HOUSING ACCESSIBILITY: A STUDY OF RETROFITTING EFFICIENT RAMPS IN PUBLIC BUILDINGS IN KISUMU CITY, KENYA

BY

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DECLARATION

I hereby declare that this thesis is my original work and has not been presented for the award of degree in any other University. No part of this work may be reproduced without the prior written permission of the author and/or University of Eldoret.

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Declaration by Supervisors

This thesis has been submitted for examination with our approval as University supervisors.

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DEDICATION

To my mother Grace Midecha, wife Lucy Chebitok and sons Basil Kary and Nelson Olwenya.

Thank you all.

ABSTRACT

The recent past has seen an increased inquiry into the mobility of the aged and physically impaired persons in public buildings in Kenya. The rapidly growing population paralleled by an increase in the number of physically challenged people and the elderly has driven up the need for accessible housing. For this reason, the government of Kenya through the Persons with Disability Act (PDA) of 2003 has made it mandatory that all public buildings that do not have ramps be retrofitted with ramps. Despite this directive by the government of Kenya on the requirements for building accessibility, many public buildings in the study region do not have accessibility ramps. It is for this reason that the research was envisaged and conducted to determine the compliance with the PDA Act 2003 and the requirements for efficient ramp construction. The purpose of the study was to investigate the factors that hinder the incorporation of efficient ramps in some of the existing low-rise public buildings in Kisumu City, Kenya. A descriptive survey design was adopted, and data collected through semi-structured questionnaires and observation checklist. Descriptive statistics and inferential statistics (Chi-square test) were used to validate the outcome of the analysis which was performed using SPSS version 16. A significance level of 0.05 was used to determine the acceptance or rejection of the hypotheses. The study sample was selected through stratified and purposive sampling with a total of 53 participants and 48 existing public buildings forming part of the research. The findings showed that; public buildings in the study area had not complied with the requirements for efficient ramp construction. Also, some factors that impeded the retrofit of efficient ramps included inadequate guides on inclusive design, space requirements, strength of existing building and inadequate building inspection. Additionally, building owners and building inspectors considered retrofitting of ramps in public buildings possible. The study concluded that; many public buildings in the study region remain largely inaccessible to persons with mobility challenges. The available building documents, part of the building and architectural requirements impede the process of retrofitting ramps in public buildings. Building owners and building inspectors however considered the retrofit of ramps possible. The study recommends that; the Government of Kenya should consider reviewing the existing construction guides to include principles and specifications for construction of efficient ramps, promote housing accessibility principles through workshops and seminars and also, involve persons with disabilities in the drafting and implementation of policies relating to the construction industry.

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LIST OF ABBREVIATIONS AND ACRONYMS

ADA	Americans with Disabilities Act.
CBD	Central Business District.
HC	Health Centre.
IBC	International Building Code.
JKUAT	Jomo Kenyatta University of Agriculture and Technology.
KU	Kenyatta University.
LRPBs	Low Rise Public Buildings.
MCA	Member of County Assembly.
MoH	Ministry of Health
PDA	Persons with Disabilities Act (No.14) of 2003.
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific.
UNESCO	United Nations Educational, Scientific and Cultural Organization

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May the almighty God bless you all.

CHAPTER ONE

INTRODUCTION

1.0. Background to the Study

For a long time, buildings have formed part of the human habitat. The built environment has ensured increased human production and socialization. The built environment influences almost every aspect of human activity. The ability of a person to live independently, receive an education, find a job, travel, take part in religious, social, athletic, and recreational activities, and choose where to live is affected.

Despite the numerous benefits, the built environment consists of many barriers. These obstacles which include inaccessible floor spaces, broken pavements, out of reach door knobs and shelves, toilets with accessibility barriers among many others, limit the access to the services offered therein especially for the physically challenged and the elderly. Such impediments make an environment unsafe and cause a high level of difficulty to persons with physical challenges and the elderly. But more importantly, barriers cause spaces to be out of reach, denying people the opportunity to participate in various spheres of life such as education, economic, social, and cultural and many other activities (UN Report, 2004).

Persons with mobility impairments have been widely ignored in the past, but in recent years, they have begun to wage a campaign for equality. Their campaign includes equitable opportunities for employment, education, and access to goods and services among others.

All of this requires a minimum degree of access to the places where employment, education, and goods and services may be found (Shannon & Foote, 1996)**.** It is from this perspective that the built environment should be made accessible to all.

Currently, there are many documents and policies put in place in many countries to facilitate the remodelling of the built environment to make it accessible to all and minimize discrimination regarding access to services and socialization. Some of these documents include the Americans with Disability Act, 2010 that set minimum requirements – both scoping and technical – for newly designed and constructed or renovated State and local government amenities, public accommodations, and commercial facilities to be readily accessible to and usable by mobility impaired persons.

The City of Winnipeg Accessibility Design Standards (2010) addresses accessibility requirements for the design and construction of new amenities, as well as the retrofit, alteration to existing built facilities, owned, leased or operated by the City of Winnipeg. It supports the City's Universal Design Policy. The document provides a diverse range of user needs, including people with disabilities. It embraces the spirit of universal design through the creation of inclusive environments.

Also, the South Africa Disability Policy Guideline (2009) recognizes access needs of all diverse disabilities including lighting, sound, signage, tactile, ramp, parking, ablution facilities, lifts, etc. The Policy Guideline offers criteria to guide the Department in prioritizing public buildings and properties in making them accessible by catering to the diverse needs of persons with disabilities.

In Kenya, the Persons with Disability Act of 2003 requires public buildings to be retrofitted with ramps to ease access to services offered therein by persons with physical disability and the elderly. According to the Kenya Constitution (2010) part 3, subsection 54, individuals with any disability are entitled to access to facilities for persons with disabilities that are integrated into the society to the extent compatible with their interests and access to all places.

The study focuses on the ramp as one of the facilities that individuals with disabilities can use in low-rise buildings. It can act as a safe means of circulation by the physically challenged and elderly when constructed to required standards. Ramps are relatively easy and less expensive to build, at least in one storey buildings and will benefit many (UNESCO, 2009).

The Americans with Disabilities Act of 2010 lists several guidelines for construction of efficient ramps. Some of the guidelines include; a slope ratio of 1:12 to 1:20, a minimum width of 900mm edge protection to keep anyone from slipping off, landings at top and bottom should be as wide as the ramp and at least 1.5m long. All ramps that rise steeper than 150mm or have a horizontal projection of more than 1.8m should have handrails on both sides.

From the literature review, the process of making the built environment barrier free is very gradual with some buildings completely inaccessible to persons with mobility challenges. The aim of this study was to investigate the constraints to the retrofitting of public buildings with ramps that comply with accessibility requirements.

1.1. Statement of the problem

An accessible built environment enables persons with mobility challenges to get better chances to integrate into the society, access vital services and reduce their dependence on support for everything they require in life. For independent movement in the built environment, efficient ramps are essential for circulation, especially in low rise buildings and building entrances. A spot check of accessibility into buildings in Kisumu City, however, reveals the absence of these accessibility facilities for the mobility impaired population in most public buildings. Access into many buildings by wheelchair bound persons is almost impossible. According to Section 23 of the Persons with Disabilities Act of Kenya 2003, accessibility to buildings by persons with disabilities should be made possible by all stakeholders of the construction industry. The section states 'every public building should be made accessible to persons with disabilities'. The implementation of the Act however, remains invisible. Sidha (2010) observed that most of the policy promises outlined in the PDA act 2003 have remained unfulfilled.

It is against this absence of efficient ramps in many existing low rise public buildings that, Housing accessibility: a study of retrofitting efficient ramps in public buildings in Kisumu City, Kenya was conducted.

1.2. Purpose of the Study

Based on the stated problem, the purpose of the study was to investigate the factors that hinder the retrofitting of efficient ramps in some of the existing low rise public buildings in Kisumu City, Kenya.

1.3. Research Objectives

The objectives of this study are as follows;

1. To examine the extent of compliance by public buildings to the building requirements for efficient ramps in Kisumu city, Kenya.
2. To investigate the constraints to the construction and retrofitting of efficient ramps into existing public buildings.
3. To establish the possibility of retrofitting efficient ramps into existing public buildings.

1.4. Study Hypotheses

The study tested the following hypothesis:

H_{01}: There is no compliance by public buildings to the building requirements for efficient ramps in Kisumu City, Kenya.

H_{02}: There are no constraints to the construction and retrofitting of efficient ramps in existing LRPBs.

H_{03}: There is no possibility of retrofitting existing public buildings with efficient ramps.

1.5. Significance of the Study

The results of the analysis presented shall be of great importance in the following sectors; the education sector, where there is the need to provide equal education opportunities to all persons regardless of their ability by creating a barrier-free learning and training environment and also providing a better working environment for the aged trainees and instructors. In the medical section, where there is the need to eliminate mobility barriers for wheelchair users, pregnant women, the elderly, casualties on stretchers and crutches among others for easy access to medical care. In public offices, where every individual is entitled to governmental and other social services and in the tourism and commercial sectors where there is the need to increase the market niche by reaching as many customers as possible regardless of ability among many other fields.

1.6. Scope of the study

The study of accessibility to the built environment is a wide field. It includes accessibility to facilities like wet rooms, door knobs, kitchen shelves and worktops, use of lifts, elevators, zero steps, stair climbing wheelchairs among other mobility devices. This study, however, was confined to efficient ramps as one of the facilities that can be used in making the built environment accessible, especially in low rise buildings and building entrances, where they are economical and easy to incorporate as opposed to high rise buildings where elevators and lifts become economical accessibility facilities for all.

1.7. Limitations of the study

The study was limited to public buildings in Kisumu city, Kenya.

1.8. Conceptual Framework

The conceptual framework gives the relationship between the variables under study.

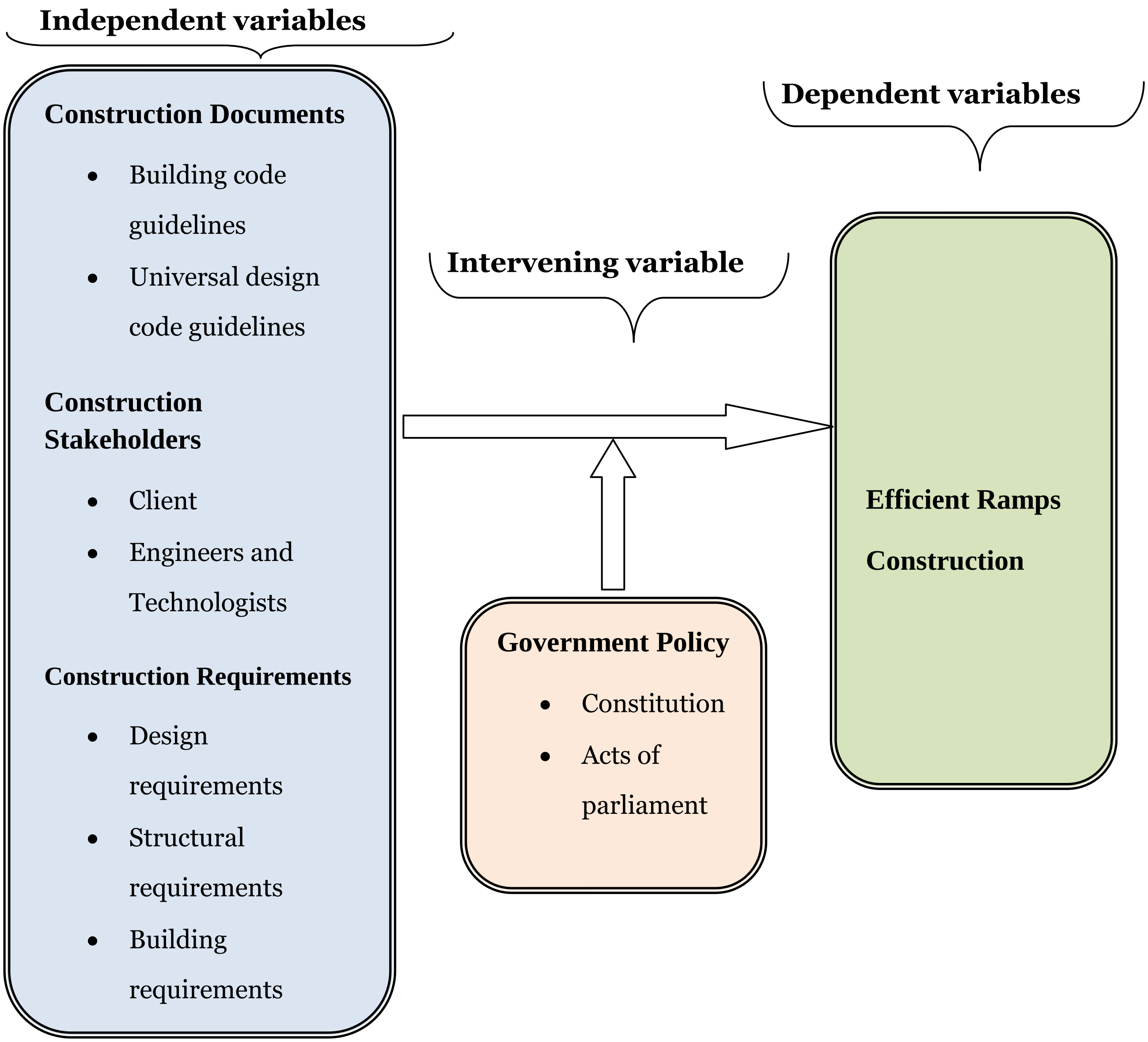


Figure 1.1: Conceptual Framework Flow Chart

The independent variables in the study are; the construction documents, stakeholders in the construction industry and building requirements. The construction documents affect the building elements either positively or negatively by providing the relevant specifications for the construction of elements. The stakeholders in the construction industry on the other hand play a crucial role in the determination of the nature of the final built facility; the client for instance is responsible for financing the project. When the project is funded adequately, all the elements are constructed to the specification and when inadequately funded, the result could be omission of some building elements and substandard construction of others. Engineers too are responsible for the implementation of the design requirements. The efficiency of the engineers may lead to the construction of either standard or substandard products. Also, design requirements allow or limit the construction of accessibility facilities. Limiting space may lead to the omission or substandard construction like using steeper slopes to fit ramps into the space. The spacing of structural elements may also influence the building of ramps by either limiting the size or altering the specification.

The intervening variable in the study was the government policy. The government through acts of parliament and the constitution can regulate the kind of built environment by providing building specifications to be followed during construction. The construction specifications are constituted on behalf of the government by the architectural association of Kenya, the board of engineers and engineering technologists.

The dependent variable in the study was the ramp; its construction depends on the by-laws put in place to guide the construction industry. The efficiency of the ramp is dependent on the construction documents available such as building codes and construction guides. It also depends on the workmanship employed during construction and the building constraints present during the retrofitting of ramps in existing buildings and the availability of funds.

1.9. Operational definition of terms

The meaning of some of the terms as used in the study is given below

Housing accessibility	Refers to the construction or modification of housing to enable independent living for persons with disabilities.
Efficient ramp	This is a ramp constructed to a slope not greater than 1:12, with a non-slippery floor surface, with guard rails and can be used by wheelchair bound persons unaided and with minimum effort.
Low rise buildings	These are buildings that do not exceed three storeys.
Inclusive housing	A built environment in which mobility barriers are minimized.
Universal design	Design of products, services and environments that can be used by as many people as possible regardless of age, ability or situation.
Mobility impaired Populations	A population that has physical or functional limitation that affect their movement about their environment.
Environmental accessibility	Is the degree to which an environment is available to as many people as possible.
Retrofitting ramps	Construction of ramps in buildings where none is available.
Inclusive design-	Design that considers the full range of human diversity with respect to ability, language, culture, gender, age and other forms of human difference.
Public building	A building used by the public for any purpose, such as assembly, education, entertainment, or worship.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0. Introduction

The chapter presents the reviewed literature related to the study, and it includes the following subsections: photographic view of the status of existing public buildings, review of previous related studies, review Construction Guides and Building Code on Accessible Design and a review of Construction Journals and Documents.

2.1. Status of existing public buildings

Figure2.1 Main Entrance to a Church in Kisumu City: The ramp superimposed on the stair nosings is too steep to be used by wheelchair bound persons unaided. **Source (**Author, 2014)

Figure 2.2: Main Entrance to a Building Department in a National Polytechnic in Kisumu City, Kenya. The first floor cannot be accessed by wheelchair users.

Source (Author, 2014)

Figure 2.3: Ground Floor of a Public Market in Kisumu, Kenya.

The surface is a barrier to wheelchair users. **Source (**Author, 2014)

2.2. Review of related research work

The current built environment poses a lot of mobility obstacles to the persons with physical challenges and the elderly. Barriers in the built environment can contribute to limiting achievements of everyday activities and restrict participation (Helle, 2013). Pynoos (2001) finds that Over 90% of the elderly population lives in conventional single-family houses as well as apartments. Unfortunately, most of these buildings were not designed to meet their needs. They live in housing with problems such as inaccessible entrances and stairs as well as unsafe kitchens and bathrooms.

Access to Education facilities by persons with mobility challenges is also an issue; most schools have not attempted to make the classrooms accessible for children with physical impairments or on wheelchairs (Ingstad & Grut 2007). In higher learning institutions, Ongeta (2013) studied the learning environment and academic participation of students' with physical disabilities in higher education at KU and JKUAT. The study findings revealed that some buildings had stairs or too steep ramps to navigate through. These hindered the students in attending some classes in time. As a result, their participation in class activities was minimized.

Hospitals too have problems of building accessibility. In his study, Ewemar (2008) found that of all the accessibility design features mentioned during the survey, the ramp had the highest tally followed by stairs, spacious rooms, accessible sanitary room features, and hand guardrails respectively 48%36%10%4%2%.

Concerns about urban accessibility include small kerbs that are not a problem for the physically fit community but that are inaccessible for wheelchair bound persons (Adams, 2006).According to the findings of a study by Ochien'g et al (2010) there was a planning problem in the Kisumu CBD concerning accessibility for people with physical disabilities, as most buildings have discriminatory designs that significantly hamper accessibility. Within the building interior, the barriers encountered included absence of lifts and ramps.

Other built environments limit the productivity of employees with mobility challenges. The few persons with mobility challenge employed, experience hindrances at the workplace. A study by Sajjad (2004) finds there was no special provision made for physically challenged employees to give them a barrier free built environment and to cater for their individual needs. In low-rise buildings access to services in upper floors is a problem. In a study by Ikechukwu,et al (2015) there was no building with ramp connecting to an upper floor, in Nigeria. Only 11% of the buildings had an elevator in place to aid movement to the upper floors.

Accessibility of the built environment to individuals with mobility challenges has continued to be a challenge. In a separate study, a majority of the participants (92%) said that they experienced problems while trying to enter buildings that had not complied with the adjustment order as cited in the PDA of 2003 (Wambugu, 2012). Able bodied persons put forth excuses not to make the built environment accessible to all. The courts view physical access to schools as non-negotiable and have not accepted arguments such as the one put forth by the defendants in one case that there are currently no handicapped students in the school system and therefore no ramp is necessary (Manis, 2013).

All stakeholders in the built environment need to embrace the spirit of universal design. An atmosphere that makes people more aware of disabilities of all types would appear to be more likely to improve the built environment for those with disabilities (Winheld, 2010). A barrier free environment is highly welcome. In a study intended to establish whether mobility services improve socialization of students. All the teachers 17 (100%) and students comprising 59 (100%) were of the opinion that mobility services provided enhanced interaction among students and teachers. It was further established from teachers that mobility services enhanced socialization through students playing together with peers, moving in groups and also working together in class. In view of this, socialization took place through the peer interaction in various activities both in and out of class within the school compound (Wachianga, 2010). In a separate study, almost all teachers and key respondents 95% and 90% respectively agreed that the absence/presence of disability friendly facilities affect access to education for all (Najjingo, 2009).

