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SCHOOL OF ENVIRONMENTAL STUDIES

DEPARTMENT OF ENVIRONMENTAL PLANNING AND MANAGEMENT

PROJECT RESEARCH

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**TITLE**

**“Strategies for the Prevention of Road Carnages Along Kibarani Hot Spot, Changanwe  
Sub-County, Mombasa County- Kenya”**

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*Student Research Project submitted for partial fulfillment for the award of Bachelor of Science Degree  
in Environmental Planning and Management*

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## DECLARATION

I declare that this project report is my original work and findings and has never been submitted in this way before or any other way to any university for examination or award.

**APPROVAL**

This project report has been submitted with my approval as a supervisor.

Signature.....Date.....

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## **DEDICATION**

This work is dedicated to Kenyatta University; Department of Environmental Planning and my ally and our family members

## ACKNOWLEDGEMENT

I wish to register my sincere gratitude to the following individuals who have made my entire project proposal a success in one way or another. First and foremost, I thank Kenyatta fraternity at large, specifically my supervisor, Dr.Kamau, in the department of Environmental Planning and Management.

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Thanks much for your support of whatever kind is greatly appreciated.

## ABSTRACT

Globally, it is clearly evidenced that road transport is the main cause of many vital accidents where many lose their lives and others become lamed and crippled for the rest of their lives. This is due to careless driving and overtaking where roads are too narrow, alongside intoxication, poor road designs as well as lack of road signs. Kenya is no exception to this global trend since it has become a threat to many. Prone areas to this in Kenya such as Kaseve in Machakos county, Maimahiu, Molo areas, Mazeras and Kibarani in Mombasa county, Kwa Vonza in Kitui county and Masii in Machakos county have really contributed to life-loss.

This project report comprises of pure findings of a research undertaken on the strategies to prevent road carnages along the Kibarani hotspot, a section of the road located between Changamwe and Makupa locations, within the jurisdiction of Mombasa County. It is the chosen area among many since according to traffic statistics, it has recorded the highest number of accidents annually for the past two decades compared to the other areas. It is a fresh research from the scratch which has never been carried out any before in this area and was conducted within the period of time between September 2013 to April 2014, to ultimately find out and address the problems and the challenges experienced by residents and local communities within Kibarani area and its outskirts, as a result of the alarming rate of the road carnages along this area.

The detailed scope of this project report runs from introduction of the broad objective of the problem to be addressed, the literature review, study area, the physical, economic and biophysical setup of the area, the problem itself being addressed at large and proposed

mechanisms and mitigation measures to curb it, recommendation and conclusion, basing on the data and information gathered from the local stakeholders.

It also covers a wide range of benefits, both economically and socially that will be drawn and be useful to not only the Government and the residents of the Mombasa County, but also to the whole nation, upon its implementation, since it is a research that aims to come up with feasible solutions to comfortably mitigate and combat the issue of road carnages at this area.

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## STRATEGIES FOR THE PREVENTION OF ROAD CARNAGES ALONG KIBARANI HOT SPOT, CHANGAMWE LOCATION, MOMBASA COUNTY- KENYA

### CHAPTER 1. INTRODUCTION

#### 1.1 Problem background

Definition of road carnages refer to any event that happens unexpectedly, without deliberate plan/cause or an undesirable or unfortunate happening that occurs unintentionally and usually results in harm, injury, damage, or loss of lives of persons for which compensation or indemnity is legally sought.

Basing this on global general view, the world's first road traffic accident to occur involved a motor vehicle and it is alleged to have occurred on 31<sup>st</sup> August, 1869, where Irish scientist, by the name *Mary Ward* died when she fell out of her cousins' steam car and was run over by it.

After that, a road Engineer from Britain, by the name *J.J. Leeming*, compared the statistics for fatality rates in Great Britain, for transport-related incidents both before and after the introduction of the motor vehicle, for journeys, including those once by water that now are undertaken by motor vehicle, for the period starting from 1863 to 1870, where he found out that there were 470 fatalities per million of population (76 on railways, 143 on roads, 251 on water) and for the period starting from 1931 to 1938, the figures were 403 (22 on railways, 311 on roads, 70 on water). Basing on his findings, Leeming concluded that, the data showed that travel accidents may even have been more frequent a century ago than they are now, at least for men. (Leeming, J.J, (1969).

A number of issues have been raised as contributors of road accidents in most Africa's road accident-prone countries.

For instance, just like every other African country, Nigeria is not immune to problems of road accidents. A research conducted by Akpogome, 1998, and Atubi, 2012, indicates that Nigeria is ranked the first position in Africa and position two in the world as far as casualty rates resulting from road accidents are concerned.

Equally, the 2006 stats from the Nigerian Federal Road Safety Commission (FRSC), confirm that the country recorded the highest number of road accident related deaths. Human error is the major contributor to such crashes since it causes about 95% of traffic road accidents in this country more especially during the months of festivals.

Narrowing it down, it has become almost normal to hear news about a fatal road accident in our own country Kenya at any given time and this has risen various questions that always lingers in our thoughts day and night, such as; how many traffic police officers gave the speeding or rickety vehicle clearance?, how much money exchanged hands?

Accident rates in Kenya has reached intolerable levels is a fact given the outcries from various points of our nation. The country continues to pay very heavily in terms of human lives, materials and otherwise.

Recently, our country Kenya has acquired the notorious distinction as a country with the highest road carnage rates in the category of countries at the same stage of development (3<sup>rd</sup> world countries in the first stages of development). Frankly saying, we lose several thousands of lives to road accidents annually. A number of victims are maimed, others become permanently incapacitated, doomed to lives of perpetual dependency.

The cumulative costs to the country, generally, and the families of victims, specifically, must be immense considering that many accident victims are active and economically productive lives. Those maimed require costly long term care both in hospital and at home.

Here, Kibarani area has become a “hot spot” and a major contributor to the huge number of road carnages in our country, claiming the so uncountable thousands of lives of our beloved ones every year.

## **1.2 Statement of the problem**

According to the annual traffic statistics of every year, more than 3,000 people die of road accidents in Kenya thus ranking it the fifth highest in number of road accidents worldwide. About 65 % of deaths involve pedestrians and passengers, while 35 % of pedestrian and passenger deaths are children.

In the most recent years, most people are really afraid of the Kibarani hot spot, cyclists, pedestrians, cat pushers, and even drivers find it a life risking area day and night because of the accidents that occur from just a clear road, and due to a number of pressing issues, I have clearly seen the need of conducting this study so as to educate the Kenyan people, through both interdisciplinary and multi-disciplinary approaches, in order to attain the so called Sustainable Development.

