



UNIVERSITY OF NAIROBI

SCHOOL OF BUILT ENVIRONMENT

DEPARTMENT OF URBAN AND REGIONAL PLANNING

URBAN TRANSPORTATION, LAND USE AND THE ENVIRONMENT:

A CASE OF KATIMA MULILO TOWN, CAPRIVI REGION, NAMIBIA.

BY

CLETIUS SINABU MUBITA

REG. NO. B63/70601/2009

University of NAIROBI Library



0385628 3

Submitted in fulfillment of the award for the M.A. Degree (Planning) at the
University of Nairobi-Kenya

Declaration

I Cletius Sinabu Mubita registration number B63/70601/09 hereby declare that this research project is my original work and to the best of my knowledge has not been presented for any degree in any other university or institution.


.....

26/08/2010

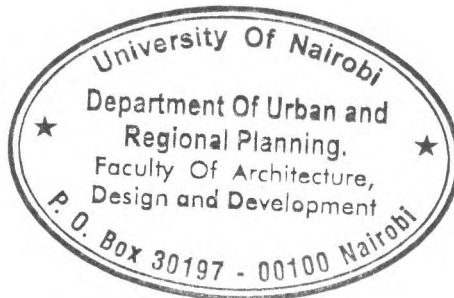
Student: Cletius Sinabu Mubita

Date

This project has been submitted as a thesis for examination with my approval as a University

Supervisor.


.....



27/08/2010

Supervisor: DR.S.V. OBIERO

Date

Dedication

I dedicate this work to my late twin sister (Matildah Miyaze Mubita “Mache”) and my late mother (Mary-Clare Lunza Mubita) may their souls rest in internal peace.

Acknowledgements

I hereby acknowledge the Namibian Government in general and Caprivi Regional Council in particular for the financial support I received during my two years special study leave. Without such financial support my further studies would not have been realized financially. Thus, I recognize both the political and administrative authorities of the Council.

The special thanks goes to the United Nation Center for Regional Development (UNCRD) Team (Professor Peter Ngau, Dr. Isaac Mwangi and Mr. Zachariah Malleche) for identifying and encouraging me to come for full-time study in Urban and Regional Planning during the In-country Training Planning Workshop that was held in Windhoek-Namibia. I am also thankful to the entire University of Nairobi Staff, Students and my only two Classmates (Randu Eric and Fawcett Komollo) for the educational and social support they all gave during the entire programme, without such support life and learning would have been difficult and success would not have been anticipated. Furthermore, I am delighted by the professionalism shown by my research supervisor: Dr. S.V. Obiero for his critical view and tireless editing of my work to reach the acceptable standard.

It is my pleasure to acknowledge my Daddy (Mr. Mubita Sylvester Mubita), brothers, sisters, cousins, my children (Chuma, Kahundu and Lunza), friends and my beloved wife (Lindiwe Nanja Mubita) for their courageous words and support they have shown during my study period in Nairobi-Kenya. I wish my mother had lived this far to experience and witness her son's success, however, wherever she is, she deserves special thanks and recognition for laying my education background.

It was also my honor that I had always strived to do the best in my studies.

Abstract

One of the results of non synchronization of transportation, land use and the environment in developing countries, Namibia included, has been poor attractiveness and maintenance of roads, storm water drainages, urban sprawl and poor solid waste management that has manifested into environmental pollution and degradation. This has been the case in the town of Katima Mulilo where poor road infrastructure has failed to attract investors to the town. On the other hand, the end of civil wars in the region saw the Namibian Government establishing new inter and intra road infrastructures. The new roads and bridges across international boundaries were opened to enhance trade and movement of people such as the Trans Caprivi Highway and Zambezi Bridge.

Those infrastructures have contributed to the economic growth of Katima Mulilo Town on one hand and temporal traffic congestion and environmental degradation on the other. The completion of the Trans Caprivi Highway and Zambezi Bridge in 2004 and 2005 respectively has visualized economic growth by turning Katima Mulilo into a busy stopover town.

This study centers its attention on transportation, land use and environmental degradation within the boundaries of Katima Mulilo Town. It examines the relationship between urban transportation system on one hand and land use and environmental degradation on the other. The findings shows that transportation system is inadequate for the travel need at regional, national and local level while land use and environment are not in harmony with the transportation system of the town. This research study used both primary and secondary data to arrive at those conclusions. The study recommends the tarring of the major arterial roads in the short run while the in the long run it suggest a comprehensive rehabilitation program for all roads and its storm water drainage. The outcomes further suggest the incorporation of garden fuses in the contracts of solid waste management. The study support council's policy to privatize the solid waste management. The town experiences difficulties in providing sufficient services to its residence, because the town serves as a service center for the neighboring countries and its hinterland.

Acronyms and Abbreviation

CBD	Central Business District
CRC	Caprivi Regional Council
DRC	Democratic Republic of Congo
DSWA	German South West Africa
GDP	Gross Domestic Product
HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome
KMTC	Katima Mulilo Town Council
MEATCO	Meat Company
NABTA	Namibia Taxi Association
NDP	National Development Plan
RDP	Regional Development Plan
RFA	Road Fund Administration
SADC	South Africa Development Community
SWAPO	South West Africa People's Organization
TCC	Trans Caprivi Corridor
UN	United Nations
UNCRD	United Nation Center for Regional Development
WNLA	Witwaterland Native Labour Association
ZWFTP	Zambezi Waterfront Tourism Park

TABLE OF CONTENTS

Declaration	ii
Dedication	iii
Acknowledgements	iv
Abstract	v
Acronyms and Abbreviation	vi
CHAPTER 1: INTRODUCTION	1
1.1 Background of the problem	1
1.2 Problem Statement	4
1.3 Research Question	6
1.4 Objective of the study	6
1.5 Research hypothesis	6
1.6 Significance of the study	7
1.7 Scope of the study	9
1.8 Methodology	9
1.8.1 Study design	10
1.8.2 Purposive sampling	10
1.8.3 Oral Interviews	10
1.8.4 Personal field observation	11
1.9 Limitation of the study	11
1.10 Organization of the study	11
CHAPTER 2: LITERATURE REVIEW	13
2.1 General	13
2.1.1 Urban Transportation	14
2.1.2 Urban land use	16
2.1.3 Urban environment	17
2.2 Conceptual framework of the relationship between transportation and land use	19
2.3 Interrelationships of urban transportation, land use and the environment	20

2.4 Summary of issues	21
2.5 Operational definitions used in the study	21
CHAPTER 3: STUDY AREA.....	23
3.1 Historical Background National Context.....	23
3.2 Regional, National and Local context	25
3.2.1 Regional context.....	25
3.2.2 National Context	26
3.2.3 Local context of the study area	28
3.3 Historical development of Katima Mulilo Town	29
3.3.1 Connectivity of the region	32
3.3.2 The importance of highway transportation to Katima Mulilo Town.....	34
3.4 Physical Environment of the Town	35
3.4.1 Topography	36
3.4.2 Climate.....	36
3.4.3 Importance of Katima Mulilo Town.....	37
3.5 Land Use.....	38
3.5.1 Existing Land Use	39
3.5.2 Urban Land use and Transportation	41
3.6 Population and Demographic Characteristic.....	41
3.6.0 Overview.....	41
3.6.1 Population	42
3.6.2 Population Size.....	42
3.6.3 Population Projection and Growth trends	43
3.7 Demographic Characteristics	45
3.8 Energy source.....	47
3.9 Economic Activities	47
3.10 Health and Education	48

3.11 Tourism.....	48
3.12 Dumpsite.....	50
3.13 Imaging issues.....	51
CHAPTER 4: TRANSPORT INFRASTRUCTURE	52
4.0 Overview	52
4.1 Road Transport.....	53
4.2 Road Classification	55
4.3 Maintenance and reconstruction	55
4.4 Roads management	58
4.5 Transportation demand / supply.....	58
4.6 Terminal Facilities.....	59
4.7 Railway Transport.....	60
4.8 Air Transport.....	61
4.9 Road infrastructure and storm water drainage	61
4.10 Environmental degradation.....	63
4.11 Critical emerging issues.....	64
CHAPTER 5: DATA ANALYSIS AND PRESENTATION	66
5.1 Road Conditions.....	66
5.2 Land Use.....	72
5.3 Environmental Management	73
5.4 Transportation, land use and environmental relationship.....	75
5.5 Traffic counts	76
5.6 Synthesis.....	78
CHAPTER 6: SUMMARY OF FINDINGS AND RECOMMENDATIONS.....	83
6.1 Overview	83
6.1.1 Short term interventions	83
6.1.2 Long term innervations.....	87
6.2 Conclusions.....	87

6.3 Further Research 88

REFERENCES 89

APPENDIX 90

LIST OF MAPS

Map 1: Towns of Namibia	3
Map 2: Strategic location of Caprivi Region within SADC.....	26
Map 3: Regional Map of Namibia	28
Map 4: Constituency Map of Caprivi Region	29
Map 5: Arial Map of Katima Mulilo Town	31
Map 6 :Namibia's Major Road Networks	34
Map 8: Connectivity of Katima Mulilo with the hinterland.....	37
Map 9: Katima Mulilo Land use Map.	39
Map 10: Population Map per Constituency.....	42
: Map 11:10% tarred and 90% gravel/earth roads in town.....	54
Map 12: General Storm water drainage of the town River	62
Map 13: Priority of roads to be tarred	85

LIST OF TABLES

Table 1: Namibia's regions, main towns, sizes in km ² and population for 1991 and 2001	27
Table 2: shows population projection for Caprivi Region and Katima Mulilo Urban Constituency.....	44
Table 3: Population Distribution by sex and area for Caprivi Region	44
Table 4: Applied and approved budget per financial years	57

LIST OF PLATES

Plate 1: Zambezi Waterfront Tourism Park	5
Plate 2: Katima Mulilo Open Market	47
Plate 3: Tourism attraction in Caprivi	49
Plate 4: Dumping of refuse around town	50
Plate 5: Poor road maintenance	56
Plate 6: Unofficial terminal	60
Plate 7: Degraded environment in town	63
Plate 8: Gravel/Earth Roads in Katima Mulilo	80

LIST OF FIGURES

Figure 1: shows gender representation in the study	66
Figure 2: Respondents' views on road conditions	66
Figure 3: shows opinion whether roads should be improved.....	67
Figure 4: shows opinion of materials for roads construction	68
Figure 5: Effect of bad roads.....	69
Figure 6: Whether the local transport demand is in line with town's transport needs	70
Figure 7: Town's problems during dry season	70
Figure 9: the level of pollution.....	73
Figure 8: Proposal of solid waste management.....	74
Figure 10: General comments on transportation, land use and environment.....	75

TABLE OF DIAGRAMS

Diagram 1: Transport and Land Use Systems.....	19
Diagram 2: Transportation, Land Use and Environment	20

CHAPTER 1: INTRODUCTION

1.1 Background of the problem

Since the opening of a road bridge in 2004 between Namibia and Zambia, Katima Mulilo Town (*the name Katima Mulilo is derived from Silozi language, meaning 'quenches the fire', in reference to nearby Zambezi rapids*) has been transformed into a busy stopover point along the new Trans Caprivi Highway Corridor connecting the Copper-belt of Zambia with Namibia's sea port of Walvis Bay. The booming town is characterized by a force of wide-open opportunities for agriculture, tourism, commerce and social mobility. The town is located at the point termed as "transport hub". The recently completed Trans Caprivi Highway Corridor is one of these spaces. The rapid long-distance roads and real infrastructures development are emerging across Southern Africa as a result of the end of apartheid and civil wars, increased commodity prices and foreign investment¹. This study examines urban transportation how it relates to urban land use and the urban environment. But in this case, Katima Mulilo has a unique case of history, strategic geographical location and geo-political influence within the SADC countries.

Katima Mulilo's current economic growth can be understood as the combined result of its unique geographical location, economic influence, national and international corridor and borderland. Despite the boom being a new development, the town has been a site of potential opportunities throughout changing protectorate of Britain, German, South Africa and now independent Namibia. It is a fact that development opportunities are never neutral, they have both negative and positive effects. Thus, towns all over the world are growing that so many of the farmlands, wetlands, hinterland, forests have been and will be transformed into human settlements, while urban population growth rates show no signs of slowing down².

¹ Wolfgang Zeller, 2004, Danger and Opportunities in Katima Mulilo: A Namibia Border Booming Town at Transnational Road

² Sten Hansen (1997) A Fuzzy Logic Approach to Urban Land Use Mapping, Roskilde, Denmark

Urban sprawl reinforces the need to travel and increases dependence upon private motorized transport, leading in turn to increased traffic congestion, energy consumption, environmental degradation, fuel emission and noise pollution. The UN Habitant report of 2005 stated that one-third of all Africans were urban dwellers during 1990s. However the latest publication on the State of African Cities (2008) it notes that, Africa was in its early phases of urban development and that the rate of change in urban population was the highest in the world recording 3.3 percent growth rate per year between 2000 and 2005. The report further projects a steep growth of African's urban population that by 2030, the continent may reach the landmark of half of its population living in urban areas³. Africa is still the least urbanized continent in the world; with approximately 38.7% of its population living in areas classified as urban⁴. The continent's population and urbanization is geographically and unevenly distributed with inter-regional urbanization differences.

For example, East Africa Region had been the least urbanized in the world, but was urbanizing very rapidly while the Northern and Southern Africa's regions had the continent's highest urbanized figures, but their average annual growth rates of urbanization, as expected were declining⁵. In Southern African region, Namibia had been one of the least populated countries with a population of 1.8 million in a country size of 825,118 km², with very few scattered urbanized centers (Map: 1 below)⁶. The towns and cities in Southern African regions share the common heritage of ethnic segregation under which the majority of the indigenous nationals were denied movement between the homelands under the racial division rule⁷.

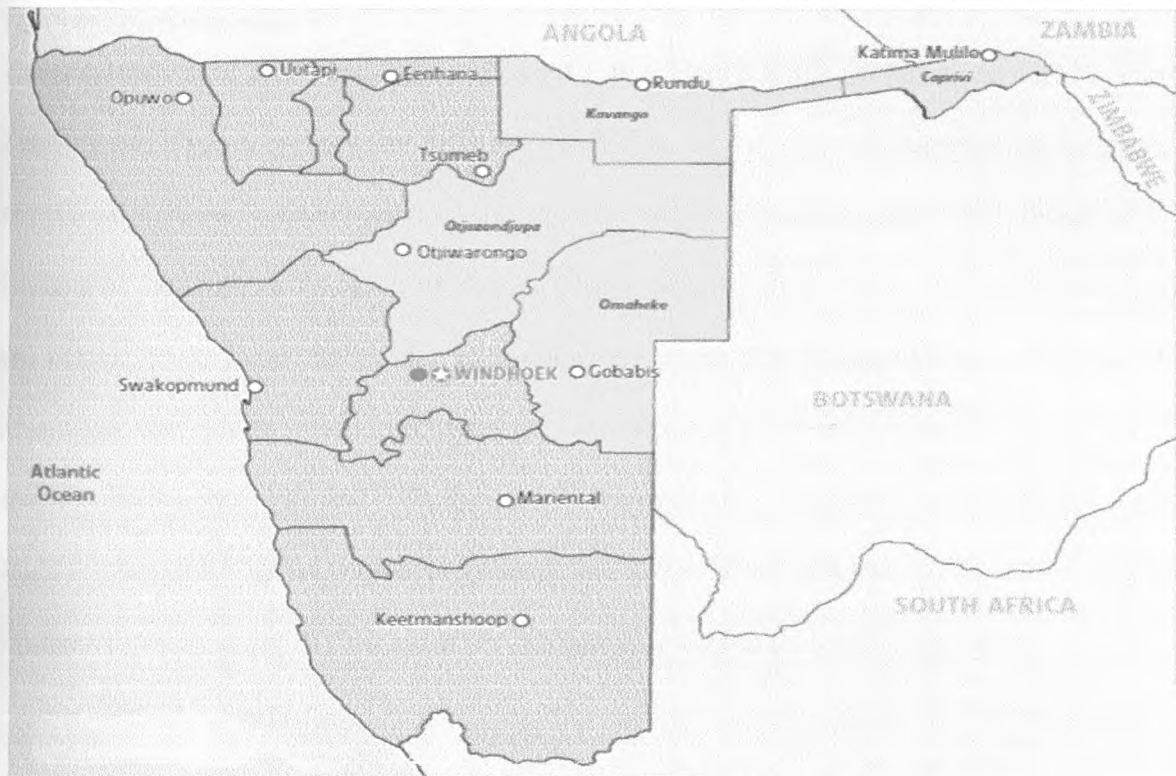
³ United Nation Habitant Report (2008) Regional Conference of Mayors of Capital Cities of Africa, Plenary Session 5

⁴ United Nation Report (2008) Capital cities and finances: challenges and opportunities

⁵ United Nation Habitant Report (2008) State of African Cities: framework to address urban challenges in Africa

⁶ Namibia Population and Housing Census (2001), National Planning Commission, Windhoek, Namibia

⁷ Wolfgang Zeller, 2004, Danger and Opportunities in Katima Mulilo: A Namibia Border Booming Town at Transnational Road.



Map 1: Towns of Namibia (Source: Population Census 2001)

When Namibia got its independence from South Africa on March 21, 1990, immediately the country adopted the Constitution that provided for the freedom of movements within Namibia under the Fundamental Human Rights and Freedoms Chapter 3; article 21(g)⁸. The country realized the potential of urbanization and road infrastructure development network linking all towns within the country and its neighboring countries in the event to overcome the country's poor intra and inter regional connectivity inherited from the colonial governments. The road network did not only provide major logistic and economic integration, but also unlocked vast tracks of rural land that translated the utilization of geographically better spread urbanization sprawl and its benefits. An example of such road networks is the Trans Caprivi Highway linking several towns of Namibia and other landlocked SADC countries to the ports of Walvis Bay through Caprivi region.

⁸ The Constitution of the Republic of Namibia, adopted by the Constituent Assembly on the 9th day of February 1990

1.2 Problem Statement

The construction of the Trans-Caprivi Highway that links Katima Mulilo to the rest of Namibia, Zambezi and Ngoma bridges that links Katima Mulilo to Zambia and Botswana respectively, has caused an increase in transportation and environmental degradation that need attention, this is because of the strategic location of Katima Mulilo Town within SADC region. Within Zambia, the nearest town from the border is Livingstone some 200 kilometers from Katima Mulilo. Meanwhile the closest proclaimed town in Botswana and Zimbabwe from the border is Kasane and Vic Falls some 130 and 170 kilometers respectively. Therefore, the residents of Katima Mulilo Town and Caprivi region in general, and those of the neighboring countries adjacent to the border use the town as their main service center to access their basic necessities.

Furthermore the influxes of tourist and other country's residents have contributed to economic growth on one hand, temporal traffic congestion, land use conflict and environmental degradation on the other. Borrowing from the World Bank report (1994) on infrastructure development, it argues that the adequacy of infrastructure helps to determine one town's success and another's failure. Thus, Katima Mulilo Town has better infrastructure facilities within a radius of 120 kilometers or more from the international borders. A pull factor, why it is used by the hinterland of neighboring countries as their service center, adding to that is the completion of major infrastructure developments (Road Bridges, Tran Caprivi Highway and Zambezi Waterfront Tourism Park) that were envisaged in the town that has generated much traffic and environmental decay. Moreover, Caprivi is a tourism attraction destination because of its prosperous fauna and flora of the Bwabwata, Mudumo and Nkasa National Parks and several conservancies joining to the famous Chobe National Park and Zimbabwe/ Zambia's Victoria Falls.



Plate 1: Zambezi Waterfront Tourism Park (Source: Field Survey 2010)

Zambezi and Lake Lyambezi recreation fishing gives another tourist attraction to the town. This has motivated the Namibian Government to investment and develop the Zambezi Waterfront Tourism Park (ZWFTP) (Plate: 1). A true investment that will generate more tourist attraction once completed. Such an investment, projects a further heavy traffic inflow to the town. The recent agreement between the Namibian and Botswana Governments on the provision of a port to the land locked Botswana at Walvis Bay will further generate more traffic in years to come just like the existing port of Zambia at the same harbor.

1.2 Research Question

The research question, which guided this study, was the effect of urban transport system on land use and the environment on the other hand.

1.4 Objective of the study

The Overall objective of the study is to:

Examine the relationship between urban transportation system on one hand and land use and the environment on the other.

The specific objectives of the study are:

1. To examine the transport network and traffic in Katima Mulilo.
2. To examine the land use pattern and the state of the physical environment in the study area.
3. To assess the effect of the transport system on both the land use pattern and physical environment.
4. To propose policy framework on the appropriate strategies for optimal and integrated development of the transport system, land use and environment in the town.

1.5 Research hypothesis

1. H_0 "The transport system is adequate for the travel needs in Katima Mulilo"

H_1 Transport system is inadequate for the travel needs in Katima Mulilo.

2. H_0 "Land use and environment are in harmony with the transport system in Katima Mulilo"

H_1 Land use and environment are not in harmony with the transport system in Katima Mulilo"

1.6 Significance of the study

Katima Mulilo Town was purposefully chosen because of its transport hub, strategic location within the SADC and its service to several hinterlands of neighboring countries. Economically, the construction of the Zambezi Bridge had strengthened the buying power on one hand and led to temporally traffic congestion on the other. Administratively, Katima Mulilo is the administrative center of Caprivi Region. Thus a well planned neighborhood is always self-sufficient because it ensures adequate provision of facilities and services to serve its inhabitants. Because of the influence that the town has over its hinterland and those of other countries the infrastructure development has proven to be insufficient or inadequate. The town like many urban areas is undergoing increase in population and physical expansion.

Internationally, the town has a potential of developing into a major tourist attraction area because of its functional and strategic location within SADC region. The town boosts with tourism attractions areas, the availability of land, low crime rate and the demand for business that was demonstrated after the commissioning of the Trans-Caprivi Highway and Zambezi Bridge respectively. Despite those potentials, investment is still very slow resulting from the poor appearance and lack of infrastructure development such as roads and storm water drainage.

The Katima Mulilo's internal road network consists of the following types and length: 6.5 kilometers of tarred roads, 77.5 kilometers earth/gravel roads and 12.5 kilometers of undeveloped road tracks⁹. It should be noted that the above length does not include the two main tracks (B8) that passes through Katima Mulilo, which is the responsibility of Road Authority Company. Normally, when roads are in unfavorable condition in many cases the storm water drainage will not be able to drain water¹⁰. For this reason it is therefore a common practice to see

⁹ Republic of Namibia, 2007, Project: NAM341-Urban Development Katima Mulilo, Lox Development Namibia, Windhoek, Ministry of Regional and Local Government, Housing and Rural Development

¹⁰ Republic of Namibia, 2007, Project: NAM341-Urban Development Katima Mulilo, Lox Development Namibia, Windhoek, Ministry of Regional and Local Government, Housing and Rural Development

flood occurring in Katima Mulilo Town during heavy rain seasons. The poor drainage system has been linked to higher prevalence of malaria and other related environmental diseases by the Ministry of Health and Social Services (MoHSS). During dry seasons the town is affected by dust generated from heavy traffic, since 90% of the town's road network is gravel/earth roads.