Since mobility is one of the major difficulties which physically challenged children encounter, then the house, pavements, classroom and other structural environments should be made accessible to them. The area around the school and the school compound should be free from architectural barriers which can cause mobility and emotional disturbances. They should be able to move unrestricted with their wheelchairs, crutches, and prostheses (Chepngetich & Mulambula, 2012).Though becoming fully accessible will not happen overnight, neither should it be sidelined or put on the back burner. Even though becoming fully accessible will have some economic cost, it is the right thing to do for everyone. Not striving to become fully accessible also has economic cost through lost revenue (Lewis, 2003).

2.3. Review of Construction Guides and Building Codes on Accessible Design

The section deals with a review of building codes and construction guides, most of which are based on anthropometrics. Anthropometrics provide a range of “building blocks” of specific dimensions detailed for people with various mobility devices. These construction blocks vary considerably, for example, the length of a wheelchair as specified by Canada, Spain and Singapore is 1.2m with Mexico and the Philippines providing a longer dimension, while the Canada AFG Guideline specifies 1.4m, as they include the length of both scooters and power wheelchairs in this dimension. The minimum clear floor area of a manual wheelchair ranges from 700mm x 1.2m in Spain to 850mm x 1.3m in the AFG Guideline, while the Expert Panel judges the best practice to be 850mm x 1.3m. The minimum clear floor area to allow access for people using manual wheelchairs is consistently reported at 1.5 x 1.5 m. The minimum diameter for turning a wheelchair is 1.5m with 2.3m required for turning a power wheelchair, and 1.3m required for turning a scooter. These larger dimensions reflect the wide range of mobility devices that are increasingly posing a challenge to designers around the world**.** (International Best Practices in Universal Design Canadian human rights commission 2007).

The terms universal design and inclusive housing as used in most of the building codes are used to refer to an accessible environment. Universal design refers to the design of a built environment that is usable by as many people as possible in spite of their age, ability or situation. Universal design links directly to the political idea of an all-inclusive society. Its importance has been embraced by governments of many countries, businesses, and industries.

Universal design is a relatively new concept that has been derived from other concepts of accessibility such as barrier-free and assistive technology. Barrier-free design and assistive technology were limiting concepts. As much as they provide a level of accessibility for people with disabilities, they often lead to separate and stigmatizing situations. For instance, a ramp that is only available at the back entrance or a key operated stair lift. Universal design is a broad-spectrum solution that aims at helping everyone, not just people with disabilities alone. Additionally, it recognizes the importance of how things look. For example, while built up handles is a way of making kitchenware more usable for people with gripping limitations, some companies have gone further to introduce larger, easy to grip and attractive handles as a feature of mass production (Brunswick Building Code, 2007). The following Building codes and construction guides on accessible design give building guidelines for ramps in various cities and countries:

City of Bellingham Construction Guide(2013); according to this manual, a ramp is required where there is a change in the gradient of the floor greater than 13mm, within a built space or along an accessible route of travel. A ramp may not be necessary if an elevator or platform lift provides access to the changes of level. The ramp runs should have a slope greater than 1:20 but not steeper than 1:12. The above requirement exempts existing buildings or facilities where ramps shall be permitted to have slopes steeper than 1:12.

Table 2.1: Ramp Dimensions for Construction in Sites and Existing Buildings.

Slope	Maximum rise
Steeper than 1:10 but not steeper than 1:8	75mm
Steeper than 1:12 but not steeper than 1:10	150mm

Source: City of Bellingham Design Guide , 2013

This barrier-free access ramp guide further gives the following guidelines; **Cross Slope**: The steepness of the Cross slope of ramp runs shall not exceed 1:48. **Clear Width**: The clear width of a ramp run shall be 900mm for interior ramps and 1.1m for exterior ramps. Where handrails are provided on the ramp run, the clear width shall be measured between the handrails. **Rise**: The rise for any ramp run to the landing shall be 760mm maximum. **Landings**: Ramps shall consist of landings both at the bottom and top of each ramp run, the turning points, building entrance and exits as well as at the doors. The landings shall conform to the following requirements;

- Have a slope not steeper than 1:48.
- Clear width of landings shall be as wide as the widest ramp run leading to the landing.
- Landings shall have a length of 1.5m minimum.

Handrails: Ramp runs with a rise greater than 150mm shall be provided with handrails on either side. The gripping surfaces on Handrail shall be continuous, without interruption by newel posts or other obstructions. **Height**: The Handrail height, measured above finish surface of ramp slope, shall be uniform, not less than 850mm and not more than 975mm. **Clearance**: Clear space between a handrail and a wall or other surface shall be a minimum of 38mm. A handrail and other surfaces adjacent to it shall be free of any sharp or abrasive elements.

City of Winnipeg Design Standards Guide (2010); this guide states that accessible ramp shall be on an accessible route. The surfaces of ramps and landings shall have a surface that is slip resistant; have a colour contrast to demarcate the leading edge of the landing, as well as the beginning and end of a ramp. The ramp slope shall be between1:15 (6.7%) and 1:20 (5%).

In a retrofit situation where it is technically not feasible to provide a ramp with a ramp slope between1:15 (6.7%) and 1:20 (5%), a ramp slope not steeper than 1:12(8.3%) may be used. However, more gradual slopes are preferred. Ramps shall have landings that are level both at the top and bottom of each run and also where the ramp changes direction. The horizontal length between landings shall not exceed 9 m. The code gives the ramp maneuvering criteria as shown.

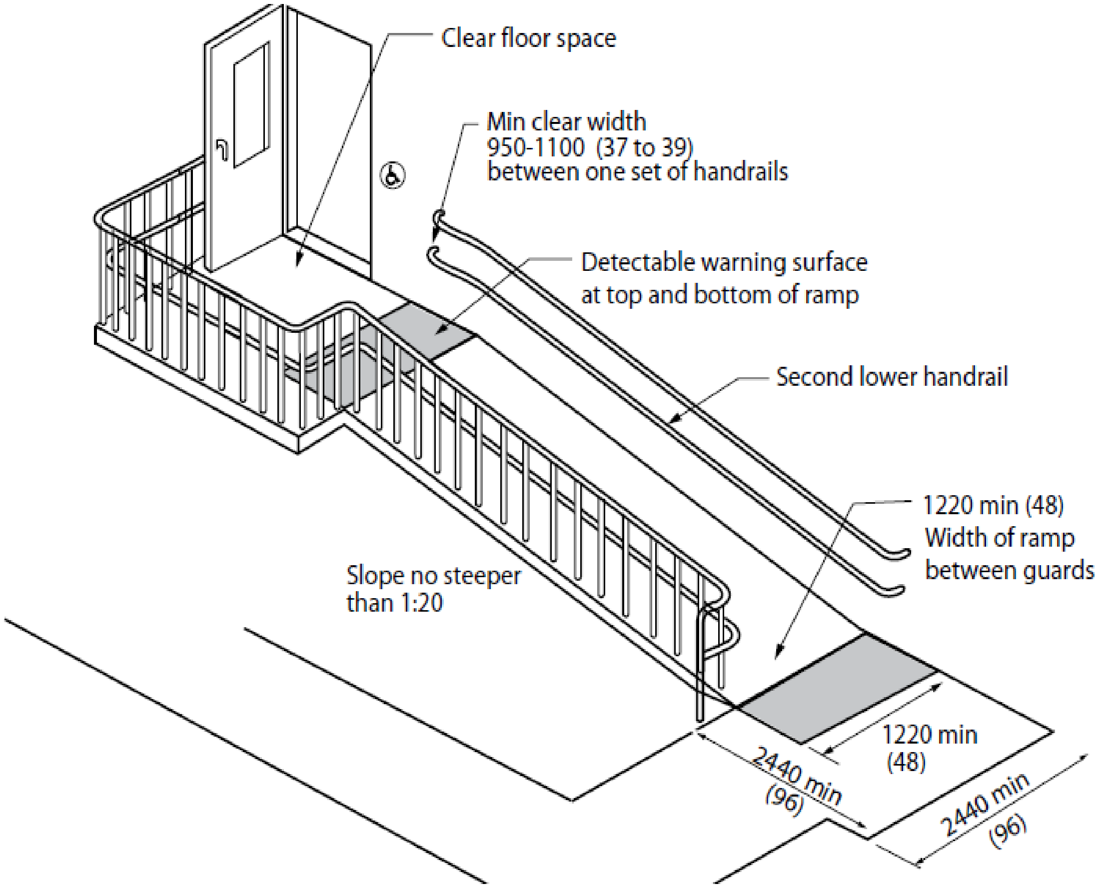


Figure 2.4: Ramp manoeuvring Criteria (City of Winnipeg design guide, 2010)

Singapore accessibility Code (2007): the states that any change in level of the floor surface, the gradient of the slope shall conform to Table 2.2.

Table 2.2: Permissible Gradients between Floor Level

Change in vertical rise(mm)	Gradient not steeper than
0 to13	1:2
More than 13to 50	1:5
More than 50 to 200	1:10
Exceeding 200	1:12

Source: Singapore accessibility Code ,2007

Where the change in slope is more than 13 mm to 200mm; the ramp and its landings shall be of contrasting colour; or a coloured strip shall be painted across the landings of the ramp. Alternatively, tactile marks may be provided instead of coloured band. The tactile indicators shall be set back 300mm from the edge of the ramp.

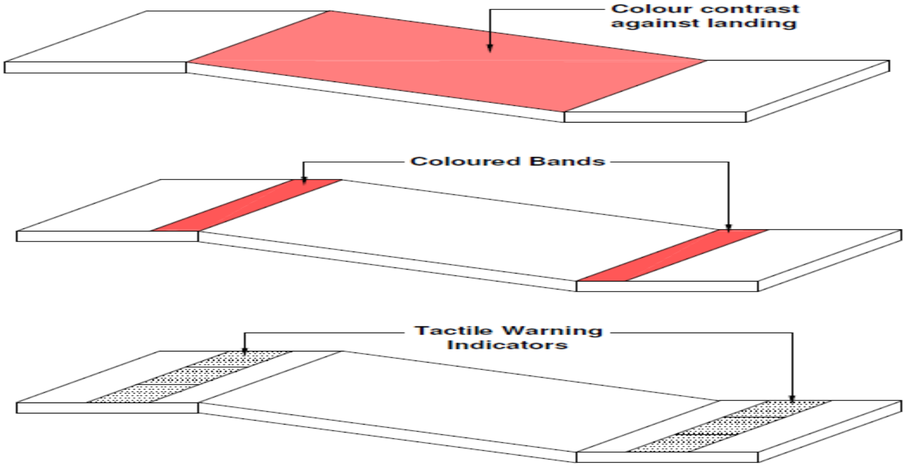


Figure 2.5: Contrasted Colours, Coloured Bands or Tactile Warning Indicators on Ramps (Singapore accessibility Code, 2007)

This guide further gives the following specifications; **Width:** The minimum breadth of a ramp shall be 1.2m. Ramps and landing surfaces shall be non-slip. **Landings**: Ramps shall have a horizontal landing at the top and bottom of each span and also where the run changes direction. **Ramp Handrails**: a ramp run with a slope greater than 180mm shall have handrails on either side and placed at a height of between 790mm and 914mm above the floor level. **Handrail extensions**: shall extend horizontally for a distance of not less than 300mm beyond the top and bottom of the ramp to give support to persons who need help in using the ramp. Besides, it should not project into another path of travel.

Portsmouth Accessible Design guide (2006); this manual stipulates the following specifications for ramped access; the gradient should ideally not be steeper than 1:20. A maximum slope of 1:12 is acceptable only if there is no alternative. The clear width of the ramp should be a minimum of 1m. Steep ramps should not be used because they can cause wheelchair users to experience difficulties in ascending.

India Barrier Free Design Manual (2004); this design manual gives the following specifications; **Slope and Rise:** in new constructions, the maximum ramp slope shall be 1:12. The maximum rise for any run shall be 760mm. Table 2.3 presents the permitted slopes and rises of constructing Curb ramps and ramps on existing sites or buildings or facilities. **Landings:** Ramps shall have level landings at bottom and top of each ramp and each ramp run, and at every 10m of the run. The landing shall be at least as wide as the ramp run leading to it. The span of the ramp landings shall not be more than1.5m clear.

Handrails: If a ramp run has a rise greater than 150mm or a horizontal projection greater than 1.8m, then it shall have handrails on both sides. Handrails are not required on curb ramps or adjacent to seating in assembly areas.

Table 2.3: Allowable Maximum Slope, Maximum Length and Rise for Ramps

Maximum slope	**Maximum Length**	**Maximum Rise**
1:20 i.e., 9%	-	-
1:16 i.e., 6%	8m	490mm
1:14 i.e., 7%	5m	360mm
1:12 i.e., 8%	5m	150mm
1:10 i.e., 10%	1.2m	120mm
1:08 i.e., 12%	490mm	60mm

Source: India Barrier Free Design Manual ,2004

The Design manual for barrier further gives the following signage for various accessibility features.

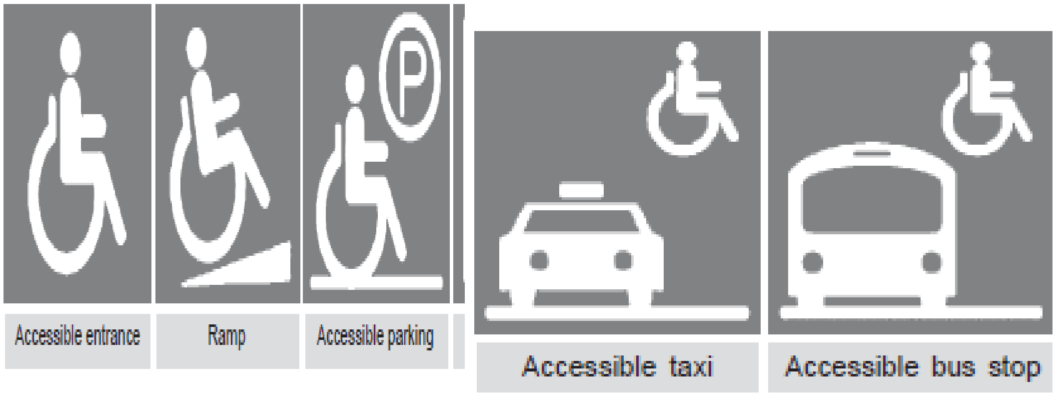


Figure 2.6: Accessibility Signs. (India Barrier Free Design Manual ,2004)

The Compliance Document for New Zealand Building Code (2011); this code provides the following specifications for accessible ramps; **Slope:** The maximum acceptable slopes for ramps are given in Table 2.4. The choice of slope must take account of the type of use and risk of slipping. **Width:** The clear width of an accessible ramp shall be 1.3m. **Landings:** Landings shall be level, and be provided at the top and bottom of all ramps. For any ramp steeper than 1 in 33, intermediate landings are to be provided at the vertical intervals given in Table 2.5.

Table 2.4: Maximum Acceptable Slopes for Ramps

Type of ramp	**Maximum slope**
Accessible ramp	1:12
Common ramp subject to wetting	1:10
Common ramp normally dry	1:8
Service ramps	1:3

Source: New Zealand Building Code, 2011

Table 2.5: Intervals for Landings

Ramp type	**Maximum rise between Landings**	**Length of Landing (m)**
Accessible	760mm	1.2m
Other	1.5m	Ramp width but need not be greater than 1m

Note:
1. 75 0 mm is the reasonable maximum level difference for a person to negotiate in a wheelchair.

Source: New Zealand Building Code, 2011

The Building Code of Kenya (1968); this code provides a brief description of the specifications of efficient ramp construction, it states that Ramps of a slope not exceeding one in ten may be employed instead of outside stairway. If used, ramps shall be maintained with non-slippery surface and if the slope is greater than 1:12, handrails shall be provided.

The ADA Standards guide for accessible design(2010); the Americans with disability code set minimum construction requirements – both scoping and technical – for newly designed and built or altered State and local government housings, public as well as commercial buildings to be readily accessible to and usable by individuals with disabilities. Each construction or part of a facility constructed for use by a public entity shall be designed and built in such manner that it is accessible to and usable by persons with disabilities. **Ramps:** Interior or exterior ramps to be built on sites or in existing buildings with limited space. The following slopes shall be used:

(i) A slope between 1:10 and 1:12 is allowed for a maximum rise of 150mm.

(ii) A gradient of between 1:8 and 1:10 is allowed for a maximum rise of 760mm. A slope that is greater than 1:8 is not allowed.

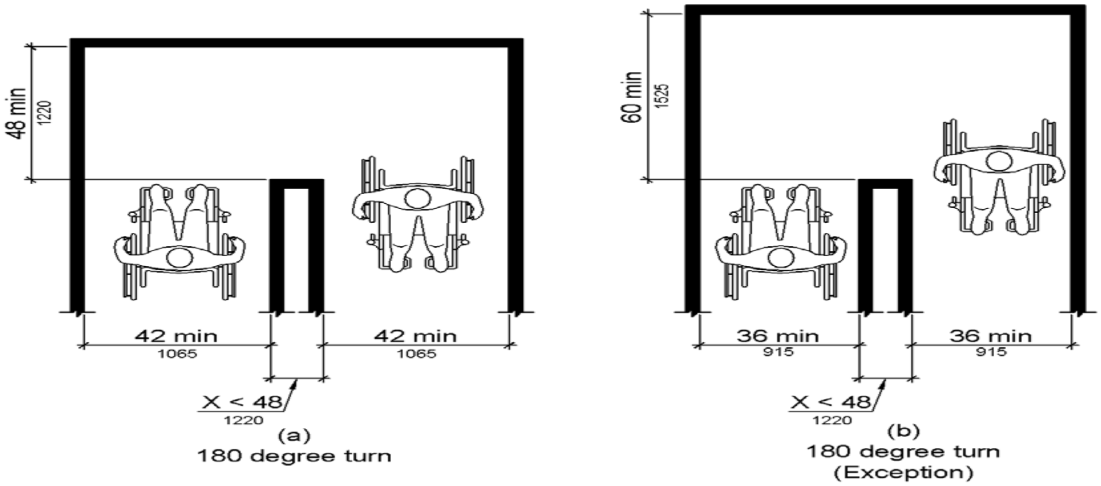
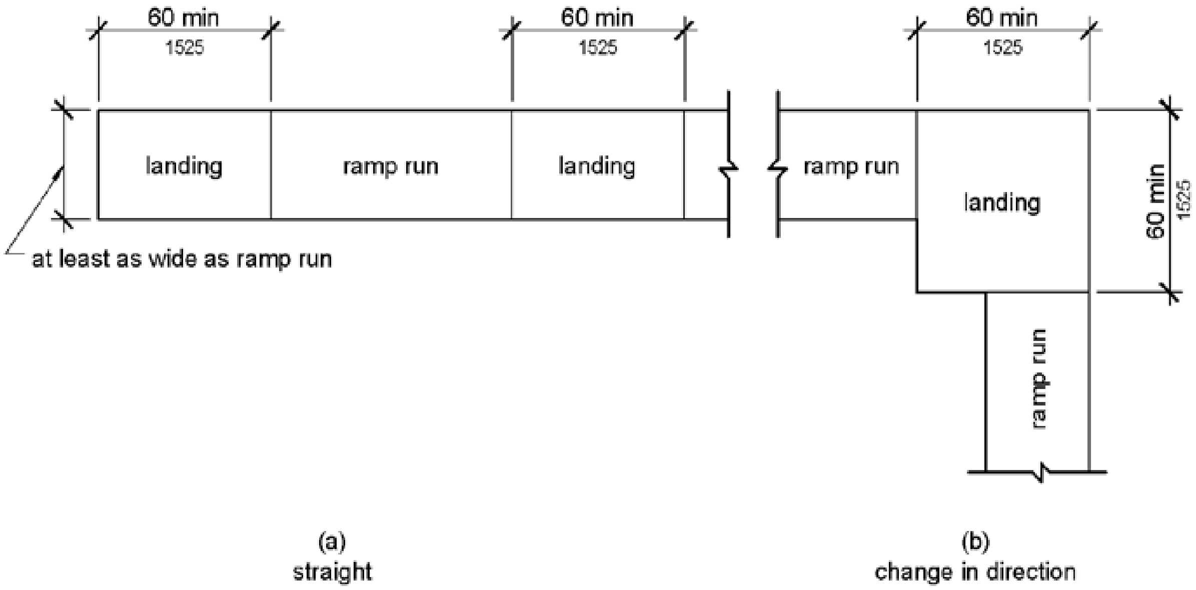


Figure 2.7: Clear Width at Turn (ADA 2010 standards)

Clear Width: The minimum clear width of a ramp shall be 915 mm. **Landings**: Ramps shall have horizontal landings at top and bottom of each ramp span. Landings shall have the following features: the landing shall be at least as wide as the ramp span leading to it. The length of the landing shall be a minimum of 1525 mm clear. When a ramp changes direction at landings, the landing shall at least 1525 mm by 1525 mm. **Handrails:** If a ramp runs has a rise greater than 150 mm or a horizontal projection greater than 1830 mm, then it shall have handrails on both sides. Handrails are not required on curb ramps or adjacent to seating in assembly areas. The Handrails shall be provided along both sides of ramp segments. The inside handrail on switchback or dogleg ramp shall always be continuous.

