REVIEW OF THE LOCAL GOVERNANCE BUILDING CONSTRUCTION QUALITY CONTROL FRAMEWORK IN ZAMBIA-CASE OF LUSAKA CITY

BY

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(MEng-Construction Management)

THE UNIVERSITY OF ZAMBIA

LUSAKA

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DECLARATION

I, Jere, Nahum Stackson, do hereby declare that the work presented in this dissertation is the result of my research work except to the extent indicated in the Acknowledgements and references and comments included in the report and that it has not previously been submitted for any degree at this or another University.

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APPROVAL

This dissertation of Jere Nahum Stackson is approved by the University of Zambia as partial fulfilment of the requirements for the award of the degree of Master of Engineering in Construction management by the University of Zambia

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ABSTRACT

Building Construction in Zambian has been booming at a faster rate than ever before. Local authorities have had the challenge of pacing up in quality control with these fast developments. The integrity of built infrastructure in a city guarantees safety of occupants, minimises maintenance costs to buildings, and safeguards the economic investments secured in the infrastructure. This results in important savings which can be available for economic growth. The quality of built infrastructure in Zambia has been clearly put to the test by adverse conditions as heavy storms and floods, earth vibrations and movements, and fires. These incidental conditions are all becoming too common in Zambia, especially with the effects of climate change. The news media reports houses and buildings collapsing, roofs being blown off, and public infrastructure damage especially during the rainy months of October to March. Noteworthy also is the many reported fires to buildings, and the limited buildings resilience to fires, compromising the structural integrity of the infrastructure. More diverse is the residential building construction, which accommodates all classes of social and economic standing. It is therefore important to identify the factors affecting the quality of building infrastructure in Zambia. This research focussed on identifying these factors to the built environment with central focus on one of the fastest developing cities in Zambia, Lusaka. Key input was sought from the developers in Low, Medium, and High-cost development areas of Lusaka. The Institutional mechanisms of the Local authority on development control were also reviewed to identify gaps in the building quality control. It was evident from the research that most developers lacked the technical input into the design and construction methodology of their developments. This was further exacerbated by the inadequate stage inspections to buildings by the Local authority, prolonged timelines to obtain approvals, and gaps in the design scrutiny framework. The identified factors and gaps affecting building construction quality forms a clear basis for regulatory review.

Key Phrases: Building Construction, Developers, Institutional framework.

DEDICATION

To the late ***Stackson Jeryvas Jere****, a great inspiration of hard work and diligence despite being blind. A true example of not letting drawbacks and challenges determine final outcome. To a loving Father.*

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Not forgetting my loving wife Monde, for the support and being a patient research assistant in the Peri-Urban settlements, and my three research assistants namely Kochelani Saili, Chakuthali Hara, and Tresphor Lengwe for their endurance and patience in the data surveys.

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ACRONYMS AND ABBREVIATIONS

CPD	City Planning Department
ECZ	Environmental Council of Zambia
EIZ	Engineering Institute of Zambia
GRZ	Government of the Republic of Zambia
JICA	Japanese International Cooperation Agency
LA	Local Authority
LCC	Lusaka City Council
MCC	Millennium Challenge Corporation

MLGRD	Ministry of Local Government and Rural Development
NCC	National Council for Construction
PWDRE	Plans, Works, Development and Real Estate Committee
ZEMA	Zambia Environmental Management Agency
ZIA	Zambia Institute of Architects
ZNBC	Zambia National Broadcasting Corporation
ZSA	Zambia Statistical Agency

CHAPTER 1: INTRODUCTION

1.1 CHAPTER OVERVIEW

This chapter introduces the problem and defines the aim and objectives of this research.

1.2 BACKGROUND

Cities in Zambia are faced with rapid population expansion. This is a product of the increase in national population increase. As of 8th September, 2022, the Zambia Statistics Agency (ZSA) reports a national population of 19,610,769 (ZSA, 2022 press release). The country covers a land area of 752,618 km2 (World Bank 2018b). This translates into a national population density was 26.1 persons per square kilometer, compared with an average density of 44 persons per square meter in sub-Saharan Africa (Cheelo, et all 2020). This depicts an increase in the number of persons per square kilometer at national level from 17.4 in 2010 to 26.1 persons per square kilometer in 2022. ZSA reports that Lusaka Province was the most densely populated with the density of 140.1 persons per square kilometre. The second most densely populated province was Copperbelt with a density of 88.0 persons per square kilometre. North Western Province was the least densely populated with 10.1 persons per square kilometer. These prevailing statistics indicate that (1) There is clear anticipation of more potential increase in building construction, as more land is yet to be developed and (2) The densely populated districts like Lusaka have increased demand for building construction. Lusaka Urban District, where the capital city is located, has by far the highest population density at 5,808 persons per square kilometer compared with, say, 856 persons per km2 in the second most densely populated district, Kitwe (Brinkhoff 2018). Lusaka has therefore established itself as the most preferred destination for private investments in residential housing, as well as in commercial private buildings for office accommodation and retail space (shopping malls and supermarkets). The demand for related building construction services is therefore much greater in Lusaka than in other parts of the country. This proportionately increases the demand for new housing and infrastructure in the city. As a result, there is a strain on Local authorities' institutional mechanism to pace up the building construction quality needs.

The quality of building infrastructure in Zambia has been tested with the global climate change adverse climatic conditions i.e. More heat, floods, winds, etc. the following news reports illustrates this:

- Zambia Daily Mail, December 24, 2014:

''GOVERNMENT has distributed 45 tents to homeless families of Mazabuka whose houses collapsed following last Mondays downpour…

Last Monday around 09:00 hours, a hailstorm left 120 families of homelessafter their houses collapsed in four townships of Mazabuka. The affected residents are from Makalanguzu, Zambia, Hillside andChanga-Changa townships.''

Figure 1: Collapsed house in Mazabuka (Source: Zambia Daily Mail News 24th December, 2014)

- ZAMBIA Daily Mail: November 22, 2015 :

*'**OVER 50 houses have collapsed** in Kitwe following a downpour on Friday night, leaving several families without shelter. Five churches in Garneton – Baptist Church, Seventh Day Adventist Church, Pentecostal Assemblies of God, Life in Christ Church and Chipangano Church –also crumbled in the hailstorm.*

*..Church services today could take a different form at congregations that have had **the roofs of their buildings ripped off.** Kitwe district commissioner Chanda Kabwe, who visited some of the affected residents, said the initial assessment is that 50 houses have been affected.''*

- Zambia Daily Mail: March 15, 2017

*OVER 180 families have been rendered homeless after their **houses collapsed** in Shilenda Ward in Kalumbila district, North-Western Province, as a result of heavy rains that have been pounding the area insistently.''*

- *ZNBC November 23, 2021*

*''**Over 28 houses have collapsed** in Chingola's Ipafu area on the Copperbelt province following heavy rains that characterised the district.*

Figure 2: Picture showing one of the collapsed houses in Chingola (Source: Zambia National Broadcasting Corporation (ZNBC) News Online 23rd November, 2021)

These news captions demonstrate that the building infrastructure quality is under test from the climatic and environmental adverse conditions. These adverse conditions continue to test the resilience of built infrastructure.

More related to the destructive rain storms experienced in Zambia are the frequent floods experienced in many districts of Zambia which are a result of increased rainfall patterns, poor drainage infrastructure, and effects of poor area planning amongst other factors. Floods also test the resilience of Building construction. Flooding has been increasing in the recent years, with the highly prone areas illustrated in figure 3 below and Table 1 below:

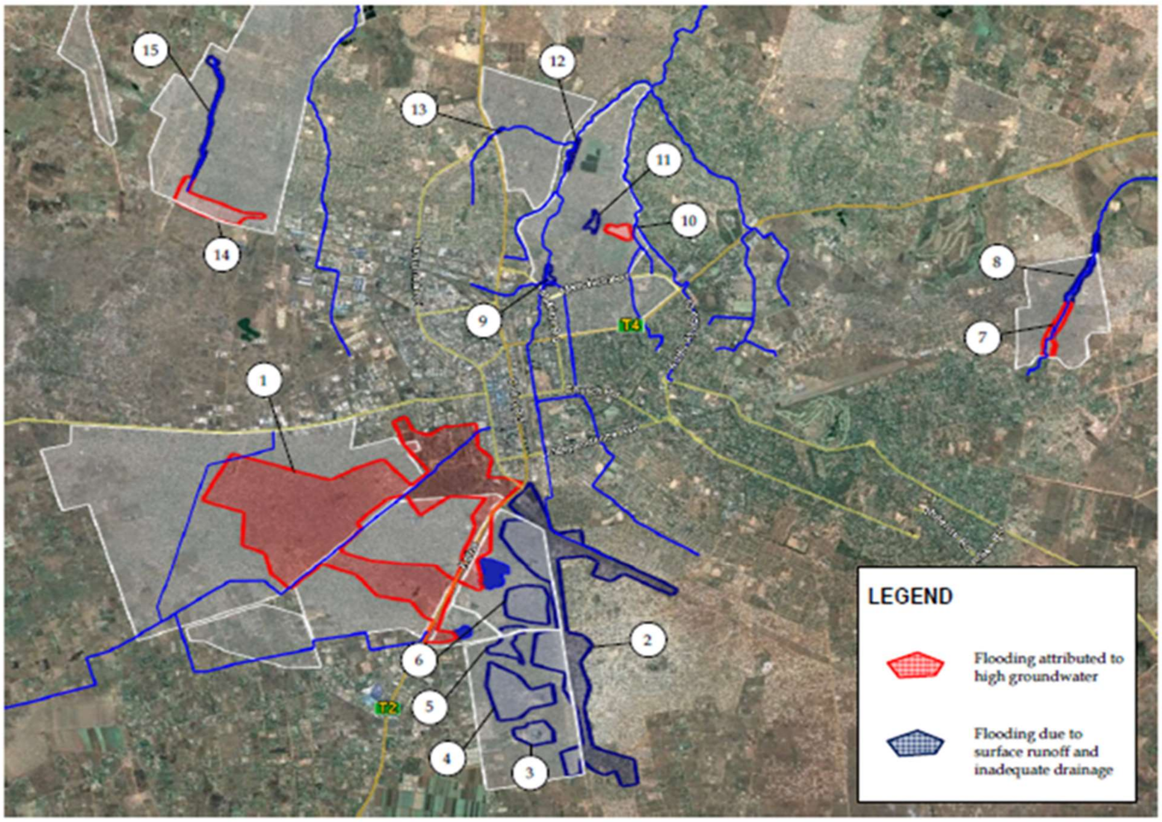


Figure 3-Flood prone areas of Lusaka

Source: Lusaka Drainage Investment Plan (MCC, 2011)

Table 1: Flood prone areas of Lusaka (Source: Lusaka Drainage Investment Plan (MCC, 2011)

Number	Area
1	Kanyama, John Laing, Kuku
2	Kamwala South 1
3	Kamwala South 2
4	Chawama Central
5	Chawama North
6	Misisi East

7	Misisi North
8	Upper Kalikiliki
9	Lower Kalikiliki
10	Chilulu Garden
11	Luangwa (Garden)
12	Garden
13	Garden West
14	Mandevu
15	George South
16	Balastone

The Lusaka Drainage Investment Master plan by Millenium Challenge Corporation (MCC, 2011) identifies some of the areas prone to flooding as Kamwala South, Kanyama, Chawama, Misisi, Kalikiliki area (including Kabulonga extension), Mandevu and George Compounds. It also identifies the two main sources for flooding: high ground water in some of these areas and surface runoff due to inadequate drainage.

Building construction also needs to be resilient to other factors as Fire, and Earth movements, and needs to be responsive to the need for sustainable development.

1.3 STATEMENT OF THE PROBLEM

There has been a marked increase in building construction around the City of Lusaka. Quality of building construction is regulated by legislation contained in several legislative instruments.

During the past few decades, development of the city was carried out using well intended but out-dated development guidelines. The approved development plan by Doxiadis was completed in 1975 and came into force in 1978. The plan was supposed to be reviewed after every five years; however, it has not been updated since (LCC&ECZ, 2010).

Undoubtedly, building construction trends have evolved from the 1975 review. Suffice to say, we do not have an effective regulatory mechanism to ensure quality building control.

It is noteworthy that most reported building collapses in Zambia are in low-income settlement areas. This trend might indicate a gap in the building control services by the local authorities, and a knowledge gap of the factors influencing developers in quality building construction. We do not know the gaps in enforcing quality building control by Local authorities, neither do we know the factors influencing developers in quality building construction. Therefore, there is need to investigate the Legislative and institutional framework of the Local authorities relating to quality building construction, and also match it with the developer trends and attitudes in quality building infrastructure.

1.4 AIM OF THE STUDY

The main objective of the study was to investigate the factors affecting developers in quality building construction and to review the Local authority operational framework in enforcing quality building construction.

1.5 STUDY OBJECTIVES

i) Investigate factors amongst developers affecting the quality of building construction.

i) Review the adequacy of the Local authority operational framework in enforcing quality building construction.

1.6 RESEARCH QUESTIONS

i) What factors affect amongst developers affect the quality of building construction?

ii) What gaps exist in the operational framework of Local authorities in enforcing quality building construction?

1.7 SIGNIFICANCE OF THE STUDY

This study identifies the gaps in building construction quality control by Local authorities. It will form a good basis for regulatory reform for all local authorities and Central government in Zambia in relation to building construction.

1.8 OPERATIONAL DEFINATIONS

The following are the operational definitions as used in this research:

1. Local authority: This will primarily refer to the Lusaka Local authority.
2. Developer: This will refer to individuals or corporates involved in the building construction process.

1.9 SCOPE

This research will identify the gaps in the regulatory framework of local authorities in Zambia in building construction control. Whilst a perfect indication of these gaps would have been possible if all local authorities participated in the research, an accurate and indicative existing scenario for all local authorities is obtainable by the review of Lusaka City framework. Whilst there are some differences and variations in the institutional framework of each Local authority, these are inconsequential to this research. Also, noteworthy, is that Lusaka city council is amongst the highest graded Local authority having the ‘City’ status classification of the Local government act. Also, as elaborated in the background, the City of Lusaka has had the fastest population growth rate. This is owing to the population drift from other towns to the capital, in search for ‘greener pastures.’ Therefore, the building quality control by the local authority is well stretched in the fastest growing city of Lusaka, thereby providing the opportune case study for all upcoming Local authorities.

Also, whilst there are a number of different types of building constructions taking place in a city i.e shopping malls, apartment buildings, Hospitals, Clinics, Government infrastructure, etc, this research has focussed on residential building developers, as these developers cover the majority of building developments in a city. Also, residential developers encompass all the social and economic groupings in a city.

Therefore, the research focusses on Lusaka City Councils institutional framework and Lusaka City developers.

CHAPTER 2: LITERATURE REVIEW

2.1 OVERVIEW OF STUDY AREA

Lusaka province has experienced population increase in the recent years. The population of Lusaka province was estimated at 3,079, 964 as of September 2022 census. This represented a percentage increase of 40.6 percent from the 2010 census survey. Table 0-2 shows the population growth by provinces of Zambia.

Table 2: Population by provinces (Source: Zambia Statistical Agency, 2022)

With steady increase in population, there is increased pressure for land for building development. Land is a principle necessity to human livelihood. It is an important resource of necessity for human, animal and plant life and should be managed sustainably for the benefit of both the present and future generations. Rapid population growth in Lusaka and competing uses has led to increased pressure on land. For instance there is an increase in the conversion of agricultural land to residential use.

Overcrowding, spontaneous construction and lack of financial resources have made it difficult to provide services such as proper roads, street lighting, and Sanitation and *drainage systems* in peri-urban areas. These facilities, especially drainage systems have led to flooding in these areas, resulting in eroded and compromised building structures and houses. In most cases, these areas are either squatter settlements or are settlements that have unregistered households and as such, little or no revenue is raised from them. On the other hand, provision and maintenance of services to low density areas is costly as services are provided to few households but covering large areas. Table 4 below shows the anticipated Lusaka Land use by the year 2030, and Figure 8 show the proposed Land use plan by JICA (2009) for Lusaka city.

Table 3-Lusaka Land use plan projections 2030-Unit: Hectare

Category	2030		
	Lusaka	Adjacent Area	Total
Agri (high-intense)	1,077	6,260	7,337
Agri (low-intense)	0	10,000	10,000
Rural settlement	4,360	7,570	11,930
Residential	24,040	4,270	28,310
High-dense	3,080	0	3,080
Medium	12,430	3,840	16,270
Low	8,530	430	8,960
Commercial & Business	1,130	200	1,330
Industry	1,850	1,680	3,530
Public Use	3,700	2,210	5,910
Park & Recreation	4,080	700	4,780
Green & Open Space	2,100	6,028	8,128
Vacant/ grass & bush	0	4,760	4,760
Total	42,337	43,678	86,015

Note: * Adjacent area covers some portion of three adjacent Districts of Kafue, Chongwe in Lusaka Province and Chibombo District in Central Province

Source:JICA StudyTeam.