Quality road development in urban areas, are real infrastructure that is major in shaping town structures and enhancing economic activities. Transport has a major influence on the spatial and economic development of towns, regions or countries. The change in accessibility as a result of new real infrastructure always encourages new developments/investment. Thus the attractiveness of a particular town or location depends largely on its relevant accessibility, quality and quantity of the transport infrastructure. It is the environmental conditions, land use, quality and accessibility of the present roads infrastructure of Katima Mulilo Town that forms the bases of this study. The previous studies had focused more on the social impact of the Highway Corridor, while the principal aim of this study is to investigate whether land use and environment are in harmony with the transportation system. This study investigates the above situations and come up with recommendations and coping strategies.

The outcome of the study will help the planning authorities i.e. Local and Regional Councils, Ministry of Regional, Local Government, Housing and Rural Development, Ministry of Works, Transport and Communication, Ministry of Environment and Tourism, National Planning Commission and other relevant stakeholders to understand the transportation, land use and environmental issues of urban areas. It is also the intention of this study to help planners and decision makers to decide on whether to review the existing legislation of Katima Mulilo as a unique geo-political and functional town in Namibia to suit the region's situations. The main challenge facing the town in its attempt to conserve and protect the urban ecosystem is

environmental pollution such as solid waste management, deforestation etc. The current status quo of environmental degradation within town boundaries has reached an alarming rate that needs attention, mostly at the informal settlements and dumping pit. The study explores the intervention and suggests ideas on how the problem can jointly be alleviated so as to uphold the concept of sustainable development as articulated in Local Agenda 21 where Namibia is a signatory.

1.7 Scope of the study

The study investigates issue of transportation, land use and environmental degradation within the town land of Katima Mulilo which concedes with Katima Mulilo Urban Constituency. The study limits itself within Katima Mulilo boundaries because of time and financial constraints.

1.8 Methodology

The study involved data collection, analysis, interpretation and presentation of the findings. Data was collected from both primary and secondary sources. The primary data included fieldwork that was undertaken within Katima Mulilo Town's all locations. The sampling framework included random selection of households from all suburbs; this was done so in order to cover the views of all income groups. This process covered the administration of questionnaires, conducting interviews and making observations. The secondary data included review of the existing published and non-published written materials such as Council Minutes. Those helped in forming the foundation of this study, so as to create an understanding of the theories of urban transportation, land use and environmental degradation.

1.8.1 Study design

The research was conducted under the provision of Namibia's Statistical Act 66 of 1976, which states that "the information collected shall be treated with confidentiality and shall not be devilled to anyone accept the members of the research team and shall only be used for the purpose of the research". The dressing code of the research team was formal in order to avoid rejection.

1.8.2 Purposive sampling

Caprivi Region and Katima Mulilo Town in particular were selected using purposive sampling because of its location that functions as a transport hub and a service center for the hinterlands covering bordering countries. This allowed the researcher to obtain the necessary information with respect to the objectives of the study. The political leaders and Heads of Department from relevant institutions as decision makers were also purposefully selected.

Among the residents of Katima Mulilo as the study area, cluster sampling was used to obtain the actual samples of the study. The mechanical counting was also used at selected cordial points deemed necessary to indentify traffic passing through those points at selected times of the days. A further differentiation in recording was made between national and foreign vehicles to determine the volume of national and foreign traffic.

1.8.3 Oral Interviews

This was important especially in matters of personal opinion; it was felt that the structured questions will limit the freedom of opinion and hence leave out important points in response. This method was employed to interview selected members of Caprivi Regional Council, Katima Mulilo Town Council, Business Communities, Heads of Departments, Head of Households, Pedestrians and Tourists. Questionnaires were prepared before oral interviews and reflected what was to be asked.

1.8.4 Personal field observation

This was used for the identification of the conflicting types of land uses in the study area. This method assisted in the selection of relevant photographic scenes deemed necessary for the study. The check list was used to verify that, all the intended respondents were contacted and interviewed as per plan. These research methods employed were used to obtain both qualitative and quantitative information from the range of stakeholders. It was from those populations that the sample population was drawn. The data was analyzed using Statistical Package for Social Scientist (SPSS) and findings presented in the form of charts and tables, where conclusions and recommendations were derived.

1.9 Limitation of the study

The study faced two major limitations that is, limited time and financial resources. Data was collected during a three weeks' vacation period. The research was self sponsored and financing research needs was a challenge. Despite those limitations, relevant information was obtained to bring up arguments and conclusions of the study topic.

1.10 Organization of the study

This study is divided into five chapters. Each chapter starts with an overview that highlights the main content of the chapter in the order of occurrence of the study.

a) Chapter One: Introduction

This chapter introduces the reader to the problem statement of transportation, land use and the environmental. It formulates the basic concepts of the study, how the study was formulated and its significance. It further looks at the research question and objectives. The chapter also brings out the research methodology used in data collection which includes the selection of the study area, key informants and other respondents. The chapter ends with the scope, limitation and structure of the study.

b) Chapter two: Literature review

This chapter begins with the review of the theoretical background of transportation, land use and environmental degradation in towns and cities. The chapter separately focuses of review of each concepts, transportation, land use and environment. The chapter closes with the conceptual/theoretical framework of the study and definition of concepts.

c) Chapter Three: Background of the study area

The chapter introduces the reader to the study area (Katima Mulilo Town) on the bases of national and local historical development of the town, demographics and population, economic importance of the town and physical environment in relation to transportation, land use and environmental degradation. The chapter ends with emerging issues.

d) Chapter four: Transport Infrastructure

The chapter begins with the overview of transportation, analysis of road transport, road classification, maintenance, management, road infrastructure and storm water drainage, environmental degradation and the chapter ends with emerging issues.

e) Chapter five: Data Analysis and Presentation

The chapter presents the analysis and finding of the study in relation to transportation, land use and the environment. The chapter ends with the synthesis of the findings.

f) Chapter five: Summary of Findings and Recommendations

This is the last chapter of the study. It contains various recommendations in the form of policy interventions on roads, land use and the environment. The study ends with the further research options.

CHAPTER 2: LITERATURE REVIEW

2.1 General

If modern economics began with Adam Smith, transportation and location theory began with Von Thunen. He was the first to develop a basic analytical model of the relationships between urban centers, activities and their transportation although he confined himself to the relationship between agriculture land use and markets. The relative cost of transporting different agricultural commodities to the central market determined the agricultural land use around a city. The most productive activities will thus compete for the closest land. The goal of all land uses is to maximize their productivity, which is dependent upon their location from the Central Business District (CBD). There is a strong relationship between the transport system and land use patterns.

A study done in 1939 by Homer Hoyt concluded that the land use pattern was not a random distribution, nor sharply defined rectangular areas or concentric circles but rather sectors. Communication axes are mainly responsible for the creation of sectors, thus transport has directional effect on land uses. After Hoyt's development of a sectorial city, C.D. Harris and E.L. Ullman (1945) introduced a more effective generalization of urban land uses. It was brought forward that many towns and nearly all large cities do not grow around one CBD, but are formed by the progressive integration of a number of separate nuclei in the urban fabric. These locations become specialized and differentiated in the growth process but are bound by a number of attributes, such activities require specialized facilities and need maximum accessibility.

Similar activities grouped together imply improved interactions service. Those are activities such as banks, shops and institutions. Nonetheless some activities repels to each-other, such as high quality residential and heavy industrial areas. This may be defined as centrifugal forces because some activities cannot afford the rent of locating at an optimal site. They thus locate at cheaper periphery of the town but suitable for such activities.

In a market economy, most of the urban land can be freely sold or purchased. While land economics are concerned about how the price of urban land is fixed. Spatial/physical planners are concerned with the nature, pattern and distribution of urban land uses. The value of urban land, the rent, is the result of capitalization and the advantages of location. When a city grows, more remote locations are being used, making the rent of most accessible places increase. Such locations have no other choice than to be more dense and productive. Density and rent are closely related in functionality.

2.1.1 Transportation

The land value is closely related to the roughness of space, because with no friction all locations would be perfect locations. This friction is normally overcome by transportation, but transport has its price, which is commonly a function of the distance travelled. Land use is thus determined by the rent-paying ability of different economic functions in urban areas, such as retailing, industry and residence. The optimal location, where accessibility is optimal, is the CBD. Almost all activities would like to be located there, but they do not have the same capacity to afford this optimal location. The perfect location brings the surfacing of a CBD that changes the urban form and the location of economic activities.

Urban areas are highly complex systems dealing with multiple functional relationships between transportation, land use and the environment. It is a system where locations and spatial accumulation forms the bases of land use. The locations of all land use are embodied in the concept of accessibility. The basic analysis tool for planners working in the fields of transportation and land use is forecasting, which generally acknowledge the reciprocal relationship between transportation and land use. Scholars conceptualize such relationships using mathematical, statistical and logical methods and produced models capable of predicting changes in transportation and land use systems as the result of population increase and policy measures.

A study by Cervero (1984) points out that transportation networks and the spatial patterns of land use mutually influence each other over time. Changes to transportation networks, such as the construction of a new link or expansion of an existing one, eventually influence the location of investment in land and the demand for travel to and from a particular location. This relationship is referred to as the transportation-land use “link” or “cycle”, emphasizing a feedback relationship (Kelly 1994). The mediating factor in determining changes in the location of activities and the demand for travel is *accessibility*, which measures a location with relative to other activities or opportunities distributed in space.

A change in relative accessibility is measured when researchers identify the influence of new infrastructure, such as a highway link. In such cases, accessibility is usually approximated by some measure of access to the transportation network, such as travel time or distance (Ryan 1999). Generally, the degree of land market impact is related to the impact of the new transportation link on regional accessibility and is roughly proportional to the increase in speeds (and reduction in travel time) permitted by the new link.

David (1994) considers that modern towns and cities is where opportunities and challenges coexist. On one hand, the municipal government pours a great amount of investment into infrastructure, especially transportation facilities. Although many towns in developing countries do not afford to invest 2% or more of their annual GDP in infrastructure development, even so their authorities recognize infrastructure as the power that lubricates urban development. When the city’s master plans are updated, transportation development strategies are also reviewed and modified to meet the future needs. On the other hand, rapid economic development, urban expansion and high rural-urban migration has created a high demand for transportation for which current facilities cannot meet despite the amount of money the municipalities invest in

infrastructure. Traffic congestions are worsening while poor transportation hinders development. The conventional engineering or technical methods offers no speedy solutions.

Wolfgang (2004) noted that the new road bridge across the Zambezi River has opened the main point of transit between Namibia's Caprivi Region and Zambia's Western Province and closed the gap of 2,500 kilometers long asphalt route called 'Trans Caprivi Corridor' (TCC). He further states that real infrastructure developments are emerging across Southern Africa as a result of the end of civil wars in the region.

Richard (2001) described the development of urban transport economic theory as a gradual elaboration of a colonial model. The basic model (Beckmann, McGuire and Winsten (1956)) examines travel on a point-input, point-output road. Individual drivers are identical, and the only economic decision each driver makes is trip frequency. Congestion is captured by a congestion cost function which relates trip cost to traffic volume and capacity

2.1.2 Land use

Land use is an important component to understand physical town expansion and the interactions of economic activities within the environment. Sprawl occurs because of both social and economic opportunities that exist in urban areas. The social and economic development generates different activities of urban sprawl leading to new characteristics of urban land use.

Keeble (1964) and Mwagi (2003) advocated that town and regional planning are arts and science of orderly land use, the character of sitting building and communication routes, so as to secure effective degree of economic interaction, convenience and beauty. If those are not archived then land use conflict will rise, many studies, have noted that land use conflicts are always consequences of planning and policy management failures. Although in most cases such failures are not felt at present, the effect of land use conflict and degradation surfaces slowly and in a long run will rises.

Keeble (1964) further argues that the success or failure of towns is determined by today's planning and management failure or success. Susan (2002) contends that, the connection between transportation and land use lies at the center of efforts in towns to combat sprawl through smart growth strategies. Proponents of smart growth commonly make several specific propositions about the relationships between transportation and land use they argue that building more highways will contribute to more sprawl, lead to more driving while investing in light rail transit systems will increase densities and adopting new urbanism design strategies will reduce automobile use. Generally, the core function of the urban planning is to allocate different activities in limited space.

Olima (1993) warns that land use incompatibility rises due to conflicting interests between the indigenous land owners and Local Authorities/Municipalities. In situations like this, proper planning and consultation must be undertaken to ensure that there is no land use conflict. On the other hand, conflict can be a result of mixing of incompatible land users. For example, in Katima Mulilo's Soweto Location, the researcher observed a situation where a church is sharing a fence with a public bar on one end and a school on the other (St. Joseph Roman Catholic Church, Barros Public Bar and Mavuluma Primary School). Katima Mulilo town like other urban areas is likely to face land use conflict as it grows, unless if proper land uses management system will be imposed.

2.1.3 Environment

Environmental groups had voiced concerns on the impacts of sprawl. For example, the Sierra Club (2003) stressed that scattered development has increased traffic, depleting local resources and destroys open spaces. Land degradation, river siltation and pollution from residential and industrial areas are some of the environmental concerns associated with urbanization or industrialization.

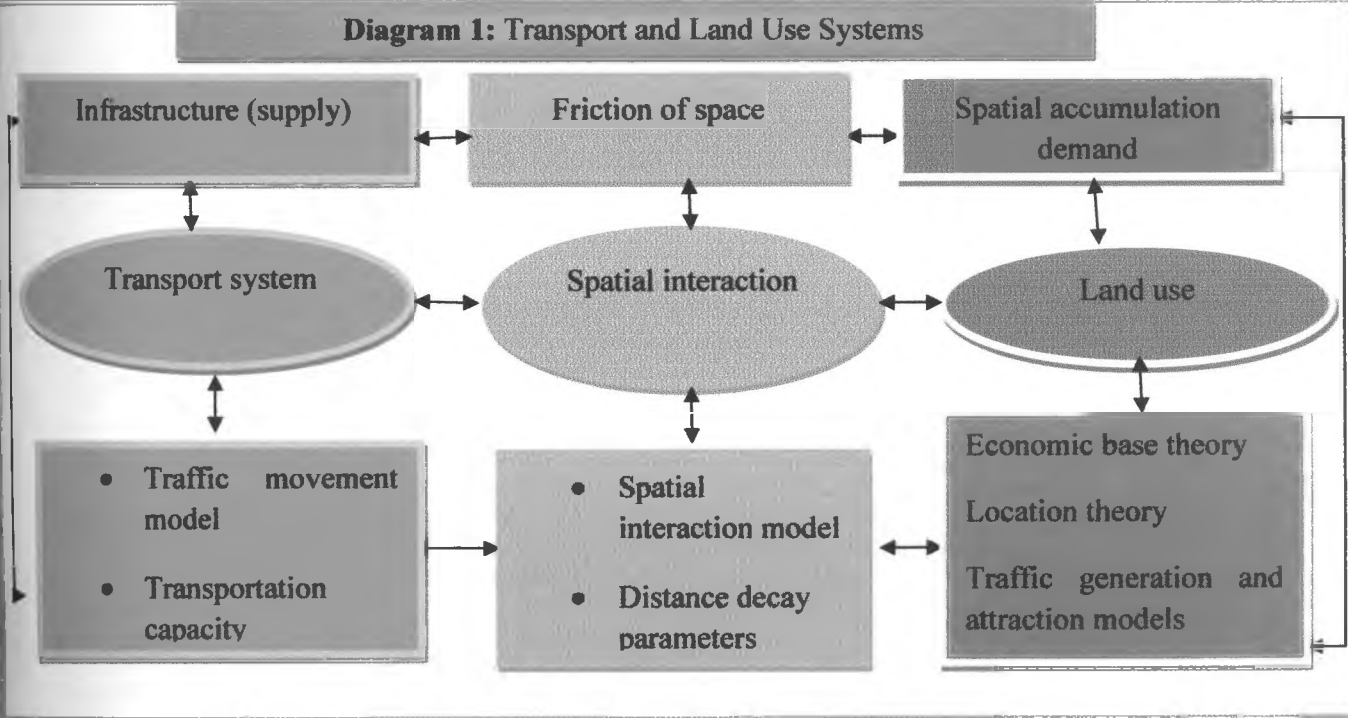
However, urbanization alone without the short sightness of man does not cause damage. Therefore, man should properly plan urban land use activities within a relevant framework that is environmentally sustainable. Urban areas occupy only 1% of the earth's land surface area, but it is the most source of environmental pollution in the world, through poor management of solid waste, emission gases etc. The land requirements for industries, transport, residential and recreation increases pressure on land as a resource¹¹

Katima Mulilo town was initially an agricultural and tourism area, the land use was purely changed to urban setting as per 1963 layout plan. In support of this, Mwangi (2003) notes that in the third world countries, towns and cities are driven by poverty rather than industrialization. This trend causes urban areas to grow at unpredictable rate where urban land becomes under severe pressure, because of increase in population and ineffective land management practices that have resulted in the environmental degradation within and around urban areas.

The essence of the town or city is that many activities should be clustered together in very close proximity. This generates a lot of externalities; most effects are not intended to individuals and businesses in a city but to the entire community. Road investments pay off very well when there are enough activities and enough people that use the road and these are referred to as positive externalities e.g. the construction of a road in urban areas leads to an increase in the price of land and proper management of solid waste. Whereas, they are also negative externalities e.g. in the congestion, nobody believes that they (individuals) are causing the congestion, but it is by the collective effect of the individual actions on congestion that affects everybody and the environment negatively while the same is true with noise and air pollution.

¹¹ United Nation for environmental Programme (2000), Nairobi, Kenya

2.2 Conceptual framework of the relationship between transportation and land use.

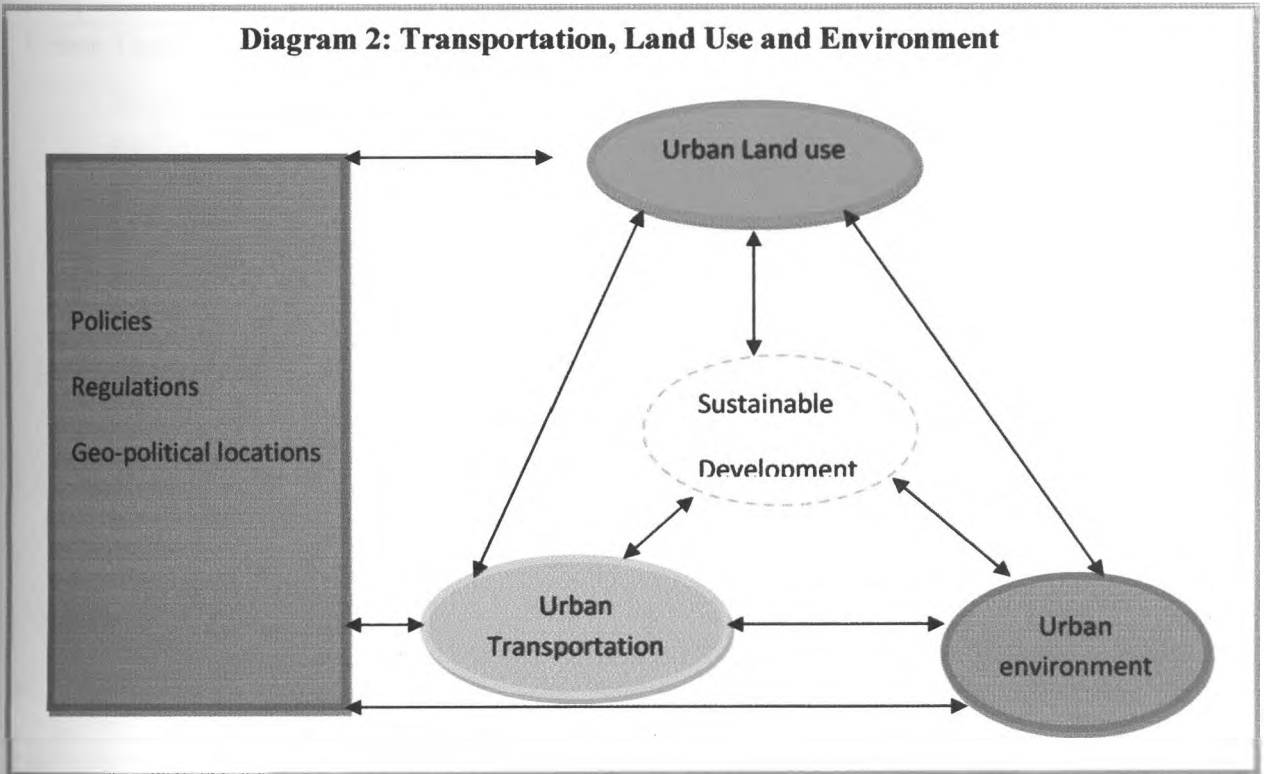


(Source: Field Survey 2010)

Transportation has impacts on economic systems while an economic system has also impact over transportation systems. In other words, transport supply and demand are mutually interdependent. The interface of the two concepts is what is referred to as friction of space. For instance, the construction of a highway interchange favors the emergence of a commercial centre, which will generate supplementary transport demand and in turn favors the location of new activities and a reorganization of the regional spatial structure. Road transportation in urban areas takes approximately 60% of the urban land. This is because every property or plot should be provided with an access point on the spatial layout. Road networks breeds traffic and goods movement that are essential for consumption. Transportation is a function of land use while on the other hand land use is also a function of transportation, demonstrating the cycle relationship.

2.3 Interrelationships of urban transportation, land use and the environment

Diagram 2: Transportation, Land Use and Environment



(Source: Field Survey 2010)

Development is never neutral; it has both good and bad implications. The reciprocal relationship among land use, transportation and the environment has leads to factors or issues that can be examined hence the conceptual framework. Towns are places having high level of accumulation and concentration of economic activities supported by a transport system. The urban productivity directly depends on the efficiency of its transport system, notably for people, goods and services between origin and destination. The waste of goods and pollution (air, water and soil) negatively affect the environment, the effect of the environment can be disasters to the population on the environment. The interface of transportation, land use and environment is sustainable environment which is normally supported by government policies and regulations. Diagram 2 emphases on the efficiency and effectiveness of various policies to manage urban transportation, urban land use and environment in order to realize sustainable development in the town of Katima Mulilo. It is a fact that urban centers generates and attracts movements.

2.4 Summary of issues

Urban Transportation	Urban land use	Urban environment
<ul style="list-style-type: none"> - Accessibility and quality of materials used for road construction. - road network and layout - Storm water drainage - Terminals and traffic flows 	<ul style="list-style-type: none"> - Regional Headquarter of the region - Geopolitical influence - Land use conflict (High demand for land use for human activities) - Geographical growth of Katima Mulilo has not been proportional to population growth (population density). - Different urban concentrations are linked to different levels of energy consumption and environmental impact (informal and formal settlements) 	<ul style="list-style-type: none"> - Physical location - Migration - Solid waste management - Pollution (air, water, soil and noise) - Deforestation - Sanitation

It should be clear that urban transportation, urban land use and urban environment are interdependent, this means that one cannot exist without the other. Failure to manage one will affect the others. Land use and transportation are functions of the environment.