Where the accessible route makes a 180 degree turn around an element which is less than 1220 mm wide, clear width shall be 1065 mm.



(a)
straight

(b)
change in direction

Figure 2.8: Ramp landings (ADA 2010 standards)

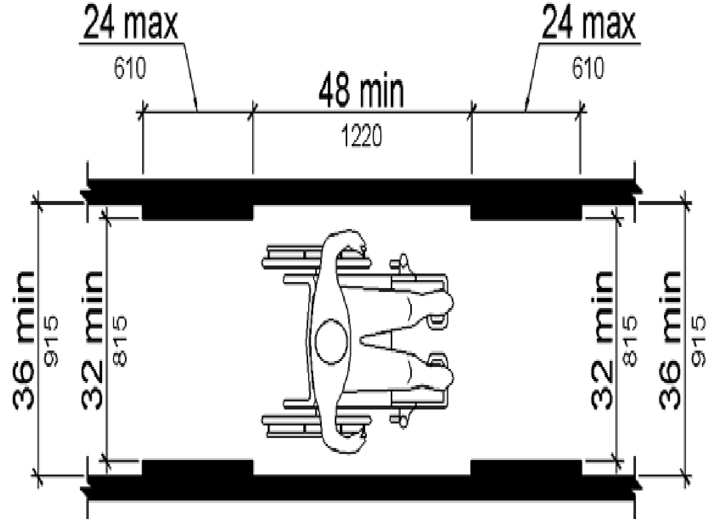


Figure 2.9: Clear Width of an Accessible Route (ADA 2010 standards)

The ramp segment shall extend at least 305 mm beyond the top and bottom as well as be parallel with the floor or ground surface if the handrail is not continuous (see Fig. 2.7). The handrail shall continue to slant for a distance of the width of one tread from the bottom riser at the bottom. The remainder of the extension shall be level. **Handrail extensions:** shall comply with the following; a clear space between handrails and wall shall be 38 mm. Gripping surfaces shall be uninterrupted by newel posts, other construction elements, or obstructions. Top of handrail gripping surface shall be mounted between 865 mm and 965 mm above stair nosings. Ends of handrail bars shall be either rounded or returned smoothly to floor, wall or post. Figure 2.10 shows various handrail protections that can be utilized on the constructed ramps.

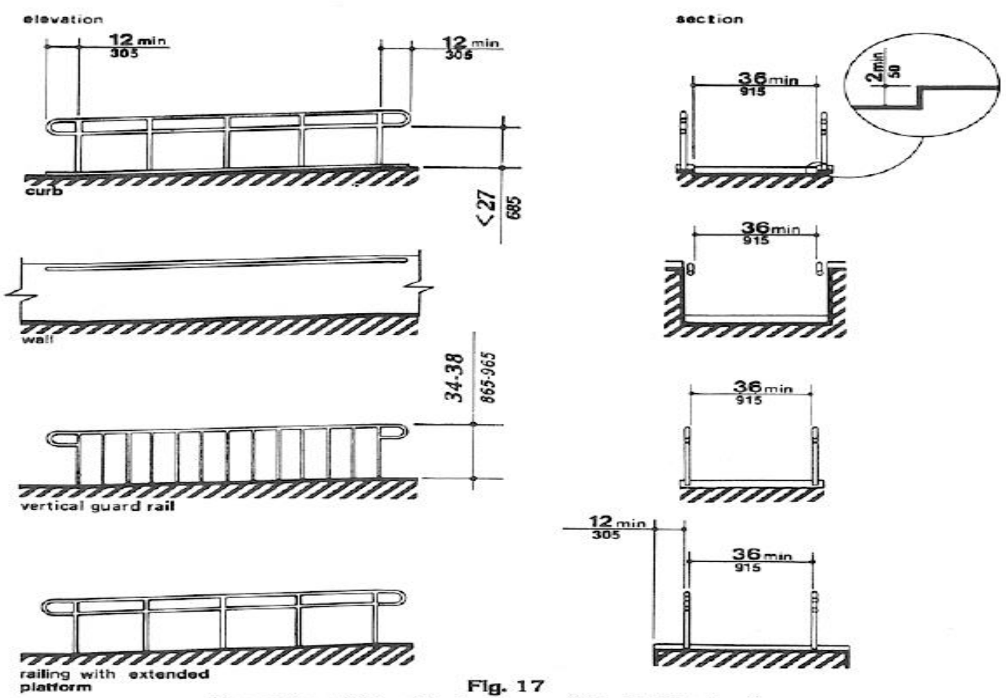


Fig. 17
Examples of Edge Protection and Handrail Extensions

Figure 2.10: Examples of Edge Protection and Handrail Extension (ADA 2010 standards)

Universal design principles for Australia's aid program (2014); the following principles are used as a guide to construction of efficient ramps. **Slope***:* 1:20 is the recommended minimum for a non-assisted person in a wheelchair. The slope can be increased to 1:14 where the wheelchair user is assisted. Greater than 1:12 is considered a hazard.

Width: Varies according to use, configuration and slope, but the minimum is 1m. **Landings:** Provide at least every 9m at every change of direction and at the top and bottom of every ramp and Landing width should be a minimum 1 m and clear from obstructions. **Handrails:** Provide on both sides and along the full length of every ramp 900mm to 1m high- returning at ends or turning down.

Design Manual for a Barrier Free Environment, UN (2004); this document gives the following design considerations for ramp construction. **Ramps:** the following information with regard to ramp construction is given in the documents;

- External ramps are preferred to Indoor ramps because the space available is enough for construction.
- Ideally, the entrance to a ramp should be immediately adjacent to the stairs.

Ramp configuration: Ramps can be constructed to the following forms: Straight-run (fig. 2.14), 90 turn (fig. 2.11); Switchback or 180 turn (fig. 2.12).**Width;** the width varies according to use, configuration and slope. The minimum width should be 0.9m. **Slope**; the ramp should be constructed to a slope not exceeding 1:20. Steeper slopes may be allowed in exceptional cases depending on the length to be covered (fig. 2.13). **Slope:** minimum slope of 1:20 is recommended for un-aided person in a wheelchair. The grade can be increased to 1:14 where the wheelchair user is assisted to ascend. A slope greater than 1:12 is considered a hazard. **Width:** Varies according to ramp use, configuration and slope, but the minimum is 1m. **Landings:** Ramps should have landings for resting, manoeuvring and avoiding excessive speed. Landings should be provided every 10m, at the change of direction, top and bottom of every ramp. The landing shall have a minimum span of 1.2m and a width equal to that of the ramp. **Handrail:** A protective handrail at least 400mm high must be placed along the full length of ramps. For ramps more than 3m wide, an intermediate handrail could be installed. The distance between handrails when both sides are used for gripping should be between 900mm and 1.4m. The ramp surface should be hard, and non-slip-carpets should be avoided. **Tactile bands:** The top and bottom of the ramp should have a coloured textural to alert blind people as to the location of the ramp.

The marking strip width should not be less than 600mm. **Drainage**; adequate drainage should be provided to avoid accumulation of water.

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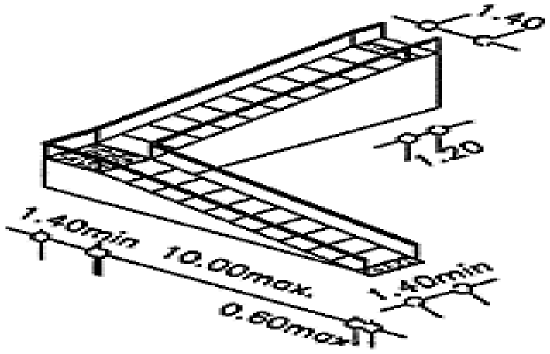


Figure 2.11: 90 Degree Turn Ramp

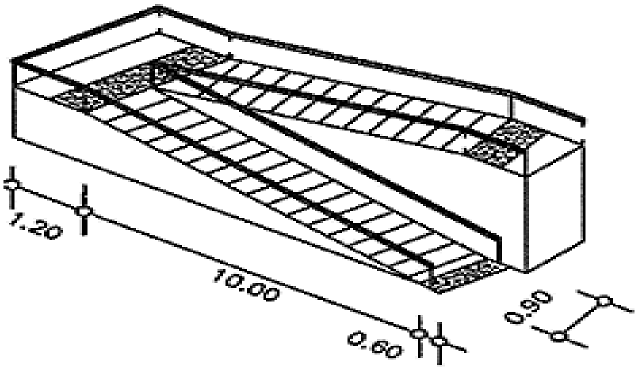


Figure 2.12: 180 Degree Turn Ramp

Figures 2.8and2.9 ramp turns, Design Manual for a Barrier Free Environment (UN, 2004)

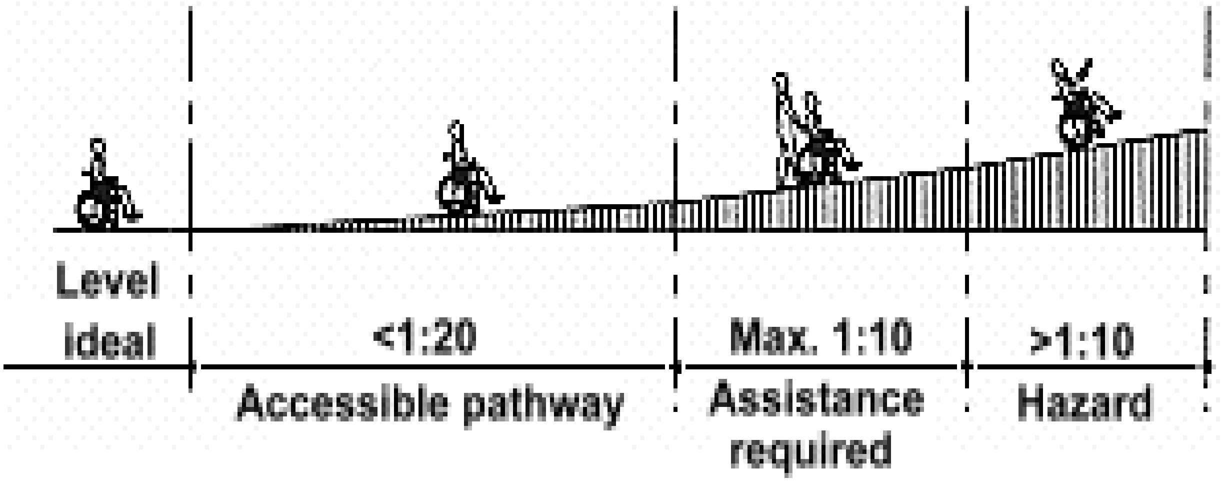


Figure 2.13: Ramp Slopes (UN, 2004 Design manual for barrier free environment)

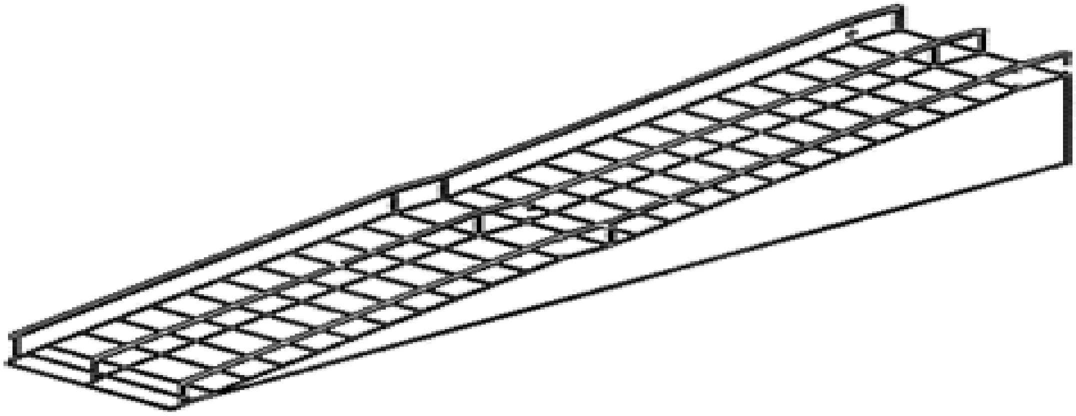


Figure 2.14: Straight Run Ramps (UN, 2004 Design manual for barrier free environment)

Table 2.6: Ramp Slopes

Maximum slope	**Maximum length**	**Maximum rise**
1:20 i.e., 9%	-	-
1:16 i.e., 6%	8m	490mm
1:14 i.e., 7%	5m	360mm
1:12 i.e., 8%	5m	150mm
1:10 i.e., 10%	1.2m	120mm
1:08 i.e., 12%	490mm	60mm

Source: UN, 2004 Design manual for barrier free environment

Uniform Federal Accessibility Standards (UFAS) Retrofit Manual, (1993): According to this design manual; Basic Design Consideration - Slope and Rise: The safest and preferred path for all pedestrians is one with little or no slope. Many wheelchair users and pedestrians with gait impairments have difficulty using ramps which are built at the1:12 maximum slopes allowed by UFAS. For this reason, it is preferred that the slope of ramps be as gentle as possible. Also, some state and local codes in northern states will permit a maximum slope of only1:20 on exterior ramps to reduce pedestrian accidents during winter weather. It should be noted that in some instances involving only a limited rise, a pathway with a slope of 1:20 may be shorter than a ramp with 1:12 slope because the route does not require level landings at the top and bottom. At existing sites and buildings there is often not enough space to accommodate a ramp with a 1:12 slope, and under these circumstances, it is possible to install limited rise ramps with steeper slopes.

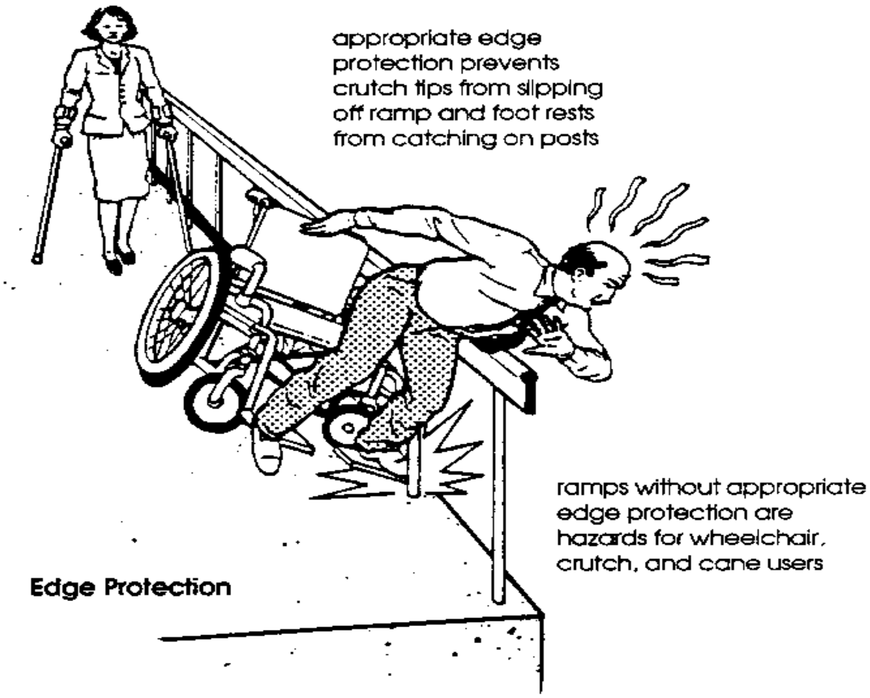
Table 2.7: Allowable Slope Requirements

Slope	Maximum Rise	Maximum Run or Horizontal Projection
Less than 1:20	unlimited	Unlimited
1:20 to 1:16	760mm	12m
1:16 to 1:12	760mm	9m
1:12 to 1:10	150mm	1.5m
1:10 to 1:8	75mm	600mm
No Greater than 1:6	100mm	600mm

Source: UFAS retrofit manual 1993

The minimum clear width for a ramp is 900mm. **Handrails** are required if a ramp has a rise greater than 150mm or a horizontal projection greater than 1.8m. Handrails ought to be on either side of the ramp with the inside rail continuous on dogleg or switchback ramps. They must be mounted between 750 and 850mm above the ramp surface with exactly 25mm of clear space between the handrail and the wall. Handrails shall provide a continuous gripping surface and not rotate in their fittings. Handrails shall project 300mm beyond the top and bottom of the ramp segment with the ends rounded and returned smoothly to the floor, wall, or post. **Landings**: if the slope of the existing ramp is within the range established by UFAS, it may be possible to re-grade the ramp and add landings at the appropriate intervals while maintaining the minimum slope requirements. If an existing ramp is already at the maximum allowable slope, then corrective action is almost impossible without demolition or extension of the ramp.

If existing landings are too small, especially in locations where doors exit onto the landing, then the size of the landing should be increased. Edge protection is required on ramps and landings with drop-offs. Curbs, walls, railings, or extending surfaces which prevent people from slipping off the ramp qualify as edge protection. If curbs are used, they shall be a minimum of 50mm high. Solid walls on each side of a ramp with wall-mounted handrails or very high curbs are the safest edge protection since a wheelchair gone off course will be gently guided down the ramp rather than colliding with the railing.



appropriate edge protection prevents crutch tips from slipping off ramp and foot rests from catching on posts

ramps without appropriate edge protection are hazards for wheelchair, crutch, and cane users

Edge Protection

Fig. 2.15: Edge Protection (UFAS Retrofit Manual, 1993)

Texas Accessibility Standards guide, TAS (1994): A ramp is considered an accessible route if it has a slope greater than 1:20 and shall comply with the following; **Slope and Rise:** The least possible slope shall be used for any ramp construction. The maximum grade of a ramp in new construction shall be 1:12. The maximum rise for any run shall be 760 mm. **Clear Width:** The minimum width of a ramp 9m or less in span shall be 915 mm. Ramps more than 9m span shall have a minimum clear width of 1118 mm. **Landings:** Ramps shall have horizontal landings at bottom and top of each ramp run. Landings shall comply with the following features: the landing shall be as wide as the width of the ramp length leading to it. The length shall be a minimum of 1525 mm clear. If a ramp changes direction at landings, the minimum landing size shall be 1525 mm by 1525 mm. **Handrails:** If a ramp runs has a rise greater than 150 mm or a horizontal extension greater than 1830 mm, then it shall have handrails on each side. Handrails shall comply with the following specifications: Ramp segments shall have Handrails on each side. The internal handrail on a dogleg ramp shall be continuous. The ramp segment shall extend at least 12 305 mm beyond the top and bottom as well as be parallel with the floor or ground surface if the handrail is not continuous. The clear space between the handrail and the wall shall be 38 mm. Besides, the gripping surfaces shall be non-stop. Top of handrail gripping surfaces shall be placed between 865mm and 965 mm above ramp surfaces. Ends of handrail bars shall be rounded or returned smoothly to floor, wall, or post. Handrails shall not rotate within their fittings. **Cross Slope**: The cross slope of ramps shall not exceed a grade of 1:50. **Edge guards**: Ramps and landings with drop-offs shall have walls, railings, or extending surfaces that prevent people from slipping off the ramp.