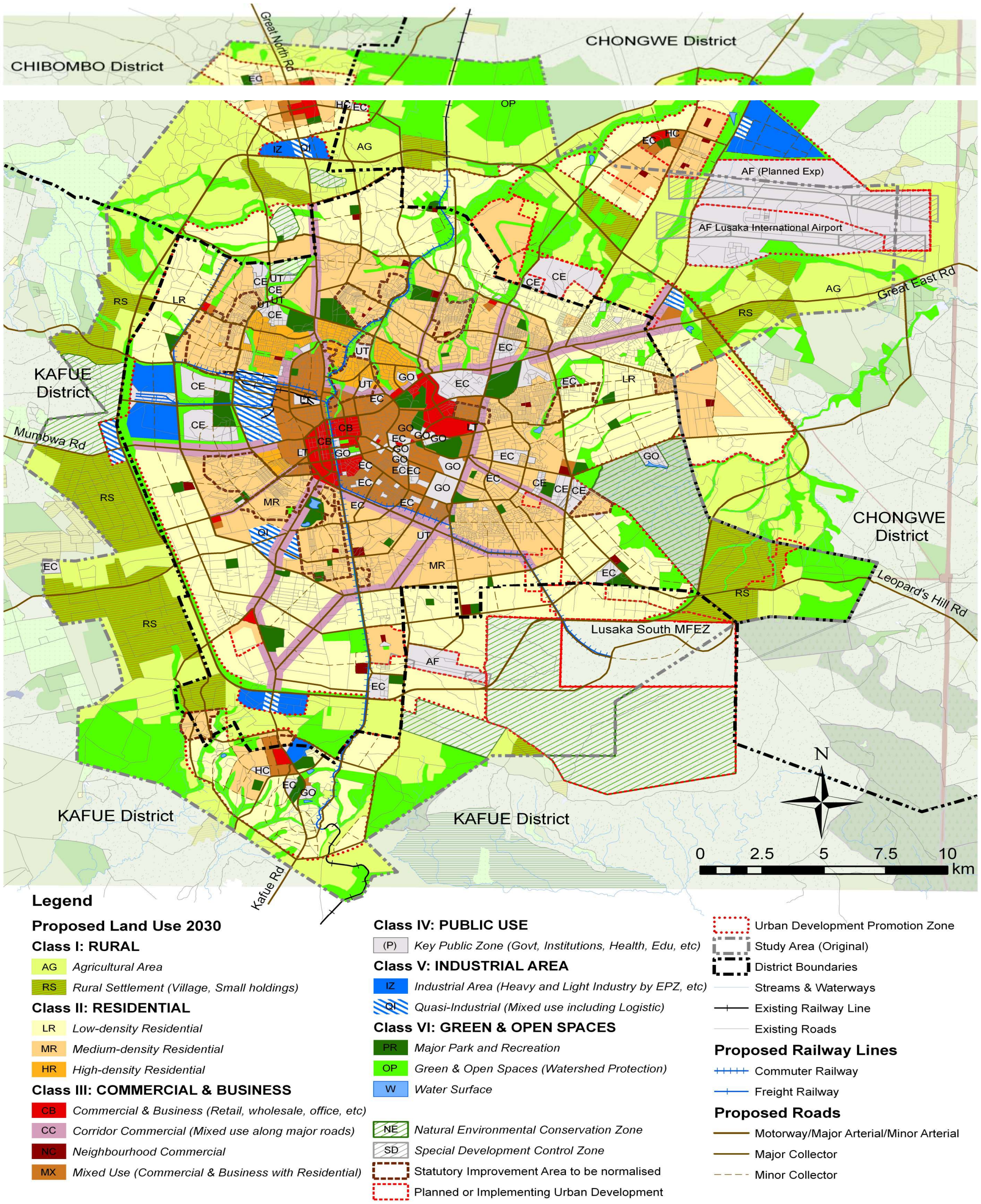


Figure 4: Proposed Land use plan for 2030 by JICA

2.2 QUALITY OF BUILDING CONSTRUCTION

The need for Quality Building infrastructure to withstand adverse effects cannot be over-emphasized. It is a key component in the construction industry (Mane and Patil, 2015; Emiedafe, 2017). Therefore, by maintaining construction quality, defects are avoided. (Allotey, 2014) defines the building defects as any exhibited characteristics that hinders the building's usability for the purpose of which the building was designed and constructed.

Ignoring *quality standards* and procedures in building construction leads to building failures, accidents, and losses (Davidkumar and Kathirvel, 2015; Oke, Dlamini and Aigbavboa, 2017)

There are several contributions to compromise in the quality of Building construction. Rustom M and Amer M (Rustom, et al, 2003) identified some of these contributions as :

- fault in design
- wrongful selection of designer, equipment and material
- unskilled sub-contractors,
- poor planning

This highlights the importance to investigate the input of *professional design services* in the building developments done in the city. Also important is to investigate the involvement of *qualified professionals* in the actual construction of these building developments. Callistus et al. (2014) also highlighted the *technical background of developer and resource input* as factors that affected building quality in Ghana. He argued that the lack of these adversely affected the building quality.

Another important factor in ensuring building construction quality is the review of the structural drawings submitted for approval to the Local authority. Approval of technically deficient *structural drawings* is a contributing factor in building construction quality management (Chetty, 2020). Hence, proper evaluation is needed of the submitted designs.

Hence, it is important to manage building quality from conceptual-design phase of the project (Oyedele, Jaiyeoba and Fadeyi, 2012). In the set up of the research area, Lusaka City Council has in place a mandatory structural certificate form which the Designer is expected to provide the structural considerations used in the design. It is therefore important to review the adequacy of this tool in structural submissions of developments.

Furthermore, Tope Femi Lagos (2014) also brought out the effects of faulty structural design and construction implementation on building maintenance. Without doubt, huge maintenance costs are incurred on structurally defective buildings, and building occupants remain at risk. He showed that there should be a thorough review of the design, including specifications and construction methodology before approval is given for implementation. This underscores the need for the local authorities to have well defined and effective drawing scrutiny process and engagement, if necessary, with the designer.

Also, Aras et al. (2016) advocated that when a technically defective structural design is approved, a building fails to perform its intended functions. The failure in design at the early stage would lead to insufficiencies in the subsequent phase after the building construction. The users of the building as well as the environment of the building get affected by the error in design (Chetty, 2020).

With the inadequate structural designs, the building is dangerous to function anymore (Basirat *et al.*, 2016).

Keegan et al(2014) also identifies another factor affecting building quality: the construction materials used. Usually, locally available materials are used in building construction, and some are imported. Keegan argues that imported and inferior products may not function or last as long as intended. Therefore, Architects, Contractors, Engineers, and Building management participants need to be quite familiar with the building material properties, and need to have a deeper understanding of appropriate techniques for preserving materials and shelf life, and that of the structures (Ahzahar et al.,2011)

2.2.1 Building collapses: International perspective-Nigeria and Kenya

Waziri (2016) presented the Nigerian perspective stating that design and construction defects have a serious bearing on the residential building maintenance. He contended that *design inadequacies* and *construction errors* are common causes of high maintenance costs on buildings and risks to human life in Nigeria. He further added that *residential constructions* are more prone to still undergo defects occasioning from insufficient design considerations and construction gaps making them susceptible to unexpected upkeep all through their life cycle.

Chendo & Obi (2015) carried out their study in the major cities of Nigeria like Lagos, Abuja, and Port Harcourt and found out that these areas are prone to a frequent collapses of a building. *Alteration of approved drawings* was found to be one of the prominent factors responsible for building collapse among other factors such as an absence of proper supervision of projects, carelessness, omission, use of *substandard materials*. They further explained that non-adherence to approved building plans resulted greatly in these failures. It was noted that builders/developers sometimes make an illegal amendment to the drawings which are already approved. He also argued that Emigrant suppliers tend to assemble the constituents in a foreign country and ship to Nigeria (Chetty, 2020), and some of these were inappropriate for the Nigeria environment. Oke (2009) pointed to *poor quality of workmanship* as one of the prominent reasons for building collapses in Nigeria in the research he conducted. He outlined that much of the construction is undertaken by amateur local contractors who possess inadequate craftsmanship skills. The research proved that there was a relationship between poor quality workmanship and building collapses in Nigeria.

Fagbenle & Oluwunmi (2010) examined the incidents of building collapses in Nigeria by focussing on the six key states from each of the six geo-political areas of the country. The study revealed that majority of the contractors evaded the sanction (obtaining building approval) before beginning the building construction works. Alike tendencies were also witnessed in the case of the residential developers, where a majority of them neglected to secure building sanction (permit) before the beginning of building construction. Therefore, it is important to analyse the contractor/developer trends in *obtaining building permission* before commencement of construction.

Tope Femi Lagos (2014) carried out a quantitative study by involving 30 architects, 20 builders and 25 civil engineers. There were 2 parts of the questionnaire. The second part focused on the flaws instigated by defective construction while the first part captured the background of the respondents. The study pointed out that when buildings are being erected without approved designs, especially in remote and rural areas, they may sometime result in collapse and building failure. This pointed to limited access to professional services in remote and rural areas, and limited influence of the local authority.

Basirat et al. (2016) pointed out that lives in Nigeria have been threatened by the collapses due to building construction without approved designs. Buildings are being erected without paying attention to some aspects and instructions which are obligatory to put in place before any construction work takes place. A building can collapse if it is erected without approved drawings or even no drawings at all. He also argued that collapses happened when the drawings were not *efficiently scrutinized by competent professionals or pertinent authorities*. This calls attention to the development plans scrutiny framework of Local authorities and the competencies of those involved to scrutinize the plans.

Among the reasons for building failure in Nigeria, non-compliance with specifications and regulations is found to be one of the key reasons highlighted by Chetty (2020).. When contractors ignore the building regulations, they take the risk of a building collapse (Chetty, 2020). This is because *Building Regulation* Act signifies all the rules that associate precisely with the control of the construction of structures (Fagbenle and Oluwunmi, 2010). However, Fagbenle & Oluwunmi (2010) also asserted that a prevailing regulation is worthless devoid of supporting with it a mechanism to guarantee compliance. An average civilian does not observe a law that is not obligatory, they argued. This, therefore highlights the need to strengthen and tighten the building regulations and standards used, with mechanisms to guarantee compliance.

Tope Femi Lagos (2014) highlighted that several defects in the buildings occur due to non-compliance with the specification by the civil engineers. Moreover, he also observed that the *non-compliance with appropriate construction codes and building standards* are also made by the builders which are evident from the construction defects. In addition to this, Tope Femi Lagos (2014) stated that a very good construction project lays down all the processes that should be followed to evade erroneous blunder during the building of a project. Such specifications by the designer to the worker state all the approaches and types of *workmanship to be hired throughout the building of a project*. However, some contractors choose to use their specific experience as an alternative to the specification offered.

Kioko (2014) presented the Kenya outlook to building failures. He pointed to initiating factors of failures as floods and Earth tremors. In his perspective, he listed building construction failures as a result of:

- sub-standard construction materials,
- Poor workmanship by suppliers,
- inept contractors,
- defective building methodology,
- dense rainstorm,
- improper supervision,
- poor assessment & observation,
- organizational flaws and,
- substandard design,
- illegal transformation and modifications.

In the subsequent year, Chendo & Obi (2015) talked about the non-compliance to the existing laws in Nigeria relating to a collapse of a four-storey building under construction at Agbama Estate, Unuahia. This was because of non-adherence to building Regulation that authorized only two floors in the area. They, therefore, recommended that all construction plans presented by any designer for sanction(permit) must fulfil with Nigeria's novel construction code and indigenous bye-laws and guidelines. While the reason to limiting all construction to two floors in that area was not explicitly explained, it is not hard to fathom that this could be a result of the Local authority having a clear understanding of the Geology and Soil mechanics of the area as one of the probable considerations. Thus, it is important for Local authorities to have a basic understanding of the Geotechnical parameters of the area under review, and know the maximum pressures the area can withstand. This could entail developments out of this scope would need to provide detailed technical justifications, investigations, and design reports to embark on any envisaged project.

Talking about Kenyan perspective, Kioko (2014) explained that death of African code of practice can also be an aspect that needs contemplation. Noncompliance with stipulations or criteria by designers and contractors resulted in building collapses. He further pointed out that in order to lessen the occurrences of building collapse in any nation, the nation-wide society of engineers and other administrative organisations should strive on developing building codes sk which will match up with the native supplies of construction materials used in a specific region. Moreover, *supervision* of the project should also be made by the qualified engineer. Application of his argument to the Zambia set up would mean that each local authority needs to determine the available materials used for construction in their area, and develop regulations in accordance with the available materials and construction techniques used. An example is the common mud houses in remote and rural areas. An area specific regulation would need to be developed to carter for he specific and unique construction needs.

Important lessons are also obtained from Wardhana et al. (2003) from his review of the American perspective of building collapses. He highlighted that the principle causes of building failures and collapses in America were due to demolitions and renovations to buildings. This makes reasonable sense because demolitions and renovations may entail a change in the loading configuration of the structure i.e. new wall line loads may be introduced at locations not originally intended in the design, thereby overstressing the existing structural elements support system from the original intent. It is therefore important that any building modifications and functionality changes are approved by the local authority.

From the review of the above studies, it can be deduced that the following parameters will be important aspects of the research in the Zambian context:

- Building quality standards (Davidkumar and Kathirvel, 2015; Oke, Dlamini and Aigbavboa, 2017)
- Incompetent design and unskilled contractors/developers (Rustom, et al, 2003 ;Waziri, 2016; Callistus et al. 2014)
- Approval of structurally deficient designs (Chetty, 2020; Aras et al. 2016)).
- Poor understanding of quality construction materials (Ahzahar et al.,2011)
- Substandard construction materials (Kioko,2014)
- Alteration of approved design during implementation (Chendo & Obi 2015; Wardhana et al. 2003))
- Non compliance to building codes and regulations (Tope Femi Lagos, 2014)
- Inadequate building regulations (Fagbenle and Oluwunmi, 2010).
- Construction without approved designs (Basirat et al. 2016)
- Inadequate supervision (Kioko,2014)
- Technical background of builder/developer (Callistus et al. 2014)

CHAPTER 3: RESEARCH METHODOLOGY

3.1 RESEARCH DESIGN

Research design defines the skeleton of the research. Kombo (2006) describes research design as the structure and glue of the research that holds all elements of the research project together.

Research methodology is thus the approach the researcher uses to conduct the research project (Leedy & Ormrod, 2001). The principal source of information for the research was the developer. From the developer, information on the local authority limitations was established i.e. stage inspections, planning approval process and timelines, and enforcement of non-compliant construction. A secondary source was to establish the institutional process in building quality control form the interviews and document review of the local authority. The figure:

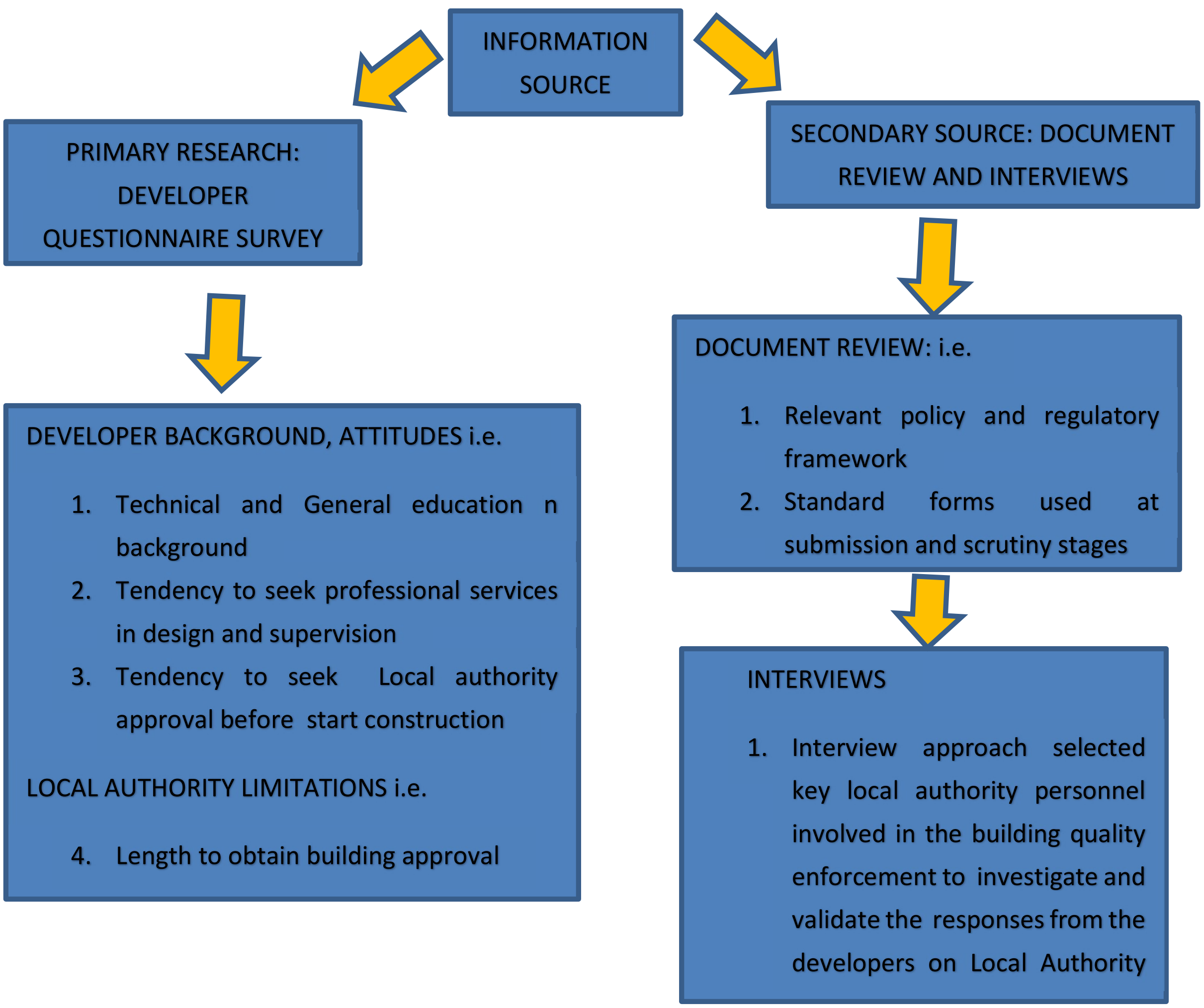


Figure 5: Research design

3.2 RESEARCH SITE/SAMPLE STUDY LOCATION

The study was carried out in Lusaka, Zambia. Purposive sampling was used to select Lusaka District as the study site because it has the fastest household population growth rate which proportionately translates into the fastest rate of construction development in Zambia. The comprehensive urban development plan (JICA, 2009) identifies six sites under development schemes, namely Chalala and South of Woodlands Extension, Kamwala South, Libala South, Bauleni Overspill, and New Kanyama. These areas are rich in information base with respect to Building construction. This is unlike most developing areas of Lusaka which until 2015, had been under the Statutory Housing and improvement areas Act which had limitations in the applicability of the building regulations. Other areas of Lusaka such as Olympia, Kabulonga, Rhodespark, Chelstone mostly have buildings which were built over 20 years ago, which could have changed hands with the passage of time from the one who originally built it, or if the original developer is still available, they could have lost much of the institutional memory of the building process and stages they went through in building their structure. For the purpose of balance of this study, three classifications of Building construction quality areas have been developed, namely Low-cost, Medium-cost, and High-cost Housing development. These classifications are mainly developed from the Local Authorities classification of these areas for building control, which criteria is based on the size of the residential property. Low cost housing have plot sizes of 288sq.m to 540sqm. Medium cost housing has plot sizes of range 540sq.m to 1,350sq.m. High-cost Housing has plot sizes equal and above 1,350sq.m.