In this context, the proposal going to focus on various concerns and issues, which have been so sensitive and pressing in the public general, not helping only the Coastal people, but also all the Kenyans and the whole world at large.

### 1.3 Research questions

- i. What are the causes of the road accidents along at Kibarani area?
- ii. What the design challenges of the road along this area that may be resulting to these fatal accidents?
- iii. Are all the traffic rules and regulations being followed by everyone using the road?
- iv. Is the road here having all the road signs required by the road users?
- v. What is the condition of the road in this area?
- vi. Are all Matatu drivers, motorists, cyclists and other road users here properly trained?

### 1.4 Research objectives

- i. To find out the various causes of the road carnages in Kibarani area
- ii. To find out the road design challenges present at Kibarani area
- iii. To find out whether the traffic rules are clearly followed by all the road users
- iv. To examine and find out whether all the road signs are there
- v. To carry out qualitative survey on the condition of the roads in this area
- vi. To examine all the road users especially the drivers to know whether they are all properly trained.

## 1.5 Research premises

- i. Along Kibarani hot spot, most of the road sections have pot holes-are not well re-carpeted
- ii. Traffic officers are bribed by drivers when overloading
- iii. There are no all road signs along Kibarani hot spot
- iv. Traffic road rules and regulations are not properly followed by the road drivers such as over speeding and overtaking.
- v. Along Kibarani hot spot, the roads here are narrow and not clearly de-marked.
- vi. Most of the sections of this part of Kibarani road, the road was poorly constructed since it lacks pavements, bumps, culverts, pedestrian walks as well as cyclic corridors.

## 1.6 Justification of the study

In the most recent years, most people including the local authorities and some ministries related to the transportation sector have taken road carnage issues for granted, yet we have been losing our so beloved ones through this.

According to the recent traffic statistics, Kenya is ranked the fifth highest in number of road accidents worldwide, whereas about 65 % of deaths involve pedestrians and passengers, while 35 % of pedestrian and passenger deaths are children.

Comparing Kenya with other nations worldwide, statistics clearly indicates that Kenya is far much behind and a very wide gap exists between. Not because of lack the required knowledge in technology for development, but the continuous loss of many rich minds through these accidents yearly. In fact, most of them hold a future for Kenya, they can take it to a higher level, play vital roles in socio-economic productivity of our nation, increasing exports and minimizing imports, act as diligent decision makers in resource utilization, solving conflicts on resource usage (tragedy of the commons),take part in rehabilitation and reclamation of the derelict lands, revise, formulate and implement useful policies in conservation of ecosystems, transforming vision 2030 from ideas to reality, protection of environment to attain environmental sustainability, which act as a key drive, great Kenyans who are in their early ages of planning

for the future of this great nation, and whose ideas when implemented can be used in gearing towards the attainment of sustainable development.

It feels so agitated when a nation is just left “empty”, when these great “Heroes” disappear from the face of the earth, just through a minor issues, which can be looked into, be corrected through the most appropriate measures put across, the issue of road carnages has been a big concern, hence a reason to carry out an investigative research, so as to curb this.

### **1.7 Significance**

Through this study, various corrective measures, mechanisms and approaches are put across to be used as well as guidelines, which when put into consideration, will help to solve the problem of road carnages.

To begin with, the Local authorities of Mombasa County will be the first one to be much advantaged and favored by these findings of my research, this is because it is a research conducted within the limits of its boundaries, addressing the key issues that have been irritating the Mombasa county community in general.

Secondly, this study is not only concerned with the problems around and within the Mombasa County, but also the whole nation at large. In so saying, the transport ministry will highly benefit from my research findings in this proposal. Basing on the worlds statistics that Kenya is ranked the fifth highest in road accidents in Africa, this proposal is aimed at looking critically at the cause issues of this, as well as providing corrective measures and mechanisms, using various approaches so as to ensure the problem is not overlooked, but solved only if my findings are put into consideration.

Commonwealth countries as well as the other nations in Africa and the world at large will be glad of the news that the level of road accidents in Kenya has tramediously gone down. This will give them faith in the investments they are establishing in our nation, knowing that it will generate income not only to them, but also to kenya. This includes the imported Technology to be uses in resource utilization and development, hence acting as a driving force to attain sustainable development.

## 1.8 Scope of the study

It is everybody's responsibility to help curb this problem of road accidents. Putting everything into consideration, all stakeholders must be involved in the whole process to help in decision making. Also, various plans and projects should be implemented so as to save precious lives that are being lost day by the day.

Various causes that have been escalating these road accidents and there are reasonable ways out as well as their alternatives. Indeed, they are the subject of the rest of the discussion in this proposal, and it is a request that the findings in this proposal becomes a food for thought for all, and especially for those in power to help its implementation without discrimination, undermining and disqualifications.

Also, this research is dealing with road carnages as the main issue only within the boundaries of Kibarani hot spot, which is sandwiched between Makupa area and Changamwe round about, Changamwe location in Mombasa county. By considering the other parts of this county, this is the only area that is prone to road accidents. Over a couple of years now, most a lot of people and families have lost their beloved ones along this area. Maybe it is because is an area reclaimed from the ocean, or, maybe it is because the road is not clear, or careless driving, these are the issues being confined in this research.

## 1.9 Operation terms

E.I.A	Environmental Impact Assessment
E.A	Environmental Audit
EMCA 1999	Environmental Management and Coordination Act-1999
NEMA	National Environment Management Authority
OHSMS	Occupational Health and Safety Management Systems
GEF	Global Environment Facility
CSIR	Center for Scientific and Industrial Research.

## **CHAPTER 2: LITRATURE REVIEW**

### **2.1 introduction**

Road carnages is the major area of concern that researchers have looked into in depth but still leaves the problem unsolved. Basing on this, various studies, views and thoughts of different prominent people in the world have been have been looked into, trying to express the same issue of road safety, particularly road carnages.

For instance, literature review of road safety in Africa has been organized by the main road safety sectors. Giving an example, the Centre for Scientific and Industrial Research (CSIR) in South Africa has been one of these sectors.

Looking at this in some other African and world nations;

### **2.2. South Africa road safety management**

South Africa abolished NRSC in the early 1990s and has relied on the Directorate of Traffic Safety within the Department of Transport to coordinate road safety activities. Many papers and presentations have discussed road safety management as shown below with the national approach discussed before any regional case studies.