Singapore code on accessibility in the built environment (2013): The code gives the following gradients for accessible ramps in table 2.8.

Table 2.8: Gradients of Ramps.

Changes in vertical rise(mm)	**Gradient not steeper than**
0- 13	1:2
More than 13to 50	1:5
More than 50 to 200	1:10
Exceeding 200	1:12

Source: Singapore Code on Accessibility in the Built Environment 2013

Landings: Shall have a level platform of 1.5m or more, be provided at regular intervals for different gradients and intervals shall not be more than as shown in Table 2.9. They are not required if the slopes are equal or gentler than 1:25.

Table 2.9: Gradients and Lengths of Ramps

Gradient of ramp	1:12-1:14	1:15	1:20	Not greater than 1:25
Interval Maximum length of horizontal Run in meters	9	11	15	18

Source: Singapore Code on Accessibility in the Built Environment 2013

The design of the ramp influences its use and safety. A steep slope is hazardous for use by wheelchair bound persons or other mobility devices. A grade that requires increased effort to negotiate the ramp must be avoided. The placement of the ramp is also important to its accessibility. Landings along a long ramp enable an individual to slow down or to rest. Textured surfaces, edge protection, and handrails all provide essential safety functions.

City of Brampton – Accessibility Technical Standards guide (2005): According to this design manual, the design intent is to meet the construction specifications of 1:20 to 1:25 grade and a maximum of 1:20 for grade differences less than 600mm. A contrasting colour strip 50mm shall be located at the landings of the running slope.

- The cross grade of a ramp surface shall not exceed 1:50.
- The minimum breadth of a ramp between handrails shall be 900mm.
- Ramps shall have a horizontal landing at the top and bottom of each run and also where the ramp changes direction.

Landings shall have the following specifications; be as broad as the widest ramp span leading to it. It should have a minimum size not less than 2.4x2.4m if constructed at the top or bottom of a slant or if served by a doorway. For intermediate landing at the switchback of U-shaped ramps, the length shall not be less than 1.6m and a width not less than 2.4m. The minimum size of 2.4x2.4m is also applicable for intermediate landings at the corner of L-shaped ramps with a length and width not less than 1.5m. The minimum size can also be employed where an intermediate landing at a straight ramp have a length not less than 1.5m and where a landing meets a slope change has a 50mm wide colour contrasted strip the width of the ramp. Ramp and landing surfaces shall be slip-resistant.

Ramp guards shall be not less than 1m measured vertically to the top of the guard from the ramp surface. Besides, they should be designed in such a way that no member, attachment or opening between 150mm and 900mm above the surface being protected by guards will facilitate climbing. Be provided with a curb at least 50mm high on any side of the ramp where no solid enclosure or solid guard is provided; and with railings or other barriers that extend to within 50mm of the finished ramp, or have a curb not less than50mm high. A ramp run with a rise greater than 150mm shall have handrails which are on both sides and are continuous on the inside of switchback (U-shaped) or dogleg (L-shaped) ramps. When not continuous, it shall; extend horizontally at least 300mm beyond the top and bottom of the ramp and return to the wall, floor, or post, measure between 850mm and 950mm from the ramp surface to the top of the handrail; and have a minimum horizontal distance between handrails of 950mm.

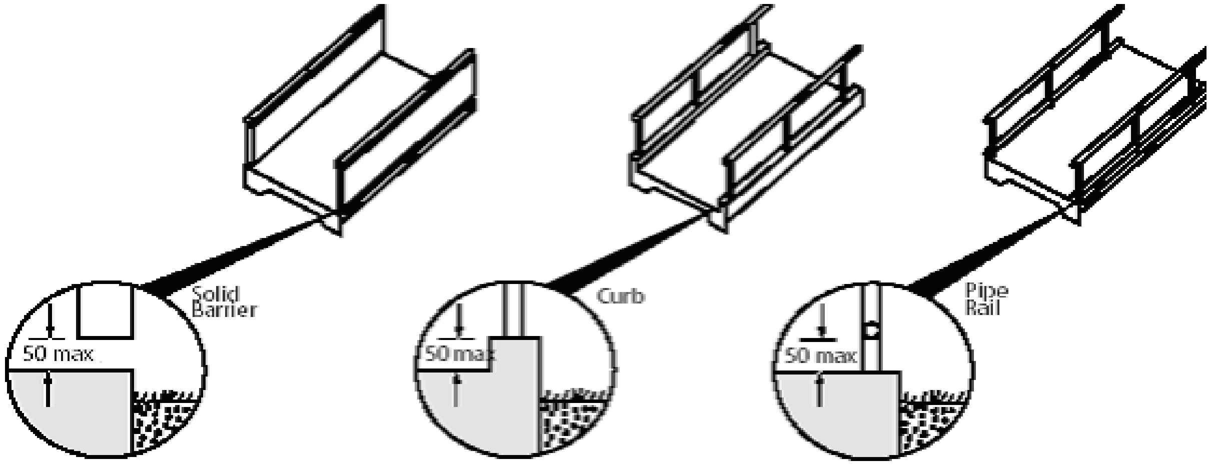


Figure 2.16: Edge Protection at Ramps (City of Brampton code 2005)

Livable Housing Design Guidelines (2012): According to this guide, accessibility ramps are needed where the height difference exceeds 200mm, and where step ramps are not necessary. The manual specifies that the maximum slope of a ramp exceeding 1.5m in length shall be 1 in 14. Also, landings shall be provided at the top and bottom of the ramps at intervals not exceeding 900mm. Other specifications are; Ramps shall be constructed from concrete 600mm or treated timber 1m high with a wood float finish to the concrete surface or approved non-slip paint finish in the case of timber ramps. Ramps shall have a maximum camber or cross fall of 1 in 40.

Where the slope requirement is to be temporary, consideration should be given to temporary modular ramps. Where long ramps are required to accommodate a larger height difference, incorporate landscaping into the design and try to avoid zigzags. The result of this is to reduce the visual impact of the ramp on the house.

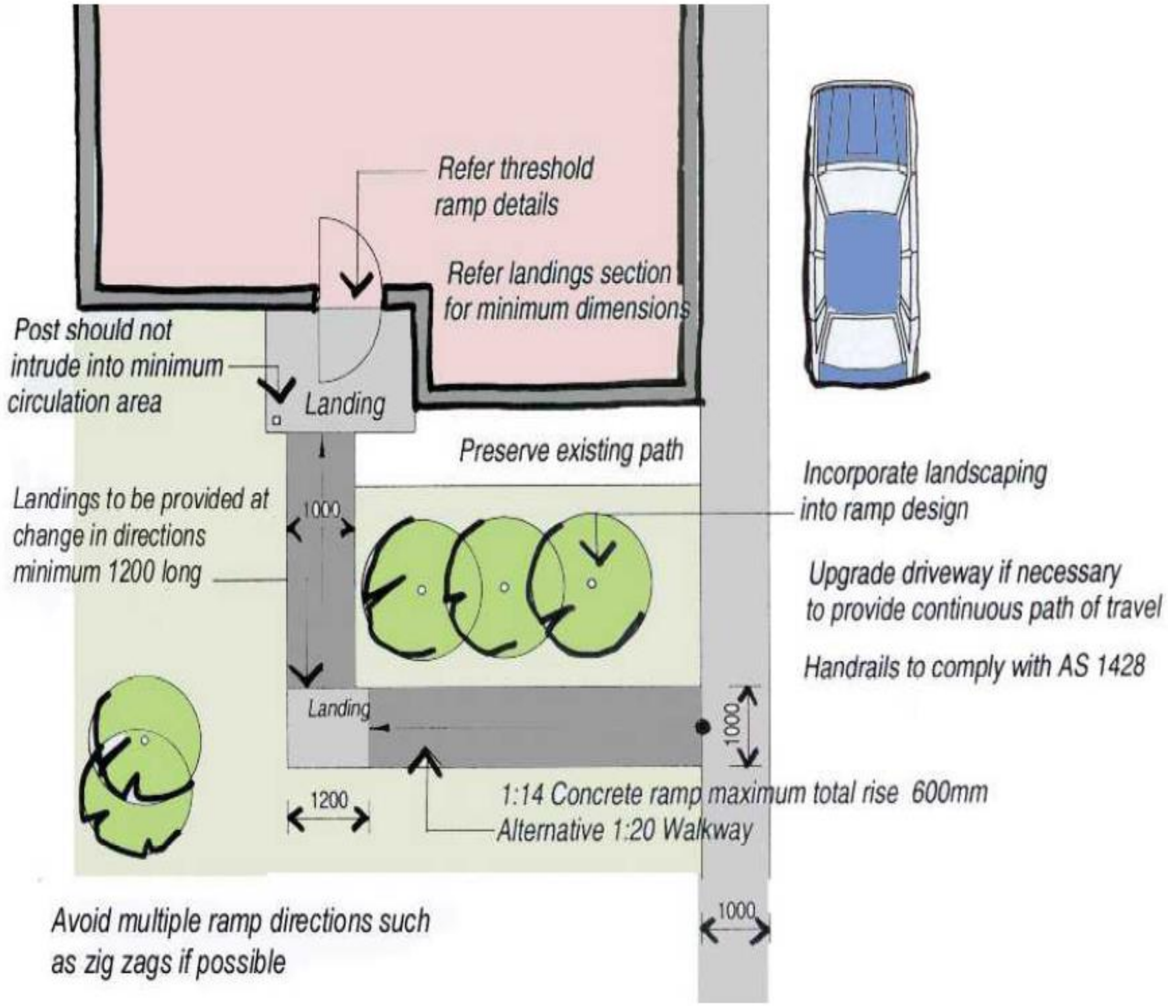


Figure 2.17: Typical Ramp Addition (Australia, 2012 Liveable housing design guidelines)

2.4. Review of Construction Journals and Documents

All built facilities, from the small to large, impact on their surroundings. The quality of these constructions – and of residential buildings in particular – have a long-term impact, both on the communities they house and on the entire built environment (Sustainable Residential Development in Urban Areas; Government of Ireland 2009).

Over the years, buildings have been constructed without provision of accessibility for persons with mobility challenges. Handicap international (2010) cites one case in which a man who had crawled on the ground to get to the hospital was turned away by staff because he was dirty. Others had to leave their wheelchairs outside the hospital and crawl inside on the dirty floor because there was no accessible ramp. Most of the older houses of worship were built on multiple levels and without elevators making them partly or wholly inaccessible to persons with mobility challenges. Individuals with disabilities are predominantly people of faith. The 2000 N.O.D/Harris survey of Americans with disability established that eight of ten people with disabilities consider their faith to be essential. The contrast is that with disabilities are far likely to attend religious services than those without disabilities. Physical barriers are partly to blame for this (Patterson&Voser,2003).

Bulleyment (2008) recommended that buildings which are used by the public must have an ‘‘accessible route’’ which is usable by people with disability. It should extend from the street boundary or car park to the building entrance and must be negotiable by unaided wheelchair users. Ramps are an essential part of a building. Places where access by people with physical disabilities or those who need the use of a wheelchair frequent require ramps. Some of this areas include residential buildings, public buildings, public walkways where there are steps or where wheelchair access may be limited or even made impossible by the lack thereof.

All public buildings should offer alternative ways of accessibility. In most cases, ramps are easy and comparatively inexpensive to build (at least in one storey buildings) and benefit many persons. Ramps ought to be added to all existing education facilities and other public constructions. When new public buildings are being planned, and designs are being developed, efforts should be made to ensure that they are equally accessible for all. Ramps and walkways should be included in the designs, in such a way that they don't become different features for children/ teachers/ parents with physical challenges, pregnant women, and the elderly, but will present beautiful, alternative access-ways for all users (UNESCO, 2009).

An accessible built environment is very vital. The Kenya constitution (2010) part 3 subsections 54, states that persons with any disability are entitled to access to facilities for persons with disabilities that are incorporated into the society to the extent compatible with interests of the persons and a reasonable access to all places. Builders should focus on the concept of universal design or inclusive housing where buildings are made accessible to all including persons with mobility challenges. Currently, there are guidelines on how to retrofit handicap ramps in the built environment.

Traditional design specifications call for a maximum ramp slope of 1:12 which translates to twelve inches of the ramp for every one inch of rising. In fact, many people find it difficult to use ramps with a slope of 1:12 because it is too steep to wheel up and at the same time maintain a walking balance. It is, therefore, desirable for a slope of 1:16 to be used where possible. Continuous ramp runs should be limited to avoid long and tiring climbs. Landings should be provided between slopes to allow for resting and manoeuvring. Try to fit ramps into compact and cost-effective in configurations. Straight ramps can be replaced with L-shaped, switch back and U-shaped in restricted areas. Space Limitations and constrained starting and ending points may require changes of direction. Provide landings at all turns to allow easy and safe manoeuvring (Florida Building Code, 2012).

As much as “standard” designs work well for many people, the specifications of how the ramp will be used may affect the design. Examples include: • If the physically challenged can only move with his/her legs stretched, wider turning platforms are required than can be accommodated by someone who is able to move in a wheelchair with his/her feet lowered. If the mobility impaired person uses a walker but is not stable on slopes, shallow steps can be used instead of a ramp. If the caretaker for the physically impaired person is not strong, the ramp steepness should be gradual. Conversely, a powered chair or scooter can be utilized when the ramp is steep. A standard design slope is 1:12; however several ramps have been built with1:10 slope due to space limitations. 1:8 slopes is an absolute maximum (Rockwell Collins Retiree Volunteers, 2006).

The retrofitting of many accessible facilities is very slow, in some cases there is a complete disregard of design specifications. A study of accessibility in Ghana showed that a larger percentage of public buildings in Ghana are inaccessible to the physically challenged. An assessment of the slope revealed that more than 80% of ramps studied had slopes of greater than the recommended value of1:12 or 8.3% to the horizontal. This could be attributed to a limited space and constraints at the starting and end points mostly because the provisions of the ramp are treated as an afterthought. For some of the buildings, the ramps could not be used because of inappropriate gradients. Fifty percent (50%) of the ramps have slopes as high as 1:5.4 making persons with disability, particularly those using clutches, finding them inconvenient and difficult to negotiate. The range of slopes was found to be hazardous even for people without disabilities (Journal of Sustainable Development in Africa Volume 14, No.1, 2012).

As much as many agree that it is essential to allow all persons to participate equally in all spheres of life, there exist many impediments to the making of the built environment accessible.

Bad examples mostly shape people's image of accessible design. What usually comes to mind are ramps clumsily tacked onto building entrances, large toilet stalls with metal grab bars, and the ubiquitous blue signs (the International Symbol of Accessibility) posted at building entrances, parking spaces, and car windshields. Architects' reliance on templates and standards leads to a somewhat superficial consideration of actual bodies and capabilities; unwittingly, they develop designs around this "normal"—in fact, idealized—human figure (Meyer, 2013).

There are many misconceptions that make people shy away from the construction of accessible features. A myth about accessibility is poor aesthetics-critics often claim accessible features are ugly and obtrusive. Even if accessibility features are retrofitted into conventional dwellings, this can be accomplished beautifully unfortunately, most noticeable retrofits are the ones poorly tacked on usually by someone untrained in universal designs. Another myth is that accessible features are very expensive to build.

Accessible features are least expensive when included in the design during the original planning stage. Some areas have even gone so far as to create builder incentive programs to alleviate cost and encourage voluntary construction of accessible buildings **(**Memken & Early, 2007).

Some creative ways of retrofitting ramps without compromising the aesthetic appearance of a building include; matching a home's style and building materials that can blend the ramp into the existing surroundings and matching the rails of the existing porch. Adding shrubs, and other flower trees around the ramp that match with the vegetation around the rest of the home. **Scale:** Balance the scale and appearance of ramps by using suitably sized materials that are compatible with existing trim styles and in line with local building code specifications. For proper construction use vertical supports 10cm x 10cm, stringers not larger than 5cm x 20cm, and decking not larger than 5cm x 15cm. Also, ramps in single-family residential buildings need not more than 0.9m to 1.6 of clear space between the handrails. These features assist in distinguishing residential ramps from those on commercial and public buildings. Configure the ramp in a way that will shorten length as possible by making use of high points on the existing site slope. Utilize the increase in elevation of the ground to shorten ramp length and mass. A 6.1m long ramp constructed on level ground can be made 4m long ramp by taking advantage of 20cm of rising on the site. Consider using a side entrance to make good use of beneficial slopes. **Combine:** The presence of the ramp can be utilized to add a larger deck or sitting area near the doorway. This addition makes the ramp become a part of a larger appealing project.

Figure 2.18: Ramp Enhancements (Duncan, 2004 Wood ramp design manual)

Separate: A very long ramp can be reduced by dividing it into two or three sections, for example by connecting two or three decks, creating appealing and functional regions that can be utilized for sitting or plants. **Finishes:** pressure treated wood for most of the wood materials should be used in the building of ramps. After completing the construction of a wood ramp, wait for three to six months for the wood to dry before applying finishes. Always use a finish matches the home's exterior (Duncan, 2004).

Another way of making an entrance ramp is by adding a brick patio along the perimeter of existing concrete patio slab. This brick patio gives two uses. First, it provides an appealing ramp with a superb traction. Second, it provides an excellent wheelchair-friendly walkway all around the house that can be of used all year. To maintain proper slope, you have to have to allow for enough ramp length. The breadth of the walkway is 1.4m wide (Duerstock, 2001)

Figure 2.19: Ramp and Walkways (https*://web.ics.purdue.edu/~bsd/building.html, 2014)*

People with mobility challenges stressed that narrow doorways, crowded interiors, and absence of accessible ramps makes it difficult to access private facilities such as cafes, salons, and clothing stores. For example, Sergei S., who uses a wheelchair, told Human Rights Watch, “Without ramps, you can’t go anywhere. You can’t go to the store to buy groceries. There are places with elevators. There’s the [supermarket] for example. But the elevator there doesn’t work” (Mazzarino, 2013).

There should be a conscious attempt of all educationists to develop young architects/planners with an awareness of creating a barrier-free environment for physically handicapped. A detail design exercise should be carried out in all schools of Architecture in their curriculums as an essential subject of architecture education. The Government departments should follow the recommended standards of provisions for efficient ramps for the physically challenged along with the general guidelines. The building codes should specify necessary architectural requirements that need to be incorporated in new buildings to make them convenient for disabled. An integrated effort should be made to prompt all local authorities to update their building codes (Guidelines and space standards for barrier-free built environment for wheelchair-bound and elderly persons India 1998).

