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POTENTIAL OF MULTIFUNCTIONAL STREETSCAPE FOR RESILIENCE: THE CASE OF KALITY

A Thesis

Submitted to the School of Graduate Studies of Addis Ababa University in Partial Fulfillment for
the requirements for the degree of MASTER OF SCIENCE IN LANDSCAPE
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I, undersigned, declare that this thesis is my own and original work that has not been presented for a degree in any other university. All sources of materials used for the thesis have been accordingly acknowledged, following the scientific guidelines of the institute.

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Confirmation

This thesis is submitted to the Ethiopian Institute of Architecture, Building Construction, and City Development (EiABC) and to the School of Graduate Studies of Addis Ababa University in the partial fulfillment of the requirements for the degree of Masters of Science in Landscape Architecture.

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Dedication

To my Family,
May Your Dreams Come True!

ACKNOWLEDGEMENT

First, I would like to splendor GOD with his mother for giving me the blessing and strength that helps me to complete this thesis. This won't be real without you.

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Abstract

The streets of Addis Ababa are found in the lowest international standard. Akaki Kality is one of the 10 sub cities in Addis Ababa situated in the southern part of the city center. In Early periods the sub city was demarcated for the industrial zone. The existence of different industries and quarry sites with heavy traffic has more exposed the sub city streets to air and noise pollution than the other sub cities in Addis Ababa. The study investigated the street from Kality Drivers and Mechanics Training Center to Kality Total gas station. The research analyzed the potential and better usage of multifunctional streetscapes for resilience, the major problems in the street, and the degree of communication and interaction with people and the street. The collected data has been analyzed by quantitative and qualitative data analysis method. Finally, according to the findings, a design is generated with specifications and design guidelines of multifunctional streetscape for resilience in the Street as a prototype for designing a streetscape.

Keywords: Multifunctional Streetscape, Resilience, Green Street, Green Infrastructure

ACRONOMYS

AAWSA: Addis Ababa water and sewerage authority

AASTU: Addis Ababa Science and Technology University

AASOID: Addis Ababa surrounding Oromia integrated development plan Project office

ASLA: American Society of Landscape Architecture

BRT: Bus rapid transit

CO₂: Carbon dioxide

CSM: Conventional Storm Water Management

EU: European Union

GI: Green Infrastructure

GIS: Geographic Information System

GIP: Green Infrastructure Plan

GS: Green Streetscape

L: Liter

Kg: Kilogram

LRT: Light railway transit

LSM: Landscape based Storm Water Management

KKG: Kality Kidus Gebriel

KT: Kality Total

MS: Multifunctional Streetscape

NDR: Neighbourhood Development Plan

ORL: Old Railway Line

OSZ: Oromia special zone

STGB: Smart Transportation Guide Book

UK: United Kingdom

UV: Ultra Violet

WCEL: West Coast Environmental Law

WOPSNA: Waveney Open Space Needs Assessment

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CHAPTER 1: INTRODUCTION

1.1 Background of the Study

Humanity has failed. Global trade increases. Prosperity increases. Freight transports increase. But we have failed in adjusting transports to a long-term sustainable society (Algirdas, 2013). Urbanization and industrialization can be viewed as essential causes for land use and land cover change, and it also increases with the majority of the world's population migrating into cities (Haifeng et al., 2015). This urbanization has altered the natural landscape and affected the natural cycle through the construction of impervious surfaces such as buildings, roads and parking lots (Michael et al., 2014). At urban areas, air and noise pollution increases, climate changes, and the amount of groundwater recharge has been reduced while the volume and rate of runoff have been increased (Michael et al., 2014). According to Mehmet, et al., (2010) urban areas account for only 2% of the world's land surface but produce 78% of the greenhouse gases. Particularly, there are a series of problems between the economic development and the protection of the ecological environment in urban areas. There are four major effects of urbanization on the environment: increased temperature, increased runoff due to impervious surfaces, lower levels of native species diversity, and increased production of carbon dioxide. In addition to that, air pollution, climate change, and traffic congestion is a local and global wise problem. This pollution, climate change, and congestion implies there has to be prepared plan to adapt or mitigate the problem (David et al., 2011). The changes in climate result miss-functionality of the ecosystem. The behavior of urban built environments and rapid population growth in urban areas increase the consequences of time to time (David et al., 2011; Peter et al., 2013).

Cities have been influenced by different theories and ideologies and modernism with no consideration of humans (Jan, 2010). Previous practices of planning and designing cities depict the condition of a city either to be resilient or not. This urban planning and design should incorporate and engage quality of different programs of neighborhoods and street network which increase city livability (David et al., 2011; Peter et al., 2013). Considerations to create better city life and for pedestrians and low priority for car traffic was the progress in practical urban planning in 21th century which missed out in the early periods. This makes cities phase out early, emergence of lifeless cities and disgraceful conditions (Jan, 2010).

One of the most criteria in order to assume a quality of a good city is having good weather (micro, local and macro climate) with a comfort zone. When the functionalities and aesthetical quality get along the city could serve as a gallery itself. Clean air, cool and peaceful environment, diversity is crucial for a city life which by having greenery (trees, shrubs, flowering plants, etc.) (David et al., 2011; Jan, 2010; Peter et al, 2013). Livability of a city could be defined in various ways. Complete neighborhoods, accessibility and sustainable mobility, a diverse and resilient local economy, vibrant public spaces and affordability make a city livable. (Mohammadreza et al., 2014). The livability of a city will be determined by the satisfaction of the public on the economic, social, and environmental qualities of a city.

Streets are the main domain which people experience the city livability. Streets are one of the underutilized public spaces in cities. Streets are a soul of a city and, they have to be considered and imagine as real part of urban ecology (Chinmoy, 2015). The street shouldn't only be considered as a corridor to serve motorization. However, the street can also serve as a public space which brings a vibrant street life. A planned street have a significant role in supporting the environment, public health, economic, social and, cultural values (NACTO, 2013).

The street should be designed for every user, be safety, healthy, and sustainable. Regarding age, ethnic group, and income; street has to serve equally. Streets also should not be exposed to criminal activity and have to create a safer environment for all. A good quality street can be defined as sustainable infrastructure that can resist future risks, that engages the community in social interactions and economic value, which can create a sense of place in the city, and that improve safety.

Streets with thier design elements, characteristics, and material types play a role for rising in temperature, urban heat island effect, and gas emission. In addition, vehicles are known for emitting carbon dioxide to the environment. In average number, per 1-liter gas 2.4 kg carbon dioxide will be produced. For this reason streets should be responsive enough to be more environmental friendly as possible (Adam, et al., 2018). Overpopulation brought lots of challenges and problems. In these areas, it is difficult to provide a good condition of bicycling and walking in developing cities. Most of the spaces are busy providing parking and traffic with pollution, and insecurity (Jan, 2010; Peter et al., 2013).

Since it's proven that the benefit of green spaces plays a significant role in order for the livable city, conventional landscape approach should be considered to be done regarding transportation industry. Landscape design approach provides a means in creating a sensitive, informed, and integral approaches which help to conserve, enhance, restore and regenerate landscape with the environment, social, and economic benefits. Streets are among the practical resources that a landscape approach could be integrated and implemented (Cambridge, 2016). Integrating landscape elements such as vegetation cover, water bodies and permeable surface for shading and aesthetically pleasing environment, enhance biodiversity, enjoyable microclimate, air, water and noise pollution reduction, purification and percolation of water (Cambridge, 2016). Therefore, this thesis reviewed various approaches that have been practiced and presented by different kinds of literatures and case studies. This will help in filling the gap regarding the usage of a street.

1.2 Problem Statement

A city has to be fun, attractive and vibrant for residences and visitors. It is known that in ensuring health and quality of life (enhancing livability), public parks, streets and open spaces are critical for a city. These spaces are expected to encourage identity and provide health and quality of life to a city. Cities are complex organisms which everything should be in balance. Urban Cities around the world have expanded physically as they grow in population with infrastructures (Peter et al., 2013). Addis Ababa has been characterized in different ways in different eras depending on human settlements.

Addis Ababa is growing and expanding rapidly with a rapidly growing population. It is becoming a jungle of buildings with noticeable congestion of street corridors at the corner of the city with high vehicular usage and flooding all over the street during the rainy season. The street of Addis Ababa is found in the lowest international standard.

Akaki Kaliti is one of the 10 sub-cities in Addis Ababa situated in the southern part of the city center. The sub-city covers around 118.1 km² with a population about 200,000. It is a strategic southern corridor, both for Addis Ababa and OSZ (Oromia Special Zone). In early periods, the sub-city was demarcated for the industrial zone. However, due to rapid population growth, the

border of the city center spreads through time. The existence of different industries and quarry sites with heavy traffic has more exposed the sub-city to air and noise pollution than the other sub-cities in Addis Ababa. It also attracts dwellers to the sub city. The street serves as a corridor to connect dwellers to the city center and to transport goods.

As stated in literature review section, a multifunctional streetscape has to meet essential elements and design components in order to be resilient (Cambridge 2016; David et al., 2011; Jan, 2010; Kevin, 2014; Leong, 2011) The current ecological provision of multifunctional streetscape of KMraKT is limited in serving peoples. The existed streets of Kality is giving and accommodating less service for the residents. The trend of streets mostly focuses on providing spaces for cars. But streets are an opportunity to increase the amount of permeable surfaces to increase infiltration, biodiversity which serve as green corridor and green belt for urban ecosystem and help to moderate micro climate and act as “lung” of the city.

Streets’ potential in supporting the environment, public health, and economic activity, social and, cultural values is not deliberated well in the Street. The street is failed in considering environmental aspects such as, street trees, air, and noise pollution reduction methods. The street is also failed in the engagement of the community that promotes knowledge exchange and social and cultural interaction. Considering street as a resource and reimagining it for social, cultural and political, health and economic reasons make it a great ecological infrastructure (Chinmoy, 2015).

Limited design consideration to streets is providing less standard streets. However, streets are crucial for the current and future development of the sub-city. There is a need to be inclusive, innovative, healthy, soulful and thriving to make the Streets multi-functional. In order to use the street beneficiary, it has to be reached out by designing of its potential. The practice of starting a complete streetscape has been developed in other sub-cities. Among them, the street from ‘Beherawi’ to ‘Piassa’, the so-called ‘Churchill Road’ could be mentioned as a typical start-up example of the good street. The provided shade and consideration of pedestrians makes the street pleasant to walk by and it engages the layer of programs at a time. There are street trees, street markets, street cafés, traffic lighting, and, proper pedestrian crossing. Even if there are missing streetscape elements (such as street furniture), the corridor creates a good street fabric. This

situation somehow it creates a safe and comfortable environment. According to Mekuria 2015, complete street has to fulfill various criteria of, vegetation cover and area of the open spaces are stated. Components of green and grey facilities have also stated. “Streets, can well mitigate air pollution and sequester carbon dioxide. They tie the streetscape together and reinforce vistas. Trees are amenities that soften and humanize the urban concrete texture.”

Incorporating resilient in streetscape is possible to the Street context. The Street has the capacity and potential of being resilient to the sub-city as well as for the city of Addis Ababa. This practice could serve as a prototype for the other sub-cities, new emerging cities and entire country. Multifunctional Streetscape has significance role in providing ecosystem services for a city. It also create networked green corridors and ways.

The Street is vehicle oriented with an unpleasant environment, an insufficient pedestrian lane, public space, street trees, medians, streetscape furniture, street lighting signage, pavement failure and usage of traditional stormwater management. But streets should not exist to convince of cars only. To enhancing the street in order to have livability is needed. Kality’s community is suffering much more in lack of mobility, safety, pleasing environment, proper treatment and enhancement of street. Noticing a flood on the street grounds and dropping many amounts of water during the rainy season, facing health problems regarding miss-treatment of streetscaping, climate change and dealing with tons of car accidents as a daily base is way far from being multifunctional and resilient.

Generally, the existing street does not promote social, cultural, economic, and environmental aspects. Perhaps this left the street to be lifeless and unpleasant. Therefore, this study has tried to focus on studying potential and better usage of streetscape according to the users, design characters, application, and management. The recommended design types and strategies incorporates aspect of comfortability and safety, environmental friendly, social and cultural enhancement, economic development, and inspired vibrant streetscape. These strategies will promote multifunctional street that improves the communication in between the streets and local community. Safety, environmental comfort, and social and cultural interactive will promote a street resilience. While this research was held, the street was in the stage of site clearing for the new NDP. The recommendation and strategies that have been stated in the later sections of this

study could be additional perspective for the developed plan. The study could also considered as a prototype for future streetscape guideline for the sub city as well as for the city of Addis Ababa.

1.3 Objective of the Study

1.3.1 General Objective

The main objective of the study is to design a multifunctional streetscape which to become resilient in Kality Drivers and Mechanics Training Center to Kality Total gas station Street.

1.3.2 Specific Objectives

The specific objectives of this study are to:

- Identify the potential and better usage of multifunctional streetscapes to become resilient
- Analyze the major problems in Kality Drivers and Mechanics Training Center to Kality Total gas station Street
- Analyze the degree of communication and interaction in between streets and local community
- Generate specifications and design guidelines for multifunctional streetscapes to become resilient

1.4 Research Questions

This research answered the following questions:

- ✓ What is the potential and better usage of multifunctional streetscapes to become resilient?
- ✓ What are the major problems encountered in Kality Drivers and Mechanics Training Center to Kality Total gas station Street?
- ✓ To what extent is the degree of communication and interaction in between streets and local community?
- ✓ What shall be done in order to generate specification and design guidelines for multifunctional streetscapes to become resilient?

1.5 Significant of the study

Streets are often neglected to serve multifunctional activities in the Street. Multifunctional streets have a capability of embracing all the different choices of the people (Jan, 2010). This

qualification offers safety, health, comfort and lots of experience for the community. Multifunctional streets help to have it all in the plate. The linear characteristic of streets has a potential and is suitable to build a green corridor too (Chinmoy, 2015).

The significance of this study is to develop multifunctional streetscape for better livability and resilient. The study puts out the potential of multifunctional streetscapes to be resilient and examine the current situation of the Street.

The other purpose of the study is to understand the major problems, the degree of communication and interaction in between the Kality Drivers and Mechanics Training Center to Kality Total gas station Street and the local community in order to have a livable street. Providing a multifunctional streetscape for Kality that welcomes the public to explore street and enhance needs and values of the community. Integrating layered of activities increase the multi-functionality of a streetscape. This multi-functionality of streetscape helps to engage Kality community to the native landscape elements which are missing.

Studying and assessing existing conditions of the Street, helped to identify the occurrence of ecosystem services that gain due to streets. After identifying and analyzing the services that are provided and not provided, it is easy to go to the next level of generation of landscape-based multifunctional streetscape as green belts.

The intent of this study is to achieve a better life of a street and get benefited from the ecosystem services and usage of streets. After saving today, thinking about tomorrow also has to be considered. Resisting today and tomorrow shake leads to environmental stress tolerance, better future and practice. The findings of the study helped to identify and understand the gap in the existing situation. Generating specification and design guidelines for multifunctional resilient streetscapes will be the final output of this study.

1.6 Scope of the Study

The thematic scope of the study focused on enhancing resilience in sub-city street level. The ecological importance and the impact of resilience streetscape have been evaluated. Streetscape has been taken as examination areas of spatial scope of the study. The significance of multifunctional resilient streetscape has been assessed during the research period to develop design guidelines. The study analyzed the street from Kality Drivers and Mechanics Training

Center to Kality Total gas station which is found in the sub city of Kality, as an example of the social scope of the study. The environmental and social issues of Kality's streets had been covered in the social scope of the study.

1.7. Research Design

Logical Frame Work

Table 1.1: Logical frame work of the research

Specific Objectives	Survey Type	Data Source	Survey Techniques	Data Analysis and Presentation	Expected Output
Identify the potential and better usage of multifunctional streetscapes to become resilient	Literature review and case study	Journals, books, and publications	Reviewing previously conducted studies and projects	Analytical presentation	A better approach to be resilience
Analyze the major problems in the Street	Field observation and questionnaire	Passengers, car drivers, pedestrians, governmental bodies, and personal diary	Purposive sampling of respondents and field observation	Descriptive maps, graphs, tables, figures, and pictures	The Street character and the desire of the community
Analyze the degree of communication and interaction in between streets and local community	Field observation and questionnaire	Passengers, car drivers, pedestrians, governmental bodies, and personal diary	Purposive sampling of respondents and field observation	Descriptive maps, graphs, tables, figures, and pictures	Previous practice of spending time and an aspiration to spend more time on the Street

Generate specifications and design guidelines for multifunctional streetscapes to become resilient		Findings, results and conclusion	Mapping, sketching, drawings, and 3Ds	Site analysis and design recommendations and guidelines	Enhanced landscape value, ecosystem services, and multifunctional streetscape
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Study flow chart

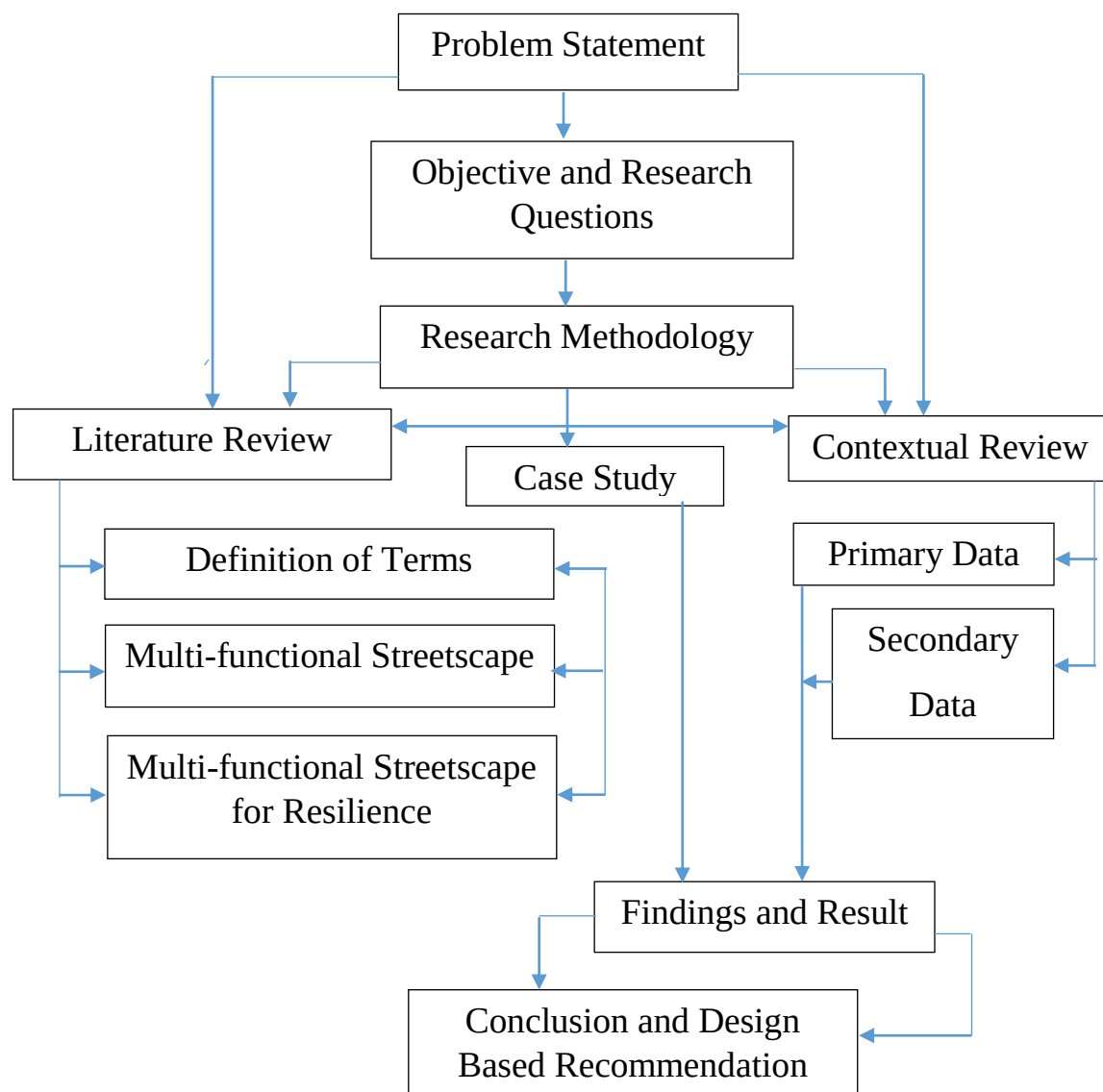


Figure 1.1: Study flow chart

1.8. Limitations of the Study

Different challenges had been encountered while conducting this research. Lack of some organized data in Akaki Kality sub city was one of the challenges. The researcher also faced lack of focused local literatures in relation to resilience. The study area have various problems that are not declared in this research. However, due to time constraints, the researcher forced to focus only few problems. Last but not least, to find out number of pedestrians that pass along the street was found difficult. The researcher took 50 number of pedestrian to grasp their aspiration as representatives of pedestrians.

CHAPTER 2: LITERATURE REVIEW AND CASE STUDIES

2.1 Definition of Terms

Multifunctional Streetscape: Multifunctional Streetscape: is a streetscape that overlaps and exhibits layers of social, environmental, cultural, and economical functions at a place (City of DAREBIN, 2012; David et al., 2011; Leong, 2011; Peter et al., 2013).

Resilience: Resilience refers to equipping cities to face future shocks and stresses from climate change and depleted oil and fuel sources - and makes it through crises. Resilient city takes into consideration appropriate infrastructure to be more resilient (Janet, 2003).

Green Streets: Green Streets are streets that aims at developing integrated, efficient and environmental friendly (infiltrate storm water close to its source and street trees) transportation hubs and and to create more vibrant, livable communities (Michele et al., 2014) (George, 2016; WOSNA, 2015).

Green Infrastructure: refers to ecological systems, both natural and engineered, that act as living infrastructure. The elements are planned and managed primarily for stormwater control, but also exhibit social, economic and environmental benefits (WCEL, 2006; Sarah et al., 2016; Authentic, 2011).

2.2 Multifunctional Streetscape

2.2.1 Streets and Streetscape

Transportation corridors and facilities are major components of the nation's landscape and public realm. Integrating comprehensive transportation planning with natural systems analysis and land

use planning is essential for creating livable communities in sustainable environments (ASLA, 2018). The transport corridors are full of bottlenecks, the capacity is underused, and transport security problems increase and last, but not least: Our environment has to pay a high price for increased transports (Algirdas, 2013). Streets with its design elements, characteristics and material types play a role for rising in temperature, urban heat island effect, and gas emission. In addition vehicles are known for emitting carbon dioxide to the environment. In average number, per 1 liter gas 2.4 kg carbon dioxide will be produced. For this reason streets should be responsive enough to be more environmental friendly as possible (Adam, et al., 2018).

Streets are places for people (London, 2017). Streets which are social indicators and one of the exploration area of everyday urban environments for the people. In any city streets are among important assets in terms of making the city livable. People need streets to enjoy and stay not to pass through only (Peter et al., 2013). Environment, society and economy get affected by streets substantiality (Jeralee, 2015). Living streets, as defined by the Denver Living Streets initiative, are vibrant places where people of all ages and physical abilities feel safe and comfortable using any mode of travel, including walking, biking, transit, or automobile (Peter et al., 2013).

Think of streets only for traffic purpose is traditional way of thinking of streets. But to use streets for their potential as public spaces adds a quality to a city. Streets are known for their integration opportunities of income generation spots for the community and a functional space for pop-up cafes (NACTO, 2012). Streets has to be beyond walking including react with one another, getting fresh air, free pleasure of life, experience engaging in many activities and getting important information (David et al., 2011; Jan, 2010). Streets have many purposes, including providing local and regional mobility, offering access to homes and businesses, and supporting economic growth (New Jersey, 2008). Streets are designed not only to carry traffic, but managed stormwater and to be vibrant spaces as well (Urban Runoff Management Plan, 2010). Streets are not just a path way for transportation from one destination to another. In fact, they are public realms with multipurpose functions (Fikreselam, 2016). Traffic accident has claimed to become a source of high amount of death and high injuries in urban areas which also cause by the characteristics of the streets. Safe streets can be achievable by involving and dedicating a line for all users. Better design which insist and deliberate of walking, parking, shopping, bicycling,

working and driving ways at streets helps to reduce the rate of death and high injury that cause by traffic accidents (NACTO, 2012).

Enclosure, human scale, transparency, complexity, coherence, linkage, legibility, and tidiness are measure protocols for enhancing street experience (Amir et al., 2014). Pedestrian safety, pedestrian-friendly environment and quality at interaction are influenced by the street width, interaction geometry, and frequency of crossing opportunities. Street should include sidewalks in both side with the appropriate amenities such as landscaping, lighting, and seating (Peter et al., 2013). In one way or another, complexity and types of streets determine community future. Therefore involving the community for the solution would bring a grate collaboration with design solutions for streets (New Jersey, 2008). Understanding the context of a good street gives a guideline to work on it. In order to evaluate and analyze a street there are things that has to be considered. Evaluating and analyzing the street in terms of determining land use and transportation context and identify special conditions. To study the land use context would help to differentiate the character, area potential and to deliver appropriate planning and design approaches. Determining transportation context will help to differentiate priorities among street users (Pazwash, 2011).

The term streetscape consist a very broad concept in terms of having more a complete and livable street. Streetscapes are the “outdoor rooms” one encounters when turning the corner, or stepping out the door into the street (Pazwash, 2011). A Streetscape can be defined by the nature and quality of street fabrics, sensitivity to local context, visual effects, and special street treatments of fixtures, facilities, signage and planting schemes (Cambridge, 2016; Handan, 2014; Peter et al., 2013). Good streetscape design begins with an approach that emphasizes wholeness, considering how various elements interact to create an overall streetscape composition. The right proportions, unique spaces, and appropriate amenities can make a streetscape a comfortable and memorable place where people want to spend their time (Pazwash, 2011). A good streetscape is Legible: easily understandable, Comfortable and safe: responsive for every ones wish, Attractiveness: aesthetically pleasing to be in and Liveliness: ability to invite more people (City of Taiwanese, 2005).

Streetscape changes the overall quality of the environment. But, in order to have quality environment streets need to have environmental comfort (e.g. Shade from sun, wind, etc.) and physical comfort (e.g. Comfortable and sufficient seating, etc.) (Fikreselam, 2016). Streetscape should respect the character of the community, and its current and planned land uses. If appropriately designed, vehicular speeds should fit local context too. Streetscapes should enhance interconnected transportation options, particularly for pedestrians, bicyclists, transit riders, and people with disabilities. All multi-modal transportation systems should be safe, efficient, convenient, and beautiful (ASLA, 2018). At the local community level, the context includes the role of the streetscape in supporting active community life. The transportation context of the streetscape is essential. In all cases, designing a street to fit its context is the smartest thing to do. The design of every streetscape must respond to its unique circumstances (New Jersey, 2008).

Contribution of quality streetscapes to the public environment is very significant. These contribution leads a city to become resilient city. Streetscape should reflect a unified, complete design that balances among a wide variety of functions, including storm water management, safe pedestrian travel, use as public space, bicycle, transit, and vehicle movement, parking and loading requirements, ease of maintenance, and emergence access (Cambridge, 2016; Handan, 2014; Peter et al., 2013). Streetscape elements are all those functional and decorative elements that are placed, laid, erected, planted or suspended within a public or communal urban space (City of Taiwanese, 2005). The elements of streetscape invite more people to gather and socialize. Enhancing social and economic integration among the society is the main aim of streetscape (Cambridge, 2016; City of Taiwanese, 2005; Handan, 2014; Peter et al., 2013).

In detail, the elements of streetscape includes pedestrian crossing and service lanes, footpaths, cycle tracks and carriageway, bus rapid transit, light rail transit, landscaping and medians, street trees and other horticultural elements, on-street parking, street furniture, street vending and street lighting, storm water management, traffic calming, bus stops and traffic signage, public utilities and amenities, general public furniture, public art, and mostly commercial and civic uses on the ground level, with residential uses primarily found on the upper level of street side buildings (Cambridge, 2016; City of Tshwane, 2005; Handan, 2014; Kevin, 2014; Leong, 2011; New Jersey, 2008; Peter et al., 2013).

2.2.2 Multifunctional Streetscapes

The role of ecosystem services for human beings is critical in capturing environmental, psychological, aesthetic, social, economic and cultural benefits. As one ecological system multi-functionality embrace human and nature together by enhancing best out of capacity usage of ecosystem services. To combat the changes applying multi-functionality from larger scale city planning to small scale water intervention is very practical (David et al., 2011; Handan, 2014; Jim, 2017). MS (Multifunctional Streetscapes) are known for their durability, reduction of storm water runoff and carbon footprint and in creation of a better place for the residents (Leong, 2011; Peter et al., 2013).

In addition, multi-functionality is very important for streetscapes. When a street become multifunctional it provide layer of function at a place (City of DAREBIN, 2012; David et al., 2011). These encourage community to walk, bike, engage with one another and spend quality time for short moderate distance trips. Bicyclists and pedestrians uses the streetscape by discourage vehicular speed (New Jersey, 2008). Multi-functionality creates choices for pedestrians in creating places to discover. Enhance health, safety and security in terms of traffic, engaging various programs and environmental friendly streets could be embraced in layered functions. (City of DAREBIN, 2012; David et al., 2011). The multi functionality, pattern and overlapping of activities contribute to stay in, walk by and even becoming a part of streets. To do something outdoors other than just walking should include protection, security, reasonable space, furniture and visual quality (David et al., 2011; Jan, 2010).

Priority to pedestrians and bicycle traffic will be an approach to sustain a streetscape in this sector with consideration of future generation. The more pedestrian walk and bicycle move around with attractive setting and inviting public spaces the better city and environmental quality scored. When a street becomes multifunctional it responds to social interactions, sharing resource, and livability (David et al., 2011; Kevin, 2014; Leong, 2011). In order to have MS, there has to be different traditions considered as necessary, optional and social activities and make it vibrant. The so called necessary activities are not optional and have to be integrated with the others, optional activities are recreational and fun activities which could be a unique quality of a city and in social activity sections it including all types of age and ethnic groups and social exchanging spaces with diversity of activities. (Jan, 2010).

MS are designed for all users, contrary to the conventional car-dominated streets most prevalent today. They create safe, convenient, and comfortable access for all users, regardless of age, ability, income, or mode of transportation, and prioritize the health, safety, and comfort for local community (Michele et al., 2014). MS should reflect a unified, complete design that balances among a wide variety of functions, including storm water management, safe pedestrian travel, use as public space, bicycle, transit, and vehicle movement, parking and loading requirements, ease of maintenance, and emergency access (Pazwash, 2011). Place making, or generating a strong sense of place is the other aspect of MS. Place making has various use including increasing positive interactions between people, increasing sense of inclusion, sense of belongingness and pride, enhance beautification, Increasing comfort and improved quality of life and economic growth (Michele et al., 2014).

