

**EXAMINING THE OPERATIONS OF BICYCLE TRANSPORT IN A TURBULENT
URBAN TRANSPORT SYSTEM: A CASE STUDY OF NGONG ROAD, CITY
COUNTY OF NAIROBI.**

Paul Njoroge Ndungu

B63/69881/2011

BSc. Surveying (Hons) Nbi

**A Research Project Submitted in Partial fulfillment for the Requirements of the Degree
of Master of Arts in Planning**

Department of Urban and Regional Planning

University of Nairobi

July, 2016

DECLARATION

This Research Project is my original work and has not been presented for a degree in any other University.

Name: Paul Njoroge Ndungu

Registration No. B63/69881/2011

Signature..... Date:

(Candidate)

This Research Project has been submitted for examination with my approval as University supervisor.

Name: Dr. Samuel Obiero

Signature: Date:

(1st Supervisor)

Name: Dr. Silas Muketha

Signature: Date:

(2nd Supervisor)

DEDICATION

This project is dedicated to my fellow Kenyan urban dwellers who spend much time in traffic snarl ups, those who trek long distances to and from work places and those bicyclists who risk their lives competing for space with motor vehicles for lack of safe and secluded tracks to ride on.

ACKNOWLEDGEMENT

My first acknowledgement goes to the Almighty God for giving me insight, strength and hope throughout this project, and provided the resources that I needed.

I also extend my honest gratitude to my supervisors Dr. Samuel Obiero and Dr. Silas Muketha who offered the much needed guidance throughout the study period and ensured that my research measured up to the standard. Special gratitude to Dr. Opiyo Romanus and the contribution of all teaching of the University of Nairobi, Department of Urban and Regional Planning for their dedication and encouragement to see me complete my study.

I am indebted to my fellow classmates for being dependable companions as we sojourned all through. Thank you for the spirit of brotherhood. Appreciation also goes to my research assistants; Peter Naibei, Stanley Ndurah and Dennis Wakaba for their help in data collection and keying in.

My studies could not have been completed without the support of my wife Beth and our two daughters Hadassah and Shiphrah for their understanding that I had to be late for home as I pursued the training and that often I had to enclose myself in the study room. You understood that I could not always personally be available to assist in your homework.

I shall forever be indebted to you all for your kind assistance. Only God who has provided all the resources I needed to undergo the training can reward you satisfactorily.

ABSTRACT

Non-Motorized Transport (NMT) is a dominant mode of transport in many African Cities. In the City County of Nairobi, the mode account for almost 50% of all trips made. The NMT mode faces a number of challenges, largely due to the secondary consideration given to the mode by policy makers and administrators. The mode is not well integrated in the transport system of the City. Ngong Road, a standard carriageway with two traffic lanes, passes through the study area and links the city of Nairobi with Ngong Town. There is inharmonious interaction between motor vehicles and cyclists along this road where cyclists are seen as nuisance and intruders of space meant for the motor transport (MT).

The objectives of the study were to establish the role of bicycle transport in the urban transport system within the area of study, to investigate the status of cyclists' infrastructure on road designs along Ngong Road, to examine the challenges /constraints of bicycle transport and to propose plausible cyclists' related planning interventions to properly integrate bicycle mode in urban transport system along Ngong Road.

The study employed descriptive survey to examine the operations of bicycle transport along Ngong Road. Convenient sampling method was used when interviewing cyclists. Cluster sampling method was used to capture data from the households. An observation survey was also carried out to come up with the transportation modal split (traffic counts) along this road.

The study revealed bicycle as a convenient, affordable, fast and flexible means of transport for short distances. Despite its desirable characteristics most city residents have avoided it since it is prone to accidents due to lack of dedicated bicycle tracks and associated infrastructure and services along Ngong Road.

The study concluded that the bicycle has a role to play in the study area but there lacks the infrastructure to support bicycle mode. As such there are many challenges that face this mode which are attributed to lack of secluded bicycle tracks system along Ngong Road.

The research recommended effective planning for NMT transport through provision of adequate funds to support cycling infrastructure, develop supportive NMT legal (policy) and institutional framework, promoting good governance and prioritizing integration of NMT with MT. With the NCC NMT policy of 2015, it's envisaged that mobility environment will be facilitated where all transport modes will be of equal importance.

TABLE OF CONTENTS

DECLARATION.....	i
DEDICATION.....	ii
ACKNOWLEDGEMENT.....	iii
ABSTRACT.....	iv
TABLE OF CONTENTS	v
LIST OF FIGURES	ix
LIST OF PLATES	ix
LIST OF TABLES	ix
LIST OF CHARTS	x
LIST OF MAPS.....	x
LIST OF ACRONYMS	xi
CHAPTER ONE	1
INTRODUCTION.....	1
1.1 Background	1
1.2 Statement of the Problem	2
1.3 Purpose of Study	3
1.4 Research Questions	3
1.5 Specific Objectives of the Study	3
1.6 Assumptions of the Study	3
1.7 Justification of the study	4
1.8 Scope of the Study Area.....	5
1.9 Methodological Scope.....	5
1.10 Definition of Key Terms	5
CHAPTER TWO	7
LITERATURE REVIEW	7
2.1 Overview	7
2.2 Concept of NMT	7
2.2.1 NMT User Requirements.....	7
2.3Historical development of NMT in Kenya.....	8
2.4Bicycling as a means of Urban Mobility.....	9

2.4.1 Role and Benefits of Bicycle as a means of NMT	10
2.4.2 Challenges facing Cycling as a Mode of Transport.	12
2.5 Cycling Opportunities as a Mode of Transport.....	15
2.6 Policy, Legal and Institutional Framework for NMT in Kenya.....	16
2.6.1 Policy Framework.....	17
2.6.2 Legal Framework.....	18
2.6.3 Institutional Framework	19
2.7 Bicycle Infrastructure Planning and Design.....	21
2.8 Case studies	25
2.8.1 Singapore	25
2.8.2 San Pablo Avenue District, West Berkeley- California	28
2.8.3 Historical overview of cycling in The Netherlands	30
2.9 Conceptual Framework	32
CHAPTER THREE.....	35
RESEARCH METHODOLOGY	35
3.1 Overview	35
3.2 Research Design.....	35
3.3 Target Population and Sampling Plan.....	37
3.3.1 Sampling Design.....	37
3.4 Data Needs and Sources	38
3.4.1 Primary Data.....	38
3.4.2 Secondary Data.....	38
3.5 Data Collection Methods.....	39
3.5.1 Secondary data.....	39
3.5.2 Primary data.....	39
3.6 Data Analysis and Presentation.....	40
3.7 Limitations of the Study	41
CHAPTER FOUR.....	43

BACKGROUND OF THE STUDY AREA	43
4.1 Overview	43
4.2 Historical Development of Nairobi	43
4.2.1 Colonial Era	43
4.2.2 Post Colonial Nairobi	43
4.3 Location Context of the Project Study Area	44
4.4 Project Area Physiographic Conditions	46
4.4.1 Topography	46
4.4.2 Geology and Soils	46
4.4.3 Climate	46
From the weather pattern graph above, it can be deduced that cycling may be a challenge during	47
4.4.4 Sun and Wind Path	47
4.4.5 Vegetation	48
4.5 Population and Demographic Characteristics of the Project Area	49
4.5.1 Population Characteristics	49
4.5.2 Social Economic Characteristics	50
4.5.3 Land Use Analysis	51
4.6 Major Estates served by Ngong Road	53
CHAPTER FIVE	56
RESULTS AND DISCUSSIONS	56
5.1 Overview	56
5.2 Modal Split along Ngong Road	56
5.3 Social Economic Characteristics	57
5.3.1 Age and Gender	57
5.3.1 Occupation and Income Levels	57
5.3.2 Common Mode of Transport to School or Workplace	58
5.4 The Role of Bicycle Mode in the Urban Transport System	59

5.4.1 Cycling along Ngong Road	59
5.4.2 Reasons for Using Bicycle as a Means of Transport.....	60
5.4.3 Consideration on Bicycling As an Alternative Means of Transport	61
5.5 The Status of Cyclists’ Infrastructure on Road Designs along Ngong Road	62
5.6 The Challenges of Bicycle Mode of Transport along Ngong Road	63
5.6.1 Lack of Supportive Infrastructure for Cycling along Ngong Road	63
5.6.2 Harsh Treatment from the Motorized Transport Modes	65
5.6.3 Constant Interferences from Other Road Users.....	65
5.6.4 Lack of Implementation of NMT Policy	66
5.6.6 Orientation of Transport system to private car use.....	66
5.7 Plausible Cyclists Related Planning Interventions	66
5.7.1 Provision of Supportive Infrastructure for Cycling	67
5.7.2 Integrate NMT Facilities on the Road Designs	67
5.7.3 Strengthening the NMT-Related Institutions	67
5.7.4 Education and Public Awareness	68
5.8 Summary of key Findings	68
CHAPTER SIX:	71
SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS	71
6.0 Overview	71
6.2 Summary of Emerging Issues	71
6.3 Conclusion.....	72
6.4 Recommendations	73
6.5 Areas of Further Research.....	76
6.5.1 Cycling along Thika Superhighway	76
6.5.2 Influx of motor cycle traffic in Kenya.....	76
REFERENCES.....	77
APPENDICES	83
Appendix 1: Household Questionnaire	83

Appendix 2: Household Questionnaire	84
Appendix 3: Roadside Interview Schedule for Bicyclists.....	86
Appendix 4: Roadside Interview Schedule for Pedestrians	87
Appendix 5: Interview Schedule for Key informants	89
Appendix 6: Modal Split along Ngong Road, Nairobi during Peak Hours.....	91

LIST OF FIGURES

Figure 1: A signed shared road way in New York City.....	22
Figure 2: A Separated multi-use path in Tsukuba City, Japan.	23
Figure 3: A bicycle parking in a New York City street (left photo) and Bicycle Parking Bay in Tsukuba International Centre.....	24
Figure 6: A bicycle transport plan for Yishun Town, Singapore.....	27
Figure 7: Bicyclists and pedestrians travelling along their designated tracks	27
Figure 6: The Conceptual Model	34
Figure 7: Summary of Research Design	36
Figure 9: Rainfall and Temperature in Nairobi City	47
Figure 10: Nairobi population growth	49
Figure 11: Age Structure of Nairobi City	50
Figure 12: Common Mode of Transport along Ngong Road.....	58
Figure 13: Proposed Cross-Section of Ngong Road with bicycle Lanes Incorporated	75

LIST OF PLATES

Plate 1: A section of Kibera Slum.....	54
Plate 2: Traffic characteristic at Ngong Road (Dagoretti Corner)	60
Plate 3: Bicycles involved in accidents at Central Police Station, Nairobi	62
Plate 4: Bicycle Parking Bay in the CBD of the City of Nairobi	64
Plate 5: A Cyclist on the Carriage Way along Ngong Road.....	64

LIST OF TABLES

Table 1: Transport modal split in Nairobi.....	3
--	---

Table 1: Transport modal split in Nairobi -excluding motorcycles	9
Table 2: NMT Potential Benefits.	11
Table 3: Deriving the sample size.....	38
Table 4: Summary of Data Need Matrix.....	42
Table 5: Nairobi population projection (2009-2030).....	49
Table 6: Proportional Distribution of Ngong Road Traffic	52
Table 7: Income versus Common Mode of Transport To school Or Workplace	58
Table 8 : Common Mode of Transport to School or Workplace	Error! Bookmark not defined.

LIST OF CHARTS

Chart 1: Ownership of Bicycle in Nairobi City	51
Chart 2: Age Distribution of Respondents.....	57
Chart 3: Advantages of using bicycle as means of transport	61
Chart 4: Road Accident Fatalities in Nairobi.....	63
Chart 5: Reasons for Not Using Bicycle as a Means of Transport	65

LIST OF MAPS

Map 1: Location of the Study Area (National and Regional Context)	Error! Bookmark not defined.
---	-------------------------------------

LIST OF ACRONYMS

AASHTO-American Association of State Highway and Transportation Officials

JICA-Japan International Cooperation Agency

KURA- Kenya Urban Roads Authority

MATATU-A common name in Kenya for a mini-bus

MDA- Ministries, Departments and Agencies

MOTI-Ministry of Transport and Infrastructure

NCC-Nairobi City County

NMT-Non Motorized Transport

NTSA-National Transport and Safety Authority

PSV-Passenger Service Vehicle

UNEP-United Nations Environmental Programme

UN-United Nations

KNBS- Kenya National Bureau of Statistics

UTM-Universal Transverse Mercator

NCCG- Nairobi City County Government

GDP-Gross Domestic Product

INTP- Integrated National Transport Policy

FABIO-First African Bicycle Information Organisation

CHAPTER ONE

INTRODUCTION

1.1 Background

Reliable means of transport is an important factor in economic growth of any area. Transport infrastructure provides conduits through which geographical spaces are linked to one another and this facilitates exchanges of resources and goods. Article 10 of the Constitution of Kenya, (Kenya,2010) guarantees all Kenyans freedom of movement and gives all Kenyans a right of access to their homes, education, healthcare services, housing, water, social security and to clean and healthy environment. This cannot be attained without reliable transportation linkages.

Non-Motorized Transport (NMT) is a dominant, cost effective and, healthy mode of transport in African cities. www.uonbi.academia.edu. In Nairobi, 60 per cent of the residents meet their daily transport needs through walking, 35 per cent travel by public transport, mostly *Matatus* and buses, while only 5 per cent use private cars (Kenya, 2010). Thus, NMT remains the most convenient and conventional way of linking places and activities, especially for those covering short distances. However, inadequate planning and provision of NMT infrastructure has resulted in NMT modes competing for space with motorized vehicles, causing conflict and compromising safety (Kenya,2010), and resulting in road accidents involving pedestrians.

According to Mairura O. (2011), the following are some of the problems and challenges facing transportation in the city of Nairobi; Inadequate integration of city development planning, poor integration of transportation network system, inadequate public transport system to meet the rising travel demand, long commuter distance and travel time, high cost of transport compared to low level of income, inadequate development of non-motorised infrastructure network, poor safety and high incidence of motor traffic accidents, increased pollution and deterioration of the urban environment.

The Nairobi Urban Transport Master Plan study carried out in 2006 had NMT transport (cyclists and pedestrians) accounting for 47% of the modal share in Nairobi city. This compares well with data of the nearly 4.8 million trips made each day in Nairobi in 2004, in which only 16% were made in private vehicles; 36% used public transport and 48% were made on foot (Gonzales G. *at al.*, 2009)

The Nairobi transport system is basically road-based, and more oriented to private car use. According to NMT policy (2015) of the Nairobi City County Government (NCCG), the transport system has not fully taken into account the contribution of all modes to offer users affordable practical choices. It does not offer practical and convenient alternatives to the private car so as to discourage Nairobi residents from using private cars. The policy suggests that public transport needs to be efficient, attractive and integrated with NMT. From the NMT policy study report (NCCG,2015), it was noted that the problem in the city of Nairobi is not the reluctance of residents to use public transport, cycle or walk but rather, the inefficient public transport and lack of safe and convenient NMT (cycling and pedestrian) infrastructure.

1.2 Statement of the Problem

Urban planning approaches over time worldwide have aimed at providing better living standards and solutions to urban challenges. By 2050, two thirds of all humans will be living in cities. Urbanization is happening at a rate never seen before (WHO, 1999). In 1993, participants in the '*Nairobi We Want*' Convention expressed desire to have non-motorized transport facilities incorporated as part of the urban fabric. Tremendous efforts have been made to achieve the above goal. However, the process has been confronted by institutional issues and challenges which affect implementation. Such issues include the challenges of land acquisition for widening road corridors to accommodate desired road designs.

Ngong Road is a standard carriageway with two traffic lanes; a major road that links Nairobi CBD all the way to the Ngong Stadium, passing by major land marks in Nairobi and Ngong such as the Kenyatta National Hospital, The Junction Mall, the Lang'ata Road roundabout in Karen, the Ngong Market. Off the road some five kilometres from Nairobi is Kibera slums; where half of Nairobi's population uses this particular road either cycle or walk to their places of work avoiding the longer route that connects Lang'ata and Ngong roads via Mbagathi Road. For decades, plans throughout the city for new roads construction and upgrades have only partially provided physical infrastructure for NMT users. Nairobi City County having hosted the *African Sustainable Transport Forum* in October 2014, is on the mirror globally whether it will implement NMT infrastructure as an effective form of mobility or transport for short trips and for last mile connectivity to the proposed mass transportation systems such as the Bus Rapid Transit systems so as to provide an efficient mobility with substantially low investment, improved access and low carbon emission.

Indeed, users of NMT modes along Ngong Road face a great risk of accidents as they share a common right of way with motorized transport. In particular, cyclists have been seen as nuisance and intruders of space meant for motorized traffic. In order to interrogate this situation, the research examined the operations of bicycle transport along Ngong road by looking into among others: the role of bicycle mode in urban transport, the status of bicycle infrastructure along Ngong road, the challenges/constraints of bicycle mode of transport along Ngong Road and lastly recommend possible cyclists related planning interventions to properly integrate bicycle mode into urban transport system which is a more sustainable mobility path.

1.3 Purpose of Study

The main purpose of the study was to examine the operations of bicycle transport along Ngong road, Nairobi as a case study and propose ways of improving the bicycle transport.

1.4 Research Questions

The research was guided by the following questions:

1. What role does the bicycle play in the urban transport system in the study area?
2. What is the status of cyclists' infrastructure on road designs along Ngong Road?
3. What are the challenges/constraints for bicycle mode of transport along Ngong Road?
4. What are the plausible cyclists-related planning interventions to properly integrate bicycle transport as a mode in the urban transport system along Ngong Road?

1.5 Specific Objectives of the Study

The specific objectives of this research were:

1. To establish the role of bicycle mode in the urban transport system in the study area.
2. To investigate the status of cyclists' infrastructure on road designs along Ngong Road.
3. To examine the challenges/constraints of bicycle mode of transport along Ngong Road.
4. To propose plausible cyclists related planning interventions to properly integrate bicycle mode in urban transport system along Ngong Road.

1.6 Assumptions of the Study

In carrying out this research it was assumed that:

- i. Pedestrians avoid using the bicycle because they fear to endanger their lives and health due to the risk that they may be exposed to if they were to cycle on the same lanes as the motor vehicles.
- ii. The greatest risk in bicycle transport emanate from using the same lanes as the motor vehicles.
- iii. Providing cyclists' lane will encourage some PSV commuters to opt for bicycle transport as the likelihood of a cyclist being affected by traffic jam is remote.

1.7 Justification of the study

NMT transport system has gained a lot of approval locally and globally. In the Rio+20 UN conference on sustainable development it was noted that the development of the transport sector within the transition to a greener economy would be well served by the adoption of a sustainable development goal specific to transportation which is 'to achieve sustainable transport that enables universal access to safe, clean and affordable mobility'. NMT and specifically cycling is supported in national as well as local policies and development plans. From the Constitutional point of view, the bill of rights stipulates that every person shall enjoy the rights and fundamental freedoms in the Bill of Rights to the greatest extent consistent with the nature of the right or fundamental freedom. It states that every person has the right to freedom of association and freedom of movement.

For decades, plans throughout the city for new roads construction and upgrades have only partially provided physical infrastructure for NMT users. With the planning of mass transport systems implementation and Ngong Road being ear marked under this massive project, NMT is envisaged to be a key intervention close to sustainable urban mobility loop. The findings of this study could be used by the Ministry of Transport &Infrastructure and road authorities especially Kenya Urban Roads Authority (KURA) to estimate the impact that bicyclists lanes would have on pedestrians and PSV commuters. Depending on the outcome of the study these MDAs may have to make it mandatory for bicycle lanes to be included in any road design and construction.

Mobility access challenges for the city are not only solved by construction of good roads but by the implementation of an effective public transport system with adequate NMT linkages. In the case of Ngong Road it is clear that the transport infrastructure and services are generally inadequate as it excludes NMT. This reduces the productivity of investments and contributes to urban poverty in the long run. The size and structure of our cities and the poor

integration between land use and transport makes movement an unfortunate necessity for everyday living. The results are three-fold: barriers to transport which has to change mode, economic inefficiency and high social and environmental costs as noted from the findings. NMT is an effective form of mobility for short trips and for last mile connectivity to mass transportation systems since it provides an efficient mobility with substantially low investment, improved access and low carbon emission.

By examining the operations of bicycle transport along Ngong Road, the study strived to facilitate a mobility environment where all transport modes are of equal importance. Objective 4 of this study aims at proposing possible cyclists related planning interventions to properly integrate bicycle mode in urban transport system (at the county or national level) both at policy and implementation levels. The integration of bicycle mode with other modes will ensure that a transportation system is in place in which different modes complements each other and that there is seamless interchange of means transportation.

1.8 Scope of the Study Area.

The study will cover Ngong Road, from Dagoretti Corner (also called Karandini market) to Haile Selassie Roundabout in Nairobi city CBD. This part of the road serves a mixture of people of different economic and social status. Kawangware and Kibera are slums which depend on this road for linkage with the city centre and other areas. Many of the slum dwellers live below the poverty line and can hardly afford the fares charged by buses and Matatus (minibuses).

1.9 Methodological Scope

The study was limited to bicycle transport as an NMT mode though walking mode was also investigated to some extent for the reason that it is the pedestrians who are expected to opt for bicycle transport together with MT commuters.

1.10 Definition of Key Terms

1. ***Non-Motorized Transport:*** a means of transport that include walking, bicycling, the use of wheelbarrows and carts, animal transport (horses, camels, donkeys, mules and oxen), animal-drawn carriages (such as sledges), and tricycles for passenger and freight transport (GOK, 2012).

2. ***Bicycle lanes/tracks:*** Special lanes for bicycle only which are separated from the vehicle lanes. The bicycle infrastructure which includes the lanes, parking spaces, traffic lights, security gadgets like CCTV and street lights etc.
3. ***Pedestrian walkway:*** A special lane dedicated for use by pedestrians only. Pedestrian walkway-system includes the pedestrian crossings, overpasses and underpasses, bridges, security enhancement etc.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview

The chapter reviews relevant literature on cycling as a mode of transport. This section defines the concept of NMT, introduces the historical development of NMT in Kenya. It covers bicycling as a means of urban mobility, the role of bicycle mode in urban transport, and the various bicycle infrastructure facilities, the challenges/constraints of bicycle mode of transport as well as policy and legal framework on NMT. It examines as a case study, the bicycle transport plan in Yishun Town in Singapore. Lastly it concludes by developing the conceptual framework for the study which shows how plausible cycling can be integrated into the urban transport system.

2.2 Concept of NMT

Non-Motorized Transport, also called “Active Transport”, essentially refers to walking and cycling (and all other modes that have wheels but no engine), as well as related infrastructure, policies and education (Godefrooij et.al, 2009). According to Todd (2005), NMT is an active transport and human powered transport; which includes walking, cycling, wheelchair travel, skating and handcarts. Todd further explains that active transport includes both utilitarian and recreational travel activity, plus stationary uses of pedestrian environments such as standing on sidewalks and sitting at bus stops.