2.5. Summary

From the reviewed literature, it is clear that very few studies on housing accessibility have been conducted in Kenya. Many articles on housing accessibility have been conducted in the Western countries, where comprehensive, universal design procedures have been outlaid. The review of construction documents indicates that comprehensive building codes on housing accessibility have been written in many countries. For example The ADA Standards for accessible design (2010); set minimum requirements – both scoping and technical – for newly designed and constructed or altered State and local government facilities, public buildings, and commercial houses to be accessible and usable by persons with disabilities. However in Kenya, very scant information exists on housing accessibility.

It is also evident that many studies have been done concerning accessibility issues in the built environment and the attitudes of persons towards making the built environment accessible to the mobility impaired population; this study, however, puts a spotlight on the factors that could be making the process of removing accessibility barriers slug.

CHAPETR THREE

RESEARCH DESIGN AND METHODOLOGY

3.0. Introduction

The chapter presents the procedure followed in carrying out the study. The chapter includes research design, the study location, target population, sampling methods and sample size, research instruments, reliability, and validity of the research instruments, data collection procedures, and techniques of data analysis.

3.1. Research Design

Orodho (2005) states that a research design can be seen as schemes, outlines or plans that are used to generate answers to research problems. The research design used in this study was a descriptive survey. A descriptive survey is an efficient method for collecting data regarding characteristics of the population and current practices, conditions, and needs. It involves questioning individuals on a topic or topics and then describing their responses **(**Jackson, 2015). Concerning this, the researcher found that the study type suited well with the study as it aimed at assessing the possible impediments to the retrofit of ramps in public buildings.

3.2. Study area

The study was conducted in Kisumu city. It is about 400 km from Nairobi the capital city of Kenya. It is bordered to the south by Nyando District, in the west by Lake Victoria, in the north by Kisumu West District, in the northeast by Vihiga District and the east by Nandi District. The city is characterized by low rise building accounting for over 50% of the total building structures. The low rise buildings made the city an excellent base for this study.

3.3. Target population

The target population was drawn from public buildings within Kisumu Municipality. The buildings selected for study were houses that were used by the public and did not exceed three storeys. At the time of the survey, the study population comprised 54 buildings; 15 Health facilities, 12 Education institutes, 12 Shopping Malls, 15 Public office buildings. In addition to this, 5 building inspectors from the National Construction Authority and the Municipal Council of Kisumu formed part of the survey. The population of buildings was derived from; the data for health facilities from the ministry of health website, data for education facilities from Kenyaplex website and selected public offices and shopping malls from the buildings in the CBD of Kisumu City. (MOH, 2014; Kenyaplex, 2014)

Table 3.1: Target Population (Buildings and persons)

Strata	Accessible population
Health facilities	15
Education facilities	12
Public offices	15
Commercial buildings	12
Building Inspectors from the National Construction Authority of Kisumu	4
Town Planner from the Municipal Council of Kisumu	1
Total	**59**

Source: Ministry of; Urban Planning and Public health, Kenya

3.4. The Study Sample

According to Mugenda and Mugenda (2003), the primary consideration for determining the sample size is the capability to collect in-depth data at affordable costs in terms of time, finances and resources. Kerlinger (1978) states that, a perfect sample range between 10% and 30% of the target population depending on the data to be gathered and analyzed. However when the accessible population is small, the percentage of the sample size from the population should be considerably large. Krejcie and Morgans (1970) provide a statistical table for sample sizes for given population. According to Morgan's table, the sample size for a population of 54 is 48.The sampling techniques employed are the stratified random sampling for the public buildings and purposive sampling for the Building Inspectors. Table 3.2A below shows the distribution of the sampled buildings for the study.

Table 3.2A: Distribution of the Sample (stratified sampling)

Strata	**Accessible population**	**Sample size**	**%**	**Number of participants**
Health facilities	15	$\frac{15}{54}x48=13$	87	13 Building Owners/Agents
Education buildings	12	$\frac{12}{54}x48=11$	92	11 Building Owners/Agents
Public offices	15	$\frac{15}{54}x48=13$	87	13 Building Owners/Agents
Commercial buildings	12	$\frac{12}{54}x48=11$	92	11 Building Owners/Agents
Total	**54**	**48**		**48**

Source: Authors sampled participants

The names of the selected buildings in the sampling procedure above are presented in Appendix E. To get meaningful information from the objects of study; the building owners or agents representing the owners were selected as participants. One participant represented each selected building structure for the research.

Apart from building owners and agents, Building inspectors in charge of approval, regulation and checking buildings under construction and renovation were purposively sampled to participate in the study. Their selection was based on the rationale that, they come from the sole institutes that regulate the construction industry in Kenya. Table 3.2B below shows the sampled building inspectors and their job titles.

Table 3.2B: Sampled Population (Purposive sampling)

Name of institute	Accessible population	Number of participants	Participants selected
National Construction Authority , Kisumu	4	2	Two Structural Engineers
		1	One Construction Engineer
		1	One Architect
Municipal Council of Kisumu	1	1	One Town planner
Total	**5**	**5**	

Source: Authors sampled participants

The total number of participants in the study drawn from owners of public buildings and Building inspectors are presented in table 3.3 below.

Table 3.3: Total Number of Respondents

Category	**Number of participants**
Building owners/agents	48
Building inspectors	5
Total	**53**

Source: Authors sampled participants

3.5. Instruments for data collection

The instruments used for data collection were: an observation checklist and questionnaires. Observation provides the opportunity to document activities, behaviour and physical aspects without having to depend on people's willingness and ability to respond to questions (Taylor & Steele, 1996). The questionnaires were administered to public building owners/agents and public building inspectors. A questionnaire is a way of getting data about persons and objects by asking the respondents rather than watching their behaviour or by sampling a bit of the behaviour. The questionnaires were used since they are economical and free of bias of interviewer. Besides, they are a suitable tool to reach respondents who are not readily available (Kothari, 2009). Furthermore, they are not only easily administered but also presented an event stimulus to a large number of people simultaneously thus providing an easy accumulation of data (Orodho, 2004).

3.5.1. Observations checklist

Two observation checklists were used to gather data on the features of available ramps; one observation schedule was used to collect information on the level of accessibility in public buildings; the data collected on this schedule was concerning the position and placement of the ramp. The other observation schedule was used to gather data on the features and conditions of existing ramps (Appendix B). The observable features of the ramp included the texture of the ramp surface, slope of the ramp, guard rails and access signs.

A Clinometer was used alongside the observation schedule to measure the slope of the ramps. The instrument is used to measure angles as they relate to the slope of natural formations or buildings and other human construction projects.

3.5.2. Questionnaires

Two sets of Semi-structured questionnaires were used to gather information for the proposed study (Appendices C&D). One set of the questionnaires was administered to owners of public buildings or their agents, and the other to building inspectors. The questionnaires were divided into four parts; the first part was designed to collect personal data and the nature of the buildings under study. The second part was structured to collect information on the level of compliance with requirements for efficient ramps. The third section was designed to gather information on the constraints to the retrofitting of ramps while the fourth part was used to gather information on the possibility of retrofitting ramps in existing buildings.

Since the owners or their agents were not always on their premises, the questionnaires were dropped and collected later when the participants had responded to them.

3.6. Validity and reliability

According to Joppe (2000) reliability is the extent to which results are consistent over time and an accurate representation of the total population under study. The statement implies that the instrument is deemed reliable if the results of a study can be reproduced under a similar methodology.

Reliability is the degree to which a measurement technique can be depended upon to secure consistent results upon repeated application. Validity is the extent to which any measurement approach or instrument succeeds in describing or quantifying what it is designed to measure **(**Chan, Fowles & Weiner, 2010).

3.6.1. Validity of the research instruments

To determine the validity of instruments for this study, observation schedule and the questionnaires having been drawn in agreement with the objectives of the study. They were presented to the student’s supervisors, in the Department of Technology Educational, who scrutinized and advised on their content. Their comments were used to improve the research instruments for ultimate data collection. The process ensured content and face validity of the instruments.

3.6.2. Reliability of the research instruments

Pilot testing was used in determining the validity of the reliability of the instruments. Four owners of public buildings in Kisumu city who did not take part in the study were given two tests of the research instruments in a span of two weeks. The scores of the two tests were correlated using Pearson's product moment correlation where reliability coefficient of 0.7 was attained hence the research instruments were accepted as reliable (Kathuri and Pals, 1993).

3.7. Procedure of Data Collection

Before the collection of data, the researcher sought permission from the Department of Technology Education at the University of Eldoret. The introductory letter enabled the researcher to acquire a research permit from the National Commission for Science, Technology, and Innovation. The researcher then sought permission from the District Commissioner and the District Education Officer from the Teachers Service Commission offices, Kisumu County.

Questionnaires were delivered by the researcher in person so as to have an opportunity to explain the purpose of the study. The researcher established a good rapport with the respondents which consequently helped get real responses from them. An observation schedule was then used by the researcher to collect observable data by ticking the appropriate guide plan.

3.8. Data Analysis

Data obtained from the instruments was organized so as to be sure that it is precise, reliable with other facts gathered, uniformly entered and well arranged to facilitate coding and tabulation. Coding was done in order to put the responses into a limited number of categories or classes. The process was necessary to ensure efficient analysis. The scores were then transcribed in a computer for analysis using SPSS program version 16.

Quantitative data was analyzed using both descriptive and inferential statistics by numerical and graphical representation of the results using measures of central tendency such as mean, frequency and percentages. The hypotheses were tested using the chi-square as a non parametric test at a significance level of 0.05.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.0. Introduction

This chapter deals with data presentation, analysis, and interpretation. The presentation is done in tandem with the objectives of the study. The initial section of the chapter deals with the questionnaire response return rate. The second section deals with the demographic aspect of respondents. The third section deals with analysis and presentation of information about the objects of study. The fourth section deals with statistical tests for hypotheses in three subsections. The first subsection presents tests about compliance by public buildings to the building requirements for efficient ramps in Kisumu city, Kenya. The tests in the second subsection are about constraints to the construction and retrofitting of efficient ramps into existing public buildings. The third subsection presents statistical analyses on the possibility of retrofitting suitable ramps into existing public buildings. Lastly, the fifth section deals with the analysis of data from observation checklists.

In each section, the raw data has been sorted, coded and analyzed using descriptive and inferential statistics. The descriptive statistical tools of percentages, frequency tables and narrative description of the tables and inferential statistics (chi-square) have been used to summarize and illustrate the findings of the study.

4.1. Rate of Questionnaire Return.

The method of data collection from the public building owners/agents and building inspectors was questionnaires. The total numbers of the questionnaire issued were 48 for public building owners/agents and 5 for building inspectors. All questionnaires issued to the respondents were returned.

The researcher used the SPSS version 16 software to analyze the statistically coded data so as to get the required analysis output for presentation. The data obtained from the returned questionnaires was organized according to gender as shown in the table below.

Table 4.1A: Frequency Distribution of Rate of Questionnaires Returned for Building Inspectors

Gender of building inspectors		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	4	80.0	80.0	80.0
	Female	1	20.0	20.0	100.0
	Total	**5**	**100.0**	**100.0**	

Source: Field data

Table 4.1B: Frequency Distribution of Rate of Questionnaires Returned for Building Owners/Agents

Gender of building owner/agents		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	35	72.9	72.9	72.9
	Female	13	27.1	27.1	100.0
	Total	**48**	**100.0**	**100.0**	

Source: Field data

A total of 48 (100%) and 5 (100%) questionnaires issued to Building owners/agents and building inspectors were all returned. According to Kothari (1993), over 60% return rate was acceptable return for survey study such as this one. The data presented in tables 4.1A and 4.1B shows that, male building inspectors 4(80%) were more than female building inspectors 1 (20%). There were also more male owners of building /agents 35(72.9%) than female owners of buildings/ agents 13(27.1%).

4.2. Demographic information of the respondents

The researcher obtained information about the personal data of the building inspectors and public building owners/agents. For building owners/agents, the data was analyzed and presented according to gender, age and building ownership. While for building inspectors, personal data presented included sex, age and job title.

4.2.1. Gender representation by age

The study sought the demographic information of the respondents, since a researcher can gauge the reliability of data obtained and understand the type of respondents. The respondents were asked to indicate their gender and age. The responses were then analyzed and the data output presented in the tables below.

Table 4.2.A: Gender Representation of Building Inspectors by Age

Gender of the respondents	**Age of the respondents**		
	below 30	Above 30	**Total**
Male	0	4	4
Female	0	1	1
Total	**0**	**5**	**5**

Source: Field data

Table 4.2.B: Gender Representation of Public Building Owners and Agents by Age

Gender of the respondents	Age of the respondents		
	18-30	above 30	**Total**
Male	3	32	35
Female	1	12	13
Total	**4**	**44**	**48**

Source: Field data

From table 4.2A and 4.2B, the responses obtained showed that a majority of the public building owners/ agents were above 30 years in which 32 were males and 12 females. The presentation also showed that 3 male and 1 female owners/ agents were between 18-30 years. On the other hand all the building inspectors were above 30 years in which 4 were male and 1 female.

4.2.2. Gender representation by ownership of building

The respondents were further asked to indicate their gender and ownership of the building. The responses were analyzed and the data output presented in the table below.

Table 4.3: **Ownership of Buildings**

Gender of the respondents	Building ownership		
	Owner	Agent	**Total**
Male	7	28	35
Female	2	11	13
Total	**9**	**39**	**48**

Source: Field data

The presentation in table 4.3 shows that there were 39 (81.25%) agents representing building ownership and 9 (18.75%) owners of buildings. Among the 39 agents, there were 28 (71.7%) males and 11(28.3%) females while in ownership of the building there were 7

(77.7%) males and 2 (22.3%) females. It is clear from the analysis that most of the buildings were under the care of agents.

4.2.3. Job title of building inspectors

The building inspectors from the National Construction Authority and Municipal Council of Kisumu were asked to indicate their job titles and their responses presented using the bar chart in figure 4.1 below.

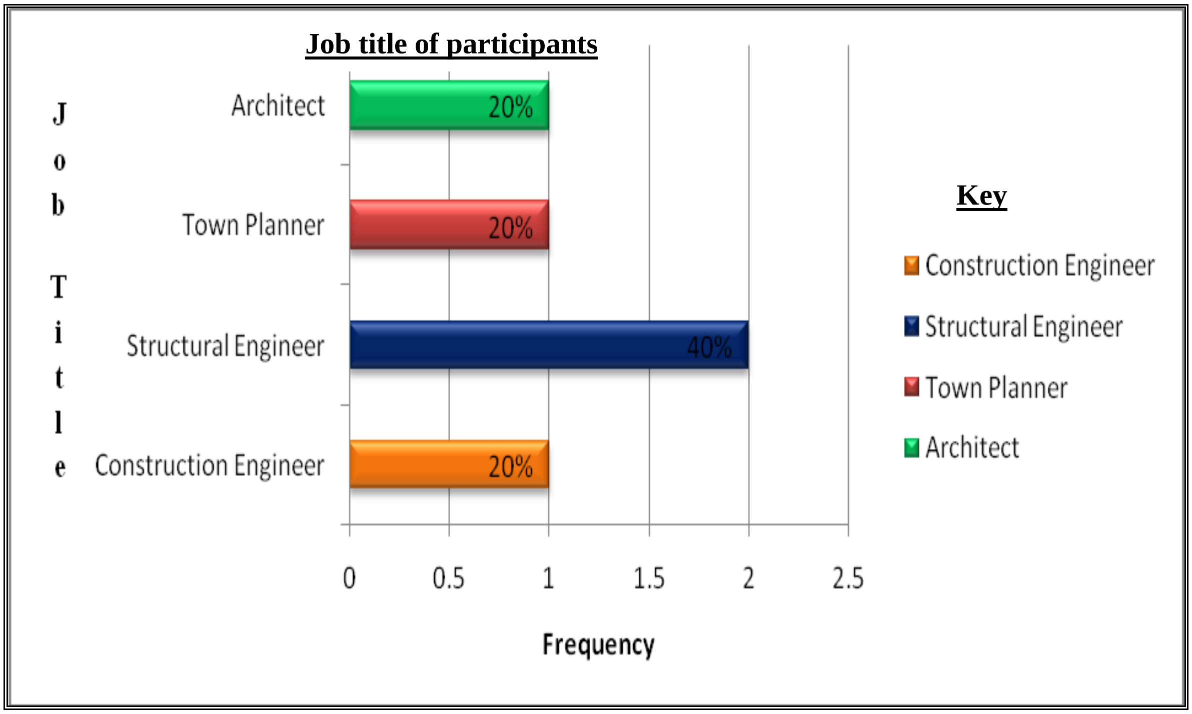


Figure 4.1: Job Title of 5 Building Inspectors

Source: Field data

The bar graph presentation indicates that, out of the 5 building inspectors who participated in the study; 1 (20%) was a Construction Engineer, 2 (40%) were Structural Engineers, 1 (20%) Town planner and 1(20%) Architect.

4.3. Information about the objects of study

The researcher sought information regarding the nature of the objects under study according to the age of buildings, the number of storeys in the buildings, the position of ramps and the function of the buildings under study. The results were presented according to the following themes;

4.3.1. Number of storeys and age of buildings under study

The building owners and agents were asked to indicate the year of construction and the number of storeys in their buildings and the result presented in the table 4.4 below.

Table 4.4: Number of Storey Building With the Year of Construction

	Number of Storeys in the building				
Year of construction	Ground floor	One storey	Two storey	Three storey	**Total**
Before 2003	22	13	5	1	41
After 2003	4	0	1	2	7
Total	**26**	**13**	**6**	**3**	**48**

Source: Field data

From the result presented in the table above, it is clear that a majority of the buildings 41(85.4%) were built before the year 2003 while those constructed after the year 2003 were 7(14.6%). The results further show that out of the 48 buildings that were studied, 26(54.1%) of the buildings were ground floor only, 13(27%) were one storey buildings, 6(12.5%) were two storey buildings and 3(6.3%) were three storey buildings. This indicates that the majority of buildings studied were ground floor buildings. It is clear from the presentation that most of the buildings under study were at a level where efficient ramps are an economical means of accessibility for wheelchair bound persons as compared to other accessibility facilities like lifts and elevators.

4.3.2. Position where ramps are mostly fitted

The building inspectors were asked to indicate the position where ramps are most fitted in the buildings they inspect and the results presented in the table below.

Table 4.5:Position where Ramps are Mostly Fitted

Retrofit Location		Frequency	Percent	Valid Percent	Cumulative Percent
	Main entrance	4	80.0	80.0	80.0
	First floor	1	20.0	20.0	100.0
	Total	**5**	**100.0**	**100.0**	

Source: Field data

From the table above, of the 5 respondents,4(80%) indicated that ramps are mostly fitted at the main entrance,1(20%) indicated that they are fitted at first floor, this shows that ramps are mostly fitted at the main entrance of buildings.

4.3.3. Information about the function of the buildings under study

This researcher sought the information about the function of the building under study. The buildings under study were public buildings categorized as, health facilities, education buildings, commercial buildings and public offices. The representation of the buildings under study in terms of the function was analyzed and presented in the bar graph below.

