative directions. Technology in Society, 28(1–2), 261–273. https://doi.org/10.1016/j.techsoc.2005.10.007

Gorham, R. (2002). Air Pollution from Ground Transportation an Assessment of Causes, Strategies and Tactics, and Proposed Actions for the International Community. Strategies, 1–194.

Greene, D. L. (2015). Sustainable Transportation. International Encyclopedia of the Social & Behavioral https://doi.org/10.1016/B978-0-08-097086-8.91073-0

Heineman, B. (2021). Sustainable pollution assessment practice.

Hook, W. (2005).Training Course: Non-motorized Transport. *Environment and Infrastructure Sector Project, "Transport Policy Advice" Germen. Sciences: Second Edition,* 9, 845–849.

Hosani, N. Al, & Salam, A. (2020). Sustainable City Transport Strategies: *Tourist Perspectives* on Dubai. https://doi.org/10.4172/2324-8807.1000184

Ieda, H. (2010). Sustainable Urban Transport in an Asian Context. In *Library for Sustainable Urban Regeneration Series* (Vol. 9, p. 448).

ITDP. (2020, 0 0). Benefits of walking & cycling – ITDP – NMT Toolkit. Benefits of Walking & Cycling – ITDP – NMT Toolkit; nmttoolkit.itdp.org. https://nmttoolkit.itdp.org/guide/introduction/benefits-of-walking-cycling/

Ilahi, A., Belgiawan, P. F., & Axhausen, K. W. (2019*).* Influence of pricing on mode choice decision integrated with latent variable. *In Mapping the Travel Behavior Genome. Elsevier* Inc. https://doi.org/10.1016/B978-0-12-817340-4.00008-5

Kamundu, E. (2020). *Challenges and Opportunities for Sustainable Urban Mobility (Non-Motorised Transport): A Case Study of Eveline Street in the Windhoek Municipality, Namibia.* PhD Thesis, Cape Town.

Klau, R. O. (2015). Sustainable urban transport: Challenges *and solutions for sustainable urban transport in cities of Vietnam.* Ekp, 13(1), 1–13.

Kumar, Dr. R. (2015, 0 0). *(PDF) NON-MOTORIZED TRANSPORT AND SUSTAINABLE URBAN PLANNING: A CASE STUDY OF PUNE METROPOLITAN REGION | IAEME Publication - Academia.edu*.

Lindholm, M. (2013). Urban freight transport from a local authority perspective-A literature review. *European Transport - Transport Europe*, *54*, 1–37. Metropolitan Areas. Journal of Basic and Applied Scientific Research

Majedi, H., Habib, F, Khanloo, & N. (2012). *An Analysis of Challenges of Sustainable Urban Transport in. Metropolitan Areas. Journal of Basic and Applied Scientific Research.*

Mansoor, U., Tamim, M., Fazal, K., & Safi, R. (2021). A review of factors and benefits of non - motorized transport : a way forward for developing countries. *Environment, Development and Sustainability*, *0123456789*. https://doi.org/10.1007/s10668-021-01531-9

Mat, Y., & Ismailb, R. R. A. (2011). *The Use of Non-Motorized for Sustainable Transportation in Malaysia.*

May, A. D. (2013). Urban Transport and Sustainability: The Key Challenges. *International Journal of Sustainable Transportation*, *7*(3), 170–185. https://doi.org/10.1080/15568318.2013.710136

May, A. D., Page, M., & Hull, A. (2008). Developing a set of decision-support tools for sustainable urban transport in the UK. *Transport Policy*, *15*(6), 328–340. https://doi.org/10.1016/j.tranpol.2008.12.010

Mercier, J. (2009). Equity, Social Justice, and Sustainable Urban Transportation in the Twenty-First Century. *Administrative Theory & Praxis*, *31*(2), 145–163. https://doi.org/10.2753/atp1084-1806310201

Ministry of transport. (2011). *The Federal Democratic Republic of Ethiopia Ministry of transport: Transport policy of Addis Ababa.*https://chilot.me/wp-content/uploads /2011/08/transport-policy-of-addis-ababa.pdf

Ministry of transport. (2020). *Ethiopia non-morotized transport strategy 2020-2029.* Addis Ababa: Ministry of transport.