MS fulfil many functions and for this reason it will be well used. The journey to work is often put forward as the only real journey, simply because it is seen as essential and causes the most congestion. However, the journey to work accounts for less than 20% of all trips and a truly great MS will not only offer an attractive route to work, but also to school, to the shops, to hospitals and stations, to visit friends, for daily exercise, for recreation and as a destination in its own right (Ewing et al., 2006). MS create a diversity of transportation options, balancing a history of automobile-centric street design in favor of opportunities for cyclists and pedestrians to safely and healthfully move through communities. Bicycle lanes should be designed with a vegetated buffer to protect bicyclists from cars. Pedestrian safety is increased by using traffic-calming techniques, such as reducing the width of vehicle lanes and creating green infrastructure bump-outs from the sidewalks (ASLA, 2018). The multifunctional streetscapes' networks also attract and retain businesses, shopping districts, cultural areas and restaurants by providing recreational opportunities and improving overall quality of life (New Jersey, 2008). Providing these various benefits and programs at a time makes a streetscape as a place where multi-functionality displays (ASLA, 2018).

In most literatures, its stated that multifunctional streetscapes are more known in calming traffic, improving air quality, improving physical health and mental wellbeing, increasing walkability of streets by providing shelter and shade, aesthetic, feeling of safety, opportunities for social and economic benefits, business opportunities, lowering stress and anxiety, managing and absorbing

stormwater flow, providing habitat for native flora and fauna, reducing urban heat island effect, sequestering carbon dioxide and shaping neighborhood character (David et al., 2011; Jan, 2010; Kevin, 2014; Leong, 2011).

More specifically, multifunctional choices in transportation construction can make a big difference. Multifunctional green streetscape category (University of Washington, 2004)

- **Resilient design:** reduce impacts and ensuring tomorrow due to design choices including the street alignment
- **Material and resources:** reduce impact from extraction, process and transport
- **Storm water management:** reduce impacts of polluted storm water and treatment devices
- **Energy and environmental control:** improve human and wildlife health
- **Construction activities:** reduce impacts from construction activities
- **Innovation:** encourage innovation in design

Elements of Multifunctional Streetscape

The elements of MS includes: (Cambridge, 2016; David et al., 2011; Kevin, 2014; Peter et al., 2013)

- Safe, attractive, pleasing and comfortable sidewalks with permeable pavement which invites more people
- Soft edge street corners which enhance social interaction and provide shorter crossing distance
- Trees and landscape elements to create safe, less polluted and comfort for pedestrians
- Integration of rain garden for storm water treatment
- Coordination of street furniture including benches, signage, trash cans, light fixtures, bicycle racks, bus shelters, curbs, medians, crossings, public art and café spaces

Principles for Multifunctional Streetscape

According to Christopher and Matthias (2011), the following principles should be considered to achieve a MS.

- **Safety:** all users of streets should be safer and has to differentiate the slow and fast zones according to user's priority.

- **Mobility:** segregating pedestrian, cycle and motor vehicles could improve the service quality of the street.
- **Pedestrian accessibility:** appropriate path width and minimum grading should be implemented for pedestrian ways.
- **Liveability:** street enhancing spaces elements for relaxation and interaction is very important aspect.
- **Local context:** creating sense of belongingness is important for the user to stay in streets.

Benefits of Multifunctional Streetscape

The advantage of MS includes: (Ana and Michael, 2013; David et al., 2011; Kevin, 2014; Peter et al., 2013)

- Environmental quality in terms of improving air and water quality and reduction of heat island effect and pollution.
- Sustain social wellbeing by providing space for public gathering and outdoor activities
- Increase permeable surface area, landscaping, and umbrella for transportation and green-infrastructure
- Enhancing visual image of a city
- Public health improvement by encourage walking, bicycling and recreational activities
- Will have a full potential to pollution flux, carbon sequestration, street stress tolerance, and enhancement of watershed

2.3 Multifunctional Streetscape for Resilience

Cities are complex organisms which everything should be in balance. Peoples use cities for housing, transportation, sanitation, utilities, land use, and communication. Cities have been characterized in different ways in different eras depending on human settlements (Christopher and Matthias, 2011). Urban Cities around the world have expanded physically as they grow in population with infrastructures. In terms of having a better life, in cities, the natural ecosystem structure and function has been influenced by the population and urbanization dynamics (Katharine, 2017). Urban infrastructure involves various physical networks and spaces necessary for transportation, water use, energy, recreation, and public functions. Infrastructure plays a great role in city development and transportation is one of them (Janet, 2003; Katharine, 2017).

Sustainable communities have well-connected, easily accessible transportation networks that provide attractive, safe, comfortable, and cost-effective access; improve mobility; enhance travel experience and support economic vitality as well as environmental quality (ASLA, 2018). There is a huge opportunity for RS (Resilience Streetscape) to ameliorate the effects of these environmental problems. It is exactly MS that offer a mechanism that balances development and future protection and makes it resilient city. RS meet local community needs for such three benefits as recreation, environmental protection, and historic and cultural resource preservation (Mehmet, et al., 2010).

Embracing multi-functionality to a city will brought resilience which could be represented in being reflective of past experiences, robustness to future shocks, redundancy, flexibility of different circumstances, resourcefulness to various stress, inclusiveness, and integration of functions (City of DAREBIN, 2012). Resilient transportation has been defined many different ways but generally emphasizes environmental preservation, compact development patterns, alternative transportation, and social equity (New Jersey, 2008). Resilience solutions provides a range of benefits, including recreation and transportation, urban beautification, increased property value, development buffers, floodplain protection, preservation of historical and cultural and environmental resources (Mehmet, et al., 2010). A successful RS will have become part of the fabric of its local area and an integral component of many local journeys (Ewing et al., 2006).

Resilient infrastructure is a functioning ecosystem that delivers valuable services to people. MS solutions contributes in reduction of the current change in climate and ensure tomorrow by reducing risk in climate change with environmental friendly transportation and in enhancing competitiveness sustainability (George, 2016, Anna and Nicklas. 2015).

According to Ana and Michael, 2013 RS has benefits of not only environmental but economic, social, and system effectiveness. The environmental effectiveness includes resource preservation like land, air and noise pollution, greenhouse effect and future sustainability, the economic effectiveness includes economic efficiency, financial affordability and regional economic development through improved accessibility, and the social effectiveness includes social equity in terms of income and minority groups, public health, enhancement of safety and security and

accessibility to various services and the system effectiveness includes system performance for multimodal transportation system (regional, highway, transit, etc.)

A MS makes a city to be beneficiary to have a resilience infrastructure to the urban environment through various landscape approaches. These benefits includes: (Ana and Michael, 2013; London, 2017).

- Calming traffic
- Improving air quality and physical health and mental wellbeing
- Enhance walkability of streets by providing shelter and shade, positive aesthetic, safety, opportunities for social and economic benefits, opportunities for different users
- Reducing stress and anxiety, anti-social behaviors including vandalism and graffiti, urban heat island effect and UV exposure
- Managing and absorbing stormwater flow
- Protection from wind and storm events
- Providing habitat for native flora and fauna
- Sequestering carbon dioxide
- Shaping neighborhood character.

Function wise MS integrates and promote walking, cycling and whether for leisure purposes or travel, the idea of streets for everyone. These lead to a more sustainable and comfortable environment for local community. Barrier free access, linkage of open spaces, alternative means of transportation and great quality infrastructure are also another important aspects of MS. GS (Green Streetscape) are the major system in providing MS for better resilience transportation solutions (Anna and Nicklas. 2015).

A desire to live and work near green spaces and green streets has led to an increase in private and commercial property values (Mehmet, et al., 2010). GS which is known for its improvement of public realm and resilience transport with high biodiversity value, is an EU concept introduced in 2007 that aims at developing integrated, efficient and environmentally friendly transportation hubs (George, 2016; Green Corridors, 2015). GS corridors promotes environmental sustainability and energy efficiency (George, 2016). Green streetscape are more economically, ecologically and socially viable than traditional transport corridors (Gunnar, 2012). A GS uses natural processes to manage storm water runoff at its source, improve water quality, reduce

urban heating, enhance pedestrian safety, reduce carbon footprints, and beautify neighborhood looks and feeling of a community (Anna and Nicklas. 2015). Green streetscape is a street that is composed of natural elements mainly soil and vegetation to convey or regulate stormwater runoff in a sustainable way. (Dill et al., 2010). GS, which promote alternative forms of transportation and utilize vegetation to filter air, could reduce the amount of vehicular air pollution contributing to high asthma rates, make space for alternative modes of transportation that combat obesity, and reduce carbon emissions which may contribute to a number of health and social problems in the future (Michele et al., 2014).

According to Dr. András, 2014 traditional street (non-multifunctional streets) construction have various impact on habitat demolition and fragmentation (ecological malfunction of the impacted ecosystem), pollution of noise, water, air and soil, barrier effect and habitat fragmentation. Green streetscape is about the development of sustainable, efficient and green transport solutions to reducing negative impact on the environment and climate and thereby preserving natural resources and habitats (Gunnar, 2012). GS provide a better environmental performance while creating attractive, safer environments (Anna and Nicklas. 2015). It should be possible for every nearby resident to reach the GS by foot or cycle without conflict with heavily trafficked streets (Ewing et al., 2006). GS are also streets that are designed to infiltrate storm water close to its source, and to create more vibrant, livable communities (Michele et al., 2014). Health and well-being-ness of a local community improvement addressed by green streets with enhanced active recreation (Anna and Nicklas. 2015). A good GS will overcome real problems of severance, or of traffic (Ewing et al., 2006). GS features include vegetated curb extensions, sidewalk planters, landscaped medians, vegetated swales, permeable paving, and street trees (Anna and Nicklas. 2015).

According to George, 2016 and (Ewing et al., 2006), Characteristics of a GS include:

- Resilient transport solutions with documented reductions of environmental and climate impact, high safety, high quality and strong efficiency
- Integrated transport, so called co modality
- Harmonised regulations with openness for all actors
- Memorable, so that users will return to it, and encourage their friends to do so too.
- be easy to use and reach

- must have a smooth and dry surface in all weathers,
- good maps and easy signing

Storm water management technique is another basic aspect of GS. A green street acts as a local storm water management system, capturing storm water runoff, allowing it to soak into soil, filtering it and, at the same time, reducing the amount of storm water that would otherwise make its way into sewer collection system (Michael et al., 2014). Green Street is very known its management of stormwater by using (GI) Green Infrastructure (Gunnar, 2012). There are two techniques of managing stormwater, the conventional stormwater management and landscape based stormwater management technique. Conventional stormwater management techniques are designed to collect and transport street stormwater runoff as quick as possible through drainage channels and pipes (conventional drainage) from urban areas. This systems transport wastewater directly to the sewage treatment plant, but during heavy rainfall, the wastewater volume in a combined sewer system can exceed the capacity of the system and leads to overflowing. As a result, the street and its infrastructures are damaged and the time and cost needed for maintenance and installation of the damaged drainage system are very high. Landscape based stormwater management uses natural drainage systems and other methods in managing street stormwater runoff. The goal of landscape based stormwater management is to reduce stormwater runoff by treating the stormwater as close to the source as possible (Fikreselam, 2016).

Comparison of CSM and LSM, (Fikreselam, 2016)

Table 2.1: Contrast in between CSM and LSM

CSM Strategies	LSM Strategies
- High construction cost for stormwater ponds, pipes, curbs, gutter and inlet	- Low construction cost
- Low potential resistance and explosion to high runoff	- Retain, detain and infiltrate stormwater
- Not environmental friendly	- Environmental friendly for habitat enhancement, flood control and recreational opportunities

- Rigid approaches	- Flexible to construct in both urbanized and developing areas
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By integrating the natural (soil, vegetation) or landscape based stormwater management practices, GI plays an important role in reducing stormwater runoff volumes and peak flows for green streets (Fikreselam, 2016). Green storm water infrastructure (GI) includes a range of soil-water-plant systems that intercept storm water, infiltrate a portion of it into the ground, evaporate a portion of it into the air, and in some cases, release a portion of the captured storm water slowly back into the sewer collection system. GI treats storm water runoff as a resource to be incorporated into the urban environment instead of as a waste product requiring removal and treatment (Michael et al., 2014). GI replicate and restore the natural hydrologic cycle and reduce the volume of storm water entering the sewer system. This, in turn, reduces overflows. GI is defined as any type of infrastructure that has the purpose of lessening the burden of development on the environment and/or has the aim of providing ecosystem services, such as runoff management, air temperature reduction, carbon sequestration, and habitat provisioning (Sarah et al., 2016). At all scales, GI provides real ecological, social and economic benefits (Authentic, 2011). The use of GI is considered vital to resilience. GI provides a broad variety of ecosystem services. These include water management and quality improvement, air temperature reduction, improved energy use efficiency, air pollution and carbon sequestration, noise reduction, habitat provisioning, the provision of recreational and educational opportunities, food production, and aesthetic improvement of the built environment (Sarah et al., 2016).

Appearance of a community is highly influenced by streetscape character. Streetscape is responsible in increasing of impervious surface and storm water runoff. GI generally includes storm water management methods that (Authentic, 2011):

- infiltrate (porous pavements, sidewalks, and gutters; linear infiltration systems)
- evaporate, transpire and reduce energy consumption (vegetated roofs, trees, planter boxes)
- infiltrate and transpire (rain gardens and bio retention)

- capture and reuse rainfall (rain barrels, cisterns, irrigation supply systems, and gray water systems)

Integrating GI to streets helps streets to serve as green streets. The potential of GI in streets serve a multiple benefits by incorporating storm water management feature into street infrastructure. In contrast to gray infrastructure, a GI approach offers multiple benefits that can achieve the approach to resilience. GI technologies are applicable for sidewalks include curb extensions, sidewalk planters, tree trenches and porous pavements (Authentic, 2011).

GI often uses vegetation, engineered soils, and permeable surfaces to intercept storm water before it reaches the wastewater system, reducing the burden on the grey infrastructure system, limiting the amount of polluted storm water runoff entering waterways, and reducing the number and volume of combined sewer overflows (Michele et al., 2014). GI technologies include Bio-retention, Cistern/rain garden, Median, Infiltration Bed, Infiltration Trench, Pervious pavement street parking, pervious pavement sidewalk, Sidewalk planter, Tree Trench, Vegetated Infiltration Basin, Vegetated Swale and Curb extension (Authentic, 2011).

GI provides various benefits for streets. These benefits includes: (Authentic, 2011)

- Improve green street health quality of life for its residents by linking clean water solutions to community improvements
- Respond comprehensively to the multiple water quality
- Reduce pollution, urban heat island, runoff volume and erosion flows
- Ensure future environment risk
- Balance parking spaces with landscape space
- Provide alternative transportation options/improve walkability
- Sequestrated CO₂
- Increased pedestrian safety
- Improved aesthetics

Physiographic (Topography and Slope, Land use, Soil type, Drainage and Imperviousness), climate, and hydrology are factors that dictate the applicability of GI practice. (Source: Woods-Ballard et al., 2007)

Physiographic Factor

- **Topography and Slope:** It determines the speed of stormwater from a point to another. In UNEP, 2003, it is stated that considering the context of existing landform characteristics and preparing catchment area is needed.
- **Land use:** Type of existing land use in surrounding areas affect the amount of runoff, surface area permeability and catchment areas.
- **Soil type:** The nature of soil type needs to be suitable for infiltration of stormwater. Sand and sandy loam soils have low runoff potential with high infiltration rate, silt loam soil have moderate infiltration rate, sandy clay loam have low infiltration rate and clay loam, salty clay loam, sandy clay, salty clay and clay soil types has highest runoff potential with very low infiltration rate.
- **Drainage:** Poor drainage result failure of street pavement. Street pavement efficiency in GI practice development insure longer street pavement life.
- **Imperviousness:** Urbanization is a cause for increasing impervious surfaces. Stormwater runoff and flooding is high in impervious surfaces.

Climatic Factors

- **Rainfall:** Intensity of rainfall vary place to place. If the intensity of rainfall is known it helps to balance the rate of infiltration at specific area.

Hydrologic Factor

- **Groundwater:** groundwater condition of an area should be identified.
- **Water depth and Flow Pattern:** understanding the depth and flow pattern helps to differentiate suitable type of GI practice.

Features of GI in GS includes permeable pavements, swales, green gutter, bio retention, stormwater tree/ extended tree pit, curb extension/stormwater bump-out, Perforated pipe systems and steeped stormwater planter (Fikreselam, 2016).

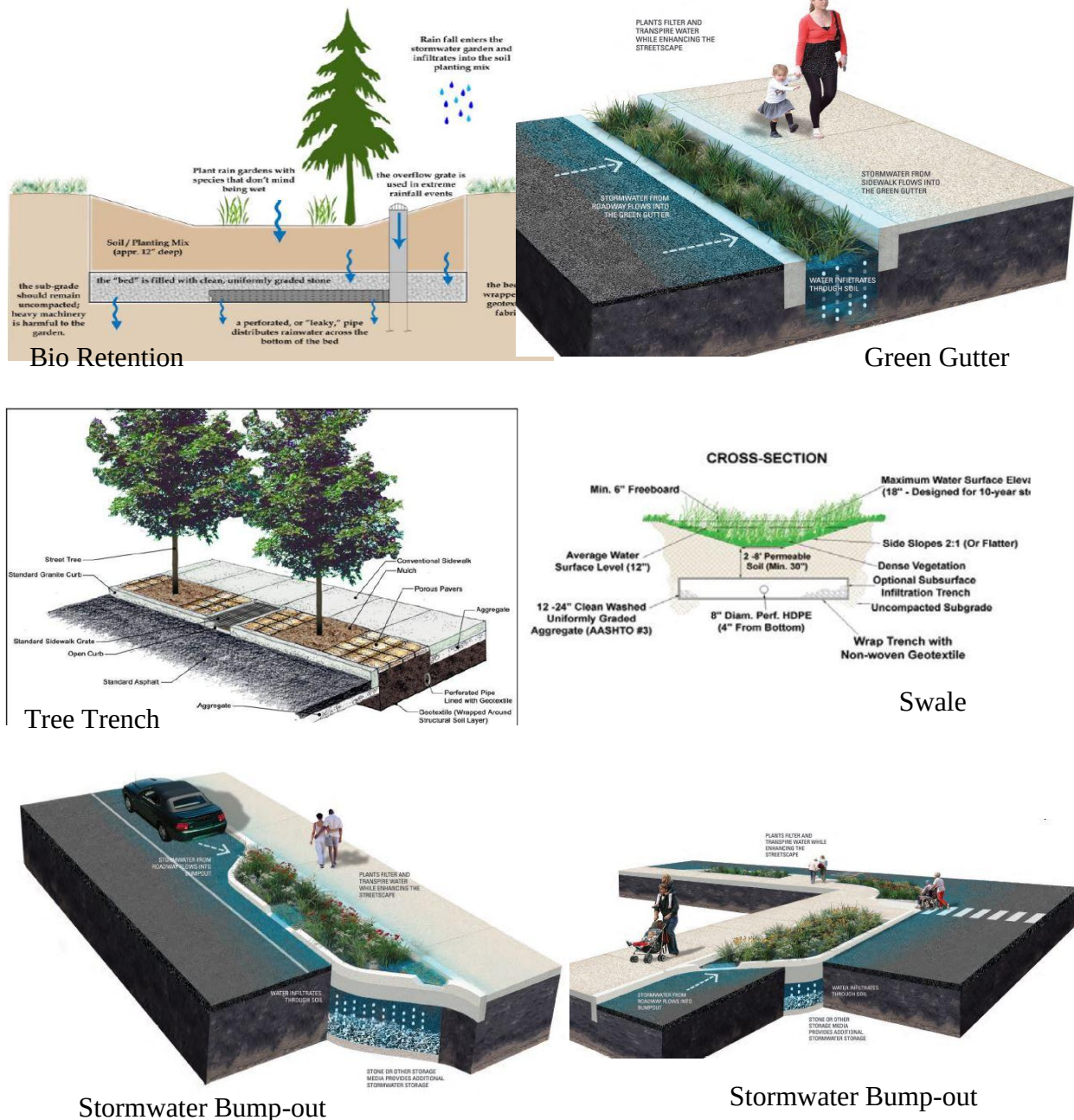


Figure 2.1 Various methods of GI for streets (Source: Ewing et al., 2006)

RS solution consider the context of a community which provides guidance on who will need to use the road and how. Converting existing street into resilient streetscape is a smart thing to do (ASLA, 2018). Design consideration and requirement for MS should integrate social, environmental, urban and economic principles to meet resilience. That includes livable and healthy with respect to social principles; reduction of environmental stress, water and air quality

improvement and pollution reduction in respect to environmental principles (David et al., 2011); and legibility, comfort and safety and attractiveness in respect to urban principles. And green and permeable materials and reduce material resource consumption in respect to economic principles. These principles are an opportunity that embrace passing by, walking, socializing, shopping, performances, food and drinks, entertainment engaging all together for social interactions (Kevin, 2014).

Urban planning and design determine basic characteristics of streetscapes. RS design as a result of a policy-planning-implementation chain, will define our future in facing of stress and shocks (Jan, 2010). Being resilient and multifunctional is not a onetime thing rather it is to deal with the existing changes and continues to resist global changes (Kevin, 2014). Among the factors in becoming a successful city having RS is the main factor. “However, this can only happen if we start working with, instead of against, nature” (Peter et al., 2013).

Lesson learned from Literature Review

- Considering street as a resource and reimagining it for social, cultural and political, health and economic reasons make it a great ecological infrastructure.
- Think of streets only for traffic purpose is a traditional way of thinking of streets. But to use streets for their potential as public spaces adds quality to streets.
- Multifunctional Streetscape promotes alternative forms of transportation and utilize vegetation to filter air, could reduce the amount of vehicular air pollution contributing to high asthma rates, make space for alternative modes of transportation that combat obesity, and reduce carbon emissions which may contribute to a number of health and social problems in the future.
- Multifunctional Streetscapes offer many benefits to the urban environment including; calming traffic, improving air quality and physical health and mental wellbeing, enhance walk-ability of streets by providing shelter and shade, positive aesthetic, safety, opportunities for social and economic benefits, opportunities for different users, reducing stress and anxiety, anti-social behaviors including vandalism and graffiti, urban heat island effect and UV exposure, managing and absorbing stormwater flow, protection from wind and storm events, providing habitat for native flora and fauna, sequestering

carbon dioxide, and in shaping neighborhood character. These benefits promote a city resilient phase by phase for a healthier future.

2.4 Case Studies

2.4.1 Case Study One

Passeig De St Joan Boulevard, Barcelona, Spain

General Information

Location: Barcelona:

Project Type: Public Space - Streetscape

Architects: Lola-Domènech

Completion Date: 2010- 2011: Phase 1; 2013-2014: Phase 2

Reason for selection:

The streetscape is that enhance social, environmental, and economic benefits (Multi-functionality)

Overall Description

The boulevard is comprised three horizontal sections which all have unique characteristics and utilities. Upper section is a strip along the center for pedestrians, the middle section is the wider and car dominated lane, and the lower section has very narrow traffic lane, large pedestrian lane, and a single segregated cycle lane in the middle.



Figure 2.2 Passeig De St Joan Boulevard (Source: Lola-Domènech)

The project/ design Success

- Effective in attracting users to the site
- Resilient streetscape / Sustain social, environmental, and economic value
- Multifunctional spaces for different users

Lesson Learned

- Give priority to pedestrians and pedestrian safety
- Create sense of belongingness
- Improve transport options/ co-modality
- Create a connection to other green spaces
- Create a 'urbanized green zone'



Figure 2.3 Wide pedestrian area of Passeig De St Joan Boulevard (Source: Lola-Domènech)

2.4.2 Case Study Two

Cherry Creek North and Fillmore Plaza, Denver, Colorado

General Information

Location: Denver, Colorado

Project Type: Mixed use retail district, streetscape revitalization

Designer: Design Workshop, Inc.

Completion Date: 2011

Reason for selection:

Cherry Creek North is a streetscape that provide a safe environment for all users, a multifunctional public spaces, ecological features, stormwater management system, and a strong identification.

Overall Description

The streetscape project improvement included landscaping, lighting, signage, and open spaces. The street is classified into three zones; the pedestrian zone, bike zone, and vehicular zone. Crosswalks, bike amenities (such as bike lanes, bike racks, and parking), and traffic calming measures are included for safety purpose.



Figure 2.4 Cherry Creek North Street (Source: www.lafoundation.org)

The project/ design Success

- Effective functionality
- Multifunctional spaces for different users
- Unique identity

Lesson Learned

- Providing user-oriented space
- Creates sense of belongingness and a unique identity
- Preserve the context
- Enhancement of natural habitat
- Create a vibrant streetscape



Figure 2.5 Fillmore Plaza (Source: www.lafoundation.org)

The design intents will be contextualized and adopted for later sections of this study.

CHAPTER 3: METHODS AND METHODOLOGY

3.1 Description of the Study Area

Building up infrastructure for local community is among the factors that control the growth of city which leads to advanced urbanization. The research is conducted in southern part of Addis Ababa, Akaki Kality Sub City. The study analysed the street from Kality Drivers and Mechanics Training Center to Kality Total gas station. The Kality Drivers and Mechanics Training Center to Kality Total gas station Street is selected because of:

- Location

The sub-city located in a strategic southern corridor, both for Addis Ababa and OSZ (Oromyia Special Zone) (Fig 3.1). The Street serve as a gate way to go out and to go in to the city centre for both heavy and light traffic.

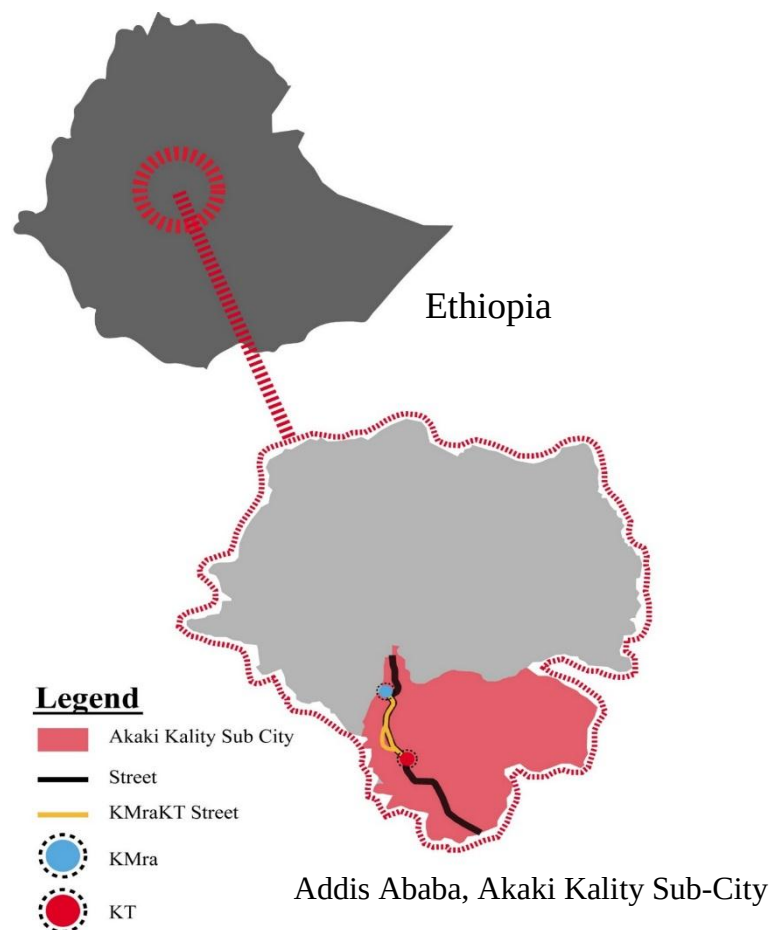


Figure 3.1 Location Map (Source: Author, 2018)

- **Bad street management**

The street is under bad street management for long time when it is compared to other streets found in the city. Small maintenance has been done to the streets for the last decades.

- **New emerging programs**

The appearance of new programs to the sub city causes increase in rapid population number which leads to a need for advanced infrastructure, transport options and various facilities. The southern bus terminal, AASTU University, Beijing hospital, the new stadium, and number of condominium sites are the appeared programs for the Sub City.

- **The end point of LRT**

The LRT station ends at the beginning of Kaliti Drivers and Mechanics Training Center roundabout, this create invisible curtain (psychological isolation) which separates the community from the rest of the society.

3.2. Research Methods

Theoretical and previous practical studies have been investigated to identify the concept of streetscape as multifunctional, and elements and principles of multifunctional streetscape to be resilient. To meet the desired output, literature review research approach has been launched. The literature review addressed journals, books, websites, newsletters, and other written literatures that are relevant to the research title.

Analytical study of Kaliti Drivers and Mechanics Training Center to Kaliti Total gas station Street, in identifying major problems and communication and interaction in between the Street and local community has been conducted for application of multifunctional streetscape for resilient. To meet the desired output, government officials (such as the Sub city Road and Transport Office, Traffic Management Agency and, Roads Authority), local communities, and personal observation has been inspected.

3.3. Data Source and Collection Methods

In this research both primary and secondary data source has been used. Primary data has been collected through original techniques (such as field observation and questionnaires) and

secondary data has been collected by referring previous data and researches held by someone else.

3.3.1. Primary Data Source

The primary data has been collected through observation and a questionnaire. With a sequence of 4 weeks, including discussion with officials, observation (personal diary), reviewing recorded data, and questionnaire has been done. The primary data that has been collected through sampling of field observation based on certain measurement protocols which analyse street character including streetscape design features ([Table 5.1](#)) and the questionnaire study pedestrian, passengers and vehicular behaviour and desires. The site survey chose three representative places for the study from Kality Drivers and Mechanics Training Center to Kality Total gas station. Kality Drivers and Mechanics Training Center, KKG, and KT are the representatives ([Fig 3.2](#)). This representatives sites were chosen because of their programs (functions), a place where lots of activities held, and are a main destinations of the local community. The data that has been collected through questionnaire has been answered by various street users, government officials, and policy makers.

