

**CAUSES OF COLLAPSE OF BUILDINGS IN MOMBASA  
COUNTY A CASE OF MOMBASA ISLAND-KENYA**

UNIVERSITY OF NAIROBI  
IKKUTU LIBRARY  
P. O. Box 30197  
NAIROBI

BY

**OBUYA VINCENT MACHUKI**

**A RESEARCH PROJECT REPORT SUBMITTED IN PARTIAL  
FULFILMENT OF THE REQUIREMENTS FOR THE AWARD  
OF THE DEGREE OF MASTER OF ARTS IN PROJECT**

**PLANNING AND MANAGEMENT OF THE**

**UNIVERSITY OF NAIROBI**

**2012**

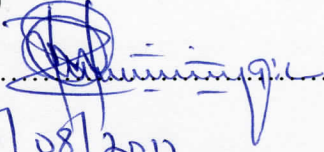
**DECLARATION**

*This report is dedicated to my dear parents Mr. and Mrs. Obuya for their constant support*

I hereby declare that this research project report is my original work and has not been presented for academic purposes in any institution.

**VINCENT M. OBUYA**

**L50/66037/2010**

SIGNATURE..........

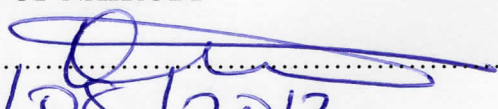
DATE .....10/08/2012.....

This research project report has been submitted for examination with My approval as the University of Nairobi supervisor.

**DR. MOSES OTIENO**

**LECTURE, DEPARTMENT**

**UNIVERSITY OF NAIROBI**

SIGNATURE..........

DATE.....10/08/2012.....

## ACKNOWLEDGMENT

### **DEDICATION**

I wish to thank my supervisor Dr. M. for his available and insightful guidance throughout this project.

This project report is dedicated to my dear parents Mr. and Mrs. Obuya for their constant support during my studies.

My other sincere thanks go to my colleagues at work and classmates at the University of Nairobi for their Moral Support.

Above all, I give thanks to the Almighty God for showing me the way of blessing throughout this project.

## AKNOWLEDGMENT

I wish to thank my supervisor Dr. Moses M Otieno for his invaluable and insightful guidance throughout this project.

Special thanks go to dear family members for their unwavering support, patience, sacrifice, understanding and faith in me as I was doing this project.

My other sincere thanks go to my colleagues at work and classmates at the University of Nairobi for their Moral Support.

Above all, I give thanks to the Almighty Lord for showering me with lots of blessings throughout this project

## CHAPTER ONE: INTRODUCTION

1.1 Background to the study	1
1.2 Statement of the problem	3
1.3 Purpose of the study	4
1.4 Objective of the study	4
1.5 Research questions	4
1.6 Basic assumptions of the study	4
1.7 Significance of the study	4
1.8 Limitations of the study	4
1.9 Delineations of the study	4
1.10 Definitions of significant terms	7

## CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction	9
2.2 Background to building construction	9
2.3 Building Specialists	12
2.4 Construction Procedures	14
2.5 Building Materials	14
2.6 Local Government and Municipality	15

## TABLE OF CONTENTS

	Page
DECLARATION.....	i
DEDICATION.....	ii
ACKNOWLEDGEMENT.....	iii
TABLES OF CONTENT.....	iv
LIST OF TABLES.....	v
LIST OF FIGURES.....	vi
ABBREVIATIONS AND ACRONYMS.....	vii
ABSTRSCT .....	xi
<b>CHAPTER ONE: INTRODUCTION</b>	
1.1 Background to the study.....	1
1.2 Statement of the problem.....	3
1.3 Purpose of the study.....	4
1.4 Objective of the study.....	4
1.5 Research questions.....	4
1.6 Basic assumptions of the study.....	5
1.7 Significance of the study.....	5
1.8 Limitations of the study.....	6
1.9 Delimitations of the study.....	6
1.10 Definitions of significant terms.....	7
<b>CHAPTER TWO: LITERATURE REVIEW</b>	
2.1 Introduction.....	9
2.2 Background to building construction.....	9
2.3 Building Specialists.....	12
2.4 Construction Procedures.....	14
2.5 Building Materials.....	14
2.6 Local Government and Municipality.....	15

### **CHAPTER THREE: RESEARCH METHODOLOGY**

3.1 Introduction.....	19
3.2 Research Design.....	19
3.3 Target Population and Sample Size.....	19
3.4 Sampling Size and Sampling Techniques.....	20
3.5 Data Collection Methods.....	20
3.6 Validity and Reliability of Data Collection Methods.....	20
3.6.1 Validity of Data Collection Instruments.....	20
3.6.2 Reliability of Data Collection Instruments.....	20
3.7 Methods of Data Analysis and Presentation.....	21
3.8 operational Definition of Variables .....	22

### **CHAPTER FOUR: DATA PRESENTATION, ANALYSIS AND INTERPRETATION**

4.1 Introduction .....	23
4.2 Response rate.....	23
4.3 Demographic characteristics of respondents.....	23
4.3.1 Response by department.....	23
4.3.2 Age of respondent.....	24
4.3.3 Occupation of respondents.....	25
4.4 Building Materials and how they contribute to collapse of buildings .....	25
4.5 Testing of hypothesis on building materials.....	27
4.6 Regression analysis of materials.....	27
4.7 Local Government and how they contribute to collapse of buildings.....	28
4.7 testing of hypothesis.....	29
4.8 Regression analysis on local government.....	29
4.9 Professionals / Experts and how they contribute to collapse of buildings.....	30
4.10 testing hypothesis on building professionals.....	31
4.11 Regression analysis on building professionals.....	31
4.12 Building Procedures and how they contribute to collapse of buildings.....	32
4.13 Testing of hypothesis on building procedure.....	33

4.14 Regression analysis of building procedures.....	34
4.15 Building Developers and the way they contribute to collapse buildings.....	34
4.16 Testing of hypothesis on building developers.....	35
4.17 Regression analysis on building developers.....	35

**CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSSIONS AND RECOMMEDATIONS**

5.1 Introduction.....	37
5.2 Summary of the study finding.....	37
5.3 Discussion of findings.....	37
5.3.1 Building Materials.....	38
5.3.2 Local Government/ Municipality.....	39
5.3.3 Professions/ Experts .....	39
5.3.4 Building Procedures.....	40
5.3.5 Building Developers.....	40
5.4 Conclusion.....	41
5.5 Recommendations.....	42
5.6 Suggestions for further Research .....	43

**LIST OF APPENDICES**

Reference.....	44
Appendix 1: Permission to conduct research.....	47
Appendix 2: Letter of transmittal.....	48
Appendix 3 Respondent Questionnaire.....	49

## LIST OF TABLES

Table 3.1: Population and Sample Distribution .....	20
Table 3.2: Operational definition.....	22
Table 4.1: Responses by departments.....	24
Table 4.2: Age of respondents.....	24
Table 4.3: Occupation of respondents.....	25
Table 4.4: How materials contribute to the collapse of buildings.....	26
Table 4.5: Hypothesis analysis on building materials.....	27
Table 4.6: Regression analysis on building materials.....	28
Table 4.7: How local government contribute to collapse of buildings.....	28
Table 4.8: Hypothesis analysis on local government.....	29
Table 4.9: Regression analysis on local government .....	30
Table 4.10: How professionals contribute to collapse of buildings.....	30
Table 4.11: Hypothesis analysis on collapse of buildings.....	31
Table 4.12: Regression analysis of collapse of buildings.....	32
Table 4.13: How building procedures contribute to the collapse of buildings.....	32
Table 4.14: Hypothesis analysis on building procedures.....	33
Table 4.15: Regression analysis of building procedure.....	34
Table 4.16: How building developers contribute to collapse of buildings.....	34
Table 4.17: Hypothesis analysis on building developers.....	35
Table 4.18 Regression analysis on building developers.....	36



## ABBREVIATIONS

## LIST OF FIGURES

## SYMBOLS

Figure 2.1: Conceptual Framework

- 1 National Construction Code
- 2 Ministry of Works
- 3 Load carrying capacity
- 4 Certificate of Occupancy
- 5 Time and Material Formula
- 6 Architectural Association of Kenya
- 7 Health Safety and Environment Education
- 8 Heating, Ventilation and Air Conditioning
- 9 Provincial Works Officer

## ABBREVIATIONS AND ACRONYMS

- IBEAC – Imperial British East Africa Company  
NCC – National Construction Corporation  
M o W - Ministry of Works  
LCC - Load carrying capacity  
CO - Certificate of Occupancy  
TMF - Time and Material Formula  
AAK - Architectural Association of Kenya  
HSEE - Health Safety and Environment Education  
HVAC - Heating, Ventilation and Air Conditioning  
PWO - Provincial Works Officer

## ABSTRACT

Building collapsing essentially refers to the structural failure of a building or failure to transmit both imposed and non-imposed loading to the ground evenly without any problem. This can also mean the inability of the ground to carry or resist the loadings from the building where the loadings surpass the allowable loading of the ground causing uneven settlement of the building. This study is aimed at establishing the causes that lead to building failure or collapsing that usually leads to loss of lives and enormous investments. The study is carried out in Mombasa Island as guided by the following five specific objectives, to determine the kind of materials used in construction that lead to collapse of building, to determine the construction processes used that lead to collapse of buildings, to determine the role played by the municipal council that lead to collapse of building, to establish the role played by building developers that lead to collapse of building. The literature review showed how building failures happened, in other words, it showed the courses of building failure and how they were avoided, it also looked at the importance of quality control in construction industry. It also looked at the effects of the building failure to the economic growth of our country. The research design that was used was in such a way that, simple random sampling was applied in each of the specialized building group and people in construction industry in Mombasa city. The sample which runs in thousands, the sample size was in the range of 5% to 20%, but for a population that is in hundreds the sample size was 50%. The size of the target population was 120 people. To ensure data validity and reliability, the researcher conducted a pre-test of the data collection instrument among the individuals that work in the construction industry about the courses of collapse of building with the aim of ensuring that, the questions were well understood by all the respondents. Likewise, simple random sampling in each of the construction team member plus the developers was conducted to ensure that, each respondent had an equal opportunity to be included in the study. The study established that materials used in construction, professionals who were engaged in the building industry, the building procedure, the developers and the municipal council in Mombasa Island contributes immensely towards the collapse of buildings in Mombasa County. The study therefore recommends that all materials to be tested before being used for construction by an authorized body, the government to train more professionals in the building industry and send them to this Island. The government should formulate laws and regulation on building procedures and defaulters to be penalized for any law breaking. Building developer's to follow all laid down construction regulation and stopped to interfere with the construction process.

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background of the Study

The history of construction is a complex subject encompassing the history of building materials, the history of engineering, the history of building techniques, economic and social history of builders and workmen, the history of construction machinery and temporary works, etc. Each of these has a complex literature devoted to it. The first buildings were simple huts, tents and shelters meant to suit the basic needs of protection from the elements, built by their inhabitant. The very simplest shelters, tents, leave no traces. Because of this, what little we can say about very early construction is mostly conjecture and based on what we know about the way nomadic hunter-gatherers and herdsmen in remote areas build shelters today. (Bo Johansson, 1993)

The absence of metal tools placed limitations on the materials that could be worked, but it was still possible to build quite elaborate stone structures with ingenuity using dry-stone-walling techniques. The first mud bricks, formed with the hands rather than wooden moulds, belong to the late Neolithic period and were found in Jericho. One of the largest structures of this period was the Neolithic long house. In all cases of timber structures in these very early cultures, only the very lowest parts of the walls and post-holes are unearthed in archaeological excavations, making reconstruction of the upper parts of these buildings purely conjectural. (Alfredo, 2004)

In Kenya for example, building construction history can be dated back from the mid-1800s to the 1960s. Kenya was a British protectorate from 1895 to 1920 and a colony from 1920 to 1963. During this period building construction in different communities was done as per the tradition of that community. The shape of the building and the materials used in the construction basically depended on the geographical location of that community and the environment of that area. Some of the traditional building designs exist up to date. People like the Maasai community have been able to keep their building design culture to date. Since Kenya was a British protectorate from 1895 to 1920 and a colony from 1920 to 1963. The Imperial British East Africa Company (IBEAC) was the administrator of Kenya and was given a Royal Charter to exploit Kenya commercially. This factor gave the westerners the opportunity to come to Kenya and with them came development which forced most of the indigenous communities to abandon their building designs in favor of the western designs. IBEAC facilitated the construction of a railway

connecting the east coast region of Mombasa to Lake Victoria. The company employed James Macdonald assisted by John Wallace Pringle, both officers in the Royal Engineers, to undertake the survey in 1891-1892 this led to the construction of the Kenya-Uganda railway. Nairobi was founded in 1899. It grew up around a railway line constructed by the British colonial officials from Mombasa on the Indian Ocean coast to Uganda. Records indicated that by 1967, 200 Africa-owned contracting firms were registered. Some were briefcase companies while others offered labour-only contracts to Ministry of Works, projects in gravel roads. These firms faced disadvantages such as:

1. Little experience as far as site organization is concerned
2. Inadequate knowledge of managerial, commercial or administrative matters
3. Lack of knowledge on matters of tendering for construction contracts
4. Inadequate plant and equipment
5. Inadequate/lack of capital
6. The Asian suppliers were not sympathetic of African entry into the industry and were unwilling to afford the Africans credit (Anita, Perspective in housing and planning, 2001)

The Government formed the National Construction Corporation that sought to enable African contractors enter the industry, a very competitive market. Its philosophy was 'learning by doing' whereby the African contractors were to be assisted and trained during the construction process. They were only supposed to meet the following requirements:

1. Obtain the work
2. Obtain the finance required to complete the project

From the above, the functions of NCC were:

1. To help contractors obtain work
2. Provide them with adequate finance
3. Assist them with the actual construction process [By Mr. Barrack Obaga (29, 2, 2012)]

With the advance technology, the introduction of steel bars, cement, composite materials, fabricated materials and the general design brought in the modern buildings with better aesthetics and limitation of lateral space with the use of vertical space for construction purposes, this was brought about by the increased population and scarcity of land in some parts of the country especially the urban areas that lead to rural – (Adams, 2001) (Anita) (Baris, 2001) (Baris, 2001) (Adams, 2001) (Anita, Perspecky) urban migration to cities like Nairobi and Mombasa.