Non-motorized transport is a key mode of transport which can be promoted at relatively low cost and with considerable benefits. One modality in which it has been promoted is by means of bicycle sharing systems such as *Paris's Velib system* with 21,000 bicycles available to citizens throughout the city (Felipe, 2007).

Todd (2005), further narrates that generally, bicycles serve as a means of transport of goods and people in peri-urban and rural areas, while in urban areas, the recreational purpose of cycling is important (UN-HABITAT, 2010).

2.2.1 NMT User Requirements

According to the NMT policy of the Nairobi City County Government (2015), the five main requirements for NMT users includes: (1) Safety (and security); (2) Directness, (3) Coherency;

(4) Comfort; and (5) Attractiveness. Attractiveness is mainly considered as requirement by those who have other modal choices, like private car users. It refers to conducive surrounding environment such as shades; landscaping; clean streets; and parks along routes.

Safety is a key requirement to the use of any transport mode, especially for cyclists in Nairobi who have to share the same space with fast moving motor vehicles. Directness means that the route or crossing provides the NMT user with the short and less cumbersome link between his/her origin and destination. Delay at signalized and un-signalized crossings due to waiting for pedestrian green phase/adequate gaps in the MT traffic stream are also elements of directness.

Coherency means that the NMT route/lane must have no gaps or missing links between the origin and destination. Missing links can be unpaved and muddy sections; lack of abridge; dug up lanes due to construction works; and lack of facilities along the route (eg. repair shops, convenience facilities). Comfortable NMT movement means minimal hindrance by other users (less congestion); smooth, stable and clean road surface; fair gradients; proper waiting areas at bus stops and crossings; and convenience facilities along the route. (NCCG,2015)

2.3 Historical development of NMT in Kenya

The role and need for non-motorized transport in Kenya started receiving appreciation over 30 years after independence when it was first mentioned in the 1994 –1996 National development plan, which recognized NMT as a sixth and the youngest mode of transport and development in both urban and rural areas (Kasuku, 2001, Kasuku, 2001a).

Subsequently, the Government of Kenya in 1996 launched the National Forum Group on Rural Transport and Development, whose efforts together with that made by others transport enthusiasts led to the recognition of NMT as the sixth and the youngest mode of transport in the 8th National development Plan 1997 – 2001(Kenya,1997). This plan recognized that the majority of urban and rural residents live below the poverty line and are captive in the NMT mode, hence the justification to provide facilities and vehicles in the same. The government's Interim Poverty Reduction Strategy Paper (2000) and the National Poverty Eradication Plan by the year 2015 (1999) all recognized transport (NMT included) as a requisite ingredient for fighting poverty in Kenya. The Poverty Reduction Strategy paper 2001 – 2004 further underscored the need to provide pro-poor transport facilities inclusive of NMT (Kenya, 2001).

Further, this led to the Government of Kenya in the 2001/2002 financial year budget to zero rate bicycle import duty to enable a wider population access NMT with a view of improving urban and rural mobility among the poor. Indeed, the earlier omission of NMT issues in national development plans and policies explain why no financial measures were put in place to address NMT infrastructure and facilities demand (Kasuku, 2002). The 9th National Development Plan 2002 – 2008 (Kenya,2002) stressed the importance of including provision of NMT infrastructure and vehicles in national planning hence attesting to the acceptance of NMT in National Planning Policy. Kenya (2002) in the policy document observed that planned construction of NMT facilities would relieve many town dwellers off the high cost of urban and rural transport. It noted that productivity at places of work would subsequently improve, and further measures would be put in place to encourage development of NMT (Kasuku, 2002).

In Kenya today, majority of individual trips in the cities are made on foot (Table 1), as public transport services are comparably expensive or inadequate to meet demand, and private cars are out of financial reach for the majority of Kenyans (Lachlan et. al, 2012).

Table 1: Transport modal split in Nairobi -excluding motorcycles

Mode	Walking	Cycling	Private car	Matatu / mini-bus	Bus	Train	Institution bus	Other
Modal split	47%	1.2%	15.3%	29%	3.7%	0.4%	3.2%	0.2%

Source: Omwenga Mairura, 2011.

Walking and cycling are considered to be the most sustainable modes in urban transport in industrialized countries. There are reduced local environmental effects like noise or air pollution, the need of space is minimal, they have very low energy consumption and from the users perspective it is healthy and affordable for everyone (Thilo,2011). In Nairobi, Kenya, 49 % of all trips are done by use of NMT (no subdivision in bicycle and walking in the statistic). The public transport achieves a modal share of 42 %, while the role of cars stays as low as 9 % (Aligula, 2005). The current Nairobi share of NMT (mostly walking) is already close to Copenhagen’s target goal of a bicycle share of 50 % by the year 2015 (Copenhagen, 2011).

2.4 Bicycling as a means of Urban Mobility

To achieve the sustainable transport, RIO+20 conference recommended the provision of universal access to sustainable transport through support for safe, affordable public transport and safe attractive facilities for walking and bicycling (UN, 2012). According to Schwartz (2013) cycling may not only be a healthy way to get around a city, helping to reduce traffic congestion and pollution but it is often the fastest and most reliable way to get around a city too. Schwartz concludes that there are only two reliable methods of transportation that can consistently transport you to a destination on-time: bicycling and walking. Bicyclists can hardly be caught up in traffic snarl ups due to the ability of the bicycle to manoeuvre and given that it requires only a narrow space to travel along (Ibid, 2013)

Bicycles offer freedom and mobility that you often cannot get with automobiles, and speed and efficiency that you cannot achieve by walking. www.theurbancountry.com. When it comes to the cost of bicycle transport, the main cost is procurement of the bicycle itself. Other costs that come with it are maintenance costs due to wear and tear. Servicing of the bicycle is cheap as it generally involves greasing the moving parts and inflating the tyres when necessary.

Time taken to travel using a bicycle depends on the speed that the rider can comfortably achieve with it. Factors determining this include the type of bicycle, the slope of the terrain and the road surface (UNHABITAT, 2010). One can afford higher speed if the road surface is smooth. On a fairly flat terrain one can cycle a bicycle at a speed of about 15 kilometres per hour. This means that the case study area i.e. Dagoretti Corner to Nairobi Railways terminus which is only 8 kilometres can be covered in half an hour or less. The highest bicycle speed ever attained was 134 Kilometres per hour using a special bike in an open desert area. (Ibid, 2010)

2.4.1 Role and Benefits of Bicycle as a means of NMT

Non-motorized transport is available to almost everyone (Steely, 2003). Steely and Felipe agree that the majority of non-motorized classes of transport modes are healthy, non-polluting, versatile and reliable and they encourage local movement and hence support local community facilities. A shift away from private car use to non-motorized transport, including improving accessibility for the mobility-impaired people, has a key role to play in using the existing road network more efficiently and delivering significant potential economic and environmental benefits to society, alongside tangible health and lifestyle benefits for individuals (Smart, 2004).

Internationally, NMT has enticed an increased attention as an environmentally sustainable means of transport, reason because bicycles do not cause noise and air pollution (WHO, 2002). Introduction of more cycling preferences in urban areas in place of cars could ease congestion on our roads and majorly reduce on energy consumption from travel activity (World Bank, 2000) According to UN-HABITAT (2010), promoting NMT as mode choice of travel will also make a significant contribution to reducing greenhouse gases as well as other emissions. MT mode of transport e.g. cycling has been experiencing a noticeable popularity as an everyday means of transport and as a recreational or holiday activity (Todd, 2014).

Non-motorized travel provides many indirect benefits (Todd, 2014). Todd confirms that a community designed for walking and cycling must be compact. In this respect so many destinations are within convenient distance of each other, connected with streets that allow direct travel, designed at a human scale. In addition, the design has to have functional and attractive sidewalks and paths, effective strategies to control traffic speeds, and must make users feel safe. Increased non-motorized travel tends to improve community cohesion in terms of the quality of neighbourly interactions which has positive effect on the social fabric, security and aesthetics. These features provide many benefits besides just mobility (Todd, 2004a and 2003b). In summary, Todd (2004a) concludes that NMT or Active transportation can provide various types of benefits, depending on their impacts, as summarized in the Table 2 below:

Table 2: NMT Potential Benefits.

	Improved NMT Conditions	Increased NMT Transport Activity	Reduced Automobile Travel	More Compact Communities
Potential Benefits	<ul style="list-style-type: none"> • Improved user convenience and comfort • Improved accessibility for non-drivers, which supports equity objectives • Option value • Higher property values • Increased security 	<ul style="list-style-type: none"> • User enjoyment • Improved public fitness and health • Increased community cohesion (positive interactions among neighbors due to more people walking on local streets) which tends to increase local security 	<ul style="list-style-type: none"> • Reduced traffic congestion • Road and parking facility cost savings • Consumer savings • Reduced chauffeuring burdens • Increased traffic safety • Energy conservation • Pollution reductions • Economic development 	<ul style="list-style-type: none"> • Improved accessibility, particularly for non-drivers • Transport cost savings • Reduced sprawl costs • Openspace preservation • More livable communities • Higher property values • Improved security

Source: Adopted from Todd L, (2004a)

The World Health Organization (1999) recognized the importance of cycling in achieving greater sustainability and mobility and improving public health (WHO, 2002). Cycling is a simple, convenient, yet effective way of incorporating exercise into everyday life. It is likely to be much more sustainable than targeted exercise initiatives and encouraging individual behavioural change in the long-term (Haines *et.al*, 2000). Above all, it is critical to focus on creating an environment where people feel safe to cycle, through measures such as reduced traffic speed and provision of a well-planned cycle infrastructure. In doing this, some of the risks associated with cycling can be minimized and this will help to ensure that people who try cycling will continue throughout their lives (National Cycling Strategy, 2003).

2.4.2 Challenges facing Cycling as a Mode of Transport.

FABIO (2004), further explains cyclists face major problems related to the lack/inadequacy of road infrastructure, scarcity of parking facilities, safety and security of cyclists and harsh weather conditions. Cycling related Challenges are categorized into the *User-Cyclist, institutional and the infrastructure/facilities provision* based as presented below:

a) Cyclist (User)related Challenges

Cycling as a means of transport has myriad of challenges which include safety and security, harsh weather conditions and poor inter-modality.

b) Safety and Security

The world over deaths resulting road accidents are on the rise. Safety and security of road users is of paramount importance in all parts of the world. This made Rio+20 UN conference on sustainable development (UN, 2012) to note that the development of the transport sector within the transition to a greener economy would be well served by the adoption of a Sustainable Development Goal specific to transportation which is, 'to achieve sustainable transport that enables universal access to safe, clean and affordable mobility', Among the objectives to enable achievement of this goal were;

- a) to support Decade of Action for Road Safety (2011-2020) and cut traffic-related deaths by half by the year 2025.

- b) to provide universal access to sustainable transport through support for safe, affordable public transport and safe attractive facilities for walking and bicycling.

According to FABIO (2004), most African countries do not have a good road infrastructure network for cyclists. If there are cycle paths, most are poorly maintained, dirty and not entirely safe. However, we acknowledge the government level of concern for cyclist that some of the recently constructed roads such as Thika Superhighway have incorporated cycling lanes though partially. Lack of cycling lanes forces cyclists to share road space with motorized vehicles or with pedestrians. This normally causes accidents and injuries. The inadequacy of the cycle tracks makes cyclists feel unsafe and dissuades them from increasing their bicycle usage, primarily in urban areas. Separate infrastructure for bicycles is essential to avoid conflicts and potentially dangerous circumstances. It is also important to prevent accidents involving vehicles and cyclists by providing traffic control measures and training children and adults in better and proper cycling behavior.

c) Harsh Weather Conditions

According to Alta Planning (2005), even if weather conditions may seem to be a secondary issue, this is not in fact the case. It is helpful for cyclists to know the weather forecasts related to their journey. They can wear appropriate clothes and/or choose to travel using a combined means of transport. In essence, bikers should be notified of the prevailing weather conditions for better decision-making of a trip to work or any other occupation of the day (Ibid,2005)

d) Poor Inter-Modality

Currently, very few major urban settings have equipped their public transport with bicycle tracks (Todd, 2014). Todd further explains that more cities have started to implement bicycle sharing programmes. The idea of offering public bicycles at the main railway or bus stations gives residents a choice of the modes of travel. This also makes it easier to switch from one mode of travel to another within the shortest time possible thus cutting the total travel time by a significant margin (Shayler, Fergusson, and Rowell,1993).

e) Lack of Bicycle Transport Infrastructure Facilities

According to FABIO (2004), scarcity of bicycle transport facilities such as bicycle parking facilities in urban centers and main attractions discourages cyclists from using their bicycles for regular trips. The major threat here is that of bicycle theft which could be a very big problem and threat to cycling as a mode of transport (NMT). However, bicycle theft can be tackled quite successfully by introducing innovative anti-theft devices in bicycles (World Bank, 2000).

Supervised or locked bicycle parking may help to prevent damage to bicycles and vandalism. Parking facilities are also required to allow users to change from bike wear into everyday clothes. Good fully equipped bicycle parking facilities should offer services for cyclists like bicycle accessory shops, bicycles to rent, and lockers (UN-HABITAT, 2010).

f) Inadequate Infrastructure for Non-Motorized Transport

According to Omwenga (2011), inadequate infrastructure for NMT is a major challenge facing cycling or bicycle as a NMT mode in Kenya. Omwenga also notes that a large portion of the city population walks or cycle to work, to school and other destinations covering distances of about 7–15 km (Ibid, 2011). This is because of low income earnings compared to the high cost of transport. Cycling is attractive but only a few people cycle to work or school; due to high incidence of road accidents affecting cyclists. Unfortunately, infrastructure for pedestrians and cyclists is not well developed (Omwenga, 2011). Omwenga (2011) and Kasuku (2002) both agree that there is little provision for footpaths, footbridges, zebra crossings, and cycle tracks and even where provided, the same are poorly designed, poorly maintained, and are not secure.

The development of infrastructure in both urban and rural areas has tended to ignore NMT (Kasuku, 2002). He further notes that although in the early 1960's there were provisions for pedestrian footpaths, bicycle and motor cycle parking bays in Nairobi and Mombasa, for instance, these soon disappeared from the town and city planners' schemes and as of now, both NMT and motorized transport compete for the same road space, including pedestrians in many areas. Lack of appropriate infrastructure and partly because of cultural biases against NMTs (often seen as inferior modes), there had not been a positive policy to develop infrastructure that can accommodate NMT until recently. (Obiero S., 1992, Kasuku S., 1995, 2001).

g) Policy and Institutional challenges

According to Obiero,1992), one of the bottlenecks in the provision of an optimal and well-functioning NMT in urban and rural transport modes and services in Kenya is the weak management and organization or institutional framework. They further confirm that weak horizontal linkages largely dodge institutional arrangements between the undertaking departments where each of them works independently or with weak linkages while dealing with the same problem. It eventually results to uncoordinated, un-integrated and poor provision of NMT facilities and services despite immense resources sunk in the efforts (Kasuku, 2002).

The authority to acquire/safeguard, design, construct and maintain NMT facilities lies with the local authority (now defunct) in question with exception for primary distributor roads and rural roads which are under the County Government (Kasuku, 2002). For a local authority to access funds from the central (now (National)) government, or acquire/design, and construct a transport facility, the same authority had to first of all prepare a development plan. However, the local authorities lack the resource capacity to undertake preparation of development and action plans to form the basis for their funding from central government (Obiero,1992) and Kasuku,2001).

2.5 Cycling Opportunities as a Mode of Transport

NMT is a service and a supportive factor for production in both economic and social aspects of life as noted in the 1997 – 2001 National development plan, which departed from the earlier emphasis that development is only supported by motorized transport (Economic Survey Report 2000, 2001). Omwenga (2011), advises Kenyan cities to develop a comprehensive infrastructure network for non-motorized transport – footpaths, footbridges, zebra crossings, and cycle tracks and so on. Indeed, NMT infrastructure must be incorporated as part and parcel of any city transport system (Ibid, 2011). He further notes that this will considerably reduce motor traffic volume and reduce the overall cost of transport in the city and also lead to improved traffic safety, and reduced air pollution, and enhanced health of the urban environment.

Low-carbon options in the Kenyan transportation sector should be considered in the transportation planning (Lachlan et. al, 2012). Lachlan et.al proposes improving conditions for pedestrians and bicyclists which forms an important component of the Integrated National Transport Policy and Vision 2030; and also necessary construction efforts for a Bus Rapid

Transport (BRT) or Light Rail Transport (LRT) can also provide a starting point for investment in NMT infrastructure, which may be developed in parallel with the mass transit system infrastructure.

As the cost of motorized transport is likely to increase, there is a need to ensure continued agricultural productivity in the rural areas, particularly in the up and coming towns outside Nairobi and other major urban centres, by promoting NMT in smaller towns especially for rural and urban freight transport (Kasuku, 2002). Kasuku further recommends that the use of horses on farms, ox-carts, and mule-drawn carts should be promoted in the rural areas as cheaper means of increasing agricultural productivity.

Omwenga (2011), Obiero (1992) and Kasuku (2002) agree that Participatory Planning Approaches (PPA) should be given preference over expert oriented approaches when it comes to NMT planning in Kenya. They justify this statement by noting that collaboration between Central government, Local authorities (now County Governments) including the NMT users themselves (the workers' organizations, Industrialists, and pedestrians) needs to be adopted so as to provide an all-inclusive forum for transport planning. Kasuku further notes this would ensure that optimal transport facilities are provided as a service to other sectors of the economy. Hence transportation planning should be considered an integral part of the social and economic system of an urban area. This would be viewed as a set of interconnected facilities designed to provide opportunities for travel from one location to another (Kasuku, 2002).

Litman, (2009) indeed underscores the potential for realizing sustainable and equitable economic growth by promoting infrastructure investments that enhance transport diversity of the majority. Litman asserts that investment policies favouring NMT stand to yield longer term economic stimulants than those that focus on expanding highways especially in the urban areas.

2.6 Policy, Legal and Institutional Framework for NMT in Kenya

Transport policy and practice in Kenya, and many developing countries focuses on the mobility of vehicles rather than access for the people. Good urban planning helps to create a viable and sustainable transport framework (World Bank, 2000). According to Felipe, (2007), a sustainable urban NMT transport system lies on a strong policy, legal and institutional framework for implementation, monitoring and evaluation.

2.6.1 Policy Framework

The Integrated National Transport Policy (2012) recognizes the importance of NMT in addressing the needs of the poor as well as in promoting the health of the population. The policy also recognizes that transport policies have largely supported motorized transport at the expense of non-motorized transport and have denied the poor and disadvantaged benefits inherent in NMT. This has led to marginalization of NMT users in the urban areas. The policy strongly recommends harmonization of NMT and their concomitant infrastructure into technical, legal and institutional mandates of transport agencies. The Kenya Vision 2030 aspires for a country firmly interconnected through a network of roads, railways, ports, airports, waterways and telecommunications. It envisages that by 2030, it will become impossible to refer to any region of the country as remote and so the focus would be on investing in the nation's infrastructure.

The Study on the Nairobi Master Plan (JICA,2014), proposes the development of a compact urban centre that is creative, livable, green, and competitive. It proposes that the urban centres should be pedestrian-friendly for an efficient, effective and inclusive transport system. The plan however advocates for the development and full integration of NMT within the whole of the Nairobi transport system, not just the urban centre.

The Nairobi City County Government is the first county in Kenya to have an NMT policy (*Nairobi City County Government, 2015*). The policy aims to develop and maintain a transport system that fully integrates NMT as part of the Nairobi transport system. This Policy aims at helping to create a safe, cohesive and comfortable network of footpaths, cycling lanes and tracks, green areas, and other support amenities. Further, it puts in place laws and regulations to ensure that NMT facilities and areas are not encroached by the MT modes and other street users (*See section 2.6.3*)

Lastly the Physical Planning Handbook (Kenya, 2008) provides that the standard provision for footpaths shall be two metres wide footway on each side of the carriageway, subject to the following relaxations: (a) for Cul-de-sac serving less than 10 plots a single footway will suffice; (b) occasional obstructions shall nowhere reduce the footway width below 1.2meters. Moreover, it is provided that pedestrians shall be physically separated from moving vehicles by a barrier such as an up-stander, open drain or wide verge.

2.6.2 Legal Framework

NMT is supported in national as well as local policies and development plans. The Constitution of Kenya (Kenya, 2010), Section Four stipulates that every person shall enjoy the rights and fundamental freedoms in the Bill of Rights to the greatest extent consistent with the nature of the right or fundamental freedom. It states that every person has the right to freedom of association and freedom of movement. It is on this basis that Nairobi City County Government NMT policy proposes an integrated and all-inclusive transport system for Nairobi in which the non-motorized users are provided with appropriate space and facilities to enjoy their freedom of safe movement, which is a fundamental human right.

The Physical Planning Act (1996) postulates that any physical development plan prepared with reference to any public land or private land should serve the purpose of improving the land and providing for the proper physical development of such land, and securing suitable provision for transportation, public purposes, utilities and services, commercial, industrial, residential and recreational areas, including parks, open spaces and reserves and also the making of suitable provision for the use of land for building or other purposes (Kenya, 1996)

The Traffic Act, Cap 403 (Kenya, 2013) provides the framework for the enforcement of traffic laws, including those relevant to NMT users. The Kenya Vision 2030 aspires for a country firmly interconnected through a network of roads, railways, ports, airports, water ways, and telecommunications. It aspires to setting up a strong institutional framework for infrastructure development, implementation of infrastructure projects that will target increased connectivity and reduced transport and other infrastructure costs. The Vision targets the development and maintenance of an integrated, safe and efficient transport network. Traffic Act, Cap 403 (Kenya, 2013) gives provisions relating to traffic on the roads. This Act, invariably, gives much emphasis to vehicular mode of transport with the only NMT mode related provisions being on bicycles. Under section 45a it is provided that ‘no person shall, in order to avoid a buildup of traffic on a road, drive a motor vehicle on, or through, a pavement, cycling lane or a pedestrian walkway.’

The Environmental Management and Coordination Act (EMCA) (Kenya, 1999), in its second schedule, identifies all major roads, railways, airport etc. projects for which Environmental Impact Assessment has to be done before their undertakings. Kenya Roads Act

(Kenya, 2007) provides for the establishment of the Kenya National Highways Authority, the Kenya Urban Roads Authority and the Kenya Rural Roads Authority and provides for the powers and functions of the authorities and for connected purposes. The authorities are mandated to perform responsibilities, which are collectively aimed at ensuring a good road network throughout the country.