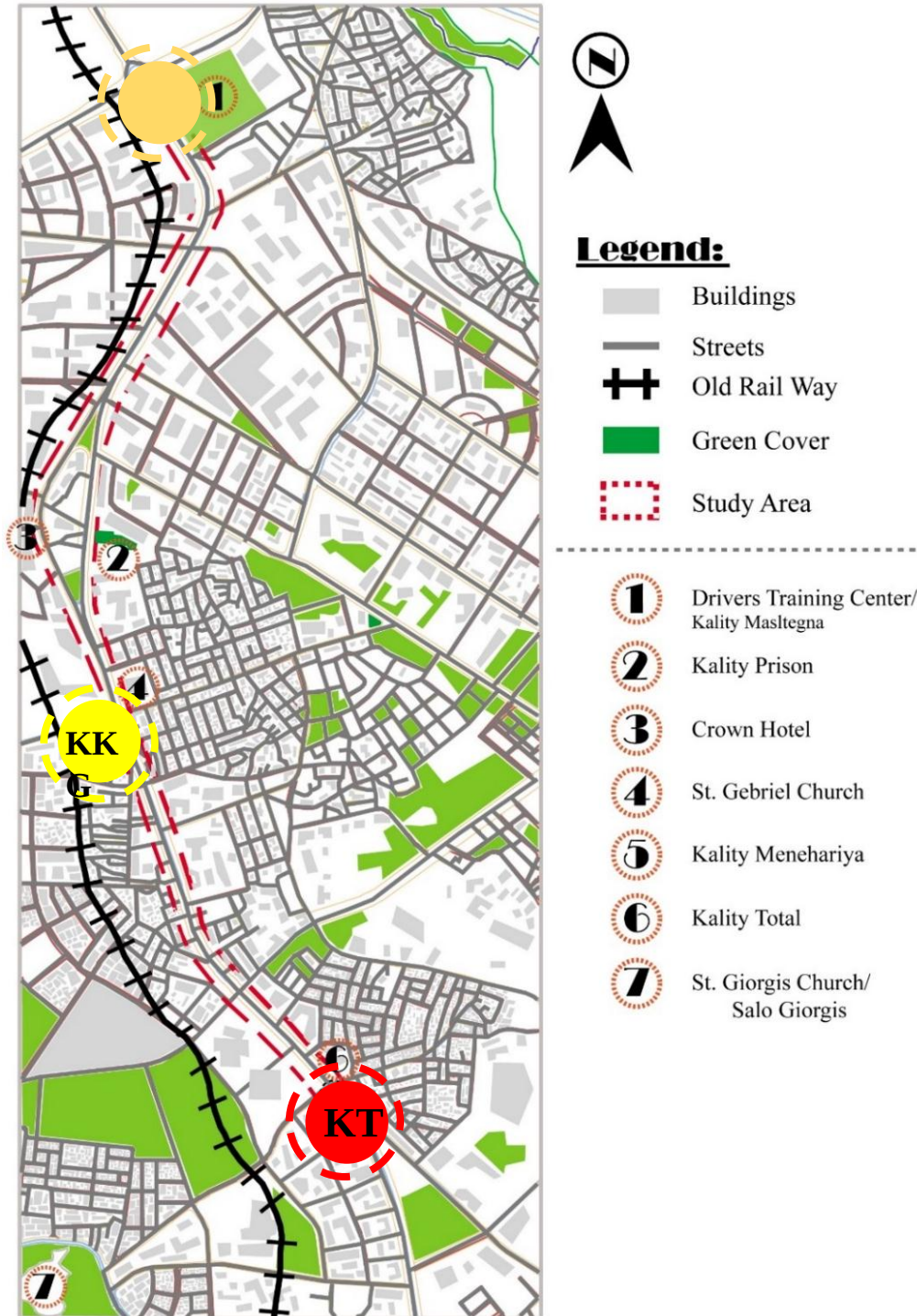


Figure 3.2 The general map and three selected representative surveyed places (Source: Author, 2018)

3.3.1.1 Sampling Technique

Purposive sampling method has been conducted in this research. Users of streets in different places of the Kality Drivers and Mechanics Training Center to Kality Total gas station Street and policy makers and professionals have been integrated by purposive sampling method.

Number of Sampling Determination

The surveyed questionnaire has been prepared for different stakeholders. The purpose of the series of questions used to gather a better idea of existing situations and what the local community desire to see for the future Street of Kality Drivers and Mechanics Training Center to Kality Total gas station. Agreed respondents had participated on the survey. To capture opinions on the Street, answering the questionnaire, took 8-10 minutes.

According to the surveyed data, per day an average total number of **256,882** passengers and **22,152** drivers were counted. There was a need to take representatives from each category according to the quantity of passengers and drivers that pass through the corridor ([Table 5.2](#)). In total, five hundred fifty (**550**) local community assessment surveys has been conducted, which includes three hundred (**300**) number of passengers (minibus passengers, lada taxi passengers, public transport passengers and cyclist), two hundred (**200**) number of vehicle drivers (vehicle owner, public transport and minibuses drivers, heavy truck drivers and motor cycle drivers) and fifty (**50**) number of pedestrian. The questions that has been prepared for '**Passengers**' is differentiated into four categories of Minibus Passengers, Lada Taxi Passengers, Public Transport Passengers, and Cyclists. The questions that has been prepared for '**Car Drivers**' is differentiated into four categories of the Vehicle Owners, Public Transport Drivers, Heavy Duty Vehicles and Motorcycle Drivers. Questions have been prepared for 50 '**Pedestrians**' for random purposive sampling. Questions have been prepared for '**Sub city officials (such as the Sub city Road and Transport Office, Traffic Management Agency and, Roads Authority)**' to examine selected officials from their respective offices.

3.3.1.2 Observation Check List

The survey used observation (personal diary) method through check list. In addition to the questions that are prepared for different stakeholders, observation (personal diary) used to witness what is there and what is missing. Finding out the major problems on the street, the degree of communication in between the street of Kality Drivers and Mechanics Training Center

to Kaliti Total gas station and local community (if they sit, walk along the street, bicycle, buy, etc.), type of stormwater and sewer system is in used, and form and layout of the street has been included to the check list.

Check List for Neighbourhood Characteristics

- Historical buildings, active uses (Public Park, restaurant, shops, nearby open space), dominated building colour, traffic control devices, power, stormwater infrastructure utilities, identity, pedestrian movement, and vehicular movement.

Check List for Streetscape Elements

- Street trees, medians, planters, street lighting, transit shelter, kiosk, public art, street furniture, bikeway and bicycle racks, pedestrian lighting, overhead street lighting, pavers, and trash cans.

Check List for Pedestrian Circulation

- Pedestrian plaza, wide sidewalks/footpaths, street café, pedestrian crossing, traffic calming design/ pedestrian bump-outs, designated bicycle lane, public transit, and curbs.

Check List for Parking Elements

- On street parking, surface parking lots, and parking structures

Check List for Signage

- Uniform public and directional signage, pedestrian signage, and gateway entry signage

3.3.2. Secondary Data Source

Secondary data has been collected from official reports of government, previously conducted studies, GIS data for the study areas, maps, publications, books, journals, articles, brochures, and blogs from the Internet.

3.4. Data analysis and Presentation Methods

The collected data through observation and questionnaire has been analyzed by quantitative methods to interpret evidence and qualitative data analysis method that explain the specific occurrence of the street in deductive approach. Descriptive maps, tables, and pictures had been interpreted data from observation (personal diary) and questionnaire. Interpretation in number and percentage had evaluated the quantitative data, discussion and narration with graphs, tables, and maps that state the qualitative data.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Background Information

The Kality Drivers and Mechanics Training Center to Kality Total gas station Street covers 6.1 km long, is dominated with mixed-use development (Fig. 4.1), with inclusive land uses of, commercial, residential, mixed-use, governmental offices, industries, social services, transport hubs, military camp/prison, rivers, and green areas.

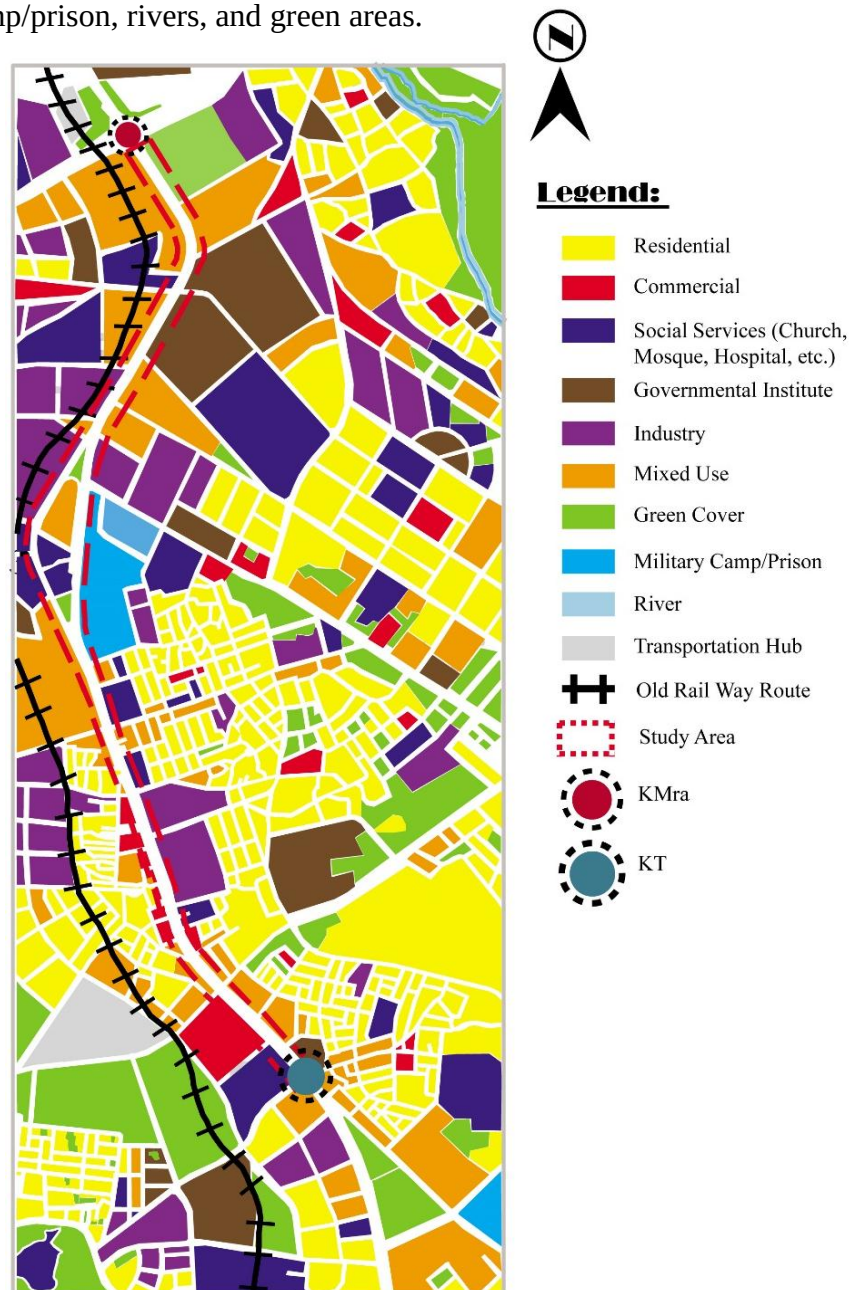


Figure 4.1 Land use map (Source: Author, 2018)

4.1.1 Overall View

According to the recorded data, the sub-city population number is increasing from time to time. The new 12 condominium sites, Kilinto Industrial Park, and 200, 000 new inhabitants are the factors that are found in affecting the rapid growth of the population of the sub-city. Also, increasing in a number of population size is as expected by the sub-city statistics for the coming years. According to AASOID (Addis Ababa surrounding Oromia integrated development plan Project office), the population number is expected to arise 535,000 in 2023 and 696,000 in 2038. The sub-city supposes that the existing street of Kality does not have the capacity to serve the current and coming population size. As the collected data depicts, 2017 depicts, the rate of an accident along the street from Kality Drivers and Mechanics Training Center to Kality Total gas station (Fig. 4.2) is increasing from time to time (Kality Sub city Traffic Management Agency and Wubshet et al., 2017). There are various factors which contribute to the increases in the traffic accident. As reported by various studies regarding the increase in traffic accidents, poor street quality, and drivers behaviours are the most noted problems for the last decades in the Street. Maintaining the road when there is a pavement failure which usually occurred by a frequent heavy truck trip along the street and introducing optional routes has been done to improve the street quality. The absence of street lights, dedicated pedestrian lanes, and traffic signage has been also mentioned in the studies in increasing the traffic accident. The absence of networked drainage line in the Street leads to runoff and pavement failure during the rainy season which becomes a cause for congestion and traffic accident. According to the data, there is no street guideline for the sub-city although for the existed Street. But, an extension of LRT (Light Rail Transit) or introduction of BRT (Bus Rapid Transit) and improvement of city bus routes are the future plans to be implemented. It is difficult to say the street is free from criminal activities such as sexual harassment, theft and, robbery. There are reports that are clamming the street as criminal activity places, as the recording data. As the records assure most of the criminal activities takes place at night. Related to criminal activities, illegal trade in some places of the street is becoming a trend after 5 pm. Becoming one of the future major sub-centres, the existence of major industries in the sub-city, the street being connected with the eastern part of Oromia Towns, namely; Dukem, Bishoftu, and Adama, and emerging of condominium sites are among the potential to develop a successful and useful street future, that the street has.

4.1.2 Existing Street Technical Assessment

Table 4.1: Findings from observation checklist

Observation Check List	Availability		
Neighbourhood Characteristics	Available at respected places	Available at few places	Not available
- Historical buildings/structures	-	√	-
- Public park, restaurant, shops, nearby open space	-	√	-
- Dominated building colour	-	-	√
- Traffic control devices	-	-	√
- Stormwater infrastructure utilities	-	-	√
- Identity	-	-	√
Streetscape Elements			
- Street trees	-	√	-
- Medians	-	-	√
- Street lighting	-	-	√
- Transit shelter	-	-	√
- Kiosk	-	√	-
- Public art	-	-	√
- Street furniture	-	-	√
- Bikeway and bicycle racks	-	-	√
- Trash cans	-	√	-
Pedestrian Circulation			
- Pedestrian plaza	-	-	√
- Street café	-	√	-
- Pedestrian crossing	-	-	√
- Traffic calming design/ pedestrian bump-outs	-	-	√

Parking Elements			
- On street parking	-	-	√
- Surface parking lots	-	√	-
- Parking structures	-	-	√
Signage			
- Uniform public and directional signage	-	-	√
- Pedestrian signage	-	-	√
- Traffic lighting	-	-	√
- Gateway entry/exit signage	-	√	-

The observation checklist has been prepared to examine the status of the Street comparing to the standardized streetscape types (Christopher and Matthias, 2011). The checklist is categorized into 5 as neighborhood characteristics, streetscape elements, pedestrian circulation, parking elements, and signage. The observation revealed that; most of the services are categorized under ‘Not available’ sections which take 78% of the service while the rest categorized under ‘Available at few places’ which account 28% of the observation list. None of the checklists is found under ‘Available at respected places’ (Fig 4.19).

The only historical structure that is found near to the street from Kality Drivers and Mechanics Training Center to Kality Total gas station is the ORL (Old Railway Line). The significant historical background behind the railway in being of the first rail way of Ethiopia has been neglected. The Due to infrastructure installation and construction of various structures that takes place in different decades, the railway line is sniped and removed in different places. The absence of public parks, restaurants, shops, and nearby open spaces at respected spots is also the missing characters from the neighborhood but these characteristics are available at few locations (Fig 4.19). There is no dominated building color that could be mentioned as a characteristic of the neighborhood. The mobility along the street of Kality Drivers and Mechanics Training Center to Kality Total gas station is not supported with any traffic control devices. Regarding stormwater management, the street is not utilized by stormwater infrastructure which exposed

the street to flood during rainy seasons. Due to lack of all these, the street is serving without iconic identity and harmony.

According to the site survey, most streetscape elements of the Street is missing. Along the street, street trees are located in very few spots without any medians (Fig 4.19). The absence of street lighting, transit shelter, public art, street furniture, and bikeway and bicycle racks with the respected location are the results that are found on the survey. Kiosks and trash cans are available in very few spots along the street (Fig 4.19). Regarding the pedestrian circulation, the absence of pedestrian plaza, pedestrian crossing, and traffic calming design/ pedestrian bump-outs are the missing street characters. Street café are available at very few spots. Regarding parking elements, there is no on-street parking as well as parking structure along the street. There are few spots which serve as surface parking lots along the street (Fig 4.19). Uniform public and directional signage, pedestrian signage, and traffic lighting are the missing characteristics regarding street signage. Gateway entry/exit signage is available only at the entry of the street. (Table 4.1).

Table 4.2: Number of selected respondents for passengers, car drivers, and pedestrians

No	Users	Users Type	Average number per day	Number of Respondent (Representatives)
1.	Passengers	Minibus Passengers	131,560	120
		Lada Taxi Passengers	1,670	50
		Public Transport Passengers	123,590	105
		Cyclist	62	25
Total			256,882	300
2.	Drivers	Vehicle Owner	6,699	45
		Public Transport, Lada Taxi and Minibus	12,409	75
		Heavy Truck	2,660	40
		Motor Cycle	384	30
Total			22,152	200
3.	Pedestrian	Pedestrians	-	50
	Total		-	50

Grand Total	550
--------------------	------------

The community uses the Street as being a passenger, driver or a pedestrian. A number of respondents were selected with regard to the types of street users. The study detects the Street serves a maximum number of 300,000 passengers with a maximum number of 35, 000 cars per day. According to the surveyed data that have been held for 3 consecutive days of counting pass by number of passengers and vehicles, the Street serves for a maximum number of 300,000 passengers with a maximum number of 35, 000 cars per day. To come up with these numbers there was a need to take an average number of passengers and vehicles from the collected data of the 3 days (Table 4.2).

According to transport experts that are found in the sub city office, those maximum numbers of each cars per day use an average liter of 1.25 gas to pass by the streets corridor. Vehicles are known for emitting carbon dioxide to the environment. In average number, per 1-liter gas 2.4 kg, carbon dioxide will be produced (Adam et al., 2018).

$$\frac{1 \text{ Vehicle} * X \text{ L Fuel}}{1 \text{ Vehicle}} = \frac{35,000 \text{ Vehicle} * 1.2 \text{ L Fuel}}{1 \text{ Vehicle}}$$

$$\underline{\underline{X = 43,750 \text{ L Fuel}}}$$

$$\frac{\therefore 1 \text{ L Fuel} * X \text{ Kg CO}_2}{1 \text{ L Fuel}} = \frac{43,750 \text{ L Fuel} * 2.4 \text{ Kg CO}_2}{1 \text{ L Fuel}}$$

$$\underline{\underline{X = 105,000 \text{ Kg CO}_2}}$$

As a result, a total Kg of 105, 000 CO₂ is emitting to the environment per day.

From the survey that has been done, passengers from minibus taxi, Lada taxi, public transport, and cyclists; drivers from private vehicle owners, public transport, heavy trucks, and motorcycles; and randomly selected pedestrians have been involved in the survey as shown in Table 4.2.

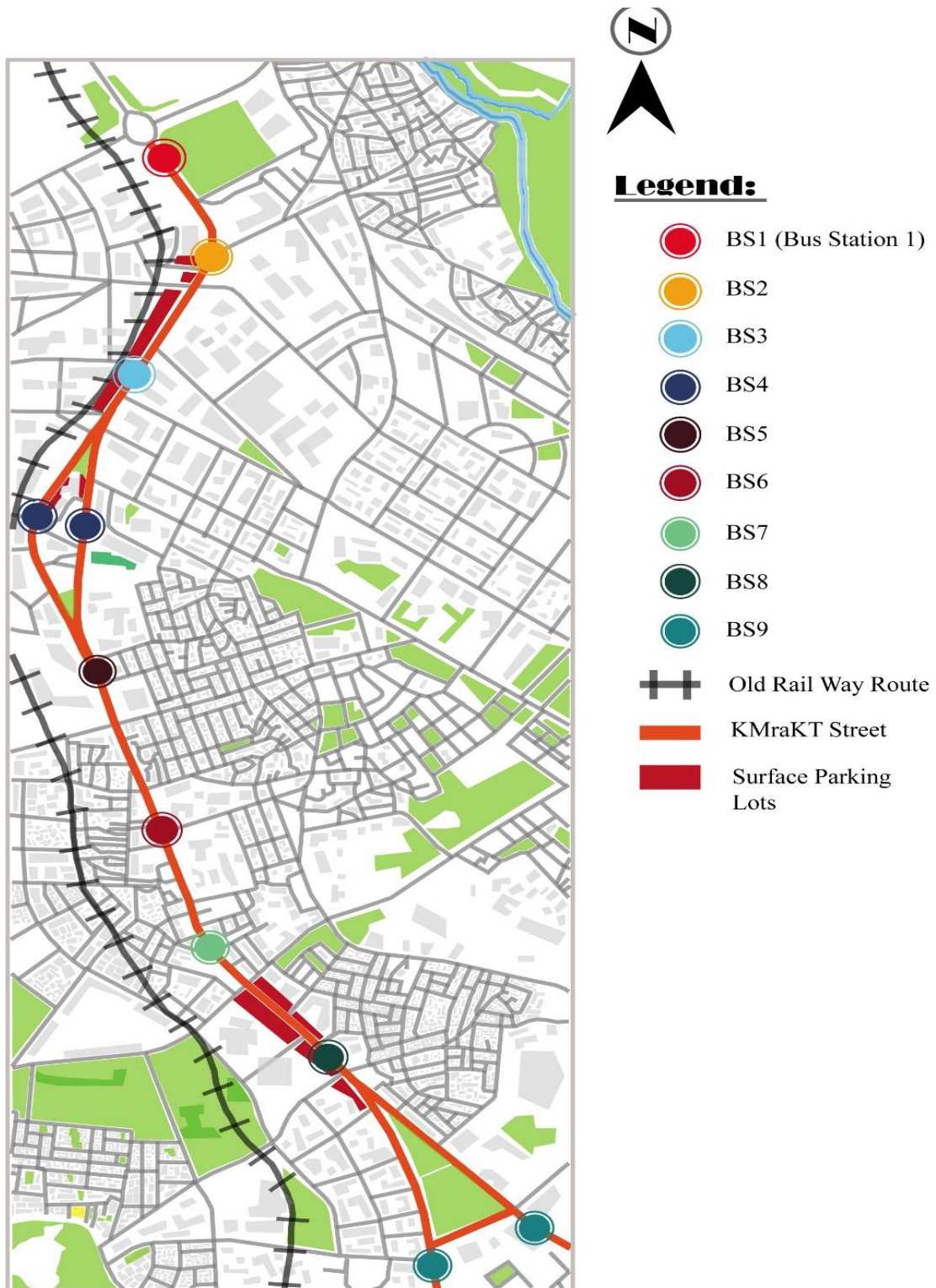


Figure 4.2: Vehicle route and bus stations on the street (Source: Author, 2018)



Congested Street



Congestion of vehicles and pedestrians



Restaurants along the streets



Children cycle racing



Street Vending



Street condition during the rainy season



Categorizing of vehicle types



Street Vending

Figure 4.3: General conditions during site survey (Source: Author, 2018)

4.1.3 Respondent Characteristics

In order to address the various community groups, respondents were categorized by age, gender, marital status, and educational background. 9.3% of the respondents were under the age of <20, 28.4% were in between the age of 20 and 35, 31.6% in between 36 and 50, 20% in between 51 and 65 and 10.7% were 66 and above (Fig.4.4).

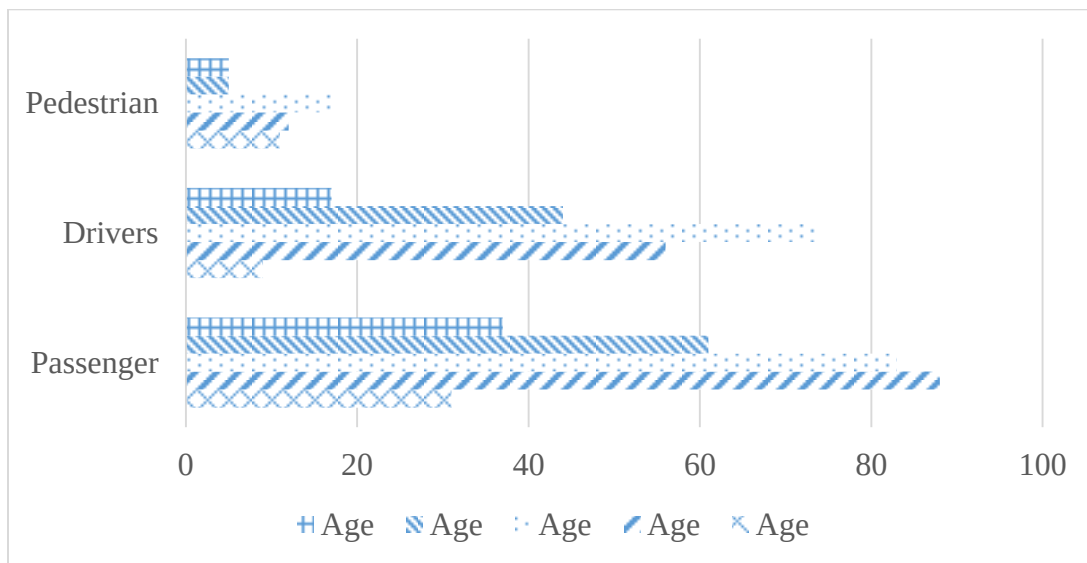


Figure 4.4: Age range that characterized by respondent type

67% male passengers with 33% female passengers were surveyed. The highest number of male respondents has been surveyed (Fig. 4.5).

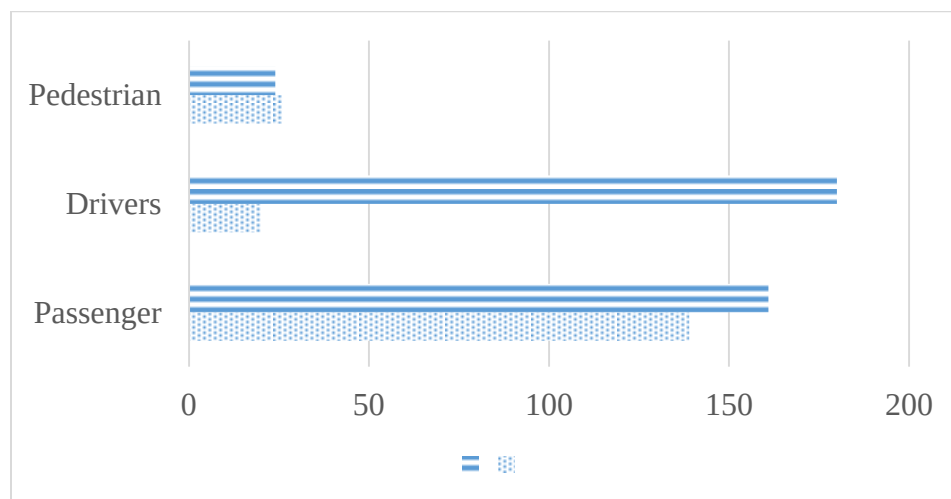


Figure 4.5: Gender group that characterized by respondent type

Table 4.3: Marital status that characterized by respondent type

Marital Status	Respondent Type			Total
	Passenger	Drivers	Pedestrian	
Single	124	58	21	203
Married	153	113	23	289
Divorced	6	7	4	17
Widow	17	22	2	41
Total	300	200	50	550

53%, 37%, 7%, and 3% of the respondents were married, single, widow and divorced. More than half of respondents were found to be married ([Table 4.3](#)).

Table 4.4: Educational background that characterized by respondent type

Educational Background	Respondent Type			Total
	Passenger	Drivers	Pedestrian	
No educational background	37	0	11	48
Primary school completed	40	61	16	117
High school completed	90	99	10	199
University /High level Degree	95	29	10	134
Master's Degree and above	38	11	3	52
Total	300	200	50	550

With respect to educational background, the highest number of respondents (36.2%) has completed high school, 24.4% have a university/ high-level Degree, 21.3% completed primary school, 9.5% have master's degree and above, and the rest 8.7 % have no educational background ([Table 4.4](#)).

4.1.4 Existing Street Status Measurements

Table 4.5: Respondent presence that characterized by age group

Respondent Type	You are in this neighborhood today because of you?					Total
	Working Here	Shopping Here	Leaving Here	Studying Here	Visiting	
Passenger	76	23	136	51	14	300
Drivers	0	0	0	0	0	0
Pedestrian	8	5	26	6	5	50
Total	84	28	162	57	19	350

46%, 24%, 16%, 8%, and 6% of the respondents were people that live in the neighborhood, who came from another neighborhood to work, to study in the neighborhood, shops in the neighborhood, and got in the neighborhood to visit their families and friends respectively (Table 4.5)

Table 4.6: Average time spent passing by the street that characterize by respondent type

Average Time	Passenger	Drivers	Pedestrian	Total
5 - 10 min	0	24	0	24
11-20 min	0	41	0	41
20-30 min	0	86	0	86
Above 30 min	0	49	0	49
Total	0	200	0	200

43% of the respondents spend 20 - 30 average minutes, 25% of the respondents spend above 30 average minutes, 20% of the respondents spend 11 - 20 average minutes, and 12% of the respondents spend 5 to 10 average minutes while passing by the street. Most of the respondents spend 20 to 30 average minutes to pass by the street (Table 4.6).

66.2% of the respondents with the highest number of passengers who completed high school, 39% of respondents with a highest number of passengers who completed high school, and 19% respondents with a highest number of drivers who completed high school suggested that the Street is found in poor condition, fair condition, and good condition. None of the respondents

found the street in an excellent condition. The absolute number of respondents think that the street is found in poor and fair conditions (Fig 4.6 and Fig 4.7).