With the increased need of buildings for accommodation, construction procedures have been overlooked since they are perceived to be delaying the construction process, the use of quacks for construction, corruption and poor quality materials became the order of the day. These factors contributed dearly to collapse of buildings evident in our major cities which have contributed in a big way towards the loose of lives, and live investments.

## **1.2 Statement of the Study**

The building construction industry is considered an important aspect in any country, particularly due to the growing population and focus of the public towards the infrastructure development. With this, government, local authorities and the communities are focusing on better ways of building construction in order to improve the quality of life of the people and the quality of buildings that are coming up to avoid loss of live-time investments and loose of lives of the people. The collapse of buildings in Kenya has been on the rise killing many people. For example a building was ordered to be demolished on 8<sup>th</sup> November 2011 when it nearly collapsed in Mombasa. Secondly, several people were feared to have died after a four storey building under construction came tumbling down at Spaki in Mombasa on Thursday 9th April 2009. Moreover, in Nairobi several cases have been reported like the infamous kahonge building in river road which collapsed on 26<sup>th</sup> January 2006, another one in kiambu in October 2009, in July 2011 in pipeline estate in Nairobi's embakasi a 6 storey building was halted and 14 people trapped, June 20<sup>th</sup> 2011, The Langata Building near Carnivore restaurant along the bypass collapsed. All the above cases which have been in increase in the recent past have resulted to the massive loose of lives and investments these has been majorly coursed by several factors that need to be looked in to. The local authorities or municipality need to put more emphasis on the building rules and regulations is just but one of the factors that contribute the collapse of building

in our cities. Therefore this study has tried to establish other factors that needed to be looked into keenly to avoid the building collapse incidents.

### **1.3 Purpose of the Study**

The purpose of the study was to examine the general causes of collapsing of buildings in our cities especially areas around Mombasa county and specifically Mombasa island.

### **1.4 Objectives of the Study**

The broad objective of this study was to examine the factors that have lead to collapse of buildings in our major cities. These objectives include:

1. To assess how building professionals have contributed to collapse of building in Mombasa County.
2. To assess how the procedures followed in construction has contributed to the collapse of building in Mombasa city.
3. To determine how building materials used in construction in Mombasa city have contributed to collapse of buildings.
4. To assess the role that the local government or the Mombasa municipality plays, that contribute to the collapse of buildings within the county.
5. To establish the role building developers play that contribute in the eventual collapse of buildings in Mombasa County.

### **1.5 Research Questions**

The research was guided by the following questions:

1. How do building specialists contribute to the collapse of buildings in Mombasa city?
2. How do building procedures contribute to collapse of buildings in Mombasa city?
3. How do materials used in construction of buildings contributed to collapse of buildings in Mombasa city?
4. What role does the local government play that lead to the collapse of buildings in Mombasa city?
5. How do building developers contribute to the collapse of buildings in Mombasa city?

## **1.6 The Research Hypothesis**

A research hypothesis is the statement created by researchers when they speculate upon the outcomes of a research or experiment. The hypothesis is generated through a number of means, but is usually as the result of a process of inductive reasoning where observations lead to the formation of a theory. Some of the hypothesis in this research report includes;

- i) Building professionals do not contribute to the collapse of buildings in Mombasa County
- ii) Construction procedures are not the cause of the collapse of buildings in Mombasa County.
- iii) Building materials do not contribute to the collapse of buildings in Mombasa County.
- iv) The municipal council do not contributes to the collapse of buildings in Mombasa County.

## **1.6 Basic Assumptions of the Study**

The study was guided by the following assumptions:-

1. That building specialists were not involved in the design and construction process of the collapsed buildings.
2. Corruption cases in the local government contributed immensely to the collapse of buildings in our cities
3. Sub-standard materials are used in the construction of buildings that end up collapsing.

## **1.7 Significance of the Study**

For the different stakeholders in the housing sector, the study on factors that have lead to the collapse of buildings is very important because it will enlighten them on particular aspects that contribute to the collapsing of buildings and hence help them to avoid loses of both lives and investment

For the Government of Kenya, the study will help in identifying the factors that have led to the collapse of building. It will also help the Government in reviewing the building codes and procedures and consequently strengthen the laws regarding construction of building in the country. It will also assist the government to convince international investors that construction in



the country is taken care of with the set laws. It assisted the government to avoid looses in terms of lives and public investments.

The study provided necessary information to building contractors on what they were supposed to do and what they avoided while doing their construction work. This assisted them to avoid shortcut in construction hence reduce deaths related to collapsing of building and also avoid loosing their investment.

The study also assisted building owners to follow the specified construction procedures and involve construction specialists in the construction process from the initial stages to the completion of the project. This helped them to avoid loosing a lot of investments which to some was a lifetime investment.

### **1.8 Limitations of the Study**

The study was faced by the following limitations

1. The accessibility to the respondents especially the high ranked like the provincial works officer and district works officer was a problem since most of the time they were very busy.
2. The researcher identified the key respondents and tried to get their contacts and gave them questionnaires directly or sends to their destination after communicating to them through telephones or e-mail.
3. The researcher organized to travel to the sites where he used other forms or tools of collecting data like the interview method to get the required information.

### **1.9 Delimitation of the Study**

The study focused on the causes of collapse of building in Mombasa County. The research will be conducted within the city of Mombasa and will specifically look at how some factors contributed to the collapse of building within the city. Some factors looked into were materials, building developers, the construction professionals and the local authorities.

## 1.10 Definition of Significant Terms

**Building demolition:** This is the process or act of wrecking or destroying, especially destruction by explosives of buildings to ensure that the building is brought down. Usually this is done to buildings that have developed structural problems, those that have been build in wrong places or simply those people who want to erect new buildings

**Structural failure:** This refers to loss of the (LCC) load-carrying capacity of a component or member within a structure or of the structure itself. Structural failure is initiated when the material is stressed to its strength limit, thus causing fracture or excessive deformations.

**Building codes:** These are Community ordinances governing the manner in which buildings may be constructed or modified. These ordinances are usually passed in parliament to regulate the construction process within the urban and rural settings so as to avoid congestion and unplanned construction.

**CO-** An abbreviation for "**Certificate of Occupancy**" This certificate is issued by the local municipality and is required before anyone can occupy and live within a given area. It is issued only after the local municipality has made all inspections of the buildings that have been brought up and the surrounding and all monies and fees have been paid.

**Construction Contract:** A legal document which specifies the what-when-where-how-how much and by whom in a construction project.

**Building Foundation:** The supporting portion of a structure below the first floor construction, or below grade, including the footings

## 1.11 Organization of the study

This study is organized into five chapters. Chapter one outlines the background to the study, the statement of the study, the purpose and the objectives of the study, as well as the delimitation the study and how they were overcome.

Chapter two outlines the key theories of the literature review as per the objective of the study which are; to assess how building professionals have contributed to collapse of building in Mombasa County, to assess how the procedures followed in construction has contributed to the collapse of building in Mombasa city, to determine how building materials used in construction in Mombasa city have contributed to collapse of buildings, to assess the role that the local government or the Mombasa municipality plays, that contribute to the collapse of buildings within the county and to establish the role building developers play that contribute in the eventual collapse of buildings.

Chapter three gives the research design, the target population as well as sample size and sampling procedures. It also outlines the data collection methods, the validity and reliability of the data collection instruments and the operational definitions of variable.

In chapter four the data collected is presented, analyzed and interpreted as per the objectives of the study while chapter five has given the summary and discussions of the findings, recommendations and the areas for further research.

## 1.1 Background to Building Construction

The first bridges made by humans were probably wooden logs placed across a stream. The first buildings were simple huts, tents and structures meant to shield the body from the elements, built by their inhabitants. However the very early construction is mostly enclosure and based on what we know about the way Neolithic hunter-gatherers and herders in various areas built shelters today. The absence of metal tools placed limitations on the materials that could be worked, but it was still possible to build quite elaborate stone structures with ingenuity using dry-stone-walling techniques (Al-Sokhal, 2009).

One of the largest ancient structures was the Neolithic long house. It had all cases of timber structures and only the very lowest parts of the walls and post-holes were unearthed in archaeological excavations, making reconstruction of the upper parts of these buildings purely conjectural this building collapsed after it has stayed for over 150 years due to structural failure. Traditionally, construction varies enormously with topography, traditions and needs of different regions (Habri, 2003).

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Introduction

This chapter briefly outlines the motivation for this work and explains why research in collapsing of building is of great importance to Kenya and human beings. It focuses on the core courses of building collapsing in Mombasa County. It also focuses on the steps taken by the government to reduce the risks involved with collapsing of buildings. It also focuses on the need to understand the factors contributing to building collapsing so as to strengthen and harness these programmes which is important for sustainable, cost effective, reduced lives loss and improvement of building structures.

In undertaking the literature review, the researcher relied greatly on journals, various articles on the internet and one on one site interviews.

#### 2.2 Background to Building Construction

The first bridges made by humans were probably wooden logs placed across a stream. The first buildings were simple huts, tents and shelters meant to suit the basic needs of protection from the elements, built by their inhabitants. However the very early construction is mostly conjecture and based on what we know about the way nomadic hunter-gatherers and herdsmen in remote areas build shelters today. The absence of metal tools placed limitations on the materials that could be worked, but it was still possible to build quite elaborate stone structures with ingenuity using dry-stone-walling techniques (Al-Sakkaf, 2009).

One of the largest ancient structures was the Neolithic long house. It had all cases of timber structures and only the very lowest parts of the walls and post-holes were unearthed in archaeological excavations, making reconstruction of the upper parts of these buildings purely conjectural this building collapsed after it has stayed for over 150 years due to structural failure. Traditionally, construction varies enormously with topography, traditions and needs of different regions (Habri, 2003).

In Kenya collapsing of building experienced in most of the towns and cities were due to the following factors:

1. Using substandard materials for construction which in most cases do not meet the set standards.
2. Avoiding the use of building specialists like the engineers, architects, quantity surveyors who are perceived to be expensive.
3. The use of quack contractors who are in construction industry for money making and not a serious business that mind about quality
4. The municipality or the city council laxity to do routine supervision on all buildings under construction to see whether they conform to the drawings they satisfied.
5. Corruption cases involving the contractors and the council officials and sometimes it also involves the client
6. In this consumerist world, quality is not an issue but quantity because quantity brings money very fast,

The reasons why buildings keep on collapsing in Kenya are: The need for use of qualified personnel in all construction activities as a step towards restoring sanity in the industry, that most of those buildings notably do not have a registered professional working on site for supervision purposes. Buildings, like all structures, are designed to support certain factored loads without deforming excessively. The loads include the weights of people, objects and the pressure of wind. Together, these are called live loads, besides the dead load of the building itself. The causes of building collapse can be classified under general headings to facilitate analysis.

At the pre-construction stage, collapse can be caused by bad design calculations and detailing; lack of holistic interpretation of all site drawings as a total building package, that is, structural and architectural drawings fail to be seen as one whole building package; lack of adequate soil investigation reports and proper interpretation of the same; lack of records of laboratory results on building materials to be used (Quality Control & Quality Assurance); and, inadequate soil compaction and consolidation of reclaimed land causing differential settlement.

During actual construction, collapse may arise from use of inexperienced site engineer (quacks); lack of proper supervision; use of substandard building materials such as sand blocks with improper cement/sand mix; and, engaging improper constructional methods such as not mixing concrete in correct proportions and improper curing of concrete

At this stage also, client involvement may compromise quality to save on costs (out of greed). This is mostly seen with private developers where owners, perhaps due to limited budgets, constantly compromise the quality of materials used in construction. This would definitely reduce the characteristic strength of such material and hence its behavior/response when periodically exposed to internal and external stresses. This of course eventually leads to collapse, if not immediately, over time. (Irene Keino AAK June 2011)

Lack of Health Safety and Environment Education (HSEE) may also contribute to anomalies in construction. When the labour force that are engaged in the daily construction works are not properly orientated on professional ethics as it relates to constructional practices, discipline and respect for standards, it would lead to poor workmanship or professional negligence as the case may be. This may eventually lead to buildings collapsing afterwards. Failure of regulatory agents (the local authorities) to inspect building sites has also largely contributed to this anarchy in the sector.