#### **2.2.1. Road traffic management strategy.**

This paper provides a summarized broad description towards implementation of the nineteen chapters of road traffic management strategy and includes additional issues provided for in the chapter on "Road Traffic and Safety" in the White Paper on National Transport Policy of the national Department of Transport (Botha, G, Sep-97).

#### **2.2.2 The road traffic management corporation.**

The current road traffic management picture in South Africa is very gloomy and innovative ways have to found to get out of this perilous situation. To achieve the improvements required, the Road Traffic Management Corporation (RTMC) concept was developed. This paper discusses the objectives, functions, duties, financing of the Corporation, so as to enable solve the problem of road accidents.(Van Tonder, H, Jul-99).

#### **2.2.3. Towards a quantitative management approach to road traffic safety in South Africa.**

To successfully reduce the number of road traffic accidents, it was discussed in South Africa that it is essential that limited resources be utilized as effectively and efficiently as possible.

This requires that correct decisions be made on required resource levels and on the correct allocation of these resources to the different possible remedial measures. The objective of this paper is to describe how a quantitative management model could be constructed to assist road safety managers and investors in managing road safety in the most efficient way possible (Mollett, CJ, Jul-99).

### **2.3. Tools and mechanisms that have been used to solve the problem of road carnages**

Since road carnages have become a critical problem almost in the whole world, various tools and mechanisms have been used to gear towards its solving. These include inter-alia;

#### **2.3.1. Road safety funding**

Road safety funding activity was one of the most prioritized mechanism that was used in the areas in the Second United Nations Transport and communication decade in Africa(UNTACDA II),and it was used in the period from 1991-2000.A general review of road safety financing was presented at the most recent Africa Road Safety Conference(Wetteland and Lundebya,1997).

This mechanism was subdivided into sub-mechanisms;-

#### **2.3.2. Self-financing.**

Government grants are the main source of funding for road safety activities (traffic policing, traffic signs and hospital treatment, etc.) but this is still found to be insufficient, especially in the areas outside road maintenance and construction (Assum 1997).

As of 1997, Ghana's National Road Safety Council was receiving less than US\$10,000 a year from the government (Kwake et al, 1997) for its operation and publicity activities. Insufficient financing was found in other countries as well with Zimbabwe receiving less than one fourth its requested amount in 1997 (total of \$5.1 million instead of \$24 million) and the case of Zambia has already been described.

In Uganda, the government spent US\$300 million on road rehabilitation in a recent decade, but less than US\$ 0.05 per head per annum is spent on road safety publicity and education (Kwamusi, 1996).

In Zimbabwe, in addition to maintaining the Zimbabwe Traffic Safety Board and its activities, the government also used to subsidize defensive driving courses to make them more affordable for drivers in order to avoid causing road accidents.

In Zambia, the government has occasionally provided the fuel for the mobile patrols conducted by the Honorary Road Marshalls, private citizens who are authorized to assist in traffic law enforcement (Ross, 1999).

### 2.3.3. User fees.

User fees were some of the proposed mechanisms to become the long term financial source for road safety work in Tanzania, so as to impose discipline and behavior in roads, such sub-mechanisms included;-

- Third party insurance levy
- Annual road safety levy paid by vehicle owners
- Vehicle inspection fee
- Driving school levy
- Driving license fee
- Portion of road fund
- Portion of traffic fines (Assum, 1998)

### 2.3.4. Traffic fines.

A share of the traffic fines collected has been requested reserved for road safety in several countries, including Zimbabwe and Ethiopia. No country in Africa is believed to receive any part of the income received from traffic fines for safety measures (unlike Vietnam where traffic fines are allocated to road safety work).

These fines have been imposed in-order to ensure that no overloading and any driver found doing it, this fine must heavily be imposed on him so as to act as an example to others, by so doing, and this has reduced road accidents in most parts of Africa and Kenya as well.

### 2.3.5. Donor financed projects.

Donors have financed most of the major road safety programmes in Africa. This is inclusive of Botswana, Uganda, Ethiopia, Togo, Malawi, and Ghana. An example, Togo was presented, where the World Bank financed road safety project (1991-95),the team included members of the German Road Safety Council and sought the close involvement of Togolese experts. Some of the outputs included:

- Restructuring and updating of the Togolese road traffic legislation and the production of a rulebook on traffic regulations, licensing requirements for vehicles, licensing requirements for persons, and traffic offences.
- Standardizing vehicle inspection forms.
- Developing a six month driving instructor training course which concluded with an exam consisting of a written and oral art, a demonstration lesson and a practical demonstration lesson in the vehicle. Practical training was emphasized and the course included an introduction to first aid provided by the Togolese Red Cross (Toure, 1997).

### 2.3.6. Planning and design.

This was a tool used in trying to minimize road accidents. While not restricted to Africa, the then Overseas Development Administration (ODA) funded manual "Towards Safer Roads in Developing Countries; A Guide for Planners and Engineers", is still a key reference for both policy makers and engineers, aimed at using improved road designs.

The Road Safety Checklists included were for land-use/physical plans, network planning, highway design, and countermeasures related activities.

A checklist for a site visit to hazardous locations was provided in a separate appendix. Towards Safer Roads has served as the basis of several training courses and a slide pack is also available (TRRL, 1991).

### 2.3.7. Design guides.

Several design guides in Tanzania have been used as road accidents prevention tool, a safety audit conducted on the Mikumi-Kidatu road, a gravel road which was to be upgraded to bitumen standard was used for this experiment. As with many highways, narrow bridges located on the highway and especially at sharp corners, were a safety problem. The design of the upgraded road included the added safety features of;

- i. Pedestrian walkways to the bridges
- ii. Speed humps and road signs (including reflective warning signs) at approaches to narrow bridges
- iii. Guard rails at bridges and where large drops (above 3 meters) occur
- iv. Bus bays and parking areas
- v. Straightened approach to Ruaha Bridge (Kiza and Kayoza, 1997).