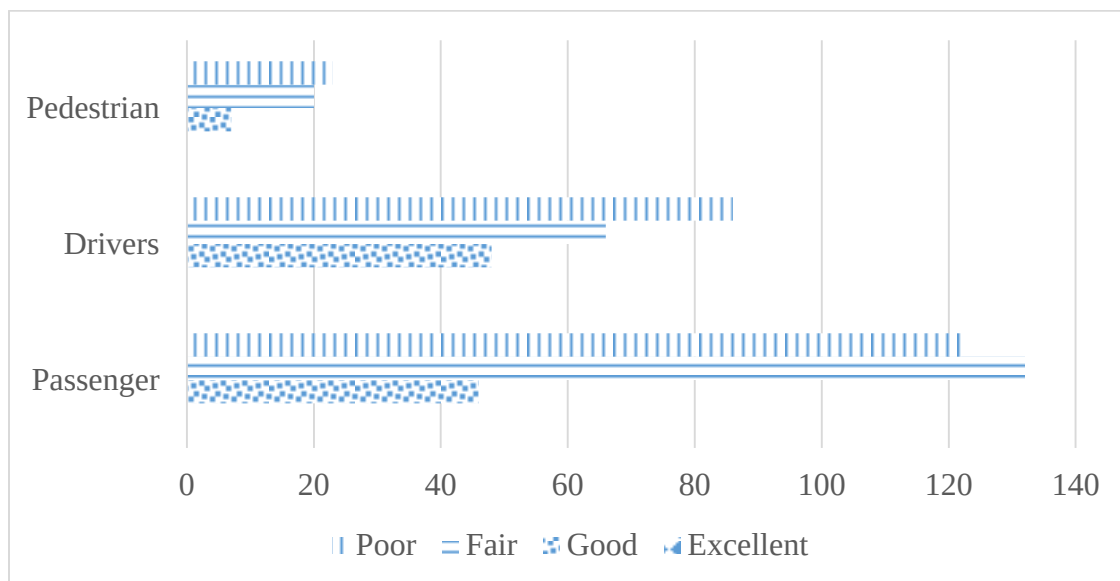


Figure 4.6: Estimated street quality proportion of respondents characterized by respondents type

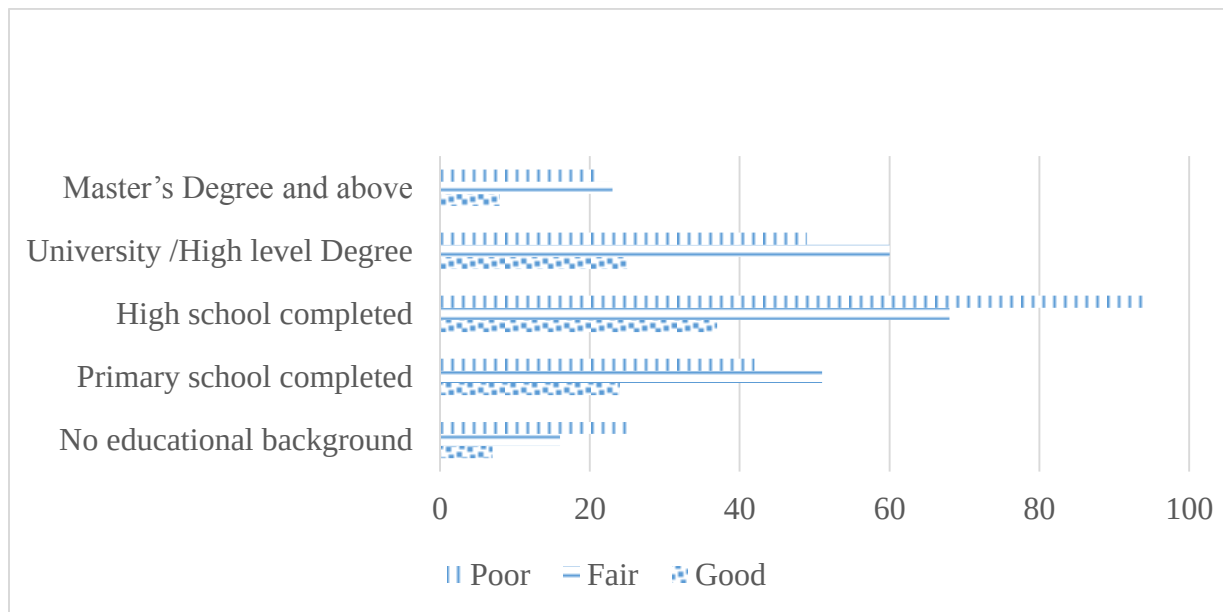


Figure 4.7: Estimated street quality characterized by educational background

Table 4.7: Potentials of the Street that characterized by respondent type

Respondent Type	What potentials do you think the Street has?			Total
	Main gate to in and out of the center of Addis Abeba	The newly emerging programs	None	
Passenger	82	98	120	300
Drivers	64	66	70	200
Pedestrian	16	11	23	50
Total	162	175	213	550

Table 4.8: Potentials of the Street that characterized by age range

Age	What potentials do you think the Street has?			Total
	Main gate to in and out of the center of Addis Abeba	The newly emerging programs	None	
< 20	16	14	21	51
20 - 35	52	46	58	156
36 - 50	42	61	71	174
51 - 65	38	37	35	110
65 <	14	17	28	59
Total	162	175	213	550

According to the surveyed data, 29.5% of the respondents mentioned that the Kality Drivers and Mechanics Training Center to Kality Total gas station Street is the main gate to in and out of the center of Addis Ababa as a potential to develop a successful and useful street furniture. Passengers and the age range that is found in between 20- 35 took a large number in choosing that being the main gate to in and out of the center of Addis Ababa as a potential to develop a successful and useful street future. 32% of the respondents mention that the newly emerging programs (Stadium, Condominium Housing, AASTU University, Bus Terminal [*Menhariya*] and Beijing Hospital) as another potential to be an important corridor to connect the community. Passengers and the age group that is found in between 36- 50 took a large number in choosing the newly emerging programs as an important corridor. 38% of the respondents mention that the Street has no potential. Passengers took the large portion of respondents other than drivers and

pedestrians. The highest numbers of respondents think that there is nothing to be mentioned as a potential to develop a successful and useful street furniture. (Table 4.7 and Table 4.8).

The poor street quality found to be the highest by 27% of respondents and among them the highest number of respondents found in passengers and an age range of 36-50 and 36 – 50. 17% of the respondents found to be congestion and among them, the highest number of respondents found in between age range of 36-50 and in 51-65. 15% of the respondents found to be traffic accidents and among them, the highest number of respondents found in between the age range of 36-50 and in 20–35. 12% of the respondents found to be lack of pedestrian lane and among them, the highest number of respondents found in between the age range of 20-35. 12% of the respondents found to be narrow vehicle lane and among them, the highest number of respondents found in between the age range of 36-50 and in 20–35. 9% of the respondents found to be narrow pedestrian lane and among them, the highest number of respondents found in between age range of 20–35. And 8% of the respondent found to be a high number of cars and among them, the highest number of respondents found in between the age range of 36-50 and in 20–35. Poor street quality, congestion, and traffic accidents found to be the most three problems that are observed on the Street (Fig 4.8 and Fig 4.9). The most congested areas has been identifies through observation (Fig 4.10).

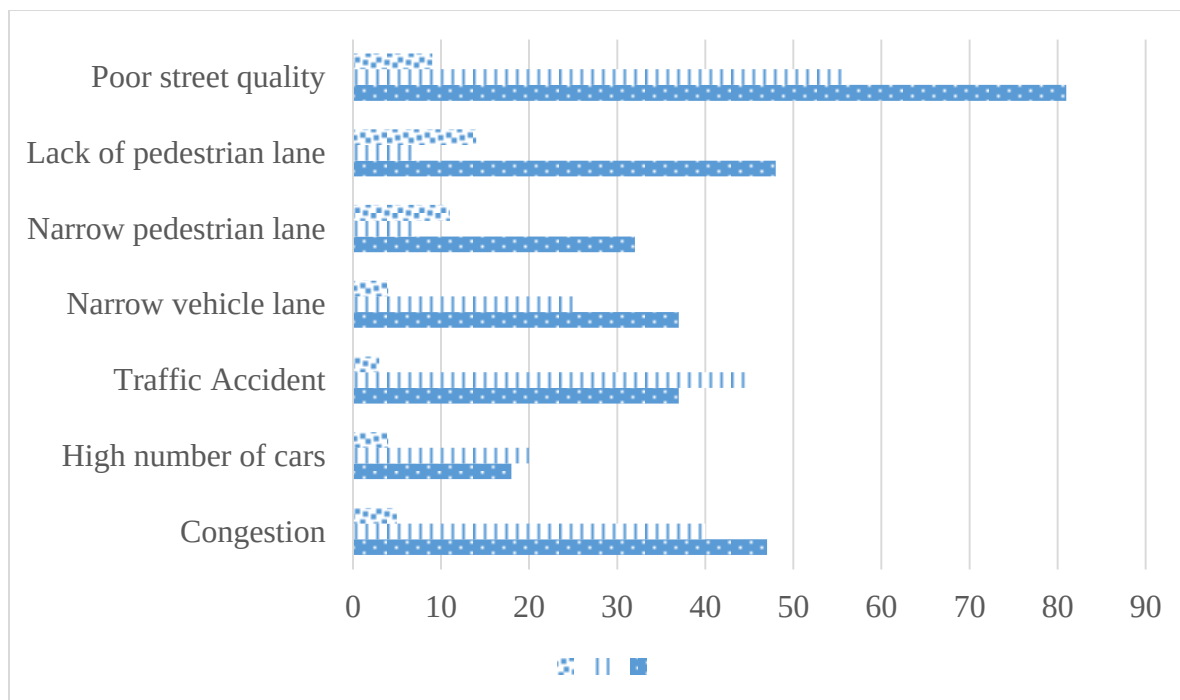


Figure 4.8: Five most encounter problems that characterized by respondent type

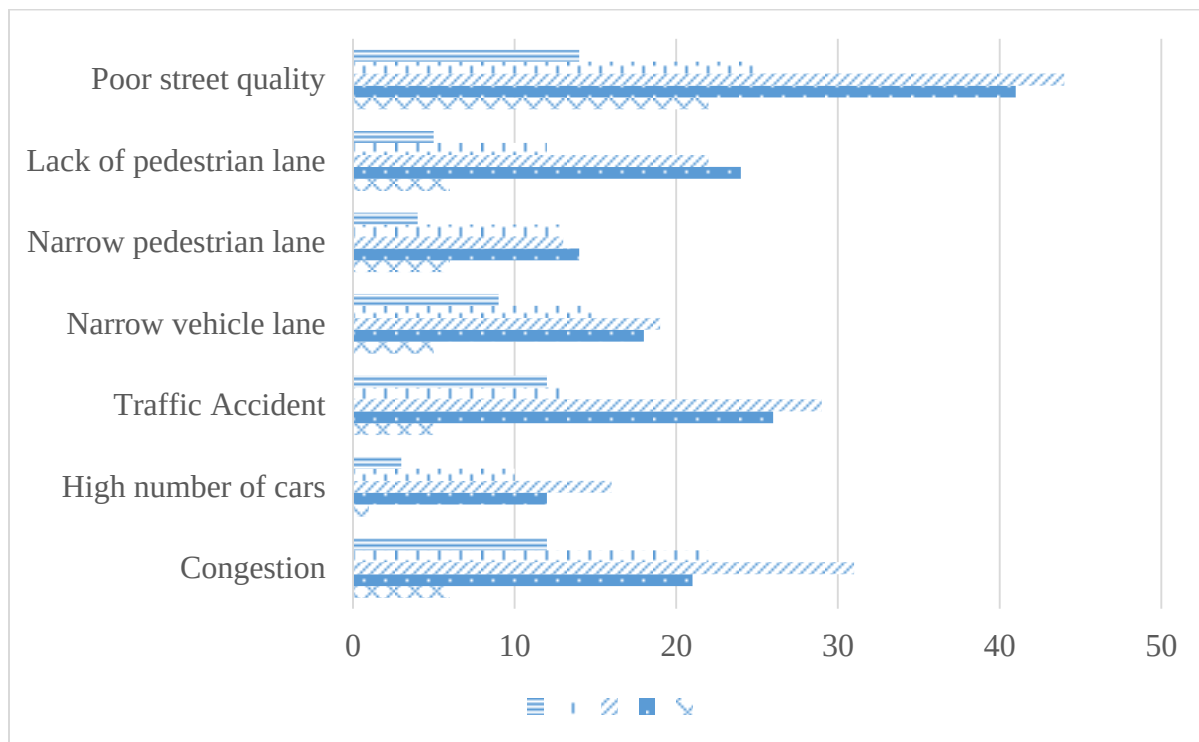


Figure 4.9: Five most encounter problems of respondents that characterized by age range

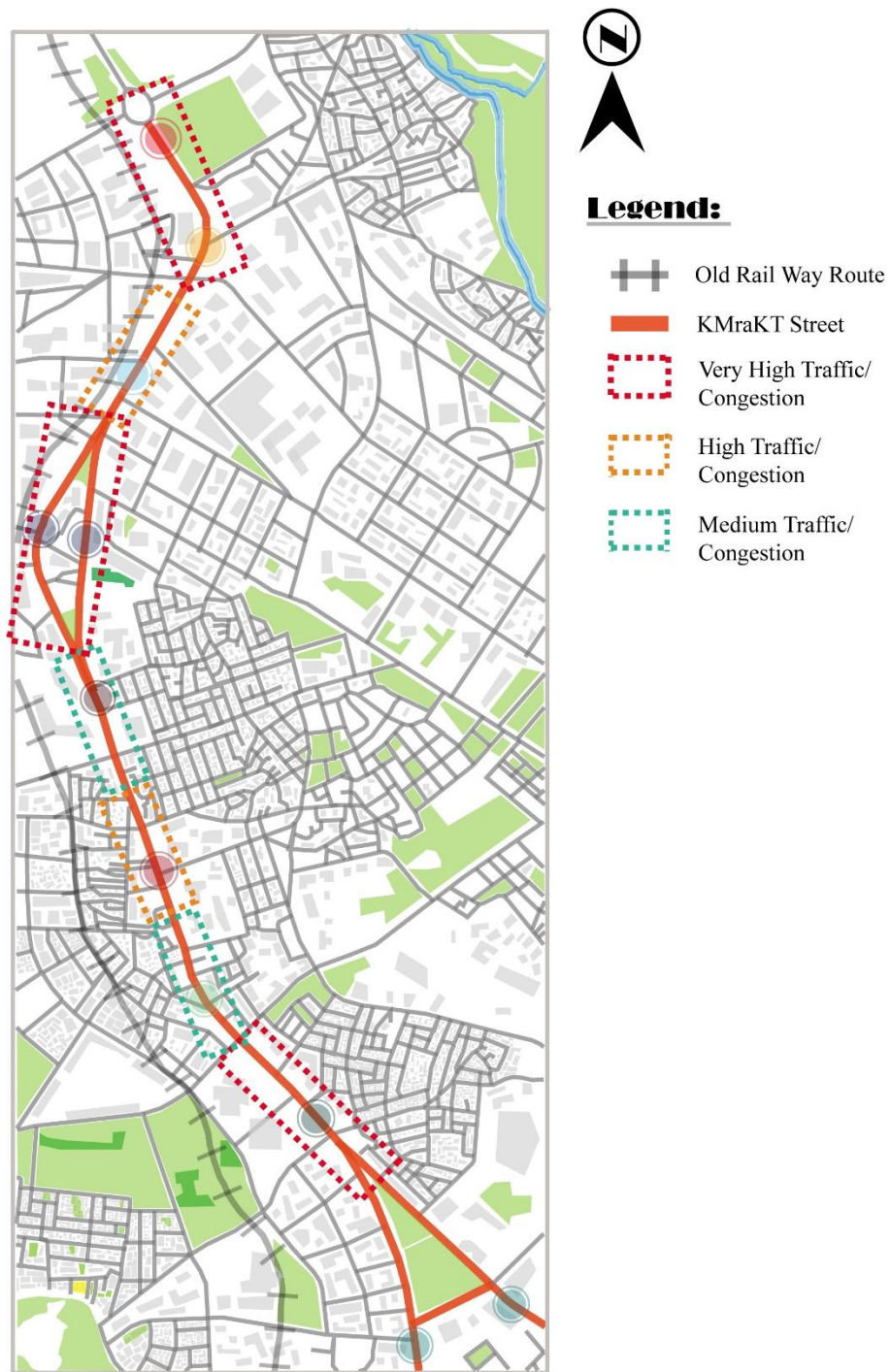


Figure 4.10: Traffic congestion volume along the street (Source: Author, 2018)

Table 4.9: Comparison of street character with activities that are taking place which is characterize by respondent type

Respondent Type	Are the characteristics (size, form and layout) of the Street appropriate to the activities that are taking place?		Total
	No	Yes	
Passenger	0	0	0
Drivers	182	18	200
Pedestrian	0	0	0
Total	182	18	200

Among the respondent, only 9% of the respondents think that characteristics (such as size, form, and layout) of the Street are appropriate to the activities (such as drive, walk, sit, transit, and stand) that are taking place. 91% of the respondents think that such characteristics of the Street are not appropriate to the activities that are taking place. The majority of respondents (91%) think the characteristics of the Street are not appropriate to the activities that are taking place (Table 4.9).

Table 4.10: Street Consideration that characterized by respondent type

Respondent Type	Which of the following is considered along the Street?							Total
	Elders	Disables	Children	Pedestrian	Street Business	Cyclers	None	
Passenger	27	22	22	41	24	37	127	300
Drivers	0	0	0	0	0	0	0	0
Pedestrian	3	3	3	6	3	6	26	50
Total	30	25	25	47	27	43	153	350

Table 4.11: Street Consideration that characterized by age range

Age	Which of the following is considered along the Street?							Total
	Elders	Disables	Children	Pedestrian	Street Business	Cyclers	None	
< 20	4	2	3	9	4	7	13	51
20 - 35	8	8	8	10	8	12	46	156
36 - 50	7	6	11	11	7	10	48	174
51 - 65	8	7	3	9	3	7	29	110

65 <	3	2	0	8	5	7	17	59
Total	30	25	25	47	27	43	153	550

According to the study, 44% of the respondents chose none of the parameters but they believe that the Street doesn't consider elders, disables, children, pedestrian, cycles and street business with the majority of passenger respondents within the age range of 36 – 50. 13% of the respondents believe that the Street doesn't consider pedestrians with the majority of passengers' respondents within the age range of 36 – 50 and 20 – 35. 12% of the respondents believe that the Street doesn't consider street business with the majority of passengers' respondents within the age range of 20- 35. 9% of the respondents believe that the Street doesn't consider elders with the majority of passengers' respondents within the age range of 20 – 35 and 51 – 65. 8% of the respondents believe that the Street doesn't consider cyclers with the majority of passengers' within the age range of 20 – 35. 7% of the respondents believe that the Street doesn't consider disables with the highest number of passengers' respondents within the age range of 20 – 35 and 51 – 65. 7% of the respondents believe that that Street doesn't consider children with the majority of passengers' respondents within the age range of 36- 50. Most of the respondents believe that none of the parameters has been considered in the street ([Table 4.10](#) and [Table 4.11](#)).

Table 4.12: The street suitability that characterized by respondent type

Respondent Type	Is the street of suitable for driving, walking, sitting and biking?		Total
	No	Yes	
Passenger	228	72	300
Drivers	176	24	200
Pedestrian	44	6	50
Total	448	102	550

Table 4.13: The street suitability that characterized by age range

Age	Is the street of suitable for driving, walking, sitting and biking?		Total
	No	Yes	
< 20	41	10	51
20 - 35	137	19	156
36 - 50	147	27	174
51 - 65	84	26	110
65 <	39	20	59
Total	448	102	550

18% of the respondents said that the existing situation of the street is suitable to drive, walk, sit and bike. Among them the majority of passengers' respondents were found within the age range between 36 – 50 and 51 – 65. But, 82% of the respondents said that the existing situation of the street is not suitable to drive, walk, sit and bike. These respondents were found in passengers with a very high number of pedestrians and an age range in between 36 – 50 and 20 – 35. More than half of the respondents believe that the existing situation of the street is not suitable to drive, walk, sit and bike ([Table 4.12](#) and [Table 4.13](#)).

Table 4.14: Pavement appearance that characterize by respondent type

Respondent Type	In the street, in what conditions do pavements appear?			Total
	Good	Bad	Very Bad	
Passenger	0	0	0	300
Drivers	16	84	100	200
Pedestrian	0	0	0	50
Total	16	84	100	550

The survey found out that 8% of the respondents believe that the street pavements appear in good condition, while bad condition by 41% of the respondents, and very bad condition by 51% of the respondents. None of the respondents believe that the street pavements appear in very good condition. However, over half of respondents believe that the street pavements appear in the very bad condition ([Table 4.14](#)).

Table 4.15: Estimated air pollution rate that characterized by respondent type

Respondent Type	How do you estimate/evaluate air pollution rate in the street				Total
	Very Clean	Clean	Polluted	Very Polluted	
Passenger	0	42	141	117	300
Drivers	10	32	84	74	200
Pedestrian	0	6	23	21	50
Total	10	80	248	212	550

Table 4.16: Estimated air pollution rate that characterized by educational background

Educational Back Ground	How do you estimate/evaluate air pollution rate in the street?				Total
	Very Clean	Clean	Polluted	Very Polluted	
No educational background	0	4	26	18	48
Primary school completed	1	15	42	59	117
High school completed	7	36	97	59	199
University /High level Degree	2	19	54	59	134
Master's Degree and above	0	6	29	17	52
Total	10	80	248	212	550

The survey found out the air pollution rate of the street to which 45% of the respondents estimate that the Street is polluted. Of these respondents, the majorities have an educational background of high school completion. 39% of the respondents having an educational background of a primary school, high school, and university/ high-level degree found out that the Street is in the much-polluted state. 14% of the respondents found the Street is clean and among them, the majorities have an educational background of high school completion. Only 2% of the respondents believe the street is very clean and among them, the majorities have an educational background of high school completion. The majority number of respondents estimated the air pollution rate of the Street to be polluted and much polluted ([Table 4.15](#) and [Table 4.16](#)).

Table 4.17: Estimated noise pollution rate that characterized by respondent type

Respondent Type	How do you estimate/evaluate traffic noise pollution rate in the street?				Total
	Very Quiet	Quite	Noisy	Very Noisy	
Passenger	11	49	121	119	300
Drivers	7	19	87	87	200
Pedestrian	0	5	18	27	50
Total	18	73	226	233	550

Table 4.18: Estimated noise pollution rate that characterized by educational background

Educational Back Ground	How do you estimate/evaluate traffic noise pollution rate in the street?				Total
	Very Quiet	Quite	Noisy	Very Noisy	
No educational background	1	6	28	13	48
Primary school completed	3	15	48	51	117
High school completed	8	21	77	93	199
University /High level/ Degree	5	23	47	59	134
Master's Degree and above	1	8	26	17	52
Total	18	73	226	233	550

43% of the respondents estimated that the street is very noisy and among them, the majorities completed high school education. 41% of the respondents found the street is noisy and among them the majorities who completed high school education. 13% of the respondents found the street is quiet and among them, the majorities have a university/ high-level degree. 3% of the respondents believe the street is very quiet and among them, the majorities completed high school. The majority number of the respondents estimated the noise pollution rate of the Street to be very noisy and noisy ([Table 4.17](#) and [Table 4.18](#)).

The survey found out that 36% of the respondents believe that poor street quality is the first most stated factor causing traffic accident along the street, the high number of cars becomes the second most stated factor causing traffic accident along the street by 24% of respondents. Driver's characteristics were the third most stated factor causing traffic accident along the street

by 21% of respondents and pedestrian characteristics comes last as most stated factor causing traffic accident along the street by 19% of the respondents (Fig 4.11).

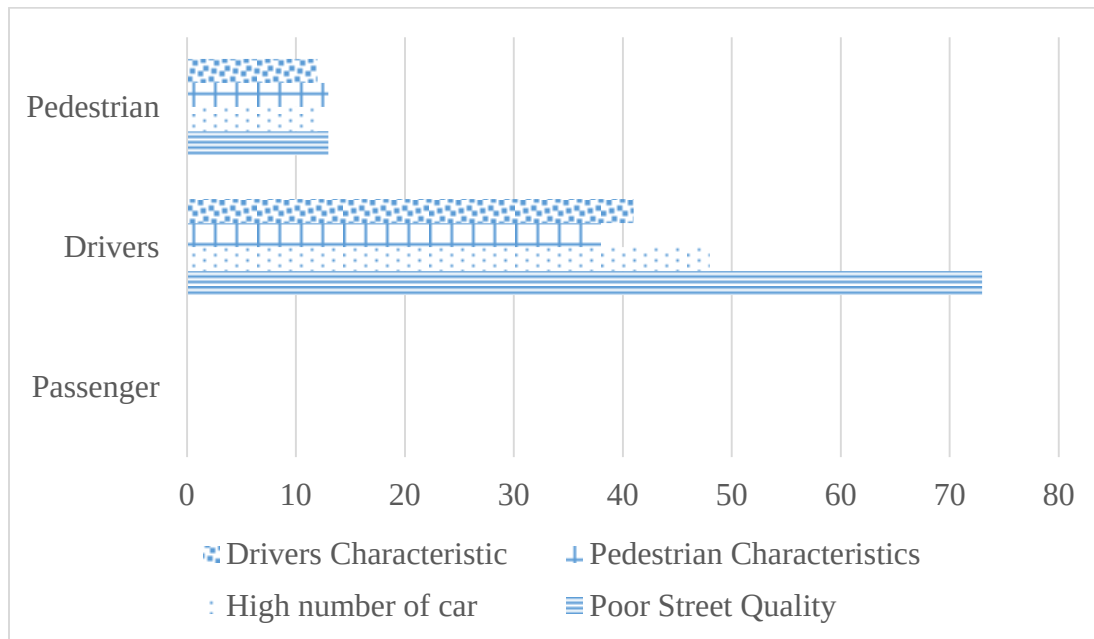


Figure 4.11: Most two factor causing traffic accident that characterized by respondent type

Table 4.19: Respondents exposure to criminal activities that characterized by respondent type

Respondent Type	Is the Street safe from criminal activities? If your answer is No please explain		Total
	No	Yes	
Passenger	114	186	300
Drivers	0	0	0
Pedestrian	27	23	50
Total	141	209	350

40% of the respondents, of which the majorities are passengers, believed that the Street is free from criminal activities. 60% of the respondents believe that the Street is not free from criminal activities with the majority of passengers' respondents. Since most of the criminal activities take place at night time, lack of street lighting and security were mentioned as common problems for the cause of crimes. More than half of the respondents believe that the street is exposed to criminal activities (Table 4.19).

Table 4.20: Availability of sufficient street lighting that characterized by respondent type

Respondent Type	Is there appropriate street lighting for night along the Street?		Total
	No	Yes	
Passenger	0	0	0
Drivers	193	7	200
Pedestrian	50	0	50
Total	243	7	250

The survey found out that, only 3% of the respondents believe that there is appropriate street lighting along the Street. The majorities of respondents (97%) didn't believe that there is appropriate street lighting along the Street. These respondents were all number of pedestrians and the majorities of drivers. A lot of respondents believe that there is no convenient street lighting along the street ([Table 4.20](#)).

Table 4.21: Availability of sufficient traffic signage that characterized by respondent type

Respondent Type	Is there appropriate traffic signage with appropriate location along the Street?		Total
	Yes	No	
Passenger	0	0	0
Drivers	0	200	200
Pedestrian	0	50	50
Total	0	250	250

The survey found out that, none of the respondents believe that there is appropriate traffic signage with the appropriate location along the Street. All drivers and pedestrian respondents didn't believe that there is appropriate traffic signage with the appropriate location along the Street. All respondents witnessed that there is no convenient street signage for both pedestrian and vehicle drivers along the street ([Table 4.21](#)).

Table 4.22: Existence of obstacles in pedestrian ways that characterized by respondent type

Respondent Type	Is there obstacles in pedestrian ways along the Street?		Total
	No	Yes	
Passenger	0	0	0
Drivers	118	82	200
Pedestrian	19	31	50
Total	137	113	250

45% of the respondents reflected that there are obstacles in pedestrian ways along the Street. Uncomfortable pavement, and combined vehicle and pedestrian lane are among the obstacles that are observed by pedestrians. More than half of the respondents didn't believe that there are obstacles in pedestrian ways along the Street ([Table 4.22](#)).

Table 4.23: Existence of sufficient tree shade along the street that characterized by respondent type

Respondent Type	Is there sufficient tree shade along the Street?		Total
	No	Yes	
Passenger	0	0	0
Drivers	194	6	200
Pedestrian	47	3	50
Total	241	9	250

The survey found out that, 4% of the respondents believed that there is sufficient tree shade for pedestrians along the Street while the remaining respondents didn't believe that there is sufficient tree shade for pedestrian along the Street. The majority of respondents believed that there is a lack of sufficient tree shade for pedestrians along the Street ([Table 4.23](#)).

4.1.5 Interaction between the Community and the Street

Table 4.24: Importance of people interaction on street that characterized by respondent type

Respondent Type	How important do you think interacting with other people in streets is crucial for community engagement?			Total
	Very Important	Important	Not that Important	
Passenger	80	159	61	300
Drivers	86	71	43	200
Pedestrian	18	22	10	50
Total	184	252	114	550

Table 4.25: Importance of people interaction on street that characterized by age group

Educational Back Ground	How important do you think interacting with other people in streets is crucial for community engagement?			Total
	Very Important	Important	Not that Important	
No educational background	10	24	14	48
Primary school completed	48	41	28	117
High school completed	72	89	38	199
University /High level/ Degree	39	69	26	134
Master's Degree and above	15	29	8	52
Total	184	252	114	550

According to the survey, 48% of the respondents with the majorities of passengers' respondents, believed that interacting with other people in street is important for the local community. Of these respondents, the majorities have an educational background of high school completion. 31% of the respondents believe that interacting with other people in street is very important for the local community. The majorities of respondents were drivers who have an educational background of high school completion. 21% of the respondents believe that interacting with other people in street is not that important for the local community with the high number of passengers' respondents with an educational background of high school competition. For the

most number of respondents, interacting with other people in street is important for the local community (Table 4.24 and Table 4.25).

Table 4.26: Estimated communication degree between the community and street that characterized by respondent type

Respondent Type	How do you express degree of communication between the community and the street in terms of engagement in the day to day routine?			Total
	Close Enough	Distant	Very Distant	
Passenger	0	0	0	0
Drivers	0	0	0	0
Pedestrian	5	15	30	50
Total	5	15	30	50

60% of the respondents estimated that the degree of communication between the community and the street is very distant; while distant by 30%, close enough by 10% of the respondents (Table 4.26). None of the respondent estimated that degree of communication between the community and the street is very distant.

Table 4.27: Street appliance to stay in and enjoy that characterized by respondent type

Respondent Type	Is the street inviting to stay in and enjoy?		Total
	No	Yes	
Passenger	0	0	300
Drivers	193	7	200
Pedestrian	46	4	50
Total	239	11	550

Table 4.28: Street appliance to stay in and enjoy that characterized by age range

Age	Is the street inviting to stay in and enjoy?		Total
	No	Yes	
< 20	19	1	20
20 - 35	66	2	68
36 - 50	84	7	91
51 - 65	48	1	49
65 <	22	0	22
Total	239	11	250

4% of the respondents the majority of which are in the age range of 36-50 stated that the existing situation of the street is inviting to stay in and enjoy. 96% of the respondents said that the existing situation of the street is not inviting to stay in and enjoy similarly with the leading respondents were within the age range of 36 – 50. The majority of respondents believe that the existing situation of the street is not inviting to stay in and enjoy ([Table 4.27](#) and [Table 4.28](#)).