A building under construction at Mwibona area in Luanda town collapsed due to negligence from the municipality. Mr. Muyera who is also a civil engineer said in his annual report on strength of materials and structures that the proprietors of the buildings do not involve a structural engineer while putting up their buildings. He added that the ratio of concrete, sand and ballast did not meet the required standards adding that materials used to reinforce slabs and columns of the building were substandard, for example, they use Y8 to reinforce the columns which is not allowed whatsoever. He disclosed that the plan of the buildings is not prepared and supervised by a draftsman adding that after digging through the rubble, the rescue team discovered that the building had no foundation.

According to Mr. Andrew Moran (June 2011) says that rushed building projects are leading to collapsed buildings that are slowly killing the very builders that are building these projects.

People are so eager to make money that quality is not an issue. This solidifies our former point that in this consumerist world, quality is not an issue but quantity because quantity brings money very fast, yet it is bringing death and destruction very fast.

According to Eng. Evans Kamau of Nairobi city council, (Feb. 2006), 11 people were killed and dozens more were injured in Nairobi when a building collapsed. Three years later, another building collapsed and caused harm to those in the building and the teams involved in rescue efforts. For years now, Kenya has been criticized for its paucity of enhanced building safety regulations and poor workmanship during construction process.

According engineer Mc Daltod (28th June 2009). A newly built 13-storey residential building collapsed in Shanghai, killing one worker. The block of high-rise flats toppled onto its side in the muddy construction site raising concerns that building safety standards are being overlooked in favour of fast construction in China's rush to modernize, Shoddy construction and the use of sub-standard materials is a concern in China's construction sector as the country scrambles to build out cities and finish massive infrastructure projects to keep pace with fast economic growth. The collapse of dozens of schools during Sichuan earthquake also led to a wave of public outrage about corrupt officials and construction firms.(Source: <http://www.dailymail.co.uk/news/article-1196064>)

### **2.3 Building Specialist**

A specialist is a person who is devoted to a particular occupation or branch of study. Building Specialists therefore are people who have devoted themselves in building as their occupation. They include;

Structural engineers who are involved in the analysis and design of physical objects such as buildings, bridges, equipment supports, towers and walls. Those concentrating on buildings are responsible for the structural performance of a large part of the built environment and are, sometimes, informally referred to as "building engineers". Structural engineers require expertise in strength of materials and in the seismic design of structures. Architectural Engineers sometimes practice structural as one aspect of their designs; the structural discipline when practiced as a specialty works closely with architects and other engineering specialists like the

Mechanical engineering and electrical engineering engineers they come up with a structure which sound and will never collapse. But in our counties these professionals are not available and most of those practicing are either under qualified or people of different specialty trying to get to that kind of business. Also known as "building services engineering", Mechanical engineers design and oversee the heating, ventilation and air conditioning (HVAC), plumbing, and rain gutter systems and all the mechanical aspects of a building. Plumbing designers often include design specifications for simple active fire protection, drainage systems, cold and hot water systems, but for more complicated projects, fire protection engineers are often separately retained fire protection. Electrical engineers are responsible for the building's power distribution, telecommunication, fire alarm, signalization, lightning protection and control systems, as well as lighting systems.

Building specialists within Mombasa Island are very few and the few available are very expensive when it comes to design and supervision of the building works. This has lead to developers opting for cheaper ways for them to save money. The unavailability of specialist is majorly coursed by the few institutions of higher learning that provide related courses and some specialists opting for foreign countries where they get more pay. Within the municipality, The Mombasa university collage is the only institution that has been providing these courses and it is only recently that they started to offer degree courses in some of the professions.(Annual building report of Mombasa Island 2010)

Building specialists within the town are not registered with the ministry of public work, thus making them unqualified in the construction industry. This fact renders them unqualified to take up major construction projects legally. Most people on construction sites purported to be specialists had no papers to support or show there qualification hence they were rendered to be quacks. And some people go overboard and do jobs they are not specialized in hence making a bunch of mistakes that result in collapse of building. The structural engineer may make errors in computation, and fail to take into account the loads the structure is designed to carry and thus cause the Collapse of Buildings in Kenya. He may also adopt erroneous theories and rely on inaccurate data, ignore the effects of repeated or impulsive stresses, and make improper choice of materials to be used during construction. The engineer is responsible for these failures, which are created at the drawing board. (The buildings status report, Mombasa municipal council 2011)



## 2.4 Construction procedures

Construction of a building is a process that should be followed to the latter, in these fields of architecture and civil engineering, construction is a process that consists of the building or assembling of infrastructure. Far from being a single activity, large scale construction is a feat of human multitasking. Normally, the job is managed by a project manager, and supervised by a construction manager, design engineer, construction engineer or project architect.

For the successful execution of a project, effective planning is essential. Involved with the design and execution of the infrastructure in question must consider the environmental impact of the job, the successful scheduling, budgeting, construction site safety, availability of building materials, logistics, inconvenience to the public caused by construction delays and bidding, etc.

The construction procedure consists of design work which involves the translation of the client's dreams to reality, usually done by the architect in conjunction with other engineer. Tendering process, which is a process of establishing the right person or company to perform the construction task. This is where competence in construction is required. Actual construction involves the interpretation of the architectural and structural drawings and putting them on ground for erection of wall. With proper interpretation all that is in the drawings will be reflected on ground. After completion of the building process, handing over of the building is done and some money for the contractor is retained (retention money) just in case something happens to the building after some period of time.

## 2.5 Building Materials

The housing construction industry in Kenya requires affordable high quality building materials and the use of appropriate building techniques to effectively generate more housing. Kenya requires an industrial policy that would promote production and availability of conventional and local material like cement, steel, stone, and micro-concrete roofing tiles. Building materials must be taken care of right from the manufacture of the materials, transportation, storage, use and after use.

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background of the Study

The history of construction is a complex subject encompassing the history of building materials, the history of engineering, the history of building techniques, economic and social history of builders and workmen, the history of construction machinery and temporary works, etc. Each of these has a complex literature devoted to it. The first buildings were simple huts, tents and shelters meant to suit the basic needs of protection from the elements, built by their inhabitant. The very simplest shelters, tents, leave no traces. Because of this, what little we can say about very early construction is mostly conjecture and based on what we know about the way nomadic hunter-gatherers and herdsmen in remote areas build shelters today. (Bo Johansson, 1993)

The absence of metal tools placed limitations on the materials that could be worked, but it was still possible to build quite elaborate stone structures with ingenuity using dry-stone-walling techniques. The first mud bricks, formed with the hands rather than wooden moulds, belong to the late Neolithic period and were found in Jericho. One of the largest structures of this period was the Neolithic long house. In all cases of timber structures in these very early cultures, only the very lowest parts of the walls and post-holes are unearthed in archaeological excavations, making reconstruction of the upper parts of these buildings purely conjectural. (Alfrodo, 2004)

In Kenya for example, building construction history can be dated back from the mid-1800s to the 1960s. Kenya was a British protectorate from 1895 to 1920 and a colony from 1920 to 1963. During this period building construction in different communities was done as per the tradition of that community. The shape of the building and the materials used in the construction basically depended on the geographical location of that community and the environment of that area. Some of the traditional building designs exist up to date. People like the Maasai community have been able to keep their building design culture to date. Since Kenya was a British protectorate from 1895 to 1920 and a colony from 1920 to 1963. The Imperial British East Africa Company (IBEAC) was the administrator of Kenya and was given a Royal Charter to exploit Kenya commercially. This factor gave the westerners the opportunity to come to Kenya and with them came development which forced most of the indigenous communities to abandon their building designs in favor of the western designs. IBEAC facilitated the construction of a railway

connecting the east coast region of Mombasa to Lake Victoria. The company employed James Macdonald assisted by John Wallace Pringle, both officers in the Royal Engineers, to undertake the survey in 1891-1892 this led to the construction of the Kenya-Uganda railway. Nairobi was founded in 1899. It grew up around a railway line constructed by the British colonial officials from Mombasa on the Indian Ocean coast to Uganda. Records indicated that by 1967, 200 Africa-owned contracting firms were registered. Some were briefcase companies while others offered labour-only contracts to Ministry of Works, projects in gravelling roads. These firms faced disadvantages such as:

1. Little experience as far as site organization is concerned
2. Inadequate knowledge of managerial, commercial or administrative matters
3. Lack of knowledge on matters of tendering for construction contracts
4. Inadequate plant and equipment
5. Inadequate/lack of capital
6. The Asian suppliers were not sympathetic of African entry into the industry and were unwilling to afford the Africans credit (Anita, Perspective in housing and planning , 2001)

The Government formed the National Construction Corporation that sought to enable African contractors enter the industry, a very competitive market. Its philosophy was 'learning by doing' whereby the African contractors were to be assisted and trained during the construction process. They were only supposed to meet the following requirements:

1. Obtain the work
2. Obtain the finance required to complete the project

From the above, the functions of NCC were:

1. To help contractors obtain work
2. Provide them with adequate finance
3. Assist them with the actual construction process [By Mr. Barrack Obaga (29, 2, 2012)]

With the advance technology, the introduction of steel bars, cement, composite materials, fabricated materials and the general design brought in the modern buildings with better aesthetics and limitation of lateral space with the use of vertical space for construction purposes, this was brought about by the increased population and scarcity of land in some parts of the country especially the urban areas that lead to rural – (Adams, 2001) (Anita) (Baris, 2001) (Baris, 2001) (Adams, 2001) (Anita, Perspecky) urban migration to cities like Nairobi and Mombasa.

With the increased need of buildings for accommodation, construction procedures have been overlooked since they are perceived to be delaying the construction process, the use of quacks for construction, corruption and poor quality materials became the order of the day. These factors contributed dearly to collapse of buildings evident in our major cities which have contributed in a big way towards the loose of lives, and live investments.

## **1.2 Statement of the Study**

The building construction industry is considered an important aspect in any country, particularly due to the growing population and focus of the public towards the infrastructure development. With this, government, local authorities and the communities are focusing on better ways of building construction in order to improve the quality of life of the people and the quality of buildings that are coming up to avoid loss of live-time investments and loose of lives of the people. The collapse of buildings in Kenya has been on the rise killing many people. For example a building was ordered to be demolished on 8<sup>th</sup> November 2011 when it nearly collapsed in Mombasa. Secondly, several people were feared to have died after a four storey building under construction came tumbling down at Spaki in Mombasa on Thursday 9<sup>th</sup> April 2009. Moreover, in Nairobi several cases have been reported like the infamous kahonge building in river road which collapsed on 26<sup>th</sup> January 2006, another one in kiambu in October 2009, in July 2011 in pipeline estate in Nairobi's embakasi a 6 storey building was halted and 14 people trapped, June 20<sup>th</sup> 2011, The Langata Building near Carnivore restaurant along the bypass collapsed. All the above cases which have been in increase in the recent past have resulted to the massive loose of lives and investments these has been majorly coursed by several factors that need to be looked in to. The local authorities or municipality need to put more emphasis on the building rules and regulations is just but one of the factors that contribute the collapse of building

in our cities. Therefore this study has tried to establish other factors that needed to be looked into keenly to avoid the building collapse incidents.

### **1.3 Purpose of the Study**

The purpose of the study was to examine the general causes of collapsing of buildings in our cities especially areas around Mombasa county and specifically Mombasa island.

### **1.4 Objectives of the Study**

The broad objective of this study was to examine the factors that have lead to collapse of buildings in our major cities. These objectives include:

1. To assess how building professionals have contributed to collapse of building in Mombasa County.
2. To assess how the procedures followed in construction has contributed to the collapse of building in Mombasa city.
3. To determine how building materials used in construction in Mombasa city have contributed to collapse of buildings.
4. To assess the role that the local government or the Mombasa municipality plays, that contribute to the collapse of buildings within the county.
5. To establish the role building developers play that contribute in the eventual collapse of buildings in Mombasa County.

### **1.5 Research Questions**

The research was guided by the following questions:

1. How do building specialists contribute to the collapse of buildings in Mombasa city?
2. How do building procedures contribute to collapse of buildings in Mombasa city?
3. How do materials used in construction of buildings contributed to collapse of buildings in Mombasa city?
4. What role does the local government play that lead to the collapse of buildings in Mombasa city?
5. How do building developers contribute to the collapse of buildings in Mombasa city?

## **1.6 The Research Hypothesis**

A research hypothesis is the statement created by researchers when they speculate upon the outcomes of a research or experiment. The hypothesis is generated through a number of means, but is usually as the result of a process of inductive reasoning where observations lead to the formation of a theory. Some of the hypothesis in this research report includes;

- i) Building professionals do not contribute to the collapse of buildings in Mombasa County
- ii) Construction procedures are not the cause of the collapse of buildings in Mombasa County.
- iii) Building materials do not contribute to the collapse of buildings in Mombasa County.
- iv) The municipal council do not contributes to the collapse of buildings in Mombasa County.