Also, a recent World Bank funded project in Uganda was to revise the chapters of the Road Design Manual, which pertained to geometric design, junctions and road furniture (including traffic signs and road markings). Key design features which required priority attention included the need for a wide shoulder (2 m) on Class 1 rural roads. The study proposed the following design elements for urban arterial roads:

- i. Dual carriageway, with a kerbed median and kerb and channel at the outer edge.
- ii. Each carriageway 8.0 m width, comprised of 4.5 m lane (including a 1.0 m shoulder for cyclists), and a 3.5 m auxiliary lane.
- iii. Pavement markings at 3.5 m from the median
- iv. Kerbed median minimum width 1.8m, desirable width 3.0m.
- v. Footpath minimum width 2.0m, typically 3.0m

### 2.3.8. Identification and improvement of hazardous locations.

A road carnage prevention mechanism used and its purpose was to provide a practical and easy-to-use method for identifying and prioritizing hazardous locations in a given area, and to provide guidelines for establishing the most cost-effective remedial measures for a specific site.

Although a much more simplified approach towards the identification of hazardous locations, and step-by-step procedures regarding the investigation of such sites as well as determining the benefit/cost ratios of possible improvements were given in this manual, much of the information contained was very useful.

To assist the user, a list of collision patterns, their probable causes and general countermeasures were given. Furthermore, the improvement recommended for various type of collisions are described and an estimate of the degree to which these improvements could reduce collisions. Also included are updated collision costs and unit costs of road locations (Opperman, RA, Mar-91)

### 2.3.9. Speed control at road works.

Existing and alternative methods of setting speed limits and controlling speed at roadwork sites, used by road authorities, contractors and consultants locally and overseas, were also used as a preventive mechanism towards road accidents.(De Beer, EJH, Jul-90).

## 2.4. The new approach, views and ideas in solving the problem

There is a need to integrate the social, economic and cultural aspects with legal frameworks and policies, since this issue of road carnages has greatly become the slaughter and kiln for human lives. Having been a persisting problem for the last decades, there is need for extra effort in finding out programmes and projects to be implemented in order to burry these irritating and annoying occurrences deep into unexculvable graves.

Basing on a new approach, this proposed project has in it various ideas which upon implementation, will curb this.

These ideas s are based on; *Development perspective,*

### 2.4.1. Development perspective.

Kibarani hot spot is located between Changamwe round-about and Makupa police station, Mombasa County .It is the most busiest traffic lane within Mombasa county since it is the entrance of all types of vehicles (passenger vehicles, goods transportation vehicles, personal cars, as well as heavy and light trucks) to Mombasa town ,as well as the main exit from Mombasa town connecting to the Main Mombasa-Nairobi Highway.

Due to the increased levels of road accidents in this area, this proposed project focuses to having a super-lane of class A-road constructed, like in the case of Thika super-highway, inclusive of over passes, so as to ensure that all vehicles entering the Mombasa town, they take the upper lane after reaching the Changamwe round about. At the same time, all vehicles

moving from Mombasa town, at Makupa point, they can take the lower lane up to a place past round about, then connect to the Main Mombasa-Nairobi highway.

Over-head passes must be inclusive to enable pedestrians cross the busy superhighway at ease without abstracting with the over-speeding vehicles, since each vehicle takes its own sub-lane according to its speed.

Also ,in the so developed super-highway, road culverts must be well defined and constructed to a point of making the road not only beautiful, but also portraying a significance of a modern class road.

Modern technology must be employed as well as use of skilled and qualified labor in order to bring the super-Highway to perfection of the best design that will favor the stakeholders, and be used profitably aiming at sustainable development, putting into consideration the social, economic and cultural aspects.

#### 2.4.2. Illustration of the proposed kibarani super highway model.



***Plate.2.0.The model illustration of the proposed Changamwe round-about connecting to the kibarani Hot Spot.***



*Plate 2.1. Showing the illustration of the proposed Kibarani hot spot development plan, with overpass and underpass to minimize traffic jams.*



*Plate .2.2. swowing the proposed pedestrian overpasses to avoid confusion crossing the road.*

## CHAPTER 3: AREA OF STUDY.

### 3.1. Introduction.

Kibarani hot spot is an area located between Changamwe round-about and Makupa police station, within the Mombasa municipality .It is the most busiest traffic lane in Mombasa county since it is the entrance of all types of vehicles (passenger vehicles, goods transportation vehicles, personal cars, as well as heavy and light trucks) to Mombasa town, as well as the main exit from Mombasa town connecting to the Main Mombasa-Nairobi Highway.



*Fig 3.0. Showing the location of the Kibarani hot spot.*

### 3.2. Physical setup

The county, within which Kibarani hot spot is located, lies between the latitudes 3°56' and 4°10' south of the equator and longitudes 39°34' and 39°46' East. Its capital and the only city in the county of Mombasa, though initially it was one of the former districts of Kenya, but reconstituted as a county in 2013, on the same boundaries. It is the smallest county of Kenya covering an average area of 229.7KM<sup>2</sup>, excluding 65KM<sup>2</sup> of water mass. The county is situated in the South Eastern part of the former coast province. It borders Kilifi county to the North, Kwale county to the Southwest and Indian ocean to the East.

Currently, the county is divided into four divisions- namely Mombasa island, Changmwe division, Likoni division and Kisauni division, eighteen locations and thirty sub-locations.

The county lies within the coastal lowlands, which rises gradually from the sea level in the east to slightly over 76M above sea level in the mainland west. The highest point is at Nguu Tatu hills in the mainland North , that raises up to 100M above sea level.

The coastline feature is between 4-6 km wide and lies between sea level and about 45 metres above sea level. This plain consists of extensive flat terrain dominated by a series of raised beach terraces underlain mainly by Coral limestone and back reef sand deposits. The Coral lime and sand deposits are well drained. Other physiographic features include the sea, the fringing coral reef and sand beaches. These features are as a result of interaction between the existing geological conditions and natural processes such as sea level changes, erosion and deposition. The shoreline with extensive sandy beaches forms one of the main attractions for the development of the tourism industry. The fringing coral reef in the Coast of Mombasa is an important marine conservation .

### **3.3. Climatic conditions**

Mombasa being a coastal town has a warm tropical climate, in addition to this, famed for being one of the top tourist destinations in Kenya, Mombasa is characterized by a distinctive hot and humid climate it is hot for the better part of the year, despite the heavy downpours between April and May and occasional showers towards the end of the year.

Local weather here is influenced by monsoon winds. Annual rainfall varies between 1015-1270mm, with a mean of 1040mm. Rainfall pattern is characterized by two distinct long and short seasons corresponding to changes in the monsoon winds. The long rains occur in March-July and average 655mm with a peak of 330mm in May

In general, the coastal general records highs of 88°F and lows of 80°F, representing a small range, this explains why the most of Kenya is hot for most parts of the year. The amount of rainfall depends on the season, the rainiest months are April and May, while in January to February, the rainfall is minimal.