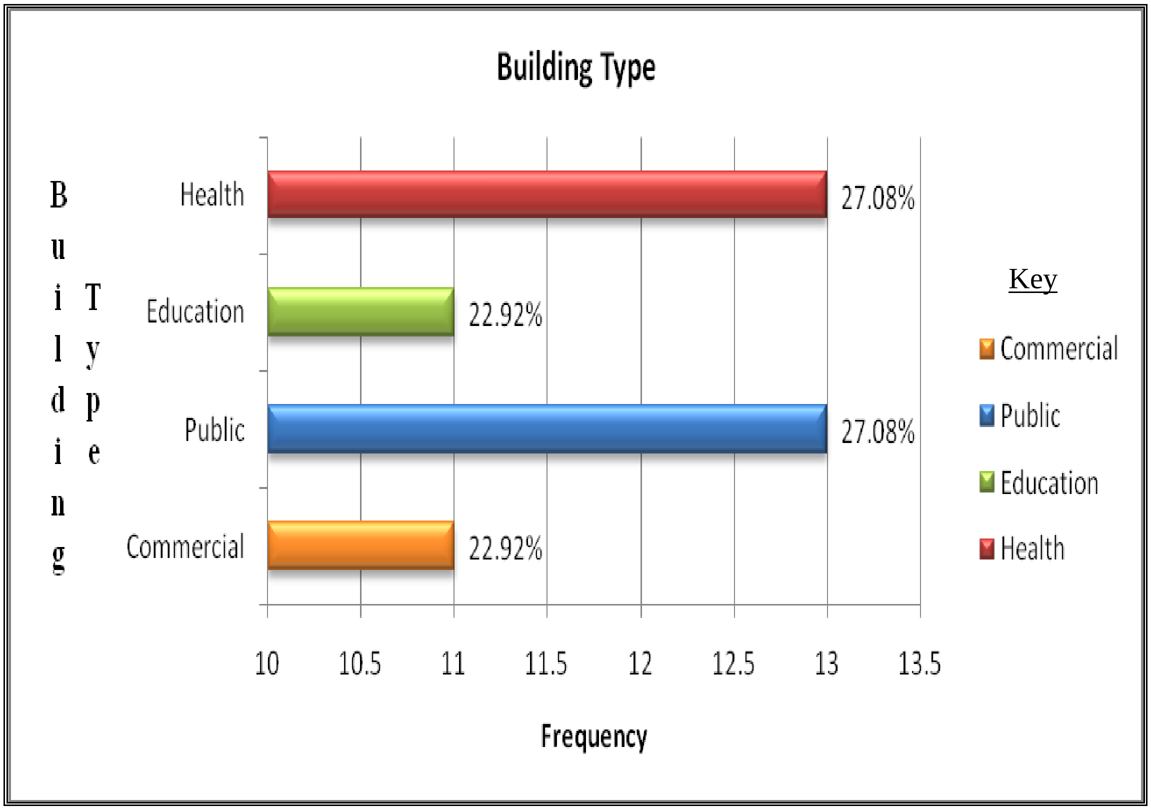


Figure 4.2: Categories of the 48 Buildings under Study

Source: Field data

The result presented in figure 4.2 shows that 13(27.08%) of the buildings studied were Health facilities, 11(22.92%) Education buildings, 13(27.08%) Public offices and 11(22.92%) were Commercial buildings.

4.4. Statistical tests for hypotheses

The researcher used descriptive and non parametric inferential statistics (Chi- square test) to analyze the data collected in the questionnaires for both building owners/agents and the building inspectors in order to test the stated hypotheses. The analysis and presentation was done based on the three objectives of the study.

4.4.1. Objective one: To examine the extent of compliance by public buildings to the building requirements for efficient ramps in Kenya.

To test the first research objective stated above, the researcher sought information on the extent of ramp retrofit in existing public building and compliance to requirements of efficient ramp construction.

The building owners/agents were asked whether their buildings had access ramps. The results of analysis of the responses to this question were presented in table 4.6 below in the form of frequencies and percentages.

Table 4.6:Responses for Availability of Access Ramps in Existing Public Buildings

Presence of access ramp		**Frequency**	**Percent**	**Cumulative Percent**
Valid	Yes	15	37.7	**37.7**
	No	33	62.3	**100.0**
	Total	**48**	**100.0**	

Source: Analyzed field data

The results indicated that, out of the 48 building owners/agents, 15(37.7%) stated that their buildings had accessibility ramps while 33(62.3%) building owners/agents indicated that their buildings had no access ramp. The result shows that majority of the building owners 33 (62.3%) had not fitted their buildings with accessibility ramps. The information further indicates that the existing public buildings in Kisumu city are largely inaccessible to persons with mobility challenges.

The researcher further sought information on the features for efficient ramps recommended by building inspectors during the process of ramp construction and retrofit. The building inspectors were asked to select from the set of features they use for inspection or recommend for ramp construction and retrofit.

Table 4.7: Responses to Features of Efficient Ramps by Building Inspectors.

Set of compliance features for efficient ramps **(**Slope ≤1:12, Guard rails present& Surface texture non-slip)	**Frequency**	**Percent**	**Cumulative percent**
Full response to the set of efficient ramp features	4	80	**80**
Partial response to the set of efficient ramp features	1	20	**100**
Total	**5**	**100**	

Source: Field data

The results in table 4.7 indicate that, out of the five building inspectors, 4(80%) selected the whole set of features for efficient ramps that were presented and stated that they use them during the inspection of ramp retrofit works, while 1(20%) of the building inspectors did not select the full set of features for efficient ramp retrofit that was presented. The findings show that majority of the building inspectors 4(80%) were fully aware of construction requirements for efficient ramp construction. The researcher further sought to establish whether the observed ramps complied with the requirements of efficient ramps. A combination of the following three specifications was considered mandatory for total compliance with efficient ramp requirements.

i. Slope should be not greater than1:12

ii. The surface texture should be non-slip

iii. Presence of guard rails on both sides

In order to test the first null hypothesis, the responses from questionnaires and details in the observation schedule regarding the observed features of the existing ramps that paired with requirements for efficient ramps were tabulated below.

Table4.8: Compliance Features for Efficient Ramps

Compliance feature	Observed compliance of ramp features by researcher		Ramp compliance features as indicated by owners/agents		Total
	Compliant	Non compliant	Compliant	Non compliant	
Slope ≤1:12	1	14	1	14	**30**
Guard rails present	1	14	1	14	**30**
Surface texture non-slip	13	2	13	2	**30**
Total	**15**	**30**	**15**	**30**	

Source: Field data

The data from the observation checklist for compliance to features of efficient ramps as indicated by the researcher were used to test whether there was compliance or no compliance by the existing ramps, a chi-square test was used. The null hypothesis was tested at 5% significance level.

Table:4.9:Test Statistics for Hypothesis 1 (Observation data by researcher)

Test	Value	Degree of freedom	Asymp. Sig. (2-sided)
Pearson Chi-Square	0.714[a]	1	0.398

Source: Analyzed Field Data

From the analysis, at 5% significance level, the null hypothesis is accepted that there is no compliance by public buildings to the building requirement for efficient ramps in Kisumu city.

Similarly the responses from the questionnaires about the features of efficient ramps as indicated by the building owners/agents were used to test for compliance to the requirements of efficient ramps by the existing ramps.

Table:4.10: Test Statistics for Hypothesis 1(Stated Compliance by Building Owners/Agents)

Test	Value	Degree of freedom	Asymp. Sig. (2-sided)
Pearson Chi-Square	0.714^a	1	0.398

Source: Analyzed Field Data

From the analysis, at 5% significance level, the null hypothesis is accepted that there is no compliance by public buildings to the building requirement for efficient ramps in Kisumu city.

The study further sought to establish whether the observed non-compliance by the researcher in the observation checklist and the stated non-compliance by the owners/agents in the questionnaires were in agreement. The data in table 4.8 was used to conduct the kappa test.

Table: 4.11:Kappa Test for Hypothesis 1

Kappa test		Value
Measure of Agreement	Kappa	1.000
N of Valid Cases		15

Source: Analyzed field data

The result in table 4.11 indicated a kappa value of 1.000; therefore, there was perfect agreement on observed non-compliance to features of efficient ramps by researcher and that indicated by building owners/agents. Therefore, there was enough evidence to fail to reject the null hypothesis H_{o1}: there is no compliance by public buildings to the building requirements for efficient ramps in Kisumu city, Kenya. This result indicates that buildings in the study area are largely inaccessible to the mobility impaired population.

4.4.2. Objective two: To investigate the constraints to the construction and retrofitting of efficient ramps into existing public buildings.

The purpose of this objective was to investigate the constraints to the construction and retrofitting of efficient ramps into some of the existing public buildings. The data collected for this section presented information on Construction documents, Architectural requirements, Structural requirements and Building requirements. The stated factors were considered as constraints to the construction and retrofitting of ramps. The information gathered in this section was analyzed and presented in two parts. In the first section, descriptive statistics were used to present information on construction documents, architectural factors, structural and building factors. The presented information was about the factors that were considered to be the most hindrance to the retrofitting of ramps in existing public buildings. In the second part, a non parametric test (Chi- square) was used to test the null hypothesis stated under the research objective.

4.4.2.1. Construction Documents

Owners/agents of public buildings and building inspectors were asked whether they considered construction documents a hindrance to the retrofitting of ramps. The frequencies of their responses as to whether construction documents hinder the retrofit of efficient ramps in existing were presented in table 4.12 below.

Table 4.12: Responses to whether Construction Documents Hinder Ramp Retrofit

Response		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	47	88.7	88.7	**88.7**
	No	6	11.3	11.3	**100.0**
	Total	**53**	**100.0**	**100.0**	

Source: analyzed field data

The results in table 4.12 indicate that, 47(88.7%) of the 53 respondents considered construction documents, a hindrance to ramp retrofit while 6(11.3%) did not consider the building documents a hindrance to ramp retrofit. The researcher further sought information about the kind of building documents with information on efficient ramp retrofit that the respondents had read.

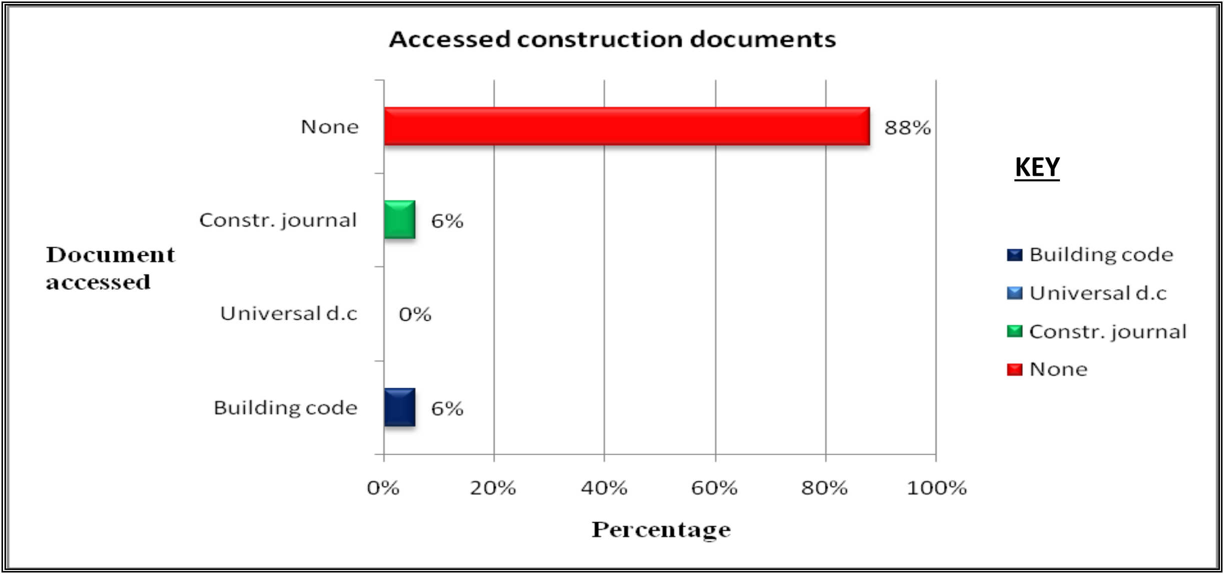


Figure 4.3: Accessibility to Construction Guides **Source:** Analyzed field data

The result from figure 4.3 indicate that, out of the 53 respondents, 47(88.00%) had never accessed a construction document, 3(6%) accessed a Building code and 3(6%) accessed a Construction journal and none accessed a Universal design code.

The researcher also wanted to find out if the accessed documents had information on retrofitting ramps and whether the construction clauses required the retrofitting of ramps in buildings to be mandatory or not.

Table 4.13: Ramp Retrofit Information in Construction Documents

Have you interacted with documents on provision of efficient ramps		**%**	**Did the document have information on Retrofitting of ramps in existing building**		**%**	**Was the clause about provision of ramps mandatory or not**		%
YES	6	11.32	YES	4	8	Mandatory	1	2
NO	47	88.68	NO	2	4	Not mandatory	3	6
No Comment	0	0	No Comment	47	88	No Comment	49	92
Total	**53**	**100**		**53**	**100**		**53**	**100**

Source: Analyzed Field Data

The information presented in table 4.13 indicate that, out of the 6 respondents who accessed construction documents, 4(8%) agreed that the documents had information on ramp retrofit while 2(4%) said the documents had no such information. Further to this, of the 4 respondents who accessed documents with ramp retrofit information, only one respondent 1(2%)indicated that the construction document had a mandatory clause on ramp retrofit while the remaining 3(6%) stated that the documents they interacted with had no mandatory clause on ramp retrofits. This shows that majority of the stakeholders 47(88.68%) had no access to information regarding ramp retrofit. Also only a limited number of construction documents 1(2%) can be used to promote the quest for ramp retrofit in public building because it has information on ramp retrofit and also makes it mandatory for buildings to be retrofitted with ramps.

4.4.2.2. Architectural requirements

The researcher sought to establish whether architectural requirements hinder the incorporation of ramps in existing building. The owners/agents of public buildings and building inspectors were asked to indicate on the questionnaires whether architectural requirements hinder the retrofit of ramps in existing public buildings. The frequencies of their responses are presented in the table below.

Table 4.14:Responses to whether Architectural Requirements are a Hindrance

Response		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	44	83.0	83.0	83.0
	No	9	17.0	17.0	100.0
	Total	**53**	**100.0**	**100.0**	

Source: Analyzed field data

The result from table 4.14 indicates that, 44(83%) of the respondents agreed that architectural requirements hinder the incorporation of ramp in existing public buildings while 9(17%) disagree. The researcher also sought to find out what architectural requirements hinder most the incorporation of ramps in existing buildings.

Table 4.15:Architectural Requirement that Hinder Ramp Retrofit

Factor considered a hindrance	Frequency	Percent	Valid Percent	Cumulative Percent
Space requirement	32	60.37	60.67	60.67
Aesthetics	12	22.64	22.64	83.31
Not a hindrance	9	16.99	16.99	100
Total	**53**	**100.0**	**100.0**	

Source: Analyzed field data

From the analysis it is clear that space requirement 32(60.37%) is the most hindrance to retrofitting in existing public building. While aesthetics 12(22.64%) is also a hindrance to retrofitting in existing building. Nine participants, 9(16.99%) did not consider any of the architectural requirements a hindrance.

4.4.2.3. Structural requirement

The researcher sought information on whether structural requirements hinder the incorporation of ramps in existing buildings.

Table 4.16: Responses to whether Structural Requirements are a Hindrance

Response		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Yes	47	88.7	88.7	88.7
	No	6	11.3	11.3	100.0
	Total	**53**	**100.0**	**100.0**	

Source: Analyzed field data

From the analysis, 47(88.7%) of the respondents agreed that structural requirements hinder the incorporation of ramps in existing buildings while 6(11.3%) of the respondents disagreed. The researcher also sought information on what structural requirements hinder retrofitting of ramps in existing public buildings.

Table 4.17:Structural Requirements that Hinder Ramp Retrofit

Factor considered a hindrance		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Strength of the building	25	47.17	47.17	41.17
	Spacing of structural elements	22	41.51	41.51	88.68
	Not a hindrance	6	11.32	11.32	100
	Total	**53**	**100.0**	**100.0**	

Source: Analyzed field data

From the analysis, it is clear that the strength of the building 25(47.17%) is the most hindrance to the retrofitting of ramps under the category of structural requirements. Spacing of structural elements was considered a hindrance at 22 (41.51%).Six of the respondents 6(11.32%) did not consider any of the structural requirements a hindrance to the retrofitting of ramps.

4.4.2.4. Building requirements

The researcher sought information on whether building requirements hinder the incorporation of ramps in existing buildings.

Table 4.18: Responses to whether Building Requirements are a Hindrance

Response		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Yes	43	81.1	81.1	81.1
	No	10	18.9	18.9	100.0
	Total	**53**	**100.0**	**100.0**	

Source: Analyzed field data

From the analysis, 43(81.1%) of the respondents indicated that building requirements hinder the retrofitting of ramps in existing buildings while 10(18.9%) of the respondents did not consider building requirements a hindrance.

The researcher also sought to establish what building factor is the most hindrance to the retrofitting of ramps in existing public buildings. The respondents were asked to select amongst the following factors; Poor or inadequate house inspection, Ignorant and inexperienced building contractors, Inadequate construction guides and cost cutting techniques. The frequencies of their responses were presented in the table below.

Table 4.19: Building Factors that are Considered a Hindrance to Ramp Retrofit

Factor considered a hindrance		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Poor or inadequate house inspection.	15	28.30	28.30	28.30
	Ignorant and inexperienced building contractors.	13	24.53	24.53	52.83
	Inadequate construction guides	12	22.64	22.64	75.47
	Cost cutting techniques	3	5.66	5.66	81.13
	Not a hindrance	10	18.87	18.87	100
	Total	**53**	**100.0**	**100.0**	

Source: Analyzed field data

The result in table 4.19 indicated that poor and inadequate house inspection15 (28.30%), ignorant and inexperienced building contractors 13 (24.53%) and inadequate construction guides 12(22.64%) are the building factors that hinder most the retrofitting of ramps in existing public buildings. The Other factor considered was cost cutting techniques at 3(5.66%). Ten participants, 10(18.87%) did not find any of the building factors a hindrance to the retrofitting of ramps.

Table 4.20: Responses to Factors Considered a Hindrance to Ramp Retrofit

Response question	YES	NO	TOTAL
Do Construction documents hinder ramp retrofit?	47	6	**53**
Do Architectural requirement hinder ramp retrofit?	44	9	**53**
Do Structural requirements hinder ramp retrofit?	47	6	**53**
Do Building requirements hinder ramp retrofit?	43	10	**53**
TOTAL	**181**	**31**	**212**

Source: Analyzed field data

A Chi-square test was conducted to establish whether construction documents, architectural requirements, structural requirements and building requirements as presented in table 4.20 hinder the incorporation of ramps in existing buildings. The null hypothesis was tested at a significance level of 0.05.

Table 4.21: Test Statistics for Second Hypothesis

Do you think Construction documents, Architectural , Structural and Building requirements hinder the incorporation of ramps in existing public building	
Chi-Square	47.302^{a}
Degree of freedom	3
P value	0.001

Source: Analyzed field data

From the analysis, the chi-square test is 47.302. The significance level for the chi-square test for requirements is 0.001 which falls below the significance level of 0.05. Therefore the difference between the frequencies of the observed requirements and frequencies of the expected information on the requirements is significant. Since $P<0.05$ thus we reject the second null hypothesis of the study that; there are no hindrances to the construction and retrofitting of efficient ramps in existing LRPBs. This result indicates that there are constraints to the retrofitting of ramps in existing public buildings.

4.4.3. Objective three: To establish the possibility of retrofitting efficient ramps into existing public buildings.

To test the stated research objective, the owners/agents of existing public buildings were asked to indicate on questionnaires whether they considered retrofitting of ramps in their buildings possible. The building inspectors too were asked to indicate whether they considered retrofitting of ramps in existing public buildings possible. The frequencies of their responses were presented in table 4.22.

Table 4.22: Frequencies of Responses to Possibility of Retrofitting Ramps

Do you consider retrofitting of ramps in building(s) possible	**Frequency**	**Percentage**
Yes	47	88.68
No	6	11.32
Total	**53**	**100**

Source: Analyzed field data

The results indicated that a majority of the respondents 47 (88.68%) consider retrofitting of ramps in existing public buildings to be possible while 6(11.32%) think it is not possible. The researcher used a chi-square test to find out whether the responses given in table 4.22 were in support of the third null hypothesis of the study stated under the research objective. The null hypothesis was tested at a significance level of 0.05.