2.6.3 Institutional Framework

Ngong Road falls partly under the jurisdiction of the NCCG and partly under the jurisdiction of the County Government of Kajiado. The part of the road under study falls within NCCG. The various institutions in charge of provision of NMT along this road include:

1) The Nairobi City County Government

The Devolved Government Act (2011), provide for county governments powers, functions, and responsibilities to deliver services and to provide for other connected purposes. The NCCG NMT policy provides for integration of cycling into the urban roads. Some of the roles the Nairobi City County Government has under the 2015 NMT policy to perform as far as addressing Cycling along Ngong Road is concerned include provision of:

- a) **Cycling Facilities**-According to the Policy, the NCCG will:
 - i) Explore ways of providing incentives for its employees to cycle to work-related purposes. Incentive will include: free bicycle parking and convenience facilities along cycling routes and at major destinations; bicycle racks and lockers at major transit connections; shower rooms at its premises; bike/bus passes; convenient and free bike parking locations; bicycle sharing programmes; and flextime for employees who come to work cycling. The NCCG will also make bicycle parking available at private properties through a public/private partnership arrangement.
 - ii) Encourage public transport operators to make provisions for cyclists to be able to take their bicycles on board so that journeys can be continued by cycling to the final destination.
 - iii) Provide and maintain clear and consistent signage to guide NMT users to destinations and to other NMT routes, at route beginning, end and intersections. Additional pedestrian signage and bicycle route maps will be provided on approved kiosks and

bicycle repair shops along the routes. Information to include: distance to destinations, and transfer opportunities along cycle routes.

- iv) Strategically allocate space to cyclists- repair shops along cycle routes and provide other support to create employment and security to cyclists.
 - v) Promote cycling for public health, sport and tourism.
 - vi) Partner with investors to set up a bicycle manufacturing/assembly company in Nairobi to make quality and more affordable bicycles.
- b) **Funding**-The NCCG will ensure that at least **20%** of its existing and future transport budget is allocated to NMT and PT infrastructure and services. Annual road and transport improvement project estimates shall include costs related to planned NMT interventions covering both development and maintenance and available to the public.
- c) **Planning**-The NCCG will undertake NMT project planning and implementation in a consultative and transparent way to send a clear message that NMT policies are implemented in close consultation with users, key stakeholders and broad citizen participation. The county will also develop adaptable and flexible long-term NMT plans, which will be updated regularly. The plans will include reporting on an evaluation of progress, the existing conditions, current initiatives, appraisal of available funding sources, and defining future interventions. The plans will be data-led and should eventually result into a dense network of streets and paths that meet NMT requirements as much as possible.
- d) **Street Design and Maintenance**-the NCCG will design attractive and comfortable walkable and cycle-friendly streets by including features such as trees, plantings, landscaping, benches for resting, convenience facilities, and street lighting to create “dignified spaces”. The county will also abide by the following criteria when designing and retrofitting intersections and crossings:
- i) Provide at-grade crosswalks as much as possible instead of over-bridges and subways, in accordance with the function of the road.
 - ii) Provide crosswalks (raised zebra crossings) of at least 2 m width at all intersections (signalized and uncontrolled) and at frequent intervals in midblock locations. At locations with either high motor vehicle speeds or heavy pedestrian volumes, such crossings will be elevated to the height of the adjacent footpath (100 – 150mm) with ramps for motorized vehicles to mount the crosswalk.
 - iii) Redesign intersections to accommodate NMT volumes safely by minimizing crossing distances, reducing motor vehicle speeds, simplifying signal cycles, or through other means.

- iv) Implement and maintain street lighting for NMT paths by providing appropriate street illumination through proper street light spacing, street light heights and lamp brightness, etc.

2. *Ministry of Transport and Infrastructure*

The Ministry of Transport and Infrastructure is responsible for the transport sector in Kenya encompassing a transport system comprising of road, rail and air. In relation to NMT provision, the department of Infrastructure - is mandated to perform the following functions: National Roads Development Policy Management; Transport Policy Management; development, Standardization and Maintenance of Roads and Protection of Road Reserves.

3. *Kenya Urban Roads Authority (KURA)*

KURA, as defined in the Kenya Roads Act, (Kenya, 2007), is the agency in charge of the management, development, rehabilitation and maintenance of all public roads in the cities and municipalities in Kenya except where those roads are national roads. Ngong Road falls under the domain of KURA.

4. *Kenya Roads Board*

It oversees the road network in Kenya and thereby coordinates its development, rehabilitation and maintenance and to be the principal adviser to the Government on all matters related thereto.

5. *National Transport and Safety Authority (NTSA)*

The objective of forming the Authority was to harmonize the operations of the key road transport departments and help in effectively managing the road transport sub-sector and minimizing loss of lives through road accidents. The Authority identifies its core functions to be: to advise and make recommendations on matters relating to road transport and safety; to implement policies relating to road transport and safety; to plan, manage and regulate the road transport sector in accordance with the provisions of the Act no.33, (Kenya, 2012); to ensure the provision of safe, reliable and efficient road transport service.

2.7 Bicycle Infrastructure Planning and Design

The bicyclist is categorised in three ways namely advanced or experienced riders, basic adult riders and children or inexperienced riders. In the design of bicyclists lanes, the interests of all

these need to be addressed. The *1999 AASHTO Guide* (America, 1999) defines four classifications or categories of bicycle ways/tracks:

- i) ***Shared Roadway***- The rider shares the lane with the vehicles and only the experienced riders are expected to use.
- ii) ***Signed Shared Roadway***-This is a type with signed route with an indicative sign that the road is generally suitable for advanced and basic adult riders.
- iii) ***On –Street, Signed Bicycle Lanes*** - This type allocates dedicated portion of the road surface for the bicycle used by stripping and signing an approximately 1.5m path between the curb and vehicular travel lane in both directions.

Figure 1: A signed shared road way in New York City.



Source: Field Study, 2014.

- iv) ***Separated Multi-Use Paths***- This type of facility is a dedicated hard and graded surface used by all forms of non –motorized travel e.g. bicycle, carts and pedestrians though in some cases separate travel lanes are dedicated for pedestrian to minimize conflict. A multiuse path should have a minimum of 3.05m according to 1999 AASHTO guide. A typical bicycle takes approximately 0.76m of space including the rider’s elbow and knees.

Where bicycle bridges are to be provided to overcome major barriers, they must be wide enough to accommodate the bicyclist and provide a clear zone in either side of the path. Generally, 4.27m is considered ample span. When it comes to crossing busy roads where an

overpass /underpass cannot be provided, a phase for bicycle and pedestrian use should be dedicated in the traffic lights cycle. In case ramps are provided for, when approaching bridges, they should have a gentle slope for everyone to comfortably use including the elderly and the ones with disabilities. In America the recommended shape is 5%.

Figure 2: A Separated multi-use path in Tsukuba City, Japan.



Source: Google Earth, 2014.

Other ways of improving bicycling in urban streets include the following:

1. Providing Bicycle Parking Spaces

The bicycle owner need to be assured that his/her bicycle is safe where it has been parked. Kempton (2000) notes that, ‘the lack of a secure parking space keeps many people from using their bikes for basic transportation. A space with minimum dimension for example 1.83m long 0.7 wide and a minimum overhead clearance of 2.28m is necessary for each stall.

Figure 3: Bicycle Parking Bay in Tsukuba International Centre, Japan



Source: Google earth, 2014

The bicycle parking should be covered to protect the bikes from rain and heat of the sun. It should be visible to passers-by and or building occupants to deter theft.

2. ***Replacing Dangerous Drain Grates-*** Paralleled –bar drainage grates can trap the bicycle wheel and they should be replaced with others that are perpendicular to the traffic flow.
3. ***Keep the Street Clean-*** Keeping the streets clear of debris make it more comfortable for bicyclist to ride.
4. ***Improvement of Rail Road Crossing-*** The grade at railroad crossing should be reduced and preferable be flush with the bicycle track level so that the bicyclist does not need to disembark when crossing.
5. ***Install Bike Sensitive Traffic Signed-*** Bicycles often have problem triggering sensors designed for vehicles to trip a signal. More bicycle friendly detection loops should be adopted.

6. *Applying Traffic Calming Measures*- Bicycle safety can also be achieved by reducing vehicle travel speed in areas where there is likelihood of vehicle/bicycle conflict occurring.

2.8 Case studies

The study considered some other parts of the world where bicycle transport has been adopted as a transportation mode by authorities and cycling infrastructure provided to facilitate this mode.

2.8.1 Singapore

It is not authoritatively documented as to when bicycling started in Singapore but it is taken to be around 1930s when the bicycle became common throughout Asia after Japan developed its own bicycle industry (Koh et al, 2012). By 1960, there were 268,000 bicycles compared to 63,000 cars and 19,000 motorcycles. Bicycling became a popular means of transport and several major roads had bicycle tracks next to the footpaths. However, in the 1970s the usage of the bicycle dropped when car and motorcycle ownership rose rapidly. Walking, cycling and public transport were viewed as inferior and so this led to promotion of use of private cars. By 1981 the Government Registry of Vehicles stopped registering bicycles (Ibid, 2012). The concern on health and environment has turned cycling into a mascot for green and sustainable transportation. This has revived interest in cycling in Singapore.

Cycling infrastructure need to grow in tandem with increased cycling activities. When Singapore opened its first Mass Rapid Transit (MRT) rail line in 1987, cycling became common to and from these stations. By 1991, some 80 bicycle parking stands at 24 MRT stations were constructed (Tan, 1992). In 1995 there was an estimated bicycle ownership of 24% in the country (Singapore) (Ibid, 1992). By 1997 the Land Transport Authority (LTA) had provided some 869 bicycle stands to 38 MRT stations (LTA,2005). LTA has projected doubling the rail network by the year 2020 and adding 1600 bicycle stands at 10 MRT stations (MOT, 2012)

In 1996 a new signalised bicycle crossing was introduced in the traffic lights (green bicycle/red bicycle) (Tan, 1996). In 1992 a 300km round-island green network for cycling, jogging and walking was started (Tanuwidjaja,2011) and by 2012 200km had been completed. The traffic laws as at 2012 prohibited cycling along foot paths but bicycle riders still do so as they consider it safer than the road and also given that there exist a comprehensive foot path network. This is with the exemption of Tampines New Town which was made the first cycling

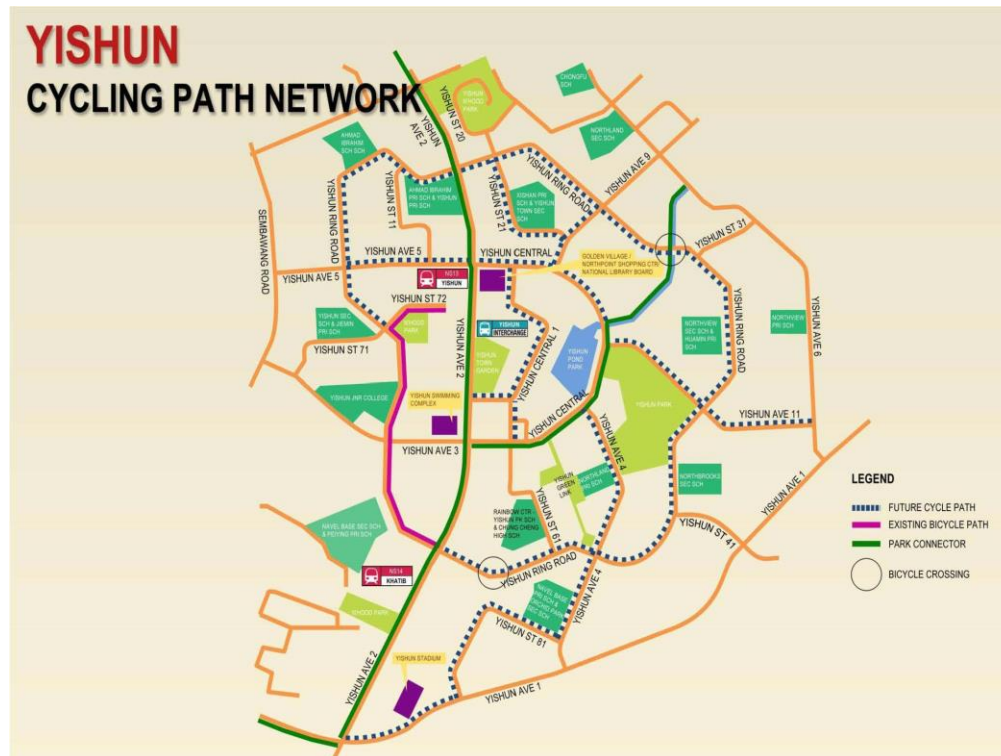
town in 2010 with legalised sharing of footpaths between pedestrians and cyclists after a successful pilot project. The project was to be rolled out to other towns after a National Cycling plan was established (MOT, 2012). The plan includes a 41 Singapore Million Dollars (US\$ 30.4M) programme to design and construct dedicated cycling tracks next to pedestrian footpaths in some selected towns. It was projected that by the end of 2014 there will be at least 50km of intra-town cycling paths.

In 2009 a Cycling Facilitation Committee was established which comprised of key grass root leaders, government agencies and cycling support groups (Koh, 2012). Its main objective was to a common community-led approach to handle issues arising from the implementation of dedicated cycling tracks.

A study carried out in 2011 on the likelihood of pedestrians and short distance bus commuters switching to bicycling mode if more cycling infrastructure was put in place stood at 30% (Ibid, 2012)

In conclusion to this case study, we find that there was a time in history when cycling was popular in Singapore. Later on cycling was ditched as people went for the car and motorcycle. As these automobiles increased in number, there was resultant traffic congestion accompanied by environmental pollution. Due to these negative effects of increased use of the automobiles, the bicycle has regained popularity. There is now the programme to put better bicycling infrastructure including National Cycling Plan, to facilitate this mode of transport, something that the National and County Governments of Kenya should emulate.

Figure 4: A bicycle transport plan for Yishun Town, Singapore



Source: Ministry of Transport, Singapore-1996

It is common in Singapore to come up with bicycle transport plan and this has been done in several towns and cities. The introduction of the green and red bicycle in the traffic lights sequence and establishment of Cycling Facilitation Committee were excellent innovations. All these show the dedication that the authorities and policy makers have towards promotion of the bicycle transport and NMT in general. Figure 5 is a photograph showing pedestrians and bicyclists travelling along designated tracks separated from the motor vehicle carriage way by both distance and a physical barrier.

Figure 5: Bicyclists and pedestrians travelling along their designated tracks



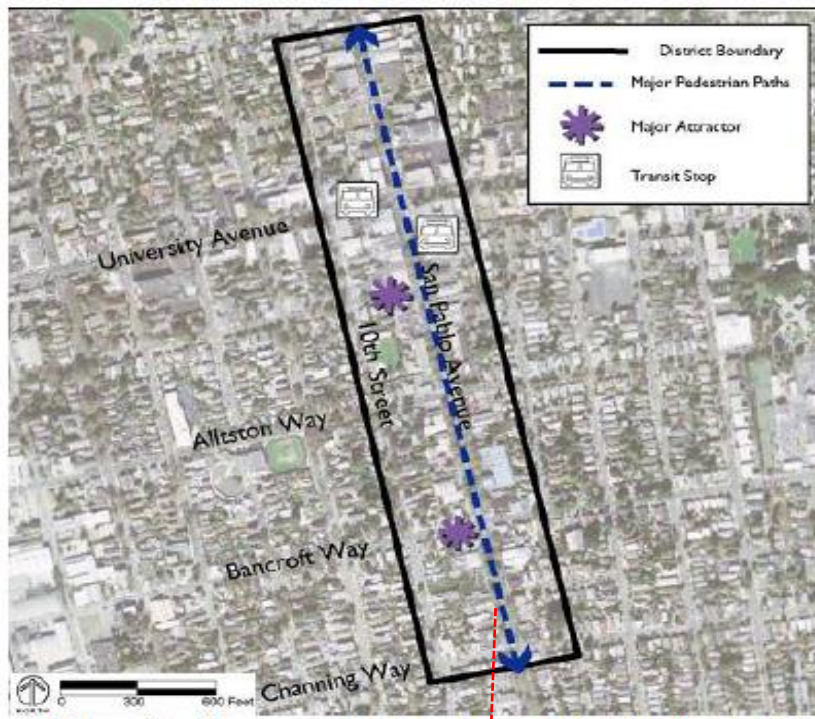
Source: Ministry of Transport, Singapore, 2003

2.8.2 San Pablo Avenue District, West Berkeley- California

The San Pablo Avenue is located in Berkeley, Alameda County in California. The district is a half-mile (5 blocks) long corridor covering approximately 20 acres. Single family residential uses and some multi-family housing surround the corridor. San Pablo Avenue (State Route 123) is a north-south four-lane arterial street with a median strip that extends through West Berkeley and the East Bay. San Pablo Avenue has a long history as a busy transportation and commercial corridor. Cyclists and pedestrians from the surrounding neighborhoods use the corridor to access transit, businesses, schools, and other uses, and the corridor's specialty shops draw people from other parts of Berkeley and the region.

The district has a long-established cycling infrastructure, including wide pedestrian and cyclists side-walks, street trees, crosswalks, and median refuge islands, which all help to create a comfortable walking environment.

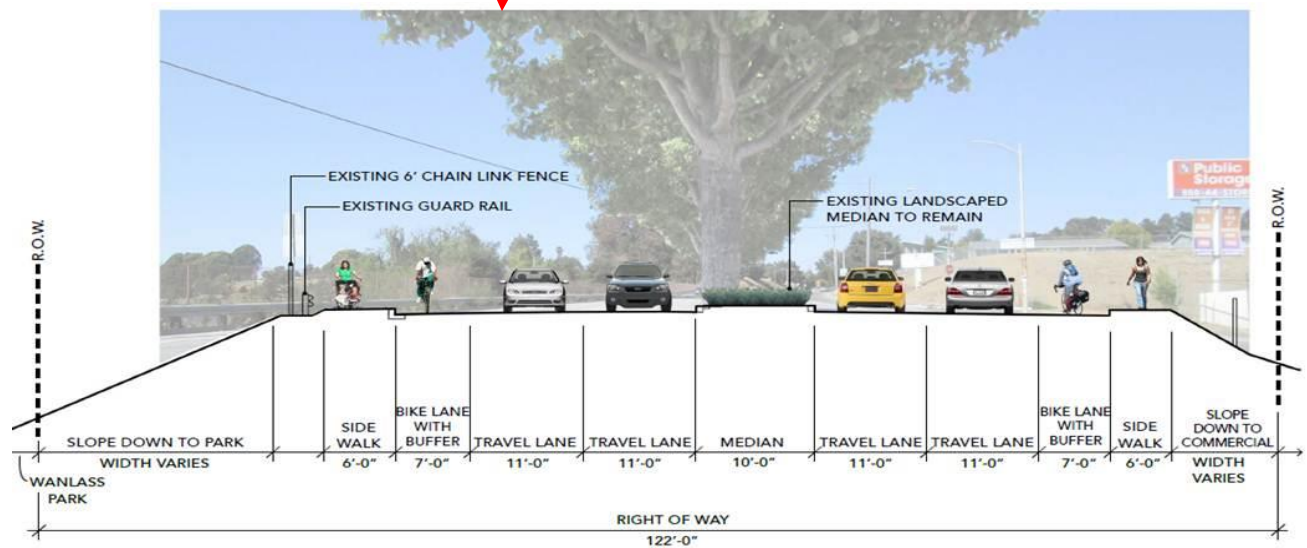
Figure 6: San Pablo Avenue



Project components

Wide sidewalks
 Landscaped median
 Curb extensions
 Trash receptacles
 Bike parking
 Bus shelters
 Benches
 Street trees

Source: Metropolitan Transportation Commission: Pedestrian Districts Study (2014)



Source: <https://bikeeastbay.org/sanpabloave> Accessed on 11.07.2015

Experience and Lesson Learnt

Creating this avenue in West Berkeley led to the following impacts:

1. A diverse array of retailers that provide daily essentials and specialty items, drawing both local and regional visitors
2. Wide pedestrian and cyclist lanes with mature street trees creating a comfortable walking and cycling environment.
3. All-weather bus shelters with changeable message signs and bike racks provided to encourage transit use.
4. The mix of uses on the district, including housing above retail, reduces auto dependency and encourages walking.
5. Regular maintenance and sweeping helps to keep the area attractive and comfortable for pedestrians.

The city of San Pablo has a well-designed ‘complete avenue’ that enhances complete street general policies, designation of circulation system and incorporates more multimodal designations. Its main objective was to a common community-led approach to handle issues arising from the implementation of dedicated cycling tracks. The area was identified as a commercial node in the General Plan, which is defined as “a commercial area small enough for people to comfortably cycle or walk around in.”

2.8.3 Historical overview of cycling in The Netherlands

Prior to 1900 cycling was not given priority when it came to transportation in the Netherlands. Bicycle usage increased thereafter continuously in the first half of 20th century and reached a peak around 1950, before the usage started to decline majorly due to competition from the motor vehicle. One theory as to why the popularity of cycling increased was due to the fact that the cities there were old by the time the motor vehicle came along. The existing built environment provided a planning constraint which made it difficult to comfortably accommodate the vehicle and so bicycle transport continued to prevail.

With the increase of the motor transport between 1950s and early 1970, there was increase in traffic related accidents because the roads were narrow. This endangered cyclists and pedestrians and there was an outcry in the country which led to protests. Around the same time, in 1973, there was the world oil crisis which acted as a factor towards the growth of the bicycle

transport. During this period the government declared the need to become less dependent on foreign energy and so government policies began to actively promote bicycle transport as a way of addressing the energy concerns. Car-free Sundays were launched which went on to making the cities more and more car-free. In the mid-1970 and 1980s, the government developed bicycle transport plans and the planned routes were constructed. Launching of this project was done in The Hague and Tilburg Cities where bicycle use steadily rose to 70% thereafter. The country integrated safe cycling into the school curricula which is still the practice today. Motorists are routinely trained to be aware of cyclists and there are also fines imposed on cyclists whenever they flout traffic rules.

The promotion of bicycle infrastructure as a matter of policy was not enough and legislators needed to discourage use of motor vehicle by making the car a less attractive form of transport. Taxes and parking restrictions were imposed which made the use of car expensive and inconvenient.

Figure 7: A Dedicated 2-way Cycle Track in the Netherlands



Source: www.holland.com, accessed 22.07.2016

Lessons learnt

Bicycle usage in the Netherlands increased in the first half of 20th century. This later declined as the car pushed its way through to become the preferred mode of transport. Due to increased traffic accidents, there was protest and people championed against the motor vehicle. This led the government to start promoting the bicycle usage. The oil crisis of 1973 acted in favour of bicycle transport because the government considered bicycle transport convenient since it did not require foreign energy (fossil fuel energy). Promotion of the bicycle transport was done by providing dedicated cycle track and sensitizing (by training) the masses on merits of use of the bicycle transport. Measures were also put in place to deter people from using the bicycle. As a result the bicycle usage grew and is now among the most important mode of transport in the Netherlands.