### **3.4. Geology and geomorphology.**

The Kenya Coast environments are set in a passive continental margin, the evolution of which was initiated by the break-up of the mega Gondwanaland in the Lower Mesozoic. The Coastal Plain is the lowest of the three physiographic zones observed on the Kenya Coast rising from sea level to 140 meters. On average, this belt is narrowest at the southern coast.

Due to its evolutionary nature, the principal rocks observed along the Coastal margin are of sedimentary origin. Along the coastal plain the Quaternary representatives include windblown Magarini Sands, Limestone cemented sands and coral sands while recent unconsolidated windblown sands, beach sands and clays overlie the older rock formation.

### **3.5. Soils.**

The porous parent rocks of sedimentary origin, generally give rise to soils of low fertility. However patches of highly productive soils have been observed in areas of alluvial deposits. The principal soil types in the location include a narrow strip of Coastal sands interspersed by narrow bands of grum soils and clay soils.

### **3.6. Hydrology**

The Coastal region has enormous potential in terms of groundwater resources as a result of its geological structure, which promotes rapid infiltration and percolation of surface runoff to recharge. Highest water yields are experienced in areas along the coast and Kilindini sands on the Coastal belt. This includes Diani and Tiwi areas

### **3.7. Social-economic setup.**

The main socio-economic activities in Mombasa county revolves around the tourism trade. These include hotels, restaurants, curio and curving shops. There are a number of 3-5 star hotels in Mombasa island, which include-Severin Sea Lodge in Shanzu, New Plam Tree Hotel in Ganjoni, Serena Beach Hotel & SPA in Shanzu, Chamiachi Luary Apartments in Kongowea, Tijara Beach Hotel ,Pride Inn Villas in Nyali and Haille sallasie Avenue among others. In place are also rental cottages. Local people are engaged in tourism related activities including sale of curving and crafts, shells; restaurants and operating small shops.

### 3.8. Population

The population of Mombasa county is as follows:

Constituency name	Population as at 2009 census.	Area covered in KM <sup>2</sup>	Wards
Changamwe	147,613	16	Port reiz,kipevu.airport.changamwe,chaani
Jomvu	102,566	29	Jomvu kuu,mikindani,miritini
Kisauni	194065	88.7	Mjambere,junda,bamburi,mwakirunge,mtopanga,magogoni,shanzu.
Nyali	185990	22.88	Frère town, ziwa la ngombe, mkomani, kongowea, kadzandani
Likoni	166008	41.10	Mtongwe, shika adabu, bofu, likoni, timbwani
Mvita	143128	14.80	Mji wa kale/makadara, tudor, tononoka, majengo ganjoni/shimanzi
Totals.	939370	212.48	

## CHAPTER 4: STUDY DESIGN AND METHODOLOGY.

### 4.1. Introduction.

Study design refers to the arrangement of conditions for the collection and analyzation of data, targeting the combination of relevance to research purpose with the economy of procedures.(Claire at el 1962).

While methodology refers to the process, procedure and principles by which approaches are made to problems seeking solutions. This research is aimed at finding out, discussing and estimating the various causes and the extend of road accidents along Kibarani hot spot, methods of data collection and analysis, sampling procedures as well as various data sources .

### 4.2. Research design.

This research study will be based on both descriptive and explanatory designs. Descriptive design aims at giving more details on description of the various road accidents causatives. Describing the problem at a wider perspective is the only sure way of coming up with an appropriate solution. Also, Explanatory design will be employed since it will help in;

- Giving more information as to why many accidents occur here along Kibarani area,
- The reason as to why the current condition of Kibarani road is the way it is,
- Analyzing the collected data from stakeholders thus gearing towards fulfillment of achieving te objectives of the study.

### 4.3. Nature and sources of data.

In order to come up with appropriate planning mechanisms and a models solving problem for preventing road accidents along Kibarani hot spot, putting into consideration the importance of sustainable development in attaining the vision 2030 goals, there are two types of data to be collected;

- Primary sources of data, which will give the first-hand information and
- The secondary data sources, giving a more detailed second hand information from documentation of the physical infrastructural plan of Mombasa County.

#### **4.3.1. Primary and secondary data sources.**

Basing on this research, primary sources of data will involve direct observation and recording(traffic monitoring),discussions with stakeholders and the local residents to get the first hand information about the main causes of these road accidents here, interviews, note taking when having a conversation with either a driver or a pedestrian, as well as filling into questionnaires.

The secondary source of data includes of the published and unpublished information about the status of the road transportation system worldwide, regional and local levels. Basing on this study, the secondary data sources will be from The Mombasa county status reports. Others will be obtained from the Kenya roads and Traffic policy, National and District Development Plans, Aerial photographs as well as satellite maps.

#### **4.4. Sampling limits and size.**

In order to get the best and up to date information, the key sampling limits will be the stakeholders, residents and the households around the Kibarani hot spot. This will be guided basically on the information obtained from the chief's office. Here, the information gathered will be based on the classification of the stakeholders and residents according to either whether a pedestrian, a driver or just a daily worker around the area.

In regard to this, a total of ten (10) households around the study area are to be interviewed. This is so because Kibarani hotspot is of just a distance walk region hence small since response will give vividly a detailed and concrete information.

The number of sampling size is small since the area is sparsely populated with countable households hence not possible to get a large number of individuals to interview.

#### **4.5. Methods of collecting data.**

In this study, methods of data collection will include observation and recording, filling in questionnaires, interviewing and taking photographs of the area. The information gathered here will be used in achieving of the so stated objectives in the first chapter of this research study.

#### **4.5.1. Observation and recording.**

Most of the information gathered using this method is usually for true and direct, though it may have some few errors such as numerical, repetitions or climatic interruptions such as rainfall. The current status of the road, whether in good or bad condition, traffic jams, availability of road signs and the actual size of the road (putting into consideration the regulations of road-buffer as stated in the Physical Planning Act), are the key issues.

#### **4.5.2 Filling in questionnaires**

A questionnaire is an information gathering tool used to collect a wide range of information from either an individual or an organization. Here, questionnaires will be distributed all around within various sub-locations around the Kibarani hot spot, to gather some information, to enable the identification and concerns of issues that are contributing to the acceleration of road accidents along Kibarani hotspot.

#### **4.5.3 Interviewing**

Targeted people here to be interviewed are the pedestrians, drivers and any workers along or on this section of the Kibarani hot spot. Questions being asked here are almost the same like the one in questionnaires, only that the information will be presented in form of notes.