Table 4.23: Test Statistics for Third Hypothesis

Do you consider retrofitting of ramps in existing public building possible?	
Chi-Square	31.717[a]
Degree of freedom	1
P value	0.001

Source: Analyzed field data

The findings indicated that the calculated chi-square statistics for 1 degree of freedom is 31.717. Additionally, it shows that the significance value 0.001 is less than the typical threshold value of 0.05. Since $P < 0.05$, the frequency of observed values differs significantly from the frequency of expected values for no possibility of retrofitting ramps in existing public buildings. Therefore, the third null hypothesis of the study: H_{03} (There is no possibility of retrofitting public buildings with efficient ramps), was rejected.

4.5. Analysis of data from observation checklists

The observation checklist was used to collect information to back up the questionnaires. The information gathered included; the number of storeys in the buildings, the number of buildings with accessibility ramps, the location of the observed ramp, the condition of the observed ramp and compliance with features of efficient ramps.

The researcher sought to find out the nature of buildings under study regarding the number of storeys.

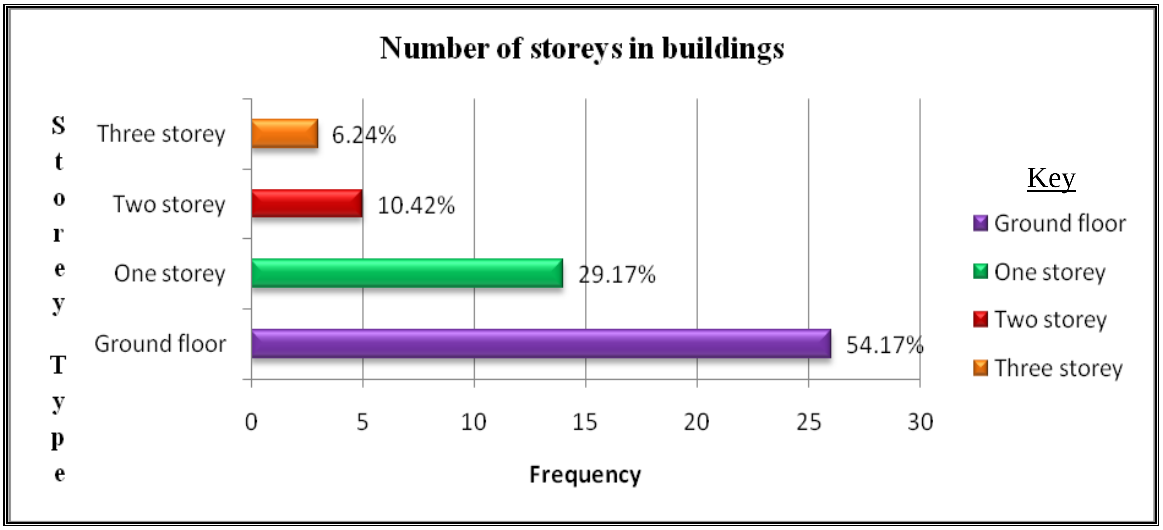


Figure 4.4: Nature of the 48 Observed Buildings **Source:** Analyzed field data

Figure 4.4 presented the information about the nature of buildings as observed and recorded in the checklist. The bar graph indicates that, of the 48 buildings that were observed, 26(54.17%) were buildings with ground floor only, 14(29.17%) were one storey building, 5(10.42%) were two storey and 3(6.24%) three storey buildings. The findings indicated that a majority of the buildings under study were ground floor buildings.

The researcher further sought information about the number of buildings that were retrofitted with accessibility ramps.

Table 4.24: Number of Buildings with Accessibility Ramps

Building	Frequency	Percent (%)
With access ramp	15	31.25
Without Ramp	33	68.75
Total	**48**	**100.00**

Source: Source: Analyzed field data

The result from table 4.24 indicates that 15(31.25%) of the buildings had an access ramp while 33(68.75%) of the buildings had no accessibility ramp. The finding indicates that majority of the buildings under study had no access ramps.

The researcher sought to find out the distribution of the 15 observed ramps amongst the public buildings that were studied.

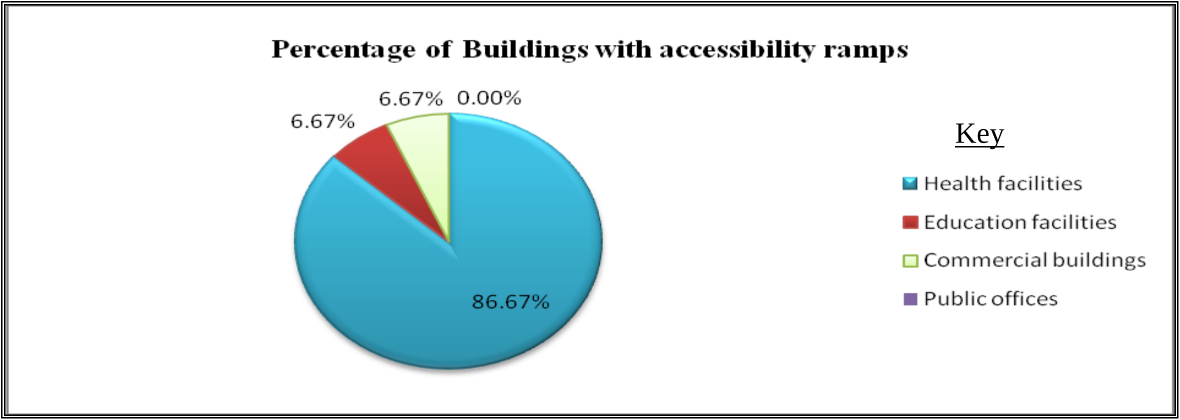


Figure 4.5: Distribution of the 15 Buildings with Access Ramps

Source: Analyzed field data

From figure 4.5 above, the study established that out of the 15 buildings that had accessibility ramps, 13(86.66%) were Health facilities, 1(6.67%) Education buildings, 1(6.67%) Commercial buildings and 0(0.00%) were Public buildings. The result indicates that all the health facilities studied had access ramps.

The researcher sought to find out the position where ramps are mostly retrofitted. The positions of observed ramps were entered in appropriate columns in the observation checklist.

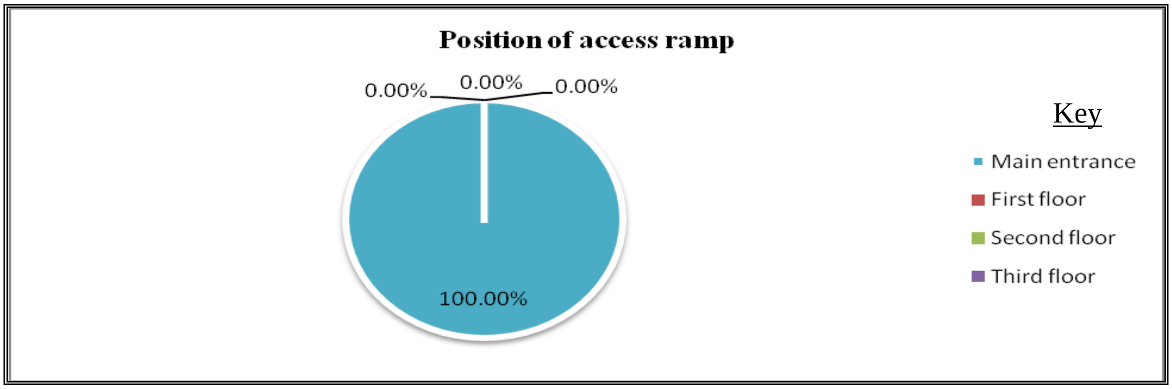


Figure 4.6: Location of the Ramps in the 15 Observed Buildings
Source: Analyzed field data

From figure 4.6 above the result indicates that 15 buildings had ramps at the main entrance were at the main entrance and none 0(0%) at first, second and third floors. The data implies that it was easier for owners of buildings to retrofit ramps at the main entrance than at any other position.

The study sought information on whether the observed ramps had complied with requirements for efficient ramps. The researcher used the observation checklist to tick the observed features of the ramps. Also, a clinometer was used to measure the slant of the observed ramps. The frequencies of the observed features for the ramps were presented in Table 4.25.

Table 4.25: Observed Features for Accessibility Ramps

	Ramps	
Features of compliance	**Frequency**	**percent**
Slope≤1:12, non-slip surface &guard rails present.	0	0
Slope≤1:12 & non-slip surface only.	1	6.67
Non-slip surface &guard rails only.	1	6.67
Slope≤1:12&guard rails only	0	0
Non- slip surface only.	13	86.66
Total	**15**	**100**

Source: Observation checklist

From the findings on compliance with features of an efficient ramp, the study depicts that none of the observed ramps 0(0%) had fully complied with the requirements for efficient ramp construction. However, most of the observed ramps had partially complied; (86.66%) of them had met surface texture requirements, 1 (6.67%) complied with the non-slip surface and guard rails only while 1 (6.67%) complied with Slope≤1:12 and non-slip surface only. The result shows that the observed ramps were of poor condition since they don’t comply with the set of the three requirements for efficient ramp construction.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0. Introduction

This chapter presents a summary of the study findings, conclusions, and recommendations for practice, policy, and further research.

5.1. Summary of Findings

The purpose of the study was to investigate the factors that hinder the incorporation of efficient ramps in some of the existing low-rise public buildings in Kisumu City, Kenya. It was based on the rationale that, the persons with disability act of 2003 has been faced with minimal implementation, accompanied with a slow pace of construction and retrofitting of ramps in existing public buildings.

The study focused on the following research objectives; firstly, to examine the extent of compliance by owners of LRPBs and developers in Kenya with the construction requirements of efficient ramps, Secondly, to investigate the constraints to the construction and retrofitting of efficient ramps into existing public buildings, and thirdly, to establish the possibility of retrofitting efficient ramps into existing public buildings.

The findings of this study were summarised in two parts. The first section presented the summary of results from observation checklist and the second part presented a summary of results from the questionnaires issued to building owners/agents and the building inspectors.

5.1.1. Summary of findings from observation schedules

The objects of study were buildings; the data presentation indicated that majority of the buildings that formed part of the study were ground floor buildings 26(54.17%). The rest were; one storey buildings 14(29.17%), two storey buildings 5(10.42%) and three storey buildings 3(6.24%). The result indicated that majority of the buildings in Kisumu City were constructed to heights where lifts and elevators are uneconomical means of access. Hence, they require ramps as alternative means of accessibility by the mobility impaired population.

The findings from observation schedules revealed that only a few buildings, 15(31.25%) out of the selected 48 had access ramps while 33(68.75%) had no access ramps. It indicates that many owners of buildings have not complied with the requirements for the provision of access ramps for wheelchair bound persons. The findings further showed that, of the fifteen buildings that had ramps, a majority of them were health facilities 13(86.66%), the rest were education buildings 1(6.67%) and commercial buildings 1(6.67%). A majority of the health facilities have ramps because they are the most visited public facilities due to the urgency and nature of services sought. Therefore, the wheelchair bound persons as the rest of the population when sick, are obliged to visit health centers. It also indicates that public sectors like education and public service have not fully embraced the spirit of inclusive design.

The study results on the placement of ramps showed that all of the observed ramps were at the main entrance 15(100%). The ramps are at the main entrance of the building since a majority of the buildings were at ground floor level, and it was also easy to incorporate ramps at this level than at any other.

The findings also revealed that of the 15 observed ramps, none 0 (0%) had fully complied with the requirements for efficient ramps. For full compliance, the ramp ought to conform to all of the following three conditions; Slope not greater than 1:12, non-slip surface texture and provision of guard rails on both sides. The observed ramps, however, had partially complied; 13 (86.66%) of the ramps had the required texture. These results indicate that, the available ramps could be too steep for wheelchair persons to navigate unaided and unsafe for use due to inadequate edge protection.

5.1.2. Summary of findings from questionnaire responses

The responses from questionnaires that were issued to building owners/agents and building inspectors were coded, analyzed and presented in the following three themes that were based on the study objectives;

1. Compliance with requirements of ramp retrofit.
2. Constraints to the retrofitting of ramps.
3. The possibility of retrofitting ramps in public buildings.

5.1.2.1. Compliance with requirements of ramp retrofit

The findings from descriptive statistics in this section revealed that; a majority of the buildings 33(62.3%) in the study area had not been retrofitted with access ramps. Only 15(37.7%) had access ramps. However, the results from the responses of building inspectors showed that majority of them 4(80%) were aware of the requirements for efficient ramp construction.

The null hypothesis stated for the test under this theme is, H01: There is no compliance by public buildings to the construction requirements for efficient ramps in Kenya. The chi-square test gave a result of $P > 0.05$ for the observed compliance by the researcher and compliance indicated by building owners/agents in questionnaires. The kappa test showed the perfect agreement of these two categories of compliance; therefore, there was enough evidence to fail to reject the null hypothesis Ho1; there is no compliance by public buildings to the requirement of efficient ramps in Kisumu City Kenya. It shows that public buildings in Kisumu city have not complied with the requirement of PDA act of 2003 and concurs with the findings of Sidha (2010) that, most of the policy promises outlined in the PDA act 2003 have remained unfulfilled. The results also suggest that there is laxity on the side of the building inspectors in the supervision and inspection of construction works under renovation. The findings indicated that the building inspectors were fully aware of the requirements for efficient ramps, yet the ramps sampled for the study were substandard.

5.1.2.2.Constraints to the retrofitting of ramps

The results on whether construction documents could be impeding the retrofit of ramps indicated that majority of the respondents, 47(88.68%) had never accessed a construction document and only 6(11.32%) had accessed. Out of the six respondents who had access to construction documents, 4(8%) indicated that the manuals had information on ramps retrofit. On the other hand, 3(6%) of the respondents stated that the clause on retrofitting of ramps was not mandatory. A majority of the stakeholders’ in the building sector like clients, builders, and engineers had no access to information regarding ramp retrofit. Also, only a limited number of construction documents 1(2%) can be used to promote the quest for ramp retrofit in public buildings because it has information on ramp retrofit and also makes it mandatory for buildings to be retrofitted with ramps.

The analysis further revealed that 32(60.37%) of the respondents considered space requirement as the most architectural hindrance to ramp retrofit. On the structural aspect, 25(47.17%) considered the strength of the building as the most barrier to ramp retrofitting and 15(28.30%) considered inadequate house inspection as the most hindrance to ramp retrofit on the construction requirement. The results show that even though there is an advocacy for ramp retrofit in buildings, there are constraints that make the process not to be entirely successful. It is, therefore, critical for all stakeholders in the construction industry to converge and come up with comprehensive procedures that can foster a viable and practical method for ramp retrofit.

The hypothesis stated for the test under this theme was Ho2: There are no hindrances to the construction and retrofitting of efficient ramps in existing LRPBS. The chi-square test result gave $P < 0.05$; therefore, the null hypothesis was rejected. It shows that there are constraints to the retrofitting of ramps in existing public buildings. The result reveals why there is a slug in the process of making existing public buildings fully accessible to persons with mobility challenges. The findings reveal that most of these buildings were not designed to meet the need of the disabled as observed by (Pynoos, 2001).

5.1.2.3. Possibility of retrofitting ramps in public buildings

Under this theme, the respondents were asked whether it was possible to retrofit ramps in their premises. The chi-square test gave a statistical value of $P < 0.05$. Therefore, the third null hypothesis of the study; H_{03}; There is no possibility of retrofitting ramps in existing LRPBs, was rejected indicating that ramp retrofit was possible. It shows that, though there are challenges in making the built environment inclusive, stakeholders have the will to remove the accessibility barriers. The finding agrees with the views of Chepngetich and Mulambula (2012) that, though becoming fully accessible will not happen overnight, neither should it be sidelined or put on the back burner.

5.2. Conclusions

Based on the discussed findings of the study, the following conclusions were made about the retrofitting of efficient ramps in existing buildings.

1. There is no compliance by public buildings to the construction requirements for efficient ramps and as a result, many public buildings in the study region remain largely inaccessible to persons with mobility challenges.

2. There exist constraints which are not limited to the following; space requirements, the strength of existing buildings and inadequate house inspection.

3. The stakeholders in the construction industry consider the retrofit ramps in buildings possible.

4. Building owners, agents, building contractors and some building engineers are not fully aware of the requirements for constructions of efficient ramps. The construction documents available have insufficient information on efficient ramps; they do not outline the required procedures for construction and retrofitting of ramps.

5.3. Recommendations

The following recommendations were made based on the findings and the conclusions of the study:

1. The study proposes that the Government of Kenya through the National Construction Authority and the Local government should be tasked with the drafting of comprehensive and adequate construction guides for accessible housing and efficient ramps construction and avail them to all stakeholders in the

construction industry. The guides should put into consideration the impeding factors to the retrofitting of ramps and how to overcome them.

2. In line with the above, through seminars, workshops, and vigorous campaigns on universal designs, all stakeholders including operatives should be made aware of the construction guides. The Media should be assigned the responsibility of removing attitudinal barriers and changing behaviour and attitudes towards persons with mobility challenges. Individuals with disabilities and or those who champion for the rights of the physically impaired should be involved in the drafting and implementation of policies relating to the construction industry.

3. The government of Kenya should also consider availing funds for retrofitting ramps in public institutions such as education facilities and hospitals. The funding should be for ramp construction up to the first floor or subsidize the cost of building materials' procured for retrofitting ramps in existing buildings.

4. In buildings where there exist constraints that make it practically impossible to retrofit ramps, an effort should be made to ensure the entrance to the building's ground floor is made accessible. Besides, vital services should be devolved in such a way that persons with mobility challenges can benefit most.

5. The government ought to capitalize on the goodwill from interested parties in the built environment to foster its campaign on inclusive housing.

5.4. Suggestions for Further Research

Based on this research work:

1. A similar study should be carried out in other types of buildings to compare the results.
2. A comparative study can be conducted to establish better and cost-effective ways of implementing retrofits in existing buildings.
3. Studies can be carried out on other aspects of inclusive design like access to washrooms, shelves, door knobs and other facilities in the built environment used by persons with mobility challenges in Kenya.