From the public development schemes identified by JICA Study team (JICA, 2009), it is evident that New Kanyama and Bauleni overspill are both Low-cost housing areas. Therefore, very minimal variance in results can be anticipated from the two schemes. Thus, for the purpose of this research, Bauleni overspill was purposively selected to represent the data from Low-cost housing residential building construction because of its relative ease of accessibility by the research team.

Similarly, Kamwala South and Libala South development schemes identified in the comprehensive plan report are also quite similar as Medium Cost Housing Schemes. Of the two, Kamwala South was purposively selected as the research site for the Medium cost development areas. This is because of its relative ease of accessibility and convenience.

However, Woodlands extension and Chalala have not been selected as study areas in this research. This is because these areas show a very great variance in plot sizes, being mostly inclined to Medium Cost type sizes of plots. This is attributed to the fact that a good portion of these areas were farm blocks which have been subjected to change of Land use to residential schemes of smaller plot sizes to maximize number of developers. Therefore, these fall off as high-cost residential development sites. However, a physical inspection of Kabulonga extension was observed to fulfil this condition of High-cost development area. Thus, Kabulonga extension was selected to represent High-cost development areas of Lusaka. Figures 6 shows the overview of the study area map, and figures 7 and 8 show the zoomed in satellite map for Bauleni overspill, Figures 9 and 10 show the mapas for Kamwala South and Kabulonga extension respectively.

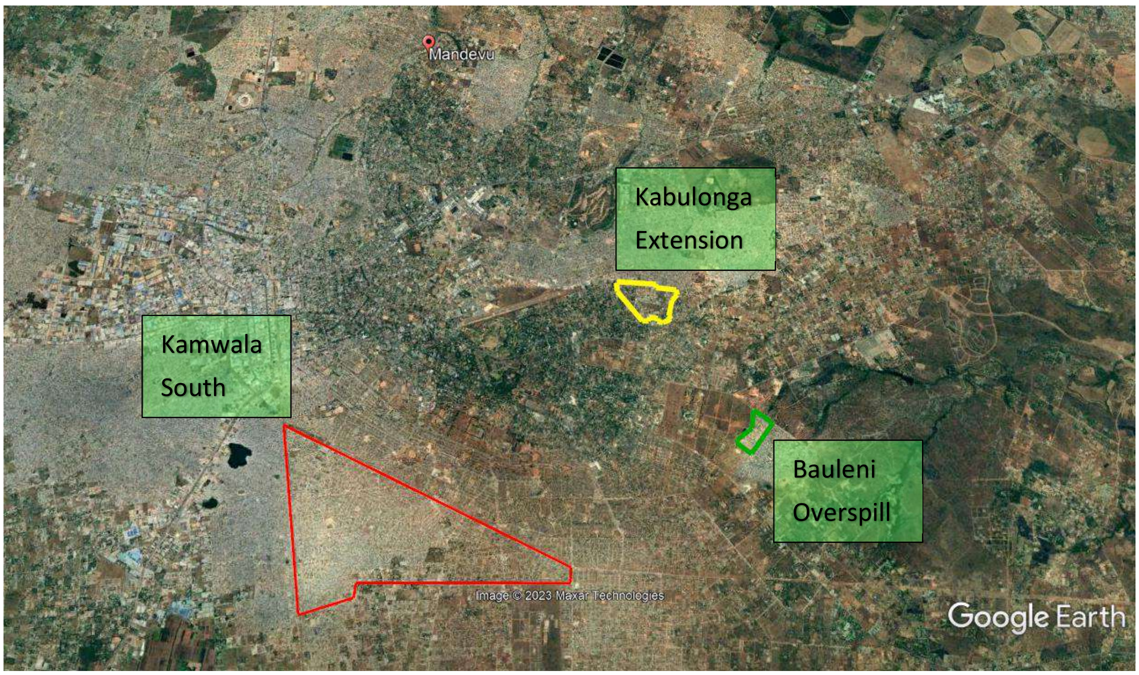


Figure 6: Study areas-overview

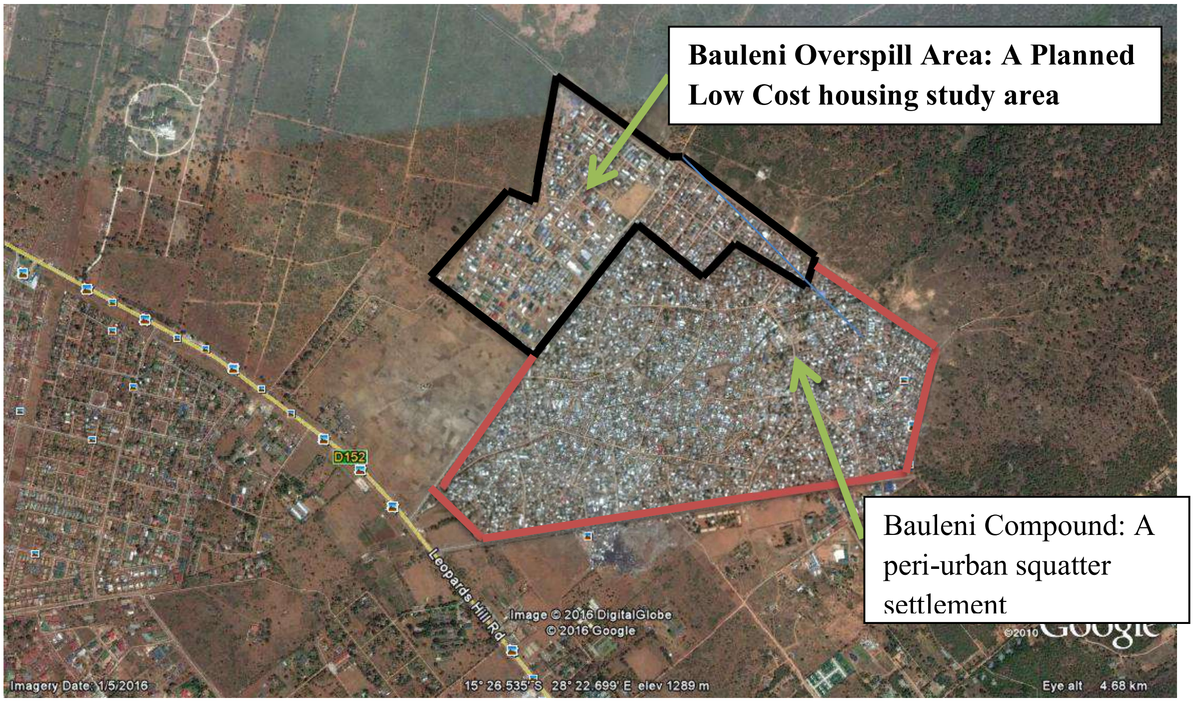


Figure 7-Satellite image of General location Bauleni Compound and the newer Bauleni Overspill

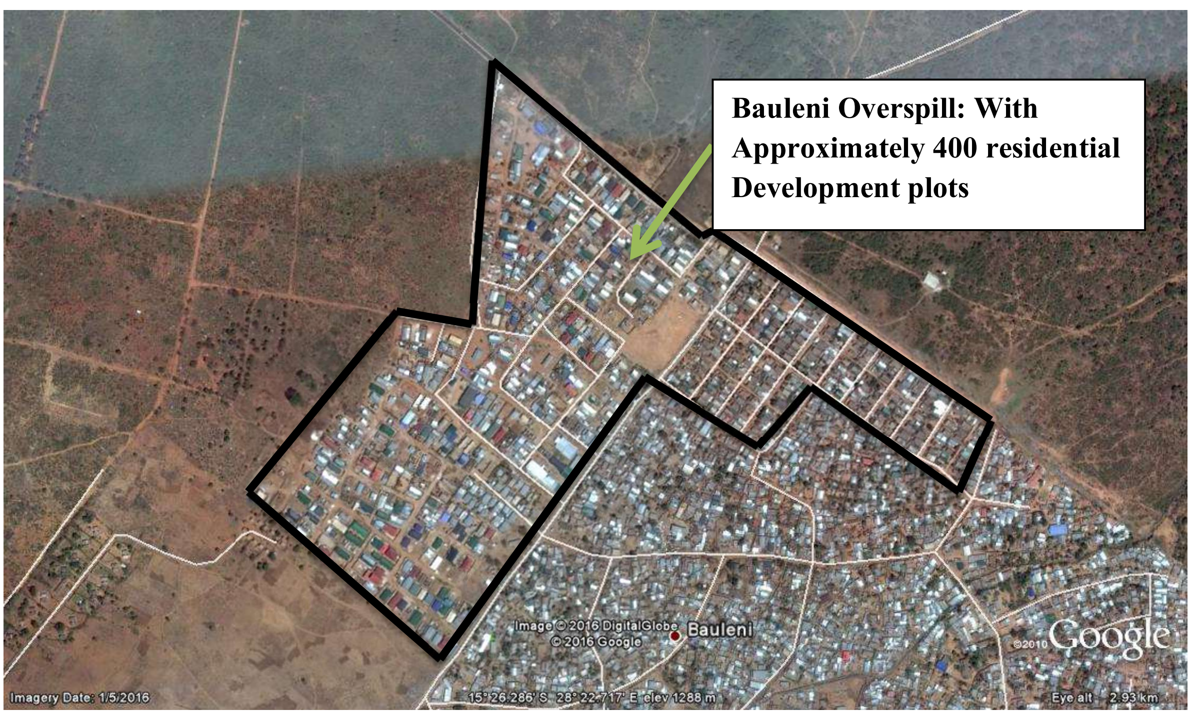


Figure 8-Bauleni Overspill area-A public sector planned Low Cost Residential scheme

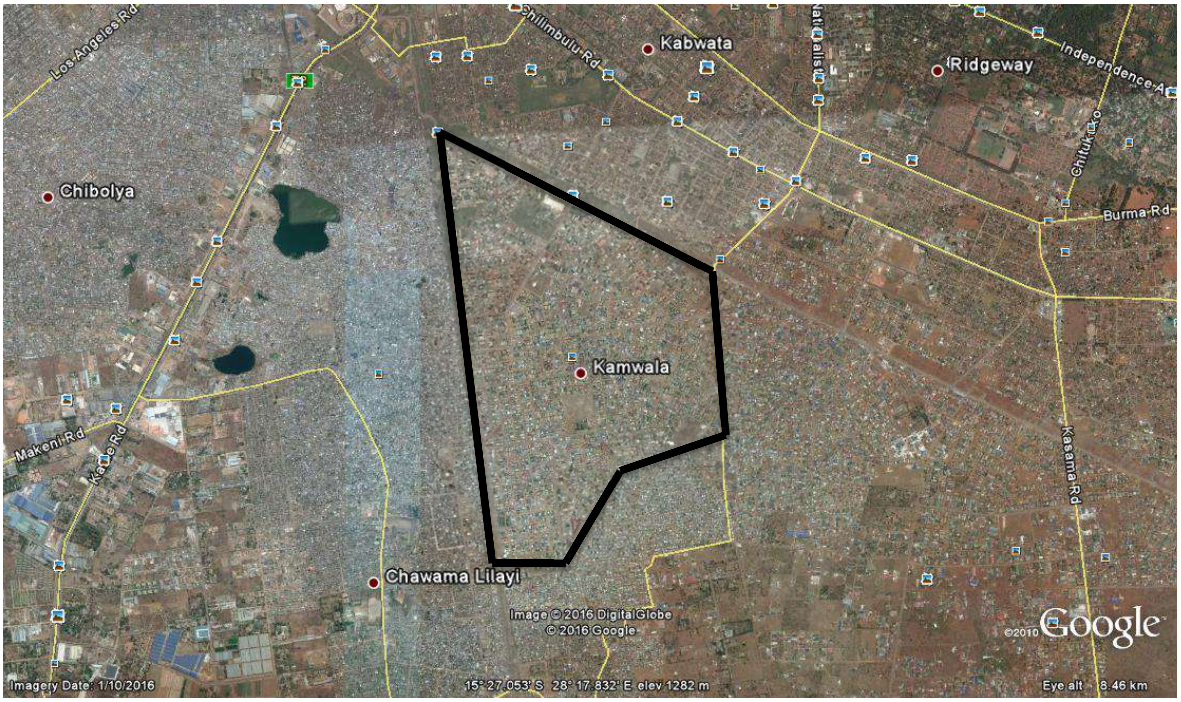


Figure 9-Kamwala South -Medium Cost Housing development

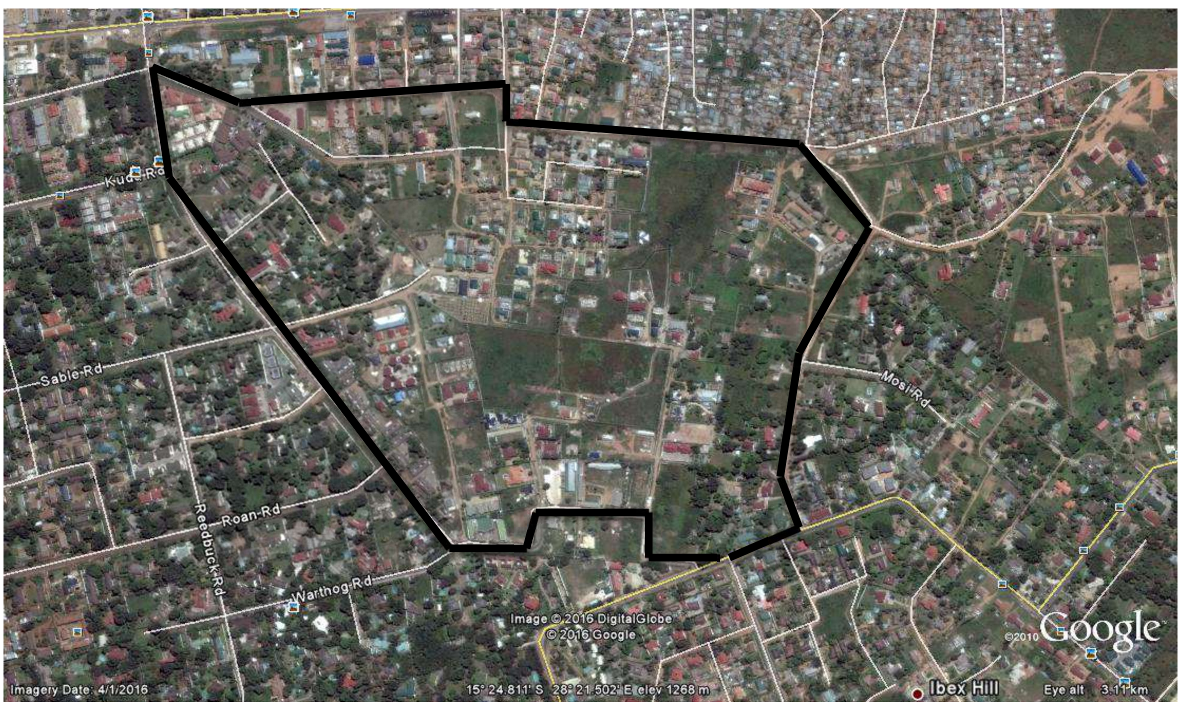


Figure 10-Kabulonga Extension-High Cost residential housing development

3.3 SAMPLE STUDY POUPULATION

Saunders et al (2012) explained that the size of the sample in a non-probability sampling possess an important logical relationship between the purpose and focus of the research. The study population in Bauleni Overspill consisted of nearly 400 plots. In Kamwala South, there is an estimated 2,818 development medium cost plots. Kabulonga Extension has approximately 87 plots constructed, or under construction. The study drew from all these development areas. Critical case sampling was used to target those who have at least finished the construction and the structure occupied. A physical verification and satellite image of Bauleni Overspill reveals that developed plots are about **387**, and these form the target population for this area. In Kamwala South, of the 2, 818 residential plots, about **2,512** residential developments were developed and occupied, or at an appreciable stage in construction. In Kabulonga Extension, **79** plots were developed and occupied.

Considering how vast the population sizes discussed, it would not only be quite costly, but also time consuming to sample all of them. Thus, an appropriate sample size was used to represent the whole population under consideration. Selective sampling of developers who had either completed or at substantial completion stages were selected. How large or small a sample size was determined by the purpose of the study and the size of the population.

In addition to the purpose of the study and population size, three criteria considerations were used to determine the appropriate sample size: the level of precision, the level of confidence or risk, and the degree of variability in the attributes being measured (Miaoulis and Michener, 1976). Each of these is reviewed below.

The Level of Precision

The *level of precision*, sometimes called *sampling error*, is the range in which the true value of the population is estimated to be. This range is often expressed in percentage points (e.g., ±5 percent). For example, if the percentage of those who received full stage inspections of their structures were found to be 60percent, with a level of precision of +/- 5percent, then we can conclude that between 55percent and 65percent received full stage inspections.