## **1.6 Basic Assumptions of the Study**

The study was guided by the following assumptions:-

1. That building specialists were not involved in the design and construction process of the collapsed buildings.
2. Corruption cases in the local government contributed immensely to the collapse of buildings in our cities
3. Sub-standard materials are used in the construction of buildings that end up collapsing.

## **1.7 Significance of the Study**

For the different stakeholders in the housing sector, the study on factors that have lead to the collapse of buildings is very important because it will enlighten them on particular aspects that contribute to the collapsing of buildings and hence help them to avoid loses of both lives and investment

For the Government of Kenya, the study will help in identifying the factors that have led to the collapse of building. It will also help the Government in reviewing the building codes and procedures and consequently strengthen the laws regarding construction of building in the country. It will also assist the government to convince international investors that construction in

the country is taken care of with the set laws. It assisted the government to avoid losses in terms of lives and public investments.

The study provided necessary information to building contractors on what they were supposed to do and what they avoided while doing their construction work. This assisted them to avoid shortcuts in construction hence reduce deaths related to collapsing of building and also avoid losing their investment.

The study also assisted building owners to follow the specified construction procedures and involve construction specialists in the construction process from the initial stages to the completion of the project. This helped them to avoid losing a lot of investments which to some was a lifetime investment.

### **1.8 Limitations of the Study**

The study was faced by the following limitations

1. The accessibility to the respondents especially the high ranked like the provincial works officer and district works officer was a problem since most of the time they were very busy.
2. The researcher identified the key respondents and tried to get their contacts and gave them questionnaires directly or sends to their destination after communicating to them through telephones or e-mail.
3. The researcher organized to travel to the sites where he used other forms or tools of collecting data like the interview method to get the required information.

### **1.9 Delimitation of the Study**

The study focused on the causes of collapse of building in Mombasa County. The research will be conducted within the city of Mombasa and will specifically look at how some factors contributed to the collapse of building within the city. Some factors looked into were materials, building developers, the construction professionals and the local authorities.

## 1.10 Definition of Significant Terms

**Building demolition:** This is the process or act of wrecking or destroying, especially destruction by explosives of buildings to ensure that the building is brought down. Usually this is done to buildings that have developed structural problems, those that have been build in wrong places or simply those people who want to erect new buildings

**Structural failure:** This refers to loss of the (LCC) load-carrying capacity of a component or member within a structure or of the structure itself. Structural failure is initiated when the material is stressed to its strength limit, thus causing fracture or excessive deformations.

**Building codes:** These are Community ordinances governing the manner in which buildings may be constructed or modified. These ordinances are usually passed in parliament to regulate the construction process within the urban and rural settings so as to avoid congestion and unplanned construction.

**CO-** An abbreviation for "**Certificate of Occupancy**" This certificate is issued by the local municipality and is required before anyone can occupy and live within a given area. It is issued only after the local municipality has made all inspections of the buildings that have been brought up and the surrounding and all monies and fees have been paid.

**Construction Contract:** A legal document which specifies the what-when-where-how-how much and by whom in a construction project.

**Building Foundation:** The supporting portion of a structure below the first floor construction, or below grade, including the footings

## 1.11 Organization of the study

This study is organized into five chapters. Chapter one outlines the background to the study, the statement of the study, the purpose and the objectives of the study, as well as the delimitation the study and how they were overcome.



Chapter two outlines the key theories of the literature review as per the objective of the study which are; to assess how building professionals have contributed to collapse of building in Mombasa County, to assess how the procedures followed in construction has contributed to the collapse of building in Mombasa city, to determine how building materials used in construction in Mombasa city have contributed to collapse of buildings, to assess the role that the local government or the Mombasa municipality plays, that contribute to the collapse of buildings within the county and to establish the role building developers play that contribute in the eventual collapse of buildings.

Chapter three gives the research design, the target population as well as sample size and sampling procedures. It also outlines the data collection methods, the validity and reliability of the data collection instruments and the operational definitions of variable.

In chapter four the data collected is presented, analyzed and interpreted as per the objectives of the study while chapter five has given the summary and discussions of the findings, recommendations and the areas for further research.

## 1.1 Background to Building Construction

The first bridges made by humans were probably wooden logs placed across a stream. The first buildings were simple huts, tents and shelters meant to suit the basic needs of protection from the elements, built by their inhabitants. However, the very early construction is mostly conjecture and based on what we know about the way ancient hunter-gatherers and herders in remote areas build shelters today. The absence of metal tools placed limitations on the construction that could be achieved, but it was still possible to build quite extensive stone structures with high walls using dry-stone-walling techniques (Al-Salhi, 2009).

One of the largest ancient structures was the Neolithic long house. It had 40 rooms of similar structures and only the very lowest parts of the walls and post-holes were unearthed in archaeological excavations, making reconstruction of the upper parts of these buildings purely conjectural this building collapsed after it had served its purpose due to structural failure. Traditionally, construction is wide harmoniously well planned, organized and made of different regions (Habri, 2001).

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter briefly outlines the motivation for this work and explains why research in collapsing of building is of great importance to Kenya and human beings. It focuses on the core courses of building collapsing in Mombasa County. It also focuses on the steps taken by the government to reduce the risks involved with collapsing of buildings. It also focuses on the need to understand the factors contributing to building collapsing so as to strengthen and harness these programmers which is important for sustainable, cost effective, reduced lives loose and improvement of building structures.

In undertaking the literature review, the researcher relied greatly on journals, various articles on the internet and one on one site interviews.

#### **2.2 Background to Building Construction**

The first bridges made by humans were probably wooden logs placed across a stream. The first buildings were simple huts, tents and shelters meant to suit the basic needs of protection from the elements, built by their inhabitants. However the very early construction is mostly conjecture and based on what we know about the way nomadic hunter-gatherers and herdsmen in remote areas build shelters today. The absence of metal tools placed limitations on the materials that could be worked, but it was still possible to build quite elaborate stone structures with ingenuity using dry-stone-walling techniques (Al-Sakkaf, 2009).

One of the largest ancient structures was the Neolithic long house. It had all cases of timber structures and only the very lowest parts of the walls and post-holes were unearthed in archaeological excavations, making reconstruction of the upper parts of these buildings purely conjectural this building collapsed after it has stayed for over 150 years due to structural failure. Traditionally, construction varies enormously with topography, traditions and needs of different regions (Habri, 2003).

In Kenya collapsing of building experienced in most of the towns and cities were due to the following factors:

1. Using substandard materials for construction which in most cases do not meet the set standards.
2. Avoiding the use of building specialists like the engineers, architects, quantity surveyors who are perceived to be expensive.
3. The use of quack contractors who are in construction industry for money making and not a serious business that mind about quality
4. The municipality or the city council laxity to do routine supervision on all buildings under construction to see whether they conform to the drawings they satisfied.
5. Corruption cases involving the contractors and the council officials and sometimes it also involves the client
6. In this consumerist world, quality is not an issue but quantity because quantity brings money very fast,

The reasons why buildings keep on collapsing in Kenya are: The need for use of qualified personnel in all construction activities as a step towards restoring sanity in the industry, that most of those buildings notably do not have a registered professional working on site for supervision purposes. Buildings, like all structures, are designed to support certain factored loads without deforming excessively. The loads include the weights of people, objects and the pressure of wind. Together, these are called live loads, besides the dead load of the building itself. The causes of building collapse can be classified under general headings to facilitate analysis.

At the pre-construction stage, collapse can be caused by bad design calculations and detailing; lack of holistic interpretation of all site drawings as a total building package, that is, structural and architectural drawings fail to be seen as one whole building package; lack of adequate soil investigation reports and proper interpretation of the same; lack of records of laboratory results on building materials to be used (Quality Control & Quality Assurance); and, inadequate soil compaction and consolidation of reclaimed land causing differential settlement.

During actual construction, collapse may arise from use of inexperienced site engineer (quacks); lack of proper supervision; use of substandard building materials such as sand blocks with improper cement/sand mix; and, engaging improper constructional methods such as not mixing concrete in correct proportions and improper curing of concrete

At this stage also, client involvement may compromise quality to save on costs (out of greed). This is mostly seen with private developers where owners, perhaps due to limited budgets, constantly compromise the quality of materials used in construction. This would definitely reduce the characteristic strength of such material and hence its behavior/response when periodically exposed to internal and external stresses. This of course eventually leads to collapse, if not immediately, over time. (Irene Keino AAK June 2011)

Lack of Health Safety and Environment Education (HSEE) may also contribute to anomalies in construction. When the labour force that are engaged in the daily construction works are not properly orientated on professional ethics as it relates to constructional practices, discipline and respect for standards, it would lead to poor workmanship or professional negligence as the case may be. This may eventually lead to buildings collapsing afterwards. Failure of regulatory agents (the local authorities) to inspect building sites has also largely contributed to this anarchy in the sector.

A building under construction at Mwibona area in Luanda town collapsed due to negligence from the municipality. Mr. Muyera who is also a civil engineer said in his annual report on strength of materials and structures that the proprietors of the buildings do not involve a structural engineer while putting up their buildings. He added that the ratio of concrete, sand and ballast did not meet the required standards adding that materials used to reinforce slabs and columns of the building were substandard, for example, they use Y8 to reinforce the columns which is not allowed whatsoever. He disclosed that the plan of the buildings is not prepared and supervised by a draftsman adding that after digging through the rubble, the rescue team discovered that the building had no foundation.

According to Mr. Andrew Moran (June 2011) says that rushed building projects are leading to collapsed buildings that are slowly killing the very builders that are building these projects.

People are so eager to make money that quality is not an issue. This solidifies our former point that in this consumerist world, quality is not an issue but quantity because quantity brings money very fast, yet it is bringing death and destruction very fast.

According to Eng. Evans Kamau of Nairobi city council, (Feb. 2006), 11 people were killed and dozens more were injured in Nairobi when a building collapsed. Three years later, another building collapsed and caused harm to those in the building and the teams involved in rescue efforts. For years now, Kenya has been criticized for its paucity of enhanced building safety regulations and poor workmanship during construction process.

According engineer Mc Daltod (28th June 2009). A newly built 13-storey residential building collapsed in Shanghai, killing one worker. The block of high-rise flats toppled onto its side in the muddy construction site raising concerns that building safety standards are being overlooked in favour of fast construction in China's rush to modernize, Shoddy construction and the use of sub-standard materials is a concern in China's construction sector as the country scrambles to build out cities and finish massive infrastructure projects to keep pace with fast economic growth. The collapse of dozens of schools during Sichuan earthquake also led to a wave of public outrage about corrupt officials and construction firms.(Source: <http://www.dailymail.co.uk/news/article-1196064>)

## **2.3 Building Specialist**

A specialist is a person who is devoted to a particular occupation or branch of study. Building Specialists therefore are people who have devoted themselves in building as their occupation. They include;

Structural engineers who are involved in the analysis and design of physical objects such as buildings, bridges, equipment supports, towers and walls. Those concentrating on buildings are responsible for the structural performance of a large part of the built environment and are, sometimes, informally referred to as "building engineers". Structural engineers require expertise in strength of materials and in the seismic design of structures. Architectural Engineers sometimes practice structural as one aspect of their designs; the structural discipline when practiced as a specialty works closely with architects and other engineering specialists like the

Mechanical engineering and electrical engineering engineers they come up with a structure which sound and will never collapse. But in our counties these professionals are not available and most of those practicing are either under qualified or people of different specialty trying to get to that kind of business. Also known as "building services engineering", Mechanical engineers design and oversee the heating, ventilation and air conditioning (HVAC), plumbing, and rain gutter systems and all the mechanical aspects of a building. Plumbing designers often include design specifications for simple active fire protection, drainage systems, cold and hot water systems, but for more complicated projects, fire protection engineers are often separately retained fire protection. Electrical engineers are responsible for the building's power distribution, telecommunication, fire alarm, signalization, lightning protection and control systems, as well as lighting systems.

Building specialists within Mombasa Island are very few and the few available are very expensive when it comes to design and supervision of the building works. This has lead to developers opting for cheaper ways for them to save money. The unavailability of specialist is majorly coursed by the few institutions of higher learning that provide related courses and some specialists opting for foreign countries where they get more pay. Within the municipality, The Mombasa university collage is the only institution that has been providing these courses and it is only recently that they started to offer degree courses in some of the professions.(Annual building report of Mombasa Island 2010)

Building specialists within the town are not registered with the ministry of public work, thus making them unqualified in the construction industry. This fact renders them unqualified to take up major construction projects legally. Most people on construction sites purported to be specialists had no papers to support or show there qualification hence they were rendered to be quacks. And some people go overboard and do jobs they are not specialized in hence making a bunch of mistakes that result in collapse of building. The structural engineer may make errors in computation, and fail to take into account the loads the structure is designed to carry and thus cause the Collapse of Buildings in Kenya. He may also adopt erroneous theories and rely on inaccurate data, ignore the effects of repeated or impulsive stresses, and make improper choice of materials to be used during construction. The engineer is responsible for these failures, which are created at the drawing board. (The buildings status report, Mombasa municipal council 2011)

## **2.4 Construction procedures**

Construction of a building is a process that should be followed to the latter, in these fields of architecture and civil engineering, construction is a process that consists of the building or assembling of infrastructure. Far from being a single activity, large scale construction is a feat of human multitasking. Normally, the job is managed by a project manager, and supervised by a construction manager, design engineer, construction engineer or project architect.