Mollenkamp, D. T. (2021). Sustainability*: Sustainable Urban transport*. http://doi.org/19.1098763/y.blotino.2021.8.03

Msigwa, R. E. (2013). *Challenges Facing Urban Transportation in Tanzania*. *3*(5), 18–26.

Notes, G. (2019). *8 Helpful Steps for Solving the Problems of Urban Transport* (pp. 1–19).

Narayan, A. (2018). The electrification of transport could transform our future – if we are prepared for it. *World Economic Forum.* World Economic Forum. Retrieved from https://www.weforum.org/agenda/2018/08/we-must-get-it-right-with-electric-vehicles-for-the-sake-of-our-planet

OCASI. (2021, November 10). *What are the health benefits of walking and cycling?* What Are the Health Benefits of Walking and Cycling? settlement.org.

https://settlement.org/ontario/daily-life/transportation/walking-and-cycling/what-are-the-health-benefits-of-walking-and-cycling/

Pankhurst, R. (1962). Transport and communications. *Transpot history* doi:10.1177/002252666200500406

Pardo, C., Jiemian, Y., Hongyuan, Y., & Mohanty, C. (2014). *Sustainable urban transport: A Guidefor Sustainable Urban Development in the 21st Century*.

Peter, M. O. (1986). *Transportation and urban form: stages in the special evolution of the American metropolis.*

Paul, S., & Comfort, S. (2018). *urbanization.* doi:10.13140/RG.2.2.23495.96161

Phayane, Sekadi & Vanderschuren, Marianne & Jennings, Gail & Newton–Reid, L. (2014). Non-Motorized Transport – Best Practice Manual.

Pojani, D., & Stead, D. (2015). Sustainable urban transport in the developing world*: Beyond megacities. Sustainability (Switzerland),* https://doi.org/10.3390/su7067784

Pojani, D., & Stead, D. (2018). Policy design for sustainable urban transport in the global south. *Policy Design and Practice*, *1*(2), 90–102. https://doi.org/10.1080/25741292.2018.1454291

Popovic, T., & Avramenko, Y. (2013). Computer Aided Chemical Engineering. *23rd European Symposium on Computer Aided Process Engineering.*

Raghav. (2020). 5 *Major Environmental Impact of Transport Development* (pp. 1–11). http://www.geographynotes.com/articles/5-major-environmental-impact-of-transport-development/249

Rahman, H., & Chin, a. H. (2011). *SUSTAINABLE URBAN TRANSPORT IN SINGAPORE: A.* singapore.

Robinson, M. (2020). *Climate Justice.* Retrieved from https://www.mrfcj.org/about/international-advisory-council/gro-harlem-brundtland/

Rodrigue, J.-P. (2017). 1. *Urban Transportation at the Crossroads. The Geography of Transport Systems*, 1–27.

Salihahsally, T. (2019). *Difficulties for Pedestrians There are two issue here Firstly pedestrian _ Course Hero. https://www.coursehero.com/file/p788c17g/Difficulties-for-Pedestrians-There-are-two-issue-here-Firstly-pedestrian/*

Schauer, C. B. (2015, October 11). *Efficiency Master - a Comparison of Different Modes of Transportation. Bikecitizens;* www.bikecitizens.net. https://www.bikecitizens.net/efficiency-master-for-modes-of-transportation/

Singh, A. S., & Masuku, M. B. (2014). Sampling techniques and determination of sample. *International Journal of Economics, Commerce and Management, United Kingdom*.