2.9 Conceptual Framework

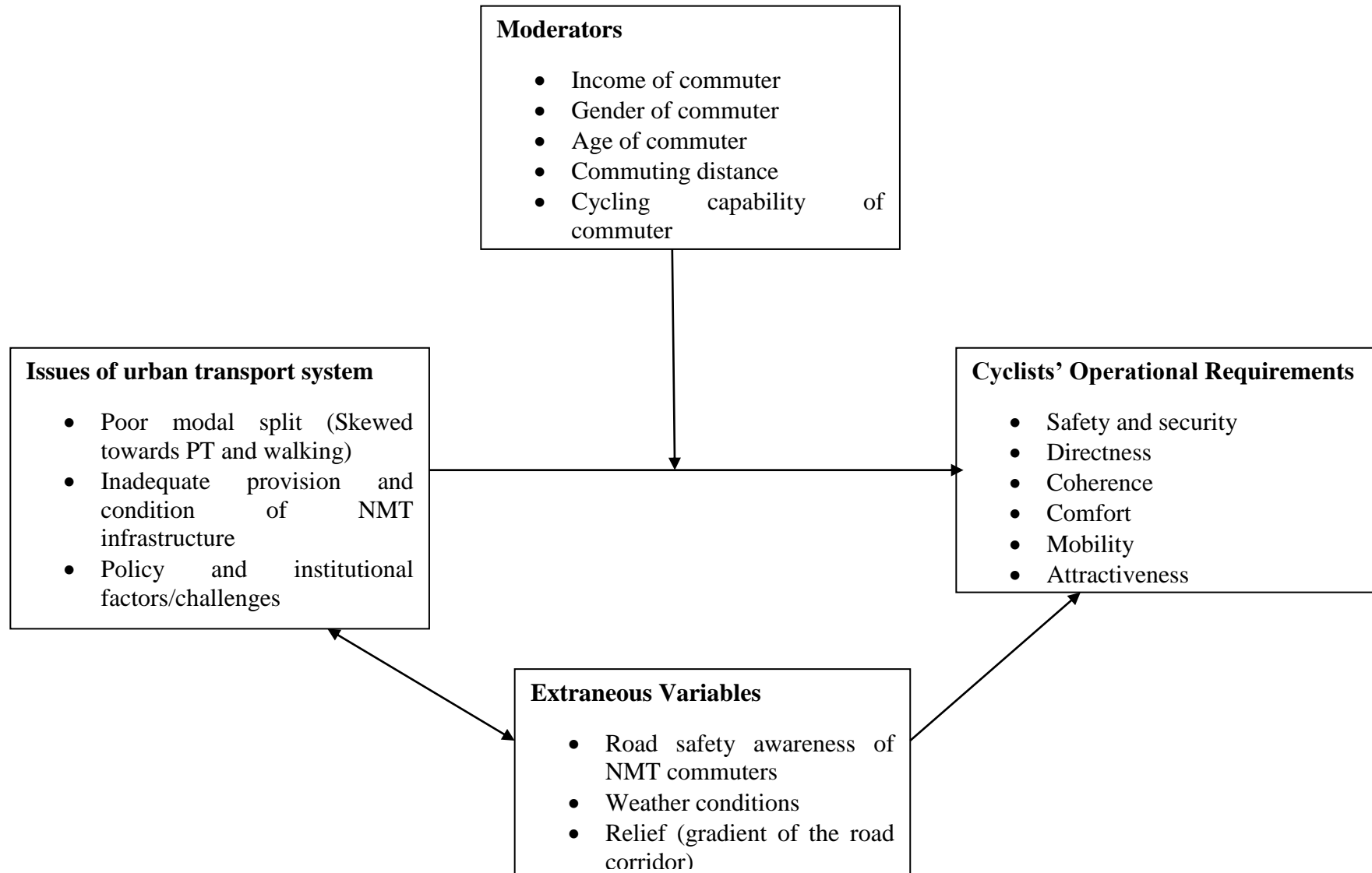
Improvement of public transport, non-motorized transport and ensuring sustainability cannot be disregarded as literature shows that demand of NMT use has a significant share in the transport sector. There is a critical concern to ensure adequate provision for metropolitan wide non-motorized transport, mobility network. Due to the many authorities handling transport sector, sometimes there is overlap of responsibilities. This therefore render some roads remain unmaintained or take too long to be constructed.

Integration of an efficient, reliable and sustainable cycling lanes and other NMT facilities along urban roads needs to address the issues of safety, sustainability, equity, vitality, and health by targeting specific areas of poor safety, poor quality infrastructure, or high volume potential in an organized, efficient manner. From literature review it can be concluded that bicycle transport is considered a convenient means of transport which is affordable. Unfortunately, where no dedicated bicycle track system exists, the modal split conflict between the bicycle and automobiles often result in accidents. Bicycle offers a transportation means which is less tiring than walking and one that is not adversely affected by traffic congestion. As such it is fast and reliable time wise for short distances. By providing bicycle track system many pedestrians who opt to walk for fear of being involved in accidents in case they ride would now opt for the bicycle. Commuters who strain to pay the high fares would also step out of the *Matatus* and go for the bicycle. The *Matatus* and buses would lose demand and therefore lower and stabilize the fares they charge.

Riding bicycle would make people to have body exercises while travelling. This would in turn reduce the sedentary lifestyle diseases. Cycling does not involve burning of fossil fuels and therefore environmental pollution would be reduced. In conclusion effective NMT transport planning requires a vigorous examination and understanding of the full range of road policy and institutional actors. This facilitates the generation of optimal satisfactory design solutions and the use of streets and spaces, by all modes of transport, including NMT. While this has been a missing gap in the Kenya cities, absence of a national policy and an integrated transport plan, as well as the existing bias of administrators and decision makers towards motorised transport, there are signs of hope as reflected in the emerging innovative approaches to NMT provision used by a combination of actors/drivers.

Thus issues to be addressed include; equity sharing of the modal split which is currently skewed towards public transport and walking with the latter taking the largest share, inadequate provision and conditions of NMT infrastructure, and policy and institutional challenges. These issues should be addressed with the aim of meeting the operational requirements of NMT namely; safety and security, Directness, coherence, comfort, mobility and attractiveness. Factors such as age of the commuter, gender, origin-destination and income would be moderator variables. There would also be extraneous variables that would come into play namely; road safety awareness of NMT commuters, weather conditions, and gradient of the road corridor.

Figure 8: Operational Conceptual Model



CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Overview

The purpose of this chapter is to introduce the research strategy or procedure applied in this study. It describes the research methodology, the sample selection procedure, the procedure used in designing the instruments, collecting the data and finally gives an explanation of the statistical procedure used to analyze and present the data. A summary of the data need matrix is presented at the end of this chapter.

3.2 Research Design

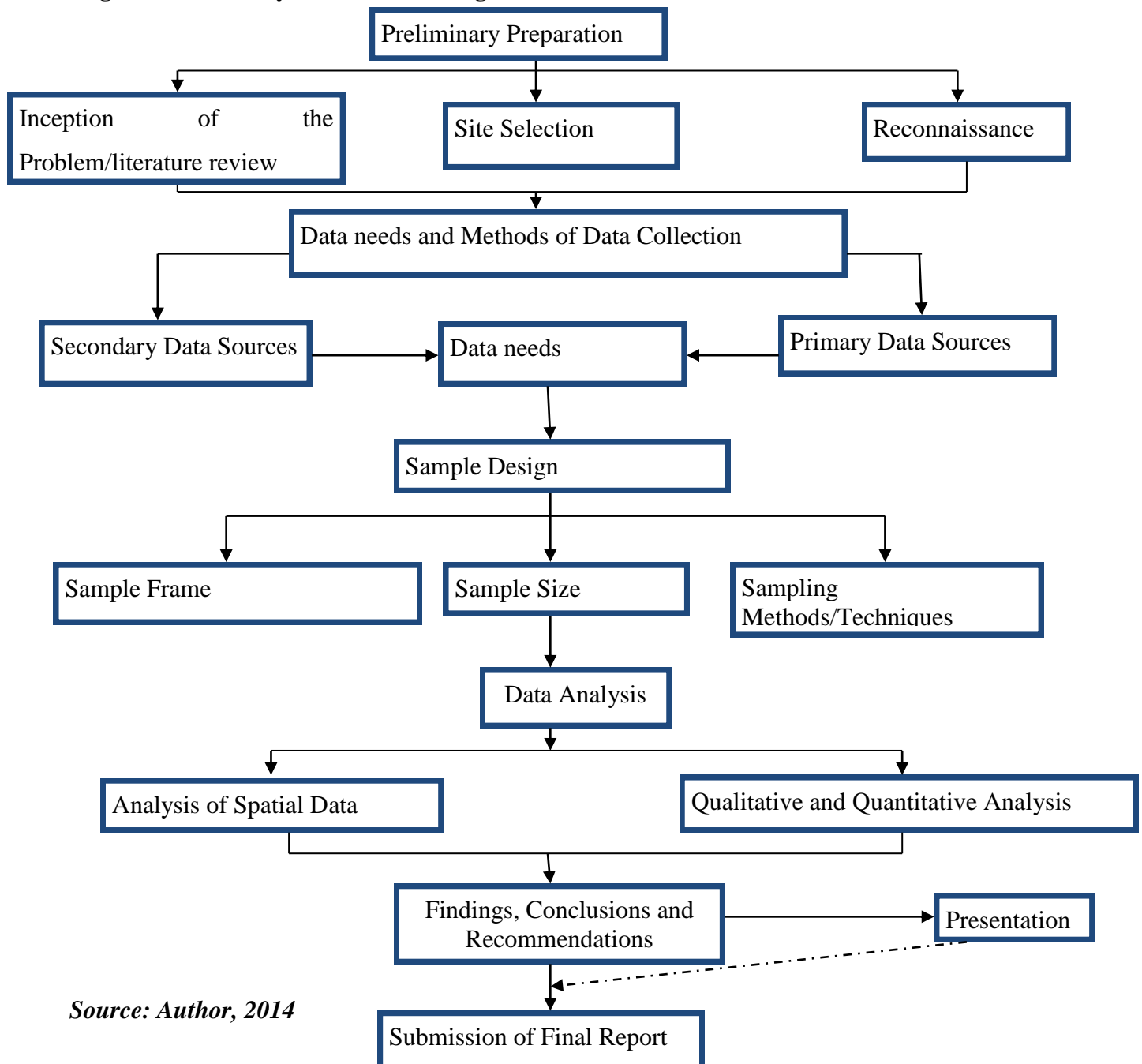
Research design can be defined as the roadmap of the researcher's investigation and the procedure the investigator wants to adopt to solve the identified problem (Anene, 1998). This study employed a descriptive survey design. It sought to examine the operations of bicycle transport along Ngong Road. Below is an outline of how the various steps were undertaken to ensure successful completion of this research: -

1. **Step 1:** The study started through inception of the idea and problem identification. This involved undertaking of a comprehensive literature review for purposes of conceptualizing the problem and identifying the gap that needed to be filled. It is also in this stage where a reconnaissance visit to the site was done by the researcher to have an overall view of the selected case.
2. **Step 2-**Methodological stage which summarized the type of survey to be done and the methods that would be used for data collection in the field. This stage also involved an analysis of all the stakeholders as well as budget formulation. A pilot study was carried out prior to the main study in order to ensure unforeseen errors are dealt with and relevant corrections made before the actual study is carried out.
3. **Step 3-** The actual field survey which started off by getting a research permits from University of Nairobi and National Council of Science Technology and Innovation (NACOSTI) in order to undertake the survey. This was followed by comprehensive data collection using different methods and instruments formulated in the methodological stage,

instrument administrations such as questionnaires were administered and interviews with key informants and relevant stakeholders held.

4. **Step 4**-This step was followed by analysis of the collected data. This involved data editing coding and finally analysis of the findings for purposes of scenario building.
5. **Step 5**-The final step was the report compilation and presentation of the research findings, recommendations and conclusions.

Figure 9: Summary of Research Design



Source: Author, 2014

3.3 Target Population and Sampling Plan

The study target population was the households of estates served by Ngong Road from Dagoretti Corner to the CBD and commuters who use Ngong Road as they go to and from their places of work. It was not possible to collect data from all the commuters who use Ngong Road during the peak hours. Sampling was done for the commuters who were either bicyclists, or pedestrians. For the case of the bicyclists the evening peak hours was capitalised on and convenient sampling method employed. Household questionnaires were also administered to various residential estates served by Ngong Road namely; Kibera, Jamhuri, Dagoretti Corner and Kawangware. Key informants that were interviewed were Kenya Urban Roads Authority, National Transport and Safety Authority and the Ministry of Transport and Infrastructure. Others were; traffic police department, Nairobi City County Government, the Department of Urban Development and National housing Corporation.

3.3.1 Sampling Design

Sampling is the selection of part of an aggregate of material to represent the whole aggregate/population (Mugenda & Mugenda, 2003). The case of this study employed the following:

- i. Purposive Sampling-* Purposive Sampling is applied to select individuals who concern themselves to the topic under study (Richie, Lewis and Elam, 2003). For example, it will target various key informants, groups, organizations and administrators who have relevant information concerning NMT along Ngong Road.
- ii. Random sampling-* Household questionnaires were administered randomly to the area neighbouring.
- iii.* Ngong Road from Kenyatta National Hospital to Dagoretti corner and the surrounding estates. To do this cluster random sampling method was employed. Using the formula in the table below where the sample size is n, margin of error E, N is the population size and x is the response distribution: a total of 68 questionnaires for households were administered randomly. See table 3:

$$n = \frac{N x}{(N-1) E^2 + x}$$

Table 3: Deriving the sample size

Population size	Confidence Level	Margin Error	Response distribution	Sample size (n)
43,122 (2009 Housing and population census)	90%	10	50%	68
		15		31
		20		15

Source: Author, 2014.

- iv. Convenient sampling-* From the pilot study, it was estimated that about ten (10) bicycles passed a point on the road every 30 minutes during the peak hours. This would translate to 120 no. of cyclists in the morning and evening peak hours. Convenient sampling method was used since the bicyclists were not many. It was not easy to stop a bicyclist heading to work place and start administering a questionnaire. Thus the evening peak hours was capitalized on.

3.4 Data Needs and Sources

A comprehensive data collection exercise was carried out in line with the objectives of this study. Two sets of data types were used i.e. primary and secondary data.

3.4.1 Primary Data

Primary data is data that is obtained directly from the field survey. These data included: -land use practices along Ngong Road; cyclists traffic counts settlement patterns in the study area; household characteristics such as education, household income, household sizes, assets owned etc.

3.4.2 Secondary Data

Secondary data is processed data that was originally collected, analyzed and documented by previous researchers on the same subject. Based on this study, this information mainly covered areas to do with the role of bicycle mode in urban transport, the status of bicycle infrastructure along urban transport systems, the challenges/constraints of bicycle mode of transport and plausible cyclists related planning interventions to properly integrate bicycle mode into urban transport system. Secondary data was obtained from reviewing of existing literature on existing national development plans, relevant text books, internet, relevant journals, existing policy

documents, published and unpublished research documents; newspaper articles, local TV programmes on Counties, the University of Nairobi libraries among others.

3.5 Data Collection Methods

The research used different methods for gathering the two sets of data, i.e. primary and secondary data. These were as follows: -

3.5.1 Secondary data

Secondary data was obtained by reviewing literature on NMT provision, previous research on the topic and the spatial entity of the study area, existing and revised policy guidelines and documents on Ngong road. This aided in the understanding of the area of study and establishing what had been previously uncovered by others in the same area of study. This data type was sourced from journals, internet sources, government publications, articles, maps etc.

3.5.2 Primary data

Primary data formed the main data source that informed the study. The main methods used to collect primary data included:

a) Administration of Questionnaires

This consisted of open and closed ended questions and other prompts for the purpose of gathering information from commuters and residents of estates along Ngong Road. The questionnaires were presented to the respondents and answered in written form. Direct household/pedestrians questionnaire administration was to further establish an understanding their opinion on the role of bicycle mode in urban transport, the status of bicycle infrastructure along Ngong Road, the challenges/constraints of bicycle mode of transport along Ngong Road etc. This was important in providing pieces of information, which were not readily available or obtainable by direct observations and which people were shy to disclose in group discussions.

b) Interview Schedules

Interview schedules were prepared to target mainly the key informants and stakeholders on NMT industry such the traffic police department, NCCG- officer in charge of Road and Transport

department, the Kenya Urban Roads Authority, Directorate of Urban Development, National Transport and Safety Authority and officer from the Ministry of transport and infrastructure.

Discussions with key sources took the form of individual interviews facilitated using a specific agenda of either directed/structured or non-directed/open ended or unstructured questionnaire schedules as appropriate. Discussions were useful in obtaining in-depth understanding of the role of bicycle mode in urban transport, the status of bicycle infrastructure along Ngong Road and the contributions of the interviewees to bicycle transport.

c) Direct observation

This tool of assessment involved actual observation of the bicycle transport infrastructure and facilities along Ngong Road such cycle lanes, street lighting, NMT safety infrastructure, etc

d) Traffic Counts

Traffic counts of the Bicyclists, Matatus, pedestrians, private cars and buses using Ngong Road at peak hours.

e) Mapping and Photography

Maps were employed to establish the spatial location of Ngong Road and the extent of the study area. Photographs of the area were taken to facilitate the analysis of the status of bicycle infrastructure along Ngong Road, the spatial/physical layout of land uses.

3.6 Data Analysis and Presentation.

Data analysis entailed the use of appropriate methods to synthesize data to answer the research questions as stated below:

Both qualitative and quantitative data was reviewed and analyzed along the themes provided by the detailed methodology. At the end of the fieldwork all data collected from the structured questionnaires was coded, entered, cleaned and analyzed using the Statistical Package for Social Sciences (SPSS) Version 20 which generated various frequencies, cross tabulation simple tables, pie charts, bar graphs etc. Content analysis of data from key informants

was done and findings incorporated in other findings. Interviewing key informants enabled clarification of issues which may not have been clear and thus enabled triangulation.

The quantitative data collected was presented by the use of charts, maps, plans, sketches, illustrations and photographs. Sketches and photographs were equally used to illustrate data, which was discussed in descriptive analysis, for example in illustrating condition of cyclist infrastructure along Ngong road etc. The in-depth interviews, reviews of policies and regulations with relevance to NMT provision along Ngong Road was also analyzed and organized as well, then presented in form of descriptive and analytical reports.

3.7 Limitations of the Study

The study had the limitation that cyclists and pedestrians were interviewed during the peak hours only. The study did not come up with the transportation scenario during the off-peak hours. Since the cyclists and pedestrians were mainly interviewed as they came from work, most of them could only offer limited time for the interview. This affected the depth of probing that the researcher could do. The study intended to interview African Bicycle Network (an organization promoting bicycle transport) but this was not possible as the contact address available were no longer operating.

Table 4: Summary of Data Need Matrix

Objective	Data Needs	Sources Of Data	Method Of Data Collection	Expected Output
To establish the role of bicycle mode in the urban transport system.	Modal split, Traffic conditions at various points of the road, Road design and capacity	Primary sources, Literature review or secondary sources, Records at the Traffic police offices, Records at the City Transport office, Field observation	Observation, Photography, Mapping, Questionnaires administration, Interviews, Analysis of existing literature	Understanding of the role of bicycle mode in the urban transport system
To investigate the status of cyclist's infrastructure on road designs along Ngong Road in Nairobi.	Cyclist's infrastructure, NMT road designs, Catchment population size and characteristics, Travel patterns, Land uses along the road and a land use map of the area, Road network patterns.	Literature review-existing policy documents, relevant journals, TV programmes, development plans, library and primary sources	Reviewing of exiting literature, interviews, FGD, Questionnaires administration	Establishing what is the status of cyclist's infrastructure on road designs along Ngong Road in Nairobi.
To examine the challenges/constraints of bicycle mode of transport along Ngong Road in Nairobi.	Cyclist's infrastructure, NMT road designs, Catchment population size and characteristics, Travel patterns, Land uses along the road and a land use map of the area, Road network patterns, and modal split.	Field survey, key informants, county government, ministries and review of existing literature in development plans, journals, magazines etc.	Reviewing of exiting literature, interviews, Questionnaires administration	In-depth understanding of the challenges/constraints of bicycle mode of transport along Ngong Road in Nairobi.
To propose plausible cyclists related planning interventions to properly integrate bicycle mode in urban transport system along Ngong Road.	NMT policy from Kenya and other countries, Opinions and suggestions from households, key informants;	Case studies, key informant interviews, and review of existing NMT literature in development plans, journals, magazines etc.	Reviewing of exiting literature and Questionnaires/Interviews	Developing plausible cyclists related planning interventions to properly integrate bicycle mode in urban transport system

Source: Author, 2015.

CHAPTER FOUR

BACKGROUND OF THE STUDY AREA

4.1 Overview

This chapter gives an overview of the study area such as the background information in thematic areas such as the location context of the study area, the physiographic aspects, geology & soils, hydrology, climate and vegetation, human settlements, natural resource base, resource use, land use, settlement patterns and demographic characteristics among others.

4.2 Historical Development of Nairobi

4.2.1 Colonial Era

The city of Nairobi, like many other major urban centers in Kenya, owes its birth and growth to the Uganda Railway (Akumu, 2002). The railhead reached Nairobi in May 1899 to the present day Kisumu that was then part of what is Uganda. The moving of the railway headquarters from Mombasa to Nairobi resulted in the subsequent growth of Nairobi as a commercial and business hub of the then British East Africa protectorate (Situma S., 1992).

Founded by the British in 1899 as a simple rail depot on the railway linking Mombasa to Uganda, the town quickly grew to become the capital of British East Africa in 1907, and eventually the capital of a free Kenyan Republic in 1963. The City and its surrounding area also form the Nairobi City County. During Kenya's colonial period, the city became a centre for the colony's coffee, tea and sisal industry. By 1900 Nairobi had already become a large and flourishing place with the settlement consisting mainly of the railway buildings and separate areas for Europeans and Indians/Asians, the latter being mainly the laborers employed on the construction of the railway. There was practically no African settlement. In the same year 1900, Nairobi assumed the function it was to perform as the capital of Kenya, with the boundary of the urban centre being defined. In 1907 Nairobi was made the capital of Kenya. Later in 1950, Nairobi was made a city.