#### **4.5.4. Taking photographs.**

Photographs actually act as evidence that actually the area was visited. Photographs taken here are for the road at Kibarani section and round-about, the buffer-road, vehicles, the available road signs as well as the neighboring. Tools used here will include digital cameras and android phones.

## CHAPTER 5

### DATA ANALYSYS AND DISCUSSION

Data analysis refers to the process of modeling, synthesizing, cleaning and transforming data from the original sources collected in the field to form useful and reliable information that aid in the support of the process of decision making.

In this project, the main instruments used to collect data as stated in the chapter of literature review include;

- Questionnaires (For gathering verbal information)
- Cameras and
- Android phones (for taking photographs of the study area).

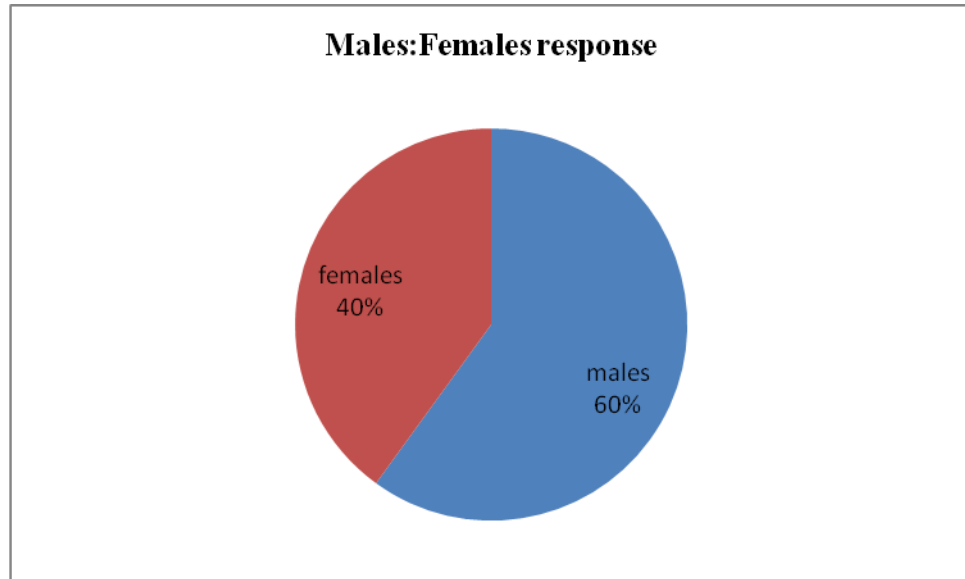
Hence this data is analyzed as follows;-

#### 5.1. Gender ratio response and its relationship to the problem

Due to the topographic nature of the area and the availability of the local residents, the number of interviewed homesteads were ten, with males showing the highest number of respondents.

<b>GENDER</b>	<b>NUMBER</b>	<b>PERCENTAGE</b>
<b>Males</b>	6	60%
<b>Females</b>	4	40%
<b>TOTAL</b>	<b>10</b>	<b>100%</b>

This information can also be represented inform of a pie chart,

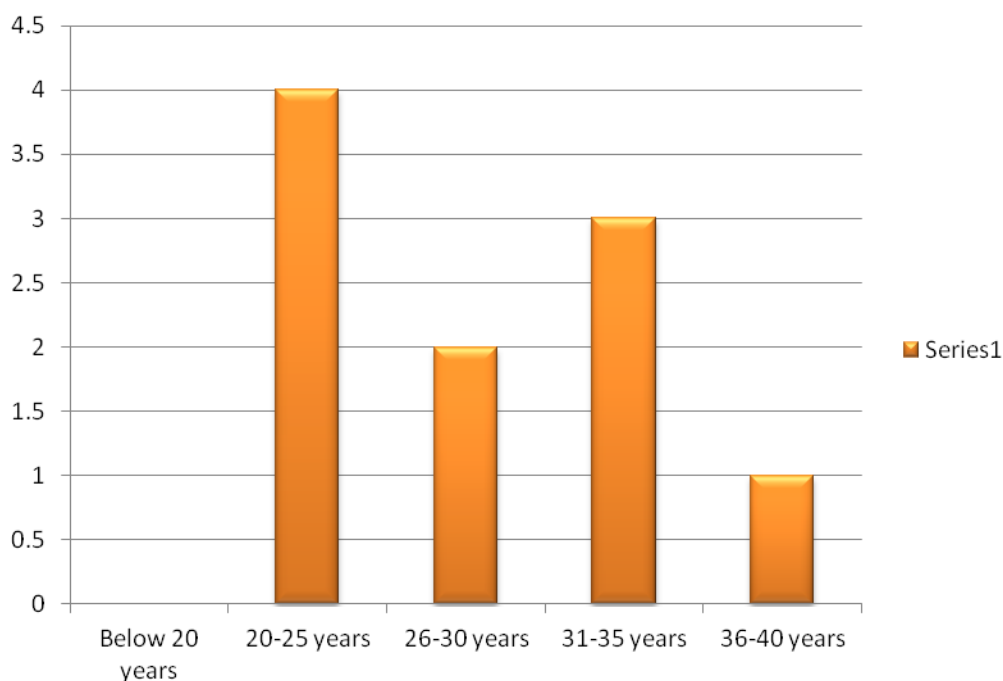


This interpretation clearly shows that men have access to a lot of information and like participating on issues within their locality (road accidents), thus part of problem solving.

**5.2. Age group response and its relationship to the problem**

Also, the interviewer focused on a middle-range age group response, ie. Getting the information from literate and intelligent people,(not too young/too old),meaning this information is valid and can be relied on for problem solving of road accidents at Kibarani hotspot.

Age groups	Below 20 years	20-25 years	26-30 years	31-35 years	36-40 years
No. of respondents.	0	4	2	3	1



### 5.3 Time-span stay of respondents and relationship to the problem

Data collected on the type of the land these respondents have lived in and also the duration of stay also have given the baseline information on the persistence of road accidents at Kibarani hotspot.

Most of people have been experiencing this problem since they were born and to make it worse, they have grown up witnessing their relatives and also their beloved ones lose their lives in this hotspot area.