35% of the respondents never go out on the street to interact with people, walk, jog and sit. Among the respondents, the majorities were passengers within the age range of 36 – 50. 25% of the respondents go out on the street to interact with people, walk, jog and sit once in 2 weeks. Among the respondents, the majorities were passengers within the age range of 65 <. 17% of the respondents go out on the street to interact with people, walk, jog and sit for once a week. Among the respondents, the majorities were passengers within the age range of 36 - 50. 13% of the respondents go out on the street to interact with people, walk, jog and sit for 3 - 5 days. Among the respondents, the majorities were passengers within the age range of 20 – 35 and 36 – 50. 8% of the respondents go out on the street to interact with people, walk, jog and sit as daily bases. Among the respondents, the majorities were passengers within the age range of 20 - 35. Most of the respondents never go out on the street to interact with people, walk, jog and sit ([Fig 4.12](#) and [Fig 4.13](#)).

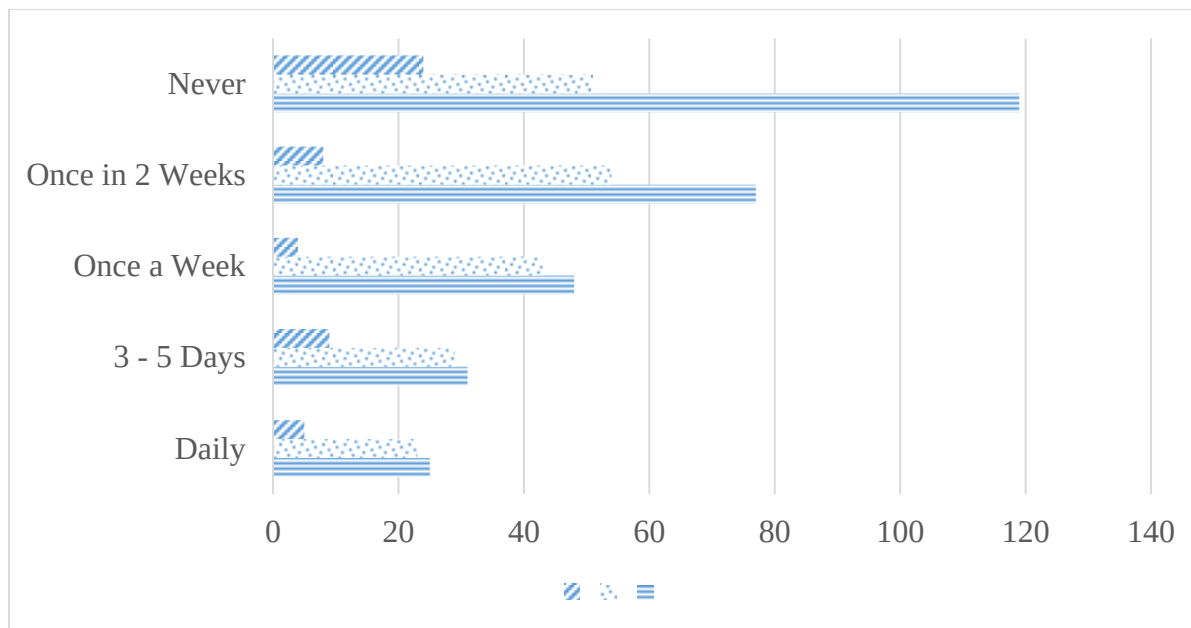


Figure 4.12: Time interval that used to interact with people, walk, jog and sit that characterized by respondent type

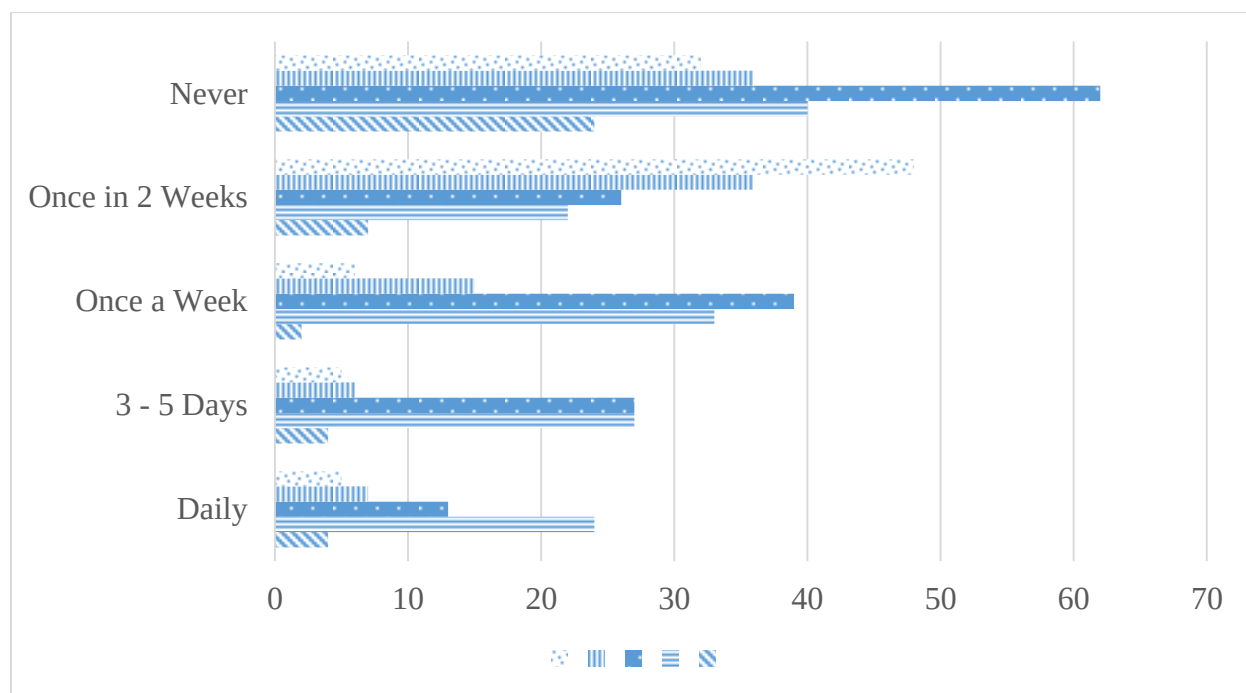


Figure 4.13: Time interval that used to interact with people, walk, jog and sit that characterize by age range

Table 4.29: Interaction and communication demand that characterized by respondent type

Respondent Type	Would you insist to interact and communicate with peoples in the street (as a type of public space)?		Total
	No	Yes	
Passenger	86	214	300
Drivers	92	108	200
Pedestrian	12	38	50
Total	190	360	550

Table 4.30: Interaction and communication demand that characterized by age range

Age	Would you insist to interact and communicate with peoples in the street (as a type of public space)?		Total
	No	Yes	
< 20	18	33	51
20 - 35	53	103	156
36 - 50	57	117	174
51 - 65	43	67	110
65 <	19	40	59
Total	190	360	550

66% of the respondents would insist to use a well-designed street to interact and communicate with people as public space. Among them, the majorities reacted were in the passengers' category. Respondents with the age range that lies between 36 – 50 and 20 – 35 were the majorities. 34% of the respondents would not insist to use a well-designed street to interact and communicate with people using a public space. Amongst the majorities of respondents reacted were from the drivers' category. Respondents with the age range between 36 – 50 and 20 – 35 were the highest in number. More than half of respondents are willing and showed an interest to interact and communicate with people as public space in a well-designed street (Table 4.29 and Table 4.30).

4.1.6 Demand for Future Improvement

Table 4.31: Demand of respondents in additional street amenities and utilities that characterized by respondent type

Respondent Type	Do you think the street has needed additional street amenities and utilities? (Streetscape elements, pedestrian circulations, parking elements, signage, etc.)		Total
	No	Yes	
Passenger	24	276	300
Drivers	19	181	200
Pedestrian	4	46	50
Total	47	503	550

92% of the respondents showed an interest in the need for additional street amenities on the Street. Among them, the majorities reacted were in the passengers' category. 8% of the respondents believe that the existing street amenities are enough for the Street. A majority of respondents think that the street needs additional street amenities (Table 4.31).

Table 4.32: Necessity of co-modal transport system that characterized by respondent type

Respondent Type	How essential is integrating optional (co-modal) transport system to the Street? (Bus Rapid Transport, Light Rail Transport, Bicycle Lane, Pedestrian Lane, etc.)			Total
	Very Essential	Essential	Unnecessary	
Passenger	165	120	15	300
Drivers	85	74	41	200
Pedestrian	22	21	7	50
Total	272	215	63	550

According to this study, 50% of the respondents believe that integrating optional (co-modal) transport systems such as BRT, LRT. Bicycle lane, the pedestrian lane, etc. are very essential for the community. The majority of passengers reacted to the very essential category among others. 39% of the respondents believe that integrating optional (co-modal) transport system is essential for the community. The majorities of passengers reacted to the essential category among the others. 11% of the respondents believe that integrating optional (co-modal) transport system is unnecessary for the street. The majority of drivers reacted on the unnecessary of co-modality.

Half of the respondents believe that integrating optional (co-modal) transport system is very essential for the street. From the rest responses, the majority of respondents (39%) believe that integrating optional (co-modal) transport system is essential for the street (Table 4.32).

Table 4.33: Needed improvements to the Street that characterized by respondent type

Respondent Type	What are the three (3) improvements to the street that you would want to see? (If there is more, please feel free to put it down)										Total
	Attractive, complete, and comfortable street to walk and drive	Rich earlier to our destination	Integrated street infrastructure	Durable street	Separation of heavy trucks	Vast street	Street with plantation	Street which considers all community groups	Street with traffic light	Dedicated cycle lane	
Passenger	103	71	5	5	67	0	27	12	0	10	300
Drivers	44	22	31	47	25	31	0	0	0	0	200
Pedestrian	10	0	0	0	0	0	9	13	8	10	50
Total	157	93	36	52	92	31	36	25	8	20	550

Table 4.34: Needed improvements to the Street that characterized by age range

Age	What are the three (3) improvements to the street that you would want to see? (If there is more, please feel free to put it down)										Total
	Attractive, complete, and comfortable street to walk and drive	Rich earlier to our destination	Integrated street infrastructure	Durable street	Separation of heavy trucks	Vast street	Street with plantation	Street which considers all community groups	Street with traffic light	Dedicated cycle lane	
< 20	13	8	3	2	8	1	5	8	2	1	51
20 - 35	43	27	11	13	29	10	8	8	2	7	156
36 - 50	51	30	15	15	27	13	10	2	3	4	174
51 - 65	32	13	7	17	19	5	10	5	0	4	110
65 <	18	15	0	5	9	2	3	2	1	4	59
Total	157	93	36	52	92	31	36	25	8	20	550

According to the survey result, only 1% of the respondents showed an interest to see a street with a traffic light. All the pedestrians chose the presence of traffic light. Respondents with age range of 36- 50 were the majorities to choose the presence of traffic light. Only 4% of the respondents

showed an interest to have a dedicated cycle lane. An equal number of passengers and pedestrians chose to have a dedicated cycle lane. Also, respondents within the age range of 20-35 were the majorities to choose a dedicated cycle lane. Another 4% of the respondents showed an interest to have a street which considers all community groups. The majority of pedestrians choose to have a street which considers all community groups. Also, respondents with age range of <20 and 20 - 35 were the majorities to choose to have a street which considers all community groups. Only, 6% of the respondents showed an interest to have a street with integrated infrastructure. The majority of drivers choose street with integrated infrastructure. Also, the age range of 36- 50 were the majority of respondents to choose the presence of traffic light. Only 6% of the respondents demanded to have a wide street. All the drivers within the age range of 36- 50 choose to have a wide street. 7% of the respondents showed an interest to have a street with the plantation. The majorities of passengers choose to have a street with a plantation. Also, the age range of 36 - 50 and 51 - 65 were the majority of respondents to choose to have a street with a plantation. 8% of the respondents choose to have a durable street. Among them, the majority of drivers within the age range of 51 – 60 and 36 – 50 choose to have a durable street. 17% of the respondents showed an interest to rich earlier to their destination. The majority of passengers within the age range of 36- 50 choose to rich earlier to their destination. 17% of the respondents showed an interest in the separation of heavy trucks. The majorities of passengers within the age range of 20 - 35 and 36 – 50 choose to have separation of heavy trucks. 30% of the respondents showed an interest to have an attractive, complete, and comfortable street to walk and drive. The majorities of passengers within the age range of 36- 50 choose to have an attractive, complete, and comfortable street to walk and drive ([Table 4.33](#) and [Table 4.34](#)). Having an attractive, complete, and comfortable street to walk and drive are the majority of the respondents' desire. An equal number of respondents choose to rich earlier to their destination and would love to have separation of heavy trucks.

4.1.7 Assessment of Existing Street

Table 4.35: Time interval that used to interact with people, walk, jog or sit that characterized by street quality

Please rate the quality of the Street?	How often do you go out on streets to interact with people, walking, jogging and sitting?					Total
	Daily	3 - 5 Days	Once a Week	Once in 2 Weeks	Never	
Good	8	14	20	19	28	89
Fair	34	29	28	57	65	213
Poor	11	26	47	63	101	148
Total	53	69	95	139	194	550

35% of the respondents, of which the majorities believed that the street has poor quality, never go out on the street to interact with people, walk, jog or sit. 25% of the respondents, of which the majorities believed that the street has poor quality, go out on the street to interact with people, walk, jog, and sit once in 2 weeks. 17% of the respondents, of which the majorities believed that the street has poor quality, go out on the street to interact with people, walk, jog or sit for once in a week. 13% of the respondents, of which the majorities believed that the street has fair quality, go out on the street to interact with people, walk, jog or sit for 3 - 5 days. Only 8% of the respondents, of which the majorities believed that the street has fair quality, go out on the street to interact with people, walk, jog or sit as daily bases. The majority of the respondents (35%) never go out on the street to interact with people, walk, jog or sit (Table 4.35).

4.1.8 Interaction In Between the Community and the Street

Table 4.36: Interaction and communication demand that characterized by importance of people interaction on street

How important do you think interacting with other people in streets is crucial for community engagement?	Would you insist to interact and communicate with peoples in the street (as a type of public space)?		Total
	No	Yes	
Very Important	67	117	184
Important	83	169	252
Not that Important	40	74	114
Total	190	360	550

66% of the respondents would insist to use a well-designed street as public space to interact and communicate with people, of which a large number of respondents believed that interacting with other people in street is important for the local community. 34% of the respondents would not insist to use a well-designed street as public space to interact and communicate with people, to which a large number of respondents believe that interacting with other people in street is important for the local community. More than half of respondents are willing and interested to interact and communicate with people as public space in a well-designed street. They also believe that interacting with other people in the street is important for the local community (Table 4.36).

According to the this study, 48% of the respondents believe that interacting with other people in street is important for local community, of which large number of respondents that never go out on the street to interact with people, walk, jog or sit. 31% of the respondents believe that interacting with other people in street is very important for local community, of which large number of respondents that go out on the street to interact with people, walk, jog or sit as daily bases. 21% of the respondents believe that interacting with other people in street is not that important for local community, of which large number of respondents that go out on the street to interact with people, walk, jog or sit once in 2 weeks (Fig. 4.14).

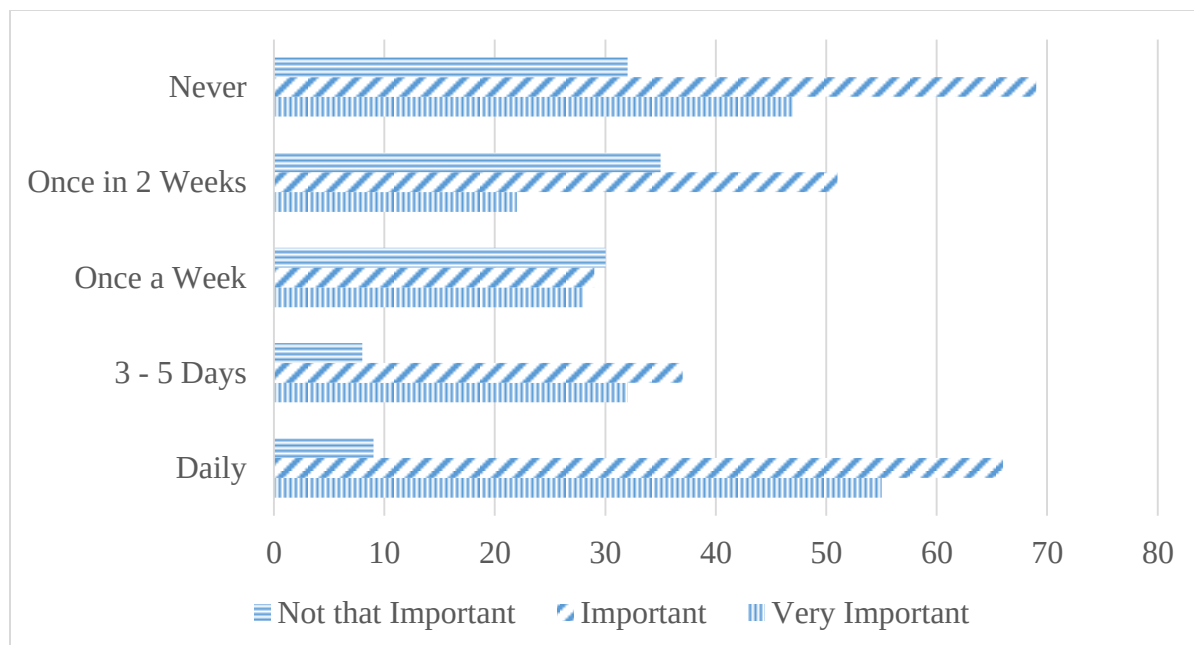


Figure 4.14: Importance of people interaction on street that characterized by time interval that used to interact with people, walk, jog or sit

Table 4.37: Interaction and communication demand that characterized by street appliance to stay in and enjoy

Is the street inviting to stay in and enjoy?	Would you insist to interact and communicate with peoples in the street (as a type of public space)?		Total
	No	Yes	
No	99	140	239
Yes	5	6	11
Total	190	360	550

66% of the respondents would insist to use a well-designed street as public space to interact and communicate with people. But the majority of respondents stated that the street is not inviting to stay in and enjoy. Even though, 34% of the respondents would not insist to use a well-designed street as public space to interact and communicate with people. The majority of respondents' stated that the street is not inviting to stay in and enjoy. More than half of the respondents are willing and interested to interact and communicate with people as public space in a well-designed street ([Table 4.37](#)).

4.2. DISCUSSION

Due to various factors, the sub-city population number is increasing from time to time. The existing capacity of the street along with the increasing number of population raises a question of accommodation capability. Besides traffic accidents, congestion, poor street quality, and unpleasant environment to live in are the most visible problems of the street as a daily bases. The street is serving as a corridor to carriage and import and export goods. Perhaps, as the recorded data, observation and majority of responsive questions from the local community, the Street was found in poor condition due to poor street quality (pavement failure), congestion, and traffic accidents. The current local and global problems such as pollution, climate change, and congestion imply that there has to be prepared plan to adapt or mitigate the problems (David et al., 2011). In descending order according to the high number of respondents, poor street quality, driver's behaviors, the large number of cars, and pedestrian behaviors are the major factors causing traffic accident along the street (Kality Sub city Traffic Management Agency and Wubshet et al., 2017). With inappropriate and unsuitable size, form, and layout of the Street, it will take an average time of 20 to 30 minutes to pass by the Kality Drivers and Mechanics Training Center to Kality Total gas station Street.



Figure 4.15: Appearance of the Street (Source: Author, 2018)

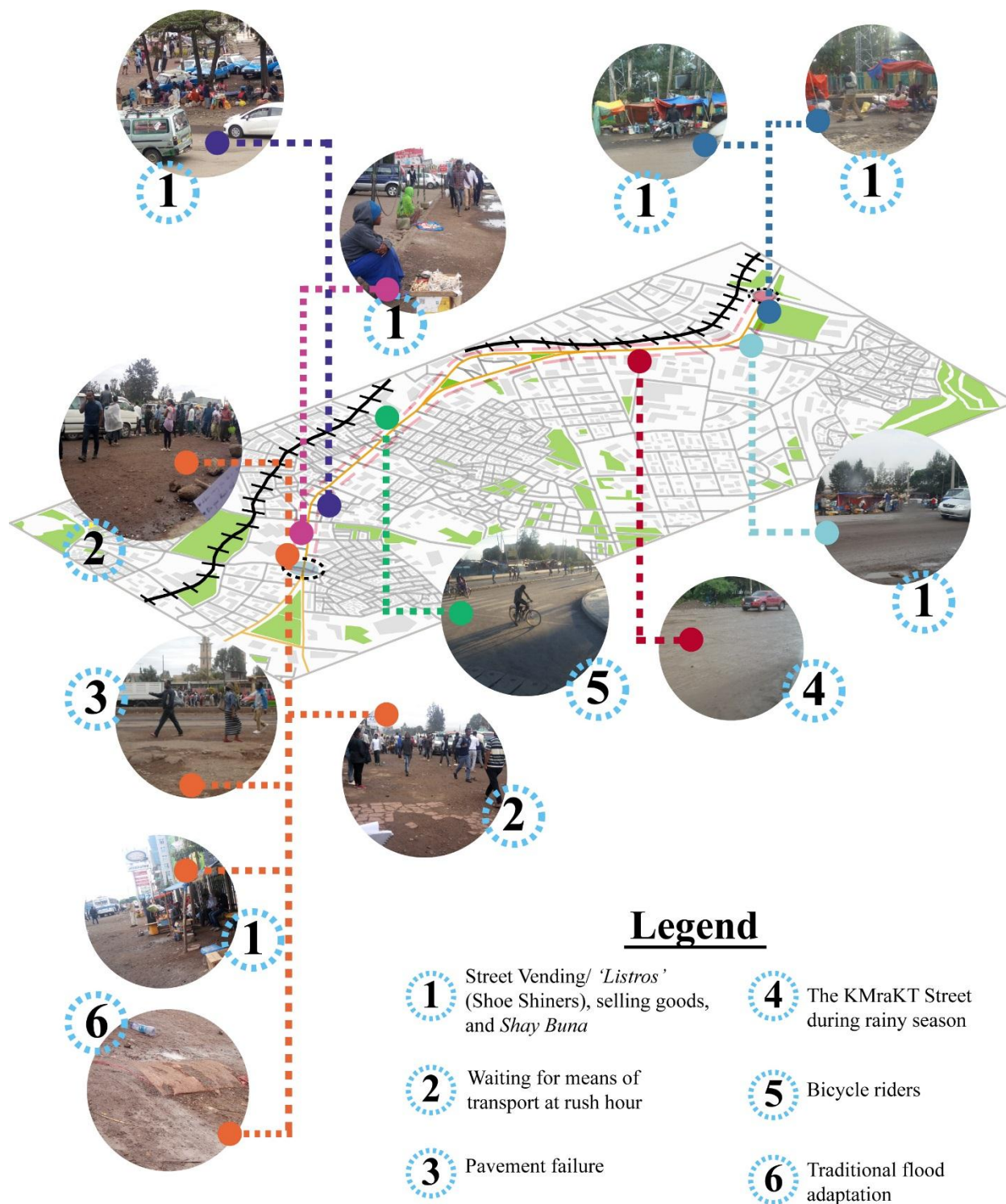


Figure 4.16: Characteristics of the Street (Source: Author, 2018)

However, the study found out that the street surpluses neighborhood characteristics, such as historical buildings, public parks, restaurants, shops, dominated building color, traffic control devices, stormwater infrastructure utilities, and identity (Fig. 4.17). A sense of belongingness enhances a desire to spend more times on streets and to explore streets. The occurrence of a sense of belongingness depends on neighborhood characteristics (Bain, 2012). As not only a character, but as a public realm, absence of public parks, restaurants, shops, and nearby open spaces along the street brought loss of community comfort. Think of streets only for traffic purpose is a traditional way of thinking of streets. But to use streets for their potential as public spaces enhance a quality to a city. Streets are known for their integration opportunities of income generation spots for the community and a functional space for pop-up cafes (NACTO, 2012). The street should include social benefits for the community through mobility, place making, and natural systems (Bain, 2012). People-oriented Street rather than car-oriented street can bring multi-functionality by diversifying the uses of the street, for example encouraging street business (Bain, 2012; Jacobs, 1961).

Streetscape elements, such as street trees, medians, street lighting, kiosk, public art, street furniture, bicycle way and racks, and trash cans are also missing (Fig. 4.16). Trees are considered as green infrastructure in providing the street setting and community health (New Jersey, 2008). Also, trees used to capture stormwater, filter pollutants, and set attractive street fabric (David et al., 2011). Dedicated pedestrian circulation, such as pedestrian plazas, street cafes, pedestrian crossings, and traffic calming design is not located within the respected places. Parking elements, such as on-street parking, surface parking lots, and parking structures are among the missing elements in the street. Also the street lacks, street signage (such as uniform public and directional signage), pedestrian, traffic lighting, and gateway entry and exit signage. The significant history behind the old railway line is neglected and ignored in order to install new infrastructures. Removal of this structure leads to entangled history (Fig. 4.17).

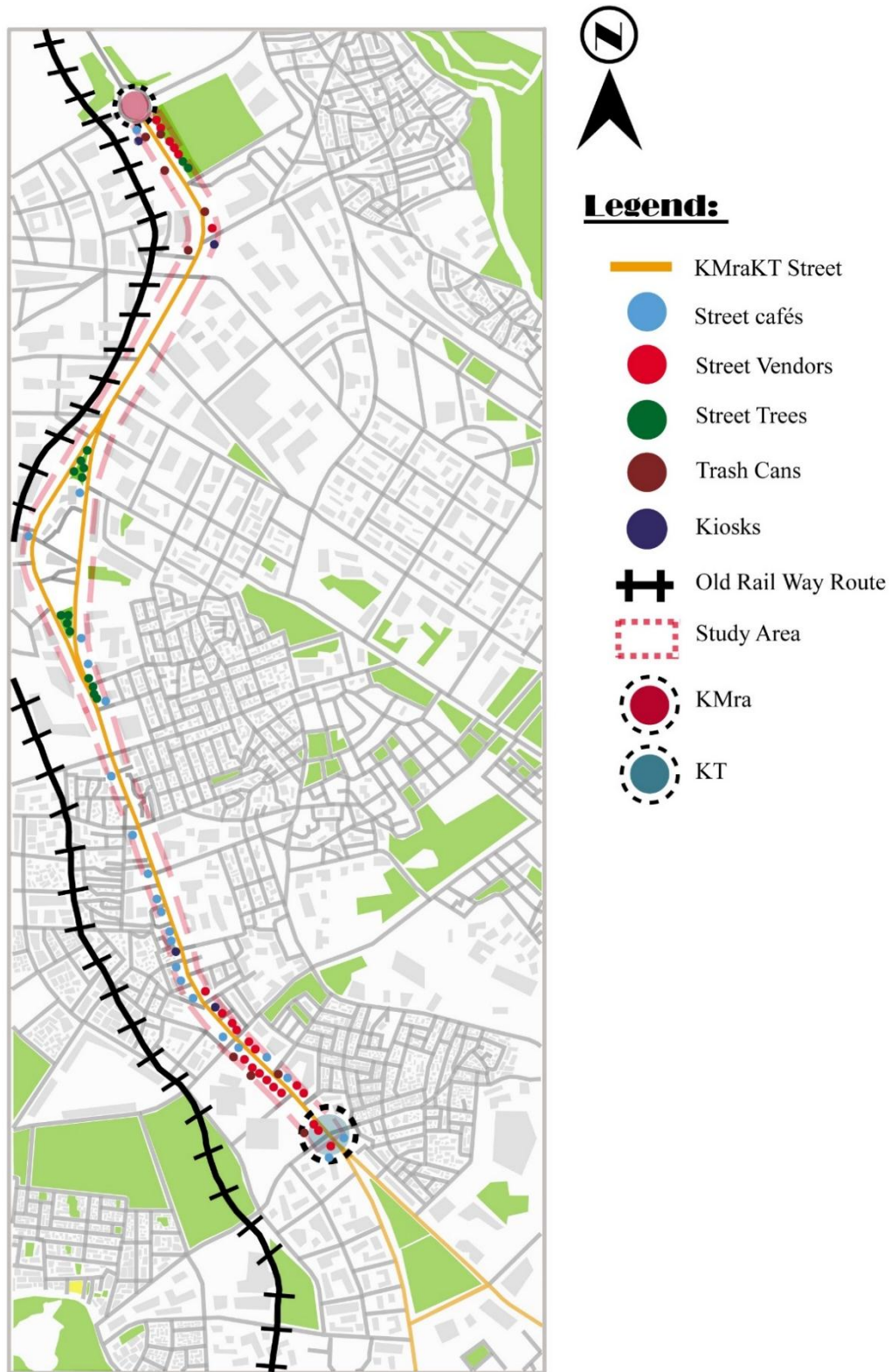


Figure 4.17: Availability of street café, street vendors, street trees, trash cans, and kiosks along the street (Source: Author, 2018)

The traffic accident has claimed to become a source of a high amount of death and high injuries in urban areas which also caused by the characteristics of the streets. Safe streets can be achievable by involving and dedicating a line for all users and by integrating appropriate traffic lights (NACTO, 2012). According to the survey, the number of traffic accidents along the street is increasing time to time. The absence of traffic control devices, pedestrian circulation lane, and pedestrian crossing, and buffer between vehicle traffic and pedestrian lane contributes for increasing traffic accident. A buffer that separates the vehicle traffic and pedestrians, protect pedestrians, bicyclists, and drivers from accidents. Street trees and on-street parking are effective buffers to decrease traffic accidents (Chinmoy, 2015; London, 2017). For example, a conducted study in Toronto indicated that trees and concrete planters occasioned decrease in the number of crashes by five to twenty percent (Chinmoy, 2015; London, 2017).

Street flood during the rainy season is a visible fact that is displayed every season. The absence of stormwater management contributes to this phenomenon. Streets are designed not only to carry traffic but managed stormwater and to be vibrant spaces as well (Urban Runoff Management Plan, 2010). Designing a stormwater strategy for a street is one approach to treat underutilized street and to transform the street into vibrant public spaces (NACTO, 2012). In order to have a complete streetscape, a street should include street lighting, transit shelter, public art, street furniture, kiosk, trash cans, and bikeway and bicycle racks. But in the case of Kaliti Drivers and Mechanics Training Center to Kaliti Total gas station Street, these elements are missing with respected locations which also lead to being incomplete and unpleasant street. Presence of a street tree along a street is very crucial. But along the street, street trees and medians are not considered as the level of high consideration (Fig. 4.17). Street trees create vertical walls framing streets, providing a defined edge, helping motorists guide their movement and assess their speed (David et al., 2011). Vehicles are known for emitting carbon dioxide to the environment. In average number, per 1-liter gas 2.4 kg, carbon dioxide will be produced. This implies that, per 43, 750 L gas 105, 000 CO₂ is produced along the Street per day. But the street is not responsive enough in being environmentally Friendly Street.