4.2.2 Post Colonial Nairobi

Nairobi is the capital city of Kenya and one of the most important economic centres in East and Central Africa. Due mainly to population migration from rural area, its population had grown to 3.1 million in 2009 (KNBS, 2010) and the trend continues. In addition, urban problems such as

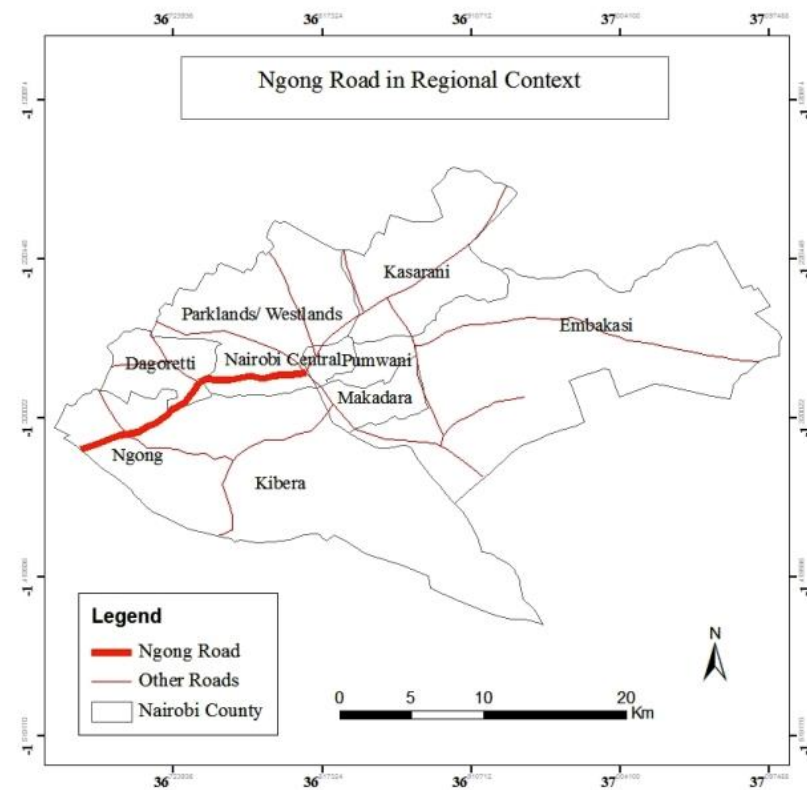
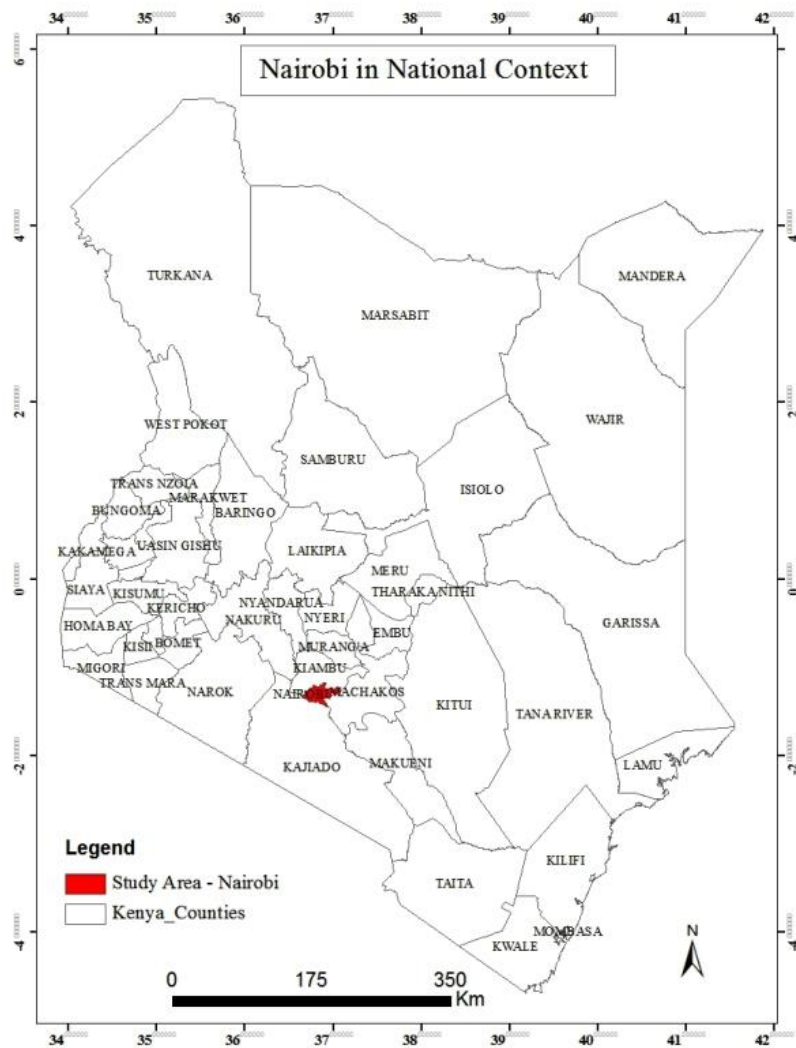
perennial traffic congestion, expansion of slum area, and environment deterioration have been left unsolved for a long time and are already causing negative impact on the economic activities and daily lives of the people in Nairobi City. In order to accelerate sound and sustainable development, an integrated urban master plan has to be prepared, and thus, transport network, water supply and sewerage, solid waste management, and living environment have to be improved. As mentioned earlier, Nairobi City loses KSh. 50 million daily (IBM Corporation, 2014) which translate to 18 billion annually due to traffic congestions. Commuters spend a lot of time on the road and a lot of funds are spent on fuel. Lack of reliable public service transport makes many to strive to own private cars for use when travelling to and from work. There is therefore need to provide an affordable alternative means of transport that will decongest the motor traffic, noting that the congestion is set to increase with increase of population influx into the city. The alternative mode of transport popular with the city residents is walking, accounting for 47% of the modal split. Despite having the largest single modal share walking lacks the supportive infrastructure in many of the city roads. There is need to provide these pedestrians with a more efficient, faster and affordable means of transport such as bicycle transport, of which infrastructure lacks in the city's transport system.

4.3 Location Context of the Project Study Area

Ngong Road is classified as Road C60 and has a road reserve of 60 metres. Its function is that of Principal Arterial road (NCC). It starts at the junction of Haile Selassie avenue and Uhuru highway and runs in a westerly direction up to Dagoretti Corner roundabout before turning to south westerly direction up to Ngong Town which is located at approximate 15 kilometres away. Currently the road is a two-way traffic with a single lane to each direction. The graphical presentation of the study area is represented by map number Appendix 1.

At Dagoretti Corner, Ngong Road joins Naivasha Road, which is classified as C61 and runs in a North Westerly direction to serve Kawangware area before branching to Uthiru market centre and Kikuyu Township.

Figure 10: National and Regional Context of the Study area



Source of Basemap: Survey of Kenya

4.4 Project Area Physiographic Conditions

4.4.1 Topography

The Nairobi City is characterized by undulating hilly topography with an elevation ranging from 1,460m to 1,920 m. lowest elevation occurs in the Athi River at the eastern boundary of the city while its highest is at the western rim of the city. It is unique that it has the Nairobi National Park with an area of 117 km² within its administrative area, extending along the western boundary and attracting a large number of international and domestic tourists annually. The gradient of Ngong Road within the study area is gentle except for Upper Hill area and the Haille Selasie roundabout. Thus the topography of the road is good enough to support bicycle transport.

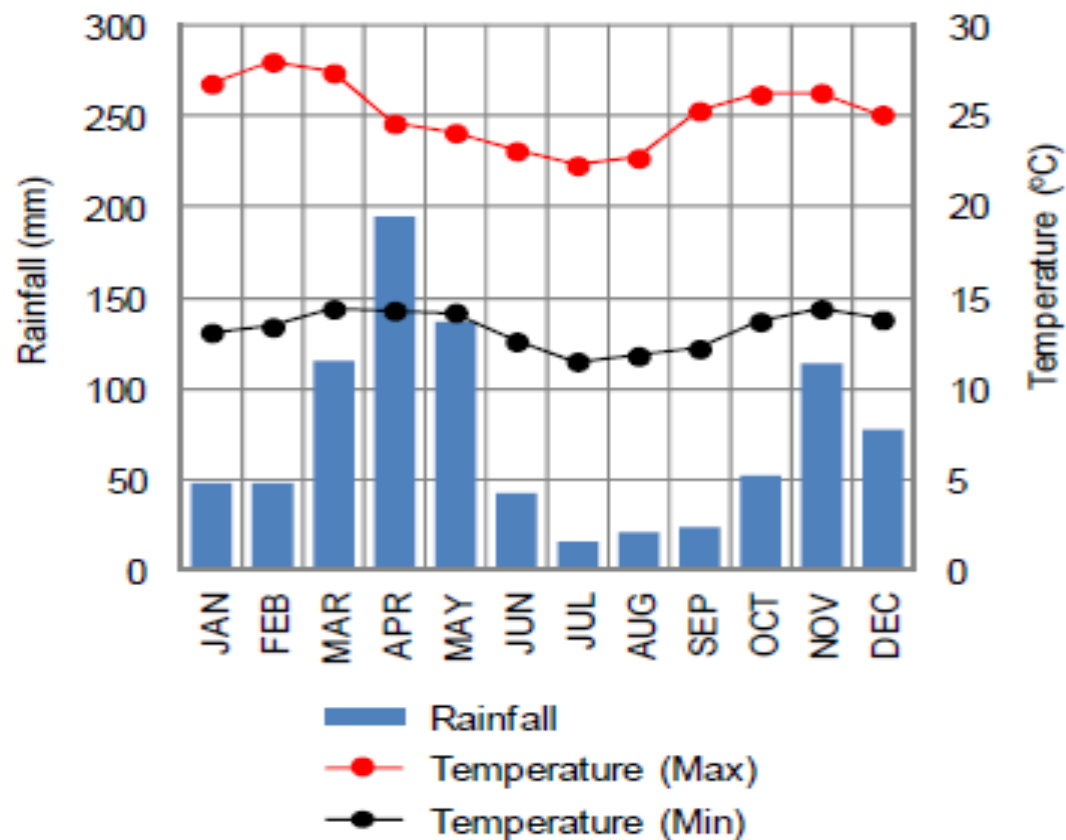
4.4.2 Geology and Soils

Ngong Road being in Nairobi county has the same geology and soil characteristics as the whole of Nairobi which is predominantly underlain by the Nairobi phonolytes of middle Pliocene rocks and extensively quarried for use as concrete, road stone and railway ballast. They are found about 2-3 feet below the ground (Muraguri, 2008). The area falls under the upper Athi basin where the Athi plains phonolite have weathered into black cotton soil of up to ft. in depth with secondary Kunkar formation at the junction with the parent rock (Muragiri, 2008). Within the study area, soils are generally black cotton with a depth of about 2-3 ft. This type of soil is not usually fertile and supports mostly shrubs as natural vegetation. Therefore due to the black cotton type of soil cover the study area can be slippery during rainy season and the soil develops wide cracks during sunny seasons. There is therefore need to provide a stable road surface to facilitate bicycle riding.

4.4.3 Climate

The climate in Kenya is primarily influenced by the movement of the Inter-tropical Convergence Zone (ITCZ) and by the topography. The climate in Nairobi City is usually dry and cool between July and August but hot and dry between January and February. The average annual rainfall in Nairobi City is about 900mm. The first peak of monthly rainfall occurs in April and the second peak takes place in November. The mean daily maximum temperature by month ranges from 28 °C to 22°C and the minimum ranges from 14 °C to 12°C.

Figure 11: Weather Pattern in Nairobi



Source: Nuplan, 2015

From the weather pattern graph above, it can be deduced that cycling may be a challenge during

the rainy seasons (March-May and October –December). Cycling can also be a challenge during the hot months of January and February. A consideration should be made of the possibility of providing a roof over any cycling track that may be provided to make cycling an all-weather mode of transport.

4.4.4 Sun and Wind Path

The monsoon wind generally blows through this area from the North East and to a lesser degree to the South East. The winds are high in January, February and March and they coincide with a period of higher potential evaporation. The strongest winds occur during the dry season just prior

to the long rains with speeds of up to 25 miles per hour especially from mid-morning to early afternoon.

Nairobi experiences a total of about 2500 hours of bright sunshine per annum, which is equivalent to annual mean of approximately 6.65 hours of sunshine per day. July and August are characterized by cloudiness and during these months the average daily sunshine in Nairobi is 4 hours. There is about 30% more sunshine in the afternoon than in the morning and it follows that westerly exposures receive more isolation than easterly ones. It can be concluded that there is generally enough day light to support bicycle transport from morning to evening. For people working from 8 am to 5 pm it would be convenient for them to ride under sunshine light.

4.4.5 Vegetation

Ngong Road and its neighbourhood have a lot of shrubs, trees which are both natural vegetation planted. Also it has planted flowers and hedges (<http://www.unhabitat.org/content.asp>). Most of the existing vegetation cover consists of trees, grass and flowers planted by residents. The trees can provide shade to bicyclists during sunny seasons.

Figure 61: Vegetation along Ngong Road



Source: Field Study 2014

4.5 Population and Demographic Characteristics of the Project Area

The expansion of Nairobi city presents a mirage of planning and development challenges that are not only synonymous with the city, but also adjacent regions. During the 1999-2009 period, areas adjacent to the city experienced higher urbanization rate than the city itself (IUDMP, 2014). The city's overall population density is 3,079 people per square kilometre (CBS 2001). Dagoretti North Constituency in which the study area falls has a population density of 9,721 persons per square kilometer as per KNBS Statistical Abstract of 2014 (Kenya, 2014).

4.5.1 Population Characteristics

The city's population is increasing sharply and is estimated to reach over 5 million by the year 2030. This presents increased demand for services that the city cannot provide. Below are tables showing the population growth in the city and population projection for 2030. Dagoretti North where the study area is situated had a population of 106,208 persons in 2014 (Ibid, 2014)

Figure 12: Nairobi population growth

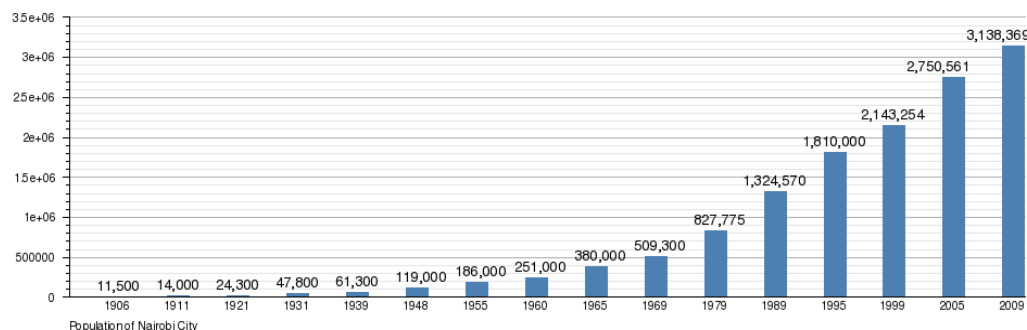


Table 5: Nairobi population projection (2009-2030)

Year	2009	2013	2018	2023	2030
Nairobi	3,138,369	3,601,351	4,174,952	4,677,677	5,212,500

Source: JICA study team (2014) and Population census 2009

The population growth rate of Nairobi has been considerably higher than that of Kenya. The average annual growth rate of Nairobi was 4.2% based from the 1989 Census to the 1999 Census and 4.0% based from the 1999 Census to the 2009 Census, while that of Kenya was 3.0% in both periods.

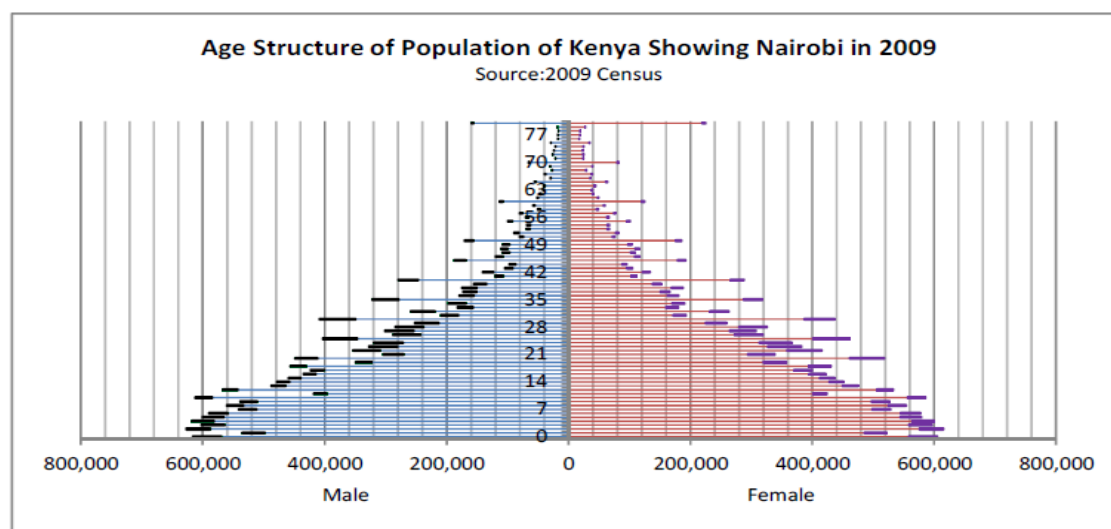
4.5.1.1 Day-time Population

Work Places-Based on the business registration data of NCC in 2013, the total number of formal workers was estimated at approximately one million. On the other hand, based on the 2009 census, the number of active employees who lived in the city was estimated at 1,648,000 in 2013. By assuming a net in-flow of 165,000 commuters from outside the city based on the cordon line survey, the total number of jobs in the city was estimated at 1,813,000 and the number of informal workers was estimated at 813,000.

4.5.1.2 Age structure

The age structure of the population of Kenya in 2009 formed a shape of a pyramid while that of Nairobi City showed a pair of wings with large share of population consisting of people around their twenties.

Figure13: Age Structure of Nairobi City



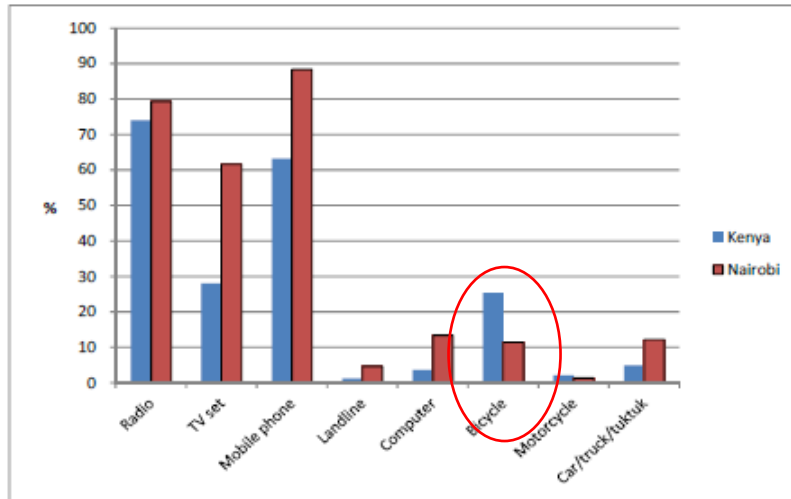
Source: JICA study team (2014) and Population census 2009

4.5.2 Social Economic Characteristics

a) Ownership of Bicycle

The percentage ownership of bicycle in Nairobi city stands at 12% compared to the national average of 25%. This is according to the 2009 national population and housing census. Therefore the percentage of people in Nairobi who use bicycle is below the percentage at national level. This means that the bicycle is not a popular means of transport in Nairobi as it is in the rest parts of the country.

Chart 1: Ownership of Bicycle in Nairobi City



Source: 2009 Census

According to NIUPLAN (2015), only 12% of the Nairobi City population own bicycle compared to national statistics where bicycle ownership stands at 25%.

Source: JICA study team (2014) and Population census 2009

4.5.3 Land Use Analysis

Land use planning is one of the key tools of land management in Kenya. It has been used as a means of controlling developments for the achievement of sustainability, economy and compatibility of land uses.

4.5.3.1 Land Use Activities

The land uses along Ngong road are mainly commercial, residential and community facilities. Ngong Road is fast transforming into a commercial corridor with centres such as Kenyatta National Hospital, The City Mortuary, Nairobi Baptist Church, Nazarene University Central Campus, Uchumi Ngong Road Hyper, Nakumatt Prestige supermarket, Adams Arcade commercial centre, Nairobi women hospital, Impala Club, Kenya Science campus (University of Nairobi), The Junction Nakumatt Shopping Mall, Dagoretti Corner Shopping centre. The transformation into commercial hub has pulled huge traffic into the area which has compounded the congestion that the area used to experience, noting that the volume capability of the road remains the same.

4.5.3.1.1 Land Tenure

The predominant tenure system along Ngong Road is private leasehold. This follows the disposal of government properties owned by the government, the then Nairobi City Council, and Parastatals such as Kenya Railways and Telkom Kenya. There has also been a large influence on the scale of development activity going on in the area since more land was made available for private development (Waweru, 2007).

4.5.3.1.2 Transportation

Transport is an important component of any spatial development plan. Transport impacts in a profound way the spatial structure of a city and its region. It is also a factor that determines the directions of growth. Transport affects the economic viability and social mobility of the region and its people and consumes a large share of the resources (land, capital, time environment.).

i. Ngong Road Transport Network

Ngong Road, currently a standard carriageway with two traffic lanes, is a major road in Kenya that links the city of Nairobi to Ngong town. About 47% of Nairobi's population that uses this particular road either cycle or walk to their places of work. To note is that there is inharmonious interaction between MT and cyclists along Ngong Road where cyclists have been seen as nuisance and intruders of space meant for the MT leading to related accidents

ii. Traffic Volume

Ngong Road links Nairobi CBD all the way to the Ngong town, passing through major places in Nairobi and Ngong such as the Kenyatta National Hospital, The Junction Mall, the Lang'ata Road roundabout in Karen, the Ngong Market to Kibera slums.

For decades, plans throughout the city for new roads construction and upgrades have only partially provided physical infrastructure for NMT users. Traffic volume and proportional distribution of Ngong road is below:

Table 6: Proportional Distribution of Ngong Road Traffic

Road	Location	AADT 2010	% of AADT
Ngong Road	West of Karen RA	8088	5.70%

Note: AADT – Annual Average Daily Traffic

Source: Draft Nairobi Metro Spatial Plan, 2011

a) Cycling and Non-Motorized Transport Facilities Along Ngong Road

Cycling and walking is a key element of a balanced urban transportation system. It is an integral element in the majority of trips made by other modes. Along Ngong Road, it is the predominant mode of travel. The increased numbers in the population are generating trips which are split into the modes of vehicular, pedestrian and cyclists' traffic. Ngong Road lacks NMT infrastructure and with the increased traffic received by this road, there is need for provision of pedestrian walkways, cyclists' routes and installation of street lights.

b) Environmental Degradation

Along Ngong Road, environmental degradation is on a spiraling increase as more vegetation cover is cleared to pave way for urban developments. As a consequence, increased concrete works, interference with the natural drainage systems has resulted in increased surface run-offs and even flash flooding. The road also experiences noise and air pollution due to highly motorized traffic.

4.6 Major Estates served by Ngong Road

Ngong road serves several residential and commercial estates/centres. Among them are as listed below.

- a) Ngumo Estate*-This is a middle income residential estate which is about 5 kilometres South of Nairobi city centre. It is connected to Ngong Road via Mbagathi Road.
- b) Lavington Estate*- This is a suburb of Nairobi city and is a high income residential estate located about 10 kilometres West of Nairobi.
- c) Kawangware*- Kawangware is mainly a slum estate situated about 15 kilometres West of Nairobi. It has a population that is ethnically diverse. There is a striking characteristic of many churches. It has one of the major open air markets in Nairobi and cash flow is assumed to be high which may be supported by the many banks present in the area. There is traffic congestion especially near the open air market due to many businesses which have encroached onto the road and impunity of motorists. Kawangware is linked to Ngong road through Naivasha road and forms a major catchment of traffic along Ngong road.