Type of land	No. of respondents
Private Land	6
Trust Land	0
Government Land	4
Other	0

<b>Type of land</b>	<b>Duration of stay in years.</b>
<b>Private land</b>	21
	24
	15
	10
	24
	20
<b>Government Land</b>	17
	14
	20

According to the above table, it is clearly indicated that most respondents live in their homes/privately owned lands along the Kibarani hotspot, showing this problem of road carnages here have persisted over a long period of time, over many decades hence there is a need for finding a solution as soon as possible.

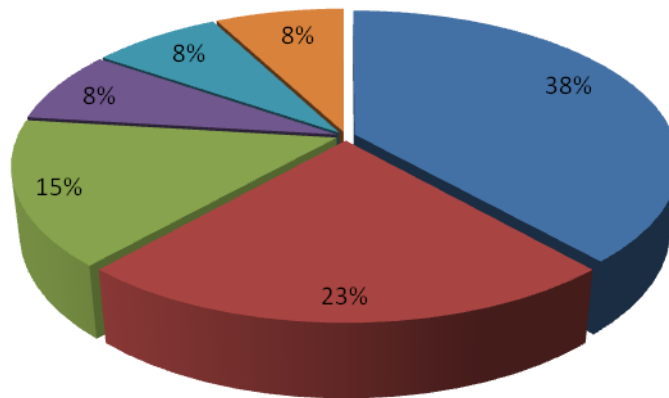
#### **5.4. Transportation mode used by most respondents and its relationship to the problem.**

Here, most respondents rely on various transportation modes across the Kibarani hotspot at different times of the day. A respondent may opt to use more than one mode depending on its availability and the most commonly one is evidenced to be main contributor to these alarming number of accidents day by day, due to its high demand. These modes are stated here in the table below;-

<b>Transport mode</b>	<b>No. of respondents.</b>	<b>Percentage.</b>
Matatus	5	38%
Tuktuks	3	23%
Bicycles	2	15%
Personal cars	1	8%
Motor-bikes	1	8%
Not specified	1	8%
<b>Totals</b>	<b>13</b>	<b>100%</b>

This information can be represented on a pie chart as follows to visually show the largest contributor mode to the problem.

■ Matatus ■ Tuktuks ■ Bicycles ■ Personal cars ■ Motor-bikes ■ Not specified

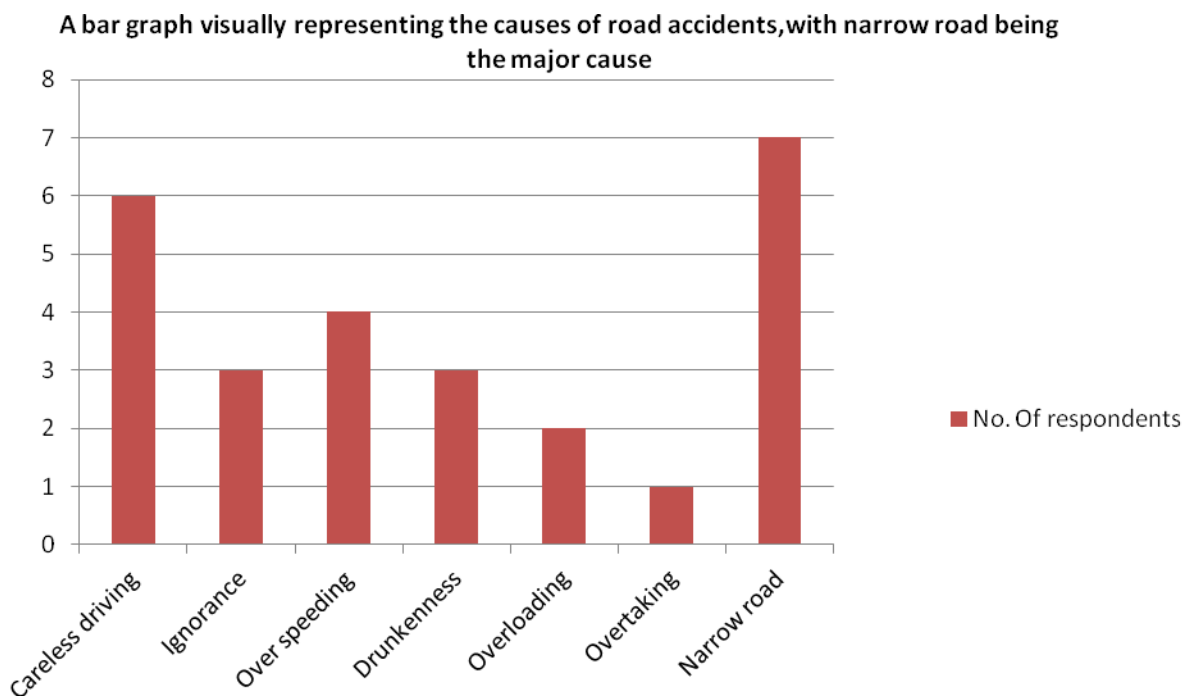


**5.5. Information on the main causes of the road accidents**

Interviewed stakeholders gave the following assumptions as the main causes of road accidents along the Kibarani hotspot. More than one cause was allowed due to the curiosity from the respondents.

Cause	No. Of respondents
Careless driving	6
Ignorance	3
Over speeding	4
Drunkenness	3
Overloading	2
Overtaking	1
Narrow road	7

Also, this information can be represented inform of a bar graph as follows;-



Also, photos taken of the study area are used to evidently show and support the mentioned above state of the Kibarani road hotspot, such as vehicles overtaking anyhowly,narrow road as

well as ignorance where vehicles turn any howly across the road where there is no even turning point.



***Plate 5.0. showing a Matatu overtaking a lorry along the Kibarani hotspot***



***Plate 5.1. showing lorries overtaking any howly across the Kibarani hot spot, thus resulting to severe accidents***



***Plate 5.2. Showing how this road is so narrow hence this is one of the main contributors to the so persistently alarming problem across this area.***



***Plate 5.3. Showing two Matatus overspeedingly overtaking along this hotspot.***

### **5.6. Road design and its relationship to the problem**

According to the questionnaire respondents, the road design used to construct Kibarani area is so poor and that has been the cause of so many road accidents along this place.

This is evidenced pictorially below;



*Plate 5.4*



*plate 5.5.*

***Plates 5.4 and 5.5 showing how the road along the Kibarani hotspot is too narrow to be a class A-road, thus this is a poor road design used which is the major contributor to accidents along this area.***

Again , according to the data collected ,this road has no zebra for pedestrians nor overpasses, hence people just cross at any point and so over speeding vehicles just roll on them. So many cases are been reported daily of people losing their lives through this.