The Confidence Level

The *confidence* or *risk level* is based on ideas encompassed under the Central Limit Theorem. The key idea encompassed in the Central Limit Theorem is that when a population is repeatedly sampled, the average value of the attribute obtained by those samples is equal to the true population value. Furthermore, the values obtained by these samples are distributed normally about the true value, with some samples having a higher value and some obtaining a lower score than the true population value. In a normal distribution, approximately 95 percent of the sample values are within two standard deviations of the true population value (e.g., mean).

In other words, this means that if a 95 percent confidence level is selected, 95 out of 100 samples will have the true population value within the range of precision of +/-5percent (Figure 1). There is always a chance that the sample you obtain does not represent the true population value. Such samples with extreme values are represented by the shaded areas in Figure 1.

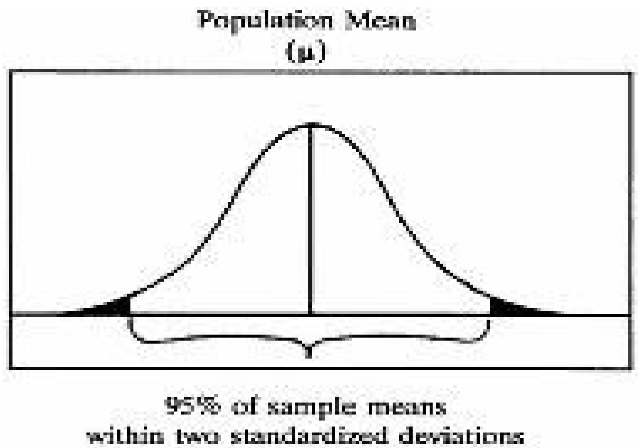


Figure 11-Distribution of Means for repated samples

For the purposes of this research, a confidence level of 95% is appropriate as the values will lie within two standard deviations of the true population value.

Degree of Variability

The third criterion, the *degree of variability* in the attributes being measured, refers to the distribution of attributes in the population. The more heterogeneous a population, the larger the sample size required to obtain a given level of precision. The less variable (more homogeneous) the population is, the smaller the sample size. Because a proportion of .5 indicates the maximum variability in a population, it is often used in determining a more conservative sample size, that is, the sample size may be larger than if the true variability of the population attribute were used. A more conservative sample size has been chosen for this research. This is because of the wide and varied social-economic factors of the developers such as education, financial ability, etc. which could affect the developers keen interest to seek professional and quality building services

Yamane (1967:886) provides a simplified formula to calculate sample sizes. A 95 percent confidence level and Maximum variability P = 0.5 are assumed for Equation 1.

$$n = \frac{N}{1 + N(e)^2}$$

Equation 1

Where n is the sample size, N is the population size, and e is the level of precision.

When this equation is applied to the research site for Low Cost Housing area of Bauleni Overspill for 95% confidence level and Maximum variability P=0.5:

$$n = \frac{N}{1 + N(e)(e)}$$

$$Sample\ size, n = \frac{387}{1 + 387(0.05)(0.05)} = 196.7$$

Therefore, 197 respondents from Bauleni Overspill is the appropriate sample size for the level of precision given. The total number of valid responses for this Low Cost development area (i.e. Bauleni Overspill) was 200.

For the Medium cost housing development of Kamwala South, with total research population N= 2,512 for 95 percent Confidence level and maximum variability P=0.5:

By equation 1,

$$Sample\ size, n = \frac{2512}{1 + 2512(0.05)(0.05)} = 345.055$$

Therefore, the appropriate sample size for Kamwala South was 345 respondents targeted so as to meet the required level of precision. **However, only 106 valid responses were acquired for this area.** This was because of the apathy and fear of the respondents in this area thinking that perhaps their structures were being investigated by the Local Authority for compliance and demolition. Using the same formulae, the expression becomes

$$Sample\ size, n = \frac{2512}{1 + 2512(e)(e)} = 106$$

This expression then makes the level of precision, e, for this area to be 9.5 percent

For Kabulonga Extension where N=79 for 95 percent Confidence level and maximum variability P=0.5:

By Equation 1,

$$Sample\ size, n = \frac{79}{1 + 79(0.05)(0.05)} = 65.97$$

Therefore, the targeted sample size for Kabulonga Extension was 66 respondents for the desired level of precision. **However, only 57 valid responses were acquired**. This was because some respondents were difficult to reach so as to participate in the research. Thus, using the formulae above, the **Level of precision attained was 7 percent.**

Table 3 presents the summary of the sample distribution.

Table 4: Sample size distribution

Area	Population (developers)	Adopted Sample size	Valid responses	Level of Precision %
Bauleni Overspill	387	197	200	5
Kamwala South	2512	345	106	9.5
Kabulonga Extension	79	66	57	7

3.4 RESEARCH INSTRUMENTS

Primary information was obtained from field surveys. The primary research instrument used in these Surveys was the Questionnaire.

3.4.1 QUESTIONNAIRES

This is a research instrument that gathers data over a large sample (Kombo, 2006). In this research, a structured questionnaire was formulated to capture influencing factors in the quality Building control process, and stage inspections **(See Appendix I).**

As seen in the preceding section, a total of 363 questionnaires had been prepared. Various demographic characteristics were obtained for the sample population as Age of the respondents, Gender, employment status, monthly income, and Level of education. Key variables captured from the survey include patterns relating to:

- Tendency of developers to engage professional design and supervision services
- Tendency of developers to submit the designs for approval to the local authority
- Period of time taken to obtain approval from the time designs were submitted to the Local authority
- The stage inspections received by the developer from the Local authority

These key variables were then correlated to social and demographic background of the developers such as:

- Level of education and income
- Area classifications

The responses were analysed with the help of a statistical software package *Statistical package for Social Science* (SPSS version 23) and *Microsoft excel*.

3.5 RELIABILITY AND VALIDITY TESTS

This is an important aspect of the research. Saunders et al (2012) mentions that reliability of a research is the ability to produce the same result in subsequent studies following the same procedures used in the prior study. The main tool used in this research to collect information from developers was the questionnaire. This instrument was pre-tested in a pilot survey which was conducted on a sample of respondents. This proved quite useful as it predicted challenges the respondents may encounter and assisted in re-phrasing the questionnaire questions so as to maintain clarity. Eight respondents were used to provide an assessment and collect feedback on the questionnaire.

Validity is the degree to which the results are truthful and dependable. This is an important aspect this research took into consideration. Validity of the results was achieved by carefully considering the selection of participants, data recording, and analysis. Correlations of variables were mathematically examined.

CHAPTER 4: RESEARCH RESULTS AND ANALYSIS

4.1 INTRODUCTION TO CHAPTER

This chapter presents the findings from the primary research instrument: the questionnaire survey and also the interview survey. Demographic distributions of the respondents are presented and factors affecting them are cross tabulated and analysed. The Pearson's Chi-square test of independence is used to establish actual relationships (or lack thereof) between the variables.

This chapter presents the data captured and presents the statistical and mathematical models.

4.2 EDUCATIONAL BACKGROUND OF RESPONDENTS

From the literature review, it was evident that background of the developer affected adherence to building standards (Callistus et al. 2014). Table 7 below presents the educational background of the respondents.

Table 5: Highest Level of education attained.

Developer Education Background	Frequency	Percent	Valid Percent	Cumulative Percent
No Education Formal Background	94	25.9	25.9	25.9
Completed Primary Education	11	3.0	3.0	28.9
Completed Form 5/G12	24	6.6	6.6	35.5
Trade Certificate	61	16.8	16.8	52.3
Diploma	27	7.4	7.4	59.8
Bachelors Degree	127	35.0	35.0	94.8
Masters/Doctorate	19	5.2	5.2	100.0
Total	363	100.0	100.0	

4.3 CROSSTABULATION OF HIGHEST EDUCATION ATTAINED WITH DEVELOPMENT AREA CLASSIFICATION

Table 8 presents a cross tabulation of the development area category with Highest education attained of the respondents. Table 9 demonstrates that there is an actual relationship of these variables. The correspond bar graph in figure 12 illustrates this relationship.

Table 6: Cross tabulation of Highest Level of education attained by developer with Development area classification

Economic Category of Area Developments * Highest Level of Education attained Cross tabulation

		Highest Level of Education attained							Total
		No Education Formal Background	Completed Primary Education	Completed Form 5/G12	Trade Certificate	Diploma	Bachelors Degree	Masters/Doctorate	
Low Cost Development	Count	94	11	24	61	9	1	0	200
	% within Economic Category of Area Developments	47.0%	5.5%	12.0%	30.5%	4.5%	0.5%	0.0%	100.0%
	% within Highest Level of Education attained	100.0%	100.0%	100.0%	100.0%	33.3%	0.8%	0.0%	55.1%
Medium Cost Development	Count	0	0	0	0	15	86	5	106
	% within Economic Category of Area Developments	0.0%	0.0%	0.0%	0.0%	14.2%	81.1%	4.7%	100.0%
	% within Highest Level of Education attained	0.0%	0.0%	0.0%	0.0%	55.6%	67.7%	26.3%	29.2%
Count		0	0	0	0	3	40	14	57
High Cost Development area	% within Economic Category of Area Developments	0.0%	0.0%	0.0%	0.0%	5.3%	70.2%	24.6%	100.0%
	% within Highest Level of Education attained	0.0%	0.0%	0.0%	0.0%	11.1%	31.5%	73.7%	15.7%
Total	Count	94	11	24	61	27	127	19	363
	% within Economic Category of Area Developments	25.9%	3.0%	6.6%	16.8%	7.4%	35.0%	5.2%	100.0%
	% within Highest Level of Education attained	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	367.835[a]	12	.000
Likelihood Ratio	468.794	12	.000
N of Valid Cases	363		

a. 5 cells (23.8%) have expected count less than 5. The minimum expected count is 1.73.

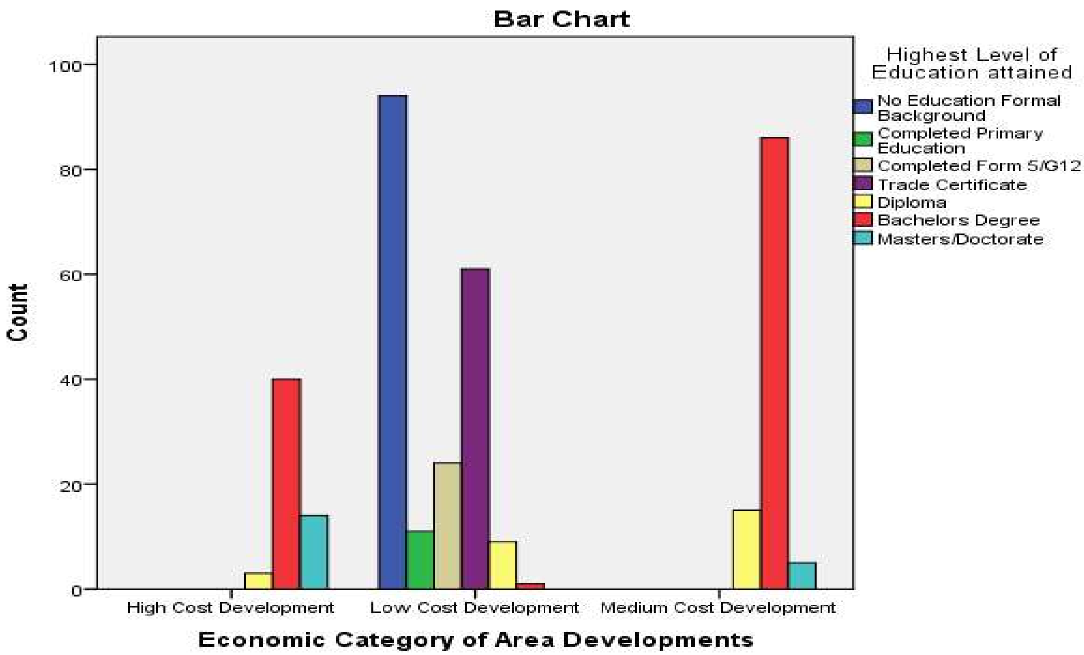


Figure 12: Bar graph showing education status in relation to development area classification

From the Tables 8 results and analysis of Table 9, and as illustrated in figure 12, it is evident that there is a relationship between educational background and the development area classification i.e. Highcost development areas have more developers with academic training background compared with the Low cost development areas.

4.4 PREVALENCE OF FLOODING AND CROSSTABULATION WITH THE DEVELOPMENT AREA CLASSIFICATION

Table 9 presents the flooding statistics experienced by the respondents, with the corresponding bar graph in figure 9 illustrating this. Table 10 presents a cross tabulation of flooding frequency with the development area classification; Table 11 establishes the relationship of these two variables, and the corresponding bar graphs in figures 13 and 14 illustrates this cross tabulation.

Table 7: Developers experiencing flooding of their property.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	84	23.1	23.1	23.1
	Yes	279	76.9	76.9	100.0
	Total	363	100.0	100.0	

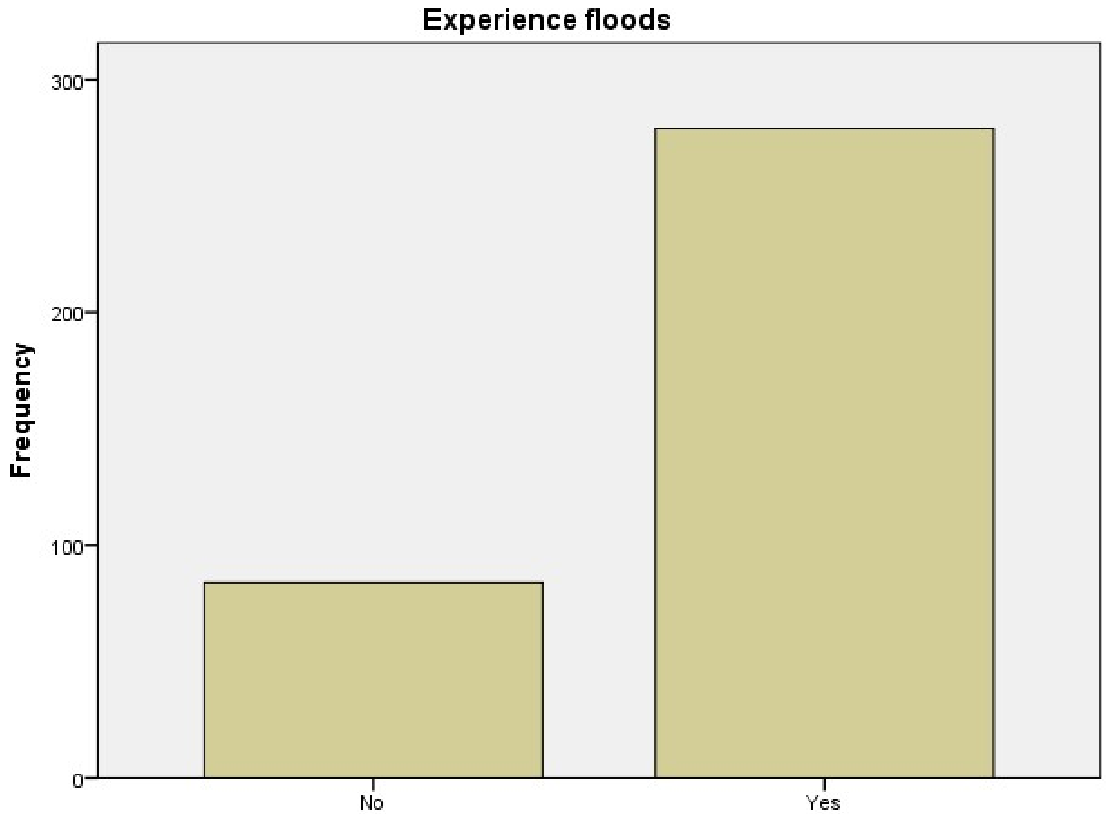


Figure 13: Bar graph showing the frequency of developers experiencing flooding

Table 8: Cross tabulation of developers experiencing floods with Development area classification

*Economic Category of Area Developments * Experience floods Crosstabulation*					
			Experience floods		*Total*
			No	*Yes*	
Economic Category of Area Developments	*High Cost Development*	*Count*	*53*	*4*	*57*
		% within Economic Category of Area Developments	*93.0%*	*7.0%*	*100.0%*
		% within Experience floods	*63.1%*	*1.4%*	*15.7%*
	Medium Cost Development	*Count*	*27*	*79*	*106*
		% within Economic Category of Area Developments	*25.5%*	*74.5%*	*100%*
		% within Experience floods	*32.1%*	*23.8%*	*29.2%*
	Low Cost Development	*Count*	*4*	*196*	*200*
		% within Economic Category of Area Developments	*2.0%*	*98%*	*100%*
		% within Experience floods	*4.8%*	*70.3%*	*55.1%*
Total		*Count*	*84*	*279*	*363*
		% within Economic Category of Area Developments	*23.1%*	*76.9%*	*100.0%*
		% within Experience floods	*100.0%*	*100.0%*	*100.0%*

Table 9: Chi-Square tests for independence of the variables: Development area classification with flooding

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	206.908[a]	2	.000
Likelihood Ratio	204.260	2	.000
N of Valid Cases	363		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 13.19.