For the successful execution of a project, effective planning is essential. Involved with the design and execution of the infrastructure in question must consider the environmental impact of the job, the successful scheduling, budgeting, construction site safety, availability of building materials, logistics, inconvenience to the public caused by construction delays and bidding, etc.

The construction procedure consists of design work which involves the translation of the client's dreams to reality, usually done by the architect in conjunction with other engineer. Tendering process, which is a process of establishing the right person or company to perform the construction task. This is where competence in construction is required. Actual construction involves the interpretation of the architectural and structural drawings and putting them on ground for erection of wall. With proper interpretation all that is in the drawings will be reflected on ground. After completion of the building process, handing over of the building is done and some money for the contractor is retained (retention money) just in case something happens to the building after some period of time.

## **2.5 Building Materials**

The housing construction industry in Kenya requires affordable high quality building materials and the use of appropriate building techniques to effectively generate more housing. Kenya requires an industrial policy that would promote production and availability of conventional and local material like cement, steel, stone, and micro-concrete roofing tiles. Building materials must be taken care of right from the manufacture of the materials, transportation, storage, use and after use.

In Mombasa County, however, most buildings that collapsed were reported to have used either wrong materials or they never followed proper material care procedures. They also may have probably used substandard materials for construction. Ideally all construction materials are supposed to be taken for standardization process which is to determine the strength of materials and if it meets the required standard. This is usually the most important cause of Collapse of Buildings in Kenya. The engineer or the supervisors on site are also at fault here, if inspection has been lax. This includes the use of poor quality of sand and aggregates to make concrete, non adherence to the mix design, lack of quality control of the materials to be used like the quality of water for concrete and curing, substitution of building materials for inferior quality and size, going for cheap materials instead of the specified type and quality just but to save, Inadequate care of building materials during transportation, storage and after use like curing of concrete and other practices well known to the construction worker, it will cause the Collapse of Buildings in Mombasa. Moreover, material testing facilities which are critical to the improvement of building construction standards and reduction of collapsing of buildings in our city due to substandard materials, in most cases are provided by the Kenya bureau of standards and the city council department of building and material testing. These institutions are quite reluctant in performing there work, at times you will find them closed and when they are functional, they are very expensive forcing other contractors to avoid them.(architectural report of may 2008)

## **2.6 The local government**

The local Government by-laws outlaws or oppose issuance or granting of trade licenses to buildings or premises that have not been inspected and issued with fire safety and health certificates. The decision to issue a certificate is a breach and indeed abuse of the councils' mandate and responsibility. Council officers are supposed to uphold, apply and enforce the by-laws equally, fairly, accordingly and without fear or favour as they discharge their duties or services to the public at large.

Recently there has been nationwide outcry or reported cases of buildings collapsing during construction or after construction specifically within Mombasa or gutted by fire in which many innocent or unsuspecting Kenyans got injured, maimed and killed even some lost their valuable



properties. Other duties of the council is to approve buildings at the design stage to ensure that they are designed according to the set requirements found in the building codes

The council also through its officers is required to supervise all buildings within the council jurisdiction that are under construction to ensure that they follow all building procedures and requirements laid down in the architectural drawing and specifications. The building is also supposed to be built on the land that has been approved by the council.

Supervision of buildings through the council was done in stages. The stages are sub-structure works where they ensured that the building foundation was excavated to the required depth, reinforcements to the foundation were done as specified by the engineer. The second stage was the superstructure work that involved the walling, roof work and all finishes.

This way disasters and tragedies will be prevented as incidents of buildings collapsing due to poor condition would be eliminated completely.

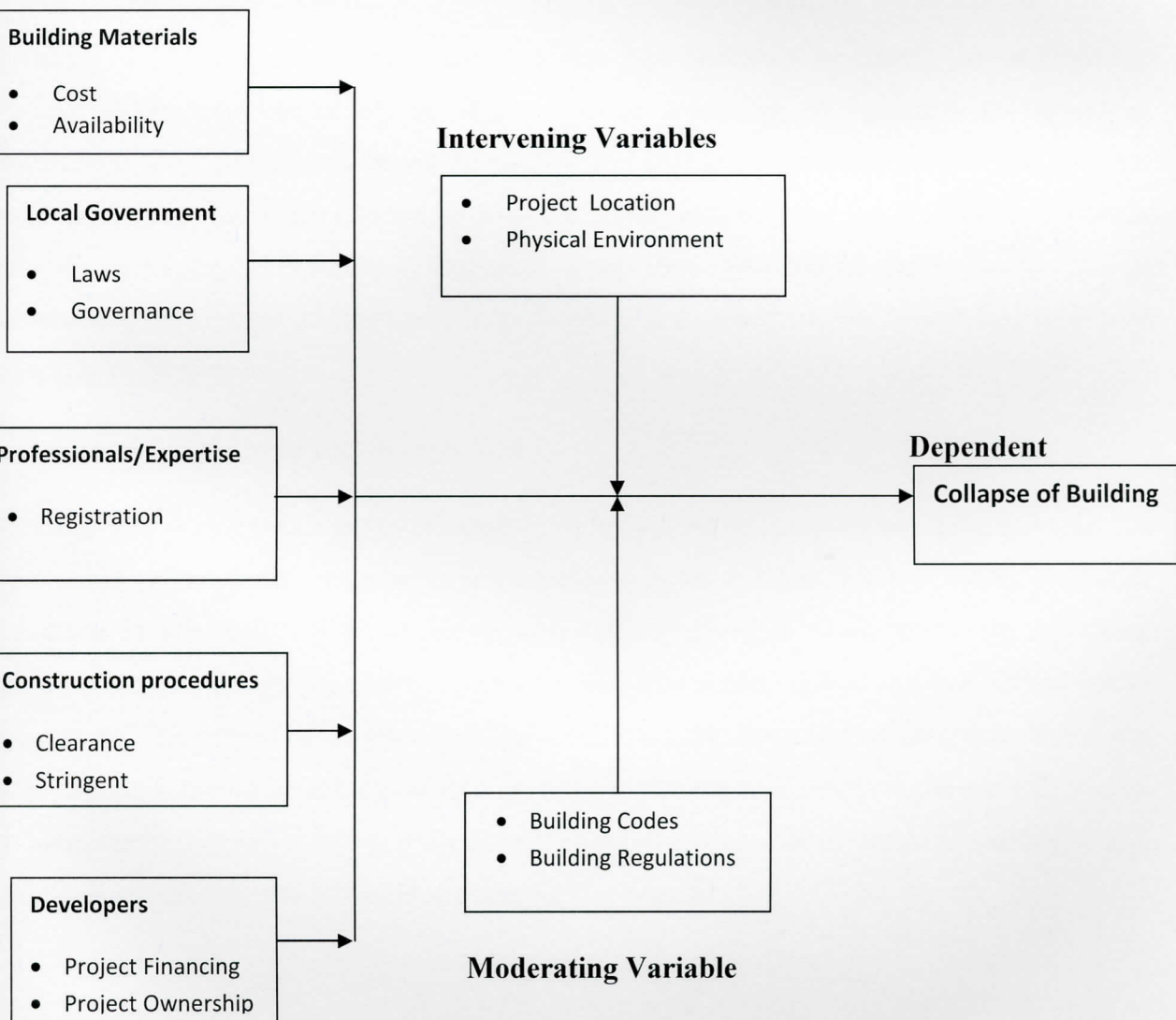
## **2.7 Building Developers**

These are the owners of the building. They finance the construction of the building fully from the onset to the completion of the building. While this is their responsibility, most developers tend to be mean on the financing of the project or they don't provide enough money for the construction process (jesca smith 2009). The developer is also known as the client to the construction team his main work is give funds for the construction process to proceed. At times developers may be individuals, organizations or just a group of people who have the intention of investment in the construction industry. Most building developers do not have any knowledge with the construction process, this forces them to hire the services of professionals like the architecture and the quantity surveyor to provide the architectural drawings and the bill of quantities or in other terms construction estimates so that he/she can be able to raise the amount for the construction process prio to the actual construction. This makes it possible for the construction process to run smoothly without delays.

## 1.5 Conceptual Framework

A conceptual framework (theoretical frameworks) is a type of intermediate theory that attempt to connect to all aspects of inquiry (e.g., problem definition, purpose, literature review, methodology, data collection and analysis). Conceptual framework can act like maps that give coherence to empirical inquiry. Because conceptual framework is potentially so close to empirical inquiry, it takes different forms depending upon the research question or problem. A conceptual framework is used in research to outline possible courses of action or to present a preferred approach to an idea or thought

### Independent Variables



Figure; 1

The conceptual framework above is a descriptive kind of a framework which comprises of independent variables like building materials, local government, professionals or experts, construction procedures and building developers. These independent variables facilitate the outcome of the dependent variable. It also has intermediate variables and moderating variables which are project location, physical environment and building codes, building regulations respectively the dependent variable in case is the collapse of buildings

### 3.2 Research Design

The study was descriptive research survey design that described the causes that affected the effective implementation of causes that prevented collapsing of buildings for improved construction. The study gathered information and analyzed to explain the problem as it was found in the field. The study focused on what the respondents said and did in order to reduce the rates of collapsing of buildings. Therefore observation also played an important role in documenting and improved construction by focusing and improving on factors that increased collapsing of building.

### 3.3 Target Population and Sample Size

The target population was a group or category of human beings, animals and objects which had one or more characteristics in common and selected as focus of study (Makoni, 1997). The target population in this case was those people who were involved in construction industry. They include engineers, architects, quantity surveyor, and construction, skilful and non skilful labors (operatives). The subject of the study was those buildings that developed structural problems and those buildings that collapsed. Building owners were also the respondents target since they were the financiers of the project and in most cases they acted occasionally in material provision. The total target population was 110 while the sample size was 34.

## **CHAPTER THREE:**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

This chapter focuses on applied research techniques and methods that were used to validate study objectives. It includes research design, the target sample, sampling procedures and methods of data collection. It also looks into validity and reliability of the data collected the collection tools, and how data was presented and the data analysis techniques.

#### **3.2 Research Design**

The study was descriptive research survey design that described the causes that affected the effective implementation of causes that prevented collapsing of buildings for improved construction. The researcher gathered information and attempted to explain the problem as it was found in the field. The study focused on what the respondents said and did in order to reduce the cases of collapsing of buildings. Therefore observation also played an important role in documenting any improved construction by focusing and improving on factors that facilitated collapsing of building.

#### **3.3 Target Population and Sample Size**

The target population was a group or category of human beings, animals and objects which had one or more characteristics in common and selected as focus of study (Mulusa, 1988). The target population in this case was those people who were involved in construction industry. They include engineers, architects, quantity surveyor, and contractors, skilled and non skilled labors (operatives). The subject of the study was those buildings that developed structural problems and those buildings that collapsed. Building owners were also the researchers target since they were the financiers of the project and in most cases they acted economically in material provision. The total target population was 120 while the sample size was 98.

### 3.4 Sampling size and Sampling Procedures

Kothari (2006) defined a sample as a representative part of a population. Thus, by studying the sample, one can know about it without having to study the entire population. The selection process of the sample was the sampling technique or sampling procedure Kothari (2004). Stratified random sampling, was used in the study since the population from which a sample was drawn constituted a homogenous group. Then stratified sampling technique was applied so as to obtain a representative sample. In this technique the population was stratified into a number of non-overlapping sub-population or strata and sample item were selected from each stratum. The item selected from each stratum, was based on simple random sampling from the departments that mainly dealt with building namely; municipality offices, contractors, skilled and non skilled labours and public works office.

**Table 3.1 Population and Sample Size Distribution**

Department	Population	Sample	Percentage
Municipality	10	8	80%
Contractors	22	20	90%
Labours	80	63	79%
Public Works	8	7	82%
Total	120	98	82%

$$n = \frac{N}{1 + N(e)^2} \quad \text{Where } n = \text{sample size, } N = \text{estimate of the population. (Miller and brewer 2003)}$$

$$\text{Therefore, } n = \frac{120}{1 + 120(0.05)^2} \quad n = \frac{120}{1.3} \quad n = 98$$

Deliberate sampling which is also known as purposive sampling was carried out. The sampling method involved purposive or deliberate selection of participating units of the universe for constituting a sample which represented a universe (Kothari, 2006). A sample of 92 was selected and derived from the population which was involved in the construction. Therefore the sample size was 98 people due to resources and time constraints the researcher selected the whole a sample size of 98 which was 82% of the population. The target population was 120 and sample size was 98 as shown above.