Sphera. (2020). *Enviromental sustainablity. What Is Environmental Sustainability* https://sphera.com/glossary/ What-Is-Environmental-Sustainability/

Solanke, M. O. (2013*). Challenges of urban transportation in Nigeria. International Journal of Development and Sustainability, 2*(2), 891–901. www.isdsnet.com/ijds

SUTP. (2022, January 17). 10 Principles for Sustainable Urban Transport - SUTP. SUTP; sutp.org. https://sutp.org/publications/10-principles-for-sustainable-urban-transport/

Sustainable Cities Mobility Index. (2017).*Sustainable cities*

Takiguchi, H., & Mizuno, O. (2013). *Investigating in Sustainable Transport and Urban Systems: The GEF Experience*. 28. https://www.thegef.org/sites/default/files/publications/26211_ lowres_3.pdf

Taylor, M. E. (2020). *Ethiopia's Emperor Menelik II was the first African to drive a car in 1907. African History.* Retrieved from https://face2faceafrica.com/article/did-you-know-ethiopias-emperor-menelik-ii-was-the-first-african-to-drive-a-car-in-1907

United Nations. (2012). *A frame work for advancing environmental and social sustainability in the United Nations system* (Environment Management Group ed.).

United Nation. (2015). *Concept of Sustainable Transport: Planning and Designing forSustainable and Inclusive Transportation Systems*.

UNESCAP. (2015). *Concept of Sustainable Transport: Planning and Designing for Sustainable and Inclusive Transportation Systems* National Capacity Building Workshop on Sustainable and Inclusive Transport Development. July.

University of Alberta. (2019). *Sustainability: What is sustainability? Sustainability in higher education Canada. Sustainable and Inclusive Transportation Systems*

Vanderschuren, M., Phayane, S., Taute, A., & Zuidgeest, M. (2014). *NMT Facility Guidelines*. *December*.

Valiantis, M. (2014). Sustainable urban transport. *Sustainability behind Sustainability*, 345–369. https://doi.org/10.3141/2243-05

Weheyaga, S. (2019). *Improving Addis Ababa Transport System by Using Transport Demand Management Strategy*.

Wolfram, M. (2004). *Expert working group on sustainable urban transport plans. Rupprecht Consult,* 106. http://www.basqueecodesigncenter.net/Documentos/Noticias/5443EFB6-C6F9-4082-B86F-C124CBF4C397/final_report050128.pdf

Yazid, M., Ismail, R., & Atiq, R. (2011). Procedia Engineering the Use of Non-Motorized for *Sustainable Transportation in Malaysia. Procardia Engineering*, *20*, 125–134https://doi.org/10.10 16 /j. proeng.2011.11.14

Yigitcanlar, T., Fabian, L., & Coiacetto, E. (2008). *Challenges to Urban Transport Sustainability and Smart Transport in a Tourist City: The Gold Coast, Australia. The Open Transportation Journal*, *2*(1), 29–46. https://doi.org/10.2174/1874447800802010029

APPENDIX

Appendix A- Field observation checklist

No	Challenges		Node 1		Node 2		Node 3		Node 4		Remark
			yes	no	yes	no	yes	no	yes	no	
1	Traffic congestion										
2	public transportation										
3	Air and noise pollution										
4	Parking spaces										
5	Infrastructure Maintenance	Road									
		Pedestrian									
6	NMT infrastructure	Cycle lane									
		Pedestrian									
7	Unfinished Infrastructure	Road									
		Pedestrian									
8	Automobile dependency										
9	Informal sectors										

Appendix B- Questionnaire

ADAMA SCIENCE AND TECHNOLOGY UNIVERSITY

SCHOOL OF CIVIL ENGINEERING AND ARCHITECTURE

DEPARTMENT OF URBAN PLANNING AND DESIGN

MSC PROGRAM

Dear Participants, this questionnaire is intended to identify the major challenges of sustainable urban transport in the instance of Addis Ababa, Nefas silk Lafto sub city from the road of Mekenisa to Jomo Road, and to provide alternative ways to reduce the challenges of urban transportation. Your responses to the questions below are critical to achieving this goal and thoroughly investigating the case. The research is being carried out in order to complete a requirement for a Master's Degree (MSC) in Urban Planning and Design at Adama Science and Technology University. As a result, you are respectfully urged to carefully read the questions and provide correct and true data that exists on the ground. Please ensure that the response you provide will not be used for any other purpose other than the completion of my thesis. So, be free to respond in an honest and real manner. Thanks in advance for your response and time!!