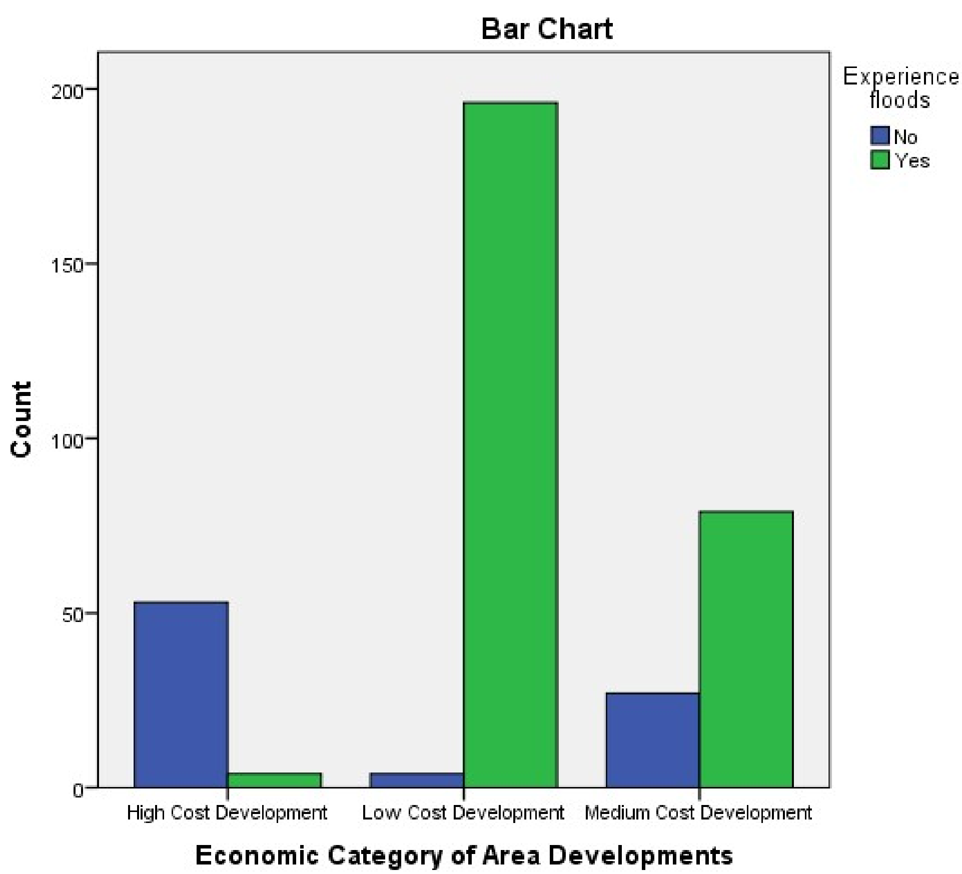


Figure 14: Graph illustrating existing relationship of development area classification with floods

It is evident that low and medium cost development areas experienced flooding to their properties. This is attributed to the limited drainage infrastructure in these areas.

4.3.1 DEVELOPERS ENGANGING PROFESSIONAL DESIGN SERVICES

From the survey, of the 363 valid responses from the developers, only 171 agreed to having involved a professional in the design development. This represents only 47 percent of the developers. Table 12 provides the statistics of engaging professional design services in the different employment categories; and table 13 presents the cross tabulation of these variables. Table 14 verifies the relationship of these variables using a chi-square test of independence.

Table 10: Employment category vs engaging professional design services

		Engage professional Building design Services		Total
		No	Yes	
Employment Status	Employed	69	96	165
	Unemployed	116	56	172
	Retired	0	6	6
	Self Employed	7	13	20
Total		192	171	363

From the figures in table 12, it is apparent that Unemployed developers were more likely **NOT** to engage professional Building design services compared to the Employed developers. The following table shows this apparent relationship by percent tabulation.

Table 11: Cross tabulation of employment status with Engaging professional design services

Table 4.3.2 Employment Status * Engage professional Building design Services Cross-tabulation					
			Engage professional Building design Services		Total
			No	Yes	
Employment Status	Employed	Count	69	96	165
		% within Employment Status	41.8%	58.2%	100.0%
	Unemployed	Count	116	56	172
		% within Employment Status	67.4%	32.6%	100.0%
	Retired	Count	0	6	6
		% within Employment Status	0.0%	100.0%	100.0%
	Self Employed	Count	7	13	20
		% within Employment Status	35.0%	65.0%	100.0%
Total		Count	192	171	363
		% within Employment Status	52.9%	47.1%	100.0%

Therefore, from the table, employment status, whether formal employment or self-employment had a positive influence in the procurement of professional Design services.

The relationship between these two variables is further confirmed by the Chi-square test on 14.

Table 12: Chi square test

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	32.041[a]	3	.000
Likelihood Ratio	34.745	3	.000
Linear-by-Linear Association	1.191	1	.275
N of Valid Cases	363		

The pearsons Chi-square test of independence p value of less than 0.001 is less than the level of significance of a=0.05. This verifies that there is an apparent relationship of these variables.

We now investigate whether the responses observed between the employment status categories are not just a shadow of the actual relationship of education background and engaging professional design services.

We therefore now add a layer variable to create a three-way table in which categories of the row and column variables are further subdivided by categories of the layer variable.
This variable-*highest education attained*- is referred to as the **control** variable because it may reveal how the relationship between the row and column variables changes when you "control" for the effects of the third variable. Table 15 presents this cross tabulation and Table 16 presents the Chi square test of independence of the variables:

ion with 'highest level of education' as control variable

tus * Engage professional Building design Services * Highest Level of Education attained Cross tabulation

Education attained			Engage professional Building design Services		Total
			No	Yes	
Formal	Employment Status	Employed	9	7	16
		Unemployed	56	22	78
	Total		65	29	94
rimary	Employment Status	Employed	3	0	3
		Unemployed	4	4	8
	Total		7	4	11
5/G12	Employment Status	Employed	4	1	5
		Unemployed	15	4	19
	Total		19	5	24
	Employment Status	Employed	8	1	9
		Unemployed	32	20	52
	Total		40	21	61
	Employment Status	Employed	7	7	14
		Unemployed	5	4	9
		Retired	0	1	1
		Self Employed	2	1	3
	Total		14	13	27
e	Employment Status	Employed	37	66	103
		Unemployed	4	1	5
		Retired	0	5	5
		Self Employed	4	10	14
	Total		45	82	127
e	Employment Status	Employed	1	14	15
		Unemployed	0	1	1
		Self Employed	1	2	3
	Total		2	17	19

st of independence

Education attained		Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
rmal Background	Pearson Chi-Square	1.504[b]	1	.220		
	Continuity Correction[c]	.863	1	.353		
	Likelihood Ratio	1.435	1	.231		
	Fisher's Exact Test				.244	.175
	Linear-by-Linear Association	1.488	1	.223		
	N of Valid Cases	94				
ry Education	Pearson Chi-Square	2.357[d]	1	.125		
	Continuity Correction[c]	.692	1	.406		
	Likelihood Ratio	3.330	1	.068		
	Fisher's Exact Test				.236	.212
	Linear-by-Linear Association	2.143	1	.143		
	N of Valid Cases	11				
5/G12	Pearson Chi-Square	.003[e]	1	.959		
	Continuity Correction[c]	.000	1	1.000		
	Likelihood Ratio	.003	1	.959		
	Fisher's Exact Test				1.000	.730
	Linear-by-Linear Association	.003	1	.960		
	N of Valid Cases	24				
	Pearson Chi-Square	2.542[f]	1	.111		
	Continuity Correction[c]	1.475	1	.225		
	Likelihood Ratio	2.974	1	.085		
	Fisher's Exact Test				.146	.109
	Linear-by-Linear Association	2.501	1	.114		
	N of Valid Cases	61				
	Pearson Chi-Square	1.409[g]	3	.703		
	Likelihood Ratio	1.800	3	.615		
	Linear-by-Linear Association	.061	1	.805		
	N of Valid Cases	27				
	Pearson Chi-Square	7.384[h]	3	.061		
e	Likelihood Ratio	8.855	3	.031		

From the table 16 of chi-square statistics, it can easily be seen that in all of the employment categories, the apparent relationship between employment status and engaging professional design services disappears (typically, a significance value less than 0.05 is considered "significant").

This suggests that the apparent relationship between employment status and Engaging professional design services is merely an artefact of the **underlying relationship between education level and engaging professional design services.**

Therefore, literacy levels in a society has a direct effect on whether a developer will engage professional design services or not, thereby being a contributing underlying factor.

From the Table 15, it is quite apparent that there is a higher frequency of ‘Not engaging professional design services’ in the Lower education levels i.e. Diploma qualifications and below.

4.3.2 EFFECT OF MONTHLY INCOME IN ENGAGING PROFESSIONAL DESIGN SERVICES

Table 17 presents values of Monthly income ranges of the developers and their tendency to engage professional services while figure 15 illustrates this using a bar gragh.

Table 15: Comparison of 'Engaging professional design services' with Monthly income

Monthly Income Category * Engage professional Building design Services Cross-tabulation

Count

		Engage professional Building design Services		Total
		No	Yes	
Monthly Income Category	Between ZMW800.00-2200.00	135	0	135
	Between ZMW2200.00-6000.00	52	44	96
	Above ZMW6000.00	5	127	132
Total		192	171	363

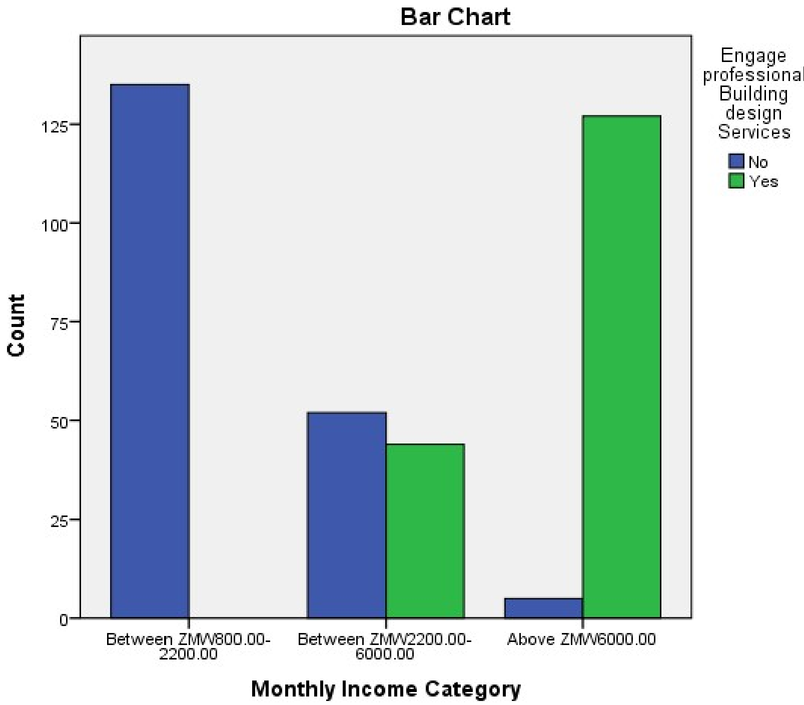


Figure 15: Bar graph of Income vs Engaging professional design services

The trend is clearly evident from 17 and the bar graph in figure 15 above: the lower the Income, the less likely that the respondents were going to engage Professional design services. Table 18 shows the trueness of this relationship, and Table 19 shows if this is also a mere shadow of the relationship Education background has with Engaging professional design services. The relationship between the variable is further tested by the Chi-square tests in Table 20

Table 16: Chi-square test of independence

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	248.039[a]	2	.000
Likelihood Ratio	327.051	2	.000
Linear-by-Linear Association	247.210	1	.000
N of Valid Cases	363		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 45.22.

From the Chi-square value p less than 0.001, it is evident that there is relationship of these variables.

Table 17: Cross tabulation of Monthly income vs Engaging professional design services with Educational background as the control variable

Monthly Income Category * Engage professional Building design Services * Highest Level of Education attained Crosstabulation					
Count					
Highest Level of Education attained			Engage professional Building design Services		Total
			No	Yes	
No Education Formal Background	Monthly Income Category	Between ZMW800.00-2200.00	65	0	65
		Between ZMW2200.00-6000.00	0	17	17
		Above ZMW6000.00	0	12	12
	Total		65	29	94
Completed Primary Education	Monthly Income Category	Between ZMW800.00-2200.00	7	0	7
		Between ZMW2200.00-6000.00	0	4	4
	Total		7	4	11
Completed Form 5/G12	Monthly Income Category	Between ZMW800.00-2200.00	19	0	19
		Between ZMW2200.00-6000.00	0	2	2
		Above ZMW6000.00	0	3	3
	Total		19	5	24
Trade Certificate	Monthly Income Category	Between ZMW800.00-2200.00	40	0	40
		Between ZMW2200.00-6000.00	0	14	14
		Above ZMW6000.00	0	7	7
	Total		40	21	61
Diploma	Monthly Income Category	Between ZMW800.00-2200.00	4	0	4
		Between ZMW2200.00-6000.00	10	5	15
		Above ZMW6000.00	0	8	8
	Total		14	13	27
Bachelors Degree	Monthly Income Category	Between ZMW2200.00-6000.00	40	1	41
		Above ZMW6000.00	5	81	86
	Total		45	82	127
Masters/Doctorate	Monthly Income Category	Between ZMW2200.00-6000.00	2	1	3
		Above ZMW6000.00	0	16	16
	Total		2	17	19
Total	Monthly Income Category	Between ZMW800.00-2200.00	135	0	135
		Between ZMW2200.00-6000.00	52	44	96
		Above ZMW6000.00	5	127	132
	Total		192	171	363

Table 18: Chi-square test of independence

Chi-Square Tests						
Highest Level of Education attained		Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
No Education Formal Background	**Pearson Chi-Square**	**94.000[b]**	**2**	**.000**		
	Likelihood Ratio	116.166	2	.000		
	Linear-by-Linear Association	79.115	1	.000		
	N of Valid Cases	94				
Completed Primary Education	**Pearson Chi-Square**	**11.000[c]**	**1**	**.001**		
	Continuity Correction[d]	7.103	1	.008		
	Likelihood Ratio	14.421	1	.000		
	Fisher's Exact Test				.003	.003
	Linear-by-Linear Association	10.000	1	.002		
	N of Valid Cases	11				
Completed Form 5/G12	**Pearson Chi-Square**	**24.000[e]**	**2**	**.000**		
	Likelihood Ratio	24.564	2	.000		
	Linear-by-Linear Association	20.565	1	.000		
	N of Valid Cases	24				
Trade Certificate	**Pearson Chi-Square**	**61.000[f]**	**2**	**.000**		
	Likelihood Ratio	78.546	2	.000		
	Linear-by-Linear Association	50.394	1	.000		
	N of Valid Cases	61				
Diploma	**Pearson Chi-Square**	**13.648[g]**	**2**	**.001**		
	Likelihood Ratio	18.297	2	.000		
	Linear-by-Linear Association	12.475	1	.000		
	N of Valid Cases	27				
Bachelors Degree	**Pearson Chi-Square**	**102.151[h]**	**1**	**.000**		
	Continuity Correction[d]	98.180	1	.000		
	Likelihood Ratio	117.567	1	.000		
	Fisher's Exact Test				.000	.000
	Linear-by-Linear Association	101.347	1	.000		
	N of Valid Cases	127				
Masters/Doctorate	**Pearson Chi-Square**	**11.922[i]**	**1**	**.001**		
	Continuity Correction[d]	5.894	1	.015		
	Likelihood Ratio	8.968	1	.003		
	Fisher's Exact Test				.018	.018
	Linear-by-Linear Association	11.294	1	.001		
	N of Valid Cases	19				
Total	**Pearson Chi-Square**	**248.039[a]**	**2**	**.000**		
	Likelihood Ratio	327.051	2	.000		
	Linear-by-Linear Association	247.210	1	.000		
	N of Valid Cases	363				

The above Tables 19 and 20 show that there is still a strong relationship between Income of the developers and engaging professional design services even when educational background is used as a control of the two variables i.e. in all the tests the pearson chi-square test is below 0.05, indicating that even with the control, the relationship of income and engaging designs services is retained. **Thus, Education Background and Income are independent variables both affecting the respondents probability of engaging professional design services.**

Now, it is possible for a developer to engage a professional for their designs, and afterward not submit those designs to the Local authority. This compromises on the quality control process as the Local authority is not involved in reviewing and recommending measures for quality control. The next section will provide this analysis.

4.3.5 FACTORS INFLUENCING NOT PROCURING PROFESSIONAL DESIGN SERVICES

It is noteworthy that all the 192 respondents who did not engage professional design services where from the Low and Medium cost development areas. Also noteworthy are the reasons they gave as influencing that trend. Three reasons stood out, namely:

1. It was not necessary to engage a professional design consultant.
2. Professional design services were unaffordable.
3. Developer was in a hurry to secure the land.

Table 21 show the distribution of these reasons amongst the developers, and Table 22 verifies the relationship with development area classification, and figure 16 illustrates these reasons with a bar graph:

Table 19: Cross tabulation of development area classification with the reasons for developers not engaging professional design services

Economic Category of Area Developments * Reason for NOT procuring professional design services Crosstabulation						
			Reason for NOT procuring professional design services			Total
			Not necessary to engage Registered Consultant	Registered Consultants Costly	Hurry to secure Land:	
Economic Category of Area Developments	Low Cost Development	Count	0	135	0	135
		% within Economic Category of Area Developments	0.0%	100.0%	0.0%	100.0%
		% within Reason for NOT procuring professional design services	0.0%	98.5%	0.0%	70.3%
	Medium Cost Development	Count	1	2	54	57
		% within Economic Category of Area Developments	1.8%	3.5%	94.7%	100.0%
		% within Reason for NOT procuring professional design services	100.0%	1.5%	100.0%	29.7%
Total		Count	1	137	54	192
		% within Economic Category of Area Developments	0.5%	71.4%	28.1%	100.0%
		% within Reason for NOT procuring professional design services	100.0%	100.0%	100.0%	100.0%

Table 20: Chi square test of independence

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	182.559[a]	2	.000
Likelihood Ratio	212.668	2	.000
N of Valid Cases	192		

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is .30.