2.5 Operational definitions used in the study

Informal Settlements (often referred to as squatter settlements or shanty town) characterized are dense settlements comprising of communities housed in self constructed shelter under condition of traditional land tenure. Such settlements are very common in developing countries and are typical a product of urgent need for shelter by urban poor. As such they are identified by dense proliferation of small corrugated building made from diverse material, degradation of the local ecosystem and severe social problems (Nam 341: 2007)

Council: the term wherever it appears refers to Katima Mulilo Town Council or Caprivi Regional Council as use in the Regional Council Act (Act no.22 of 1992) and Local Authority Act (Act no.23 of 1992).

Transportation/transport: the movement of people and goods as opposed to the movement or flow of information and ideas. The term transportation and transport have been used without assigning specific meanings. Essentially they mean one thing. Road transportation system, defines the location in space along which passengers and goods flows, it also include other transportation related systems namely weighbridge, road bridge, patrol stations and garages (Wolfgang: 2000)

Accessibility refers to the measurement of the spatial distribution of activities, adjusted for the ability and desire of people or firms overcome separation. Black (1981) defined accessibility as a concept that combines the geographical arrangements of land use and the transport that serves land uses. Accessibility can be referred to how conveniently land uses are located in relation to each other and how difficult or easy to reach them via the transport network. (Ouma 1998)

Land use is that part of the larger process of town planning. It is basically concerned with the location, intensity and amount of land development required for various spaces. While formal land use refers to the qualitative attributes of space, functional land use indicates the socioeconomic function of a territory. For instance, while *factories* are qualitative attribute, *industrial* is an economic function (Town Planning Act 1957)

Functional land use is the level of spatial accumulation of economic activities such as production, consumption, residence, transport, etc. It refers to the functions transposed in space of a city. It is of great concern to urban planners, economists and geographers (Opperman 1995)

CHAPTER 3: STUDY AREA

3.1 Historical Background National Context

The San communities are generally assumed to have been the earliest inhabitants of Namibia. The later inhabitants include the other Bantu-speaking tribes who migrated from the north of Africa around the 14th Century. The unfriendly Namib Desert constituted a terrible barrier to European exploration until in the late 18th century, when series of travelers, traders, hunters and missionaries explored the area¹². In 1878, the United Kingdom annexed Walvis Bay on behalf of the Cape Colony, and the area was incorporated into the Cape of Good Hope in 1884.

United Kingdom further recognized the hinterland up to 20 degrees east longitude as a German specialty of influence. A region today called Caprivi (*drives its name from popular mockery arising from the controversies surrounding the Heligoland-Zanzibar Treaty, by Chancellor Leo von Caprivi. It gradually came into use in the German public during the early years of the 20th Century and eventually found its way into publications and official documents*) became part of South West Africa/Namibia after an agreement on July 1st, 1890, between the United Kingdom and Germany. This was because the British realized that the Caprivi Strip would fall under German influence in order to provide access to the Zambezi River and other German colonies in East Africa, so in exchange, the British received the islands of Zanzibar and Heligoland¹³. The German administration ended during First World War following South African's occupation in 1915 over Namibia (then South West Africa).

¹² Wolfgang Zeller, 2004, Danger and Opportunities in Katima Mulilo: A Namibia Border Booming Town at Transnational Road.

¹³ Kangumu Kangumu (2000) A forgotten Corner of Namibia: Aspect of the History of the Caprivi Strip, Pretoria, South Africa.

On December 17, 1920, South Africa undertook the administration of South West Africa/Namibia under Article 22 of the Covenant of the League of Nations. The agreement gave South Africa full power of administration and legislation over the territory¹⁴. When the League of Nations was dissolved in 1946, the newly formed United Nations (UN) inherited its supervisory authority for the territory. During the 1960s, when European powers granted independence to most of their colonies and trust territories in Africa, pressure mounted on South Africa to do so to then South West Africa/ Namibia¹⁵. The United Nation General Assembly revoked South Africa's mandate in 1966. During the same year, South West Africa People's Organization (SWAPO) began its armed struggle to liberate Namibia.

In 1977, Western member states of the UN Security Council and Western Contact Group launched a joint diplomatic effort to bring an internationally acceptable transition of independence to Namibia. Their efforts led to the Security Council Resolution 435 in April 1978 for settling the Namibian problem. The proposal, known as the UN Plan, was drafted after consultations with South Africa, the front-line states (Angola, Botswana, Mozambique, Tanzania, Zambia, and Zimbabwe), SWAPO, UN officials and the Western Contact Group. This called for the holding of elections in Namibia under UN supervision and control. South Africa agreed to cooperate in achieving the implementation of Resolution 435. Nonetheless, in December 1978, in defiance of the UN proposal, it unilaterally held elections in Namibia that were boycotted by SWAPO and a few other political parties. South Africa continued to administer Namibia through its installed multiracial coalitions.

¹⁴ The Convent of the League of Nation (June 28, 1919) 30th of Sivan 5679

¹⁵ Kirsten Alnaes (1989) *The Namibian History*, Namprint, Windhoek, Namibia

In May 1988, a United States mediation team, headed by Assistant Secretary of State for African Affairs Chester A. Crocker, brought representatives from Angola, Cuba, South Africa and observers from the Soviet Union together in London. The parties worked out agreements to bring peace to Namibia and make the implementation of UN Security Council Resolution 435 possible. On December 13th 1988, SWAPO and South Africa agreed to a ceasefire and total troop withdrawal from the war zone.

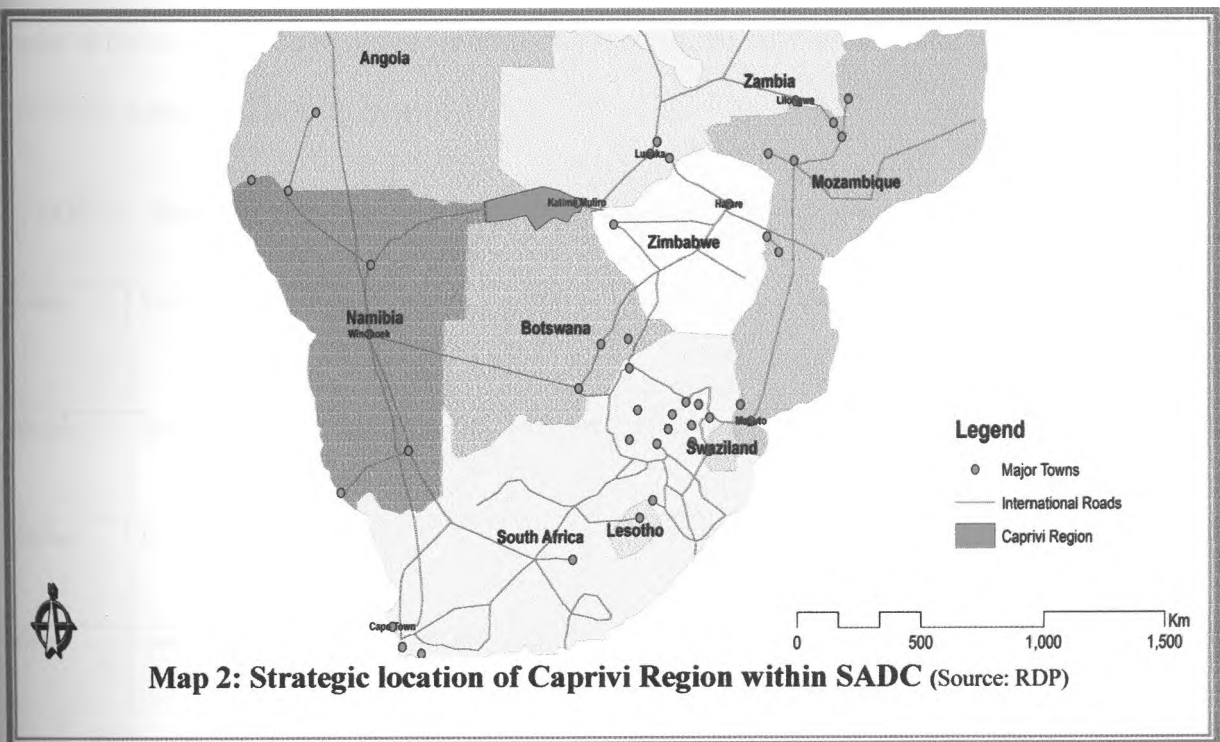
The implementation of Resolution 435 officially began on April 1st, 1989. By 9th February 1990, the Constituent Assembly had drafted and adopted a Namibian Constitution. On March 21st, 1990, Namibia officially marked its independence day. On March 1st, 1994, the coastal enclave of Walvis Bay and 12 other offshore islands were transferred to Namibia by South Africa in fulfilling the UN Security Council resolution 432 of 1978 which declared Walvis Bay as an integral part of Namibia. By then, the road networks among homelands were poorly developed, in fear of people regrouping and fight the colonial regime. Until 1994 the port of Walvis Bay belonged to South Africa, a port where the Trans Caprivi Highway starts and ends in Katima Mulilo from a national perspective. A reason as to why Trans Caprivi Highway and Zambezi Bridge could only be completed in 2004 and 2005 respectively.

3.2 Regional, National and Local context

3.2.1 Regional context

Caprivi region is situated in the north-eastern part of Namibia. The region covers a total area of 19,532 square kilometers, in a country of 825,118 km² and accounts for only 1.8 per cent of the total land area of the country¹⁶. The regions shares borders with four countries, being Angola and Zambia to the north, Zimbabwe to the east and Botswana to the south (Map: 2). the region is surrounded by Zambezi, Kavango, Kwando, Linyanti and Chobe rivers.

¹⁶ Namibia Population and Housing Census (2001) National Planning Commission, Windhoek



The river systems form the basis of fauna and flora endowment that is different from the rest of the country. The Caprivi's natural resources of forests, vegetation, fish, wildlife and rivers provide significant agriculture and tourism potential that complement the attraction to the region and town.

3.2.2 National Context

Upon independence Namibia was divided into thirteen regions in the light of urbanization and decentralization (Table 1 & Map: 3 below). The thirteen regions were transformed into 13 Regional Councils in terms of administration, that were placed under the supervision of the Ministry of Regional and Local Government, Housing and Rural Development (MRLGH&RD) which is directly responsible for the planning and administration of towns and villages¹⁷. The Regional Councils Act (Act no. 22 of 1992), Local Authority Act (Act no. 23 of 1992), the Townships and Sub-division of Lands Ordinance (Ordinance no. 11 of 1963) and the Town Planning Act of 1954 provide the legislative base for the Regional Councils. The direct planning

¹⁷ The Constitution of the Republic of Namibia adopted by the Constituent Assembly on the 9th day of February 1990

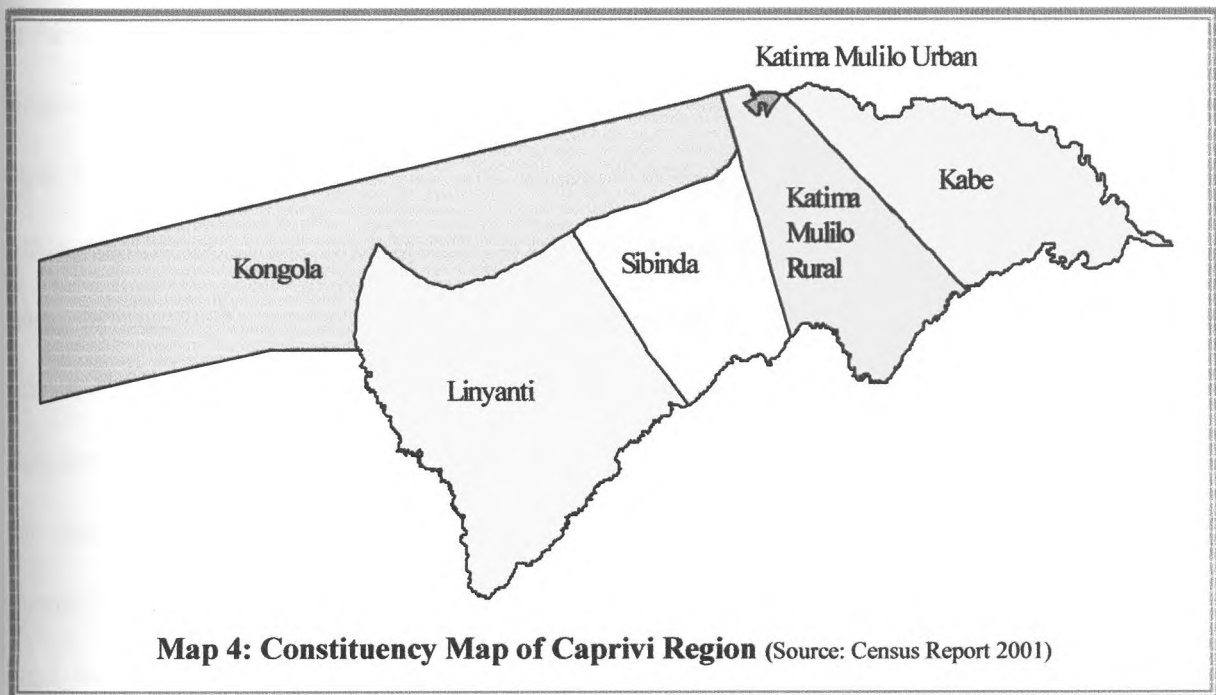
tasks of the Regional Councils are mostly confined in the rural areas while the urban areas fall under the control of Local Authorities.

Table 1: Namibia's regions, main towns, sizes in km² and population for 1991 and 2001

Region	Town	A (km ²)	1991	2001	Region	Town	A (km ²)	1991	2001
Erongo	Swakopmund	63,720	55,470	107,663	Okavango	Rundu	43,417	116,830	202,694
Hardap	Mariental	109,888	66,495	68,249	Omaheke	Gobabis	84,732	52,735	68,039
Karas	Keetmanshoop	161,324	61,162	69,329	Omusati	Outapi	13,638	189,919	228,842
Khomas	Windhoek	36,805	167,071	250,262	Oshana	Oshakati	5,290	134,884	161,916
Kunene	Opuwo	144,255	64,017	68,735	Oshikoto	Tsumeb	26,607	128,745	161,007
Caprivi	Katima Mulilo	19,532	90,422	79,826	Otjozondjupa	Grootfontein	105,328	102,536	135,384
Ohangwena	Oshikango	10,582	179,634	228,384	Namibia	Namibia	825,118	1,409,920	1,830,330

Source: Population and Housing Census 2001

Below is the map that geographically portrays Namibia's 13 Regions (Map: 3), the yellow region is Caprivi Region the study area of this study.



3.3 Historical development of Katima Mulilo Town

Caprivi Strip actually existed before the colonial powers' 1890 conference of Berlin. Before that time, the Caprivi was inhabited by various San communities during the 17th and 18th century because of its fauna and flora that supported their livelihoods. Later on, in the 1830s the area was taken over by the Barotse Empire (*Lozi*) who originally came from the Western Province of Zambia. During that time, the area was known as Itenge (*The word itenge is a former name of the Subiya Kingdom*) and was ruled by Lozi kings. The Lozi heritage is still experienced in Caprivi as the Silozi language is still taught today in both primary and secondary schools. Following the 1890's Berlin Conference and occupation of the area by Britain, The British realized that the Strip would fall under German administration in order to grant right of entry to the Zambezi River and other German colonies in East Africa, so in exchange, the British received the islands of Zanzibar and Heligoland. To honor the then present German Chancellor 'Count of Caprivi de Caprera Montecuccoli' (Leo of Caprivi) the then 'Itenge' was re-named as Caprivi Strip.

In the spirit of contemporary Cape-to-Cairo dreams the 'access corridor to the Zambezi' inspired German hopes for a direct land connection from the then existing protectorate German South West Africa (DSWA) to the interior of Southern Africa and other German territories in East Africa. Reality grounded this high-flying colonial utopia that the area was too remote and far from other established German outposts. Caprivi was effectively occupied by the Germans in the year 1909 when Captain Kurt Streitwolf found the first administrative centre at Schuckmannsburg, that was named after the then governor of German South-West Africa Bruno von Schuckmann (Bruchmann 2000:4). Thereafter, the swampy territory was left without a colonial administration for nearly two decades.

Until World War I (1914) Schuckmannsburg was the administration center of Caprivi. Katima Mulilo became important when the administration of the Caprivi was moved from Schuckmannsburg to the present area in the year 1935 (Devereux, 1993). Schuckmannsburg was abandoned because it was prone to floods, so a new administrative centre was established 70 kilometers upstream near the Zambezi's Katima Mulilo rapids. In 1939 the outbreak of the Second World War highlighted the strategic location of the Caprivi Region in the heart of Southern Africa when Pretoria took over its direct administration.

A Special Company of the Native Military Corps was based at Katima in 1940 to reinforce protection of the Victoria Falls Bridge at Livingstone 200 km downstream. In the same year the Witwatersrand Native Labour Association (WNLA) built a first air strip near the town. The air strip instantly became Caprivi's most important traffic link to South Africa and South West Africa/Namibia, which is still used for both military and civilian purposes in independent Namibia. Katima Mulilo gradually expanded over the subsequent years.

The South African administrators perceived the Caprivi Strip as unsuitable for white settler and low in commercial potential. The area was therefore neglected and continued to be a military war zone. 1963 was a turning point in the history of Caprivi when the Odendaal Commission recommended a roadmap towards a self-governing homeland. On a large scale and with great financial input, the South African administration began to implement plans for direct government-driven development in the Strip. Katima Mulilo was the designated seat of the future 'Bantustan Government', saw an unprecedented inflow of Union officials and inhabitants from the region tasked to steer and carry out the developmental efforts. Zambia had just gained independence when work began in 1964 on the all new layout of Katima Mulilo as an apartheid town (Map: 6).



Map 5: Aerial Map of Katima Mulilo Town (source: Google Map)

The layout included administrative and service headquarters, adjacent river sites were set for white settlement while on the other side were areas of shopping center and the segregated black township of Ngweze. As a first step, the government declared Katima Mulilo and its surrounding environment a native reserve. Nobody was allowed to reside outside officially designated housing areas. Cultivation, livestock rearing, cutting trees and hunting were prohibited in the reserve.

During 1970s and 1980s the Caprivi was used as a support base for the UNITA (National Union for the Total Independence of Angola), a rebel group from Angola that was supported by South African Defense Force (SADF), which was fighting against the Angolan Government then backed by Soviets and Cuban allies. The SADF's major base was stationed at Katima Mulilo that was also fighting against the independence movements of Namibia led by South West Africa People's Organization (SWAPO).

During that time, administratively, Caprivi Strip was a military area and people were not allowed to move freely neither to neighboring countries nor to the mainland of Namibia. The political instability which was in the region was the reason that led to the poor connectivity of the region from the main land. Road infrastructure development was only realized after the end of the civil wars in the region to link the region to the mainland and neighboring countries. The Namibia inherited a very poor inter and extra road infrastructure network.

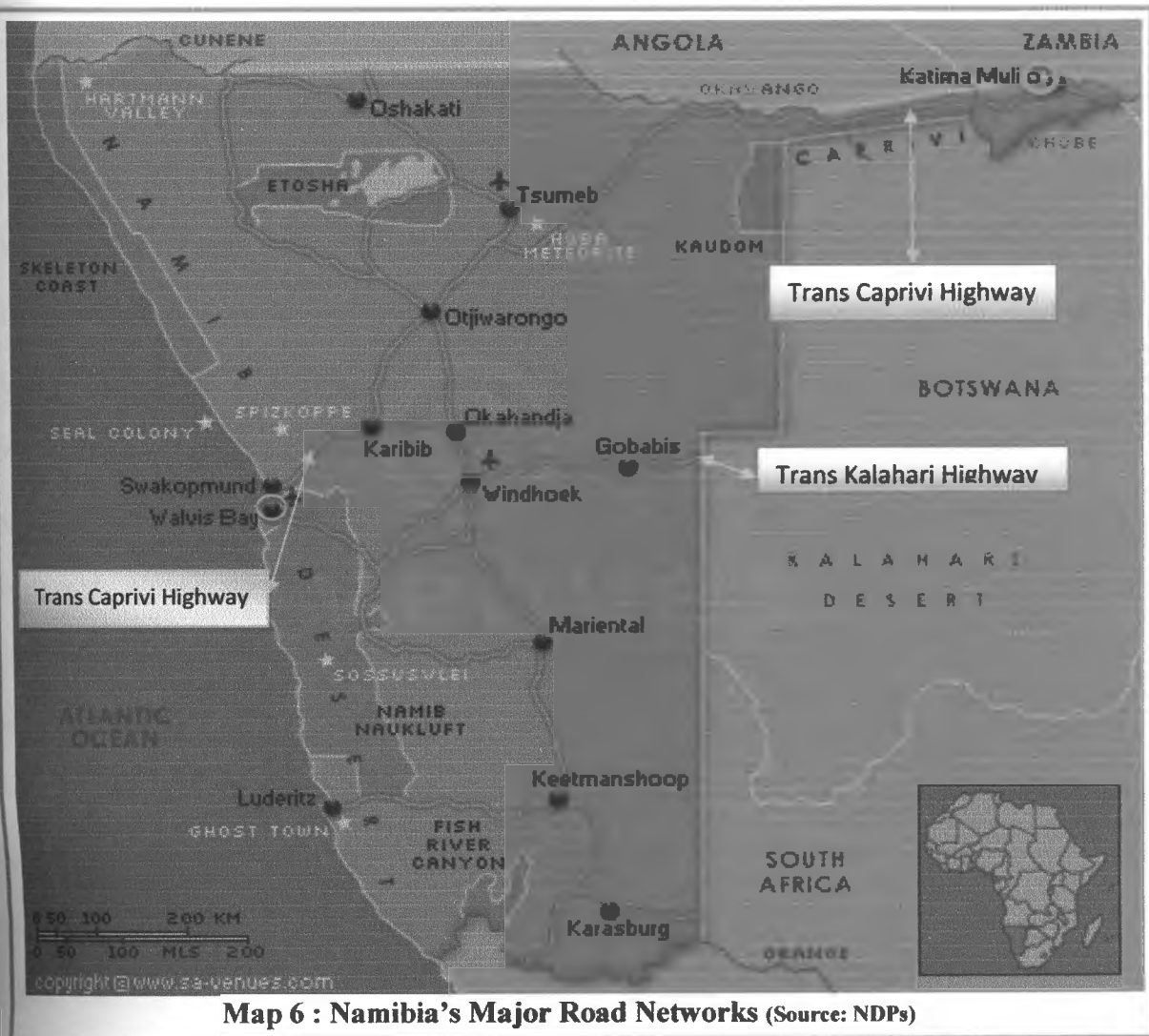
3.3.1 Connectivity of the region

In colonial times no passable roads existed in the Caprivi Region. To reach Schuckmannsburg in the far east of Caprivi the colonial powers travelled from Windhoek to South Africa and then to Southern Rhodesia (now Zimbabwe). From there they had to travel along the Zambezi upstream. The way from Windhoek to Schuckmannsburg took three months and during rainy season this route was completely impassable. Short time after the area was taken over by the South African

administration slow improvements of the roads in the Caprivi Region was observed. The improvements in infrastructure were motivated mainly by a desire to improve the tactical military position of the South African Defense Force, rather than a desire to serve the long-term national interest of South West Africa.“ (VKE 1991)

In 1979 the first alignment, basic planning and detailed design of the Trans-Caprivi Highway section from Rundu to Divundu was investigated. In the following years from 1983 up to 1997/1998 the successive upgrading of the gravel road into a highway with a continuous bituminous surface up to Katima Mulilo was realized. The idea to establish a transport corridor along the traditional route of the “Golden Highway” in the Caprivi goes back to the year 1990.