1. Sex

   ☐ Male ☐ Female

2. Age

   ☐15-29 ☐ 30-45 ☐45-60 ☐>60

3. How often do you use this street?

---

4. What kind of transport do you use the most often?

   ☐Bus ☐ Taxi ☐Bike ☐ Walk Other----------

5. Do you think the street includes all street amenities?

   ☐Street furniture ☐bus lane ☐waste receptacle ☐cycle lane ☐signage

   ☐ street light ☐ pedestrian

   other: ----------

6. Do you have any challenges related to the transport system that you are using?

   ☐Yes ☐ No

7. If your answer is yes to the question No. 6, what are the challenges of urban transport to the site?

   ☐ Congestion ☐ Automobile dependency ☐Unsafe for people with disabilities

   ☐ Parking difficulties ☐Lack of public transport ☐ Inadequate bike lane ☐Inadequate pedestrian infrastructure ☐ Lack of proper infrastructures like Road and pedestrian

   Other: ----------

8. Is there any maintenance for the existing infrastructure, such as road, bus lanes, cycle lanes, and other important elements of the street?

   ☐Yes ☐ No

9. How do you rate the current urban transport system on the site?

   ☐Excellent ☐ Very good ☐Good ☐ Not bad ☐Bad

10. At which time the road is congested?

    ☐ Morning 2:00 - 4:00 ☐ Evening 11:00 - 2:00 ☐ All-day long ☐4-10 (truck time)

    ☐ Never

11. What is the best time to travel?

    ☐ Morning 2:00 - 4:00 ☐ Evening 11:00 - 2:00 ☐ All-day long ☐4-10 (truck time)

    ☐ Never

12. Do you use non-motorized transport (Bike or walk) to go somewhere?

    ☐Yes ☐ No

13. If your answer is yes for the above question, which NMT do use the most?

    ☐Bike ☐ Walk

14. If your answer for question number 12is yes, how often do you use NMT?

    ☐Every day ☐ Every three day ☐Sometimes ☐Once a week ☐ Twice a week

15. Do you think the expansion of NMT will reduce the current challenge of urban transport?

    ☐Yes ☐ No ☐ May be

16. Do you think the existing pedestrian is comfortable and wide enough to walk?

    ☐Yes ☐ No ☐ May be

17. Do you think that the pedestrian is effectively used by the users?

    ☐Yes ☐ No ☐ May be

18. Do you think there are public and other transportation methods that are easily available in the street?

    ☐Yes ☐ No ☐ May be

19. Do you have any additional comments based on the current urban transport on the site?

    ---

20. If there are any challenges that are not stated in the questionnaire, please state your thoughts.

Appendix C- Key informant interview

ADAMA SCIENCE AND TECHNOLOGY UNIVERSITY

SCHOOL OF CIVIL ENGINEERING AND ARCHITECTURE

DEPARTMENT OF URBAN PLANNING AND DESIGN

MSC PROGRAM

Greetings, interviewee Please accept my sincere gratitude in advance for your willingness to answer the following questions. The goal of this interview is to collect data for the completion of an MSc in Urban Planning and Design on the thesis topic "Challenges for sustainable urban transportation in the context of Addis Ababa, Nifas Silk Lafto sub city Woreda (from Jomo to Mekenisa road)." As a result, the information you offer is critical to this research; thus, please feel free to share it, and I guarantee you that the information you provide will be kept private.

1.Do you think NMT can assist in the planning of sustainable urban transportation?

2 If yes, how?

3 Are there any site plans or designs in the study area? (Route from Mekenisa to Jomo)?

4.If yes, do you think that the new design will minimize 'Challenges for urban transportation'?