*Plate 5.6*



*plate 5.7*

***Plates 5.6 and 5.7, showing pedestrians just crossing the road where there are no zebra-crossing hence risking their lives.***

Furthermore, this road has no pedestrian walks/cyclists/Mikokoteni pushers and this poses very big risk to the local residents towards accidents along this place.



**Plate 5.8: Showing a cyclist along the Kibarani hot spot but there is no even the cyclist path, hence he can lose control and get into the vehicles lane.**



**Plate 5.9: Showing a Mkokoteni pusher along the Kibarani hot spot even pushing it against the vehicles direction, where's his chances of meeting an over speeding vehicles is too high thus causing a severe accident.**

**5.7 policy and legal framework**

According to the physical planning Act cap 286 of 1996, it is stipulated that, a physical planner needs to ensure that the best hierarchy of the road is provided for always even when he is planning for the neighborhood and settlement, since reduction of the intersections of feeder roads to the main aims at reducing the risk of accidents.

Here, road is classified into five categories, which are;-

<b>class</b>	<b>Reserve (buffer in Meters)</b>
A (International roads)	60
B (National roads)	40-60
C (primary roads)	25-30
D (secondary roads)	20
E (Minor roads)	18

Basing on this, Kibarani road is national road but according to its physical appearance, it does not reflect the standards of class B roads. There are a lot of commercial and business encroachments close to the road itself, consuming the buffer to even less than that one of a minor road.

Again, there are very few road signs making most drivers so ignorant on them if not at all along its way among others, hence this has resulted to so many accidents reported almost daily.



**Plate 5.10**



**Plate 5.11**

*Plate 5.10 and 5.11: showing the road buffer encroachment along the kibarani hotspot. This clearly indicating that the Physical Act regulations were not fully considered during the construction of this road*

There is need for the Kibarani road to be expanded and developed and in order to be useful to the local residents and communities socially, economically and Minimizing the road accidents ,the following must be put into total consideration as per the Physical Planning Act, cap 286 of 1996:-

- ✓ To conduct of feasibility and engineering studies of the highway, alignment and structure of the road shall be carefully studied to minimize negative effects on the natural environment.
- ✓ Upon completion of construction prompt action should be taken to protect the exposed ground by tree planting and other protection measures.
- ✓ Appropriate land use planning for adjacent land to be carried out carefully.
- ✓ Provide for boulevards along the transport corridor at 10km from the boundary of urban centers by planting trees on the clear zones and shrubs where visibility may be interfered with.
- ✓ Beautify the entire road systems by allowing compatible users such as flower selling business.

- ✓ Integrate transportation with recreation by providing bicycles paths and outdoor resting places.

## CHAPTER 6. CONCLUSION AND RECOMMENDATION

### 6.1 CONCLUSION

A concrete decision on this project implementation can only be taken by the Mombasa county Government in relation to the other priorities, both in the transport sector and other sectors. The function of this study has been to establish the necessary factual basis on which further discussions and plans can be based.

In order for the best implementation on the ground, the county urges the so concerned sectors to establish a partnership between the private and public participants so as to ease the process of decision making before it gets too late to act on the same.

In addition to this, the county government should allow for democratic, multi-sectoral and full stakeholders participation since there is need for both personal, organizational and constitutional engagement to add for more views and ideas so as to enable see this dream a success, for the people to be proud of the Mombasa county that we want.

## 6.2 RECOMMENDATION

The one main and broad objective of this study was to come up with strategies that can be useful and can be imposed in order to prevent/curb road carnages along the Kibarani hotspot upon their implementation. In the above chapter of data analysis and discussions, various factors have been discussed at length and then it has shown that it is possible to prevent these fatal accidents along Kibarani road and make the local communities, residents, Mombasa County and the whole country joyful.

Economic evaluation has clearly shown that if this section of the road is reconstructed again(expansion),putting into consideration the policies, regulations and the legal legislations as stipulated in the Physical Planning handbook ,then it would not only curb the road accidents along this area, but also the highway would generate sufficient economic benefits to justify its construction.

Also, the another role of the highway will provide focus for new other developments within the Mombasa county, such as ocean waters management, conservation of aquatic life, strong environmental conservation and pave for light on capacity building on poverty alleviation, education and health, as well as women empowerment, sustainable resource use and reduction of coastal resources and land conflicts, and this will set as a basis for other counties within our nation, where such problems have persisted over a long period of time.

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**Appendix.**

**KENYATTA UNIVERSITY  
SCHOOL OF ENVIROMENTAL STUDIES  
DEPARTMENT OF ENVIRONMENTAL PLANNING AND MANAGEMENT**

**HOUSEHOLD QUESTIONARE**

I am Abed' Kiumba, a fourth year student at Kenyatta University, Main campus Nairobi, taking a Bachelor's Degree in Environmental Planning and Management, School of Environmental Studies. I am undertaking a research study entitled "STRATEGIES FOR THE PREVENTION OF ROAD CARNAGES ALONG KIBARANI HOT SPOT, CHANGAMWE LOCATION, MOMBASA COUNTY-KENYA" ,and I would request for your little assistance in gathering the required information for the completion of this study. The information gathered here is purely for academic purposes and confidentiality is highly guaranteed. Highly appreciated is your kind support.

**BASIC INFORMATION**

Name \_\_\_\_\_ of \_\_\_\_\_ the  
Stakeholder.....

Date of birth..... Gender .....

Residential  
area.....

1. What kind of land do you reside on?

Type	Duration of Stay
Private <input type="checkbox"/> Yes <input type="checkbox"/> No	
Trust land <input type="checkbox"/> Yes <input type="checkbox"/> No	
Government land <input type="checkbox"/> Yes <input type="checkbox"/> No	
Other (specify)	

2. What is the most commonly mode of transport do you use across Kibarani area? And how efficient is it?, please indicate.

Transport mode	availability	efficiency

3. Do you encounter any difficulties when using this transportation mode? Yes No.

If YES, please specify.

Difficulty	Time of the day	How you overcome it.
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.....	.....	.....
.....	.....	.....
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4. What information do you have about road accidents in Changamwe location, specifically Kibarani area?

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5. According to your own view, what are the main causes of road accidents along Kibarani area?

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6. What do you think on current status and size of the road along Kibarani area that may be resulting to these accidents?

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7. What do you think of the road design used in the construction of Kibarani road?

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8. As a resident of Changamwe location and a frequent user of Kibarani road, what measures do you think that can be put in place curb these road accidents?

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9. Your general comments.

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