After independence in 1990, the Namibian Government decided to improve the infrastructure in the country to enhance inter and intra regional trade and strengthen the role of the port of Walvis Bay in South African overseas trade (VKE 1991).The ultimate cornerstone of the intended corridor system was the bridge crossing the Zambezi from Katima Mulilo in Namibia to Sesheke in Zambia (Map 6 below).



3.3.2 The importance of highway transportation to Katima Mulilo Town

Within the South African corridor, Trans-Caprivi Highway plays a significant role. As expected the positive effects of the corridors on economic growth was fulfilled. The aim was the progression of the traffic and reduction of costs and time on transportation. The government departments have associated different aims with the enhancement of transport infrastructure for Katima Mulilo. The construction of the bridge across the Zambezi and its opening in 2004 was the last connecting link on the trading route from Walvis Bay to Dar es Salaam was completed. Thus the strategic importance of Katima Mulilo in the heart of SADC was accelerated by this completion. The highway is an important trade route for the exchange of raw materials between

land locked countries (such as the mining area of copper in Zambia and coal deposits in Zimbabwe). The new route makes transport quicker and cheaper and improves the prospects for the importation of coal from Zimbabwe at a significantly lower price than from South Africa (VKE 1995).

Beside the benefits for the regional network to the town of Katima Mulilo, the port of Walvis Bay was connected closer to the regional markets and eased the imports and exports to Europe and America. Therefore, the improved road networks in Namibia have increased volume of heavy goods traffic and trade through Katima Mulilo. The opening of the bridge also increased small scale trading between the countries. The improved road network has also revived the potential economic growth of the town through trade and tourism.

At independence, Namibia was divided into thirteen regions. The Caprivi region was further divided into six constituencies namely, Kabbe, Katima Mulilo Rural, Katima Mulilo Urban, Kongola, Linyanti and Sibbinda¹⁸. Katima Urban Constituency boundaries correspond with that of Katima Mulilo Town. In 1992, Katima Mulilo was officially declared as a town in terms of the Local Authority Act (Act no 23 of 1992) before that it was administered by the Ministry of Regional, Local Government, Housing and Rural Development.

3.4 Physical Environment

Katima Mulilo's physical environment is characterized by its flat topography, rivers and vast area of floodplains which form the basis for its unique flora and fauna. The climate of the town is very different to the rest of Namibia and makes it a unique region in national context (Roberts 1997).

¹⁸ Republic of Namibia (1998) Second delimitation commission-Caprivi Region, Windhoek Namibia

3.4.1 Topography

As part of the Kalahari Sand forest, descending towards the Makgadikgadi depression in northern Botswana, the town is characterized by its extreme flatness. The elevation varies only from 950 meters in the east up to 1150 meters above sea level in the west forming several longitudinal west-east orientated sand dunes (Caprivi Regional Council 2001/2002; Zeller 2000).

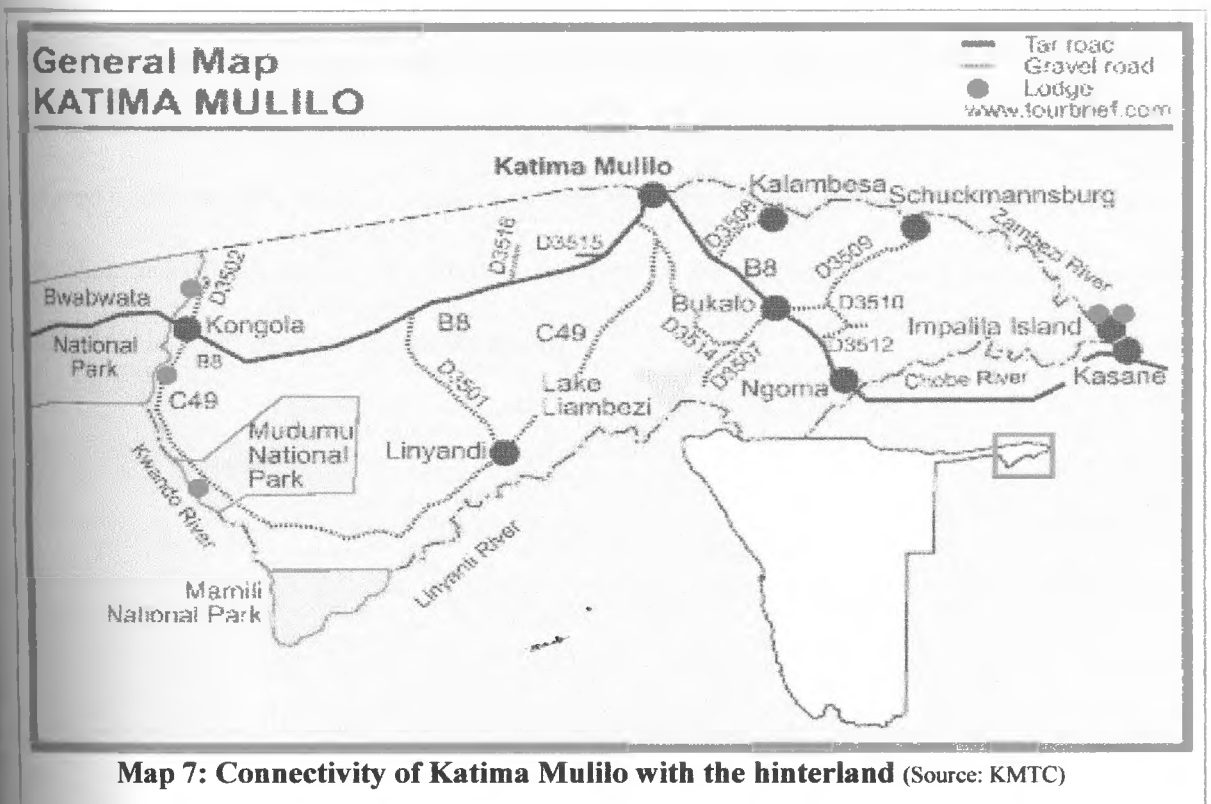
3.4.2 Climate

Due to the fact that Katima Mulilo is located in the north part of Namibia and for that matter closer to the equator, it has more tropical characteristics (sub-tropical) than the rest of the country (Devereux 1993). Compared to the entire of Namibia, Katima Mulilo registers the highest annual rainfall. Even though the rain is seasonal, this leads to two distinct seasons. The rainy season (mainly summer months) starts from November to March and dry season (mainly winter months) from May to the end of October. The Caprivi has an average annual rainfall of about 600 mm but can reach a peak of 1500 mm (Mandelsohn 1993). By that time the floodplains, pans and waterholes are filled up with water and the area turns into a deep green landscape.

During summertime (September, October, November) the temperature rises up to 39.4°C. The start of the rainy season causes high humidity up to 80% and mighty clouds emerge on the sky. With the end of summer and due to the cloudy days the temperature can be fairly low. In the winter months the rain stops and the dry season starts where no rain falls at all and the town turns into a sandy inhospitable area. During dry season minimum temperatures can drop down to 10°C (Zeller 2000). Only clear skies lead to relatively high day temperatures. The clear skies and high day temperatures causes a high potential evaporation-transpiration. Estimated to be more than 2500 mm per annum and exceeds the water input by rain over four times. This leads to the fact that almost no water can accumulate in the ground (Caprivi Regional Council 2001/2002).

3.4.3 Importance of Katima Mulilo Town

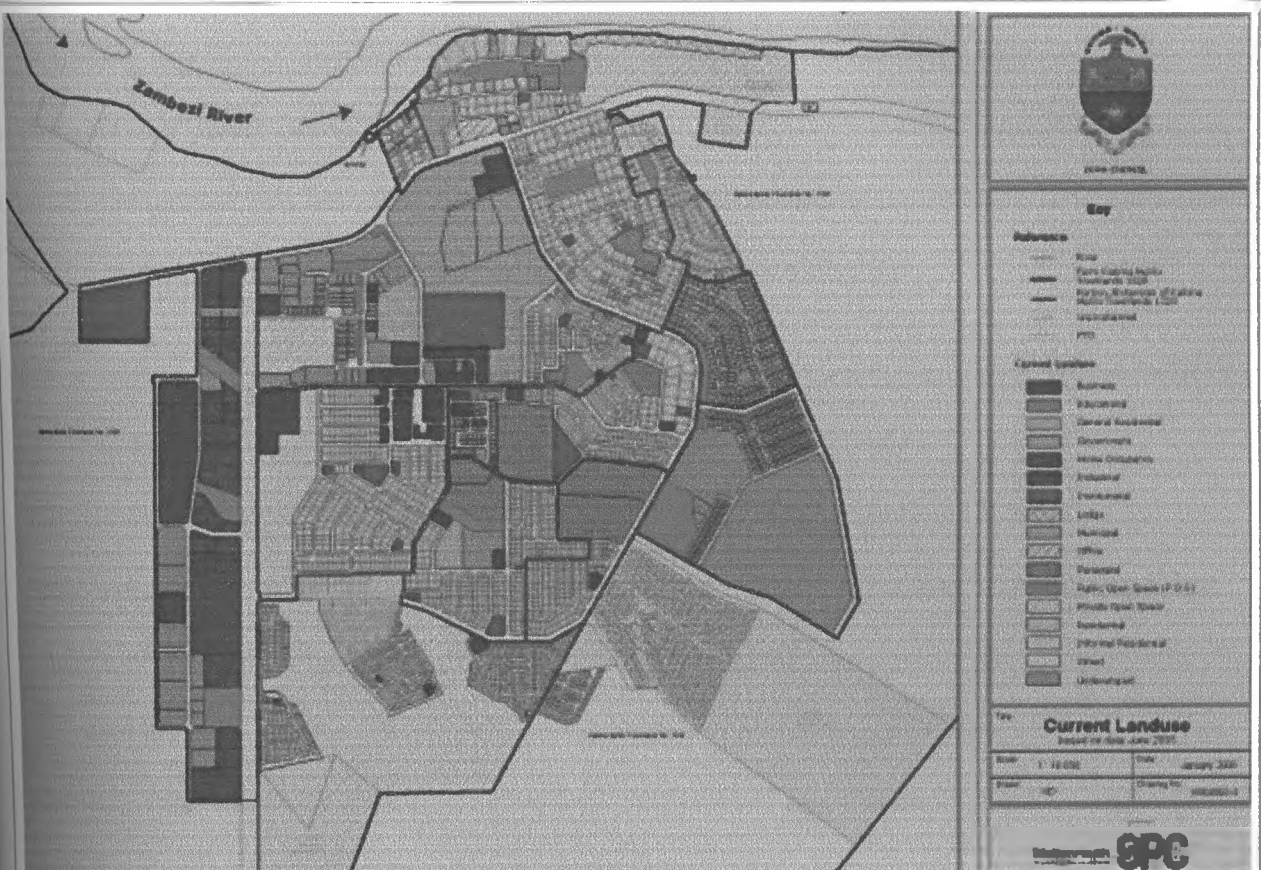
Katima Mulilo's position as the main urban centre of the region compared to the other settlements is obvious. The next equivalent sized town is Rundu in Kavango region approximately 500km west of Katima Mulilo and Livingston which is located in Zambia approximately 200km to the North. The importance of towns is defined by its administrative and public facilities, its economic attractiveness and possible availability of jobs. These are the main pull-factors for migration to the town. The urban economy is regarded as a system of production, distribution and consumption within an urban center and parts of its hinterland. The hinterland depends on the market degree of facilities and services available in urban centers. Productive facilities therefore refers not only to manufacturing, agriculture, fishing and extractive activities in which products are processed or marketed but it also includes trade, finance, government and other service providers using the town as the a base of operation.



The scale of economic activities carried out in any town depends on activities within the town alongside activities carried out in its hinterlands. This therefore means that there is always a mutual relationship between the urban center and its neighborhoods (Map 8 above). Urban centers supply goods and services to its hinterland while the hinterlands supply agricultural produce and raw materials for urban industrial development and direct consumption for urban dwellers. Katima Mulilo is flourishing because it is the center for production and distribution of goods and services. The economic explanation of urban land use pattern involves a consideration of structure and functioning of the urban economy as it fits into the broader region and the nation at large. The extent to which Katima Mulilo Town commands income beyond its borders is the key element in its economic growth.

3.5 Land Use

Land is perhaps the most essential and precious of all physical procession. It is not only the source of all natural resources but a platform on which all forms of human activities takes place. With the increasing population and wide spread development, the greater the variety of activities that need space and land must be made available to accommodate those activities. The increasing population and often conflicting activities has lead to the planning of land uses. The approved Katima Mulilo Land use plan (Map: 9 below).



Map 8: Katima Mulilo Land use Map (Source: SPC).

3.5.1 Existing Land Use

The site at which Katima Mulilo was developed is fairly flat. The land is generally suitable for urban development except for areas further to the north of the town where the land drops into the river system. The existing land uses can be divided into seven main categories: residential (represented by the yellow color on Map 9), Commercial (blue), industrial (purple), Public facilities (light blue), public utilities (green), Institutional (brown), Government land (maroon) and grey defied land. The commercial center is basically on the core of the town while the town is developing towards the southern and eastern direction of the town. The residential area constitutes approximately 70% of the total land use.

Katima Mulilo Town does not have big industries, however there are small industries located in town such as milling companies. As stated earlier the town is a commercial as well as the administrative center of the region and most commercial activities are concentrated at the town center, the commercial activities includes shops, hotels, butcheries and markets. There are also big shops selling general commodities both at retail and wholesale level.

Public facilities existing in town includes education and health facilities, administrative offices and churches among others. It should be noted that the public facilities were identified to be adequate in relation to the existing population of the town. However ministries such as Education, Health and Social Services, Immigrations and Police identified high migration from neighboring countries and rural- urban to administrative center as concern that floods some of the public institutions. The town is well served with public utilities such as safe drinking water, electricity, road and communication networks in both formal and informal suburbs. Other public utilities such as sewerage, storm water drainage, refuse collection and disposal were significant problems facing the town mostly in informal settlements. The informal settlements use bush toilets for sanitation while the storm water drainage follows naturally towards the Zambezi River. Pollution of Zambezi River seeks policy intervention as an international water body.

Katima Mulilo Town is located at the junction of two major roads, that is, Trans Caprivi Highway and Wenela- Ngoma Road. Apart from these major roads, the town is served with little tarred road and large gravel/earth roads that originates from the major roads to other areas of the town. As a component of transportation land use, there is limited parking facilities developed except in front of the shops. Despite, the improvement of the highway road, the town is without the terminal facilities both for trucks and taxis. Surrounding the town is the agricultural land but there were land use conflicts of urban agriculture noted within the town lands and back yards.

3.5.2 Urban Land use and Transportation

The transportation/land use systems of urban areas are complex entities and with large number of functions. It is a system where locations and spatial buildup forms of land uses depends in functioning. Urban land use expresses the attributes of the urban space and attempts to interpret the spatial elements and their interconnection. Each of those subsystems includes transport system, spatial interaction and land use. The relationship between land use and transportation has been investigated for a long time and was subjected to many approaches. For example, Von Thunen's regional land use, Burgess' concentric land use, Christellor' sector and nuclei land use and Roberts' land rent theory.

The form of the town generally influences and is influenced by travel pattern. The dense urban core of many towns and cities enables the residents to make approximately 30-60% of all trips by walking. The dispersed urban form of Katima Mulilo Town encourages reliance on vehicles. It is important to note that there are wide variety of urban forms and urban transportation system. One town's urban form might be different to the next town's form depending on the planning standards or evolution of the town. Many towns worldwide are developing at a scale that increases reliance on the privately owned vehicles because of the dispersion is taking place in different parts of town without proper public transport.

3.6 Population and Demographic Characteristic

3.6.0 Overview

Population in an area is very critical as it is always the subject of planning. The population in an area has a very strong bearing on the adequacy or deficiency of any infrastructure development and services. The population projections also determine the future needs of such infrastructure and land requirements for all land uses and services. Population is analyzed in terms of size,

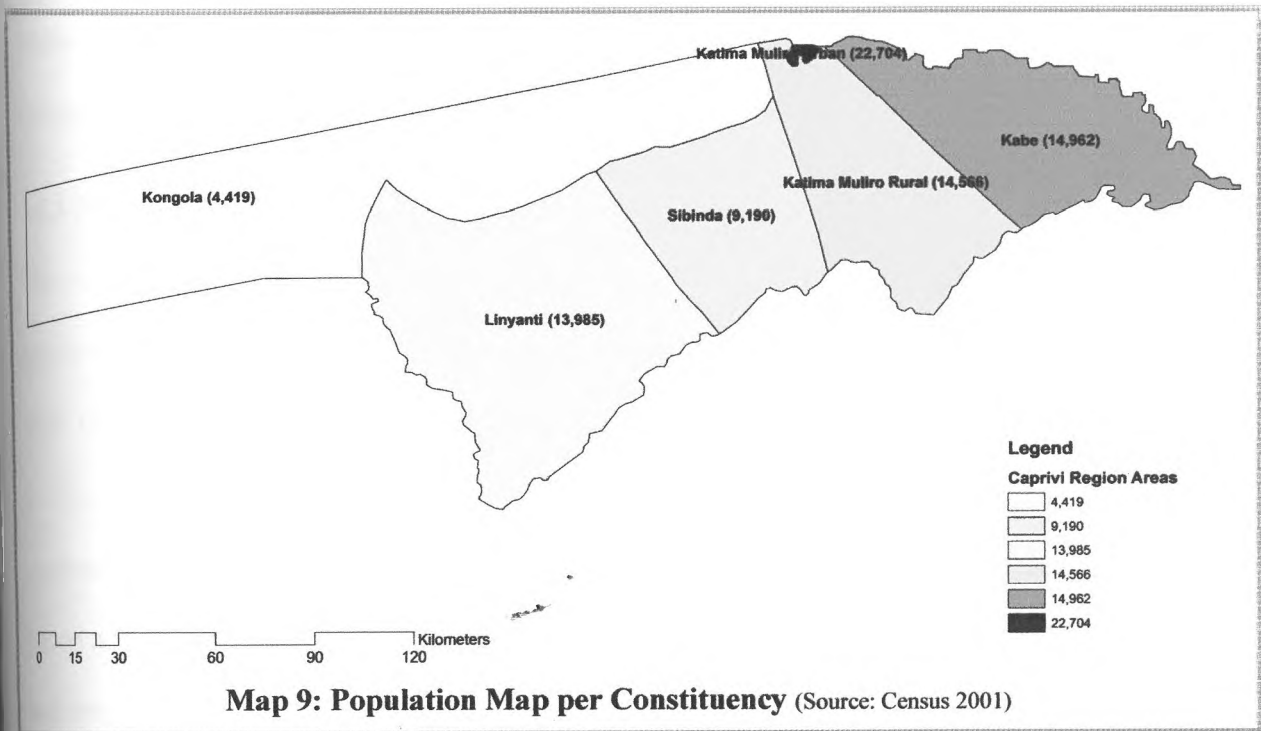
distribution, structure and composition, and other demographic characteristics which include age groups, fertility rates, labor force, mortality rates, morbidity etc

3.6.1 Population

Population is the total number of people in a specific area over a given period of time. The size and demographic characteristics of a population describe the development needs and influences the pattern of resource allocation. The analysis of population and demographic characteristics helps in predicting the future demand of essential facilities and services in an area. Population indicators include mortality, fertility, morbidity, growth rates and distribution among others.

3.6.2 Population Size

During the 2001 Housing and Population Census, Katima Mulilo town represented by the Katima Mulilo urban constituency (which concedes with municipality boundaries) recorded a total population of 22,704 residents, out of which 10,540 were male and 12,164 were female (Map:10)¹⁹.



Map 9: Population Map per Constituency (Source: Census 2001)

¹⁹ Namibia Household and population census survey 2001, National Planning Commission, Windhoek, Namibia

It is important to note that, during the 1991 Population and Housing Census, Caprivi Region recorded 90, 422 residents. However, during the second Population and Housing Census of 2001, the region experienced a decrease in population growth and enumerating a total of 79, 826. The decrease was attributed to high migration from the region to other parts of a country in search of employment and education. Those two factors that contributed much to the negative trend, was that Caprivi region was the only English speaking homeland during colonial times, the rest parts of the country were Afrikaans speaking. When English was declared official language in the independence Namibia, it gave the residents of Caprivi Region opportunities to get employment in other parts of the country. The second factor that led to high migration was the creating of the University and Polytechnic of Namibia. The two institutions recorded a number of enrollments from the region to further their education.

The region had a population density of 5.5 persons per KM². Its density was far above the national, which had 2.1 persons per sq kilometer²⁰. Major tribes of the town are the Mayeyi, Mafwe, Mbukushu, Ovambo and Masubia and a very small population of Whites and San (Bushmen) people.

3.6.3 Population Projection and Growth trends

The overall town population is projected to increase overtime from a total of 22,704 in 2001 to approximately 32, 026 in 2011 at the average growth rate of 1.8 %. This means that there is a need to put in place enough mechanisms to cater for the growing population. Community facilities and other services should be increased to be able to cater for the needs of the rising population in order to avoid overcrowding on existing ones. According to the projections the region and town will experience an increase in growth (table 2), as a result of natural growth and high migration of people from Zambia and Zimbabwe due to economic and political instabilities.

²⁰ Namibia Household Income and Expenditure Survey 2003/04, National Planning Commission, Windhoek, Namibia

a) Population projection

Year	2001	2011	2021	2031
Population (Region)	79,826	115,909	168,303	244,380
Population (KM Town)	22,074	32,026	45,176	63,725

Table 2: shows population projection for Caprivi Region and Katima Mulilo Urban

Source: Census 2001 and Own projection

Area	Total	Per cent	Female	Male	Sex Ratio
Caprivi	79 826	100	40 749	39 077	95.9
Urban	22 134	27.7	11 849	10 285	86.8
Rural	57 692	72.3	28 900	28 792	99.6
Kabbe	14 962	18.7	7 131	7 831	109.8
Katima Mulilo Rural	14 566	18.2	7 235	7 331	101.3
Katima Mulilo Urban	22 704	28.4	12 164	10 540	86.6
Kongola	4 419	5.5	2 237	2 182	97.5
Linyanti	13 985	17.5	7 334	6 651	90.7
Sibinda	9 190	11.5	4 648	4 542	97.7

Table 3: Population Distribution by sex and area for Caprivi Region (source: Census 2001)

b) Population distribution

Caprivi Region is predominately rural with 72.3 % of its population living in areas classified as rural while the remaining 27.7% were classified as urban dwellers. Katima Mulilo Urban being the only administrative center of the region is the most populated constituency. It was also interesting to note that the majority of the people living in urban were females with the sex ratio of 86.6%. In rural areas, female and male populations were slightly equal with a sex ratio of 99.6%.