### **3.5 Data Collection Method**

Data collections tools that were used included questionnaire and observation although the main tool of data collection was however to be the questionnaire. The questions were to be closed ended multiple choice questions as well as short answer questions for ease of analysis and interpretation. The researcher visited the groups and explained the details of the study and what it entailed or what it involved before administering the questionnaire.

### **3.6 Validity and Reliability of Data Collection Instruments.**

Validity of the data collection instrument was important in this study for it must be able to measure the variables under study while its reliability was to ensure it is able to measure with consistency the variable among all the groups under study for proper information analysis

#### **3.6.1 Validity**

The data collection instrument was to be designed to counter check and verify the responses given earlier. The questions were also to be formulated so as to provide answers to the objectives of this study as highlighted in section 1.4 of this document. Observation likewise played a crucial role in ensuring the validity of the data collected.

#### **3.6.2 Reliability**

Measures that were to ensure the reliability of the data collected were pre test of the data collection instruments to ensure that the questions were to be well understood in the same way by all the respondents.

Likewise, simple random sampling from the construction group was to be conducted so as to give equal chance to each and every person to be included in the sample

### **3.7 Methods of Data Analysis and Presentation**

The collected data was analyzed both qualitatively and quantitatively. The responses coded and keyed in as appropriate while descriptive data was represented in tabular forms.

### 3.9. Operational definition of variables

Table 3.2: Operational definitions

Variables		Indicators	Instrument used	Scale
Independent variable	Building Materials	Cost of Materials	Questionnaire	Nominal
		Material Availability		
	Local Government	Building Laws	Questionnaire	Nominal
		Construction Governance		
	Professionals / Expertise	Registered Companies	Questionnaire	Nominal
		Approval		Nominal
Construction Procedures	Construction Clearance	Questionnaire	Nominal	
	Stringent Requirements		Ordinal	
Builders Developers	Project Financing	Questionnaire	Nominal	
	Project Ownership			

## CHAPTER FOUR

### DATA ANALYSIS, PRESENTATION AND INTERPRESENTATION OF RESULTS

#### 4.1. Introduction

The chapter is divided into two main sections. The first section deals with a description of the geographical layout of the area of study. The second section is concerned with description and analysis of data obtained from the study in a bid to explain the factors contributing to the collapse of buildings in Mombasa county. Data is analyzed according to research hypothesis formulated. The researcher adopted regression analysis for this study analysis.

#### 4.2 Response rate

Most of the questionnaires were distributed to the respondents directly by the researcher and some were given to heads of section to help in the distributions exercise in some departments. 80 respondents returned their questionnaires out of 98 questionnaires that were sent representing a response rate of 87%. This response rate is considered very good according to Mugenda and Mugenda (2003) who considers a response rate of 50% as adequate for analysis and reporting, 60% as good and 70% and above as very good.

#### 4.3 Demographic characteristics of the respondents

In demographic characteristics the researcher was concentrating on the responses by the departments, the age of the respondents and the occupation of the respondents.

##### 4.3.1 Responses by departments

The researcher was able to collect data from the municipality of Mombasa, the registered contractors, those people who do manual work in the construction sites and the people who work with the ministry of public works who include the architects and other professionals in the industry



**Table 4.1 Responses by departments**

Department	No. of Respondents	Percentage
Municipality	8	100%
Contractors	15	79%
Labors	50	86%
Public Works	7	100%
<b>Total</b>	<b>80</b>	<b>87%</b>

It was found out that those people who work with ministry of public works and the municipality or local government had the highest number of respondents since all of them i.e. 100% were able to respond to the questionnaires as 86% of the respondents were laborers, 79% of the contractors where able to respond.

#### 4.3.2 Age of respondents

The researcher looked at different age groups that were involved in the construction industry they ranged from people below 18 years to those people who were above 50 years

**Table 4.2: The age of respondents**

	Frequency	Percent	Valid Percent	Cumulative Percent
0-18 years	12	12.0	12.2	12.2
19-30 yeas	42	42.0	42.9	55.1
31-40 years	35	35.0	35.7	90.8
41-50 years	9	9.0	9.2	100.0
Total	98	98.0	100.0	

The study set to determine the average age of the respondents in order to determine the experience of the respondents in the construction industry. The study found out that 42.9% respondents were youths with age group ranging from 19-30 years. They had reasonable work experience that was necessary for the kind of services they were giving, their frequency was 42.

### 4.3.3: Occupation of respondents

The occupations that the researcher was looking into included the fundis or those people who have technical skills in construction, operatives, professionals in construction and ordinary people but who were involved in construction.

**Table 4.3: Occupation of respondents**

	Frequency	Percent	Valid Percent	Cumulative Percent
“Fundi”	20	20.0	20.4	20.4
Operatives	39	39.0	39.8	60.2
Professional	10	10.0	10.2	70.4
Ordinary citizen	29	29.0	29.6	100.0
Total	98	98.0	100.0	

It was found out that operatives were the highest of the respondents who were working on construction sites at 39% followed by ordinary citizens who had interests in the construction industry standing at 29% some of whom reside adjacent to the construction site. Skilled workers mostly known as the “fundi’s” were 20.4% of the respondents and they were found on construction sites. Professionals mostly from the ministry of public works took 10% of the respondents hence giving their thought on the collapse of building in Mombasa Island.

The analysis and interpretation that follows, is based on the objectives of the study which is to find the causes that contribute to the collapse of buildings in Mombasa Island.

### 4.4 Building materials and how they contribute to the collapse of buildings

The researcher was looking at the standard of the materials, substitute materials, the ratio used in construction and the use of materials in building construction and how these materials contribute to the collapse of building in Mombasa Island

**Table 4.4: How Materials contribute to collapse of buildings**

	Frequency	Percent	Valid Percent	Cumulative Percent
Substandard material use	19	19.0	19.4	19.4
Substitute material use	27	27.0	27.6	46.9
Poor ratio of material used	17	17.0	17.3	64.3
Wrong use of material	35	35.0	35.7	100.0
Total	98	98.0	100.0	

Table 4.4 shows that 37.5% of respondents attributed the wrong use of materials in construction to be the major cause of the collapse of building in Mombasa County. The study further explained that the use of poor ratios of materials contribute the lowest as far as contribution of material to the collapse of buildings is concerned which was rated as 17.3%. Second to wrong use of materials is the use of substitute materials in construction other than the materials recommended by the engineer, this stands out as 27.6%. The use of substandard materials in construction came in at 19.4%. This is also shown in figure 2 below which indicates that wrong use of materials is the leading followed by substitute materials, then substandard materials and lastly the poor ratio of materials. This proofing the hypothesis using the chi-square method shows that the hypothesis to be adopted since

#### 4.5 Testing of hypothesis

$H_0$  Building materials do not contribute to the collapse of buildings

**Table 4.5 Analysis of hypothesis on how buildings contribution to the collapse of buildings in Mombasa Island**

Df	$\chi^2$	P- value	Observed	Expected	O-E
6	15.51	0.05	98	12	86

The critical value: the tabulated value of  $\chi^2 = \alpha$  0.05 for 6-1=5.

The degree of freedom  $n \chi^2$  0.005, 5 = 15.51

The degree of freedom has been presented by 6 and the  $\chi^2$  value by 15.51 with the p- value of 0.05 or less is usually regarded as statistically significant. Since the calculated value of  $\chi^2 = 26$  is greater ( $>$ ) than the tabulated 0.5, 5 =15.51 so the null hypothesis  $H_0$  is rejected and the alternative hypothesis  $H_1$  is accepted. In summary of the test of the hypothesis, building materials contribute to the collapse of buildings.  $n$ , represented by indicators of building materials, the  $\chi^2$  value was established using provision of material index.

#### 4.6 Regression Analysis of materials

Regression analysis is a statistical relationship between two variables, in our case it is the relationship between construction materials and the collapse of buildings, such that if one variable is known, we can estimate or predict the corresponding value of the other variable.

	Frequency	Percent	Valid Percent	Cumulative Percent
Building plan approval	31	31.0	31.6	31.6
Building Approval	19	19.0	19.4	51.0
Building inspection	43	43.0	43.9	94.9
Material approval	5	5.0	5.1	100.0
Total	98	98.0	100.0	

**Table 4.6: Regression Analysis of materials**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.140	8	.140	1.672	.199 <sup>a</sup>
	Residual	8.034	96	.084		
	Total	8.173	97			

a. Predictors: (Constant), Collapse

b. Dependent Variable: Materials

The regression analysis is used to analyze this data since we want to know whether the unknown variable (materials) corresponds with the collapse of buildings which is already known. The study found out that there is a positive relationship between the collapse of buildings and materials used since from the table above there is an indication of a positive 0.199 which is a value above the zero value hence we adopt our hypothesis.

#### 4.7 Local Government and how they contribute to the collapse of buildings

In the local government or the municipality the researcher was looking at building plan approval, building approval, building inspection and material approval and how they contribute to the collapse of buildings.

**Table 4.7: Showing how local government /municipality have contributed to collapse of buildings**

	Frequency	Percent	Valid Percent	Cumulative Percent
Building plan approval	31	31.0	31.6	31.6
<i>Building Approval</i>	19	19.0	19.4	51.0
Building inspection	43	43.0	43.9	94.9
Material approval	5	5.0	5.1	100.0
Total	98	98.0	100.0	

This section is aimed at establishing the role played by the local government that may lead to the collapse of buildings in Mombasa County. The respondents identified inspection of building to be the major cause of building collapse at 43.9%, while approval of building for use had 19.4 % and lastly 5% of respondents thought approval of materials for construction by the council contributed to the collapse of buildings. It is also shown in the fig 3 how municipal council departments contribute to the collapse of buildings in Mombasa County as respondents indicated. It seems that the approval of materials contribute the least to the collapse of buildings.

#### 4.7 Testing Hypothesis

$H_0$ , Local government do not contribute to collapse of buildings in Mombasa Island

**Table 4.8: Analysis of hypothesis on how local government contributes to collapse of buildings**

df	$\chi^2$	P value	Observed	Expected	O-E
4	25	0.05	98	8	90

Critical value: The tabulated value of  $\chi^2 = \alpha = 0.05$  for  $5-1 = 4$ .

Degree of freedom  $n \chi^2 0.05, 4 = 7.49$

Since the calculated value of  $\chi^2 = 0.5$ , is less than  $4 = 7.49$  so the null hypothesis  $H_0$  is rejected and the alternative hypothesis  $H_1$  is accepted. In summary of the test of the hypothesis, local government contributes to the collapse of buildings in Mombasa County. Where  $n$  represent the number of indicators used in the collapse of buildings

#### 4.8 Regression Analysis

Regression analysis being a statistical relationship between two variables, in our case the researcher is looking at the relationship between the local government and the collapse of buildings, such that if one variable is known, we can estimate or predict the corresponding value of the other variable. In our case collapse of building is constant.

**Table 4.9: Regression Analysis of local government**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.401	4	.401	4.959	.028 <sup>a</sup>
	Residual	7.772	96	.081		
	Total	8.173	97			

a. Predictors: (Constant), Collapse

b. Dependent Variable: Municipality

The regression analysis is used to analyze this data since we want to know whether the unknown variable (municipality) corresponds or has a relationship with the collapse of buildings which is already known. The study found out that there is a positive relationship between the collapse of buildings and the role played by the municipality or the local government since from the table above there is an indication of a positive 0.028 which is a value above the 0 value.

#### 4.9 Professionals/ Experts and how they contribute to collapse of buildings

In this case, the researcher was keen on how professionals are not easily available, how they are costly to hire and how they are not well qualified for the kind of work they undertake, that leads to the collapse of buildings.

**Table 4.10: Shows how professionals contribute to the collapse of the building in Mombasa County**

Variable	Frequency	Percent	Valid Percent	Cumulative Percent
They are not easily available	47	47.0%	48.0%	48.0%
They are costly to hire them	46	46.0%	46.9%	94.9%
They are not well qualified	5	5.0%	5.1%	100.0%
Total	98	98%	100%	

Table 4.6 shows that 47% of respondents thought that professionals were not easily available when construction takes place right from the design stage. The cost of getting a profession to be attached to a construction site was too high hence developers tended to avoid them hence the collapse of buildings this was the thought of 46% of the respondents. However 5.1% of the respondents thought that the professionals available in the county were not qualified enough to undertake the kind of jobs they were taking hence the collapse.

4.10 **Testing of hypothesis.**  $H_0$  building professionals do not contribute to collapse of building

**Table 4.11: Analysis of hypothesis on how professionals contribute to collapse of buildings**

df	$\chi^2$	P value	Observed	Expected	O-E
3	52.528	0.05	98	16.6	25.6

Critical value: The tabulated value of  $\chi^2 = \alpha = 0.05$  for  $4-1 = 3$ .

Degree of freedom  $n \chi^2_{0.05,3} = 9.49$

Since the calculated value of  $\chi^2_{0.05}$  is less than  $4 = 9.49$  so the null hypothesis  $H_0$  is rejected and the alternative hypothesis  $H_1$  is accepted. In summary of the test of the hypothesis, local government contributes to the collapse of buildings in Mombasa County. Where  $n$  represent the number of indicators used in the collapse of buildings

#### 4.11 Regression Analysis

In this case, the researcher was looking at the statistical relationship between building professionals and the collapse of buildings, such that, if collapse of buildings is known, we can estimate or predict the corresponding value of the other variable which are building professionals.