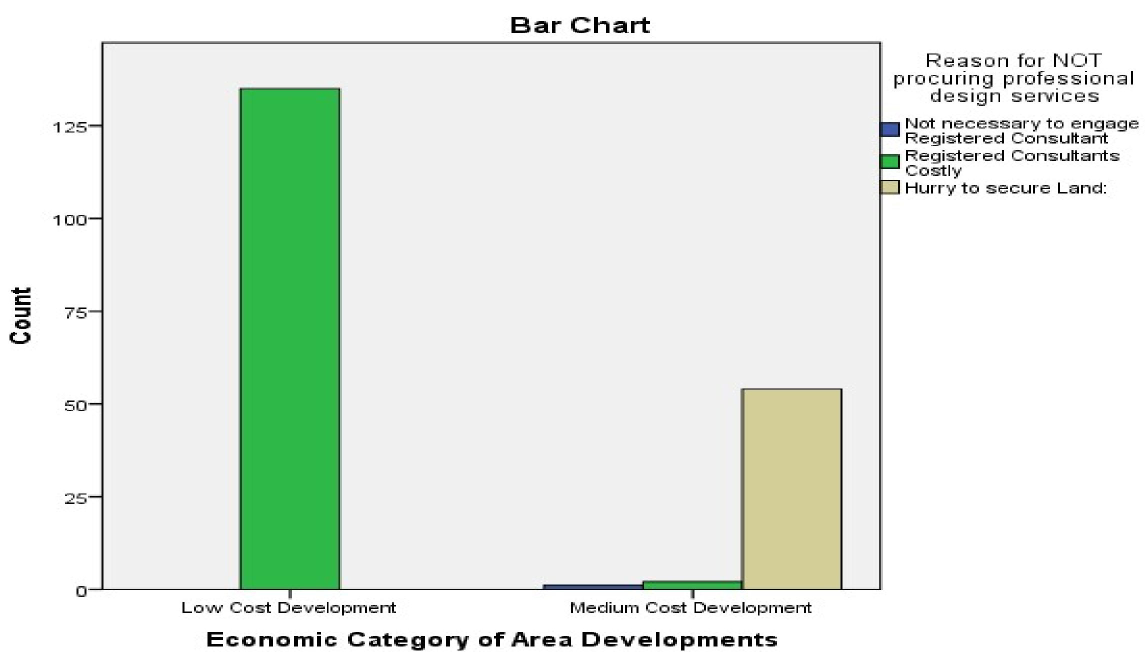


Figure 16: Bar graph illustrating the 'reasons for not procurring professional design services' by developers

Summary: It is clear from the table that of the 363 respondents, 192 respondents said they did not procure professional design services, representing 52.9 percent of the valid population sample for this examination.

It is evident in Table 21 above that all those whose reason for not engaging professional design services was that they thought it was not necessary to obtain professional design services were from Medium Cost Development areas; Of those whose reason was that registered consultants were costly, 98.5 percent came from the Low Cost Development area; Of those whose reason was that they wanted to secure their land first, 100 percent came from the Medium Cost development area.

From the Low Cost development area, 100 percent of the respondents gave their reason for not engaging professional design services to be that Registered Consultants were costly. From the Medium Cost area, 1.8 percent thought it was not necessary to engage professional design services; 3.5 percent said their reason was that registered consultants were costly; and 94.7 percent said that they had to secure land first, hence starting the construction before engaging professional services.

From these results, it will be important that the Local authority can provide subsidised standard designs which would be affordable to the low income groups who cannot afford the professional consultancy fess on the market. This provision can be made for the Low income development areas.

4.3.8 DURATION FOR PLANNING AND BUILDING PERMISSIONS TO BE GRANTED FROM TIME SUBMITTED

Table 23 shows the duration to obtain approval after submission of plans, and figure 17 illustrates these findings.

Table 21: Period to obtain approval to commence construction after submission of design drawings

Period to obtain approval after submission of drawings

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Between 1-3 months	7	1.9	1.9	1.9
	Between 3-6 months	123	33.9	33.9	35.8
	Between 6 9 months	3	.8	.8	36.6
	After 9 months	45	12.3	12.3	48.9
	Not Yet Submitted	185	51.1	51.1	100.0
	Total	363	100.0	100.0	

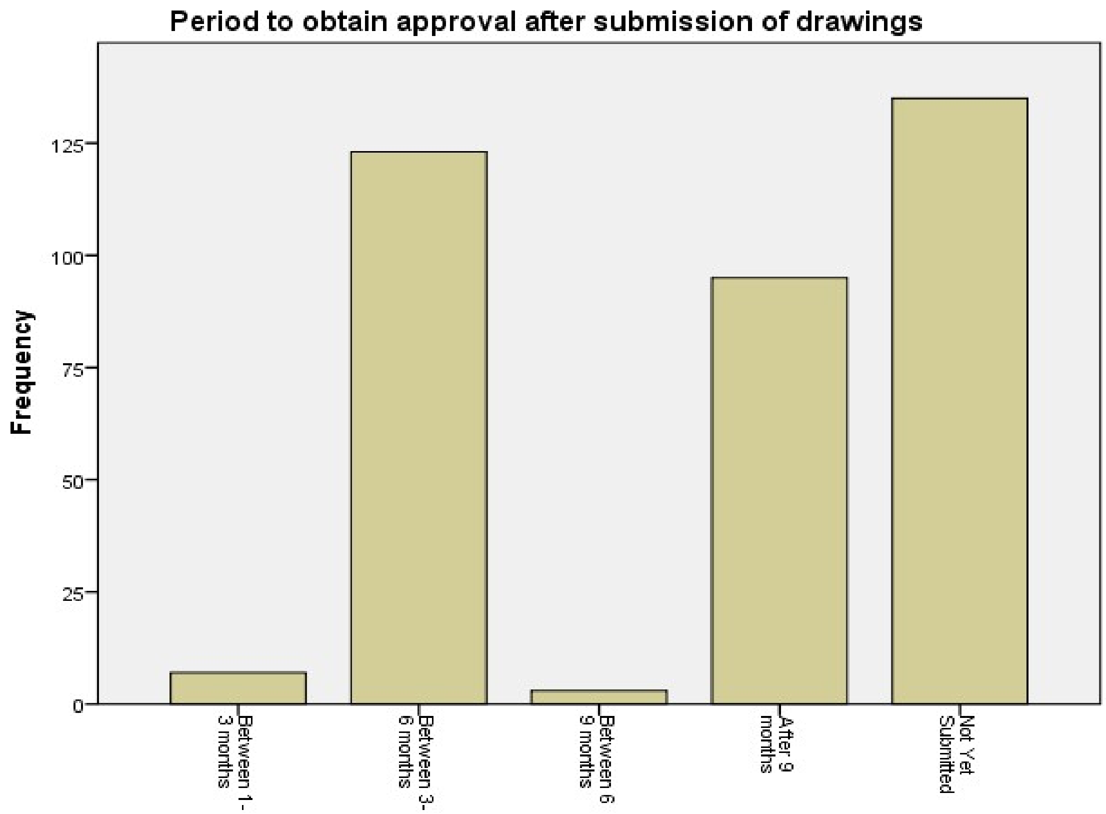


Figure 17: Period to have approval given for construction.

178 developers of 363 developments surveyed had submitted their drawings for approval indicating that over 50% of developers had not even submitted development plans for approval. Of these, only 7(1.9 percent) cited to have obtained their permissions under 3 months; 123(33.9percent) obtained their permissions between 3-6 months; 3(0.8 percent) between 6-9 months; and 95(12.3percent) after 9 months. This indicates that 96 percent of the submitted drawings were approved after 3 months of submission, with 25 percent going beyond 9 months. This is an extended period which influences developers to commence construction before obtaining approval.

4.4 STAGE INSPECTIONS

4.4.1 TRENCHES INSPECTION

Table 24 shows the frequency of trenches stage inspection for the sampled developers. It is evident that 94 percent of developers had not received an inspection of the trenches from the Local authority.

Table 22: Respondents who received trenches inspection.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	342	94.2	94.2	94.2
	Yes	21	5.8	5.8	100.0
	Total	363	100.0	100.0	

4.4.2 FOUNDATION INSPECTION

Table 25 shows the frequency of foundation stage inspection for the sampled developers. Also with this stage, less than 12 percent confirmed having received an inspection of their foundations. This inspection ensures the structural integrity of the building with respect to the foundations.

Table 23: Foundation stage inspection by the Local authority

Inspection of Foundation by Local Authority

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	321	88.4	88.4	88.4
	Yes	42	11.6	11.6	100.0
	Total	363	100.0	100.0	

4.4.3 INSPECTION OF DAMP AND ANT COURSES

Table 26 shows the frequency of damp and ant stage inspection for the sampled developers, An alarming less that 2 percent confirmed receiving this stage inspection. This is an important inspection affecting the public health of the building.

Table 24: Inspection of Damp and Ant Course stage by the Local authority

Inspection of Damp and Ant Courses by Local Authority

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	356	98.1	98.3	98.3
	Yes	6	1.7	1.7	100.0
	Total	362	99.7	100.0	
Missing	Not sure	1	.3		
Total		363	100.0		

4.4.4 DRAINAGE STAGE INSPECTION

This is a very important aspect of development inspection. This stage ensures that the design is appropriate for the site topography and averts flooding during rainy months. From the survey, less than 2 percent of the developers received this inspection. This is quite alarming, hence the flooding vulnerabilities of these areas of Lusaka, coupled with poor drainage system. The desired scenario is to have the property being developed to slope towards a road reserve the drainages as complimentary infrastructure to the road. Table 27 illustrates these findings:

Table 25: Drainage stage inspection

Inspection of Drainages by Local Authority

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	361	99.4	99.4	99.4
	Yes	2	.6	.6	100.0
	Total	363	100.0	100.0	

4.4.5 INSPECTION SUPERSTRUCTURE

This inspection includes a check of the superstructure structural elements as the masonry construction, materials used, lintols, beams, slabs, and other functional requirements for the smooth operation of the building. It is worth noting that 46 percent indicated to have received this inspection. This is an improvement compared to other inspections. This can be attributed to the fact that, at the point the development is visibly seen by all, the Local authority personnel are also 'activated' to provide enforcement. Table 28 illustrates the survey results.

Table 26: Superstructure stage inspection

Inspection of Superstructure upto Wall Plate by Local Authority

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	196	54.0	54.0	54.0
	Yes	167	46.0	46.0	100.0
	Total	363	100.0	100.0	

4.4.6 INSPECTION COMPLETED STRUCTURE FOR OCCUPATION

This is an important stage of inspection as it captures a wholistic perspective to the structural and functional requirements of the building. This inspection should be able to pick out aspects as building fire resistance, electrical fire vulnerability, waste management, amongst others. From the survey, barely 23 percent confirmed having received this inspection, with an occupational certificate.

Table 27: Occupation stage inspection

Inspection of Completed structure for occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	281	77.4	77.4	77.4
	Yes	82	22.6	22.6	100.0
	Total	363	100.0	100.0	

4.5 SUMMARY OF CHAPTER

From these results of the survey, it is evident that the following key factors have affected the quality of building construction:

1. Lack of *engaging professional design and construction services* by developers.
2. Starting construction *before submission of design plans* to local authority.
3. Long length of time taken to obtain building permit, and that influences developers to start the construction before approval is given.
4. Inadequate stage inspections by the local authorities.

These have been exacerbated by the social-economic factors of the developers such as

1. Limited educational background
2. Low income levels.

CHAPTER 5: DISCUSSION

5.1 INTRODUCTION TO CHAPTER

The previous chapter analysed the factors affecting developers adhering to the building quality control framework. This chapter will discuss these in relation to the internal mechanisms in the Local authority setup in building control. A typical case chosen is that of Lusaka Local authority.

The key factors affecting developers in building quality control, as identified from the survey, are:

1. Lack of *engaging professional design and construction services* by developers.
2. Starting construction *before submission of design plans* to local authority.
3. Long length of time taken to obtain building permit, and that influences developers to start the construction before approval is given.
4. Inadequate stage inspections by the local authorities.

These have been exacerbated by the social-economic factors of the developers such as

1. Limited educational background
2. Low income levels.

These are now discussed below

5.1 LACK OF ENGAGING PROFESSIONAL DESIGN/CONSTRUCTION SERVICES

This was observed to be one of the paramount factors affecting the quality of building construction. Among the key professionals who should be involved in the concept design and specifications of a building include Architects, Structural Engineers and Electrical Engineers. These professionals ensure that design is in accordance with all the safety and functional requirements. It was observed that over 50 percent of developers do not engage these specialists. Among the key reasons given include:

1. Lack of literacy as to the role and importance of these professionals: Some developers expressed ignorance as to the role and importance of these professionals. This indicates that more sensitisation of developers is needed by the Local authority, collaborated by the respective professional bodies such as Engineering Institution of Zambia(EIZ), Zambia Institute of Architects (ZIA), and the National Council for Construction (NCC).
2. Expensive rates for professional services: Most developers who did not engage professional services cited the cost of these services as a hindering factor. This was especially observed for Low Cost development areas. Therefore, there is need for the Local authority to carter for Low income developers by provision of some standard designs and specifications, which could be procured at minimal costs by developers. These can be customised to the site upon inspection of site by the Local authority at

minimal cost. Professional bodies can also have a buy in into these designs by providing some standard specifications.

5.2 COMMENCEMENT OF CONSTRUCTION BEFORE APPROVAL OF DESIGNS

The survey indicated that more than 52 percent of developers had not submitted their developments for approval. Lack of knowledge about the process was cited by some as a contributing factor. Some other developers cited fees to be paid to the authority just to have the drawings approved was a hindering factor, especially for Low cost development areas. Commencement of construction without approved plans robbed the Local authority necessary input into the appropriateness of the design, thereby contributing to poor building quality of developments.

5.3 LENGTH OF TIME TO OBTAIN APPROVAL AFTER SUBMISSION

This was another key factor which some developers cited for not submitting their designs or commencing construction without approval. Its noteworthy that more than 70 percent of developers obtained their approvals after 3 months of submission, with 25 percent of those getting approval after 9 months. Most developers could not be patient enough to wait this long time, especially with the limited and unstable income envelope form most developers. Undobtedly, this trend contributes to poor building construction quality.

5.4 STAGE INSPECTIONS

The Local authority has, within its framework for building control, five stage inspections for all developments in the city. These inspections come at the following phases of building construction:

1. **Trenches Stage Inspections:** This is one of the first inspections on a building development. This affords the Local authority inspectors to have an understanding of the underground soil profile and rock formations where the foundations are anticipated to sit, the depth and sizing of the foundations among other considerations. These are important structural considerations for the assured stability of a structure. This research survey showed that an alarming 94 percent of the developers had not had this inspection. This has led to many sub-standard buildings, with adverse structural frailties e.g. building sinking (Figure 18), making the buildings vulnerable to even the slightest external adverse effects of climate change as floods and winds.

Figure 18: House in Mtendere Township sinking with passage of time: House has sunk by 0.8m within past 4 years (Courtesy: Owner Mr. Mwanza)

2. **Foundation Stage Inspection:** This is an important inspection which allows the Local authority inspectors to ensure that appropriate approved foundations and Bases are implemented. This includes inspecting the sizing of the Strip footing and/or concrete bases, including the appropriates reinforcements used. Without appropriate foundations, the building is vulnerable to structural failures and functionality inadequacies such as exemplified in figure 18 above. It noted that 88 percent of developers had not had this inspection from the Local authority. This is a clear contributing factor in building quality.
3. **Ant and Damp Inspection:** The nuisance and unhealthy state brought about by ignoring Ant and Damp inspection cannot be overemphasized. This is a clear public health concern in building structures. The survey noted that 98 percent of developers had not received this inspection. This inspection allows the inspector to review the provisions for ant-poisoning of Trenches and backfill, Damp membranes, and other specifications necessary to arrest Ant and Damp nuisance.
4. **Drainage Inspection:** The flooding of properties is not a new scenario in the city. In addition to affecting the sub-structure system of buildings, flooding renders occupants homeless and destroys building infrastructure. Drainage inspection allows a review of the plots ability to drain off storm and waste water, and allows amendments to the site topography and building elevations if inadequate to drain off. 98 percent of the surveyed developers had not had this inspection. It is no wonder that flooding continues to adversely affect developers in a number of areas of the City.
5. **Superstructure Stage Inspection:** This allows the inspectors to review the superstructure configurations, window spaces, building materials used, etc. The importance of this inspection cannot be overemphasized. Its noteworthy that of all the stage inspections, this inspection received the most attention from the Local authority. From the survey, at least 46 percent confirmed having received this inspection of their developments from the Local authority, perhaps because of the visible and undeniable presence of construction activity, prompting enforcements. Even then, the 54 percent of developments which continued without inspection is

alarming. This underscores the need to build more capacity I the Local authority buildings inspectorate to be able to pace up with these developments.

6. **Occupation Stage Inspection:** This inspection ensures that the building is checked for all structural and health snags, and thereafter the building being certified safe for occupation. It was alarming that 77 percent of occupied developments had not been certified ready for occupation. Hence, snags are allowed to exist, and intensify overtime, a scenario which would be avoided if this inspection was effectively carried out.

5.5 REVIEW OF LUSAKA CITY COUNCIL BUILDING CONTROL FRAMEWORK

City planning department (CPD) ensures that upcoming structures in the city suit an orderly, aesthetically urban development pattern for a safe, healthy, and habitable environment. This can be achieved through adherence to building regulations and requirements provided for in the laws governing the development process.

The institutional mechanisms in place for development control are:

5.5.1 SUBMISSION OF INFRASTRUCTURE PLANS AND THE SCRUTINY FRAMEWORK

Prior to the commencement of any development works, a developer is required by law under the Urban and Regional planning Act of 2015 and the Public Health Act to obtain planning permissions to develop land and a Building permit from the local authority to erect a structure. The developer is required to submit a set of four copies of the building plans.

The requirements in the submission are:

- Floor plan, Foundation plans, Roof plan, sections, elevations, location plans, and Site plan and certified true copies of ownership documents (Title or occupancy license)
- Application forms
- The developer is required to pay stage inspection fees and scrutiny fees of the building plans.

The submitted building plans are scrutinised by three departments of the council, namely City planning, Engineering, and Public health departments. The recommendations of the departmental reviews are prepared for presentation to the Plans, Works, Development, and Real Estate (PWDRE) committee for outright approval, approval with conditions, or disapproval. This is followed by Full council meeting for ratifications of grants of planning and building permissions.