The Infrastructure along the street has been surveyed during the research. Clean water line and overhead electric line found in both side of the street (Fig. 4.18)

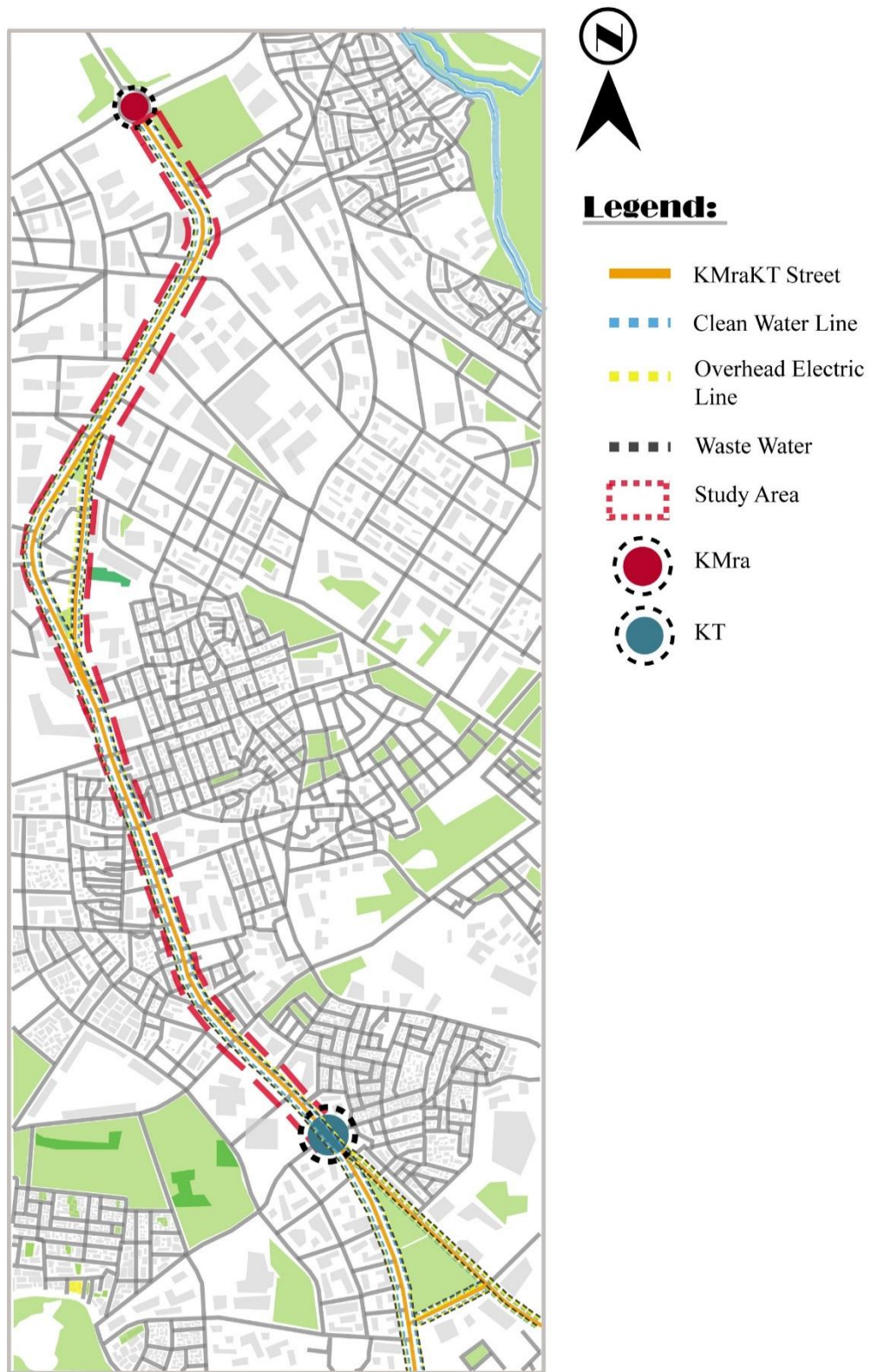


Figure 4.18: Infrastructure along the street (Source: Author, 2018)

The high rates of air and noise pollution, pavement failure, and the uncomfortable situation to drive, walk, sit and bike are encountered problems that are mentioned by respondents along the street. These factors characterized the Street to be unattractive to stay in and enjoy. Most people never go out on the street to walk, jog, sit, and interact with people. These make the community be in very distant location from the street. Multifunctional streets create safe, convenient, and comfortable access for all users, regardless of age, ability, income, or mode of transportation, and prioritize the health, safety, and comfort for the local community (Chinmoy, 2015; London, 2017).

Poor street quality and drivers' behaviors highly claim to be factors for increasing traffic accident in the street. To reduce the traffic accident, when there is a pavement failure which occurs usually, renewing the street and introduction of optional routes have been done. Due to a lack of convenient street lighting, the street is also exposed to criminal activities during the night time. Enhancing visibility and various activities at different times of a day contributes to decreasing criminal activities. Inviting a various group of the community during all times (the concept of "eyes on the street") preserve safety and comfort at streets (Jacobs, 1961). Inconvenient street signage for both pedestrian and vehicle drivers, obstacles in pedestrian ways, and insufficient tree shades for pedestrians have also been mentioned as the Street's drawbacks. The absence of guidelines for the existing street, networked drainage line, and sewer lines are challenges along the street due to the presence of runoff in the rainy season. Integrating green infrastructure system to the street is very essential. This practice helps to restore habitats, to improve water quality and quantity, and to get clean air (Dill, et al., 2010). To create an aesthetically pleasing environment, green infrastructure, while slow treat water, the natural drainage system plays a big role. Such a natural drainage system includes rain gardens and bioswales. The water that collected through green infrastructure can be used for irrigation and infiltration into the ground to recharge groundwater.

In a more well-designed, comfortable, and safe street, the community has a desire to interact and communicate with people at the street. Those respondents who never go out on the street to walk, jog, sit, and interact with people claim the poor street quality which holds them back to not go out, explore, and enjoy the street. The great majority of respondents believe that interact and communicate with people at the street is important for the local community. Also, the people

who don't go out to the street to interact with other people think it is very important for the local community to go out on the street to interact with people, walking, jogging and sitting. Even though people would insist to use a well-designed street to interact and communicate with people as public space, the street is not inviting to stay in and enjoy. Building a better street with multi-functions, bring more people and creates a sense of belongingness (Bain, 2012).

Optional transportation system (co-modal) with additional street amenities; an attractive, complete, and comfortable street to walk and drive; and too rich earlier to their destination is also the devotion of the community. Cars, emergency vehicles, transit, bicycles, and pedestrians should be considered at a time. Multi-modality increase desires for walk and bike offers mobility options for everyone, and, increase property value. Multi-modality also creates a healthy and resilient community (Bain, 2012). The study found out that the street does not take into account the elders, disables, children, pedestrian, cycles, and street business. Multifunctional Streetscape engages the various layer of interest at a place. Streetscapes encourage the community to walk, bike, engage with one another and spend quality time for short moderate distance trips. The convenient street design considers every person regarding age and ability (New Jersey, 2008).

CHAPTER 5: CONCLUSION AND RECOMMENDATION

5.1 Conclusion

As per the specific objective of this study, to identify the potential and better usage of multifunctional streetscapes to become resilient, analyze the major problems in Kality Drivers and Mechanics Training Center to Kality Total gas station Street, and analyze the degree of communication and interaction in between streets and local community streetscapes have been done. To catch various type of perceptions and perspective with diversify experience, the survey incorporates different categories of stakeholders. These stakeholders are categorized in private, public and governmental bodies.

Akaki Kality is one of the 10 sub-cities in Addis Ababa situated in the southern part of the city center. Kality Drivers and Mechanics Training Center to Kality Total gas station Street is located at Akaki Kality Sub city. With rapidly increasing the population number, the Street has less capacity and service to serve the local community. Even though the increment of population has its own factors, infrastructure is very essential to enhance the lifestyle of the community. The provisioning service of the street, which the demand, is not balanced with the need of the community, which the supply. The street serves as a corridor to connect dwellers to the city center and to transport goods. Kality's community is suffering much more in lack of mobility, safety, pleasing environment, proper treatment and enhancement of street. Due to the poor street quality and condition, it takes a longer time than it should take to pass through the street. The infrastructure does not include complete street, integrated drainage and sewer line, and co-modality.

Therefore, the Street mostly focuses on providing spaces for cars only. But streets are an opportunity to increase the number of permeable surfaces to increase infiltration, biodiversity which serve as a green corridor and green belt for an urban ecosystem and help to moderate micro-climate and act as “lung” of the city.

The street behavioral characteristics make the street not to be invited to stay in and enjoy. This causes a distant relationship between the local community and the street. The community has a desire to interact and communicate with people at the street as public space in more well-designed, comfortable, and safe-street with co-modal transportation. Criminal activities,

inconvenient street signage and street guideline for both pedestrian and vehicle drivers, obstacles in pedestrian ways, and insufficient tree shade for pedestrian are also are the street problems.

The overall unavailable neighbourhood characteristics; streetscape elements, pedestrian circulation, parking elements and signage that are found along the street generates identity loss and a corridor which is full of chose.

The street serves a maximum number of 35, 000 cars per day. Each number of cars per day use an average liter of 1.25 gas to pass by the streets corridor. Vehicles are known for emitting carbon dioxide to the environment. In average number, per 1-liter gas 2.4 kg carbon dioxide will be produced. For this reason, streets should be responsive enough to be more environmental friendly as possible (Adam, 2018). This implies that the cars use 43,750 L gas to pass by the street. Therefore, per 43, 750 L gas 105, 000 CO₂ is produced along the Street per day. But the street is not responsive enough in absorbing the emitted gas and in being environmentally Friendly Street. The gas that is emitted from the cars should be filtered along the street.

Even though the street has the opportunities, due to the less attention is given to the infrastructure, the opportunities become a threat of the street. More importantly as a major sub centre, there is a potential to build up a more pleasant, comfortable and safe than the other sub cities for being a linkage corridor to connect, eastern part of Oromia, Dukem, Bishoftu, and Adama, emerging of condominium sites, the new stadium, AASTU University, and the Kilinto industrial sites to the major city centre and other major sub centres.

Therefore, incorporating resilient in streetscape is possible to Kality Drivers and Mechanics Training Center to Kality Total gas station Street context. The Street has the capacity and potential of being resilient to the sub-city as well as for the city of Addis Ababa. Multifunctional Streetscape has significant role in providing ecosystem services for a city. It also creates networked green corridors and ways.

5.2 Recommendation

5.2.1 General Recommendations

According to the research findings, the Street is facing various problems. In order to reduce the problems and challenges, the following recommendation has been suggested.

- When a street is designed, deep analysis and design consideration in creative and contextualized strategies are needed.
- Streets should not be only for cars but it has to include other street users. There should be a dedicated lane for different users. And also street should consider disables.
- Streets should be comfortable, threat-free zones, and safe from criminal activities during at day and night times. In order to achieve these, inviting more people to the streets during day times and suitable lighting system at night time should be fused. Speed bumpers should also be included in the design in order to reduce traffic accidents.
- Street designs should be responsive to the environmental aspects in the design. This could include in terms of usage of environmental friendly materials, introduction of greenery in streets that absorb the emission of CO₂ from vehicles, and in taking care of stormwater during the rainy season. These enhance the micro climate and urban ecosystem.
- Streets could also be an ideal corner to make money. Encouraging street business is very essential for community engagement as well as for economic growth.
- Street parks have to be encouraged and incorporated. This street park services in delivering layered activities helps the street to make it more vibrant s and interactive space. This space will turned into a valuable cultural exchange corner.
- Local community engagement during planning, designing, and implementing process is very essential in order to have a successful program. And also can create a sense of belongingness.
- In order to achieve and implement what is needed, a proper budget should be assigned.

5.2.2 Recommendations for the Sub City Street Management

- Regarding accomplishing proper maintenance and management, there should be a dedicated body that would be responsible for setting standards, strategies, and principles.
- The responsible body should integrate various stakeholders such as local communities and different professionals throughout the design process.

- There should be continuous maintenance and care for landscape features for a better environment. This could include watering and replacing plants with mindful and professional care.

5.2.3 Recommendations for Street Users

- Street users should use the street in responsible and proper ways.
- Street users shall only use the dedicated lane for their functions.
- Street users should keep the street clean.
- Street users should use the provided utilities properly.

5.2.4 Specific Site Recommendations

The design proposal integrates the above recommendations with finding and discussions of the research. The design might not be the only approach to make a streetscape multifunctional and resilient, instead, it could be used as a prototype to existing and newly emerging streets.

In the proposed design, the neighborhood characteristics of the corridor such as historical structures (for instance the old railway) traffic control devices, stormwater infrastructures shall be placed with respected place. Streetscape elements such as street trees, medians, street lighting, transit shelter, kiosk, street furniture, parking lots, bikeway and bicycle racks, and trash cans shall be placed in the respected place. Regarding pedestrian circulation, pedestrian plaza, street café, pedestrian crossing, and traffic calming design shall be incorporated. There should be proper signage for drivers and pedestrians.

Concept: Multi-functionality

Motivation: car-oriented street

To create a street that deliver various functions for all users and responsive for social, environmental, economic, and recreational values.

Most of the respondents are willing to spend some spare time on the street as public space. To fulfill these demand the street will bring opportunities in terms of a pleasing environment that is suitable to walk, sit and, bike. Also, these will enhance the social interaction in between the communities and can create a vibrant public space. This will improve the idea of all eyes on street that helps to reduce street crimes. promoting safety and security is also-considered. Recreational activities like jogging could take place during the early morning period.

Recyclable and solar energy generating materials will be used throughout the corridor. The current street has very less amount of street trees. Street trees with bioswales and rain gardens is used to make the street environmental responsive. These will increase the amount of ground water and reduce amount of carbon dioxide that released from the vehicles.

The street will be responsive to a street business. This will include street shops, cafés, Shoe Shiners, small sport zones (such as Dama, Chase, etc), and book corners.

During the survey, there are some areas that could be changed to a street park. The design will consider this areas and incorporate street parks to the street design. Recreational activities and innovative activates will be incorporated to this park.

Multi-Functionality

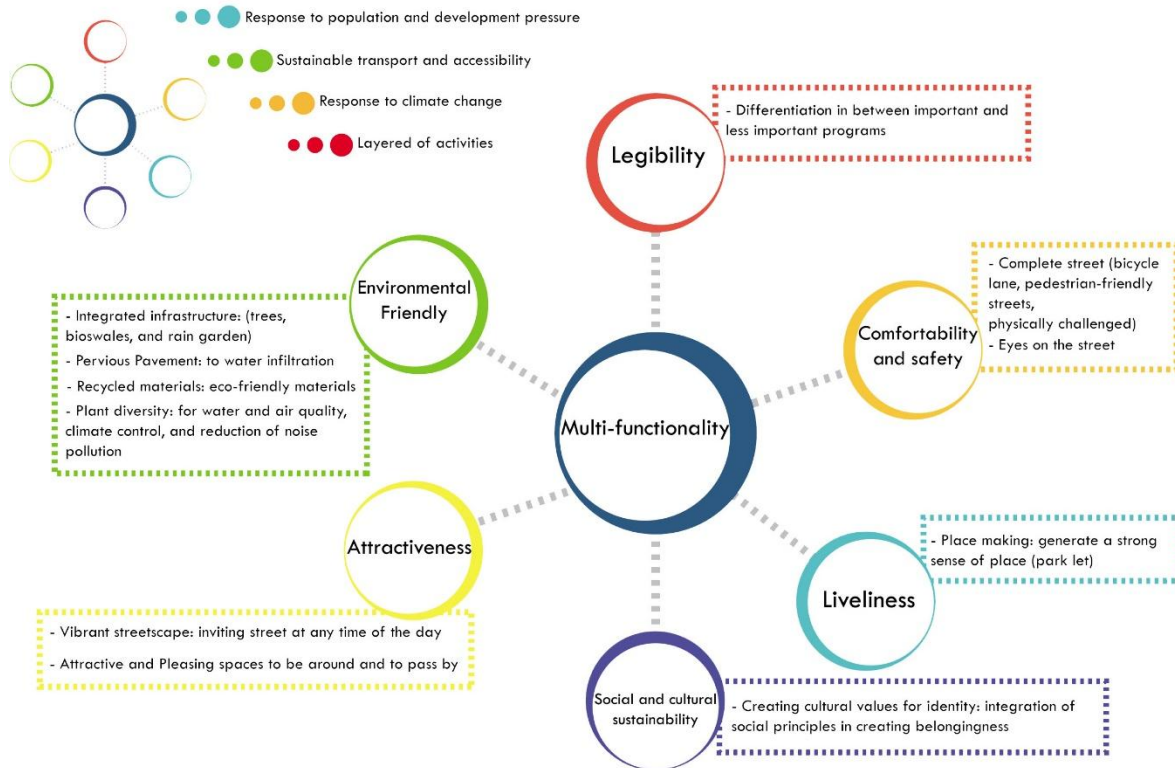


Figure 5.1: Design Concept

Strategies

Environmental Friendly/Connectivity

Integrated infrastructure: Street trees, bioswales, and rain garden



Pervious Pavement: to water infiltration



Recycled materials: eco-friendly materials



Inspired Streetscape

Layered of activities



Social & Cultural Sustainability



Community Spaces

Interaction With People
(Visually & Physically)



Cultural Identity Creation

Comfortability and safety

Encourage Walkability
and Cycling



Responsive to all users

Co-modality



BRT

Economic Development

Street Job Creation



Multi-Functional Streetscape

Programs

Multi-Functional Traffic Lane



Pedestrian Lane



Vehicle Lane



Bicycle Lane



Under the shade: Seating,
Waiting & Walking



Street Market



Street Plaza: Recreation



Street Plaza: Water & air purification

Layered of Activities



Figure 5.2: Design strategies and Programs

Multi-Functional Streetscape

Conceptual Approach

A non-traditional street type which not only car oriented but a multi-functional streetscape that incorporates optional activities for users and safe street, optional traffic lane, street business opportunities, enhancement of walkability, street that can be use as public space, pleasing environment to pass by and environmental friendly materials.

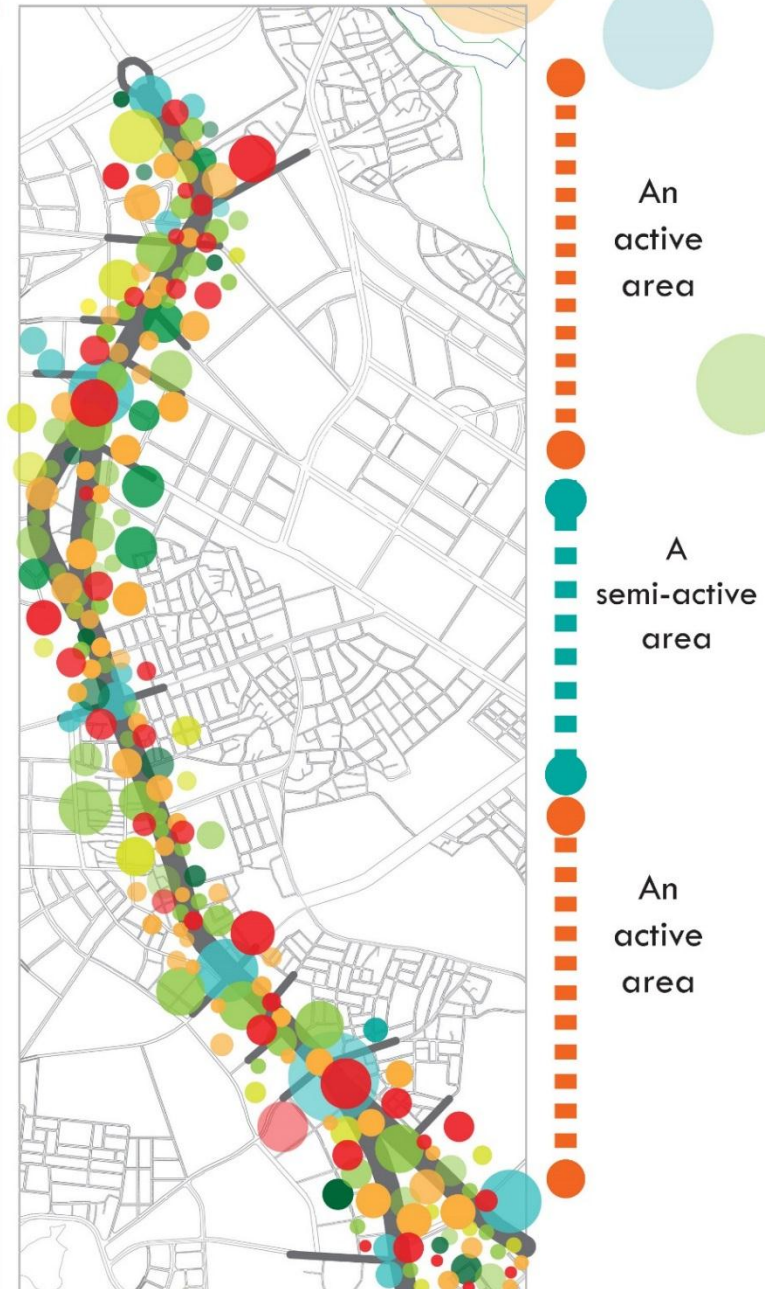


Figure 5.3: Conceptual approach to the site



■
■ From KMra to KT
■ ■ ■ ■ ■ ■ ■ ■ ■
■
■
■
■

Figure 5.4: The Street of Kality Drivers and Mechanics Training Center to Kality Total gas station

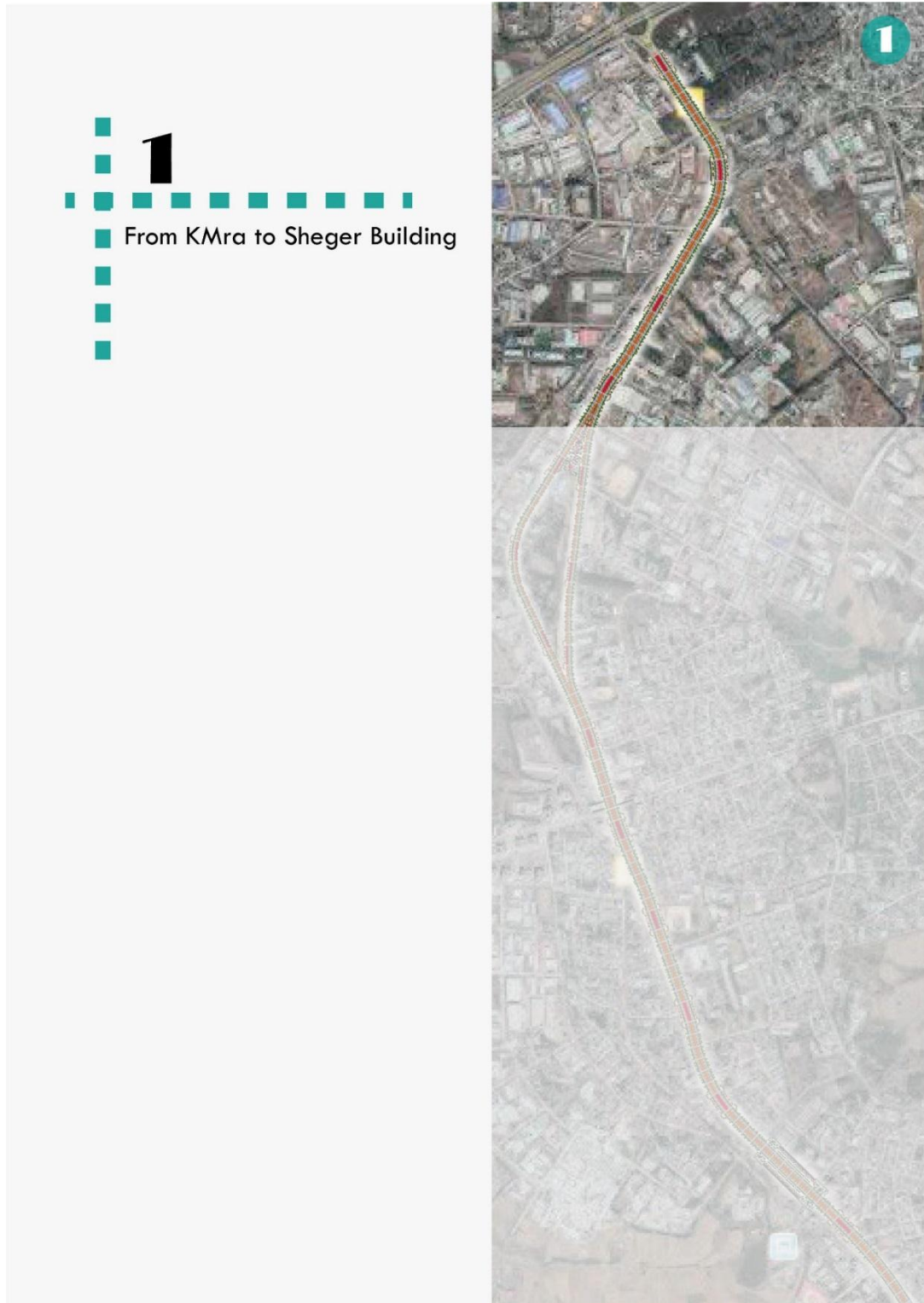


Figure 5.5: The Street from Kality Drivers and Mechanics Training Center to Sheger building
(Portion one)

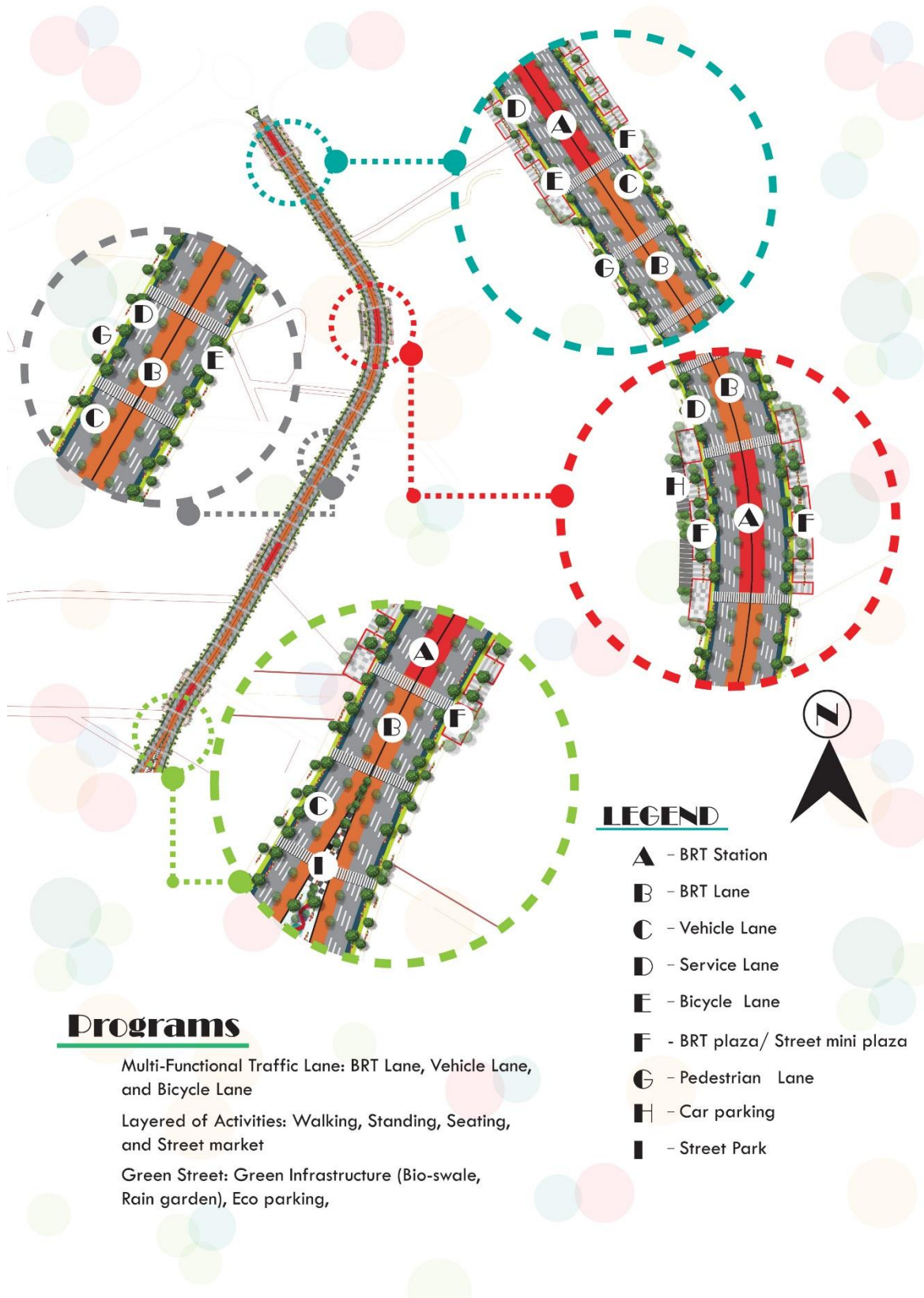


Figure 5.6: Proposed Plan (Portion One)