3.7 Demographic Characteristics

3.7.1 Age-Sex Ratio

On aggregate the females slightly outnumber the males. However the sex ratios tend to vary with specific age cohorts and in some cases the males outnumber the females. For example in table 3 above the male population outnumbers the female in Kabbe and Katima Mulilo Rural Constituencies. The high population of females in Katima Mulilo urban constituency can be attributed to migration of females to the urban center in search of employment and better social services such as education and health.

3.7.2 Average Household Sizes

The average household size in Katima Mulilo town was 4.5 persons, this was in accordance with the 2001 Population and Housing Census that was below the national average of 5.1 people per household.

3.7.3 Fertility Rates

Fertility rate is the total number of births per 1000 women in their reproductive ages per year. It is given as a percentage. Fertility involves the number of children that women have and is to be contrasted with a woman's childbearing potential. The total fertility rate in Katima Mulilo is 3.5. The fertility rate in Namibia and Katima Mulilo in particular is expected to decrease due to the impact of HIV/AIDS which is expected to play a significant role.

3.7.4 Mortality Rates

Mortality is the study of the causes, consequences, and measurement of processes affecting death to members of the population. The infant mortality rate is stated at 51 per 1000 i.e. 51 infants out of the 1000 born at a certain time die. HIV/AIDS has been a contributing factor for many deaths in the town in the past two decades.

3.7.5 Morbidity Rates

Morbidity refers to a disease state, disability or poor health due to any cause. The term may be used to refer to the existence of any form of disease, or to the degree that the health condition affects the patient. There were no statistics records for morbidity rates for the census period of 2001.

3.7.6 Life Expectancy Rates

The average life expectancy rates differ between males and female. For males life expectancy was 36 years while in females it was 44 years. The life expectancy in the area was slightly below the national life expectancy which was 48 and 50 years for men and women respectively. Again HIV/AIDS was a contributing factor for this trend.

3.7.7 Migration Trends

There has been a considerable migration of people from rural to urban and other parts of the country to Katima Mulilo town. Unemployment was the major influencing factor for migration in search of employment, better health and quality education. Given the poor economic conditions in Zambia and the political instability in Zimbabwe, the town of Katima Mulilo like any other boarder town has been a victim to such situation, experiencing high foreign migrants in search of better living conditions. Social tribal relationships between families across countries had been also another contributing to factor. The fact that Katima Mulilo town is the service center of its hinterland and those of the neighboring countries presents another measurement of migration.

3.8 Energy source

Katima Mulilo is reliably supplied with electricity via a direct feeder from Zambia Electricity Supply Company (ZESCO) with a 220 KV substations to Namibia Power Company (NamPower). The substation is located on the western side of town. Other source of energy includes fire wood, though most of the households are connected to the national grid. Northern Electricity Distributors (NORED) was granted the supply and distribution license for the areas on August 17, 2002 by NamPower. The company took over the management and operation function of electricity supply in the region before that it was a function of a Town Council.

3.9 Economic Activities

Katima Mulilo as said before is the only proclaimed town in the region with a high supply of jobs in non- traditional and agricultural occupation. This comprises jobs in the production sector (MEATCO, Nam-Mill and Namibian Breweries) and civil servant in the service sector. But the numbers of job-seekers exceed the number of job opportunities. Many people make their living through the informal sector. Women sale food, baskets and other handmade products at the town's open market (Plate: 2) or from door to door.

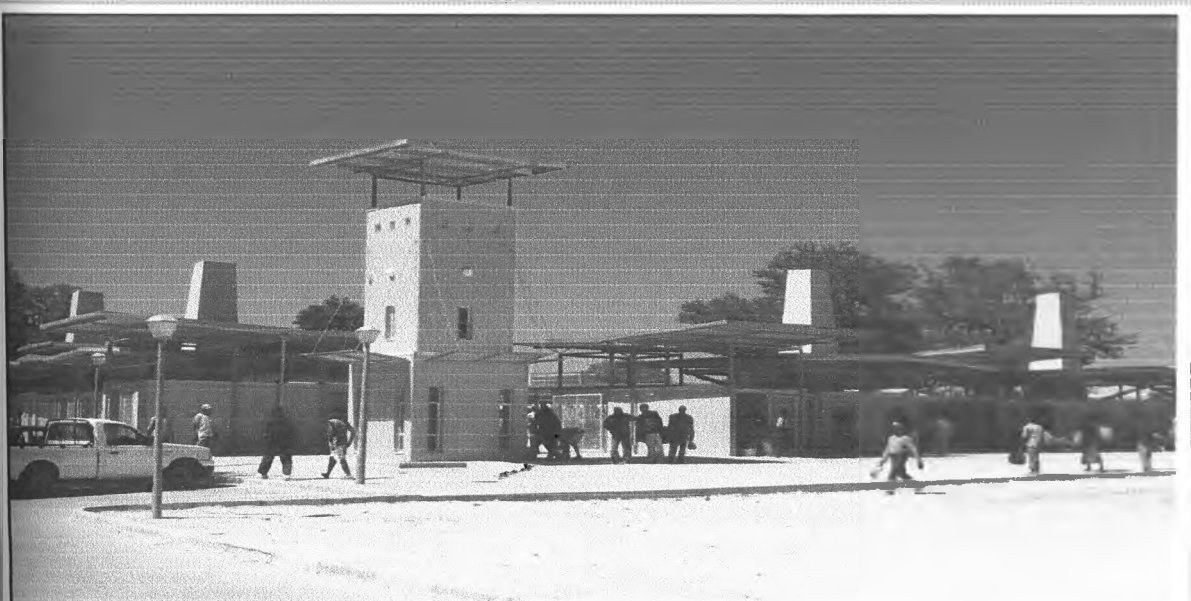


Plate 2: Katima Mulilo Open Market (Source: Field Survey 2010)

Men were mainly doing piecework or sell arts and crafts to tourists. According to the Census of 2001 it notes that 30% of the urban labour forces aged 15 years and older are unemployed. Despite being an agricultural area, there are no agricultural industries. Agriculture is practiced widely on a small scale region wide. The only industries claimed by the sector are the abattoir and milling companies.

3.10 Health and Education

There is only one hospital in Caprivi Region which is located in Katima Mulilo. It is supported by a health center, three public and private clinics within town. Though the hospital has only 200 beds and a limited number of doctors, it is the only cheapest possibility for people to get proper surgery and medical treatment. In terms of education there are six primary schools, three combined school and three secondary schools. For further education, there is Zambezi Vocational Training Centre, Caprivi College of Education and a branch of the University and Polytechnic of Namibia where people can do their distance and external studies²¹

3.11 Tourism

The tourism sector is one important aspect of the economic activities in Katima Mulilo or the entire region. This is not only for petrol stations, businesses and lodges for profit but also for the informal sector by selling arts and crafts. Large number of tourist visit Katima Mulilo's urban center, which is developing into a unique gateway to numerous game parks with special reference to Bwabwata, Mudumo and Nkasa national parks.

Tourism has made a substantial progress region wide because of increased protection of wildlife by the Ministry of Environment and Tourism. The area has a wide variety of wildlife, with more than 60 species of mammals and 400 species of birds recorded²². The region has more than

²¹ Namibia Household Income and Expenditure Survey 2003/2004, National Planning Commission, Windhoek, Namibia

²² Caprivi Regional Council, Regional Development Plan 2001/02-2005/06, Namibia

twelve (12) registered and numerous unregistered conservancies (Plate 3). The industry has become the source of employment for many residents, though human-wildlife conflict is on an increase. As expected the agriculture production is also on the decrease in areas where large numbers of wildlife are found.

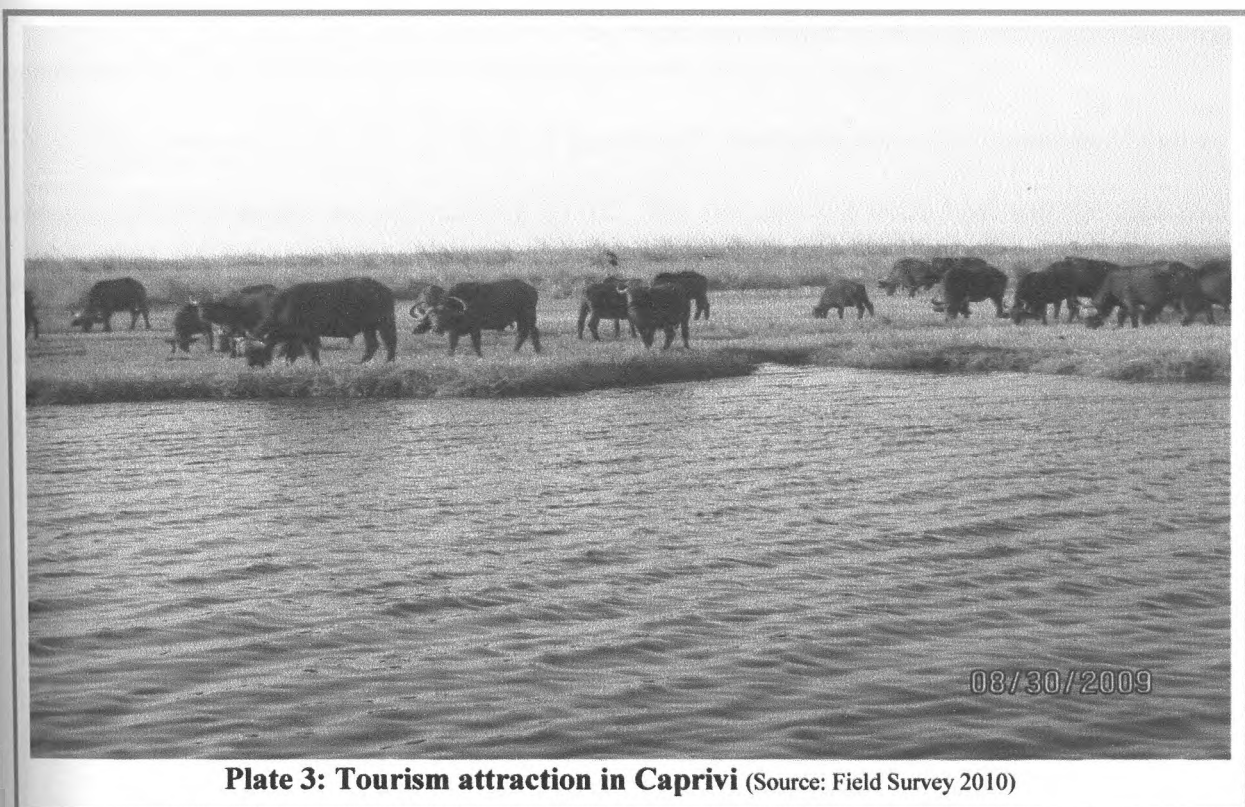


Plate 3: Tourism attraction in Caprivi (Source: Field Survey 2010)

The completion of the Zambezi Bridge has created one of the shortest routes to Victoria Falls as the major tourist attraction resort in SADC, which is only two hours drive on a smooth comfortable road for 200 km from Katima Mulilo via Zambia. The town has not yet fully unfolded its tourism potential. The construction of the Zambezi Waterfront Tourism Project, lodges, petrol stations, the upgrading of the open market and expansion of the shopping centers are some of investment examples in the effort to provide proper services to both tourist and residents.

3.12 Dumpsite

The Town's solid waste dumping pit is located approximately 2.5 km west of the town center. There are several issues to note from the dumpsite. Reports from the Town Council's Department of Health (March 2010) stated that the dumping site will only be able to accommodate solid waste for the next eight months. However should comprehensive recycling programme be instituted, the life span would be considerably prolonged.

There was no proper supervision of the pit at the time of interviews with only two casual laborers managing the site during normal working hours. The site was not fenced off and the area was without security guards after normal working hours, leaving the site open to abuse after hours, during public holidays and weekends when illegal dumping takes place time and again. All of those problems are linked to lack of financial means by Council. The informal settlements also dump their refuse at the periphery of their informal settlements (Plate: 4).



Plate 4: Dumping of refuse around town (Source: Field Survey 2010)

3.13 Imaging issues

Land use conflict: There were temporal encroachments within the roads reserve mostly informal businesses selling fruits underneath trees and unauthorized terminus to the hinterland.

The continuous increase in population has led to increased unemployment, more need for fuel and forest products, more demand for better housing, high levels of poverty and environmental degradation.

CHAPTER 4: TRANSPORT INFRASTRUCTURE

4.0 Overview

Infrastructures development is the backbone of any physical development. Such infrastructure facilities include roads, street lights, provision of water and sanitation, electricity, health and educational facilities, housing and telecommunications among others. The provision of infrastructures development in general in the Town of Katima Mulilo was satisfactory although in some cases it was lacking mostly in informal settlements. Among other infrastructures, roads and storm water drainage were in bad conditions and were unable to drain water from the town during rain seasons while roads have a fair layout but not properly maintained to standard. Road transport was the most common means of transport. The town is well covered with communication signals such as radios, television, telephones, cell phones and internet facilities.

Throughout history, the economic welfare of people has been closely tied to efficient and effective methods of transportation. Transport provides access and reduces the costs of accessing resources while promoting trade and allowing towns to accumulate wealth. Transportation systems and its routes greatly influence how and where people live, work and socialize. Good transportation network allows citizens to develop the town land and to live comfortably in suburbs far from their duty station.

Katima Mulilo's road network is fairly distributed on an iron grid formant. The town is served with little tarred roads and large gravel/earth roads. The gravel roads make accessibility to the inner suburb difficult during the rainy season and generate dust in dry seasons. Given the poor road conditions, vehicles' life spans are decreasing and maintenance cost on the increase.

Where roads are regarded to be better, such routes generate more slow traffic movement, leading to further deterioration and temporal traffic congestion, mostly during month ends and rush hours (morning, lunch and knock off hours) of the working days. One of the regional development goals for Caprivi region is the provision of efficient and adequate road infrastructure²³. A goal that is yet to be fulfilled in terms of road infrastructure after 19 years of independence.

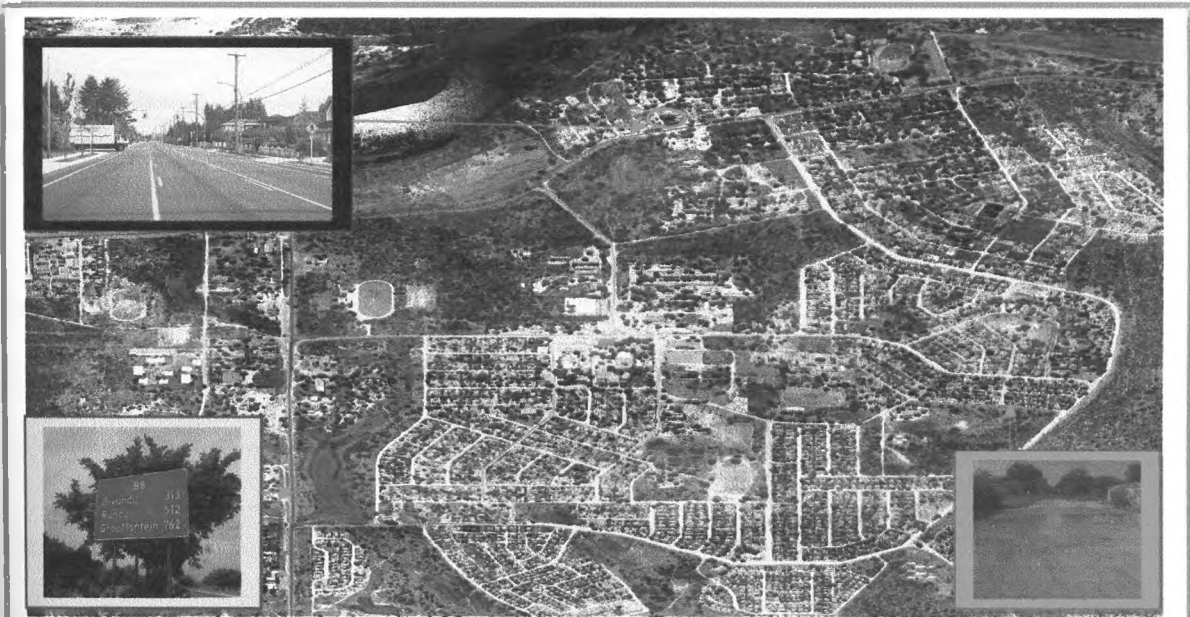
4.1 Road Transport

The interior road infrastructure of the town is poorly developed. Only about 10% of the roads were tarred meanwhile 90% had poor gravel or sandy paths which can be impassable during rainy season. The Town Council is responsible for the maintenance of roads within the town boundaries as provided for in the Local Authority Act (Act no. 23 of 1992). Due to lack of funding, the town roads have not been upgraded or frequently maintained as per roads maintenance standard. Moreover the town is located on the border entry or exit to other SADC countries. The poor attractiveness and road conditions give a bad image to the town and country at large.

According to the economic planner of the Town Council (interview: Mr. Edward Ntonda), he stated that “being a tourist attraction town, tourists, business, residents and residents of the neighboring countries that use the town complain bitterly about the condition of the road infrastructure in town. However he was quick to point out that the international and national transport sector had played a significant role in the economy growth of the town”. Two factors that had led to improved economic performance of the town considerably was the construction of the Trans-Caprivi Highway and Zambezi Bridge respectively. Katima Mulilo is also the only proclaimed town within a radius of 200 km of the neighboring countries and 500km away from the nearest town in Namibia (Rundu in Kavango Region).

²³ Caprivi Regional Council, Regional Development Plan (2001/02-2005/06), Namibia

These two massive investments have increased the transportation of goods and services to and from SADC countries via Katima Mulilo. This has impacted on the border town both positively and negatively through the traffic mode. Positively because the investments had increased trade between the service center and its hinterlands and negatively because the corridor has caused traffic congestion and environmental hazards through air pollution.



Map 10: Tarred and Gravel/earth roads in Katima Mulilo Town (Source: Google Map)

Katima Mulilo Town’s internal road networks consist of the following types and lengths: 6.5 kilometer of tar roads, 77.5 kilometers of gravel roads and 12.5 kilometers of underdeveloped road tracks (Map: 11). It should be noted here that the lengths presented above do not include the two main trunk (B8) roads that passes through the Katima Mulilo Town, which is the responsibility Roads Authority, that is, trunk road B8 from Rundu (Kavango Region) to Katima Mulilo and trunk B8 from Wenela border post (Zambia) to Ngoma border post (Botswana).

Overall, the conditions of all roads that belong to the Town Council are either extremely poor or poor. For several years town authorities for both political and administrative had been concerned with the state of the town roads. According to New Era Newspaper (Dated: 8 May 2009) it

reported that “Town and Regional Councilors cited the lack of tar roads and the general poor condition of the roads, as one of the most major infrastructure problem that need to addressed. Councilors further outlined that the gravel roads are constant and significant source of dust that lowers the general quality of life for the residents. There have not been any improvements on the roads infrastructure since proclamation of the town therefore the condition of the roads was continuously deteriorating”.

4.2 Road Classification

The main classes of roads in Katima Mulilo Town include: *National Truck Road (B8)*: Trans Caprivi Highway which further interior branch to Zambia to the west and Botswana to the east. This road is to the size that measures 90 meters. The town is accessible via major traffic arterial roads. These roads are to the size of 30 meters and play a very important role with respect to mobility within Katima Mulilo (e.g. Hage Gaingob- Hospital road and Kongola-Malena road).

The access from the main arterial into the town is provided through traffic collectors. These traffic collectors surrounds Katima Mulilo town and the width of these roads vary from 14-20 meters. Their function is more of mobility than accessibility. The internal or local roads give access to the plots within the suburbs and vary in width between 10-12 meters. Six entrances provide access to the town onto the 30 meter arterial roads. Most of those roads are in a terrible state of disrepair and were classified largely by the respondents to be among of the worst roads in town.

4.3 Maintenance and reconstruction

The Council does not maintain their roads regularly because they lack financial resources and technical expertise. However the road network such as that of KMTC requires extensive and well organized maintenance or reconstruction programme because most of those roads are in a state of disrepair. *Such an extensive recommended maintenance programme includes the improvements*

of other roads to be converted from gravel roads to tarred roads to increase accessibility and reduce the level of dust or pollution within town (Plate 5 below).



Plate 5: Poor road maintenance (Source: Field Survey 2010)

During the interview with the Town's Chief Executive Officer (Dr. Sazita), he indicated that KMTCC does not have the technical and financial resources required to maintain their roads. Council was basically implementing a very limited programme whose funding was provided to council by the Road Fund Administration. The funds availed to Council through that process were not enough to cater for the repair and maintenance of all roads throughout the calendar year.

According to the Town Planner (Mr. Mukela), he argued that the town was rushed into proclamation in 1992 without considering the improvement of basic infrastructure facilities such as the road, water, electrical and sewer networks including the provision of storm water drainage. Yet the Namibian Treasury Instruction Act prohibits central government to directly fund the Local Authorities. The funds to construct and maintain all such infrastructures cannot easily be

generated by such a young council. Furthermore to apply for such funding the Council has to engage the service of a professional Engineering Firm to prepare the estimated annual budget for the maintenance needs. This is because the Council was without the service of the Town Engineer to perform those duties. This scenario flags out Council's limited technical expertise and financial incapability. The council was unable to afford the service of the Town Engineer on its pay role.

Table 4 below summarizes the appropriate amount that was applied by the Town Council and appropriate amount that was approved by the Road Funds Administration (RFA). Note that, although the Town Council did not request for funding during the financial year 2004/05. For other reasons RFA decided to provide funding to Council for that financial year. One thing is evident, throughout the financial years where the funding was requested, funds approved were never even half of the requested amounts. The requested funds were in line with the state or condition of the existing roads maintenance needs. However the council's development budget, could not afford the difference of N\$2.1 million requested.

Financial Year	Approximate budget to RFA (N\$)	Approved amount by RFA (N\$)
2004/05	-	N\$ 200, 000.00
2005/06	N\$3 million	N\$ 900,000.00
2006/07	N\$3 million	N\$ 900,000.00

Table 4: Applied and approved budget per financial years (Source: RFA report 2008)

4.4 Roads management

The Town Councils/Municipalities are fully mandated by the Local Authority Act (Act no. 23 of 1992) to carry out maintenance, upgrading and construction of all the roads within the town boundary. In the exception of highways which pass through towns that are classified as national road, a responsibility performed by Roads Authority Company. The sources of funding for the council for road construction and maintenance come from Roads Fund Administration and Councils' own sources.

Town roads are poorly managed reading from the pot holes and condition of most roads. The result of poor road management has increased maintenance expenses to vehicle owners and slowing down the mobility of vehicles creating temporal traffic congestion and continuous dilapidation of roads. The funds received by Council are inadequate thus unable to meet the demand for infrastructure development expected by residents. The major source of income for the council is rates and taxes, water bills and selling of serviced and un-serviced land. Even then the council does not have enough money to service land and generate more income. The poor design and management of roads can be confirmed from various arterial and access roads with prominent poor storm water drainage systems that continuously damage the roads and flooding properties during rainy season.