- d) Kibera-** Kibera is a slum estate with an estimated population of about 411,760 people based on 2009 census which gave Kibera's population as 355,188 and a general population growth rate of 3% in the country. Majority of the people are low income earners. Kibera estate is connected to Ngong Road through many roads including the above mentioned Mbagathi Road. This is because the slum is expansive running along the Nairobi-Kikuyu railway line which also offers a popular means of transport especially those who commute to work in the morning and evening in town. During the study majority of bicyclists were found to be coming from

Figure 14: A section of Kibera Slum



Source: University of Nairobi Urban Studio 2012

- e) Jamhuri Estate-**This is a middle income earners residential estate which is off Ngong road but with connecting roads from Ngong road to it.
- f) Dagoretti Corner-**This is also known as Karandini Trading Centre. It is a commercial hub popular for motor vehicle repair, roasted meat joints and hardware shops. Many high rise buildings have been sprouting up in this area with lower floors being dedicated to commercial use and upper floors being used for residential purposes. It is situated at the junction of Ngong Road and Naivasha Road.

- g) Karen-**This is a high class suburb residential estate which is about 20 kilometres South West of Nairobi. During the colonial days the area was mainly inhabited by the whites. Ngong Road traverses Karen.
- h) Ngong-**Ngong area which is about 30 kilometres south west of Nairobi city was a major white settler farming region popular for livestock keeping. A veterinary research institute was started there during the colonial days. There is ethnic diversity in the region and many middle income earners have settled there. Large PSV buses are popular in transporting commuters besides the private cars. Ngong is in the County of Kajiado.

CHAPTER FIVE

RESULTS AND DISCUSSIONS

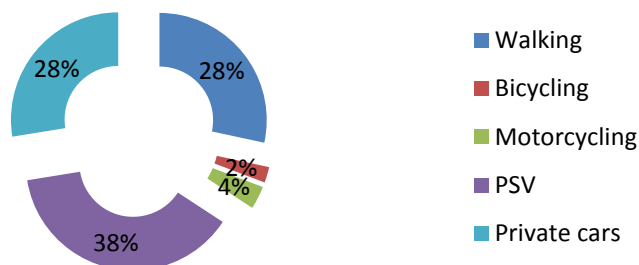
5.1 Overview

This chapter opens with presenting the modal split for Ngong road as observed in the morning peak hours followed by social economic of the attributes of those who were interviewed. Further, based on the objectives of the study, it presents the findings and analysis of the role of bicycle mode in urban transport, the status of bicycle infrastructure along Ngong road, the challenges/constraints of bicycle mode of transport along Ngong road and lastly recommend possible cyclists related planning interventions to properly integrate bicycle mode into urban transport system along Ngong Road.

5.2 Modal Split along Ngong Road

Mode of Transport	Pedestrians (Walking)	Bicycle	Motorcycle	14-Seater Matatus	Large buses	Private Cars
Count	2939	246	360	144	28	1902
No. Of commuters	2939	246	360	2419	1540	2853
				Total PSV commuters=3959		
Assumptions	Private car ferried 1.5 passengers					
	14-seater Matatus carried full capacity during peak hours					
	Large buses ferried on average 55 passengers and were full capacity					

Modal Split along Ngong Road



Source: Field Study 2015

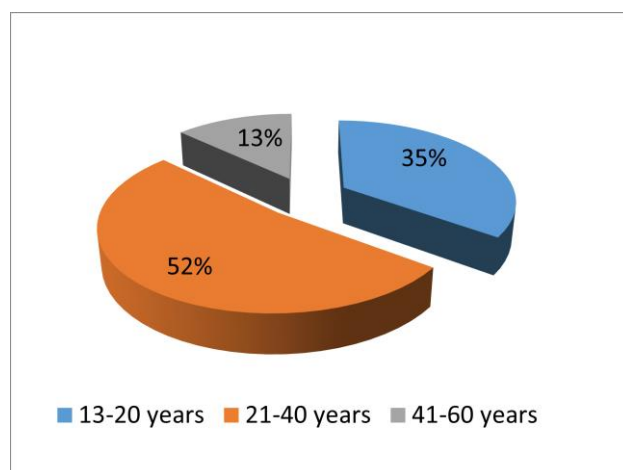
From the chart it can be inferred that there is an equal number of pedestrians as those who use private cars standing at 28%. Public service vehicle commuters formed the largest number with 38%. Motorcyclists along Ngong Road were 3.5% while bicyclists were 2.5% .

5.3 Social Economic Characteristics

The following are the social economic characteristics of the study area.

5.3.1 Age and Gender

Chart 2: Age Distribution of Respondents



For the cyclists' interviews, majority of them were male (96.9%) and a large number of them were within the age brackets of 21-40 years an indication that most cyclists are of middle aged-population. A majority (92.3%) of the cyclists interviewed owned a bicycle. Most of those who owned bicycles or tricycles (62%) used them to run personal errands, although an equally significant number (38%) used them for commercial purposes.

Source: Field Survey, 2015

5.3.1 Occupation and Income Levels

From the field survey, 46% of the respondents worked in the formal sector, 28% worked as casual labourers, and 16% ran small scale businesses while 10% were not employed. Majority that is 62% earned between KSh.10001 and KSh.30000. 14% earned less than Ksh. 10000. 12% earned between 30001 and 50000 while 6% earned between 50001 and 70000. Cross tabulation between mode of transport and income levels of the respondents reveal that most of the people who cycle to work or school earned below Ksh30,000 per month, out of which 45% are casual labourers, 14% are formally employed, 3% engaging in business while 38% are unemployed.

Table 7: Income versus Common Mode of Transport To school Or Workplace

Common Mode of Transport To school Or Workplace		Average Salary				
		Below 10000	10001-30000	30001-50000	50001-70000	Above 70000
	Walking		81.3%	12.5%	6.3%	
	Bicycle Riding		100.0%			
	Public Transport	25.9%	48.1%	11.1%	3.7%	11.1%
	Private means			50.0%	50.0%	

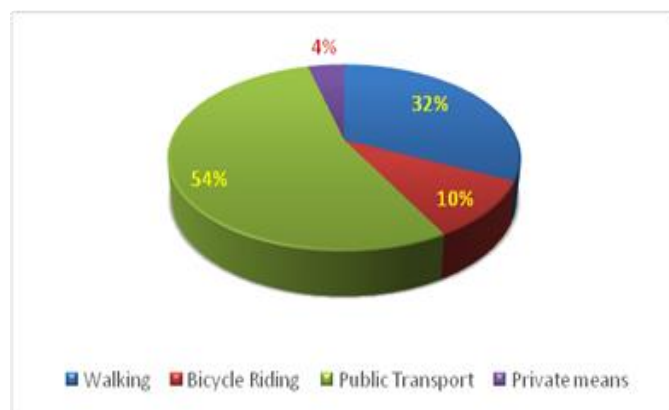
Based on the high cost of living in Nairobi, the above results show majority of the cyclists fall under the low income category hence buying and maintaining a bicycle is quite expensive for them.

Source: Field Survey, 2015

5.3.2 Common Mode of Transport to School or Workplace

From the research, 54% of the respondents interviewed used public means as their common mode, 32% walked to their places of work or school, 10% used bicycles to commute while 4% used private vehicles. Based on this research it's evident that quite a number of cyclists commute to work places or schools along this busy road. On further analysis, out of the 10%, a majority (92.3%) of the cyclists interviewed owned a bicycle out of which 62% used them to run personal errands, although an equally significant number (38%) used them for commercial purposes.

Figure 7: Common Mode of Transport along Ngong Road



From the above findings it's evident that quite a large population of the city consider using bicycle as their mode of transport. This is because cycling is quite efficient (save cost and Time) for short distances, it's affordable, convenient and flexible affordable to use, besides that over 16% of the cyclist interviewed considered it as a means of body exercise

Source: Field Study 2015

Cross tabulation of for different modes of transport over short distances of 1-4km, 61.5% preferred to walk while 7.7% cycled. 23% used public transport and 7.7% used private means. Public transport was most popular at 83.3% for those staying 5-8km from work place. Cycling was also common at 23.1% among those stay 9-12km from work place.

Table 8: Common Mode of Transport to School/ Workplace

Distance To Work Place Or School		Common Mode Of Transport To school Or Workplace			
		Walkin g	Bicycle Riding	Public Transport	Private means
1-4km		61.5%	7.7%	23.1%	7.7%
5-8Km		16.7%		83.3%	
9-12km		23.1%	23.1%	38.5%	15.4%
13-16Km		75.0%		25.0%	
20km and above		50.0%	7.1%	35.7%	7.1%

The above findings is a good indicator that cycling has a role to play in the city's transport system thus its preferably cycling lanes be integrated within the urban transport system to cater for transport needs of urban residents especially the urban poor who cannot afford other means of transport.

Source: Field Study 2015

5.4 The Role of Bicycle Mode in the Urban Transport System.

The role of bicycle mode of transport in the urban fabric was considered by studying the tread of bicycle use along Ngong Road.

5.4.1 Cycling along Ngong Road

From the traffic counts, public service vehicle commuters formed the largest number with 38%. Motorcyclists along Ngong Road were 3.5% while bicyclists were 2.5%.

Walking and bicycling was most popular with casual labourers while public transport was popular with those in formal employment. A majority (92.3%) of the cyclists interviewed owned a bicycle. Most of those who owned bicycles or tricycles (62%) used them to run personal errands, although an equally significant number (38%) used them for commercial purposes. This is

because many respondents considered bicycle as efficient, with 38% being of this view. The bicycle was also considered to be affordable and convenient in terms of flexibility.

Figure 14: Traffic characteristic at Ngong Road (Dagoretti Corner)



Source: Field Study 2014

The results also showed very limited use of cycling to the central business areas. Nearly all those who cycled to their destinations (98.5%) covered the entire distance cycling without shifting to any other mode of transport. From this it was easy to determine the main advantages of using bicycle as means of transport. The public is willing to consider the bicycle if the bicycle tracks were provided along Ngong Road. Therefore, sensitization to the members of the public to embrace bicycling as another means of transport is imperative.

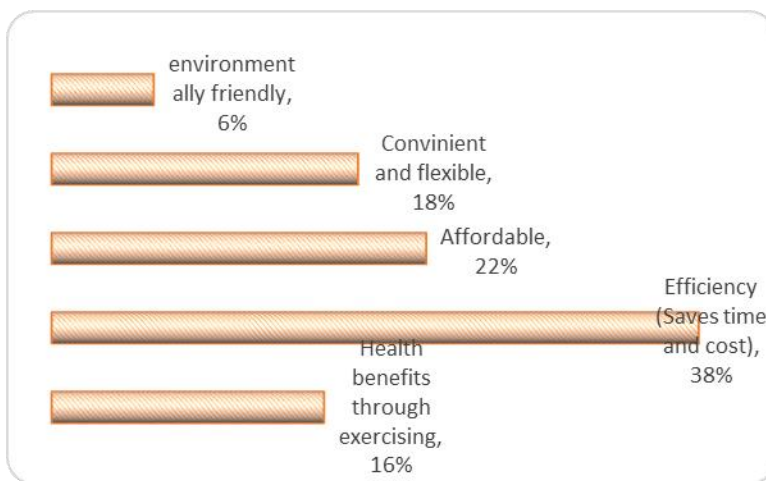
5.4.2 Reasons for Using Bicycle as a Means of Transport

Notable from this research on examining operations of bicycle transport along Ngong Road is the advantages noted from the use of bicycles as mode of transport. Cyclists interviewed commented that cycling provide numerous benefits and opportunities. Although several reasons were mentioned by cyclists as to why they preferred cycling, the major motivations for cycling were:

low cost/ affordable (22%), convenience (18%), speed/faster (38%), environmentally friendly (6%) and improvement of health (16%).

Content analysis of key informants' interviews reveal that high use of NMT modes can contribute to reduction of negative effects of motorized transport pollution (and noise) and help in achieving “clean air” initiatives and reduction of fossil fuel emissions. It's evident above the role and benefit played by bicycles as a mode of transport implying that cycling encourage local movement and hence the need to support local community cycling facilities.

Chart 3: Advantages of using bicycle as means of transport



Cyclist have revealed the main advantages of using bicycle transport out of which 38% cited efficiency in terms of time spent and cost. 22% answered along the same line in that bicycling was affordable while 18% considered it convenient and flexible. 16% considered it as a means of body exercise for better health while 6% saw it as an environmentally friendly means of

Source: Field Study 2014

5.4.3 Consideration on Bicycling As an Alternative Means of Transport

Only 32% of the respondents ever considered using the bicycle as a means of transport with majority, 68% of the respondents do not consider bicycling as an alternative means of transport. This is due to the bicycle transport being prone to accidents as affirmed by 81% of the respondents, 38% felt cycling is demeaning while only 25% (mainly the pedestrians) of the population were not able to afford a bicycle. This finding is confirmed from the various key informants from the National Transport and Safety Authority whose records reveal that on average over 105 pedal cyclist's casualties are reported every year in Nairobi with Ngong road recording a total of 50 pedal cyclists' casualties every year.

Figure 15: Bicycles involved in accidents at Central Police Station, Nairobi



Source: Field Study, 2015

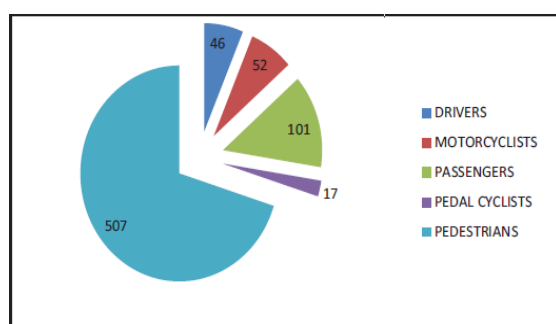
The reason for this being that Ngong Road lacks provision for NMT infrastructure as well as it has many road junctions which creates a potential bottleneck and conflict between the MT and the bicycle. The Ministry of Transport and Infrastructure (MOTI), reports that the capacity improvement of Ngong Road is well advanced and contains a comprehensive scheme on NMT. This will be the practise as the road sector will apply the policy as the standard of the road infrastructure. This was also echoed by the National Transport and Safety Authority (NTSA) which reveal that the facilities related to NMT have been reviewed as part of the elements mandatory for consideration under the Design Manual for Roads and Bridges. The Manual notes that use of bicycle is increasing in Ngong Road and thus there is need to provide bicycle traffic with paved shoulders, bicycle-safe drainage gates; adjusting man-hole covers to the grade and maintaining a smooth and clean riding surface.

5.5 The Status of Cyclists' Infrastructure on Road Designs along Ngong Road

There is lack of cyclists' infrastructure provisions along Ngong Road. Owing to motor vehicle orientated engineering and planning, NMT facilities do not always receive the attention that they

deserve. NMT networks should ideally be planned together with the MT modes but taking into account their main requirements of directness; safety; coherency; and comfort. NMT users are exposed to fast, aggressive and high MT volumes with the consequences of high traffic accidents. High accident rates among cyclists and pedestrians may be a good indicator of how it is unsafe to use NMT in Nairobi. Road accidents data for 2014 (Refer the chart below) show that out of 723 fatalities, some 507 (70%) were pedestrians, followed by passengers at 101 fatalities (14%).

Chart 4: Road Accident Fatalities in Nairobi



Despite their preference for cycling as a mode of transport, 67.7% of cyclists felt that cycling was not safe at all along Ngong Road. In the absence of cycling facilities, 63.2% cycled on the MT carriageway; 34.5% cycled on the sidewalks (34.5%), and 2.3% maneuvered through obstacles on their way. The Directorate of Urban Development has got no policy guide for bicycle parking. In deed the Building code is silent when it comes to bicycle parking.

Source: Transportation Unit, NCC, 2014

5.6 The Challenges of Bicycle Mode of Transport along Ngong Road

Several challenges were identified as hindrances to development of bicycle transport along Ngong Road.

5.6.1 Lack of Supportive Infrastructure for Cycling along Ngong Road

Cyclists along Ngong Road face many challenges which put off many PSV commuters and pedestrians from using bicycles. The risks of accidents are very high standing at 77% as a result of no bicycle lanes at 17% are some of the reason why respondents did not use the bicycle. In the whole NCC, there is only one dedicated bicycle parking bay next to General Post Office (G.P.O). The bay is not covered and the only special provisions are hooks onto which a bicycle can be locked. It has a capacity of 16 bicycles; indication that in urban governance the bias towards motorised transport is a major challenge.

Figure 16: Bicycle Parking Bay in the CBD of the City of Nairobi



Source: Field Study, 2015

Figure 17: A Cyclist on the Carriage Way along Ngong Road

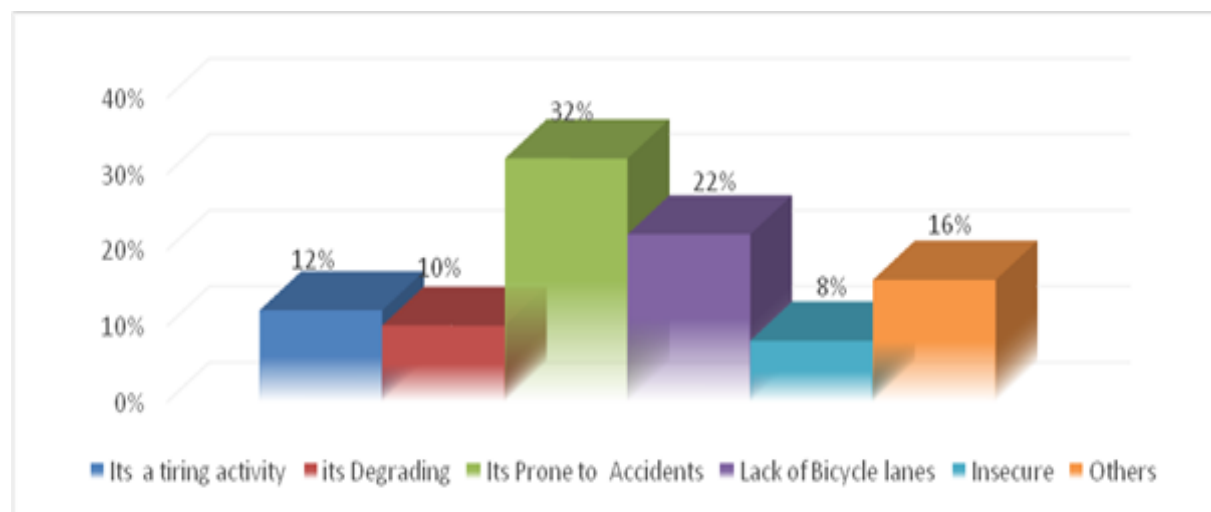


Source: Field Study 2014

5.6.2 Harsh Treatment from the Motorized Transport Modes

A large number of cyclists interviewed (78.5%) felt that motor vehicle drivers did not respect them on the road. The main reason for this is that there have been no bicycle lanes along Ngong Road and cyclists-related accidents are quite common. Fortunately, as explained by Kenya Police Service, Kilimani Station, most cause minor injuries due to the fact that vehicles move slowly because of traffic jams. Interviewees suggested strongly that the lanes be included to popularize bicycle transport as supported by 83% of the respondents.

Chart 5: Reasons for Not Using Bicycle as a Means of Transport



Source: Field Study 2014

5.6.3 Constant Interferences from Other Road Users

Cycling was made less enjoyable along Ngong road by constant interferences from other road users, especially handcarts, pedestrians, vendors selling their merchandise along the road, motor cyclists, and even fellow cyclists. Statistics from Transportation Unit, Nairobi City County shows along this particular road almost 70.8% of the accidents involved cyclists and pedestrians and 21.5% of them involved cyclist and fellow cyclists.

5.6.4 Lack of Implementation of NMT Policy

The research revealed that lack of policy implementation continues to frustrate provision of a balanced transport system that includes NMT provisions. Cyclists interviewed commented that for successful integration of cycling lanes along Ngong Road, there is need to implement NMT Policy. Various Key informants agree to the above argument citing that a NMT policy will among others strive to facilitate a mobility environment where all transport modes are of equal importance, set objectives and strategies how to realize an improved NMT environment and culture in Nairobi, for a better city, a better life as well as ensuring identification of all the NMT actors/agencies so as to facilitate the generation of optimal satisfactory design solutions and the use of streets and spaces, by all modes of transport, including cyclists.

The Integrated National Transport Policy (INTP) recognizes that over the years, transport development has focused attention mainly on roads for motorized transport basically because NMT was not fully recognized by transport professionals, and hence by national road design standards, to qualify for the Government's financial support. In terms of policy direction, the INTP states that the development and maintenance of infrastructure for NMT will be supported by all local authorities¹ and road agencies. The NMT national policy guideline is basically in place, but there are no champions at both national and county levels for universal implementation.

5.6.6 Orientation of Transport system to private car use.

Ngong Road has not fully taken into account the contribution of all modes and offer users affordable practical choices. It does not offer practical and convenient alternatives to the private car. To discourage Ngong Road commuters from using private cars, the public transport needs to be efficient and attractive, and integrated with NMT. It should be noted that the problem in the city of Nairobi is not the reluctance of residents to use public transport or NMT but rather, the inefficient public transport and lack of safe and convenient NMT infrastructure.

5.7 Plausible Cyclists Related Planning Interventions

¹ Under the current Constitutional dispensation of devolved units of government, local authorities no longer exist and in their place there are cities and other urban areas under the County Governments.

From the study several plausible planning interventions relating to bicycle transport were considered.

5.7.1 Provision of Supportive Infrastructure for Cycling

Cyclists along Ngong Road considered that their safety needed to be enhanced through: creation of cycling paths (27.3%) and walkways (14.3%), expansion of the road space (14.3%), erection of speed bumps (7.8%), and the installation of street lights (6.5%) along the respective transport corridors. The cyclists also identified certain services that need to be provided along the corridors in order to encourage cycling and to make it more enjoyable and pleasant. They include; the need to enhance security, have more shopping services, as well as bicycle repair services along the routes. These users need to be provided as plausible measure of supportive infrastructure.

5.7.2 Integrate NMT Facilities on the Road Designs

NMT should be promoted as part of an integrated transport system. Some 72.7% of the cyclists interviewed felt that the development of dedicated bicycle lanes would ease cycling by minimizing the contact between the cyclists and MT. When integrated with public transit, NMT can contribute to reduction in congestion by encouraging shift from the private car to public transit, and lower transport investment and maintenance costs. Other benefits include employment opportunities in construction and maintenance of NMT facilities which are largely labor-intensive construction; business opportunities in bicycle spare parts, repair shops; and creation of opportunities for hawkers to sell their wares alongside dedicated NMT facilities.