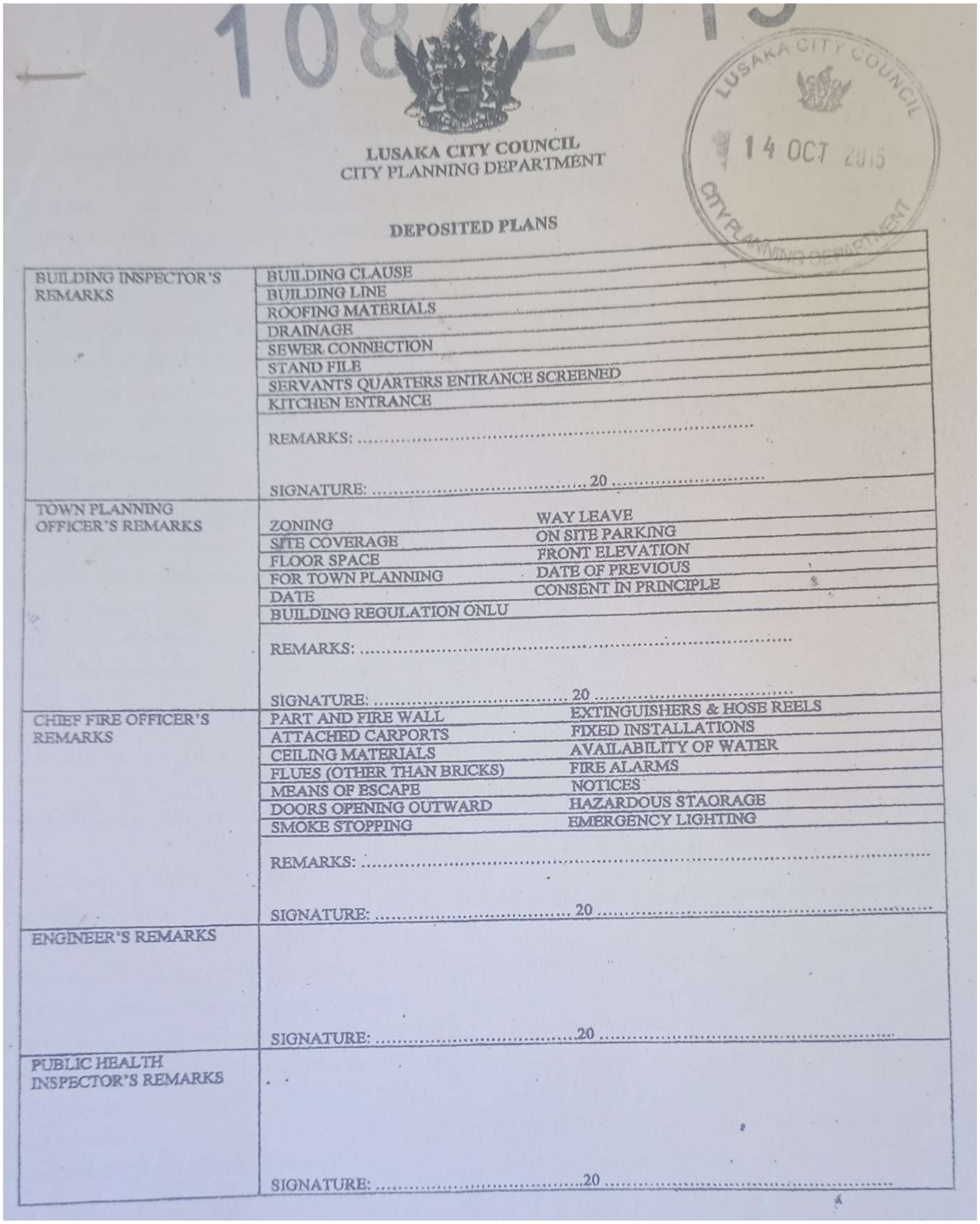
A building permit allows a developer to start developing within six (06) months failure to which the permit elapses and has to be renewed. Construction should be completed within 18 months from the date it is granted.

The building plans scrutiny stages and limitations are outlined below:

Building Inspectorate-City planning department

This section scrutinises the infrastructure plans, general layouts, and specifications provided on the drawings. At the time of the research, there were only 4 building inspectors, who, in addition to scrutinising building plans were also responsible for stage inspections.

The basic scrutiny framework is illustrated in figure 19 below:



108/2015

LUSAKA CITY COUNCIL
CITY PLANNING DEPARTMENT

LUSAKA CITY COUNCIL
14 OCT 2015
CITY PLANNING DEPARTMENT

DEPOSITED PLANS

BUILDING INSPECTOR'S REMARKS	BUILDING CLAUSE	
	BUILDING LINE	
	ROOFING MATERIALS	
	DRAINAGE	
	SEWER CONNECTION	
	STAND FILE	
	SERVANTS QUARTERS ENTRANCE SCREENED	
	KITCHEN ENTRANCE	
	REMARKS:	
	SIGNATURE: 20	
TOWN PLANNING OFFICER'S REMARKS	ZONING	WAY LEAVE
	SITE COVERAGE	ON SITE PARKING
	FLOOR SPACE	FRONT ELEVATION
	FOR TOWN PLANNING	DATE OF PREVIOUS
	DATE	CONSENT IN PRINCIPLE
	BUILDING REGULATION ONLU	
	REMARKS:	
	SIGNATURE: 20	
CHIEF FIRE OFFICER'S REMARKS	PART AND FIRE WALL	EXTINGUISHERS & HOSE REELS
	ATTACHED CARPORTS	FIXED INSTALLATIONS
	CEILING MATERIALS	AVAILABILITY OF WATER
	FLUES (OTHER THAN BRICKS)	FIRE ALARMS
	MEANS OF ESCAPE	NOTICES
	DOORS OPENING OUTWARD	HAZARDOUS STAORAGE
	SMOKE STOPPING	EMERGENCY LIGHTING
	REMARKS:	
	SIGNATURE: 20	
ENGINEER'S REMARKS	SIGNATURE: 20	
PUBLIC HEALTH INSPECTOR'S REMARKS	SIGNATURE: 20	

Figure 19-Building plans scrutiny framework

From the figure, the scrutiny framework for the building inspector includes checking for building line, roofing materials, drainage, sewer connection and Kitchen entrance.

Limitations

Building material specifications: It was observed the designs scrutiny inspectorate had no specifications framework on the quality of materials. e.g. No minimum block work strength, minimum standard grade of steel, grade of DPC and polythene sheeting, etc. With the current diverse market on building materials quality, it is important to have specific minimum performance requirements for the building materials used. Also, whilst the drainage aspect is added to the scrutiny, there is no framework for developers to add topographical and drainage plans to their drawings. Hence, this is clearly not checked. There is also no framework on minimum on-site sanitation requirements for developers. Therefore, this needs review.

Town Planner-City planning department

From the building inspector, the drawings is passed on to the town planner who verifies the area zoning and if the proposed development fits in-line with the area plan.

Fire officer-Engineering department

The fire section of engineering department reviews the design plans in relation to fire safety provisions of the building resilience. This department is especially crucial in the review of commercial development buildings for fire hydrants, horse reels, fire extinguishers, etc. The scrutiny framework for the fire sections includes: ceiling materials, water availability, escape means, fixed installations, fire extinguishers, etc.

Limitations

For residential buildings construction, there is no specification requirement on the designs scrutiny for provision of fire resilience. E.g. fire rating for doors, ceilings, wood used in construction, minimum cover for reinforced concrete, etc. There is, therefore, a need to create specification requirements of building materials used to improve fire resilience.

Architect/Engineer-Engineering Services department

After the review by the fire services section, the building plans are brought for review by the Architects/Engineers under Engineering department. The Architects check for compliance with general practice, as there is no framework to guide them on what to look out for on the building plans scrutiny framework. The same applies for Engineers. For buildings which are multiple storeys, there is a standard form called *'the structural steel and reinforced concrete certificate'* (shown in figure 20 below) where the design Engineer provides some specific design criteria.

Limitations.

The first limitation is that there is no scrutiny framework for Architects and Engineers in the review of building plans. The 'structural steel and reinforced concrete certificate' also has several limitations, including:

- For multi-storey developments, there is no scrutiny framework for structural masonry construction, Timber construction, etc.
- The available structural certificate has no provision to incorporate geotechnical investigation results of the site.
- The Electrical Engineer is not involved in the scrutiny process; no framework compelling submissions of electrical layouts

Therefore, there is need to revise this certificate, to make it responsive to modern construction needs. There is also need to create a scrutiny framework for Architects and Engineers as they review these building plans.

LUSAKA CITY COUNCIL

In accordance with the Urban & Regional planning act No. 3 of 2015

STRUCTURAL STEEL AND **REINFORCED CONCRETE CERTIFICATE**

1. GENERAL:
   Stand No: PLOT No.
   Designer's Ref. No.:
   Description of premises:
   Owner's Name and Address·
   Architects:

2. Design Loads
   All design loads are **to** be in accordance with British Standard Code or Practice C.P. 3 Chapter V (1953) or any subsequent amendment **thereto**.
   a) Basic Wind Pressure assumed (C.P. 3 - Table 3):1.4Kn/M2
   b) **Ultimate number** of **floors to** be designed for and loadings:-

FLOOR	IMPOSED LOADING KN/sqm	USE FOR WHIC EACH FLOOR IS USED
DESIGN ULTIMATE LOAD=		

   c) Maximum foundation pressure:

3. DESIGN STRESSES,ETC
   a) All reinforced concrete design and **construction will** be in accordance **with** BS 8110:1997,BS 6399,BS 4466:1989

   Unit stresses used in design:-
   Concrete
   Direct compression:
   Compression due **to bending**:
   Shear;**Normal** Shear Capacity:, Punching Shear Capacity:

   Steel Bondeck
   Tension......
   Tension **in helical reinforcement** in columns...........
   Tension in shear **reinforcement**............. Compression in **column** bars..........................

   b) All **structural steelwork** design and construction in accordance **with**:-

NOTES

a) One **print** of all **structural steel** and **reinforced concrete drawings showing the position and dimensions** of all members and **reinforcement** is **to** be **submitted with** this **certificate**. Force diagrams, calculations and bar schedules are not **required.**
b) All Portland cement concrete for **structural** use **shall** have a **minimum** resistance **to crushing** (cube **strength) within** seven days **after mixing** of **twice** the design stress used for compression due **to bending**. The Council may take cube **tests during** all stages of **construction, but this is** not **to** be **interpreted** as in any way **relieving the contractor** or supervisor **of their obligation in** this respect.
c) Where a **building** is **to** be erected up **to** a road reserve boundary the Council may **permit column foundations to project into** the road **reserve to** a **maximum distance** of 300 mm **subject to** the upper surface of the **foundation being** not less **than** 225 **millimeters below the** general **footway level** at **that point**. All **applications** for **permission must** be accompanied **by full details** of **the proposals**.

1) Designed by: `
2) **Qualifications:**
3) Signature...
4) Address:
5) **Structural work will** be supervised by:
6) Qualification!'-
7) Signature...
8) Address:

Signature of **owner** or **owner's** agent...

Date...

Figure 20-Structural steel and reinforced concrete certificate used by Lusaka City Council

Public health Inspector-Public health department

The public health inspector scrutinises the building plans in-line with the public health regulations. The public health act provides for the public health in the following:

- The pollution of potable water;
- Any collection of water or any cesspit, latrine or urinal found to contain mosquito larvae;
- Any collection of water, sewage or waste which permits or facilitates the breeding of parasites, insects or other agents which may lead to the infection of people or domestic animals;
- The accumulation or deposit of waste which is offensive or injurious or dangerous to health;
- The discharge or noxious matter or waste water into a water course not approved for the reception of such discharge;
- Premises without sufficient lighting or ventilation;
- Dangerous buildings and overcrowded premises;
- Factories giving rise to smells and effluents which are offensive or dangerous to health.

Limitations

The local authority public health building plans scrutiny does not provide a framework on how to implement scrutiny in line with the act. The following table highlights some of the areas affecting quality building construction:

	Provision in the Public health Act	Institutional Scrutiny framework need
1	The pollution of potable water	There may be need to capture on-site sanitation needs on the plot and streamline them with adjacent properties. E.g. a minimum distance between borehole and septic tanks/soakaways, latrines, etc on the plot and in relation to adjacent plots sanitation systems.
2	The accumulation or deposit of waste which is offensive or injurious or dangerous to health	The sizing and specifications of the septic tanks/soakaway need to be such that the waste undergoes adequate treatment before being discharged into the environment. Minimum specifications need to be specified.
3	Premises without sufficient lighting or ventilation;	In this regard, minimum specifications on lighting and ventilation in relation to room sizing are needed as a guide for designers and for scrutiny purposes

From the above, there is a clear need to create a public health inspectorate scrutiny framework to ensure quality and sustainable building developments.

Figure 16 below illustrates the building permission process flow:

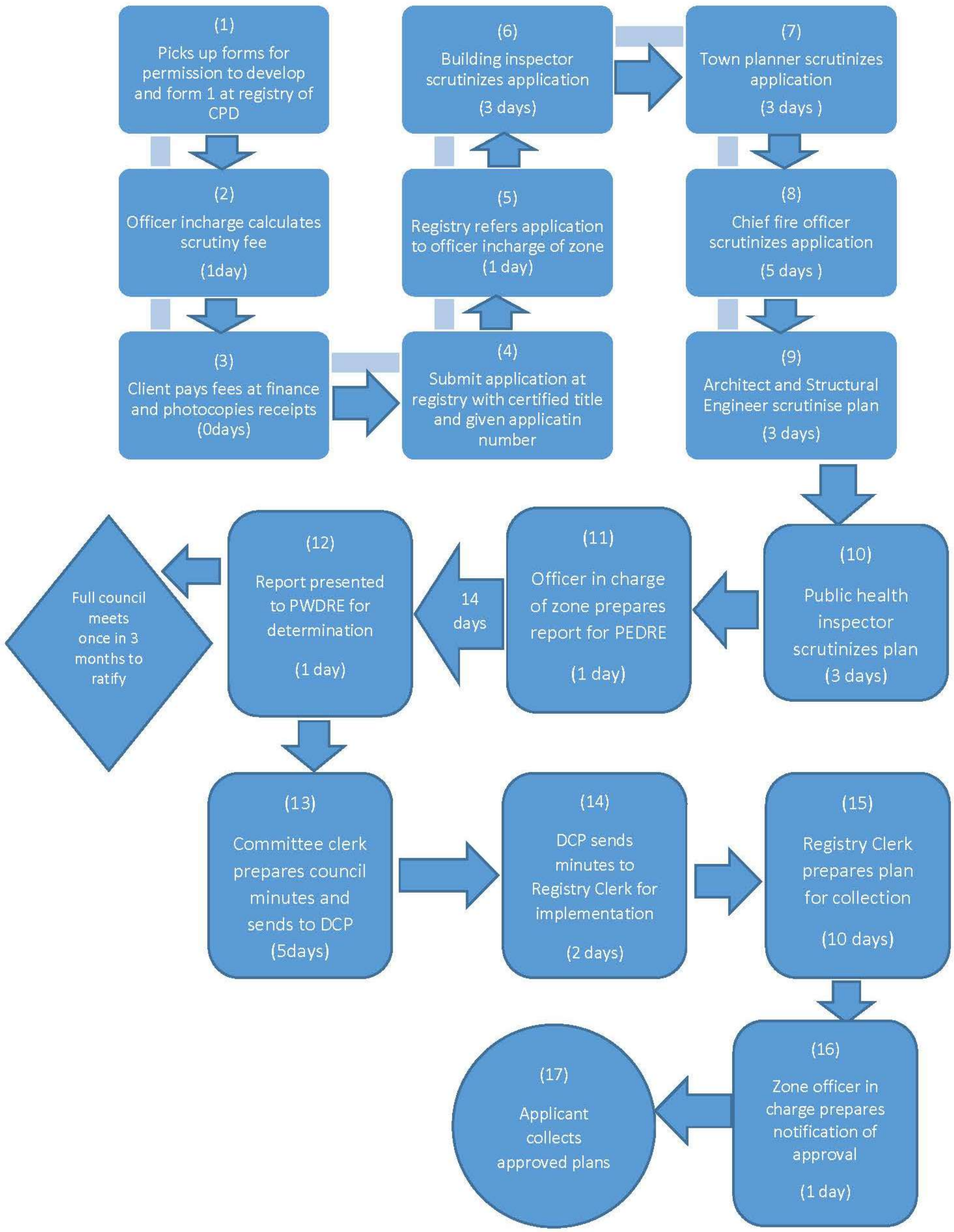


Figure 21-Permission to develop workflow.

It takes an average minimum of 54 working days to obtain planning permission to develop. This even extends to 9 months to obtain planning and building permission.