4.5 Transportation demand / supply

The transport demand surpasses the supply. This is because of the climatic condition of the area that is hot in most seasons of the year. The taxis industry operates under the umbra of Namibia Taxi Association (NABTA). At the time of writing taxis were charging a flat rate throughout towns in Namibia of N\$8.50 from one tax rank to the next between 6H00 in the morning to 10H00 in the evening, after 10H00 the fee was to increase to N\$10.00. The demand for transportation has increased since the completion of the road bridge to Zambia. This has

generated a high movement of people and goods between border countries. The main reason being the bordering hinterland was using Katima Mulilo as their service center to access basic goods.

According to the Customs Officer at Wenela Border (Mr. Simana) he stated that the poor economic and political conditions prevailing in Zambia and Zimbabwe respectively has contributed to the frequent movements of people in search of better living conditions. He further noted that cultural relationship between countries also contribute much to such movements. On average approximately 3 000 people enter and leave the town almost every day mainly from neighboring countries including Democratic Republic of Congo through Wenela border post, excluding Ngoma and Singalamwe border posts which fall outside the study area. The figure normally increases during paydays of both countries (Namibia and Zambia).

4.6 Terminal Facilities

The Trans Caprivi Highway was constructed without terminals facilities. Tracks that are in-transit were seen randomly parked around town, in other cases tracks were packed at sites that could hinder the visibility of the motorist approaching a T-junction. Others were observed using service stations as terminals (Plate 6 below). According to the Regional Aids Coordinator of the Caprivi Regional Council (Mr. Joseph Mbuche), noted that the absence of the terminals has turned the petrol stations into prostitution attraction points. The region's HIV/AIDS prevalence rate was the highest in the country with a prevalence of 39%²⁴. There is also no officially designated terminus in the interior of the town, except for unofficial strategic points that serve as taxi ranks or terminals where people gather when hiking going to their respective villages. The unplanned terminals lacked necessary support facilities such as water taps, passenger shades and toilets. Moreover the existing unofficial terminals were in conflict with the land use plans.

²⁴ Caprivi Regional Council (2005) Participatory Poverty Assessment, National Planning Commission, Namibia



Plate 6: Unofficial terminal (Source: Field Survey 2010)

4.7 Railway Transport

Caprivi Region was regarded as unsuitable for commercial farming by the colonialist, so it did not have any export products. The war zone that was in the northern part of Namibia was another contributing factor for the failure of constructing the railway. Thus the region is not connected to any railway line. This mode of transportation does not exist in Caprivi region and Katima Mulilo in particular.

4.8 Air Transport

Mpacha airport is the only airport that is used for both military and civilian purpose. It was constructed in 1940 by Witwatersrand Native Labour Association (WNLA) and was upgraded to an airport after Namibia's independence in 1990. It is one of the region's most important traffic links to the rest of the country and other countries. But due to low air transport demand the airport is underutilized with only two flights per week. The airport does not have lights in the runway and only operates during day time. Air ports in Namibia were privatized and operate under Namibia Airport Company.

4.9 Road infrastructure and storm water drainage

When roads are in a bad condition in many cases the storm water drainage will not be able to drain water out of town (Project Nam/341: 2007). The general storm water drainage pattern of Katima Mulilo town is in the northern direction towards the Zambezi River. The river flows from west to east (Map: 12 below). There are many drifts and drainage structures along the roads mostly in the old locations. However such storm water drainage infrastructure is poorly maintained and inadequate. This is the reason why, the town experiences flooding during heavy rain season that leads to increased cases of malaria and other related environmental diseases. In order to remedy this situation a comprehensive road and storm water drainage infrastructure development plan need to be developed and implemented.



Map 11: General Storm water drainage of the town River (Source: KMTC)

The following are some of the drainage problems that were identified during the interviews with the key informants.

- Poor maintenance of the existing infrastructure: in other parts of the old location many of the culverts, storm water drainage and channels frequently become clogged with earth and debris as a result of poor cleaning maintenance.
- Lack of storm water drainage infrastructure in new locations: the planning, design and construction of the new locations were without storm water drainage infrastructure. The non provision of such storm water drainage infrastructure has created serious problem that frequently causes erosion and flooding to properties in town.

4.10 Environmental degradation

The collection of the solid waste is the responsibility of the Katima Mulilo Town Council's Department of Health. The department has outsourced this function to four local contractors. Each contractor was given four areas to administer. In the Central Business District (CBD) and Industrial area the collection of waste is done on a daily bases while all residential areas including informal settlements solid waste is collected once a week. The level of service provided by those contractors is satisfactory in honoring their contractual obligations.

However garden refuses were not part of the solid waste management agreement contracted to contractors. The management of this waste has become a major problem in town. This is because the garden refuses are the responsibility of the household and end up being illegally dumped anywhere in town. On the other hand the Department of Health lacks resources and is unable to collect those refuse by itself. The council still does not have sufficient resources to administer and enforce the Council By-Laws pertaining to the removal of garden refuse. The inability of the Town Council to neither collect nor impose heavy penalties to offenders on garden refuse has affected the town negatively leading to environmental degradation (Plate: 7 below).



Plate 7: Degraded environment in town (Source: Field Survey 2010)

The garden refuse were mostly dumped illegally in open spaces throughout the town. Such cases were even worse in informal settlements and at the dumping pit. The collection of solid waste once a week has proven not enough in informal settlements due to high density of population. Solid waste management in informal settlements had been a concern to environmentalist because it had affected the environment negatively. The majority of people in the informal settlements depend much on poles for house construction, wood fuel for cooking as they regard electricity usage expensive. They are also without proper sanitation facilities. These factors have led to environmental degradation in the nearby forest. Moreover wood fuel, vehicles emission and dust generated from heavy traffic have contributed to further degradation through air pollution.

4.11 Critical emerging issues

Poor Roads infrastructure: some roads were impenetrable during the rainy season and generated dusty during the dry season.

Drainage system: The drain channels lacked maintenance where they existed.

Solid waste management: The road sizes as aforementioned earlier were relatively wide enough to support the traffic flow.

Maintenance: The roads were generally poorly maintained. This could be evidenced by the absence of the basic road support facilities such as the storm water drainage and excessive flooding during the rainy season.

Terminals: there was no officially designated terminus for trucks; some petrol stations were used as terminus for trucks and buses in transit. There were limited taxi ranks and where they existed they lacked basic support facilities such as sheds, taxi rank numbers or name that could give such facility recognition.

Traffic Congestion: This was observed during month ends when most of the residents and other country residents use the town as a service center. In other case during rush hours (morning, lunch and knock off time) mostly in roads regarded as better.

Street lights: the town was dark during night making it insecure to pedestrian at night.

Pedestrian walk ways: no pedestrian walk ways that existed because of poor road.

CHAPTER 5: DATA ANALYSIS AND PRESENTATION

5.1 Road Conditions

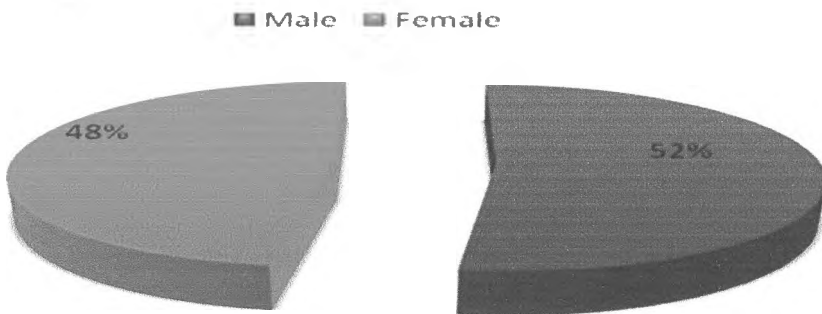


Figure 1: Gender representation in the study

(Source: field survey-2010)

The randomly interviewed selected household from all the suburbs of the study area was represented by 52% males and 48% females. The statistics represents a fair balance of opinion in terms of gender.

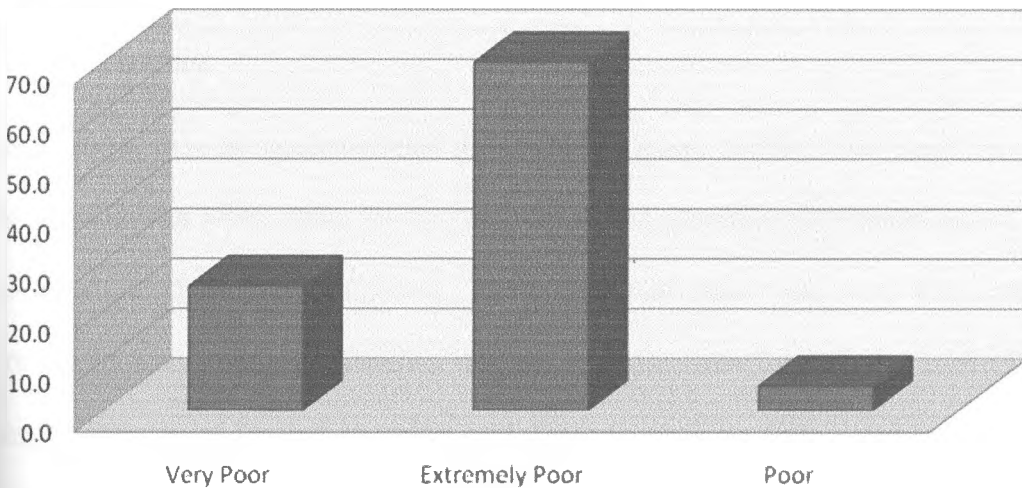
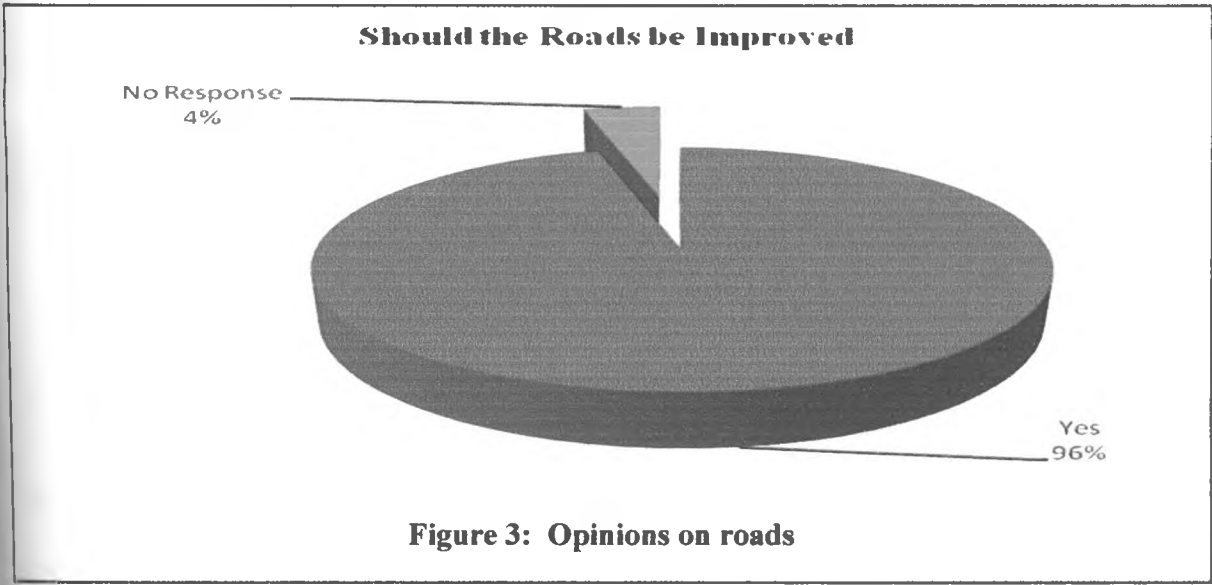


Figure 2: Respondents' views on road conditions

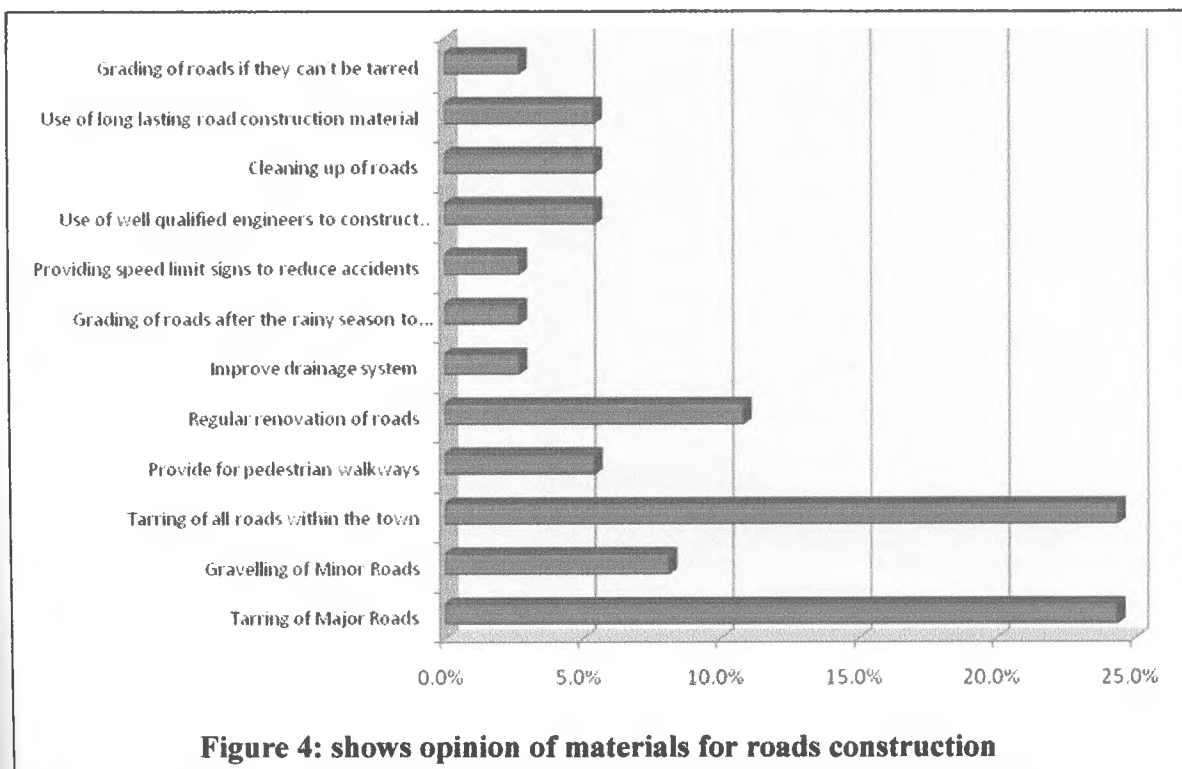
(Source: field survey-2010)

Over 70% of the respondents indicated that the road conditions in town was extremely poor, it is good to note that none of the respondents indicated that the roads were better or good. This question was open not to restrict the respondents' road rankings. The fact that the larger percentage of the town is earth or gravel roads was an attribute to this decision. The research was conducted between February and March when it was still a rainy season in Caprivi region. At the time of the study, some roads were still impassible, because such roads were flooded.



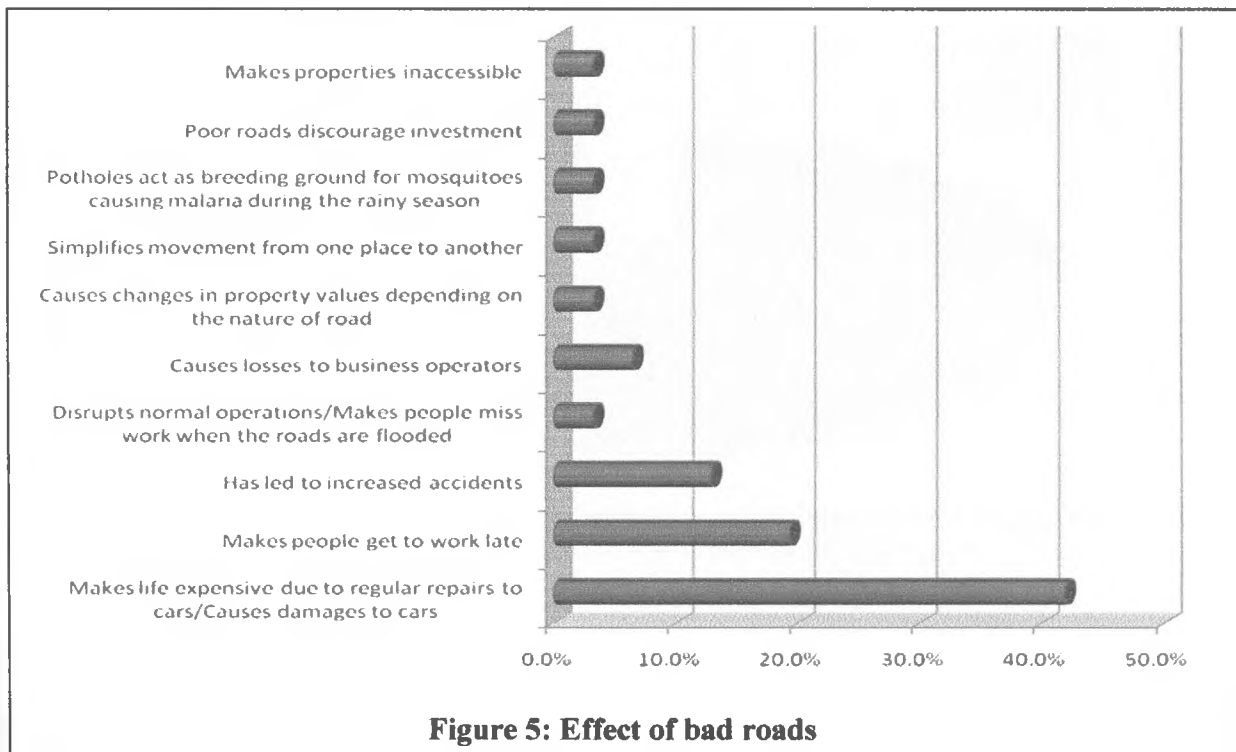
(Source: field survey-2010)

Close to 100% were in agreement that the roads in Katima Mulilo Town need improvements or reconstruction. Pot holes, dust, furrow for erosion and generally poor maintenance of the roads by the Katima Mulilo Town Council. The majority of those who were advocating on roads improvement were living in locations that are very far from the national road (Trans Caprivi Highway) that passes through the town and depends much on dilapidated town roads to access the town center.



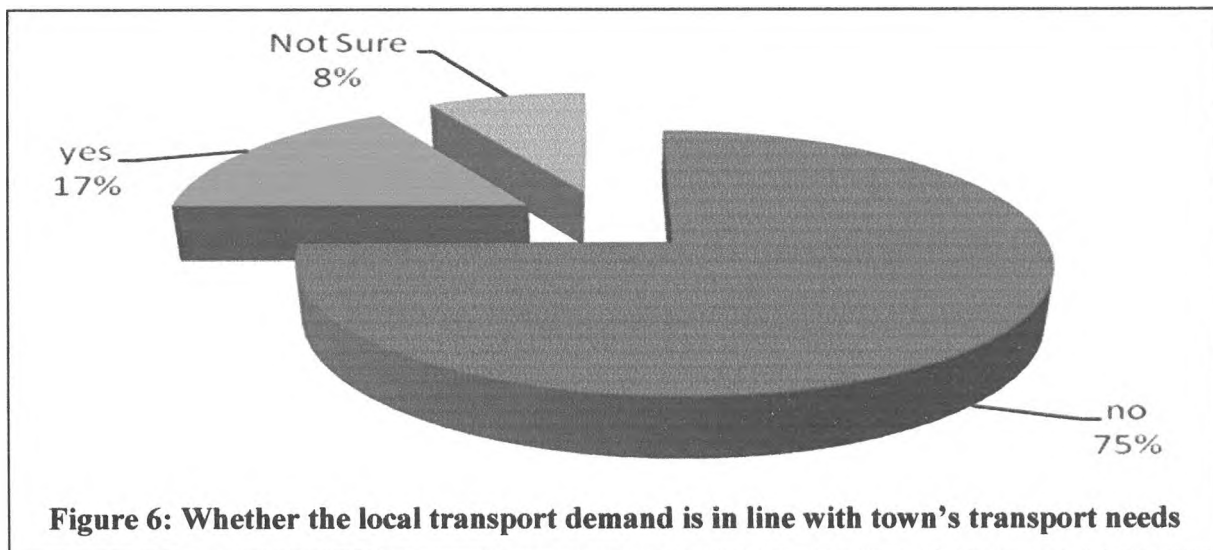
(Source: field survey-2010)

The majority of the respondents suggested tarring of either major roads or all roads within town land. The graveling of roads received lesser attention because during rainy season the gravel is washed away through erosion. However, the study reveals that if the roads are graveled then proper maintenance plan should be strictly followed. Those who were advocating of gravel roads indicated that the Katima Town Council is in the financial crisis that they cannot afford to tar the roads. The feasible solution to the current roads is gravelling though it was regarded as a short term solution.



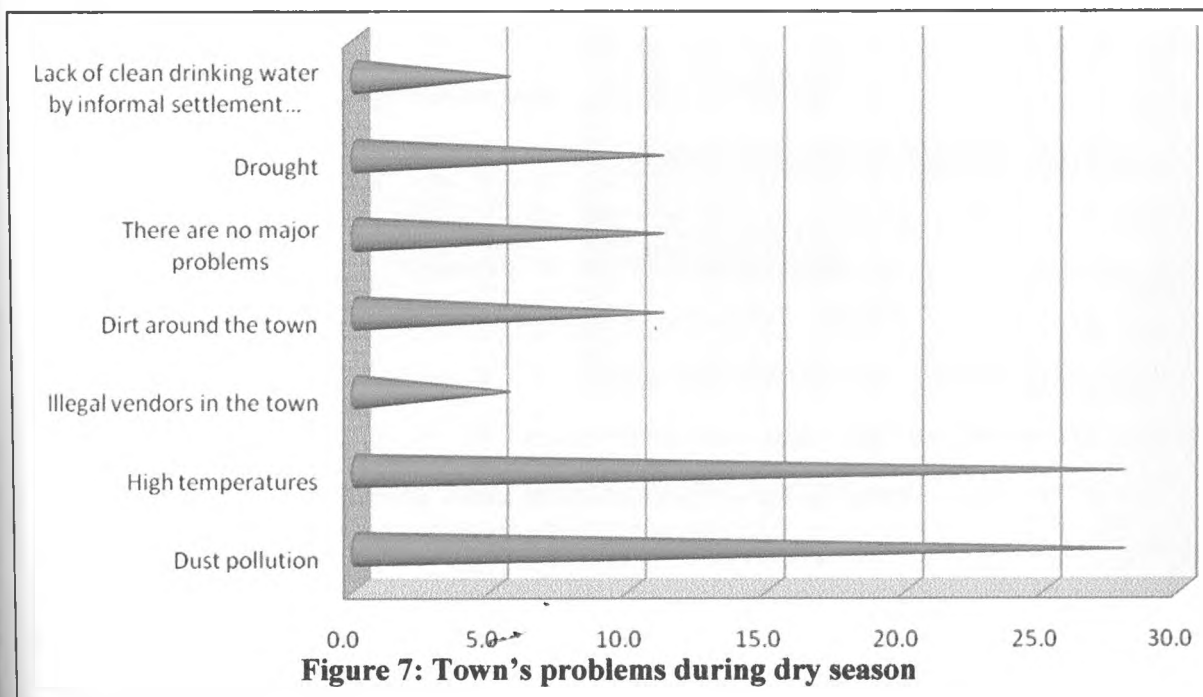
(Source: field survey-2010)

Over 40% indicated that the current roads make life expensive for vehicle owners due to high and regular maintenance cost. The cost of transport has also increased in line with maintenance cost. The values of buildings in Katima Mulilo are on a decrease when comparing to similar building in other urban areas with better roads infrastructure. The current roads also make some of the residential properties inaccessible especially during rainy season. The roads that are considered better, generates a lot of slow traffic movements leading to temporal traffic congestion during pick hours and makes people late to work during morning and after lunch hours. Poor roads have been blamed to be the route course of poor investment and attractiveness of the town. The Ministry of Health and Social Services, has also indicated that poor roads drainage has been a contributing factor to the high prevalence of Malaria in town.