**Table 4.12: Regression Analysis of building Professionals**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	.240	3	.240	2.905	.092 <sup>a</sup>
Residual	7.933	96	.083		
Total	8.173	97			

a. Predictors: (Constant), Professionals

b. Dependent Variable: collapse

The study through regression analysis revealed that there is a positive relationship between professionals in construction industry and the collapse of buildings in Mombasa County as indicated in the table above. It shows that there is a positive 1 in the regression analysis definition

#### 4.12 Building procedures and how they contribute to collapse of buildings

In building procedures the researcher was looking into whether building procedures are defaulted, whether there is any emphasis put in the construction procedures and the penalties put in place for construction procedure defaulters.

Table 4.13: Showing how Building Procedures contribute to collapse of buildings

Variables	Frequency	Percent	Valid Percent	Cumulative Percent
Building procedures are defaulted	23	23.0%	23.5%	23.5%
None puts emphasis on building procedures	39	39.0%	39.8%	63.3%
Low penalty on procedure defaulters	36	36.0%	36.7%	100.0%
Total	98	98.0%	100.0%	

Building procedure also dubbed as construction procedures begins from design process, tendering, construction and handing over process and at every process there is a required procedure that is followed for example in design, the client gets the architect and narrates his/her dream to him. He then draws a sketch from which they agree before they seek the services of the quantity surveyor who advises on the cost of the building after which they open the tendering process to get the best contractor. If a process is skipped then the building circle will not be complete hence some processes will not happen properly hence collapse of building. In this case, respondents thought that there is no one who is putting any emphasis on building procedure hence contractor get a leeway to do shoddy work that result in collapse of building this is at 39%. 36% of the respondents thought that the low penalty imposed on defaulters of the building procedures contribute to collapse of buildings. 23% though think that building procedures are defaulted hence the collapse of buildings in Mombasa County.

#### 4.13 Testing hypothesis

$H_0$  Building Procedures do not contribute to collapse of buildings

**Table 4.14: Analysis of hypothesis on how Procedures contribute to collapse of buildings**

df	$\chi^2$	P-value	Observed	Expected	O-E
4	23	0.05	98	12	86

Critical value: The tabulated value of  $\chi^2 = \alpha = 0.05$  for  $5-1 = 4$ .

Degree of freedom  $n \chi^2 0.05, 4 = 1.564$

Since the calculated value of  $\chi^2 = 0.5$ , is less than  $4 = 1.564$  so the null hypothesis  $H_0$  is rejected and the alternative hypothesis  $H_1$  is accepted. In summary of the test of the hypothesis, building procedures contributes to the collapse of buildings in Mombasa County. Where  $n$  represent the number of indicators used in the collapse of buildings

#### 4.14 Regression Analysis

The researcher was looking at the statistical relationship between building procedures and the collapse of buildings whether the relationship is either positive or negative

**Table 4.15: Regression Analysis of building procedures**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.025	4	.025	.293	.589 <sup>a</sup>
	Residual	8.149	96	.085		
	Total	8.173	97			

a. Predictors: (Constant), Procedures

b. Dependent Variable: collapse

The study proved the hypothesis through the regression analysis and adopted it since there is a relationship between the collapse of buildings and the building procedures as indicated in the analysis table above which shows a figure of 0.589 for the procedure, which is a figure close to 1 and any figure above 0 is an indication of a positive relationship.

#### 4.15 Building Developers and how they contribute to the collapse of buildings

Table 4.16: Showing how Developers contribute to collapse of buildings

Variables	Frequency	Percent	Valid Percent	Cumulative Percent
They interfere directly with construction procedure	45	45.0	45.9	45.9
They don't provide sufficient funds for construction	40	40.0	40.8	86.7
They like cheap construction	13	13.0	13.3	100.0
Total	98	98.0	100.0	

Table 4.18; Regression Analysis of building developers

These are the owners of the building. They finance the construction of the building fully from the onset to the completion of the building. While this is their responsibility, most developers tend to be mean on the financing of the project or they don't provide enough money for the construction process. This is the mind of 40.8% of the respondents. 45.9% of the respondents noted that developers interfere directly to the construction processes by giving orders to the contractor to construct as they please so long as they save as much money as they can. 13.3% of the respondents also think that developers like cheap construction process and mind less about the quality of the construction. This is shown in the table and bar-chart provided below.

#### 4.16 Testing hypothesis

$H_0$  Building developers do not contribute to collapse of buildings

**Table 4.17; Analysis of hypothesis on how building developers contribute to collapse of buildings**

df	$\chi^2$	P-value	Observed	Expected	O-E
5	18	0.05	98	12	86

Critical value: The tabulated value of  $\chi^2 = \alpha = 0.05$  for  $6-1 = 5$ .

Degree of freedom  $n = \chi^2 0.05, 5 = 4.354$

Since the calculated value of  $\chi^2 0.5$ , is less than  $5 = 4.354$  so the null hypothesis  $H_0$  is rejected and the alternative hypothesis  $H_1$  is accepted. In summary of the test of the hypothesis, building procedures contributes to the collapse of buildings in Mombasa County.

#### Regression Analysis

In this analysis the researcher was looking at the statistical relationship between building developers and the collapse of buildings, whether the relationship is positive or negative

UNIVERSITY OF NAIROBI  
 KUYU LIBRARY  
 BOX 30197  
 NAIROBI

**Table 4.18; Regression Analysis of building developers**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.019	5	.019	.218	.641 <sup>a</sup>
	Residual	8.155	96	.085		
	Total	8.173	97			

After the study of building developers the study through regression analysis found out that there is a positive relationship between building developers and the collapse of building in Mombasa County. A positive 0.641 indicates that the relationship is much close to 1 hence a strong relationship.

This study was carried out to find out the causes of collapse of building in Mombasa County. This is because collapsed projects have been put due to the collapse of buildings in our major towns or cities which also includes Mombasa city. The study looks on the major causes of project collapse and tries to determine the causes stated in relation to the given objectives from the respondents' views. The result revealed that most of the respondents who were involved in the study felt that all the highlighted causes contribute to the collapse of buildings in Mombasa County.

The researcher has also seen while the industry and the people who are directly involved in the construction process. These people included the people involved from the authority of public works like the district works officers, architects and draughtsmen, engineers, and the idea of customers, and in this case included the role of the building industry and the government bodies like the respondents to also give their contribution on the collapse of building. The respondents who were involved, these were people who have been involved in the building sites and local workers in the area. It is from these people that all information gathered in the research was drawn from. It was found out that most respondents were in agreement with all the causes that were reported.

### 5.3 Discussion of findings

In this study, most of the respondents agree with the literature review but there were small deviations from the expected results.

## CHAPTER FIVE

### SUMMARY OF FINDINGS, DISCUSSIONS CONCLUSIONS AND RECOMMENDATIONS

#### 5.1 Introduction

This chapter gives the summary of finding as per the objectives of this study. It is followed by a brief discussion of the findings which shows that most of the findings were in arrangement with the literature review. This chapter also gives the conclusion, the recommendations of the study as well as areas of further research.

#### 5.2 Summary of the study finding

This study was carried out to find out the causes of collapse of building in Mombasa County. This is because lives and property have been lost due to the collapse of buildings in our major towns or cities which also includes Mombasa city. The study looks on the major causes of this collapse and tries to determine the main causes in relation to the given objectives from the respondent's view. The result revealed that most of the respondents who were involved in this study felt that all the highlighted causes contribute to the collapse of buildings in Mombasa County.

The researcher based his study within the industry and the people who are closely involved in the construction process. These people included the professionals from the ministry of public works like the district works officer, architects and draughts men. He also sought the idea of contractors, and in this case he looked into the skilled labors (fundi) and the unskilled labors like the operatives to also give their contribution on the collapse of building. Ordinary citizens were also consulted. These were people who supply materials to the construction sites and food vendors to the site. It is from these people that all information provided in this research was drawn from. It was found out that most respondent were in agreement with all the causes that were enlisted

#### 5.3 Discussion of findings

In this study, most of the objectives agree with the literature review but there were small deviations from the expected results.

From the study it was found out that building professionals contributed to the collapse of buildings in Mombasa County where by the professionals are not easily available to be involved in the whole construction process. They can be found within a very short time during the construction process and the rest of the building process is left in the hands of unqualified people who end up with a mess in construction this factor attracted 47% of the respondents. 46% of the respondents thought that professionals are quite expensive to acquire for construction process of a medium size building hence the use of unqualified people for construction by the developer. The issue of professionals not being well qualified attracted the attention of only 5% of the respondents

### **5.3.1 Building Materials**

Building materials that were discussed by the respondents included building stones, bricks, cement, reinforcement bars, timber used for roofing and formwork. These materials were discussed one after the other and 35% of the respondents thought that the wrong use of materials was the major cause of collapse of buildings. This is where materials are put to perform a function they were not designed to perform. Substitute materials also were a major cause of collapse of building and respondents thought that a situation where the contractor finds it hard to acquire a certain materials he/she goes for other materials that can do the job even though they are not recommended for the work sometimes, contractors just preferred to use other materials to substitute the ones designed for the job they so that they can save extra money. This is due to the fact that they were a bit expensive or they are not easily available this fact had a backing of 19% of the respondents. The remaining 17% of the respondents thought that the ratios used to mix construction materials caused the collapse of building. They gave an example of concrete, which is a mix of cement, sand, ballast and water. An architect or an engineer provides a ratio for mixes in specific construction areas that ought to be followed by the contractor for example he can give a ratio of 1:2:4. This indicates that one bag of cement is to be mixed with two wheelbarrows of sand and four wheelbarrows of ballast. A contractor may decide to have a ratio of 1: 3: 6 for the same area of construction. This will be a weak mix that may lead to collapse of the building.

### **5.3.2 Local government/ Municipality**

The municipality or the local government was looked into, under this, the researcher wanted to know the extent building plans approvals caused collapse of building in Mombasa County and 31.6% respondents thought that failure to approve building plans contributed to the collapse of buildings. the inspection of buildings under construction was seen to be the major cause of building collapse where 43.4% of the respondents thought that the local government which is responsible for inspection of buildings under construction failed to inspect building under construction hence giving contractors and developers a chance to change the approved plan to what they desire. For example, the council may approve a three storey building but the contractor and the developer may continue to seven storey and this may alter the structural design hence exposing it to collapse. 19.4% of respondents also thought that approval of buildings for use, lead to collapse of building since it is a way of changing the design for which the building was designed for and lastly but not least inspection of building materials caught 5.1% respondent attention and thought that the council do not inspect the building materials that are used in construction hence exposing the building to the danger of collapse.

### **5.3.3 Professionals/ Experts**

Professionals in building construction industry include the civil and structural engineers, architects, quantity surveyors, mechanical engineers and electrical engineers. 47% of the respondents thought that professionals in this field are not easily available to manage the building sites which makes it had for managers on site to make some technical decisions about the building, hence the decisions made by these unqualified personnel on site may lead to collapse of the buildings in Mombasa County. Professionals are also thought to be very expensive to acquire for small and middle size constructions since developers feel that they cannot be able to pay for the services of these professionals hence leaving the construction in the hands of unqualified people who end up making wrong decisions that lead to collapse of buildings. Some 5% of respondents thought that some professionals are not competent enough to lead construction site since they are not well qualified this is what leads to collapse of buildings in Mombasa County.



### **5.3.4 Building Procedures**

Building construction like any other formal organization has an organized procedure that is followed for example: design stages, tendering stage, actual construction and handing over of the building to the owner. When these procedures are defaulted then some steps are neglected which will definitely weaken either the construction team or the actual construction process itself hence the collapse of the building these are thoughts of 23.5% of respondents. 39% of respondents thought that building laws and regulations are not emphasized hence letting some people break them knowing that they will not be penalized in any way. Building laws are in a book called the building code. This building code has specific rules to be followed at every construction process and provides the methods to be followed. This is the factor that most respondents thought that leads to collapse of most buildings in Mombasa County. The penalty imposed on defaulters of building laws is very low, for example a quack designs a building and collapses and the only penalty he might face is some few years in jail and he ends up being freed and sometimes they are told to pay some amount of money and they are let free to continue with their work such defaulters don't fear being penalized, 36% of respondents thought so.

### **5.3.5 Building Developers**

Developers are usually the owners of the buildings or in other terms, they are the financiers of any construction project. These people are said to directly interfere with the construction process where at some point they demand some things to be done which may compromise the stability and strength of the buildings. For example the developer may decide on site that he wants a certain design to be changed immediately and the contractor can never disobey the owner and such decision in most cases leads to collapse of buildings. 45.9% of respondents thought so but 40.8% of respondents thought that these developers at some point do not provide enough funds for their project forcing contractors to minimize the available resources for completion of the building. This usually makes the structure weak since at this point mix ratios are compromised making the building weak that may end up collapsing and even at some stages a building may stall for quite some time because the owner doesn't have money for completion and once the building has stayed for so long exposed to the environment, it becomes weak and eventually it will develop some points of weakness and

once construction commences it may collapse. 13% of respondents thought that some developers like cheap construction so that they can save some money and as the saying goes cheap is expensive. As they struggle to make the construction cheap the building is weakened and before completion it may collapse.