2

From Sheger Building to Kality
Saint Gebriel Church

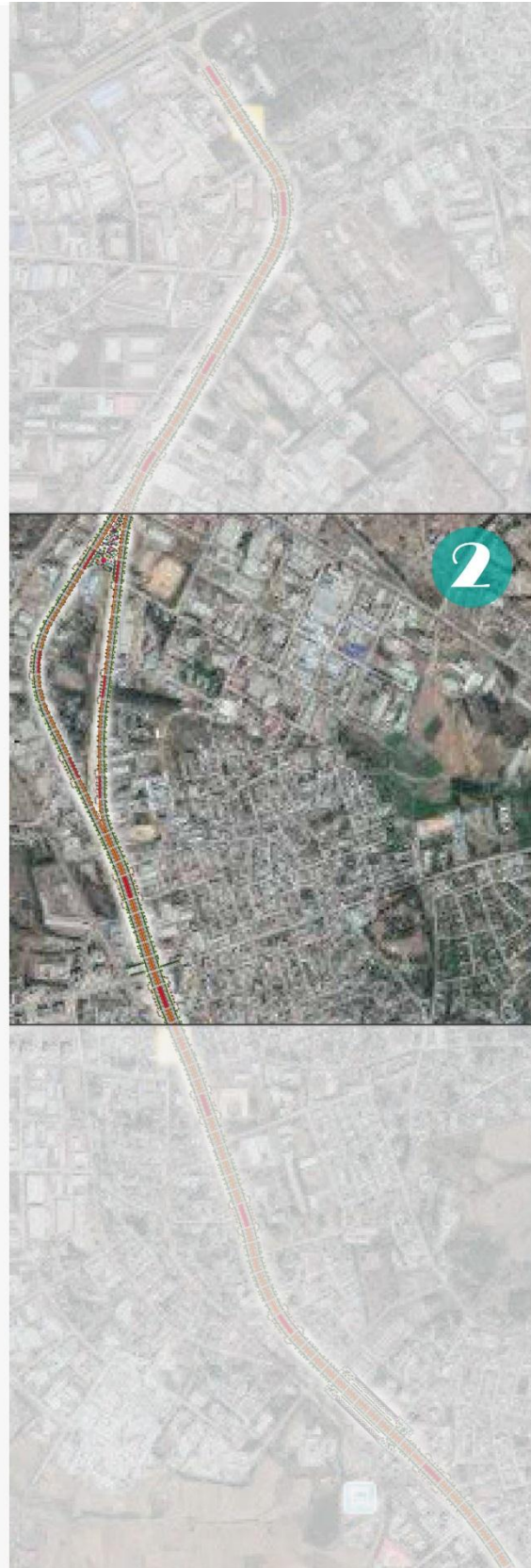


Figure 5.7: The Street from Sheger Building to KKG church (Portion Two)

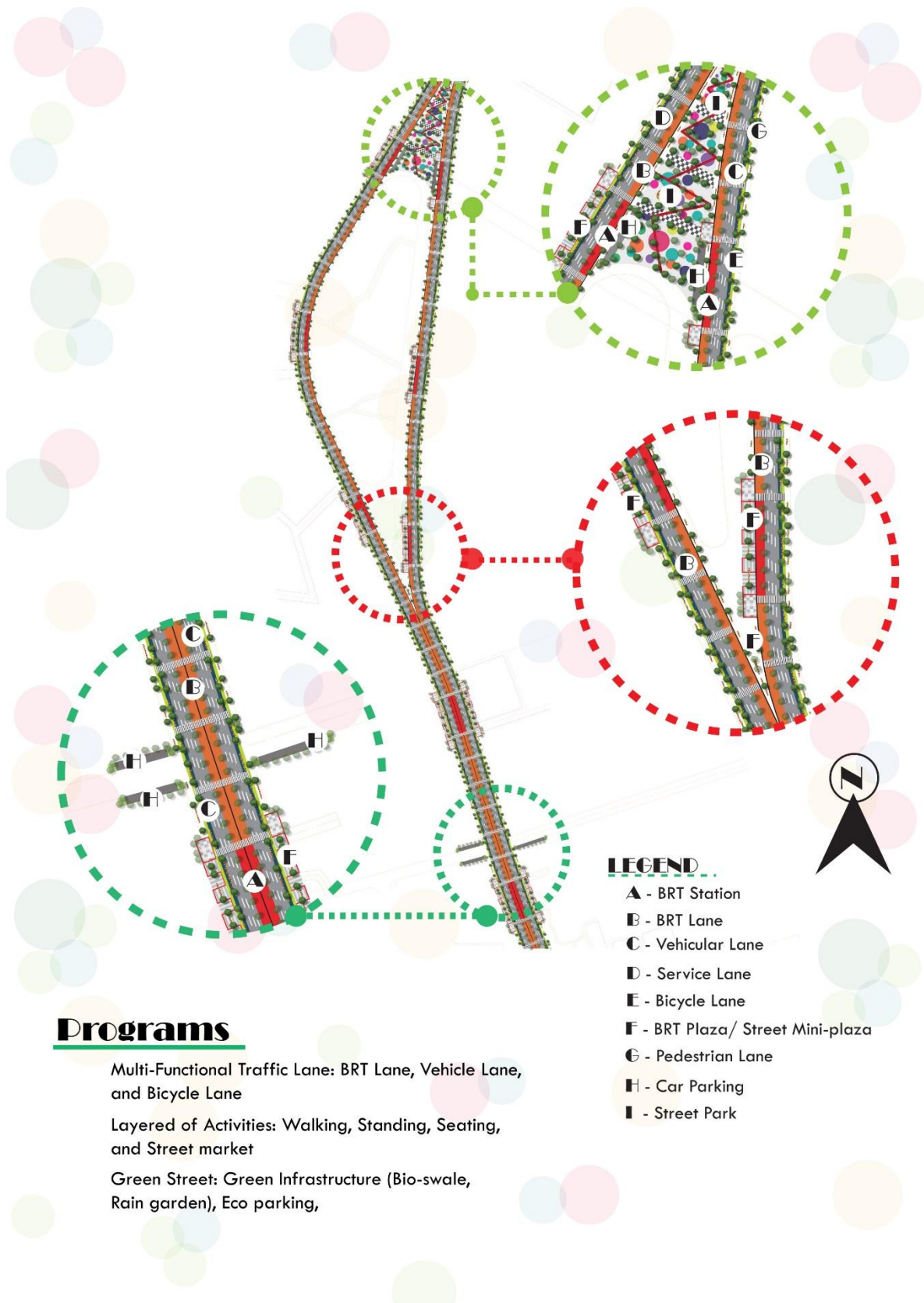


Figure 5.8: Proposed Plan (Portion Two)

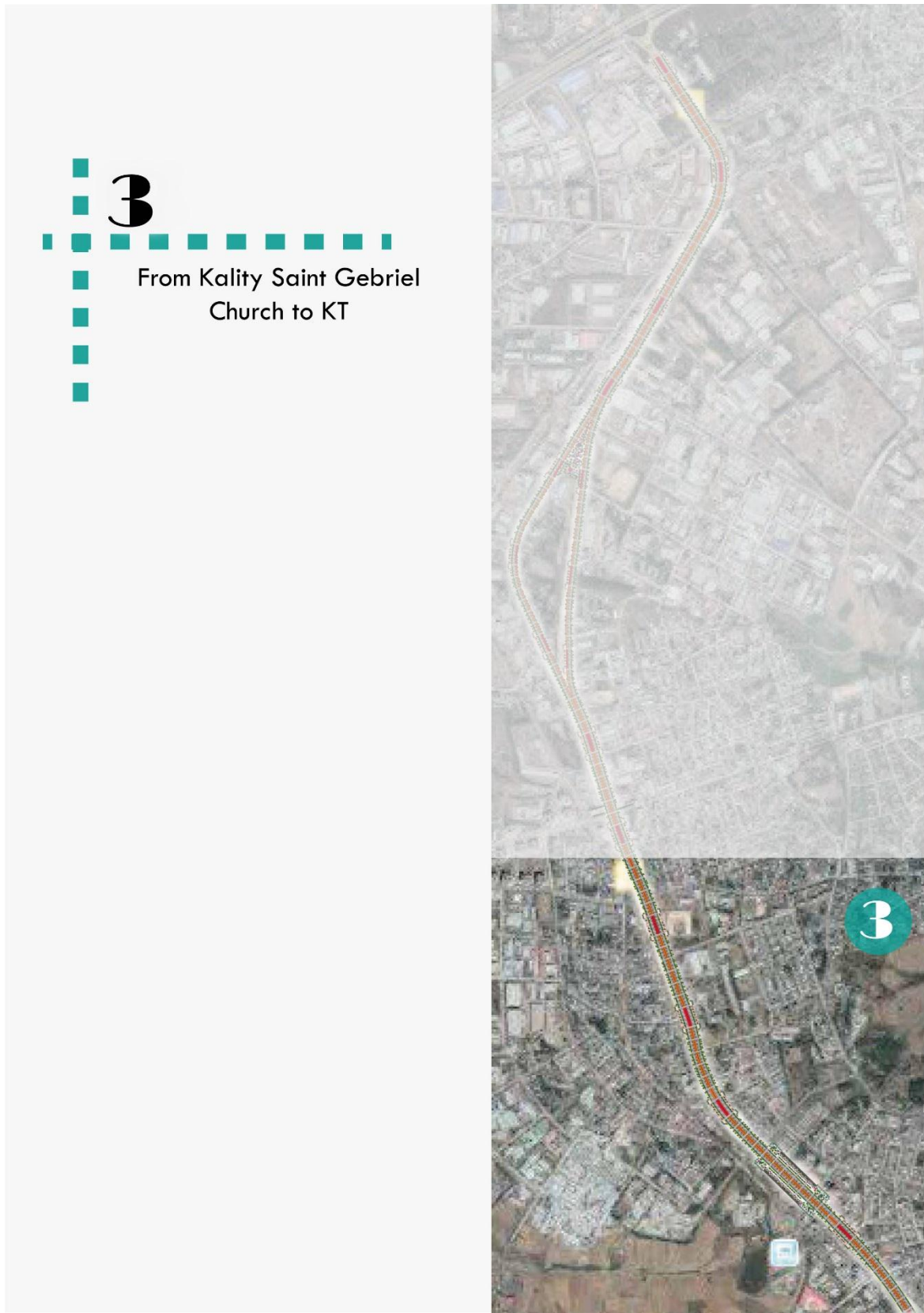


Figure 5.9: The Street from KKG church to KT (Portion Three)

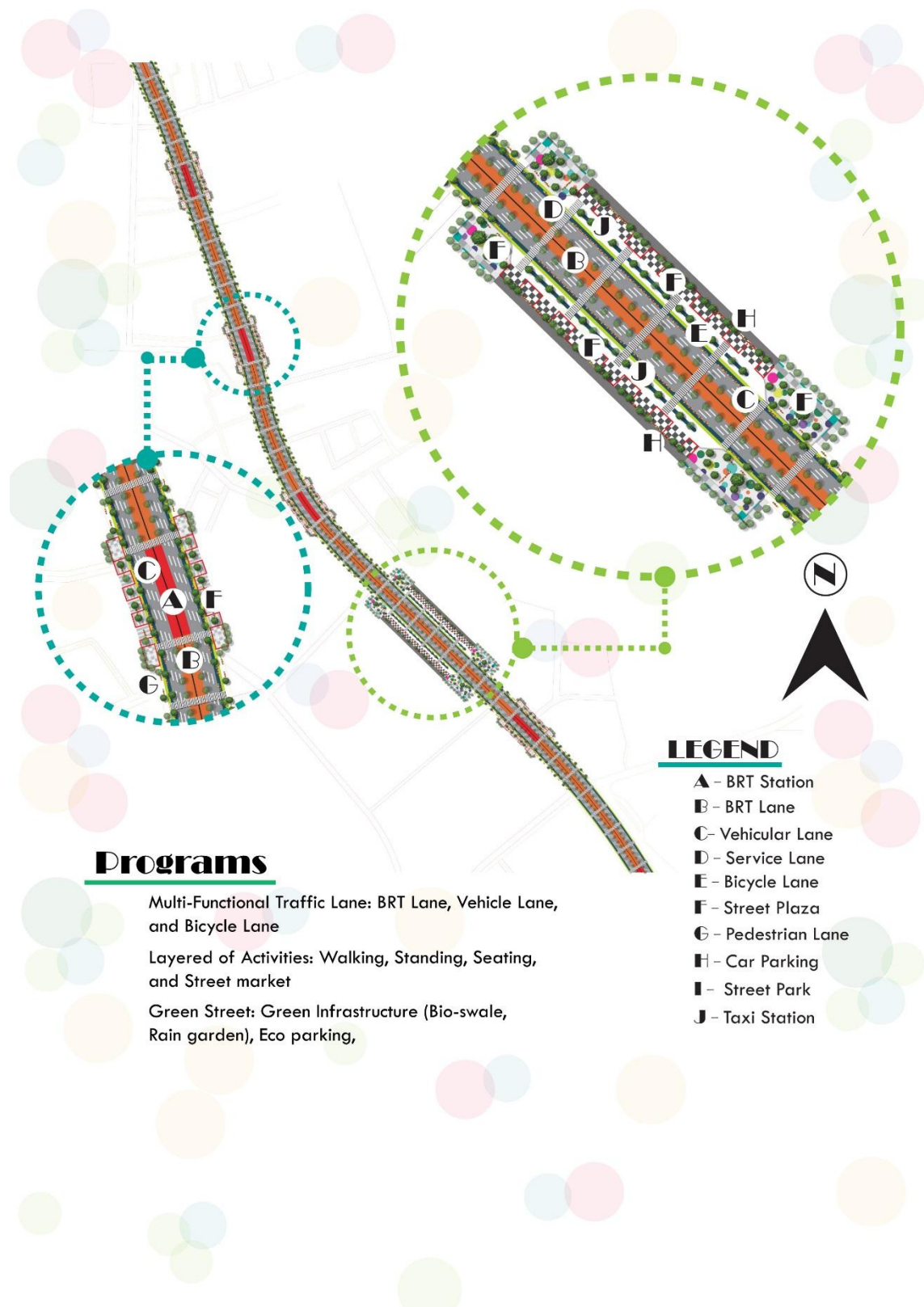


Figure 5.10: Proposed Plan (Portion Three)

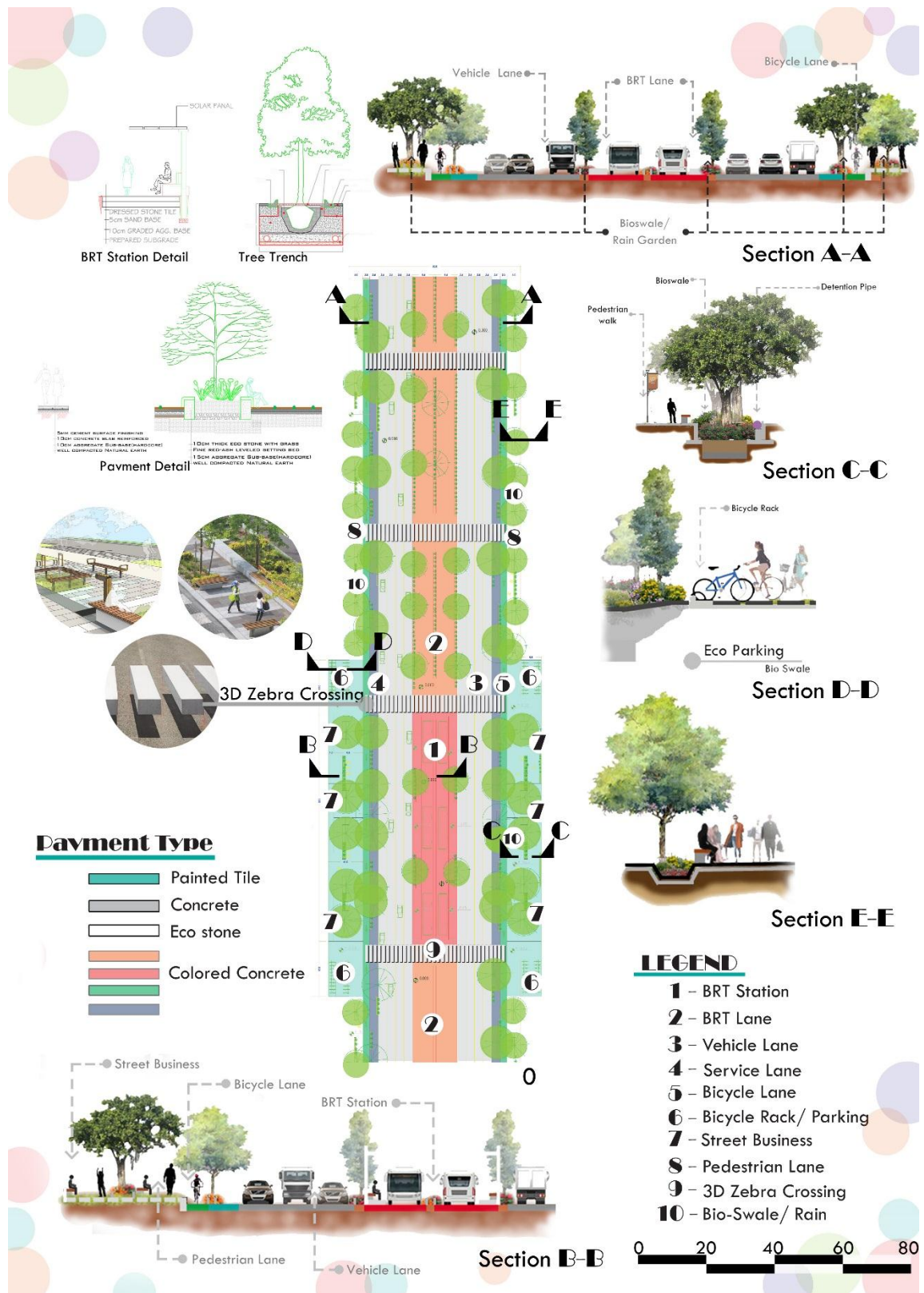


Figure 5.11: Detail Plan and Sections

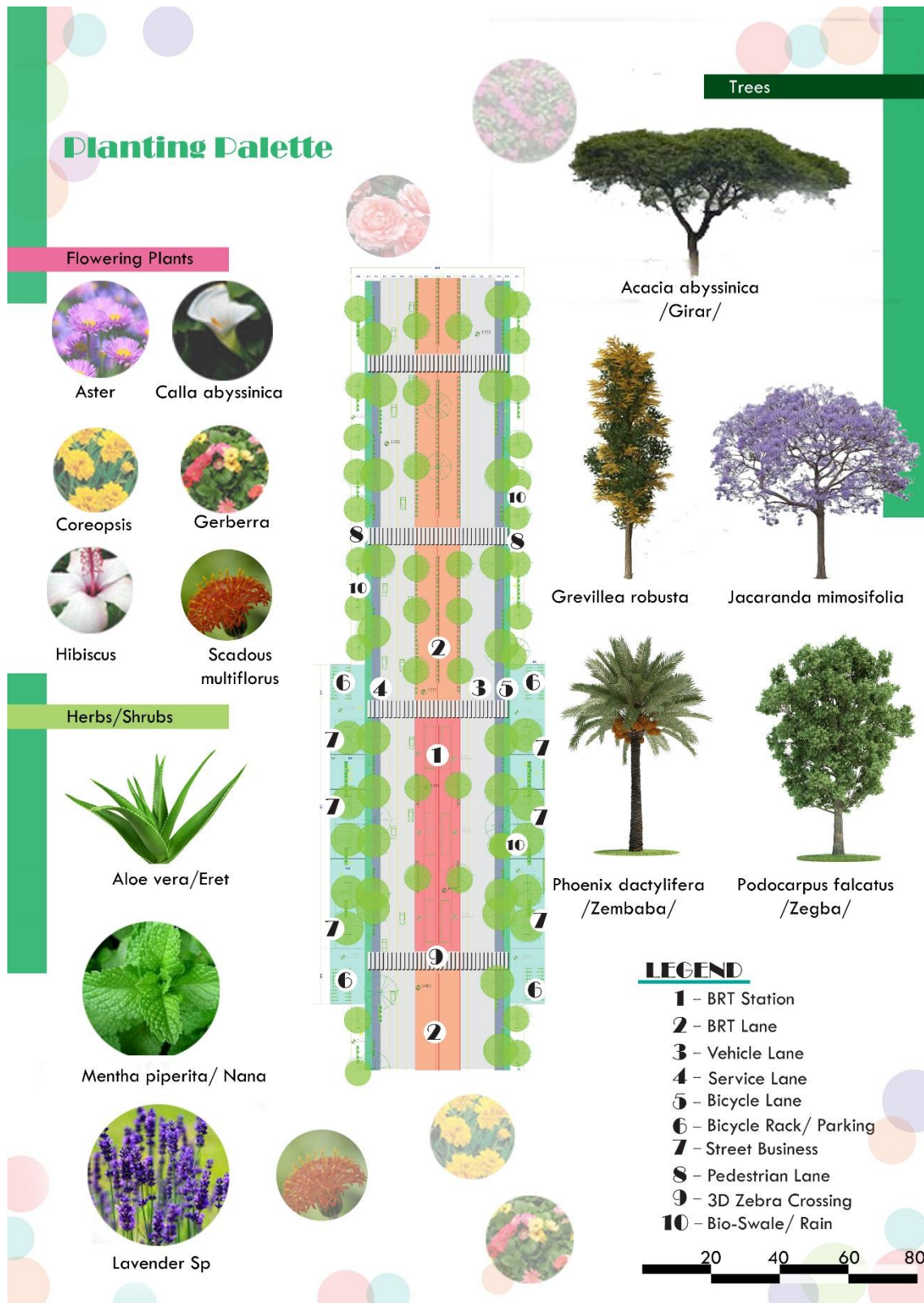


Figure 5.12: Planting Plan

Streetscape Elements



Street Lighting



Speed Bumper/ Breaker

3D Zebra Crossing



Sitting Bench



Shelter



Pervious Pavement



Pervious Pavement



Garbage Bin



Bicycle Rack



Bicycle Rack

Figure 5.13: Suggested Streetscape Elements

Reference

- Adam, S., Cheetham, T., and Howe, T., 2018. 'Global Warming and Your Car.' Accessed on May 20 2018. <<https://www.cartalk.com/content/global-warming-and-your-car-0>>
- Amir, H., Reid, E., Kathy, N., Marnie, P., Arthur, C. N., William, G., 2014. Streetscape Features Related to Pedestrian Activity. Institute for Transportation.
- Ana, E. and Michael, M., 2013. Sustainable Streets and Highways: An Analysis of Green Roads Rating Systems. 2nd ed. Atlanta: Georgia Transportation Institute O. Lamar Allen Sustainable Education Building 788 Atlantic Drive.
- Anna, H. & Nicklas, H., 2015. Final report on inventory and analysis for Green Corridor development. 1st ed. Sweden: Work Package 3 Partners press.
- ASLA (American Society of Landscape Architecture). 2018. 'Sustainable Transport.' Accessed on 3 May 2018. <<https://www.asla.org/sustainabletransportation.aspx>, 2018>
- Cambridge Transport. 'Reducing Congestion and Pollution in Urban Areas'. Accessed on 23 November 2017. <<http://www.smartertransport.uk/smarter-cambridge-transport-urban-congestion-enquiry/>>
- Chinmoy, S, Chris W, Matthew P, Dorothy T, Scott M, Xiaohu Z and Liu J., 2015. Exploring associations between urban green, street design and walking: Results from the Greater London boroughs. China: HK Urban Lab, The University of Hong Kong, Knowles Building, Pokfulam Road, Hong Kong, Hong Kong.
- Christopher, K. and Matthias N., 2011, Better Streets, better cities, A guide to street design in urban India, Institute for Transportation & Development Policy, Environmental Planning Collaborative, India.
- Ciliers, S., 2014. Social Aspect of Urban Biodiversity. Is ted. South Africa: School of Environmental Science and Development North-West University Potchefstroom.
- City of Darebin, 2012. Green Streets Streetscape Strategy, 2012-2020, Australia
- David, J. Ellen G, and Morgan K., 2011. 'Street Design: Part 2 - Sustainable Streets' Accessed on 23 November 2017. <<https://trid.trb.org/view.aspx?id=1102722>>

- Dill, J., Neal, M., Shandas, V., Luhr, G., Adkins, A. & Lund, D., 2010. 'Demonstrating the Benefits of Green Streets for Active Aging: Final Report to EPA.' Accessed on 10 April 2018.
<http://www.epa.gov/agingepa/grants/winners/psu_green_streets_active_aging_report.pdf>
- Dr. Andras. S., 2014. Green Infrastructure in road construction. 1st ed. Georgia: National Infrastructure Development Ltd
- Handan, T., 2014. 'Sustainable Development and Quality of Urban Life.' Journal of Procedia - Social and Behavioral Sciences, 202 (2015): 10 – 14
- Fikreselam. G., 2016. Improving Stormwater Management Capacity of Cobblestone Paved Local Streets through Green Infrastructure Design and Technologies (The Case of Residential District in the Eastern and North Eastern Part of Addis Ababa). 1st ed. Addis Ababa, Ethiopia: Ethiopian Institute of Architecture Building Construction, and City Development.
- George, P., 2016. Green corridors European surface freight logistics and the Super Green project. Laboratory for Maritime Transport. , Denmark: National Technical University of Athens.
- Gunnar. F., 2012. Green Corridor Manual. 1st ed. Trycksaker: NetPort Karlshman.
- H.E Mekuria H., 2015. Ethiopia National Urban Green Infrastructure Standard. Minister for Ministry of Urban Development & Housing, Addis Ababa, Ethiopia.
- Helena, K., Perben T., Michael H., nd Mikkel K.N., 2011. Green Corridor Manual (draft) – Purpose, definition and vision for Green Transport Corridors. Danish: Danish Transport Authority.
- Haifeng, L., Wenbo, C., and Wei, H., 2015. Planning of Green Space Ecological Network in Urban Areas: An Example of Nanchang, China. International Journal of Environmental Research and Public Health, 12, 12889-12904; doi: 10.3390/ijerph121012889, 1640.
- Jacobs, J., 1961. The Death and Life of Great American Cities (p. 598). New York: Random House.
- Jan, G. 2010. Cities for People. London: London Press.

- Janet, L. A., 2003, Streetscape Guideline, For the City of Chicago Streetscape and Urban Design Program, Chicago Department of Transportation Bureau of Bridges and Transit, USA
- Jeanette, D., 2002. An introduction to using native plants in restoration projects, U.S. Environmental Protection Agency.
- Jim, C., 2017. ‘Greenways: an investment which everyone can support’. Accessed on 23 November 2017. <<http://www.smartertransport.uk/greenways-will-help-reduce-congestion/>>
- Katharine, B., 2017. Urban Resilience, Urban Land Institute, Center for Sustainability and Economic Performance.
- Kevin, F., 2014. ‘The 7 Keys to Great Streetscape Design’. Accessed on 23 November 2017. <<http://schneidercorp.com/resources/blog/february-2014/the-7-keys-to-great-streetscape-design/#.WnlXTHyhDc>>
- Leong, K. P, 2011. The Green Corridor, A Proposal to Keep the Railway Lands as a Continuous Green Corridor, Singapore: Nature Society
- Mayor of London., 2017. Streetscape Guidance. 3rd ed. England: Transport for London, Mayor’s Office, London: England.
- Mehmet, E B., E. Erdogan, Z. Dilaver, M., 2010. Greenways and the Urban Form: City of Ankara, Turkey. Arslan Ankara University, Faculty of Agriculture, Department of Landscape Architecture, Diskapi, Ankara, Turkey.
- Michael, A. N., Mayor R C., and Howard N. 2014. City of Philadelphia Green Streets Design Manual. 1st ed. Philadelphia: Mayor’s Office of Transportation and Utilities.
- Mohammadreza, S., Niki Ha., Kourosh P., and Salameh A., 2014. Introducing and Implementation of Pocket Parks in Iranian Parks by Using AHP Model (Case Study: Andisheh Park in Qazvin City, Iran), Iran: Horizon Research Publishing.
- NACTO 2013, Urban Street Design Guide, Island Press, Washington, DC.
- NACTO 2013, Urban Street Design Guide, Island Press, Washington, DC.

- New Jersey Department of Transportation and Pennsylvania., 2008. Smart Transportation Guide Book, Planning and Designing Highways and Streets that Support Sustainable and Livable Communities. New Jersey: Department of Transportation.
- Pazwash, H., 2011. Urban Storm Water Management. New York: CRC, Taylor & Francis Group.
- San Francisco., 2011. Better Streets. Chapter 4.0, Approach: Designing Great Streetscapes. San Francisco.
- Peter, S. Mark Z. and Karst, G., 2013. 'Liveable streets in Hanoi: A principal component analysis.' Journal of Elsevier Science 0197-3975.2015.07.001
- Sarah, J. T., and Sara, A. G., 2016. Department of Geography and Earth Sciences, University of North Carolina at Charlotte, 9201 University City Blvd., Charlotte, USA.
- Sarel, C., 2014. Social Aspect of Urban Biodiversity. 1st ed. South Africa: School of Environmental Science and Development North-West University Potchefstroom.
- The city of Lancaster a city Authentic., 2011. Green Infrastructure Plan. Lancaster: Transportation Institute.
- The city of Taiwanese., 2005. Streetscape Design Guidelines. 1nd ed. The city of Taiwanese: Housing, City Planning and Environmental Management Department City Planning Division – Streetscape Management Section.
- UNEP., 2003. 'Groundwater Vulnerability Mapping of the Addis Ababa Water Supply Aquifers Scientific Report. Addis Ababa, Ethiopia.' Accessed on 10 April 2018. <<http://www.unep.org/dewa/water/groundwater/English/GWhmEng/Country%20Profiles/Ethiopia/AddisAbaba-Report.pdf> .>.
- United Nations, 2008. Achieving Sustainable Development and Promoting Development Cooperation: Department of Economic and Social Affairs Office for ECOSOC Support and Coordination, Dialogues at the Economic and Social Council. New York: United Nations Press.
- University of Washington., 2014. Green Roads. USA: Minnesota Pavement Conference.

- Urban Runoff Management Plan., 2010. A Guide to Stormwater Management in the City of Aspen. Aspen. Accessed on 11 April 2015<<http://www.aspenpitkin.com/>>.
- Waveney Open Space Needs Assessment., 2015. Green Corridors. 1st ed. Waveney Planning and Policy Office.
- Woods-Ballard, B., Kellagher, R., Martin, P., Jefferies, C., Bray, R. & Shaffer, P., 2007. The SUDS Manual, London: CIRIA.
- Wubshet, A. Tewodros, A. Znegnaw, W. Yihalem, A. and Mulugeta, F., 2017. Identification of Accident Prone Locations and Possible Counter Measures. Ethiopia: Debre Berhan University.