(Source: field survey-2010)

75% of the respondents indicated that the local transport demand is not in line with the town's transport needs, sitting poor road conditions as the major reason. It was interesting to note that 17% indicated that it was in line, this was because such residents were living close to the Trans Caprivi Highway or near the shopping center. Generally, the road network for the town is well planned, if maintained the transport demand can be in line with the town's transport needs.



(Source: field survey-2010)

The Major problems indentified during dry seasons were dust pollution and high temperatures. This is because 90% of the road network of Katima Mulilo Town is gravel or earth roads, the heavy movement of vehicle generates dust that affect the entire town. This occurs after the roads have been leveled. Those town roads are without speed humps to slow down the traffic. The hottest month in Katima Mulilo is during September to November in which the town has a minimum of 20 and maximum of 40 Degrees Celsius.

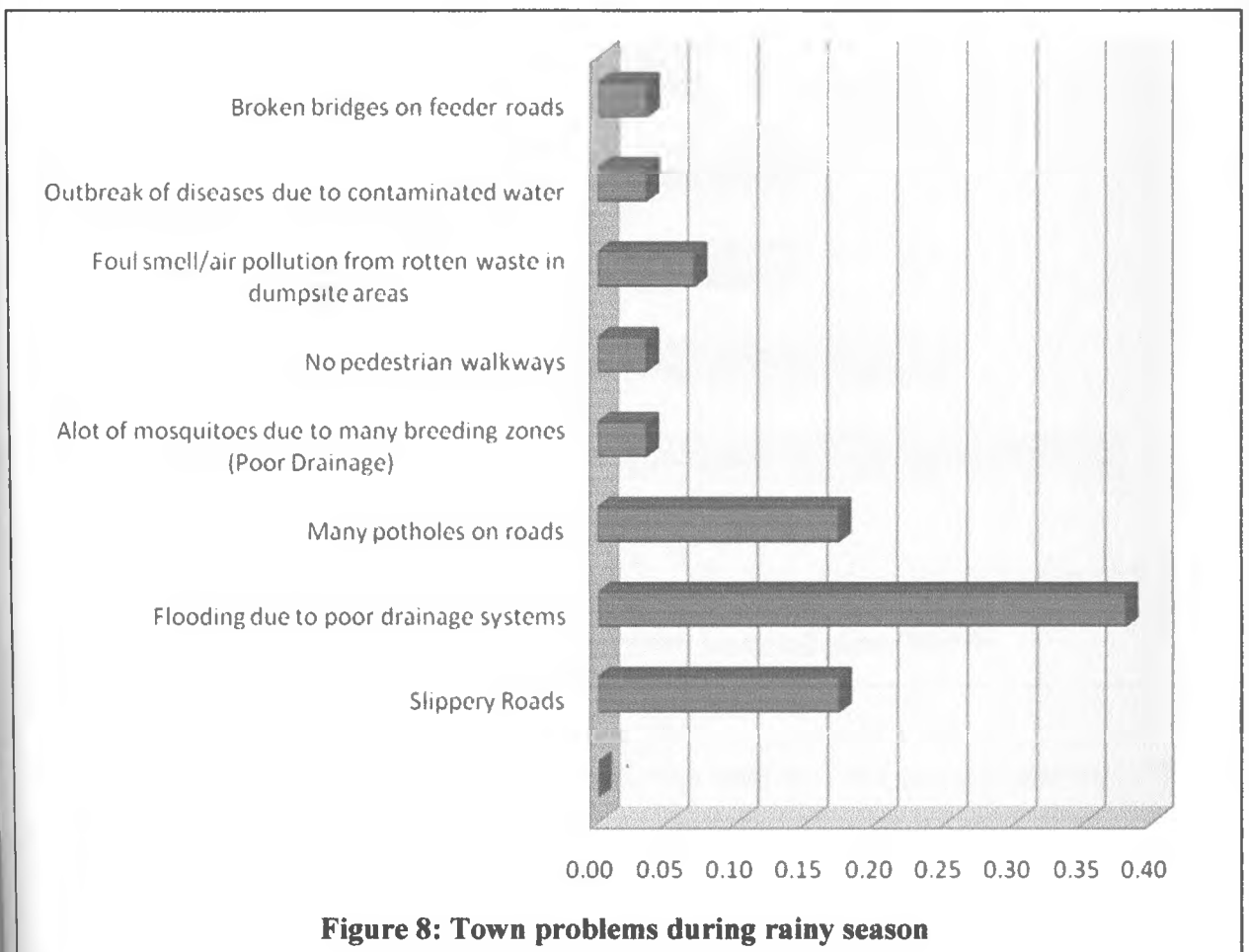


Figure 8: Town problems during rainy season

(Source: field survey-2010)

35% of the respondents indicated that the town frequently experiences flooding due to poor or non availability of the drainage system. This is because the roads were constructed without the provision of the drainage system. Because of the poor gravel materials or earth roads, roads

become flooded or slippery during season. The flooding of roads or slippery leads to many pot holes on the carriage way, this courses the road to be inaccessible or to be in a state of disrepair. Again the flooding of roads leads to a high prevalence of malaria.

5.2 Land Use

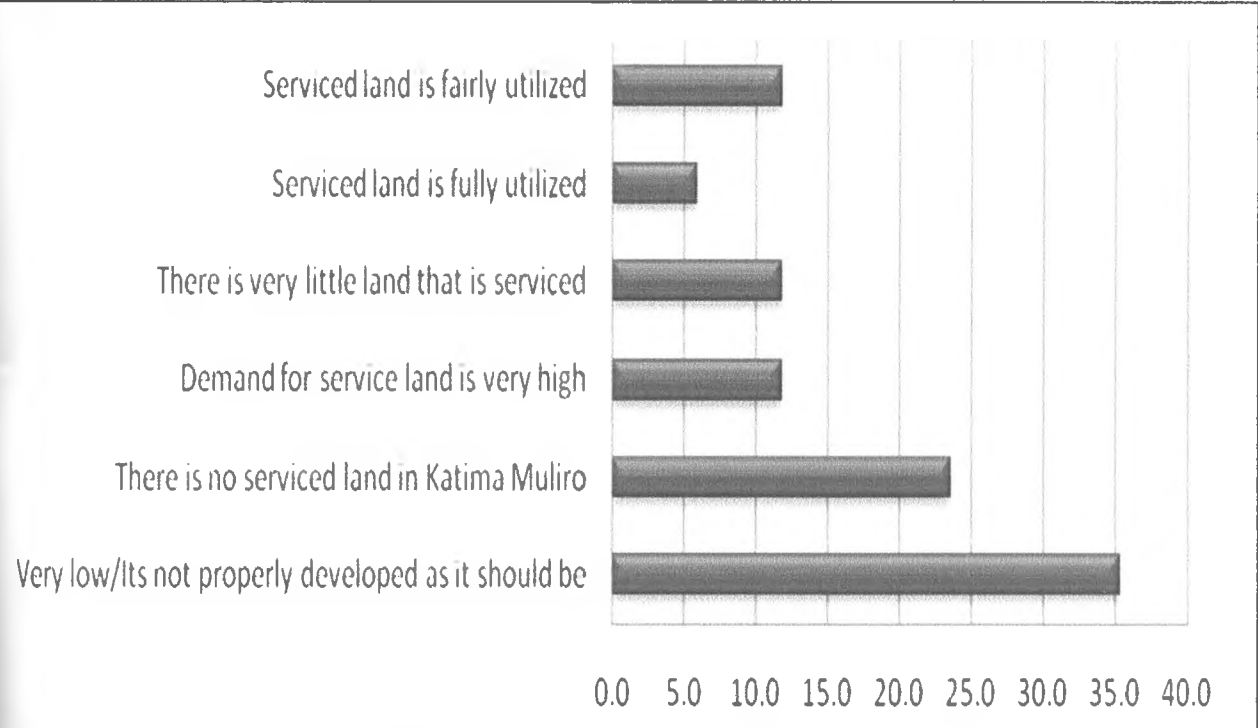


Figure 9: Utilization of serviced land in Katima Mulilo

(Source: field survey 2010)

35% of the respondent indicated that serviced town land was not properly utilized. This is because more serviced plots have been kept for years without being developed. According to the Local Authority Act (Act no. 23 of 1992) it mandates the Council to claim back the land that is not developed after a period of five years from the date of purchasing such land. The enforcement of this Act and its policy directives or Council By-Laws is poorly implemented by Katima Mulilo Town Council. Moreover the Council is unable to service more land. There is a higher demand for serviced land. According to the Namibian Planning Standards and Building

Code including the Council By-Laws, all houses constructed in the formal suburbs should be connected to services such as water, sewer, electrical and road network. The un-serviced land has limited the construction of houses in town.

5.3 Environmental Management

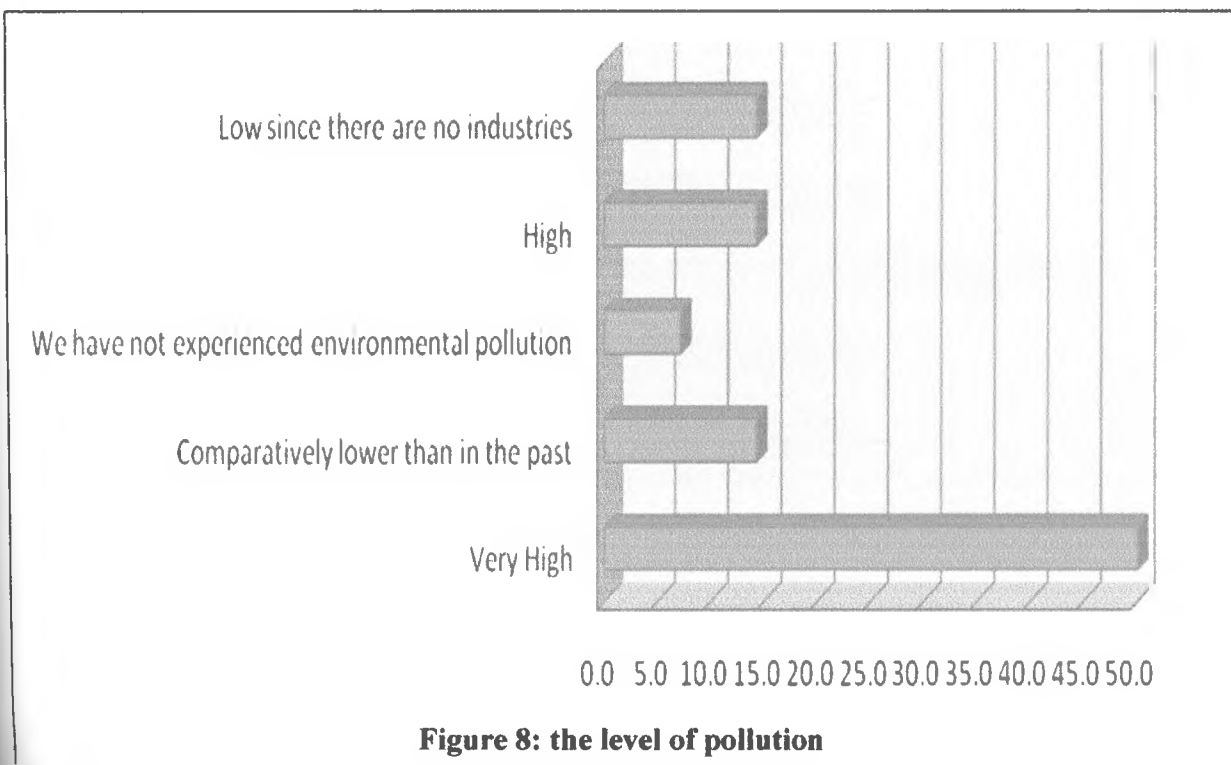


Figure 8: the level of pollution

(Source: field survey-2010)

Over 50% of the respondents strongly believe that there was very higher level of environmental pollution in town, mostly in the informal settlements. In chapter three it is mentioned that almost half of the total population of Katima Mulilo town lives in the informal settlement. The collection of solid waste is only done once a week which cannot cope with the waste generated. The responses varied with the location of residence, those living in or at the periphery of the informal settlements rated pollution to be very high while those living in formal settlement rated pollution to be relatively low, generally environmental pollution is on the increase resulting from the dumping of garden refuse and poor solid management in informal settlements.

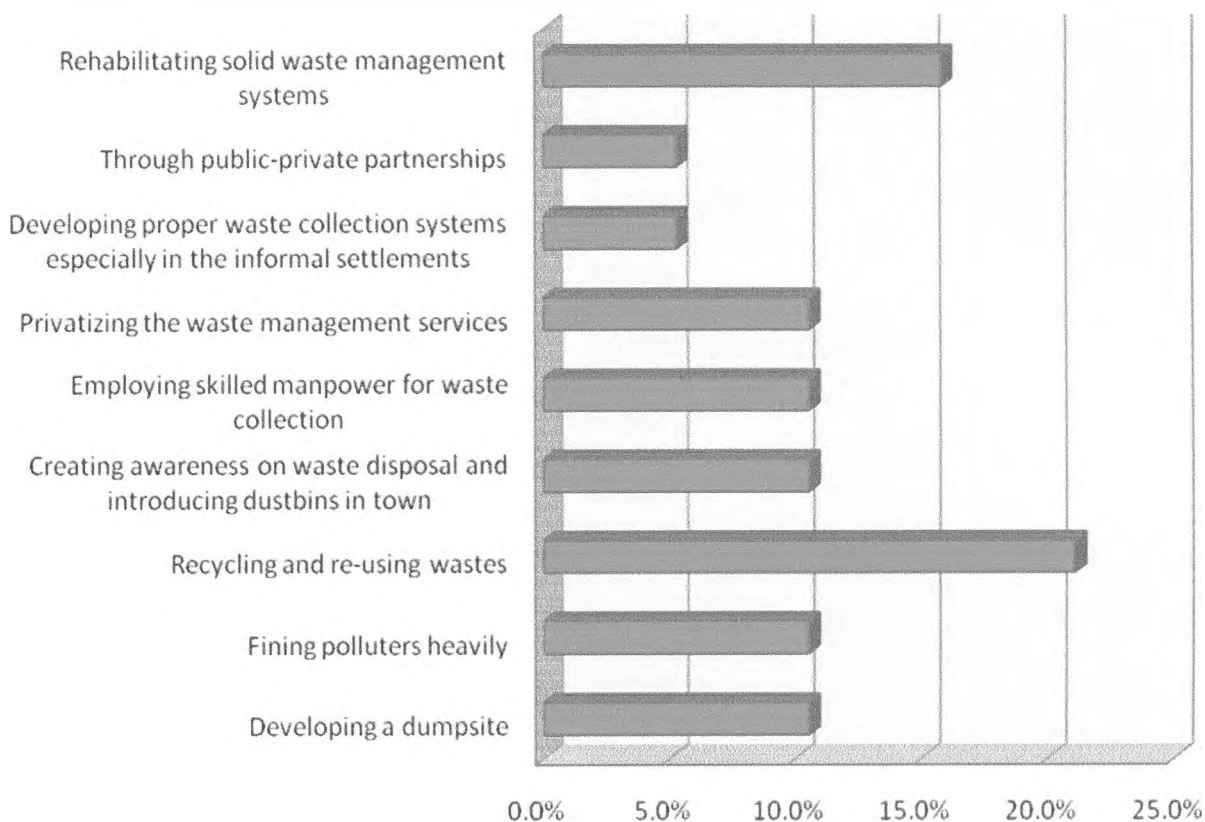


Figure 9: Proposal of solid waste management

(Source: field survey-2010)

Various methods were suggested as to remedy and betterment of solid waste management in the town. The prominent method that was strongly suggested was the recycling of possible solid waste such as plastics, bottles; papers etc. receiving attention was the rehabilitation of the current solid management system and privatization of function to contractors who have the capacity and knowledge to manage solid waste. According to the respondents the current contractors lacks capacity and knowledge in solid management. Others suggested that there was a need to create awareness on the importance of solid waste management. It also came out clearly that those who are found to ignore the law should be heavily fined.

5.4 Transportation, land use and environmental relationship

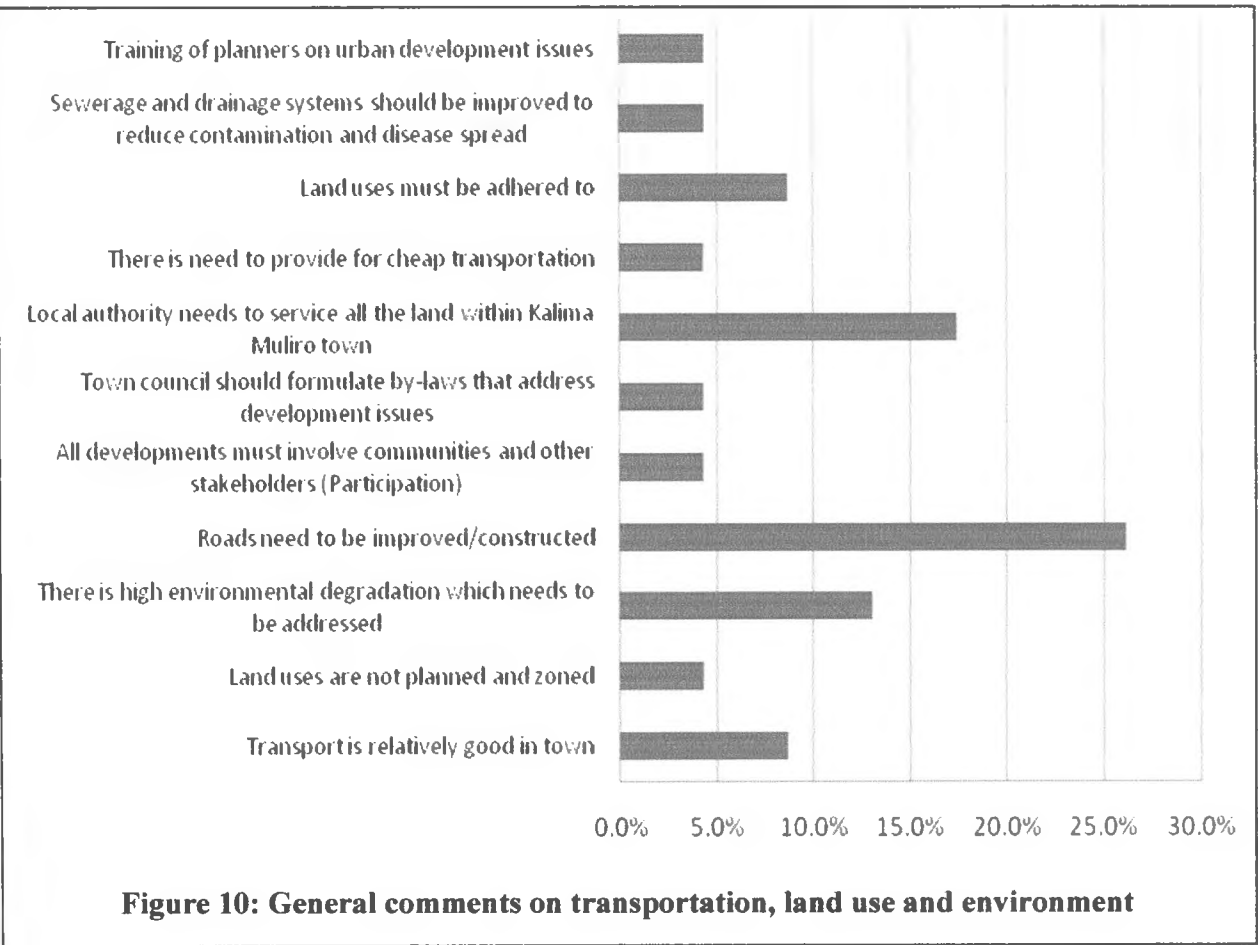


Figure 10: General comments on transportation, land use and environment

(Source: field survey-2010)

The research outcome indicates that the Local Authority needs to service more land in order to address the high demand for housing. The town planning scheme implementation should be adhered too, to avoid conflict while in the same manner the road infrastructure have to be constructed/upgraded to acceptable standard. On the environmental part, respondents feel that there was high environmental degradation that needs to be addressed. The Katima Town Council should train planners, formulate By-lows and enhance public participation on development issues.

5.5 Traffic counts

Traffic counts were performed at five intersections in Katima Mulilo, that is, intersection 1: Hage Gaingob-Hospital Road, intersection 2: Ngoma -Hospital Road, intersection 3: Kongola –Malena road, intersection 4: Ngoma-Malena road and intersection 5: Rundu-Wenela trunk road. Traffic count was defined by the total number of vehicles passing through at a given cordial point and time. This was done for two hours interval for three day, that is, day 1 morning hours between 6:00 and 8:00, day 2 was between 12:30 and 14:30 and day 3 was between 17:00 to 19:00 this was meant to capture traffic at the pick intervals. Traffic flow is expressed as vehicles per hour. It also involved the study of interactions between vehicles, drivers, and infrastructure (including highways, signage, and traffic control devices).The aim was to understand and develop an optimal road network with efficient movement of traffic and minimal traffic congestion problems. These were done by the use of the traffic tally records whereby research assistance took counts of the various modes of transport at various cordial points.

Table: 5 shows results of mechanical counts for vehicles

Movement in both directions	National- cars	Private	GRN cars	Foreign cars	Trucks	Total
Hage Gaingob-Hospital Road	9, 920		441	5,944	30	16, 335
Ngoma- Hospital Road	15, 573		715	4,896	17	21, 201
Kongola-Malena Road	4, 112		109	43	9	4, 273
Ngoma-Malena Road	7,892		5,627	17	14	13, 550
Rundu-Wenela Road	8, 055		22	13, 976	2,355	24, 408
Totals	45,552		6,914	24,876	2425	79,767

P=Private, GRN=Government Republic of Namibia Cars, F=Foreign cars and Trucks & Buses (Source: Field Survey 2010)

The Ngoma –Hospital T-junction intersection was the most busy traffic node in the town, given the relatively high total number of vehicles that passed through that junction. Attention need to be given to this intersection in order to alleviate the temporal traffic congestion experienced during pick hours and month ends. Through-lanes on Hospital Road on both sides (eastern and western direction) are needed in order to eliminate the unnecessary stoppages of the through traffic. The intersection was busy because it was the only tarred road that leads to most government offices, Katima and Kizito Schools on one end and the CBD on the other.