5.7.3 Strengthening the NMT-Related Institutions

Responsible authorities for NMT issues should be known to the community to enable reporting of issues of concern. From the interviews done, cyclist and other NMT users called for the relevant institutions in the transport sector to transform their minds and encourage a sense of belonging by creating a platform where professionals; NMT users; and policy makers can interact in the provision of transport facilities.

Institutions have a role in providing an integrated transport system which satisfies both economic and social needs of the urban dwellers but does not threaten the environment. Such systems should integrate various modes such as commuter transport, buses and non-motorized systems to

assure users of seamless journeys that are safe and comfortable. For example, a community designed for walking and cycling must be compact (so many destinations are within convenient distance of each other), connected (with streets that allow direct travel), designed at a human scale, have functional and attractive sidewalks and paths, have effective strategies to control traffic speeds, and feel safe to vulnerable users

5.7.4 Education and Public Awareness

Content analysis from key informants on the transport sector, household and cyclist interviewed suggested education and public awareness could best help promote cycling or use of bicycle as a transport mode in the city. NCCG was challenged to develop and roll-out basic NMT education and awareness programmes for local neighborhoods and public schools, and provide targeted educational and awareness opportunities for existing and potential cyclists and motorists.

“...NCCG should specifically develop awareness information targeting private car users on the individual and social benefits of using NMT modes. A shift from use of private car to cycling and PT will free road space and reduce congestion ...”- Cyclist at Ngong Road.

Cyclists interviewed recommended that due to the harassment they face from the MT along Ngong Road, public awareness can be met if the NCCG would advocate for an extensive and thorough cyclist training course that includes: defensive cycling, anticipating dangerous situations, and reacting appropriately; drivers being aware of NMT user's rights; the need to pay special attention to avoid collisions with pedestrians and cyclists even if they are ignoring traffic regulations; and so on.

5.8 Summary of key Findings

a) The role of bicycle mode in the urban transport system.

From the above findings it's evident that quite a large population that uses Ngong Road considers using bicycle as their mode of transport. Notable from this research on examining operations of bicycle transport along Ngong road is the advantages noted from the use of bicycles as mode of transport. Cyclists interviewed commented that cycling provide numerous benefits and opportunities. Although several reasons were mentioned by cyclists as to why they preferred cycling, the major motivations for cycling were: low cost/ affordable (22%), convenience (18%),

speed/faster (38%), environmentally friendly (6%) and improvement of health (16%). The results also showed very limited use of cycling to the central business areas. Nearly all those who cycled to their destinations (98.5%) covered the entire distance cycling without shifting to any other mode of transport. The public is willing to consider the bicycle if the bicycle tracks were provided along Ngong Road. Therefore, sensitization to the members of the public to embrace bicycling as an alternative means of transport is essential.

b) The status of cyclists' infrastructure on road designs along Ngong Road

Cycling is an affordable means of transport. It is convenient and flexible; enabling one to ride from the doorstep to doorstep. Unfortunately lack of bicycle infrastructure along Ngong road has been an impediment to use of this environment friendly means of transport. More than 70% of the people interviewed considered riding a bicycle along Ngong Road to be a risky affair due to modal conflicts. The lack of bicycle infrastructure along Ngong Road is a major contributor to the large percentage of people who walk to and from work along this road. Providing the infrastructure would considerably reduce the number of pedestrians and therefore people would not be as tired as they get nowadays when commuting to and from work.

c) The challenges of bicycle mode of transport along Ngong Road

Despite their preference for cycling as a mode of transport, 67.7% of cyclists felt that cycling was not safe at all along Ngong road. In the absence of cycling facilities, 63.2% cycled on the MT carriageway; 34.5% cycled on the sidewalks (34.5%), and 2.3% manoeuvred through obstacles on their way. The risk of accidents is very high standing at 77% as a result of no bicycle lanes at 17% are some of the reason why respondents did not use the bicycle.

A large number of cyclists interviewed (78.5%) felt that motor vehicle drivers did not respect them on the road. The main reason for this is that there have been no bicycle lanes along Ngong Road and cyclists-related accidents are quite common. Last but not least, Cycling was made less enjoyable along Ngong Road by constant interferences from other road users, especially handcarts, pedestrians, vendors selling their merchandise along the road, motor cyclists, and even fellow cyclists.

d) Policy interventions

The research revealed that lack of policy implementation continues to frustrate provision of a balanced transport system that includes NMT provisions. Cyclists interviewed commented that for successful integration of cycling lanes along Ngong Road, there is need to implement NMT Policy. Cyclists along Ngong Road considered that their safety needed to be enhanced through plausible policy intervention such as creation of cycling paths (27.3%) and walkways (14.3%), expansion of the road space (14.3%), erection of speed bumps (7.8%), and the installation of street lights (6.5%) along Ngong road and the respective transport corridors.

Responsible authorities for NMT issues should be known to the community to enable reporting of issues of concern. From the interviews done, cyclist and other NMT users called for the relevant institutions in the transport sector to transform their minds and encourage a sense of belonging by creating a platform where professionals; NMT users; and policy makers can interact in the provision of transport facilities.

The NCC NMT policy of 2015 recognizes NMT integration in the urban transport network is a joint initiative of the relevant institutions to improve and the Non-motorized transport mode. The authorities involved in road design have realised that NMT facilities are key to providing road infrastructure that will address the needs of all. Lastly, content analysis from key informants on the transport sector, household and cyclist interviewed suggested education and public awareness could best help promote cycling or use of bicycle as a transport mode in the city. Cyclists interviewed recommended that due to the harassment they face from the MT along Ngong road, public awareness can be met if the NCCG will advocate for an extensive and thorough cyclist training course that includes: defensive cycling, anticipating dangerous situations, and reacting appropriately; drivers being aware of NMT user's rights; the need to pay special attention to avoid collisions with pedestrians and cyclists even if they are ignoring traffic regulations; and so on.

CHAPTER SIX:

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

6.0 Overview

This chapter briefly highlights the benefits of undertaking this research along Ngong Road as well as the county at large. The chapter broadly discusses the emerging issues as well as their implications detailing the need for intervention. It also gives a conclusion of the study, the contributions this study would make on the planning profession as well as highlighting areas that require further research. It finally articulates recommendations that if implemented will ensure optimal road corridor utilisation in the study area which will improve satisfaction of all road users of Ngong Road.

6.2 Summary of Emerging Issues

The purpose of this research was to examine the operations of bicycle transport along Ngong Road, Nairobi. The research, which was extensively carried out objectively brings out various emerging issues as follows: -

This research recognized the role played by bicycles as a mode of transport along Ngong Road. Bicycle transport is an admirable means due to its affordability, convenience in terms of flexibility and speed. It is not adversely affected by traffic congestion hence faster than some other means of transport especially for short distances. Unfortunately not many people use bicycle for fear of getting involved in traffic accidents involving them as cyclists and the motor vehicles. Any collision between a cyclist and a motor vehicle has the capability of seriously maiming the cyclist since the human body cannot withstand the impact of a moving motor vehicle. Thus some of the residents in the study area are forced to walk to work for long distances of even up to 20 kilometres! Walking is tiring but with the lurking danger of cycling and economic constraints, they are left with no other option but to trek. Cycling in the study area is not an all-weather means of transport and there are those who shun it because it is not dependable during the rainy seasons.

A solution to the danger of traffic accidents involving the cyclist was seen as provision of dedicated cycling lane system within the study area. The system would include the cycle tracks, bicycle parking bays in work places and traffic lights friendly to bicycling. To deter would-be

muggers of cyclists especially at lee hours of the day, street lights and CCTV cameras would be provided to enhance the security of the cyclist.

It emerged that transportation planning in the study area did not integrate all modes of transport, giving emphasis to motor transport only. Sidewalks for pedestrians have been provided for partially but they lack continuity. For bicycle transport support system, it is completely lacking and the cyclist is left pleading for a space in the lanes used by motor vehicles.

There is however hope for cycling and NMT in general, thanks to NCCG NMT policy of 2015 which outlines the county's objective of increasing the role of NMT as a transport mode, integrating NMT as an essential element of public transport, providing safe NMT infrastructure and allocating adequate and sustainable funding for the development and promotion of NMT. With the NCC NMT policy of 2015, it's envisaged that mobility environment will be facilitated where all transport modes are of equal importance. This indeed will mark a turning point of NCCG and the country at large, particularly in their efforts to include NMT within an Integrated Transport System for a better city.

Based on the information provided by this study, the long term travel conditions for NMT users along Ngong Road can be improved and sustained through better NMT transportation planning. A sustainable urban NMT transport system requires strengthening various features of the system notably safety, directness, coherence, attractiveness and comfort to the cyclists.

However, without visionary leadership/champion, a committed team of professionals and stakeholders from responsible institutions, and adequate funding, the policy may not be fully implemented and the objectives set out may not be met.

6.3 Conclusion

The study found out that in the study area 10% of the respondents use bicycle for their daily transport to and from work places. This is low compared to 32% of those who walk to and from work and 54% who use public transport. Though bicycle transport appears to play a minor role of transportation in the study area, the respondents indicated that it was also a desirable mode of transport. About a third (32%) of the respondents indicated that they ever considered the bicycle as an alternative mode of transport, meaning that there is the potential of uptake of this mode. Out

of those who used bicycle, 38% considered it efficient in terms of speed and cost. Still 22% considered the mode as an affordable one.

The status of bicycle infrastructure on road design in the study area is unfortunately wanting. There lacks dedicated cycling tracks for bicycles which is a major impediment to the uptake of this mode of transport in the study area. Due to lack of bicycle infrastructure there is high risk of accidents involving the cyclists, a view that was held by 68% of the cyclists interviewed. Upon arrival at one's destination, a safe bicycle parking bay is needed to assure the cyclist that hi/her bicycle will be safe. This would enable him/her to concentrate with work and thus be more productive. Unfortunately such parking bays are extremely limited with only one public parking bay in the whole of Nairobi's CBD which has only 16 hooks onto which cyclists can clamp their bicycles. The building code is silent when it comes to provision of bicycle parking in buildings and only captures the interests of vehicle motorists for whom the code recommends 1.5 parking spaces per flat. Lack of sufficient bicycle parking bays also impedes of the use of the bicycle transport mode. The provision of shower rooms/ changing rooms in work places where a cyclist can change his/her bicycle riding wear to normal office wear is totally lacking in the study area.

There are many challenges/ constraints that the bicycle mode of transport faces in the study area due to lack of dedicated bicycle track system. The lack of the infrastructure makes the mode to be considered highly risky. People's perception towards cycling as an alternative means of transport is low and the application of the mode left to those who are desperate. In deed 10% of the respondents considered it as degrading or demeaning. In view of the above bicycle transport in the study area is not integrated in the area's transport system and the cyclists is seen as an intruder to the lanes 'meant' for the motor vehicle. The cyclists face harassment from *matatu* drivers, a view that was supported by 79% of the cyclists who were interviewed.

6.4 Recommendations

The national interventions on NMT transport has slowly cascaded into urban authorities with Nairobi City County launching their first NMT policy, which is a major milestone. For implementation purposes it requires a fundamental change in urban governance, including: change of attitude and bias towards motorised transport; focusing on developing relevant policies and transport infrastructure; completing the development on the on-going urban and transport policy; and, promoting NMT use. Construction and maintenance of cycling infrastructure and

facilities integration along Ngong Road should meet the five NMT user requirements that improve traffic safety through traffic calming, and enforcement of traffic laws and regulations. Other interventions include providing NMT users with information on how to safely use the roads, integration with motorized means of transport, and management of motor vehicles to release space for NMT in selected areas.

Based on the findings the research recommends the following:

There is need to urgently implement NCCG NMT policy to address issues that pertains to NMT and specifically, the bicycle mode. The policy is considered detailed enough to guide on how to address walking mobility, bicycling, carts use among other NMT modes.

The study recommends public participation during the road design process. Though the members of the public may not need to get to deep details of the road design, they should be informed of the facilities that a proposed road would have. Their views should be sought and where possible included.

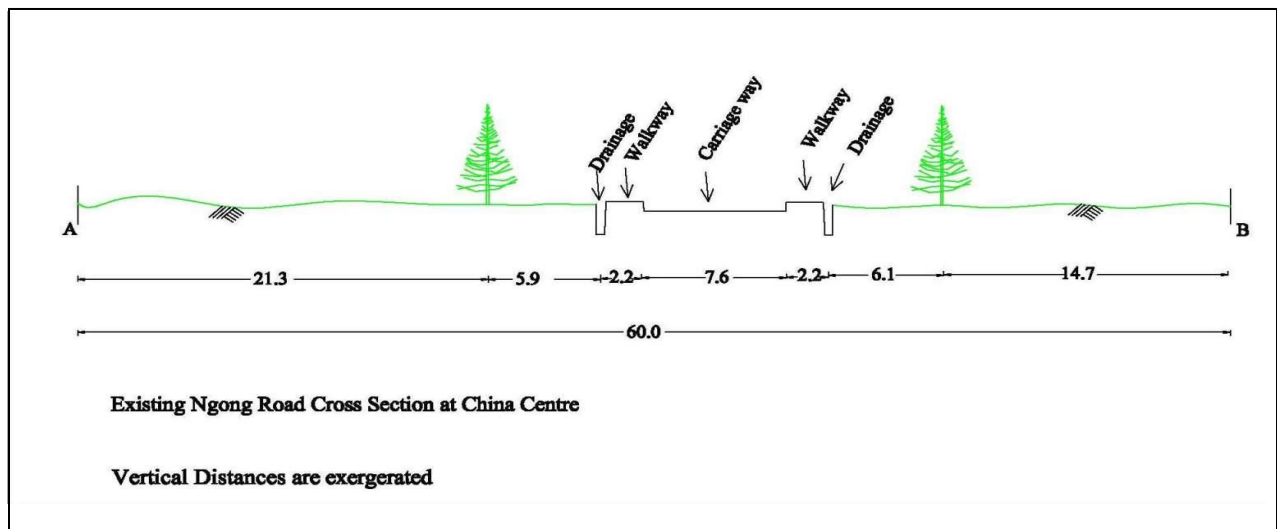
It should be made mandatory to include bicycle parking in road and building design, without which approval would not be granted. The building code therefore needs to be amended to accommodate the bicycle parking needs. Many old buildings did not have facility for the mobility of the physically challenged but when relevant policy came into force; such buildings were provided with lumps to facilitate mobility of these people. The same should happen to facilitate safe and secure parking of bicycles. Ministry of public works could design a bicycle park which should be emulated by others. CCTV cameras should be installed to enhance security in the parking and also along the bicycle track systems at convenient locations. More designated bicycle parking spaces should be provided in the urban centres and Nairobi in this case.

The traffic lights should be modified to include sign for bicyclists (Red and Green). Street lights would enhance security along the entire road for those who may be riding when dusk has fallen. Given that there are many people who have not embraced bicycle riding as an acceptable means of transportation; awareness campaign should be carried out. For example there can be set an annual day set aside as bicycling day when people would be encouraged to use bicycles . The city of Nairobi should come up with a cycling plan so that there can be a seamless cycle track system

though out the city. Just as connectivity of motorable roads has been provided, the same should be provided for the bicycle.

Below is a cross-section along Ngong road near China Centre showing the features as they are today.

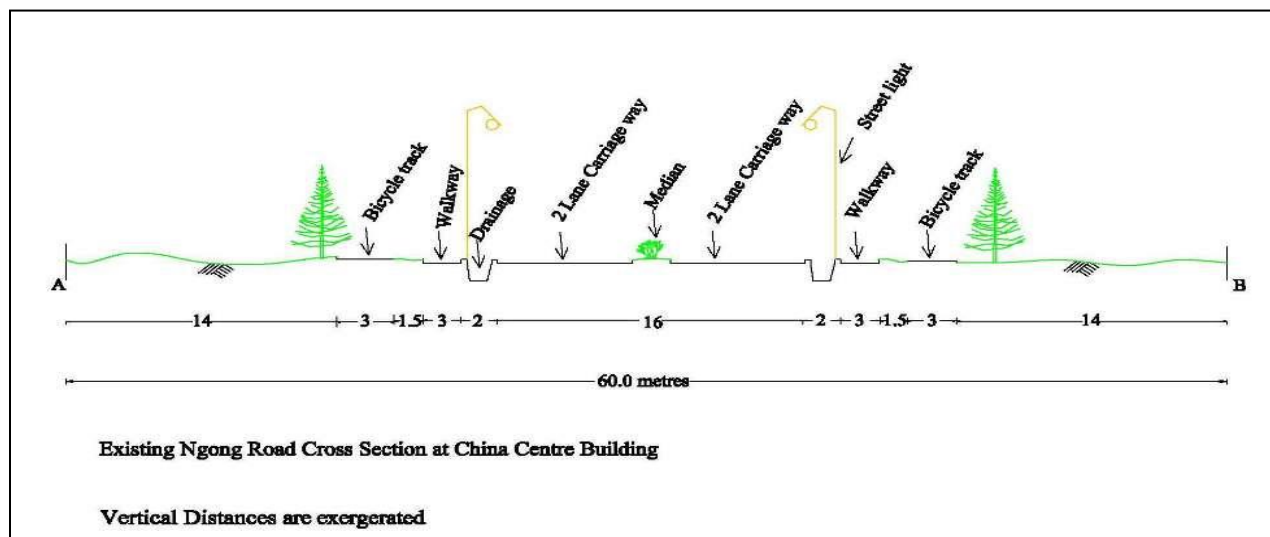
Figure 18: Cross-section of Ngong Road as it was during field survey



Source Field Survey 2014

Figure 14 depicts a proposal on the modification to accommodate bicycle track has also been drawn as a demonstration that bicycle tracks can be included within Ngong Road corridor.

Figure 19: Proposed Cross-Section of Ngong Road with bicycle Lanes Incorporated



Source: Field Study 2015

6.5 Areas of Further Research

The study recommended the following as further research in connection to transportation in Nairobi.

6.5.1 Cycling along Thika Superhighway

Thika Super Highway is a newly rehabilitated road that connects Nairobi city and Thika town and forms a part of the Great North-Trans African Highway. The road was inaugurated in November 2012 and was designed to accommodate cyclists' tracks and pedestrian walkways. Despite the provision of these facilities, cyclists still use lanes intended for the motor vehicle. It would be prudent to carry out a research as to why cyclists do not ride on the cycle tracks and come up with ways of training them on how to make proper use of the road.

6.5.2 Influx of motor cycle traffic in Kenya

Kenya has of late witnessed an influx of motor cycles on its roads. The accidents involving the motor cycles have been on the increase to an extent that many hospitals in the country have wards reserved for the motor cycle accident victims. There is need to research on the reason for the increased accident levels involving the motor cyclist, noting that the motor cyclists are supposed to have been trained in approved driving schools. The research should come with recommendation of curbing this menace.

REFERENCES

1. Aligula Eric (2005). Current Situational Analysis on Motor Vehicles Control in Kenya. Motor Vehicle Emissions Control Workshop Report, Republic of Kenya..
2. Alta Planning, (2005). Caltrans Pedestrian and Bicycle Facilities Technical Reference Guide: A Technical Reference and Technology Transfer Synthesis for Caltrans Planners and Engineers, California Department of Transportation.
3. AASHTO Guide for the Development of Bicycle Facilities (1999). Available on www.nacto.org. Accessed on 11.04.2013
4. City of Copenhagen, (2011). Copenhagen - City of Cyclists - Bicycle Account 2010, ed. City of Copenhagen, The Technical and Environmental Administration, Traffic Department. Copenhagen.
5. Claus, K, Randy, R and Raymond, F. (2011) How to Promote Cycling–Life Cycle Implementation Manual, Eu Public Health Programme.UK
6. Dobbins Michael (2009) Urban Design and People. John Wiley & Sons, Inc.Hoboken, New Jersey.
7. Earnest and Young (2009) Kenya 2009/2010 financial year budget review, Nairobi, Kenya.
8. Ewing and Hamidi, (2014). Measuring Urban Sprawl and Validating Sprawl Measures, Metropolitan Research Center at the University of Utah for the National Cancer Institute, the Brookings Institution and Smart Growth America (www.smartgrowthamerica.org).
9. Fabio, (2004). Report on transport related local condition and key problems in Jinja-Uganda. First African Bicycle Information Office, Jinja Uganda.
10. Felipe P, (2007). Sustainable urban transport. Shanghai Manual – A Guide for Sustainable Urban Development in the 21st Century.
11. Fruin J.J, (1971).Pedestrian planning and design. Metropolitan Association of Urban designers and Environmental Planners, USA.
12. Fruin J.J.(1971) Pedestrian planning and design. Metropolitan Association of Urban designers and Environmental Planners, USA.
13. Godefrooij, T.; Pardo, C.F.; Sagaris, L, (2009). Cycling Inclusive policy Development: A handbook. Eschborn.

14. Godefrooij, T.; Goeverden K.V. (2011). The Dutch Reference Study: Cases of Interventions in the Bicycle Infrastructure Reviewed in the Framework of Bikeability. Delft University of Technology.
15. Nairobi City County Government, (2015). The Non-Motorized Policy: “TOWARDS NMT AS THE MODE OF CHOICE. Nairobi City County Government, Nairobi, Kenya.
16. Government of Kenya (2007). Kenya Vision 2030, Government Printer
17. Government of Kenya (2010) The constitution of Kenya 2010, Government Printer
18. Haines, A., McMichael, T., Anderson, R. and Houghton, J. (2000). Fossil fuels, transport and public health *British Medical Journal* 321, pp. 1168-1169
19. JICA, (2014) The Project on Integrated Urban Development Master Plan for the City of Nairobi in the Republic of Kenya, Nairobi.
20. Jürgen H, (2004). ITDP Europe Making the African cities mobile: Non-motorized transport solutions in African Cities; the case of Jinja/Uganda.
21. Jurgen H.P. (2004) Making the African Cities mobile: Non-motorized transport solutions in African Cities The case of Jinja/Uganda. Uganda.
22. Jurgen H.P. (2004) Making the African Cities mobile: Non-motorized transport solutions in African Cities The case of Jinja/Uganda. Uganda.
23. Kasuku S. and Macharia L. (2003). Links Between Transport and Poverty: A review of Transport Policies in Kenya and the Links with Poverty reduction. Nairobi, Kenya.
24. Kasuku S. O. (2001). Provision of pedestrian transport facilities in Nairobi city; the Case of Jogoo Corridor, M.A Thesis 2001, University of Nairobi, Faculty of Architecture, Design and Development, Department of Urban and Regional Planning.
25. Kasuku, (2002). Rural transport, key elements of development. Transport policy reform and poverty reduction in Kenya: Bridging rural–urban transport gaps through IMT.
26. Kempton, R Bicycle Parking Guidelines. Accessed through www.apbp.org on 05.01.2014
27. Kenya Republic of (2001) .Poverty reduction strategy paper 2001 – 2004, Government printers, Nairobi.
28. Kenya Republic of (2014). Statistical Abstract 2014 Government Printers, Nairobi
29. Kenya Republic of (2002) .The Ninth Nairobi Development Plan 2002 - 2008 Government printers, Nairobi.