BIBLIOGRAPHY

- AACRA. (2015) Addis Ababa City Road Authority Yearly Book, Addis Ababa: Apple Printing Press.
- Adam, S., Cheetham, T., and Howe, T., 2018. 'Global Warming and Your Car.' Accessed on May 20 2018. <<https://www.cartalk.com/content/global-warming-and-your-car-0>>
- Algirdas, Š., 2013. A Partnership for Sustainable Transport Solutions: The Green Corridor, East West Transport Corridor II. Institute for Transportation.
- Amir, H., Reid, E., Kathy, N., Marnie, P., Arthur, C. N., William, G., 2014. Streetscape Features Related to Pedestrian Activity. Institute for Transportation.
- Ana, E. and Michael, M., 2013. Sustainable Streets and Highways: An Analysis of Green Roads Rating Systems. 2nd ed. Atlanta: Georgia Transportation Institute O. Lamar Allen Sustainable Education Building 788 Atlantic Drive.
- Anna, H. & Nicklas, H., 2015. Final report on inventory and analysis for Green Corridor development. 1st ed. Sweden: Work Package 3 Partners press.
- Appleyard, D., Gerson, M. S., & Lintell, M., 1981. Livable Streets (p. 364). Berkeley: University of California Press.
- ASLA, (American Society of Landscape Architecture). 2018. 'Sustainable Transport.' Accessed on 3 May 2018. <<https://www.asla.org/sustainabletransportation.aspx>, 2018>
- Biddulph, M. (2012). Radical Streets: The impact of innovative street design on livability and activity in residential areas. *Urban Design International*, 17(3), 178–205.
- Borst, H., Miedema, H., Devries, S., Graham, J., & van Dongen, J., 2008. Relationships between street characteristics and perceived attractiveness for walking reported by elderly people. *Journal of Environmental Psychology*, 28(4), 353–361. doi:10.1016/j.jenvp.2008.02.010
- Cambridge Transport. 'Reducing Congestion and Pollution in Urban Areas'. Accessed on 23 November 2017. <<http://www.smartertransport.uk/smarter-cambridge-transport-urban-congestion-enquiry/>>

- Cammie, F., 2016. Streetscape Study of Lower Manhattan An Analysis of the Sidewalk Features and Public Space of Manhattan Community District 1. 2nd ed. Manhattan: FCNY Community Planning Fellow.
- Campoli, J., 2012. Made for Walking: Density and Neighborhood Form. (L. I. of L.Policy, Ed.) (p. 176). Cambridge.
- Cervero, R., & Radisch, C. (1996). Travel choices in pedestrian versus automobile oriented neighborhoods. *Transport Policy*, 3(3), 127–141.
- Chester, W H., 2014. Measuring Streetscape Design for Livability Using Spatial Data and Methods. 1st ed. Vermont: The Faculty of the Graduate College of the University of Vermont.
- Chinmoy, S, Chris W, Matthew, P, Dorothy, T, Scott M, Xiaohu, Z and Liu, J., 2015. Exploring associations between urban green, street design and walking: Results from the Greater London boroughs. China: HK Urban Lab, The University of Hong Kong, Knowles Building, Pokfulam Road, Hong Kong, Hong Kong.
- Christopher, K. and Matthias, N., 2011, Better Streets, better cities, A guide to street design in urban India, Institute for Transportation & Development Policy, Environmental Planning Collaborative, India.
- City of Darebin, 2012. Green Streets Streetscape Strategy, 2012-2020, Australia
- Dan, B., 2006. Urban Street Trees, 22 Benefits Specific Applications. Glatting Jackson, Walkable Communities, Inc.
- David, J. Ellen, G, and Morgan, K., 2011. ‘Street Design: Part 2 - Sustainable Streets’ Accessed on 23 November 2017. <<https://trid.trb.org/view.aspx?id=1102722>>
- Dill, J., Neal, M., Shandas, V., Luhr, G., Adkins, A. & Lund, D., 2010. ‘Demonstrating the Benefits of Green Streets for Active Aging: Final Report to EPA.’ Accessed on 10 April 2018.
<http://www.epa.gov/agingepa/grants/winners/psu_green_streets_active_aging_report.pdf>

- Dr. Andras. S., 2014. Green Infrastructure in road construction. 1st ed. Georgia: National Infrastructure Development Ltd.
- Dover, V., & Massengale, J. (2013). *Street Design: The Secret to Great Cities and Towns* (p. 448). Hoboken, NJ: Wiley.
- Ewing, R. and Cervero, R. 2010. Travel and the Built Environment—A Meta-Analysis, *Journal of the American Planning Association*, 76(3), 265-294.
- Ewing, R., Handy, S., Brownson, R. C., Clemente, O., & Winston, E. (2006). Identifying and Measuring Urban Design Qualities Related to Walkability. *Journal of Physical Activity and Health*, 3(1S), S223–S240.
- Fikreselam. G., 2016. Improving Stormwater Management Capacity of Cobblestone Paved Local Streets through Green Infrastructure Design and Technologies (The Case of Residential District in the Eastern and North Eastern Part of Addis Ababa). 1st ed. Addis Ababa, Ethiopia: Ethiopian Institute of Architecture Building Construction, and City Development.
- Fasten, R., Rina C., and Howard, N., 2014. City of Philadelphia Green Street Design Manual. 1st ed. Philadelphia; Mayor's Office of Transportation and Utilities, Philadelphia
- George, P., 2016. Green corridors European surface freight logistics and the Super Green project. Laboratory for Maritime Transport. , Denmark: National Technical University of Athens.
- Georgia Transportation Institute., 2012. Sustainable Streets and Highways: An Analysis of Green Roads Rating Systems. 1st ed. Georgia: O. Lamar Allen Sustainable Education Building 788 Atlantic Drive, Atlanta, GA 30332-0355 P: 404-894-2236 F: 404-894-2278.
- Gunnar. F., 2012. Green Corridor Manual. 1st ed. Trycksaker: NetPort Karlshman.
- H.E Mekuria H., 2015. Ethiopia National Urban Green Infrastructure Standard. Minister for Ministry of Urban Development & Housing, Addis Ababa, Ethiopia.
- Handan T., 2014. 'Sustainable Development and Quality of Urban Life.' *Journal of Procedia - Social and Behavioral Sciences*, 202 (2015): 10 – 14

- Haifeng, L., Wenbo, C., and Wei, H., 2015. Planning of Green Space Ecological Network in Urban Areas: An Example of Nanchang, China. *International Journal of Environmental Research and Public Health*, 12, 12889-12904; doi: 10.3390/ijerph121012889, 1640.
- Helena, K., Perben T., Michael, H., and Mikkel K.N., 2011. Green Corridor Manual (draft) – Purpose, definition and vision for Green Transport Corridors. Danish: Danish Transport Authority.
- Jacobs, J. (1961). *The Death and Life of Great American Cities* (p. 598). New York: Random House.
- Jan, G. 2010. *fCities for People*. London: London Press.
- Janet L. A., 2003, *Streetscape Guideline*, For the City of Chicago Streetscape and Urban Design Program, Chicago Department of Transportation Bureau of Bridges and Transit, USA
- Jeanette, D., 2002. *An introduction to using native plants in restoration projects*, U.S. Environmental Protection Agency.
- Jeralee, L. A., 2015. *Introduction to Green roads*. India: Institute for Transportation & Development Policy press.
- Jim C., 2017. ‘Greenways: an investment which everyone can support’. Accessed on 23 November 2017. <<http://www.smartertransport.uk/greenways-will-help-reduce-congestion/>>
- Jung, A L., Jinhyung, C., and Changwoo, A., 2014. Planning Landscape Corridors in Ecological Infrastructure Using Least-Cost Path Methods Based on the Value of Ecosystem Services. *Journal of Sustainability*. 6, 7564-7585; doi: 10.3390/su6117564, 1050.
- Kandyce, P., 2017. *Green and Complete Streets: The Power of Green Infrastructure in Street Design*. 1st ed. New Jersey. Future 16 W. Lafayette St. Trenton, NJ 08608 609-393-0008.
- Katharine, B., 2017. *Urban Resilience*, Urban Land Institute, Center for Sustainability and Economic Performance.

- Kevin F., 2014. 'The 7 Keys to Great Streetscape Design'. Accessed on 23 November 2017. <<http://schneidercorp.com/resources/blog/february-2014/the-7-keys-to-great-streetscape-design/#.WnlXTHyhDc>>
- Leong, K. P, 2011. The Green Corridor, A Proposal to Keep the Railway Lands as a Continuous Green Corridor, Singapore: Nature Society
- Lipton, J., and Annie S., 2011. Conceptual Design for a Green Corridor. 1st ed. Philadelphia: 1216 Arch Street, Philadelphia, PA 19107.
- Matthews, J. W., & Turnbull, G. K. (2007). Neighborhood Street Layout and Property Value: The Interaction of Accessibility and Land Use Mix. The Journal of Real Estate Finance and Economics, 35(2), 111–141. doi:10.1007/s11146-007-9035-9
- Mayor of London., 2017. Streetscape Guidance. 3rd ed. England: Transport for London, Mayor's Office, London: England.
- M. E. Baris, E., Erdogan, Z., Dilaver, M. A. 2010. Greenways and the Urban Form: City of Ankara, Turkey. Journal of Biotechnology. DOI: 10.2478/v10133-010-0022-6, 1657.
- Mehmet E B., E. Erdogan, Z. Dilaver, M., 2010. Greenways and the Urban Form: City of Ankara, Turkey. Arslan Ankara University, Faculty of Agriculture, Department of Landscape Architecture, Diskapi, Ankara, Turkey.
- Michael A. N., Mayor R C., and Howard N. 2014. City of Philadelphia Green Streets Design Manual. 1st ed. Philadelphia: Greenways and the Urban Form: City of Ankara, Turkey.
- Mohammadreza S., Niki Ha., Kourosh P., and Salameh A., 2014. Introducing and Implementation of Pocket Parks in Iranian Parks by Using AHP Model (Case Study: Andisheh Park in Qazvin City, Iran), Iran: Horizon Research Publishing.
- NACTO., 2013, Urban Street Design Guide. 1st ed. Island Press, Washington, DC.
- NACTO., 2013, Urban Street Design Guide. 2nd ed. Island Press, Washington, DC.
- National Association of City Transportation Officials. (2013). Urban Street Design Guide (p. 192). Washington, D.C.: Island Press.

- New Jersey Department of Transportation and Pennsylvania., 2008. Smart Transportation Guide Book, Planning and Designing Highways and Streets that Support Sustainable and Livable Communities. New Jersey: Department of Transportation.
- Pandit, A., Minné, E., Li F, Brown, H., Jeong, H., James, J., Newell J., Weissburg, M., Chang M., Xu, M., Yang, P., Wang, R., Thomas, V., Yu, X., Lu, Z., and Crittenden, J., Infrastructure Ecology: An Evolving Paradigm for Sustainable Urban Development, *Journal of Cleaner Production* (2015), doi: 10.1016/j.jclepro.2015.09.010.
- Park, S. (2008). Defining, Measuring, and Evaluating Path Walkability, and Testing Its Impacts on Transit Users' Mode Choice and Walking Distance to the Station. University of California, Berkeley.
- Pazwash, H., 2011. Urban Storm Water Management. New York: CRC, Taylor & Francis Group.
- San Francisco., 2011. Better Streets. Chapter 4.0, Approach: Designing Great Streetscapes. San Francisco.
- Peter, S. Mark Z. and Karst G., 2013 'Livable streets in Hanoi: A principal component analysis.' *Journal of Elsevier Science* 0197-3975.2015.07.001
- Purciel, M.L., Neckerman, K.M., Lovasi, G.S., Quinn, J.W., Weiss, C., Ewing, R., & Rundle, A. 2009. Creating and Validating GIS Measures of Urban Design for Health Research. *Journal of Environmental Psychology*, 29(4), 457-466.
- Reid, E., Amir, H., Kathy, N., Marnie, P., Arthur, C N., and William, G. 2014. Streetscape Features Related to Pedestrian Activity. 1st ed. New York: College of Architecture + Planning, 220 AAC University of Utah.
- Sarah, J. T., and Sara A. G., 2016. Department of Geography and Earth Sciences, University of North Carolina at Charlotte, 9201 University City Blvd., Charlotte, USA.
- Stead, D., & Marshall, S. 2001. The relationships between urban form and travel patterns. An international review and evaluation. *European Journal of Transport and Infrastructure Research*, 1(2), 113-141.

- The city of Lancaster a city Authentic., 2011. Green Infrastructure Plan. Lancaster: Transportation Institute.
- The city of Taiwanese., 2005. Streetscape Design Guidelines 1nd ed. The city of Taiwanese: Housing, City Planning and Environmental Management Department City Planning Division – Streetscape Management Section.
- The Conway School., 2014. Green Streets Guidebook. 1st ed. Massachusetts: The City of Holyoke, Massachusetts.
- Troy, A., & Grove, J. M. (2008). Property values, parks, and crime: A hedonic analysis in Baltimore, MD. *Landscape and Urban Planning*, 87(3), 233–245. doi:doi:10.1016/j.landurbplan.2008.06.005
- UNEP., 2003. ‘Groundwater Vulnerability Mapping of the Addis Ababa Water Supply Aquifers Scientific Report. Addis Ababa, Ethiopia.’ Accessed on 10 April 2018. <<http://www.unep.org/dewa/water/groundwater/English/GWhmEng/Country%20Profiles/Ethiopia/AddisAbaba-Report.pdf> .>.
- United Nations, 2008. Achieving Sustainable Development and Promoting Development Cooperation: Department of Economic and Social Affairs Office for ECOSOC Support and Coordination, Dialogues at the Economic and Social Council. New York: United Nations Press.
- University of Washington., 2014. Green Roads. USA: Minnesota Pavement Conference.
- Urban Runoff Management Plan., 2010. A Guide to Stormwater Management in the City of Aspen. Aspen. Accessed on 11 April 2015<<http://www.aspenpitkin.com/>>.
- Waveney Open Space Needs Assessment., 2015. Green Corridors. 1st ed. Waveney Planning and Policy Office.
- Woods-Ballard, B., Kellagher, R., Martin, P., Jefferies, C., Bray, R. & Shaffer, P., 2007. *The SUDS Manual*, London: CIRIA.
- Wubshet, A. Tewodros, A. Znegnaw, W. Yihalem, A. and Mulugeta, F., 2017. Identification of Accident Prone Locations and Possible Counter Measures. Ethiopia: Debre Berhan University.

APPENDICES

Appendix 1: Questionnaires

For Drivers

ለአሽከርካሪዎች

የእዚህ መጠይቅ ዋና ዓላማ ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል አሁን ያለውን የመንገድ ሁኔታ ከአካባቢው ማህበረሰብ ሀሳብ ለማሰባሰብ እና ለወደፊቱ በዚህ መንገድ ላይ ምን እንደሚፈልግ ማየት ነው። በዚህ በጣም አስፈላጊ የዳሰሳ ጥናት ለመሳተፍ በመስማማትዎ እመሰግናለሁ። ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ ላይ አስተያየቶዎን ለማግኘት 4-5 ደቂቃዎችን እወስዳለሁ። ሁሉም መልሶችዎ በሚስጢር ይጠበቃሉ።

የመላሽ መረጃ

፩. ዕድሜ

☐ ከ20 በታች

☐ ከ21 እስከ 35

☐ ከ36 እስከ 50

☐ ከ51 እስከ 65

☐ 66 እና በላይ

፪. ፆታ

☐ ወንድ

☐ ሴት

፫. የጋብቻ ሁኔታ

☐ ያገባ

☐ የተፋታ

☐ ያላገባ

☐ መበለት

መጠይቅ

1. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ ላይ በሚያልፉበት ጊዜ በአማካይ ምን ያህል ጊዜዎን ያሳልፋሉ?

☐ 5-10 ደቂቃ

☐ 20-30 ደቂቃ

☐ 11-20 ደቂቃ

☐ ከ30 ደቂቃ በላይ

2. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ ላይ የታዘቡት አምስት ከባድ ችግሮች የትኞቹ ናቸው?

☐ የመንገድ መጨናነቅ

☐ ከፍተኛ የመኪኖች ቁጥር

☐ የመኪና አደጋ

☐ ጠባብ የመኪና መንገድ

☐ ጠባብ የእግረኛ መሄጃ መስመር

☐ ደካማ የመንገድ ጥራት

☐ የእግረኛ መንገድ እጥረት

3. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ ላይ ያሉ ባህርያት (የአስፋልት መጠን፣ ቅርፅ እና አቀማመጥ) እየተከናወኑ ላሉት ድርጊቶች አመቺ ናቸው ብለው ያስባሉ?

☐ አዎ

☐ አይደለም

4. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ያለው ጎዳና ለመንዳት፣ ለመራመድ፣ ለመቀመጥ እና ቢስክሌት ለመንዳት አመቺ ነው ብለው ያስባሉ?

☐ አዎ

☐ አይደለም

5. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ ላይ የአየር ብክለት መጠንን እንዴት ይገመግሙታል?

☐ በጣም ንጹህ

☐ በጣም የተበከለ

☐ ንጹህ

☐ የተበከለ

6. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ ላይ የድምፅ ብክለት መጠንን እንዴት ይገመግሙታል?

☐ በጣም ንጹህ

☐ በጣም የተበከለ

☐ ንጹህ

☐ የተበከለ

7. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ ላይ የአስፋልት ንጣፉ በምን ሁኔታ ላይ ይገኛል?

☐ በጣም ጥሩ

☐ ጥሩ

☐ መጥፎ

☐ በጣም መጥፎ

8. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ በምሽት ተገቢ የአቅራቢያ መብራት አለ?

☐ አለ

☐ የለም

9. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ አግባብ ባለው ቦታ ላይ ተገቢ ምልክት አለ?

☐ አለ

☐ የለም

10. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ ላይ በእግረኞች መንገድ ላይ እንቅፋቶች አሉ?

☐ አለ

☐ የለም

• የእርስዎ መልስ አዎ ከሆነ እባክዎ መሰናክልዎች ያብራሩ

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11. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ ላይ በቂ የዛፍ ጥላ አለ?

☐ አለ

☐ የለም

12. ከሌሎች ሰዎች ጋር በመንገድ ላይ መገናኘት ለህብረተሰቡ ምን ያህል ጠቃሚ ነው ብለው ያስባሉ?

☐ በጣም አስፈላጊ

☐ አስፈላጊ

☐ አላስፈላጊ

13. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ ላይ እንዲቆዩ እና እንዲደሰቱ ይጋብዣል?

☐ አዎ

☐ አይ

14. እርስዎ ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው ጎዳና ላይ ከሌሎች ሰዎች ጋር መገናኘት እና መዝናናት ያዘወትራሉ?

☐ አዎ

☐ አይ

15. አማራጭ (ኮምፓክት) የትራንስፖርት ሲስተም ወደ ቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ጎዳና ላይ ማዋሃድ ምን ያህል አስፈላጊ ነው ብለው ያስባሉ? (ፈጣን የአውቶቡስ ትራንስፖርት፣ ቀላል የባቡር ትራንስፖርት፣ ብስክሌት መሄጃ መስመር፣ የእግረኛ መንገድ፣ ወዘተ)

☐ በጣም አስፈላጊ

☐ አስፈላጊ

☐ አላስፈላጊ

16. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል መንገድ ላይ ተጨማሪ የጎዳና አገልግሎቶች እና የፍጆታ ቁሳቁሶች ያስፈልገዋል ብለው ያስባሉ? (የእግረኛ እና የመኪና ምልክቶችን፣ የመንገድ ንጣፎችን፣ የእግረኛ መሄጃ መስመር፣ የመኪና ማቆሚያ፣ ወዘተ)

☐ አዎ

☐ አይ

17. በአብዛኛው የትራፊክ አደጋን በቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል መንገድ ላይ የሚያስከትሉት ምክንያቶች ምንድናቸው?

☐ ደካማ የመንገድ ጥራት

☐ ከፍተኛ የመኪናዎች ቁጥር

☐ የእግረኞች ባህሪ

☐ የአሽከርካሪዎችን ባህሪ

18. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ጎዳና ምን ምን ብቃቶች እንዳሉ ያስባሉ?

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19. እንደ ህዝብ አገልግሎት ሰጪ እርስዎ ማየት የሚፈልጉት ሶስት (3) ማሻሻያዎች ምንድናቸው?

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For Passengers

ለተሳፋሪዎች

የእዚህ መጠይቅ ዋና ዓላማ ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል አሁን ያለውን የመንገድ ሁኔታ ከአካባቢው ማህበረሰብ ሀሳብ ለማሰባሰብ እና ለወደፊቱ በዚህ መንገድ ላይ ምን እንደሚፈልግ ማየት ነው። በዚህ በጣም አስፈላጊ የዳሰሳ ጥናት ለመሳተፍ በመስማማትዎ እመሰግናለሁ። ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ ላይ አስተያየቶዎን ለማግኘት 4-5 ደቂቃዎችን እወስዳለሁ። ሁሉም መልሶችዎ በሚስጢር ይጠበቃሉ።

የመላሽ መረጃ

፩. ዕድሜ

☐ ከ20 በታች

☐ ከ21 እስከ 35

☐ ከ36 እስከ 50

☐ ከ51 እስከ 65

☐ 66 እና በላይ

፪. ፆታ

☐ ወንድ

☐ ሴት

፫. የጋብቻ ሁኔታ

☐ ያገባ

☐ የተፋታ

☐ ያላገባ

☐ መበለት

መጠይቅ

1. ዛሬ እዚህ አካባቢ በምን ምክንያት ተገኙ?

☐ በስራ ምክንያት

☐ ለግብይት

☐ እዚህ ስለሚኖር

☐ ለትምህርት

☐ ለጉብኝት

2. እባክዎን ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ያለውን የመንገድ ጥራት ደረጃ ይጥቀሱ?

☐ በጣም ጥሩ

☐ መጠነኛ

☐ ጥሩ

☐ ደካማ

3. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ ላይ የታዘቡት አምስት ከባድ ችግሮች የትኞቹ ናቸው?

☐ የመንገድ መጨናነቅ

☐ ከፍተኛ የመኪኖች ቁጥር

☐ የመኪና

አደጋ

☐ ጠባብ የመኪና መንገድ

☐ ጠባብ የእግረኛ መሄጃ መስመር

☐ የእግረኛ መንገድ እጥረት

☐ ደካማ የመንገድ ጥራት

4. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ ላይ የአየር ብክለት መጠንን እንዴት ይገመግሙታል?

☐ በጣም ንጹህ
☐ ንጹህ

☐ በጣም የተበከለ
☐ የተበከለ

5. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለዉ መንገድ ላይ የድምፅ ብክለት መጠንን እንዴት ይገመግሙታል?

☐ በጣም ንጹህ
☐ ንጹህ

☐ በጣም የተበከለ
☐ የተበከለ

6. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ያለዉ ጎዳና ለመንዳት፣ ለመራመድ፣ ለመቀመጥ እና ቢስክሌት ለመንዳት አመቺ ነው ብለው ያስባሉ?

☐ አይ

☐ አይደለም

7. ከሌሎች ሰዎች ጋር በመንገድ ላይ መገናኘት ለህብረተሰቡ ምን ያህል ጠቃሚ ነው ብለው ያስባሉ?

☐ በጣም አስፈላጊ

☐ አስፈላጊ

☐ አላስፈላጊ

8. እርስዎ ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለዉ ጎዳና ላይ ከሌሎች ሰዎች ጋር መገናኘት እና መዝናናት ያዘወትራሉ?

☐ አይ

☐ አይ

9. አማራጭ (ኮምፓክት) የትራንስፖርት ሲስተም ወደ ቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ጎዳና ላይ ማዋሃድ ምን ያህል አስፈላጊ ነው ብለው ያስባሉ? (ፈጣን የአውቶቡስ ትራንስፖርት፣ ቀላል የባቡር ትራንስፖርት፣ ብስክሌት መሄጃ መስመር፣ የእግረኛ መንገድ፣ ወዘተ)

☐ በጣም አስፈላጊ

☐ አስፈላጊ

☐ አላስፈላጊ

10. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል መንገድ ላይ ተጨማሪ የጎዳና አግልግሎቶች እና የፍጆታ ቁሳቁሶች ያስፈልገዋል ብለው ያስባሉ? (የእግረኛ እና የመኪና ምልክቶችን፣ የመንገድ ንጣፎችን፣ የእግረኛ መሄጃ መስመር፣ የመኪና ማቆሚያ፣ ወዘተ)

☐ አይ

☐ አይ

11. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ጎዳና ላይ የሚከተሉት ታሳቢ ተደርገዋል?

☐ ሽማግሌዎችን

☐ እግረኛ

☐ አካል ጉዳተኞች

☐ ብስክሌተኞች

☐ ህፃናት

☐ የጎዳና ላይ ንግድ

12. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ጎዳና ከወንጀል ድርጊቶች የጸዳ ነውን?

☐ አይ

☐ አይደለም

• የእርስዎ መልስ አይደለም ከሆነ እባክዎ ለምን እንደሆነ ያብራሩ

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13. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ጎዳና ምን ምን ብቃቶች እንዳሉ ያስባሉ?

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14. እንደ ተሳፋሪ እርስዎ ማየት የሚፈልጉት ሶስት (3) ማሻሻያዎች ምንድናቸው?

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For Pedestrian

ለእግረኛ

የእዚህ መጠይቅ ዋና ዓላማ ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል አሁን ያለውን የመንገድ ሁኔታ ከአካባቢው ማህበረሰብ ሀሳብ ለማሰባሰብ እና ለወደፊቱ በዚህ መንገድ ላይ ምን እንደሚፈልግ ማየት ነው። በዚህ በጣም አስፈላጊ የዳሰሳ ጥናት ለመሳተፍ በመስማማትዎ እመሰግናለሁ። ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ ላይ አስተያየቶዎን ለማግኘት 4-5 ደቂቃዎችን እወስዳለሁ። ሁሉም መልሶችዎ በሚስጢር ይጠበቃሉ።

የመላሽ መረጃ

፩. ዕድሜ

☐ ከ20 በታች

☐ ከ21 እስከ 35

☐ ከ36 እስከ 50

☐ ከ51 እስከ 65

☐ 66 እና በላይ

፪. ፆታ

☐ ወንድ

☐ ሴት

፫. የጋብቻ ሁኔታ

☐ ያገባ

☐ የተፋታ

☐ ያላገባ

☐ መበለት

መጠይቅ

1. ዛሬ እዚህ አካባቢ በምን ምክንያት ተገኙ?

☐ በስራ ምክንያት

☐ ለግብይት

☐ እዚህ ስለሚኖር

☐ ለትምህርት

☐ ለጉብኝት

2. እባክዎን ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ያለውን የመንገድ ጥራት ደረጃ ይጥቀሱ?

☐ በጣም ጥሩ

☐ መጠነኛ

☐ ጥሩ

☐ ደካማ

3. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ ላይ የታዘቡት አምስት ከባድ ችግሮች የትኞቹ ናቸው?

☐ የመንገድ መጨናነቅ

☐ ከፍተኛ የመኪኖች ቁጥር

☐ የመኪና

አደጋ

☐ ጠባብ የመኪና መንገድ

☐ ጠባብ የእግረኛ መሄጃ መስመር

☐ የእግረኛ መንገድ እጥረት

☐ ደካማ የመንገድ ጥራት

4. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ ላይ የአየር ብክለት መጠንን እንዴት ይገመግሙታል?
- ☐ በጣም ንጹህ ☐ በጣም የተበከለ
- ☐ ንጹህ ☐ የተበከለ
5. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ ላይ የድምፅ ብክለት መጠንን እንዴት ይገመግሙታል?
- ☐ በጣም ንጹህ ☐ በጣም የተበከለ
- ☐ ንጹህ ☐ የተበከለ
6. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ያለው መንገድ በቀን እና በማታ በእግር ለመንሸራሸር አመቺ ነው ብለው ያስባሉ?
- ☐ አዎ ☐ አይደለም
7. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ ላይ እንዲቆዩ እና እንዲደሰቱ ይጋብዣል?
- ☐ አዎ ☐ አይ
8. እርስዎ ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው ጎዳና ላይ ከሌሎች ሰዎች ጋር መገናኘት እና መዝናናት ያዘወትራሉ?
- ☐ አዎ ☐ አይ
9. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ ላይ ምን ያህል ጊዜዎትን ከሰዎች ጋር ለመዝናናት፣ በእግርዎ ለመንሸራሸር፣ ስፖርታዊ እንቅስቃሴዎችን ለማድረግ እና አረፍ ለማለት ያሳልፋሉ?
- ☐ በቀን በቀን ☐ በሳምንት ሁለት ቀን ☐ አሳልፌ አላወቅም
- ☐ 3-5 ቀናት ☐ በሁለት ሳምንት አንዴ
10. አማራጭ (ኮምፓክት) የትራንስፖርት ሲስተም ወደ ቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ጎዳና ላይ ማዋሃድ ምን ያህል አስፈላጊ ነው ብለው ያስባሉ? (ፈጣን የአውቶቡስ ትራንስፖርት፣ ቀላል የባቡር ትራንስፖርት፣ ብስክሌት መሄጃ መስመር፣ የእግረኛ መንገድ፣ ወዘተ)
- ☐ በጣም አስፈላጊ ☐ አስፈላጊ ☐ አላስፈላጊ
11. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል መንገድ ላይ ተጨማሪ የጎዳና አግልግሎቶች እና የፍጆታ ቁሳቁሶች ያስፈልገዋል ብለው ያስባሉ? (የእግረኛ እና የመኪና ምልክቶችን፣ የመንገድ ንጣፎችን፣ የእግረኛ መሄጃ መስመር፣ የመኪና ማቆሚያ፣ ወዘተ)
- ☐ አዎ ☐ አይ
12. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ ላይ በቂ የዛፍ ጥላ አለ?
- ☐ አለ ☐ የለም
13. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ በምሽት ተገቢ የአቅራቢያ መብራት አለ?
- ☐ አለ ☐ የለም
14. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለው መንገድ አግባብ ባለው ቦታ ላይ ተገቢ ምልክት አለ?

☐ አለ

☐ የለም

15. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ባለዉ መንገድ ላይ በእግረኞች መንገድ ላይ እንቅፋቶች አሉ?

☐ አለ

☐ የለም

• የእርስዎ መልስ አዎ ከሆነ እባክዎ መሰናክልዎች ያብራሩ

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16. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ጎዳና ላይ የሚከተሉት ታሳቢ ተደርገዋል?

☐ ሽማግሌዎችን

☐ እግረኛ

☐ አካል ጉዳተኞች

☐ ብስክሌቶች

☐ ህፃናት

☐ የጎዳና ላይ ንግድ

17. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ጎዳና ከወንጀል ድርጊቶች የጸዳ ነውን?

☐ አዎ

☐ አይደለም

• የእርስዎ መልስ አይደለም ከሆነ እባክዎ ለምን እንደሆነ ያብራሩ

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18. ከቃሊቲ ማሰልጠኛ እስከ ቃሊቲ ቶታል ጎዳና ምን ምን ብቃቶች እንዳሉ ያስባሉ?

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19. እንደ እግረኛ እርስዎ ማየት የሚፈልጉት ሶስት (3) ማሻሻያዎች ምንድናቸው?

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Appendix 2: Number of Vehicles per Day

ተ.ቁ	የተሽከርካሪው ዓይነት	የተሽከርካሪ ብዛት					
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
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17							
18							
19							
20							
21							
22							

23							
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Appendix 3: Number of Passengers per Day

ተ.ቁ	የተሽከርካሪው ዓይነት	የተሳፋሪ ብዛት					
1							
2							
3							
4							
5							
6							
7							
8							
9							
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11							
12							
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22							
23							