Malena Street is one of the main arterial roads within the town and generates a lot of dust. Based on the result of the traffic count, no through turning lane was needed but the road need to be upgraded from the gravel road to a tarred road. Part of the road has culverts for storm water drainage that needs through cleaning and maintenance. The said road was busy because it leads to the Government Garage. Street names, road marks and signs were poorly developed within town. It was very difficult to give direction to a person or drive in Katima Mulilo Town, because street names only exist in books accept the use of landmarks. Road marks and signs boards were not in place.

The mechanical counts used differentiated between private national cars, government and foreign vehicles based on their registration number plates. The national private vehicle was identified with yellow plates, government vehicles were identified with green plates and foreign vehicle were of any other plates. Where the foreign vehicle carried a yellow number plate it was verified with registration numbers since all national plates starts with N (representing Namibia) followed by the number and the town (KM= Katima Mulilo) of registration at the end of number plates(e.g. N 713 KM).

Foreign vehicles were identified to more from/to Wenela than Ngoma road. This justifies the inflow of foreign nationals through Wenela border being 5 km away from the town. According to a Zimbabwean tourist (interview) indicated that he preferred the Zambia than Botswana route because of the unfriendly manner in which the Zimbabwean nationals were treated when traveling through Botswana. In the case of national cars Ngoma road had relatively large movement of national cars entering the town than Kongola road. This is attributed to the uneven population distribution of the region, where Kabbe and Katima Mulilo Rural Constituencies to the eastern direction of Katima Mulilo Town accounts for the majority of the population in the region. There was a pedestrian wave in the morning and evening from the suburbs, neighborhood and hinterland to and from the CBD. This could be attributed to the fact that Katima Mulilo is the only urban that serve as service center covering several countries.

5.6 Synthesis

One of the results of colonial interventions in all of the pre-colonized countries in Africa was the introduction of international boundaries, homelands and dividing rules among tribes and placing them under different political systems. This was the case among the residents of Caprivi where the region borders with Botswana, Zimbabwe and Zambia. Those communities were placed under different nationalities, after the civil wars, the Namibian Government began establishing new trade links among the region and neighboring countries. New roads and bridges were constructed across international boundaries such as the Trans Caprivi Highway and Zambezi Bridge were opened, in order to regulate the movement of people and goods between nations. The road and bridge infrastructures have resulted in the border town to experience an economic boom.

Communities across such border come from the same stock. The bordering governments have experienced difficulties in providing adequate services to such towns, because people from either countries share such services (e.g. hospital facilities, schools, shopping centers etc) that was provided. Such services have created problems for KMTC being the only proclaimed town within its hinterland and that of the neighboring countries. Judging from the availability of infrastructures, the Government of Namibia has provided enough services for its citizens. On the other hand such facilities have attracted the use of foreign residents. The Planning and coordinating development in such border towns have proven to be difficult and requires better policies and By-Laws.

There is a deep socio-economic and cultural relationship among the people of both countries. People's movement and activities in town are not limited to international boundaries. Bona fide residents of the town and those of the neighboring countries feel that they belong to one community. Despite the fact that they belong to different nations, it is this uncoordinated provision of service facilities between nations that has resulted in temporal traffic congestion, land use conflict and environmental degradation in Katima Mulilo Town.

The poor condition of roads in Katima Mulilo Town has been a concern for both regional and national members. The majority of the respondents describe the road conditions of the town ranging from extremely poor to poor. Over years the residents of the Katima Mulilo town has complained about the terrible conditions of roads through printed media and on both local and national radio service stations. His Worship the Mayor of Katima Mulilo (Mayor: John Likando) stated that efforts were made by both political and administrative office bearers of the region to address the road situation in town. However it was indentified that financing of those roads to acceptable standard is beyond the financial means of the Town Council and needed intervention from Central Government.

The Chief Executive Officer of the KMTTC (Dr. Sazita) maintained that the estimates provided to the Council by the contracted Engineering Firms indicated that the comprehensive upgrading of all town roads will cost the Council approximately 200 -300 Million Namibia Dollars for roads and storm water drainage construction. Such amount of funds cannot easy be raised from the town's population of 22,704. He further argued that the funds applied for and approved by the Road Fund Administration was not enough even for the repair and maintenance of town roads. Furthermore Council has only one old grader that is not reliable and thus unable to frequently service all the roads. He concluded that those factors have led to the poor maintenance of town roads .The leveling of the roads for the past years without the refilling of gravel has led to earth roads which are now not accessible during rainy seasons (Plate 8 below).



Plate 8: Gravel/Earth Roads in Katima Mulilo (Source: Field Survey 2010)

Given the described situation above, the majority of the respondents indicated that the roads needed urgent attention. The roads condition has affected vehicle owners negatively by incurring high maintenance and repairing cost and shortening the life span of cars that operates within town. Research outcome suggest the use of durable materials in road construction, such as tarring of major roads as a short term intervention. An insignificant percentage of respondents suggested for the re-gravelling of roads, this option comes because of the current financial position of the council and as a short term solution to the road conditions. Those advocating for the upgrading of gravel to tarred roads, sited dust reduction level, good accessibility, durability, attractiveness and quick mobility of traffic as the main reasons. Moreover Caprivi Region receives the highest rainfall in the country, so gravel is prone to both soil and wind erosion.

Potholes dominates town roads, this was because of poor storm water drainage system which has affected the roads negatively. Residents have also reported frequent housing flooding during heavy rainy season due to poor drainage system. This uncontrolled storm water has created an environmental concern as it drains water into the Zambezi River and polluting the source of water for the town. The Director of Health and Social Services (Mr. Michael Likando) expressed concern on swampy areas around town that it has been the breeding source of mosquitoes leading to increased cases of malaria.

The town further experienced environmental pollution though illegal dumping of garden refuses. This has been a result of non incorporation of the garden refuse in contracts of solid waste management that were out sourced to contractors. Environmental degradation was much worse in informal settlement and at the dumping pit. Dr. Sazita informed the researcher that there were only two casual laborers employed to manage the dumping site with no supervision after hours, weekends and public holidays when illegal dumping occurs at a higher rate. This has been so because of Council's lack of financial resources.

The enforcement of the Local Authority and By-Laws on illegal dumping, has been weak due to ignorance in effectively implement the laws. Public Health Officer (Mrs. Mundia) warned that if recycling will not take place the current dumping site will only last for the next eight months while the new dumping site has not yet been developed. Thus the period between closing the old dumping pit and opening the new one will further contribute to environmental degradation unless appropriate measures are taken. Residents strongly believe that solid waste can be properly managed and among other strategies suggested were:

- Recycling of waste or a Public-Private Partnerships
- Develop proper solid waste collection system especially in the informal settlement areas
- Privatizing waste management system to companies with capacity and knowledge in solid waste management.
- Creating awareness on waste disposal and introducing dust bins informal settlement
- Heavy penalty to polluters

The land use was generally as per the approved town planning scheme. However few land use conflict was noted in the study area. For example in Soweto Location, St Joseph Roman Catholic Church shares a fence with Mavuluma Primary School on one hand and Barros Bar on the other. Land use and transportation presents conflicts on the location of undesignated taxi ranks and terminals for people going to different destination. Another land use conflict on transportation is on parking, where vehicles are parked randomly around the CBD. The advantage is that roads were designed in such a way that there is enough space for expansion. Although there are no structures within the road reserve, women selling fruits were noted to doing so within the road reserve. This was mainly common in the informal settlements' main streets and along Hage Gaingob Drive in town. The research reveals that the local transport demand was not in line with the transport needs because of the town's poor roads infrastructure development.

CHAPTER 6: SUMMARY OF FINDINGS AND RECOMMENDATIONS

6.1 Overview

Based on the findings the study supports the hypothesis that “transport system is inadequate for the travel needs while land use and environment are not in harmony with the transportation system in Katima Mulilo Town”. The requirements of the transport system is that it should be comfortable, efficient, minimum delays and affordable. Although the material used for roads construction were of acceptable standard, poor maintenance has led to poor roads conditions. Residents have described roads generally to be extremely poor or in poor conditions. The town’s environmental condition within the formalized suburbs is fair, although spots of illegally dumped garden refuses can be seen.

The situation is much worse in the informal settlements. The nearby forest has been depleted in search of poles for housing construction, cleared for urban agriculture, used as source of fire woods, extensively used as bush toilets and dumping for solid waste at the periphery of the settlements. In addition to this the town was affected by air pollution from fire wood for cooking and dust generated from traffic flow. There were a lot of undeveloped plots within the suburbs, people have bought plots but have not developed them for the past eighteen years after proclamation in 1992, so such areas gives a poor view to the town and are hot spots for illegal dumping. They were very few land conflict that was noted. The study recommendations the following:

6.1.1 Short term interventions

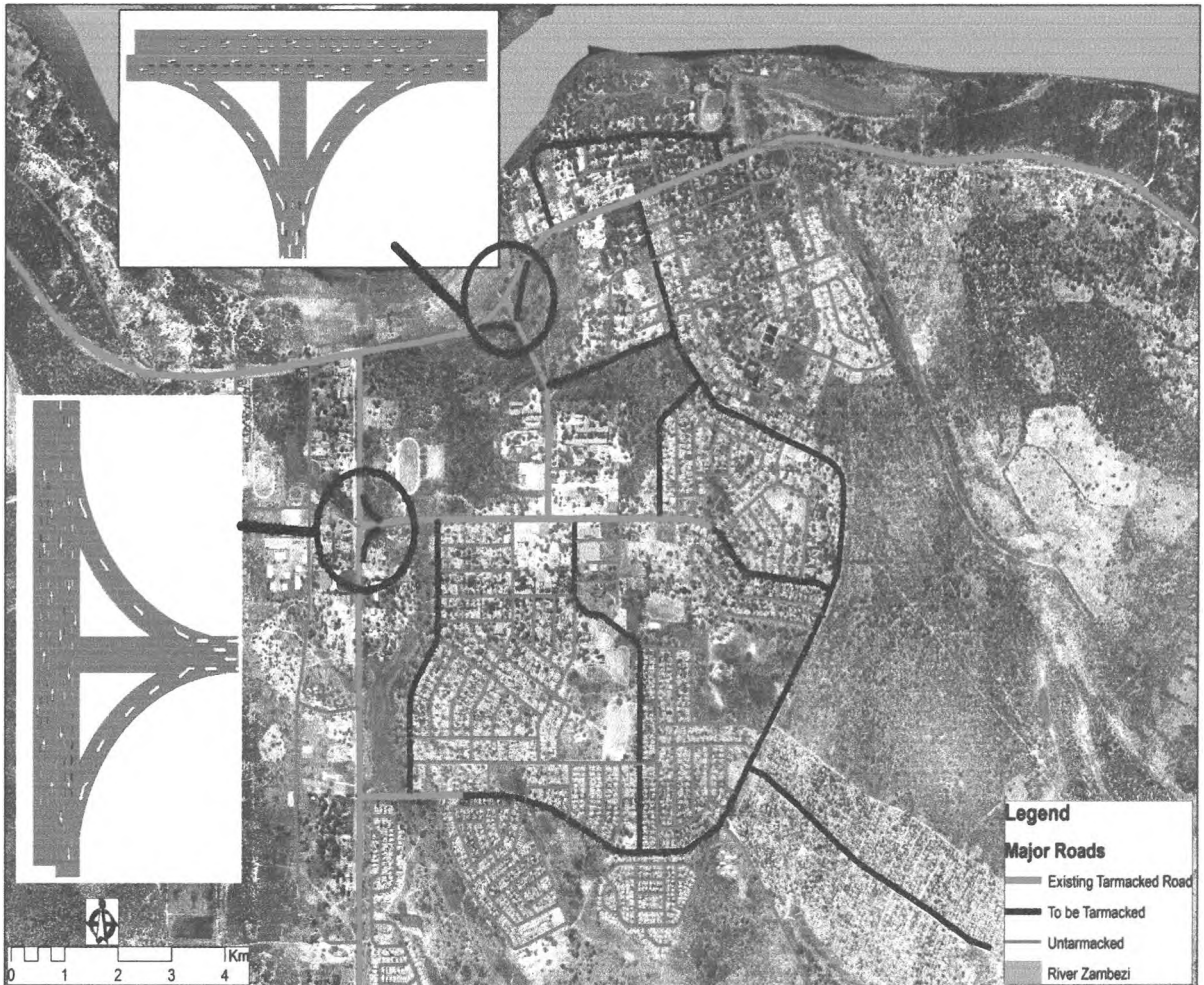
Rehabilitation of earth/ undeveloped roads: all roads that were impassible during the rainy season should be rehabilitated using gravel. This will enable the accessibility of residents to their properties at all time and will give options to drivers to use different rout and reduce the level of dust. Where a street stretches for more than 100 meters on gravel road speed humps should be

installed in order to reduce the speed of motorist around town. Road signs for speed humps and pedestrian crossing should be installed in order to caution drivers and make legal crossing provision for pedestrian.

The town lacks street names and lights: As said before it is difficult for non residents to get their directions in the town of Katima Mulilo, except for the use of land marks. Street names play an important role in the operation of the town. The naming of the streets does not require a lot of money and can be done within a short period of time. The study recommends the street naming of all roads. The town also lacked street lights and was very dark during the night which poses insecurity to both pedestrians and motorist at night. Street light in some cases only lacked bulbs and where they do not exist it is the duty of Northern Electricity Distributor (NORED) to correct the situation on the recommendation of the Town Council. Street lights enhance security.

Rehabilitation of all arterial roads to a tarmac: roads that were identified as the source of dust generation during dry season were the arterial roads. Such roads need to be tarred if ever the council needs to reduce the level of dust pollution in town. Tarring arterial roads that link the shopping center and that goes around the town will likely reduce the temporal traffic congestion that is being experienced during pick hours and month ends. Priority should be given to such roads where movements of vehicles are at a higher speed and filter the traffic quickly. The said arterial roads constitute a distance of approximately 50 kilometer of the town roads. The tarring of such roads can cost the Council approximately 70 Million Namibian Dollars including the provision of work ways and storm water drainage at the rate of N\$1.3 Million per kilometer as projection of Road Construction Company (RCC). Given the economic inflation it is advisable to construct those roads in a short run, because it will be much expensive in a long run.

SHORT TERM INTERVENTION



Map 12: Priority of roads to be tarred (Source: Google Map)

Provision of more service functions such as parking facilities and benches and dust bins:

The Local Authority Act mandates Council to generate funds through parking fees and other sources. It is through this policy statement that there is a need to develop parking facilities as a means of revenue collection and parking order. This will increase the revenue base and bring parking order of vehicles rather than the way it appears currently. In order to mark the parking properly the parking areas need to be interlock. This will also contribute to the proper storm water drainage around town mostly at the CBD. The installation of bins is vital to the cleanness and management of solid waste within the town. The bins can be provided through the

partnership of the council and businesses. There is a necessity to make provision for benches at strategic positions such as terminals, taxi ranks and other public places where motorists can sit and have their lunch or snacks. Again such facility will increase the management of the solid waste around town in general.

Equipments: the council should acquire the maintenance equipments either through Regional Council's submission of the Capital Project to central government or through soliciting such equipment to municipalities that the Council has the twinning agreements with. It is also possible to buy one or two graders from their own sources. Town Council own 75% of undeveloped land within the town boundaries, selling a reasonable portion of land to investors in order to generate income to buy equipments or use the money to upgrade town roads is not a bad idea. Once the roads are upgraded to either tarmac or gravel level. The maintenance programme should be strictly followed in order to keep the infrastructure to standard standards.

Solid waste: Garden solid waste management should be included in the contracts that will be outsourced to private contractors, meanwhile the collection of refuse disposal in informal settlement should be increased to at least twice a week just like the way it is done in the CBD and industrial area. The two interventions will help in serving the current environmental degradation going on around town. The new dumping pit should be established and fenced to protect it from illegal dumping and better management.

Council By-Laws must be fully adhered to and implemented as per policy framework. Where illegal dumping takes place, heavy penalty should be imposed. It does not require a lot of money to implement such a policy directive. The Council should create the Department of Inspectorate to uphold all By-Laws such as monitoring the contractors on solid waste management, building control, *illegal water connections, road conditions etc.*

6.1.2 Long term innervations

The town needs a comprehensive improvement of road network and storm water drainage; this will solve a number of problems emanating from the improper functioning of such utilities. The comprehensive development programme will include tarring of all roads and make provision of the storm drainage to avoid polluting the Zambezi water body. Councils that were immaturely proclaimed like Katima Mulilo should have exception and be funded by Central Government to put in place the lacking infrastructures. As matter of policy all new suburbs that will be developed in future, roads should be tarred and storm water drainage in place before construction of residential units.

Terminal facilities need to be constructed for tracks that are in transit. Such terminal facilities both on the highway and around town should be supported by sanitation facilities, safe drinking water, shed, dust bins and large parking facilities. In the case of the terminals for trucks in transit, it needs to be in a wall fence for security and control purpose.

6.2 Conclusions

The town of Katima Mulilo suffer from inadequate solid waste management, Storm water drainages, land use conflict and poor road infrastructure development such as carriageway, parking, terminal and other support facilities within the town surrounding connected by roads. One of the factors that influence the well-being of the town is mainly the proximity and accessibility of the locations and central business district, access to markets as well as nearby social and medical services. All these indispensable factors are connected by road systems, therefore the better the road infrastructure, the better the positive achievements of the town. Easy and improved access to social facilities and economic activity leads to social benefits and well-being of livelihoods for all residents.

Besides this poor access to markets, roads constrain income and consumption of local people. Town roads facilitate the social, environmental and economic activities of the town to meet the needs of urban development. Better mobility reduces transport costs and improves the competitiveness of markets by the entry of different actors into trading and stimulating information flow. This may lead to competition resulting in lower prices. An adequate road and transport system always encourages investment by raising the effectiveness of trade. Also small-scale businesses such as petrol stations, shops and garages emerge along the road and offer formal and informal job opportunities to local people. Other jobs can potentially be generated within the construction, building and transport sector. All those factors mentioned above are theoretical concerns, hopes and perspectives of regional and town planners.

6.3 Further Research

A further study needs to be done on the solid waste and environmental degradation of the town and a social and political influence of the town in SADC region.

REFERENCES

- 1) Caprivi Regional Council (2000) Regional Development Plan (2001/02-2005/06), National Planning Commission, Namibia
- 2) Caprivi Regional Council (2005) Participatory Poverty Assessment, National Planning Commission, Namibia
- 3) Kangumu Kangumu (2000) A forgotten Corner of Namibia: Aspect of the History of the Caprivi Strip, Pretoria, South Africa.
- 4) Kirsten Alnaes (1989) The Namibian History, Namprint, Windhoek, Namibia
- 5) Mendelsohn J and Roberts (1997). An environmental profile and atlas of Caprivi, Windhoek: Ministry of Environment and Tourism.
- 6) Mendelsohn, Johan; Roberts, Carole (1997): An Environmental Profile and Atlas of Caprivi. Pretoria, South Africa.
- 7) Mendelsohn, John; Jarvis, Alice; Roberts, Carol and Robertson, Tony (2002): Atlas of Namibia. A Portrait of the Land and its people. Cape Town.
- 8) Mendelsohn, John; Selma and Roberts Carol (2000): A Profile of North-central Namibia. Gamsberg.
- 9) Namibia Household Income and Expenditure Survey 2003/04, National Planning Commission, Windhoek.
- 10) Namibia Population and Housing Census (2001), National Planning Commission, Windhoek.
- 11) Republic of Namibia (1998) Second delimitation commission-Caprivi Region, Windhoek.
- 12) Republic of Namibia, 2007, Project: NAM341-Urban Development Katima Mulilo, Lox Development Namibia, Windhoek, Ministry of Regional and Local Government, Housing and Rural Development
- 13) Sten Hansen (1997) A Fuzzy Logic Approach to Urban Land Use Mapping, Roskilde, Denmark
- 14) The Constitution of the Republic of Namibia adopted by the Constituent Assembly on the 9th day of February 1990
- 15) The Covenant of the League of Nation (June 28, 1919) 30th of Sivan 5679
- 16) United Nation for environmental Programme (2000), Nairobi, Kenya
- 17) United Nation Habitant Report (2008) Regional Conference of Mayors of Capital Cities of Africa, Plenary Session 5
- 18) United Nation Habitant Report (2008) State of African Cities: framework to address urban challenges in Africa
- 19) United Nation Report (2008) Capital cities and finances: Challenges and Opportunities
- 20) Wolfgang Zeller, 2004, Danger and Opportunities in Katima Mulilo: A Namibia Border Booming Town at a Transnational Road.

APPENDIX
UNIVERSITY OF NAIROBI
DEPARTMENT OF URBAN AND REGIONAL PLANNING
M.A. 2 (PLANNING)-RESEARCH THESIS 2010

Declaration: This questionnaire is purely for academic purposes. Any information obtained will be treated as confidential.

ROAD USER QUESTIONNAIRE

1. Name of study site:..... Date.....
2. Motorist/Pedestrian/Resident:..... Gender.....
3. Occupation.....country of residency.....location.....
4. Mode of transport.....how is the condition of roads in Katima Mulilo Town.....
5. Should the road infrastructure be improved in the town of Katima Mulilo?
(1) Yes
(2) No
6. If yes, what type of improvements?
.....
.....
.....
.....
.....
.....
.....
7. What kind of building material would you suggest for road improvement?
.....
.....
.....
8. What impact do the roads have on the lives of the residents and their properties?
.....
.....

9. What role should the residents play on the maintenance of such infrastructures?

.....

.....

.....

.....

.....

.....

10. Is there any other infrastructure in this town apart from roads that you think needs improvement?

.....

.....

.....

11. Which infrastructure is in the best working condition?

.....

.....

.....

12. How is the availability/adequacy of the following services to the community?

Facilities	No. of facility in town	Very good	good	Fair	Poor
Education					
Health					
Religious					
<i>Commercial</i>					
Transportation					
Police station					
Fire fighting					
Home for people with disabilities					

13. How is solid waste managed within the town

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

14. How best can we control solid waste management in town

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

15. What is your overall comments on infrastructure development in the town of Katima Mulilo

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

16. Is the international, national, regional and local transport demand in line with the town's transportation needs

a) International:.....
.....
.....

b) National:.....
.....
.....

c) Regional:.....
.....
.....

d) Local:.....
.....
.....

17. How is the utilization of serviced land in Katima Mulilo town?

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

18. How is the level of environmental pollution in the town of Katima Mulilo?

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

19. What problems do the towns experience during

a) Raining season?

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

b) Dry season?

.....
.....

20. General comments of the respondents based on the transportation, land use and environmental degradation

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