#### **5.4 Conclusion**

Finding the causes of building collapse in Mombasa County has a great potential in reducing the cases of loss of lives and property through the collapse of building which is rampant in the County.

The researcher is encouraged by the increasing interest of knowing the real causes of building collapse in Mombasa County by many stakeholders who happened to be the respondents in this research as well as the government. It is even more encouraging to see the demand for such a research to be carried out over the media as many buildings are collapsing in other major cities. May be they want action to be taken to reduce this menace? That is yet to be seen.

However, while this is away out of collapsing of buildings, there is need for the government to pass the laws that govern the building industry and ensure that the laws are strictly followed and those people who are found breaking these laws should be held responsible and the penalty towards the defaulters to be increased from what it is now so that these people should create some fear of breaking these laws while dealing with construction of buildings.

The finding from the study however indicated that, most developers do not plan well before they engage in the construction process. This is because, at times they get short of finances while still doing the construction since they don't involve experts like the quantity surveyor who can give the estimates of the building way before construction commences. Developers therefore are advised to be involving experts right from planning stages to completion stages.

From the study, building materials should at all times be tested by well qualified personnel recommended by the government and these materials should at all times be used as they are designed in the architectural of engineer's designs so as to avoid weakening the building. Therefore, building materials, professionals, contractors, building procedures and building

developers, the research has revealed that they contribute immensely towards the ultimate collapse of building in our major cities where Mombasa county is just but one of the cities in question

## **5.5 Recommendations**

The study makes the following recommendations:-

1. The local government should at all times approve buildings and ensure that they are well supervised from onset to the completion.
2. The government should employ more professionals in the building and construction industry and hence dispatch them to various Counties.
3. The government should set up enough laboratories for testing building materials and employ well qualified personnel to carry out this work.
4. Allocations should be increased to research institutions to facilitate research on specific aspects in construction like the building materials and other related aspects and also consider imposing a research levy on the building construction industry.
5. The government should increase allocation for purchasing more equipment to cope with the demand.
6. All research actors should harness and document all existing and already known causes of building collapse and disseminate this information to the users as appropriate.
7. Promote and encourage all small and large contractors to engage in the application of researched materials.
8. The public, private and voluntary sectors should be encouraged to utilize the research materials in their construction programs.
9. More efforts should be made to promote intensified training in requisite skills and safe construction processes through youth polytechnics, women and youth groups and community-based organizations.
10. The government should ensure that all its organs that are directly involved with the construction industry to be effective in its work.

## 5.6 Suggestions for further research

Causes of collapse of buildings are a technological view and focuses on the engineering part of research. More research needs to be done on the effect of the collapse of buildings on social aspects perspective.

## REFERENCES

- Adams, E. a. (2001). *Building materials used for Construction in Sudan* . Paris: unesco.
- Adema, k. .. (2006). *Proposal and Thesis writing an introduction*. Nairobi: paulines publication Africa.
- Alfrodo, S. a. (2004). *innovative Financing for low income housing* . Lund: Rahns Tryckeri AB.
- Anita, L. (2001). *Perspective in housing and planning* . Lund: CombiGrafik.
- Baris, D. P. (2001). *Construction Failures and impact on environment*. Lund: CombiGrafiki.
- Bo Johansson. (1993). *Concrete roofing tiles and other materials*. Lund: Lwgrafik.
- Brian, J. (2010). *The way to built (Thomas, 2009) safely* . Nairobi: Paulines Publication Africa.
- Editions, C. R. (13. May 2005). Architecture Failure in Uganda. *Pilot Project in Bushenyi* , S. 254-260.
- George, M. (1996). *Service for the Urban Poor*. Lund: CombiGrafik.
- Goran, F. (1996). *Economical Use of Cement in Concrete*. Lund : CombiGrafik.
- Goran, T. &. (2006). *More Urban Poor Less Poor*. London: Earthscan.
- Goran, T. P. (1995). *Economical Use of Cement* . Lund: CombiGrafik.
- Guta, S. (2001). *Statistical Methods*. New Delhi: Sultan Chand & Sons.
- Hans, R. (2001). *The Design of Buildings using Real Technology* . Lund: CombiGrafik.
- Housing, M. o. (2004). Housing Policy for Kenya. *government printers* (S. 16). Nairobi: government printers.
- Housing, M. o. (2004). Simplified Version of Existing Housing Policy for Kenya. *government publisher* (S. 18). Nairobi: Government publisher.
- Hydraform. (2005). *Machine Construction and Building Mannual* . Sanward Park: Hydraorm.

- Institute, H. a. (2003). *Construction Building Materials (CBM's)*. Nairobi: Great Printers.
- John, N. (1998). *Woodless Construction*. Lund : CombiGrafik.
- Kenneth, S. (1995). *Mortars for Masonry and Rendering Choice and Publication*. Lund: CombiGrafik.
- Kenya National Bureau of Statistics. (2006). *National Population and Housing Census Report*. Nairobi: Government Printers.
- Kenya, R. o. (2008). *Presidential Circular*. Nairobi: Government Publishers.
- Kenya national bureau of statistics. (2006). *national population and housing census*. nairobi: kenya national of bureau of statistics.
- lars-anders, H. (1993). *Cement-bonded sraw slabs*. Lund: combiGrafik.
- Mogenda, O. a. (2003). *Research Meethods; Quantitative and Qualitative Approach*. Nairobi: ACTS Press.
- Per, I. (1994). *Faults and Faiilure Pre-Fabricated Housing*. Lund: CombiGrafik.
- Perez, A. (2009). *Mission Report, ISSB technoogy in Uganda.Disaster Management Programme*. Nairobi: UN-Habitat
- Sabastian, T. (2010). *Construction Struggle in Africa*. London: Richson Publishers.
- Services, M. E. (22. february 2012). *Makiga*. Abgerufen am 22. february 2012 von [www.makiga.com](http://www.makiga.com): [www.makiga.com](http://www.makiga.com)
- Services, M. E. (2011). The ground breaker . *Makinga engineering* , 07. (Mogenda, 2003)
- Shi Ch, S. &. (2010). *Unstable Condition that leadto Building Failure*. New Delhi: Bhavan.
- Subroto, P. M. (1993). *Human and Machine Labour in Bulding Construction*. New Delhi: Tara Crescent.
- Statistics, K. B. (2006). *Kenya Intergrated House Holds Budget Survey*. Nairobi: Government Printers.

Syagga, P. (1993). *Promoting the Use of Appropriate Building Materials in Shelter Provision in Kenya*. Nairobi: Habitat International.

Tennerfeidt, G. &. (2006). *More UrbanLess Poor: An Introduction to Urban Development and Management*. London: EarthScan.

Thomas, M. &. (2009). *Construction in Africa*. Chicago: Wiseman Publishers. (Sabastian, 2010)

Ulf, C. &. (2006). *Low-Cost Pavings*. Lund: CombiGrafik.

UN-Habitat. (1991). *Building Collapse in Kenya*. Nairobi: UN-Habitat.

UNHCR. (2009). *Loss of Lives in Collapsed Buildings: Construction Technology in Uganda*. Nairobi: UNON Publishing Services Section.

Zadock, G. (2004). *The Falling Structures*. New Delhi: Shgri Press.

Dear Sir/Madam,

I am Mr. Vincent M. Obuya a student pursuing a Master of Arts course in project planning and management at the University of Nairobi. As a requirement of the same and in partial fulfillment of the requirements for the degree I am to submit a research report. I therefore intend to carry out a study on factors contributing to the collapse of building in Mombasa County. The purpose of the study is to engage the government and other relevant stakeholders to come up with more elaborate building codes and regulations that will reduce these incidents of collapse of buildings within the county.

The findings of the study will be essential in ensuring that the building regulations are adhered to and all policies and programmes are put in place.

For this purpose I am hereby requesting for permission to conduct the research in Mombasa city.

Yours faithfully,

Vincent M. Obuya

Registration number: LS0860372010

*Appendix 1 :Permission to conduct research*

Vincent M. Obuya

P.O Box 97513- 80112

Mombasa

The District Commissioner,

P.O Box 1

Mombasa

Dear Sir/Madam,

I am Mr. Vincent M. Obuya a student pursuing a Master of Arts course in project planning and management at the University of Nairobi. As a requirement of the same and in partial fulfillment of the requirements for the course I am to submit a research report. I therefore intend to carry out a study on factors contributing to the collapse of building in Mombasa County. The purpose of the study is to enable the government and other relevant stakeholders to come up with more elaborate building codes and regulations that will reduce these incidents of collapse of buildings within the Mombasa city.

The findings of the study will be essential in ensuring that the building regulations are adhered to and all policies on construction are put in place.

For this purpose I am kindly requesting for permission to conduct the research in Mombasa city.

Yours faithfully,

Vincent M. Obuya

Registration number: L50/66037/2010



*Appendix 2: Letter of transmittal of data collection instruments*

Dear Sir/Madam

I am Mr. Vincent M. Obuya a student pursuing a Master of Arts course in project planning and management at the University of Nairobi. As a requirement of the same and in partial fulfillment of the requirements for the course I am to submit a research proposal. I therefore intend to carry out a study on the factors contributing to the collapse of building in Mombasa city in Mombasa County. The purpose of the study is to make possible recommendations for effective and efficient construction process with minimum risks of collapse of buildings.

I would therefore like to ask a few questions on the factors contributing to collapse of building in Mombasa city. This is however voluntary as you do not have to answer questions that you are not comfortable with.

I do request you to give answers to the best of your knowledge. All information will be treated with utmost confidentiality.

Thank you in advance.

Yours faithfully

Vincent M. Obuya

### RESPONDENT QUESTIONNAIRE

I am currently a student at the university of Nairobi where I am pursuing a course leading to a Master of Arts in Project Planning and Management. In order to successfully complete this course, I must conduct and submit for examination a research project on "factors contributing to the collapse of buildings" that will reduce the loss of lives and properties as a result of collapse of buildings.

Having been in contact with building construction, you have been randomly selected to participate in this study that will take place in Mombasa County. Your participation will be highly appreciated and I would like to assure you that the information you will provide will be used solely for academic purposes.

#### Gender

Male

Female

What is your academic qualification? Please specify

Primary level

Secondary level

Above secondary level

#### Location

a) Mombasa.....

b) South coast.....

c) North Coast.....

d) Other places.....

#### Occupation

a) Fundi.....

b) Operatives.....

c) Supplier.....

Professional.....

Ordinary citizen.....

Do you constantly deal with building construction industry?

Yes  No

What capacity?

Fundi.....

Operatives.....

Supplier.....

Professional.....

Ordinary citizen.....

How long have you been in the construction industry?

Less than 1 year  1 Year  2years  3years  more than 3

Have you ever come across a collapsed building in Mombasa county?

Yes  No

If yes, who was responsible exactly?

Fundi.....

Operatives.....

Supplier.....

Professional.....

Ordinary citizen.....

Were there any loss of lives or property?

Yes  No

If yes, please explain briefly

- a) Loss of lives.....
- b) Loss of life and Property.....
- c) Loss of Property.....

10. What do you think was the course of the building to collapse?

- a) Substandard materials.....
- b) Substitute materials.....
- c) Poor ratio of material used.....
- d) Wrong use of materials.....

11. Who should be held responsible for the collapse of the building

- a) Building developers.....
- b) Contractors.....
- c) Professionals.....
- d) Municipality.....

12. Why should the above mentioned individual(s) be responsible? Please explain

- a) They lack professionalism.....
- b) Saving more money.....
- c) They like shortcut construction.....
- d) They dont supervise construction progress.....

13. Do you think building materials contribute to the collapse of buildings in mombasa county?

Yes

No

If yes, explain briefly

- a) Use of substandard materials.....
- b) Use of substitute materials.....
- c) Poor ratio of materials.....

d) Wrong use of materials .....

14. Do you personally believe building specialist or professionals have contributed to the collapse of buildings in mombasa?

Yes

No

If yes, what are the reasons?

a) They are not easily available.....

b) They are expensive to hire.....

c) They are not well qualified.....

15. Do the local government or the municipal council of mombasa have an hand in the collapse of buildings in the city?

Yes

No

Explain briefly please.

a) They don't approve building plans.....

b) They don't approve building in use.....

c) They don't inspect buildings on construction.....

d) They don't inspect materials used for construction .....

16. Building developers do contribute to the collapse of buildings in mombasa county. Do you agree with this statement

Yes

No

If Yes, please explain

a) They directly interfere with construction procedures.....

b) They don't provide sufficient funds for construction.....

c) They like cheap construction process .....

you think should be done to reduce the incidents of building collapse in this

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

.....  
1 suggestions on building construction in mombasa county?

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

17. What do you think should be done to reduce the incidents of building collapse in this County?

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

18. Any general suggestions on building construction in mombasa county?

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