30. Koh, p.p, Wong Y.D., (2012) The Evolution of cycling in Singapore. Accessed through http://app.lta.gov.sg/ltaacademy/doc/J12%20Nov-p39PPKoh_The%20Evolution%20of%20cycling%20in%20Singapore.pdf on 13.12.2013
31. Lachlan C, Würtenberger L and Seton S, (2012). Transportation: Kenya's Climate Change Action Plan: Mitigation. UK Department for International Development (DFID) and the Netherlands
32. Land Transport Authority (2005) The journey, Singapore's land transport story. Singapore. SNP International Publishing Pte Ltd. (Cited by Koh,2012)
33. Litman T, (2003). Quantifying the Benefits of Non-motorized Transportation For Achieving Mobility Management Objectives. Victoria Transport Policy Institute, Canada.
34. Litman, T.A (2009) Smart Transportation Economic Stimulation, Infrastructure Investments that Support Strategic Planning, Objectives Provide True Economic Development, Victoria Transport Policy Institute.
35. Lomax T.J. and Schrank D. L. (2002) Using Travel Time Measures to Estimate Mobility and Reliability in Urban Areas. Texas Transportation Institute Technical Report. Texas.
36. Mairura O. (2011) Integrated Transport System for Liveable City Environment: A case Study of Nairobi, Kenya.
37. Midida R. (2003) "Modern Economics" Focus Publications Ltd
38. Ministry of Nairobi Metropolitan Development - Republic of Kenya. 2008.
39. Ministry of Transport (2012) Draft Roads Policy , Nairobi, Kenya
40. MOT (2012) Speech (Part 2-Private Transport) by Lui Yew, Minister for ransport for Committee of Supply 2012. Accessed through <https://www.google.co.ke/#q=Lui+Yew%2C+Minister+for+ransport+for+Committee+of+Supply+2012>on 14.12.2013
41. National Cycling Strategy (2003):*Cycling and Health*.England.
42. Obiero, V. O. Samuel (1992). Public transport and the Peak hour in Nairobi. UWCC Library, London.
43. Omwenga M, (2011). Integrated Transport System for Liveable City Environment: A Case Study of Nairobi Kenya, 47th ISOCARP Congress 2011.
44. Omwenga M. and Obiero S., (1994) .SSATP program urban mobility and non-motorized transport (NMT) studies. City structure and inventory of NMT infrastructure problems, July 1994. Nairobi.

45. Republic of Kenya (1994) .Development Plan 1994-1996 Government printers, Nairobi.
46. Republic of Kenya, (2001) .Economic Survey 2000. Government Printers, Nairobi.
47. Schwartz J.D.(2005) Bikes are for people who can't be late. Retrieved from <http://www.theurbancountry.com/2013/03/bikes-are-for-people-who-cant-be-late.html#sthash.d0LapmGQ.dpuf> Accessed 17.10.2013 at 12.00 hours
48. Sh 1.6bn Japanese grant to expand Ngong road. www.capitalfm.co.ke/news/2012/06/sh1-6b-japanese-grant-to-expand-ngong-road. Accessed on 31.10.2013
49. Shayler, M., Fergusson, M and Rowell, A (1993) *Costing the Benefits: the Value of Cycling*. A report for the Cyclist's Touring Club, CTC, Godalming, UK.
50. Shayler, M., Fergusson, M and Rowell, A (1993) *Costing the Benefits: the Value of Cycling*. A report for the Cyclist's Touring Club, CTC, Godalming, UK.
51. Smart Growth BC, (2004). Promoting Public Health through Smart Growth: Building Healthier Communities through Transportation and Land Use Policies. Available at www.smartgrowth.bc.ca/downloads/SGBC_Health%20Report%20Final.pdf .
52. Steely P.W, (2003). Mobility for the majority: A blueprint for African bicycle renaissance. Africa Programs ITDP, New York.
53. Sustainable Development(2012) Retrieved from www.un.org/content/document/403brief13.pdf Accessed 22.07.2013 at 20.30hrs
54. Tan, H.Y (1996) New bicycle crossing park connectors. The Straits Times, April 13 (Cited by Koh, 2012)
55. Tan,C (1992). PWD building more bicycle stands for 2 MRT stations. The Straits Times, December 8 (Cited by Koh, 2012)
56. The Republic of South Africa, (1996). White Paper on National Transport Policy (WPNTTP); the Ministry of Transport, Government Printers.
57. The Republic of South Africa, (2008). Draft national Non-Motorized Transport policy (DNNMTTP).The Ministry of Transport, Government Printers.
58. Thika Superhighway now a leading killer (2012)<http://www.the-star.co.ke/news/article-21751/thika-superhighway-now-leading-killer-say-olice#sthash.3UjgwbdY.dpuf> Accessed on 22.07.2013
59. Thilo B, (2011). Obstacles for non-motorized transport in developing countries – a case study of Nairobi, Kenya .Association For European Transport and Contributors.

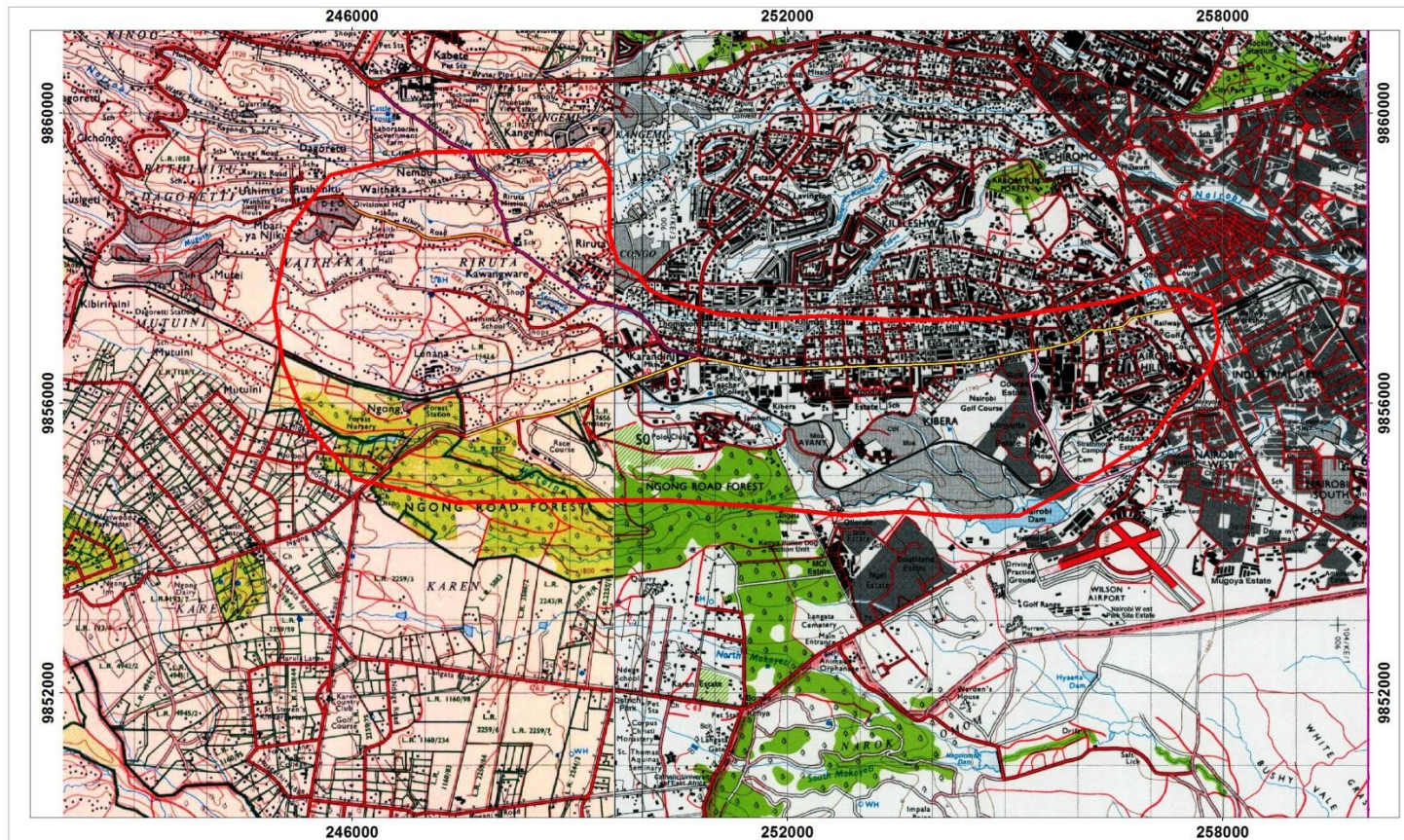
60. Todd L, (2003a). "Economic Value of Walkability," Transportation Research Record 1828, Transportation Research Board (www.trb.org), pp. 3-11.
61. Todd L, (2003b) Active Transportation Policy Issues: Backgrounder, VTPI (www.vtpi.org).
62. Todd L, (2004a). Transportation Cost and Benefit Analysis Guidebook, VTPI (www.vtpi.org)
63. Todd L, (2004d). Safe Travels: Evaluating Mobility Management Traffic Safety Impacts, VTPI (www.vtpi.org).
64. Todd L, (2005). Quantifying the Benefits of Non-motorized Transportation for Achieving Mobility Management Objectives. Transportation Research Record, No. 1441 Victoria Transport Policy Institute, Canada.
65. Todd L, (2014). Evaluating active transport benefits and cost. *Guide to Valuing Walking and Cycling Improvements and Encouragement Programs*. Victoria Transport Policy Institute.
66. Transport Policy Advisor Services, (2010). Challenges of urban transport in developing countries- A summary. GTZ SUTP - www.sutp.org
67. Tuladhar A, (2011). Motorized Transport vs. Non-motorized (Traditional) Transport. Transport in Mountains, An International Workshop, 21-27 November, 2010, Kathmandu, Nepal.
68. Tunuwidjaja, G. (2011) Park connector network planning in Singapore: integrating the green in the garden city. Paper presented at the 5th International Conference of the International Forum on Urbanism(IFOU) 2011, Department of Architecture, National University of Singapore. (Cited by Koh, 2012)
69. UN-HABITAT, (2010). Planning for the Needs of Pedestrians and Cyclists in the Context of Public Transport Improvements and Efforts towards Sustainable Urbanization. UN-HABITAT, Urban Transport Section, New York.
70. UN-HABITAT, (2014). Mobility as Access: Equitable Urban Mobility. United Nations Headquarters, New York.
71. Wasike S.K.W. (2001) Road Infrastructure Policies in Kenya: Historical Treads and Current Challenges KIPPRA Working Paper No.1,Nairobi, Kenya.
72. Watson D., Plattus A., Shibley R.G. (2001) Time-Saver Standards for Urban Design.McGraw-hill Companies,Inc. USA
73. World Bank (2000) The Significance of Non-Motorized Transport for Developing Countries. Strategies for Policy Development. A study on the effectiveness of non-motorized transport in

- relation to economic growth, reduction of poverty and quality of life in urban areas and on the applicability of arrangements developed in the Netherlands. Utrecht, the Netherlands
74. World Bank, (2000). The Significance of Non-Motorized Transport for Developing Countries. Strategies for Policy Development. A study on the effectiveness of non-motorized transport in relation to economic growth, reduction of poverty and quality of life in urban areas and on the applicability of arrangements developed in the Netherlands. Utrecht, the Netherlands
 75. World Health Organisation (WHO) (2002b) The World Health Report: Reducing Risks, Promoting Healthy Life. WHO, Geneva
 76. World Health Organization (WHO), (2002b). The World Health Report: Reducing Risks, Promoting Healthy Life. WHO, Geneva.
 77. Non Motorised Transport in Nairobi. Available on www.uonbi.academia.edu. Accessed 22.05.2014
 78. Republic of Kenya Ministry of Transport (2010) Sessional Paper On: Integrated National Transport Policy, available <http://www.transport.go.ke>
 79. Republic of South Africa, (1996). White Paper on National Transport Policy (WPNTTP); the Ministry of Transport, Government Printers.
 80. Republic of South Africa, (2008). Draft national Non-Motorized Transport policy (DNNMTTP). The Ministry of Transport, Government Printers.
 81. Scott Wilson (2002), Assessment of the Non-Motorized Transport Program in Kenya and in Tanzania, Sub-Saharan Africa Transport Policy Program
 82. Shayler, M., Fergusson, M and Rowell, A (1993) Costing the Benefits: the Value of Cycling. A report for the Cyclist's Touring Club, CTC, Godalming, UK.
 83. Mitullah W. and G. Makajuma. (2009). *Analysis of Non-Motorized Travel Conditions on the Jogoo Road Corridor in Nairobi*, 4th International Conference on Future Urban Transport: Searching for Architecture for a Sustainable Urban Transport System, Göteborg, Sweden.
 84. Omwenga M. and Obiero S., (1994) .SSATP program urban mobility and non-motorized transport (NMT) studies. City structure and inventory of NMT infrastructure problems, July 1994 Nairobi
 85. Winnie V. Mitullah and Romanus Opiyo, (2012). Mainstreaming Non-Motorized Transport (NMT) In Policy and Planning in Nairobi: *Institutional Issues and Challenges*, Southern African Transport Conference (SATC 2012)

APPENDICES

Appendix 1: The Study area

MAP OF AREA OF STUDY



© PAUL NDUNG'U JUNE 2016

SCALE 1:25,000
1 0.5 0 2 3 4 Km

Source of Base map information:-
Topographic Maps from Survey of Kenya

LEGEND

— Kikuyu Road
— Ngong Road
— Naivasha Road
— Mbagathi Road
□ Area of study

Projection: Arc_1960
UTM Zone 37S



Map prepared and designed by: Paul Ndung'u
DATE : JUNE 2016

Appendix 2: Household Questionnaire

Dear Respondent,

I am a student in University of Nairobi taking a Master of Arts course in Planning. As partial fulfilment of the requirements of the course, I am carrying out a project entitled '**Examining the Operations of Bicycle Transport in Urban Areas: A Case Study of Ngong Road, Nairobi.**' Kindly fill in this questionnaire as honestly as possible to be part of the data I will use to do my analysis. The information you give will be used for academic purpose only.

Thank you.

Paul N. Ndungu

1. Your name(Optional)
2. Your gender: Male ☐ Female ☐
3. In which age bracket do you fall? Tick as appropriate.

Below 12 years ☐
13-20 years ☐
21-40 years ☐
41-60 years ☐
61 and above ☐
4. In which estate do you live?
5. How many years have you lived in that estate?.....
6. What is your occupation?.....
7. What is the approximate distance from your house to your work place (or school if a student).....Kilometres?
8. How many days do you go to work / school in a week? Tick whichever is appropriate.

5 days ☐
6 days ☐
Others ☐
9. How many hours do you work in a day?.....
10. Which mode of transport do you commonly use to and from your place of work/ school?
Tick as appropriate.

Walking ☐
Bicycle riding ☐
Train ☐
Public transport ☐

Private means ☐

11. How much time does it take you to travel **to** your work place/ school?.....

12. How much time does it take you to travel **from** your work place/ school?.....

13. How much does it cost you to travel

a) To your work place/school?.....

b) From your work place/school?.....

14. In which of the salary bracket below does your income fall?

Below Ksh. 10,000 ☐

Ksh. 10,001-30,000 ☐

Ksh. 30,001-50,000 ☐

Ksh. 50,001-70,000 ☐

Above Ksh. 70,000 ☐

15. How much money (in Kenya Shillings) do you use on the following items per month in your household?

a) Food.....

b) Housing.....

c) Clothing.....

--

d) School fees.....

--

e) Travelling.....

--

f) Medication.....

--

g) Others.....

--

16. What major challenges do you face when travelling?

•

17. If bicycle riding is not your common means of transport, have you ever considered it as a possible alternative?

Yes ☐

No ☐

18. What are your reasons for not using a bicycle to commute to workplace/school? Choose from the answers below.

It is tiring ☐

It is degrading ☐

It is prone to accidents ☐

Lack of bicycle parking space in workplace/school ☐

Lack of bicycle lanes/ tracks ☐

Insecure ☐

Any other ☐

Please elaborate

.....For the reasons given in '18' above suggest ways of solving or reducing the problems.

.....

19. If your suggestions in '19' above were implemented would you prefer the bicycle to your present means of transport?

Yes ☐

No ☐

20. What advantages would bicycle riding have over other means of transport?

.....

Thank you for taking time to respond to the questionnaire

Appendix 3: Roadside Interview Schedule for Bicyclists

1. Your name(Optional) ...Gender...M.....F.....

2. In which age bracket do you fall? Tick as appropriate.

Below 12 years ☐

13-20 years ☐

21-40 years ☐

41-60 years ☐

61 and above ☐

3. In which estate do you live?.....

4. Where do you work(or school if you are a student)?

5. What are the reasons that make you use a bicycle rather than use other means of transport.
Tick as appropriate.

It is affordable ☐

It is fast ☐

It is reliable ☐

Others. ☐ Please give details

.....
.....

6. How much time do you spend to travel to your work place/ school?

7. How much time do you spend to travel from your work place/ school?

8. At how much money did you buy your bicycle?

9. For how long do you expect your bicycle to last?

10. How much money do you use for maintenance of the bicycle per year?

11. Is there a bicycle park in your work place/ School?

Yes ☐

No ☐

12. If yes, how slots are there?

13. What challenges do you face when riding to/from work place/ school?

.....
.....
.....
.....

14. What do you suggest the authorities should do to facilitate bicycle transport along Ngongroad.

Appendix 4: Roadside Interview Schedule for Pedestrians

1. Your name(Optional) Gender....M.....F.....

2. In which age bracket do you fall? Tick as appropriate.

Below 12 years ☐

13-20 years ☐

21-40 years ☐

41-60 years ☐

61 and above ☐

3. In which estate do you live?.....
4. Where do you work(or school if you are a student)?
5. What are the reasons why you prefer walking rather than use other means of transport?
Tick which ever are appropriate from below.

It is affordable

It is fast

It is reliable

Others.

☐
☐☐☐

Please

details

.....
.....

6. How much time do you spend to travel to your work place/ school?
.....
7. How much time do you spend to travel from your work place/ school?
.....
8. What challenges do you face when travelling to/ from work place?

9. Have you ever considered bicycling as an alternative means of transport?

Yes

☐

No

☐

10. Why haven't you been using a bicycle? Tick whichever are appropriate.

It is not affordable

It is demeaning

It is prone to accidents

Lack of parking space

Other

☐☐☐☐☐

reasons.

Explain

.....
.....
.....

Appendix 5: Interview Schedule for Key informants

I. Traffic Police, Nairobi Headquarters

1. On average how many cases of traffic accidents involving bicycles along Ngong road are reported to your office monthly?
2. In the last five years how do you rate the occurrence of bicycle accidents along Ngong road?
3. Do you have any statistical data on this?
4. Is there a particular age group with high prevalence?
5. Are there particular spots where the accidents are most prevalent?
6. Why the spots?
7. What is the time when these accidents occur mostly?
8. Which gender is most prevalent in bicycle accidents?
9. What do you think can be done to reduce the accidents?

II. Kenya Urban Roads Authority (KURA)

1. Which policy has KURA put in place for bicycling in urban areas?
2. What does the policy entail?
3. Has it been implemented in urban in urban areas?
4. How would you rate the application of the policy?
5. Has it been applied along Ngong road? Yes/ No
6. If yes what effects has it had along Ngong road?
7. If no, why and what is the way forward?
8. Do you have a particular reference where the policy has been successfully applied in Kenya?

III. Directorate of Urban Development (Ministry of Land ,Housing and Urban Development)

1. What ratio do you recommend for parking space in relation to building space in work places?
2. Do you put into consideration bicycle parking space when you talk of parking space?
3. If yes which factors do you consider when determining bicycle parking space?
4. If no how do you intend to address the issue of bicycle parking in work places?

IV. National Transport & Safety Authority

1. When was the authority formed?
2. What is it mission?
3. What is its vision?
4. At its formation what gaps did it target to fill?
5. What policy does it have on safety of pedestrians?
6. What policy does it have on safety of bicyclists?

7. What changes has it brought to safety in the transportation industry?
8. What challenges does it face when implementing its mandate?

V. City Planning department

1. What is the current population of Nairobi?
2. What percentage of this population travels to and from work place during peak hours?
3. What is the modal split of Nairobi currently?
4. Has it been changing overtime?
5. If so how?
6. What statistics do you have on modal split of Ngong Road?
7. What is the place of bicycle transport in transportation planning in the City?
8. To what extent has bicycle infrastructure (lanes, traffic lights, parking, etc) been incorporated in transportation planning in the City?
9. What is the level of implementation of bicycle transportation plan?
10. What challenges does bicycle transport face in Nairobi?

VI. City Engineering Department

1. Which is the guiding policy of the City on bicycle infrastructure?
2. To what level are they included in road design?
3. What is the percentage of roads in Nairobi that have been provided with bicycle infrastructure?
4. How does the policy work towards reducing bicycle-vehicle conflict?
5. Is there any requirement for provision of bicycle parking in buildings especially offices?
6. If yes what is the recommended ratio of parking to plot size?
7. If no, why?
8. How many bicycle parking slots are there in the CBD?

VII. Non-Governmental/ Community Based Organization Promoting Bicycle transport (African Bicycle Network)

1. When was the organization formed?
2. What are the objectives of the organization?
3. Which are the gaps that the organization intends to fill?
4. What support do you give to bicyclists?
5. What challenges do bicyclists cite in their operations?
6. Are there proposals you give to the authorities to implement to enhance bicycle transport?
7. If yes, which ones?
8. What is the level of implementation of these proposals?

IX Bicycle Manufacturing Company (Cycle City Company)

1. What is the name of the company you work for?
2. When was the company set?
3. Why did you choose Kisumu city?
4. What is the minimum cost of a bicycle?
5. In your view how much money does one require to maintain a bicycle?
6. What is the average lifespan of a bicycle?
7. Which issues do your customers cite as challenges they face when riding?
8. What are you doing as a company to promote bicycle transport?
9. Which community social responsibilities, if any, do you undertake in Kisumu?

Appendix 6: Modal Split along Ngong Road, Nairobi during Peak Hours

DATA COLLECTION CHECK LIST

Date.....

Start Time.....

S/No	Mode of Transport	Tarry
1	Buses	<div>Total=</div>
2	Mini-Buses (Matatu)	<div>Total=</div>

Closing time.....

DATA COLLECTION CHECK LIST

Date.....

Start Time.....

S/No	Mode of Transport	Tarry
3	14 Seater Matatu	<div>Total=</div>
4	Private cars	<div>Total=</div>

Closing time.....

OBSERVATION CHECKLIST

Date.....

Start Time.....

S/No	Mode of Transport	Tally
5	Motor-cycles	
		Total=
6	Bicycles	
		Total=

Closing time.....

DATA COLLECTION CHECK LIT

Date.....

Start Time.....

S/No	Mode of Transport	Tarry
7	3 wheeler cycles	
		Total=
8	Pedestrians	
		Total=

Closing time.....