5.1. 2 BUILDING INSPECTIONS

Any construction being undertaken in the city is to be inspected in five stages of construction by the building inspectors. To the approved building plans are attached a set of inspection slips which the developer must fill in and forward to the building inspectorate. These notices act as a request for building inspectors to go and inspect the development. The following six (06) stages currently require inspection:

1. Inspection of trenches
2. Foundations inspection
3. Ant and Damp-proof inspection
4. Drainage level inspection
5. Superstructure level inspection
6. Final completion inspection

The figure below illustrates these inspection stages:

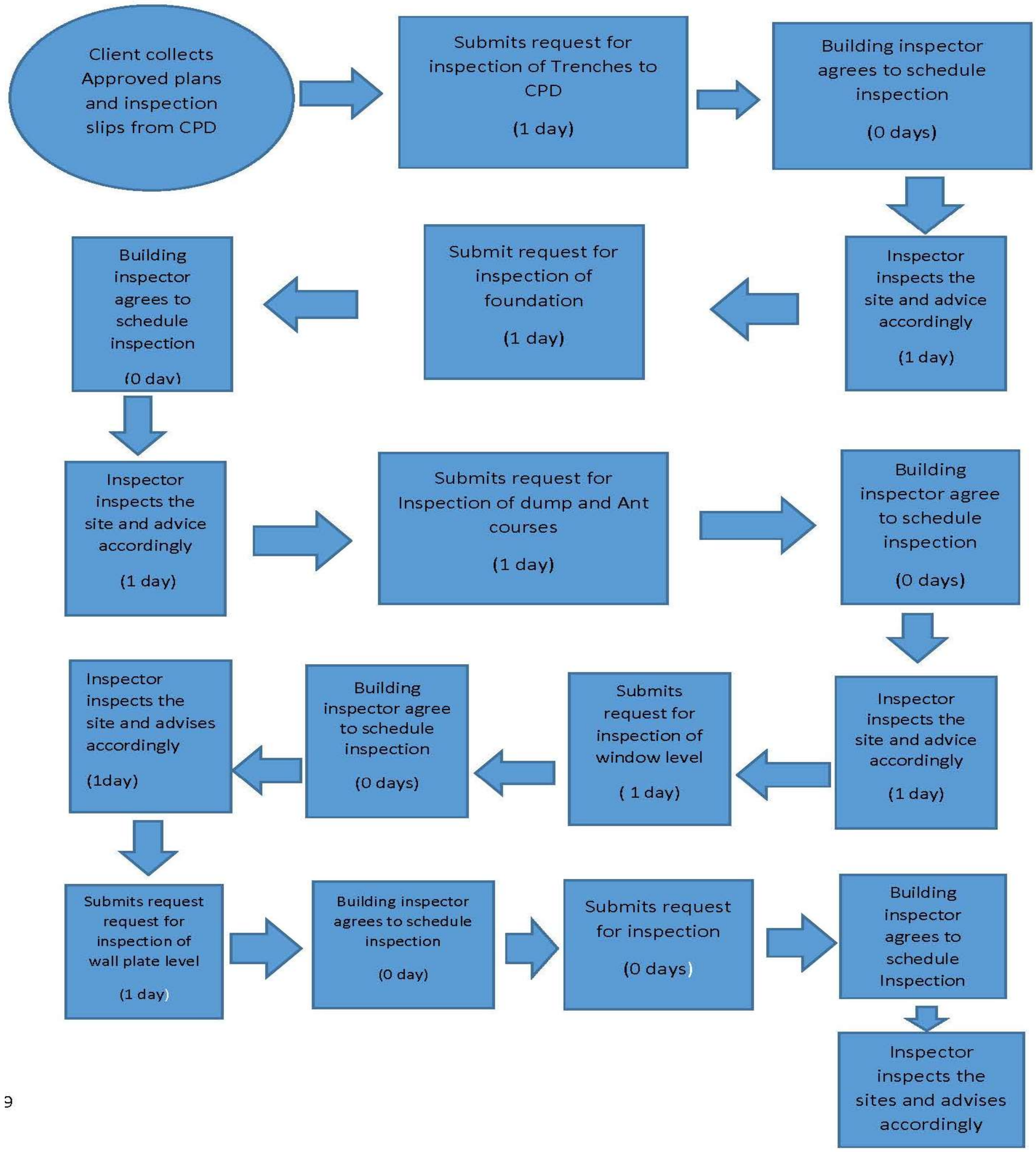


Figure 22-Stage inspection workflow

As was shown above, developers hardly receive inspections at the stipulated stages of construction. The percentage figures of those not receiving an inspection at any particular stage are quite alarming, as slightly over 30 percent in High Cost development areas receiving inspections at Trench, foundation, and damp and ant proofing stages, whilst less than a percent receiving these checks in Low Cost development areas. This may indicate the gap that developers are not calling on the authority to inspect their construction. This also clearly shows the inadequacy of the Local authority to carry out these inspections. This compromises building quality as there is no quality assurance of the construction.

To illustrate this need: The local authority receives on average about 900-1200 development plans for scrutiny each year. Taking the upper limit, this translates to about 100 building plans to be reviewed each month. By law, the building construction should be completed in 18months. Therefore, in this period 1500-1800 developments need to be inspected for the 6 stage inspections. This means that 10,800 inspections need to be carried out by the council in 18 months, translating into 600 stage inspections per month. To meet this need, taking an average reasonable limit of 2-3 inspections per day per inspector, the Local authority needs 10 building inspectors dedicated to just inspections. At the time of this research, there were only 4 building inspectors for the whole city.

Therefore, if the Local authority does not have the needed capacity to handle stage inspections for the whole city, the recommendation is that the Local authority could certify private qualified building inspectors to who can be engaged by the developer to inspect the stages of construction, who will certify the quality of materials used, construction methodology, and adherence to the design plans. These in-turn report accordingly to the Local authority for final certification of Building quality and safety. The concluding inspection is illustrated below:

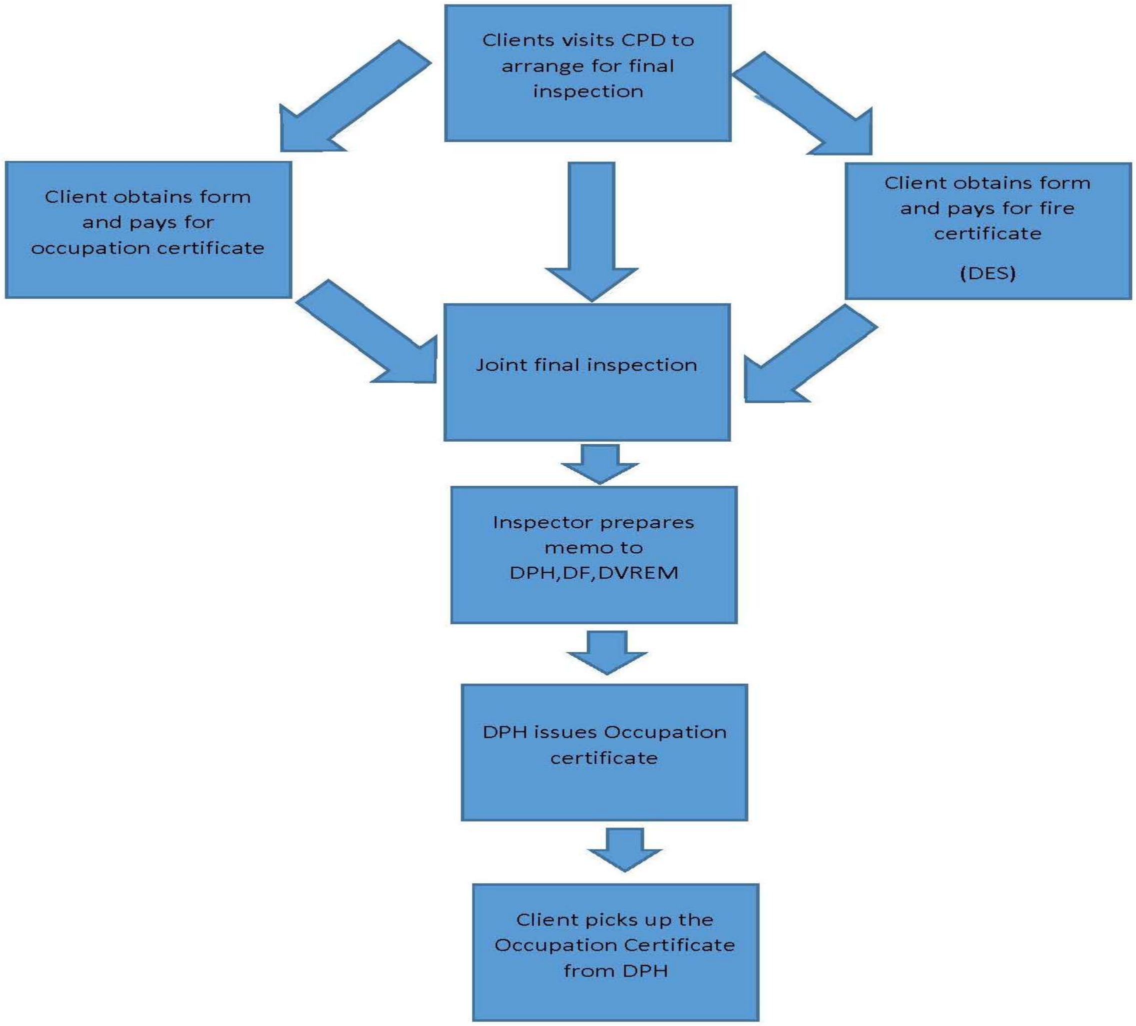


Figure 23-Final inspection process flow

SUMMARY OF FINDINGS

This research aimed at the following:

ii) Investigate factors amongst developers affecting the quality of building construction.

iii) Review the adequacy of the Local authority operational framework in enforcing quality building construction.

The following factors amongst developers affecting quality building construction wer established from the study:

- Lack of engaging professional design services

- Not submitting infrastructure plans to Local authority
- Commencing construction before approval
- No professional input in construction implementation
- Limited awareness of role of Local authority in building construction
- Unable to afford professional services.

The following Table lists the limitations of the Local authority operational framework in enforcing quality building construction:

Table 28: Operational framework gaps in Local authorities in enforcing quality building construction

	Limitation	Source	Recommendation
1.	Local authority (LA) takes too long to approve building plans	Developers Survey; Institutional framework review on approval of plans	LA can cut down on approval lead times by fully enforcing 'approval in principle awaiting Full council ratification'. This can cut down the minimum 3 months lag time of awaiting Full council meeting resolutions.
2.	LA lacks specific standards for use in scrutiny of designs, especially for Engineering designs scrutiny i.e. Fire resistance, Minimum cover to rebar in the light of minimum fire response, Electrical designs, Geotechnical parameters, etc	Institutional framework review on approval of plans	LA in collaboration with professional bodies as EIZ, ZIA, and NCC to come up with minimum design standards applicable to our Local environment
3.	No comprehensive checklist, minimum guide, or standard to Stage inspections i.e. Substructure checklist, Superstructure checklist, Drainage checklist, etc	Institutional framework review on stage inspections	LA to come up comprehensive building inspection checklist
4	Inadequate capacity to carry out stage inspections	Developers Survey; Institutional framework review on stage inspections	In addition to increasing staff establishment for this role, LA can consider tapping into the resource of external consultants from professional bodies to aid with inspections. These consultants can document the whole stage inspection process and certify quality for LA ratification and filling.
5	Minimum standard designs and specifications for Low-Cost development areas to carter for low income groups. These can be procured from the LA at very minimum affordable rates for the communities.	Developers Survey	From the Survey, it was noted that developers from Low cost development areas struggled with the fees from professional consultants. Therefore, LA, in collaboration with professional bodies can develop some minimum baseline designs, which can be procured at affordable rates, and can easily be customised to the plot area.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

It has been established in this study that more is needed to ensure that quality building construction is upheld in a city. The effects of climate change continue to test the resilience of our built infrastructure. Buildings are exposed to adverse factors as destructive windstorms, heavy rains and flooding, extreme temperatures, amongst others. If left to chance, the narrative of collapses in building infrastructure will continue to get worse, risking lives, property, and investments. This also slows down Government efforts in fostering development as it has to respond to those affected by poorly built infrastructure year-in, year-out.

Ensuring and enforcing quality building infrastructure is not a ‘one man show’, that is we cannot leave it to one institution or body alone. All need to get involved in ensuring quality built infrastructure. Among the key stakeholders in this endeavour are the developers themselves. These need to be in-sink with other bodies involved in building construction such as the Local authorities, and professional bodies as the Zambia Institute of Architects, the Engineering Institute of Zambia, and the National Council for Construction. It was noted that most developers are illiterate as to the clear roles of the Local authority and input from the professional bodies as it relates to their construction needs. Its no wonder then that many do not seek professional input in their developments, nor do they seek approval from the Local authority before commencing construction. Also, the relationship between the Local authorities and professional bodies needs to be strengthened so that they can complement each other in ensuring building quality. Especially for Low income groups, it will be necessary to have some standard designs, which can easily be customised to client interest and site conditions which can be more affordable.

Also, there is need to develop well customised design scrutiny and stage inspection framework for Local authorities to use, in line with the local society needs and available materials. This may need standard forms and checklists to be formulated and revised in-line with current construction needs and trends. Academia and research institutions also need to be incorporated in developing these frameworks. Additionally, each Local authority needs to localise their operational frameworks in quality building control by customising their framework to the specific locally available materials and construction techniques used in their jurisdiction.

The need for a clear building regulatory framework for the Zambia building industry cannot be overemphasized. Thus, there is need for research into developing the Zambia Buildings Regulatory framework, which will take into consideration developer attitudes, environmental effects, material performance standards, locally available materials and design parameters, among other considerations. This will help all players in the Zambia building industry to move together in ensuring reliant building infrastructure.

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APPENDIX I : QUESTIONNAIRE

THE UNIVERSITY OF ZAMBIA

SCHOOL OF ENGINEERING

MASTER OF ENGINEERING IN CONSTRUCTION MANAGEMENT

QUESTIONAIRE FOR DEVELOPERS

(Thesis Title: BUILDING CONSTRUCTION QUALITY ASSURANCE: REVIEW OF THE REGULATORY AND INSTITUTIONAL FRAMEWORK-CASE OF LUSAKA CITY OF ZAMBIA)

INTRODUCTION

I am a student at the University of Zambia pursuing my Master of Engineering in Construction Management. I am carrying out a research study on the challenges faced by Building Construction Quality Control in Lusaka. Kindly assist me by answering the Questions freely and honestly. Be assured that your responses will be confidentially handled by the researcher.

Your assistance will be greatly appreciated.

Jere Nahum Stackson (BEng, Unza; MEIZ): Contact-nahumsj@gmail.com; +260 965055667

Instructions

Do not write your name on this questionnaire.

Please answer the questions by ticking against your answer and fill in the blank spaces.

Section A: General Information

1. What is your Age range?

   ☐ Below 21 ☐ Between 21 and 65 ☐ Above 65

2. What is your occupation?

   ____

3. Employment status : ☐ Employed ☐ Unemployed ☐ Retired ☐ Self employed

4. Occupational background: ☐ Construction sector ☐ Non-Construction sector

5. What is the highest level of education?

   ☐ Form 5/Grade 12 ☐ Diploma ☐ Bachelor's Degree ☐ Master's Degree

   ☐ Doctorate ☐ If Others, Specify____

6. Please tick your monthly income category below.

   ☐ Below ZMW800=00 ☐ Between ZMW800=00 and 2,200=00

   ☐ Between 2,200=00 and 6000=00 ☐ Above 6,000=00

7. Where you able to access any financial facility (i.e. Loan, Mortgage, etc) to assist with the construction?

   .☐ Yes ☐ No

8. Do you experience floods on this property? ☐ Yes ☐ No

9. Have you done any training in Architecture or Building Construction?

   ☐ Yes ☐ No

10. If Yes in (6), Please specify what training/course you received and the training institution.

    Training received in (type of course)____

    Institution____

    Duration of training____

Section B: Building Design

11. Where you able to engage a registered Architect (i.e. MZIA) OR registered Engineer (i.e. MEIZ) to design/check your drawing?

    ☐ Yes ☐ No

12. If 'No' in question 11 above, which of the following best describes your reason?

    ☐ Don't know that it is necessary ☐ Registered Consultants are costly

    ☐ Was in a hurry to secure the land

    ☐ If other reason, Explain____

13. Where you able to submit your design drawings to the Local Authority before commencing construction?

    ☐ Yes No ☐

14. If 'No' in (13), which of the following best describes your circumstances?

    ☐ Don't know that it is necessary ☐ Was in hurry to secure land first

    ☐ Submission process is expensive ☐ Submission and approval process is time consuming.

    ☐ If others, Explain____

15. Please tick the aspects of the drawings you Submitted for Approval to LCC:

    ☐ Floor Plan ☐ Elevations ☐ Sections

    ☐ Drainage Plan i.e. Lines of drainage, depth, invert levels, etc ☐ Site Plan

    ☐ Block Plan ☐ Electrical Safety plan i.e. Electrical layout, wiring, etc

    ☐ Structural drawings (If multi-storey building)

    ☐ Have not yet submitted drawings

16. Did you obtain Planning and Building Permission before commencement of construction?

    ☐ No ☐ Yes

17. If 'No' in (16), Which of the following best describes your circumstances?

    ☐ Drawings took long to be approved ☐ Drawings were rejected

    ☐ Was in hurry to secure the Land

    ☐ If other, specify____

18. How long did it take to get the Planning and Building permissions from the time you submitted?

    ☐ Less than 1month ☐ Between 1 -3 months ☐ Between 3-6 months

    ☐ Between 6 -9months ☐ After 9months

Section C: Building Construction

19. Where you able to engage an NCC registered (or certified) Contractor/Builder/Supervisor or a trade certified (or registered) Builder/Contractor/Consultant to Build or supervise the construction works?

    ☐ Yes ☐ No ☐ Not sure if he/she was registered

20. If 'No' in (19), which of the following best describes your circumstances?

    ☐ Registered personnel are expensive. ☐ Don't think it's necessary to have registered personnel, so long builder has enough experience, etc.

☐ Don't think it's not a binding requirement.

☐ If Other, Explain____

21. During the course of your construction, how many inspections did you receive from the Local authority at the following stages:

- Trenches (after trenching but before concrete footing/Bases):_____________________
- Foundation:____
- Damp and Ant Courses:____
- Drainage:____
- Completed up-to Wall Plate Level:____
- Completed and ready for occupation:____

22. Where you issued with an occupancy permit or certificate from the Local Authority?

☐ No. ☐ Yes.

I would appreciate suggestions on how the local authority can improve its Building Quality Control:____

____

____

____

____

____

____

____

____

OFFICIAL USE

Type of development area:

☐ Low Cost

☐ Medium Cost

☐ High Cost

END OF QUESTIONNAIRE. THANK YOU FOR PARTICIPATING IN THIS STUDY.