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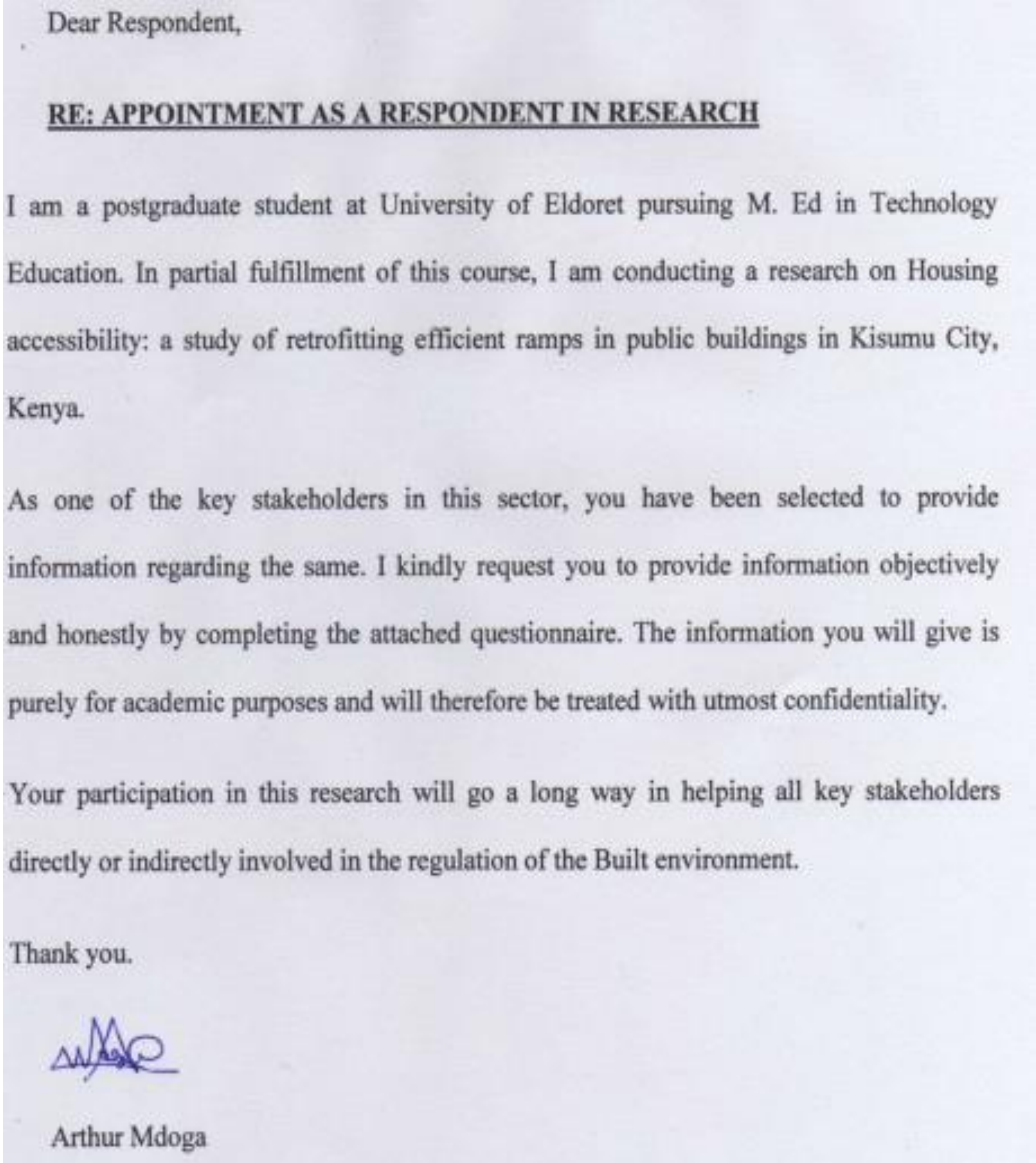
APPENDICES

APPENDIX i: LETTER OF INTRODUCTION



Dear Respondent,

RE: APPOINTMENT AS A RESPONDENT IN RESEARCH

I am a postgraduate student at University of Eldoret pursuing M. Ed in Technology Education. In partial fulfillment of this course, I am conducting a research on Housing accessibility: a study of retrofitting efficient ramps in public buildings in Kisumu City, Kenya.

As one of the key stakeholders in this sector, you have been selected to provide information regarding the same. I kindly request you to provide information objectively and honestly by completing the attached questionnaire. The information you will give is purely for academic purposes and will therefore be treated with utmost confidentiality.

Your participation in this research will go a long way in helping all key stakeholders directly or indirectly involved in the regulation of the Built environment.

Thank you.

Arthur Mdoga

APPENDIX ii: OBSERVATION CHECKLIST FOR AVAILABILITY OF RAMPS IN BUILDINGS

SHEET 1: CHECKLIST OF AVAILABILITY AND LOCATION OF RAMPS

SN	DESCRIPTION OF HOUSE	NO OF STOREYS				RAMP AT MAIN ENTRY	RAMP TO STOREY		
		0	1	2	3		1	2	3
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									

SHEET 2: CHECKLIST OF AVAILABILITY AND LOCATION OF RAMPSIN OBSERVED BUILDINGS – CONTINUATION

SN	**DESCRIPTION OF HOUSE**	**NO OF STOREY**				**RAMP AT MAIN ENTRY**	**RAMP TO STOREY**		
		0	**1**	**2**	**3**		**1**	**2**	**3**
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									

SHEET 3: OBSERVATION CHECKLIST FOR CONDITION OF RAMP

SN/ BUILDING DESCRIPTION	AVAILABLE FEATURES (tick)		CONDITION (tick)		
1	1.slope≤1:12		Features 1 to 4 present		Good
	2.guard rails available				
	3. non slip surface				
	4. Appropriate Access signs		Any of 1 to 4 absent		Poor
2	1.slope≤1:12		Features 1 to 4 present		Good
	2.guard rails available				
	3. non slip surface				
	4. Appropriate Access signs		Any of 1 to 4 absent		Poor
3	1.slope≤1:12		Features 1to 4 present		Good
	2.guard rails available				
	3. non slip surface		Any of 1 to 4 absent		Poor
	4. Appropriate Access signs				
4	1.slope≤1:12		Features 1 to 4 present		Good
	2.guard rails available				
	3. non slip surface		Any of 1 to 4 absent		Poor
	4. Appropriate Access signs				
5	1.slope≤1:12		Features 1 to 4 present		Good
	2.guard rails available				
	3. non slip surface		Any of 1 to 4 absent		Poor
	4. Appropriate Access signs				

SHEET4: OBSERVATION CHECKLIST FOR CONDITION OF RAMP-CONTINUATION

SN/ BUILDING DESCRIPTION	AVAILABLE RAMP FEATURES (tick)		CONDITION (tick)		
6	1.slope≤1:12		Features 1 to 4 present		Good
	2.guard rails available				
	3. non slip surface				
	4. Appropriate Access signs		Any of 1 to 4 absent		Poor
7	1.slope≤1:12		Features 1 to 4. present		Good
	2.guard rails available				
	3. non slip surface				
	4. Appropriate Access signs		Any of 1 to 4 absent		Poor
8	1.slope≤1:12		Features 1 to 4 present		Good
	2.guard rails available				
	3. non slip surface		Any of 1 to 4 absent		Poor
	4. Appropriate Access signs				
9	1.slope≤1:12		Features 1 to 4 present		Good
	2.guard rails available				
	3. non slip surface		Any of 1 to 4 absent		Poor
	4. Appropriate Access signs				
10	1.slope≤1:12		Features 1 to 4 present		Good
	2.guard rails available				
	3. non slip surface		Any of 1 to 4 absent		Poor
	4. Appropriate Access signs				

SHEET 5: OBSERVATION CHECKLIST FOR CONDITION OF RAMP CONTINUATION

SN/ BUILDING DESCRIPTION	AVAILABLE RAMP FEATURES (tick)		CONDITION (tick)		
11	**1.slope≤1:12**		**Features 1 to 4 present**		**Good**
	2.guard rails available				
	3. non slip surface				
	4. Appropriate Access signs		**Any of 1 to 4 absent**		**Poor**
12	**1.slope≤1:12**		**Features 1 to 4 present**		**Good**
	2.guard rails available				
	3. non slip surface				
	4. Appropriate Access signs		**Any of 1 to 4 absent**		**Poor**
13	**1.slope≤1:12**		**Features 1 to 4 present**		**Good**
	2.guard rails available				
	3. non slip surface		**Any of 1 to 4 absent**		**Poor**
	4. Appropriate Access signs				
14	**1.slope≤1:12**		**Features 1 to 4 present**		**Good**
	2.guard rails available				
	3. non slip surface		**Any of 1 to 4 absent**		**Poor**
	4. Appropriate Access signs				
15	**1.slope≤1:12**		**Features 1 to 4 present**		**Good**
	2.guard rails available				
	3. non slip surface		**Any of 1 to 4 absent**		**Poor**
	4. Appropriate Access signs				

SHEET 6: OBSERVATION CHECKLIST FOR CONDITION OF RAMP CONTINUATION

SN/ BUILDING DESCRIPTION	AVAILABLE RAMP FEATURES (tick)		CONDITION (tick)		
16	1.slope≤1:12		Features 1 to 4 present		Good
	2.guard rails available				
	3. non slip surface				
	4. Appropriate Access signs		Any of 1 to 4 absent		Poor
17	1.slope≤1:12		Features 1 to 4 present		Good
	2.guard rails available				
	3. non slip surface				
	4. Appropriate Access signs		Any of 1 to 4 absent		Poor
18	1.slope≤1:12		Features 1 to 4 present		Good
	2.guard rails available				
	3. non slip surface		Any of 1 to 4 absent		Poor
	4. Appropriate Access signs				
19	1.slope≤1:12		Features 1 to 4 present		Good
	2.guard rails available				
	3. non slip surface		Any of 1 to 4 absent		Poor
	4. Appropriate Access signs				
20	1.slope≤1:12		Features 1 to 4 present		Good
	2.guard rails available				
	3. non slip surface		Any of 1 to 4 absent		Poor
	4. Appropriate Access signs				

SHEET 7: OBSERVATION CHECKLIST FOR CONDITION OF RAMP CONTINUATION

SN/ BUILDING DESCRIPTION	AVAILABLE RAMP FEATURES (tick)		CONDITION (tick)		
21	**1.slope≤1:12**		**Features 1 to 4 present**		**Good**
	2.guard rails available				
	3. non slip surface		**Any of 1 to 4 absent**		**Poor**
	4. Appropriate Access signs				
22	**1.slope≤1:12**		**Features 1 to 4 present**		**Good**
	2.guard rails available				
	3. non slip surface		**Any of 1 to 4 absent**		**Poor**
	4. Appropriate Access signs				
23	**1.slope≤1:12**		**Features 1 to 4 present**		**Good**
	2.guard rails available				
	3. non slip surface		**Any of 1 to 4 absent**		**Poor**
	4. Appropriate Access signs				
24	**1.slope≤1:12**		**Features 1 to 4 present**		**Good**
	2.guard rails available				
	3. non slip surface		**Any of 1 to 4 absent**		**Poor**
	4. Appropriate Access signs				
25	**1.slope≤1:12**		**Features 1 to 4 present**		**Good**
	2.guard rails available				
	3. non slip surface		**Any of 1 to 4 absent**		**Poor**
	4. Appropriate Access signs				

SHEET 8: OBSERVATION CHECKLIST FOR CONDITION OF RAMP CONTINUATION

SN/ BUILDING DESCRIPTION	AVAILABLE RAMP FEATURES (tick)		CONDITION (tick)		
26	1.slope≤1:12		Features 1 to 4 present		Good
	2.guard rails available				
	3. non slip surface		Any of 1 to 4 absent		Poor
	4. Appropriate Access signs				
27	1.slope≤1:12		Features 1 to 4 present		Good
	2.guard rails available				
	3. non slip surface		Any of 1 to 4 absent		Poor
	4. Appropriate Access signs				
28	1.slope≤1:12		Features 1 to 4 present		Good
	2.guard rails available				
	3. non slip surface		Any of 1 to 4 absent		Poor
	4. Appropriate Access signs				
29	1.slope≤1:12		Features 1 to 4 present		Good
	2.guard rails available				
	3. non slip surface		Any of 1 to 4 absent		Poor
	4. Appropriate Access signs				
30	1.slope≤1:12		Features 1 to 4 present		Good
	2.guard rails available				
	3. non slip surface		Any of 1 to 4 absent		Poor
	4. Appropriate Access signs				

APPENDIX iii:SAMPLE QUESTIONNAIRE FOR BUILDING OWNERS

Dear Respondent,

My name is Mdoga Arthur undertaking a Masters degree in the Department of Technology Education, School of Education, and University of Eldoret. I am carrying out a research on **Housing accessibility: a study of retrofitting efficient ramps in public buildings in Kisumu City, Kenya.**

You have been selected as a respondent to assist by providing some of the information that we consider important to this study. Please be fair and honest. Please note that any information given will be treated with utmost confidentiality and only for academic purposes.

Instructions: Please respond to all items in the questionnaire

<u>Section A:</u> Background information [tick where appropriate**]**

1. Gender: a) Male [ ] b) Female [ ]
2. Age : a) 18-30 [ ] b) Above 30 [ ]
3. Building ownership: a) Owner [ ] b) Agent [ ]
4. Function of the building: a) Commercial [ ] b) Public office [ ]
   c) Education facility [ ] d) Health facility [ ]
5. Number of storeys in the building: a) Ground floor only [ ]
   b) One storey only [ ] c) Two storey [ ]
   d) Three storey [ ]
6. Year of construction: a) Before 2003 [ ] b) After 2003 [ ]

<u>Section B:</u> Compliance with requirement of efficient ramps [Tick where appropriate**]**

7. Does your building have an access ramp? a) Yes [ ] b) No [ ]

8. If your answer is Yes in question 7 above, kindly select he features associated with the ramp in the table below.

SN	**Location of Ramp**	**Tick**	**Slope of Ramp**	**Tick**	**Texture of ramp**	**Tick**	**Guard rails on ramp**	**Tick**
1.	Main Entrance		Slope≤1:12		Rough		Available	
			Slope≥1:12		Smooth		Doesn't have	
			Have no idea					
2.	First floor		Slope≤1:12		Rough		Available	
			Slope≥1:12		Smooth		Doesn't have	
			Have no idea					
3.	Second floor		Slope≤1:12		Rough		Available	
			Slope≥1:12		Smooth		Doesn't have	
			Have no idea					
4.	Third floor		Slope≤1:12		Rough		Available	
			Slope≥1:12		Smooth		Doesn't have	
			Have no idea					

Section C: Constraints to the construction and retrofitting of Efficient Ramps

Construction documents [*tick where appropriate****]***

9. Do you think construction documents hinder retrofitting of ramps in buildings?

a) Yes [ ] b) No [ ]

10. If your answer is No in 9 above, what kind of document about provision of efficient ramps in Kenya have you interacted with?

a) Building code [ ] Year of publication…......
b) Universal design building code [ ] Year of publication…......
c) Construction Journal [ ] Year of publication…......
d) None of the above [ ]

11. Did the document in 10 above have information on retrofitting of ramps in existing buildings?

a) Yes [ ] b) No [ ]

12. Was the clause about provision of ramps mandatory or not?

a) Mandatory [ ] b) Not mandatory [ ]

Architectural requirements [*tick where appropriate****]***

13. In your own opinion, do you think architectural requirements hinder the retrofitting of ramps in existing buildings?

a) Yes [ ] b) No [ ]
c) Don’t know [ ]

14. If your answer is Yes in 13 above, what architectural requirement do you consider as the most hindrance to retrofitting of ramps in existing public buildings?

    a) Space requirement [ ]

    b) Aesthetics [ ]

    Any other? Specify..

    ....

    ....

Structural requirements [*Tick where appropriate****]***

15. In your own opinion, do you think structural requirements hinder the incorporation of ramps in existing buildings?

    a) Yes [ ] b) No [ ]

    c) Don't know [ ]

16. If your answer is Yes in 15 above, what structural requirements do you consider as the most hindrance to retrofitting of ramps in existing public buildings?

    a) Strength of building [ ]

    b) Spacing of structural element [ ]

    Any other? Specify..

    ....

    ....

Building requirements **[***Tick where appropriate***]**

17. In your own opinion, do you think building requirements hinder the incorporation of ramps in existing buildings?

    a) Yes [ ] b) No [ ]

    c) Don't know [ ]

18. If your answer is Yes in 17 above, what building factors do you consider as the most hindrance to retrofitting of ramps in existing public buildings?

    a) Poor or inadequate house inspection [ ]

    b) Ignorant and inexperienced building contractors [ ]

    c) Inadequate construction guides [ ]

    d) Cost cutting techniques [ ]

    Any other? Specify...

    ....

    ....

<u>Section E: possibility of retrofitting Efficient ramps in buildings</u>

19. In your own opinion, do you consider retrofitting of ramps in your building possible?

    a) Yes [ ] b) No [ ]

    c) Don't know [ ]

20. If your answer is No in 19 above, give reasons...

    ....

    ....

APPENDIX iv:SAMPLE QUESTIONNAIRE FOR BUILDING INSPECTORS

Dear Respondent,

My name is Mdoga Arthur undertaking a Masters degree in the Department of Technology Education, School of Education, and University of Eldoret. I am carrying out a research on **Housing accessibility: a study of retrofitting efficient ramps in public buildings in Kisumu City, Kenya.**

You have been selected as a respondent to assist by providing some of the information that we consider important to this study. Please be fair and honest. Please note that any information given will be treated with utmost confidentiality and only for academic purposes.

Instructions: **Please respond to all items in the questionnaire**

<u>Section A:</u> Background information [tick where appropriate**]**

1. Gender: a) Male [ ] b) Female [ ]
2. Age : a) 18-30 [ ] b) Above 30 [ ]
3. Job Title: a) Construction engineer [ ] b) Architect [ ]
   c) Quantity surveyor [ ]

<u>Section B:</u> Compliance with requirement of efficient Ramps [Tick where appropriate**]**

4. Are ramps an essential tool on the inspection and approval schedule for building retrofits?
   a) Yes [ ] b) No [ ]

5. At what floor level are access Ramps most fitted

SN	**Floor level at which Ramp are mostly constructed**	**Tick**
1.	Main Entrance	
2.	First floor	
3.	Second floor	
4.	Third floor	
5.	None of the above	

6. What slope gradients do you recommend for ramp construction during inspection?

a) Slope ≤1:12 [ ] b) Slope >1:12 [ ]

7. What floor texture do you consider appropriate for house ramp?

a) Smooth [ ] b) Rough [ ]

8. Are guide rails on ramps an essential requirement for your inspection?

a) Yes [ ] b) No [ ]

Section C: Constraints to the construction and retrofitting of Efficient Ramps

***Construction documents** [tick where appropriate]*

9. Do you think construction documents hinder retrofitting of ramps in buildings?

    a) Yes [ ] b) No [ ]

10. If your answer is No in 9 above, what kind of document about provision of efficient ramps in Kenya have you interacted with?

    a) Building code [ ] Year of publication….......
    b) Universal design building code [ ] Year of publication….......
    c) Construction Journal [ ] Year of publication….......
    d) None of the above [ ]

11. Did the document in 10 above have information on retrofitting of ramps in existing buildings?

    a) Yes [ ] b) No [ ]

12. Was the clause about provision of ramps mandatory or not?

    a) Mandatory [ ] b) Not mandatory [ ]

***Architectural requirements** [tick where appropriate]*

13. In your own opinion, do you think architectural requirements hinder the incorporation of ramps in existing buildings?

    a) Yes [ ] b) No [ ]
    c) Don't know [ ]

14. If your answer is Yes in 13 above, what architectural requirement do you consider as the most hindrance to retrofitting of ramps in existing public buildings?

    a) Space requirement [ ]

    b) Aesthetics [ ]

    Any other? Specify..

    ....

    ....

Structural requirements [*Tick where appropriate****]***

15. In your own opinion, do you think structural requirements hinder the incorporation of ramps in existing buildings?

    a) Yes [ ] b) No [ ]

    c) Don’t know [ ]

16. If your answer is Yes in 15 above, what structural requirements do you consider as the most hindrance to retrofitting of ramps in existing public buildings?

    a) Strength of building [ ]

    b) Spacing of structural element [ ]

    Any other? Specify..

    ....

    ....

***Building requirements** [Tick where appropriate]*

17. In your own opinion, do you think building requirements hinder the incorporation of ramps in existing buildings?

a) Yes [ ] b) No [ ]

c) Don't know [ ]

18. If your answer is Yes in 17 above, what building factors do you consider as the most hindrance to retrofitting of ramps in existing public buildings?

a) Poor or inadequate house inspection [ ]

b) Ignorant and inexperienced building contractors [ ]

c) Inadequate construction guides [ ]

d) Cost cutting techniques [ ]

Any other? Specify...

....

....

<u>Section E: possibility of retrofitting Efficient ramps in buildings</u>

19. In your own opinion, do you consider retrofitting of ramps in your building possible?

a) Yes [ ] b) No [ ]

c) Don't know [ ]

20. If your answer is No in 19 above, give reasons...

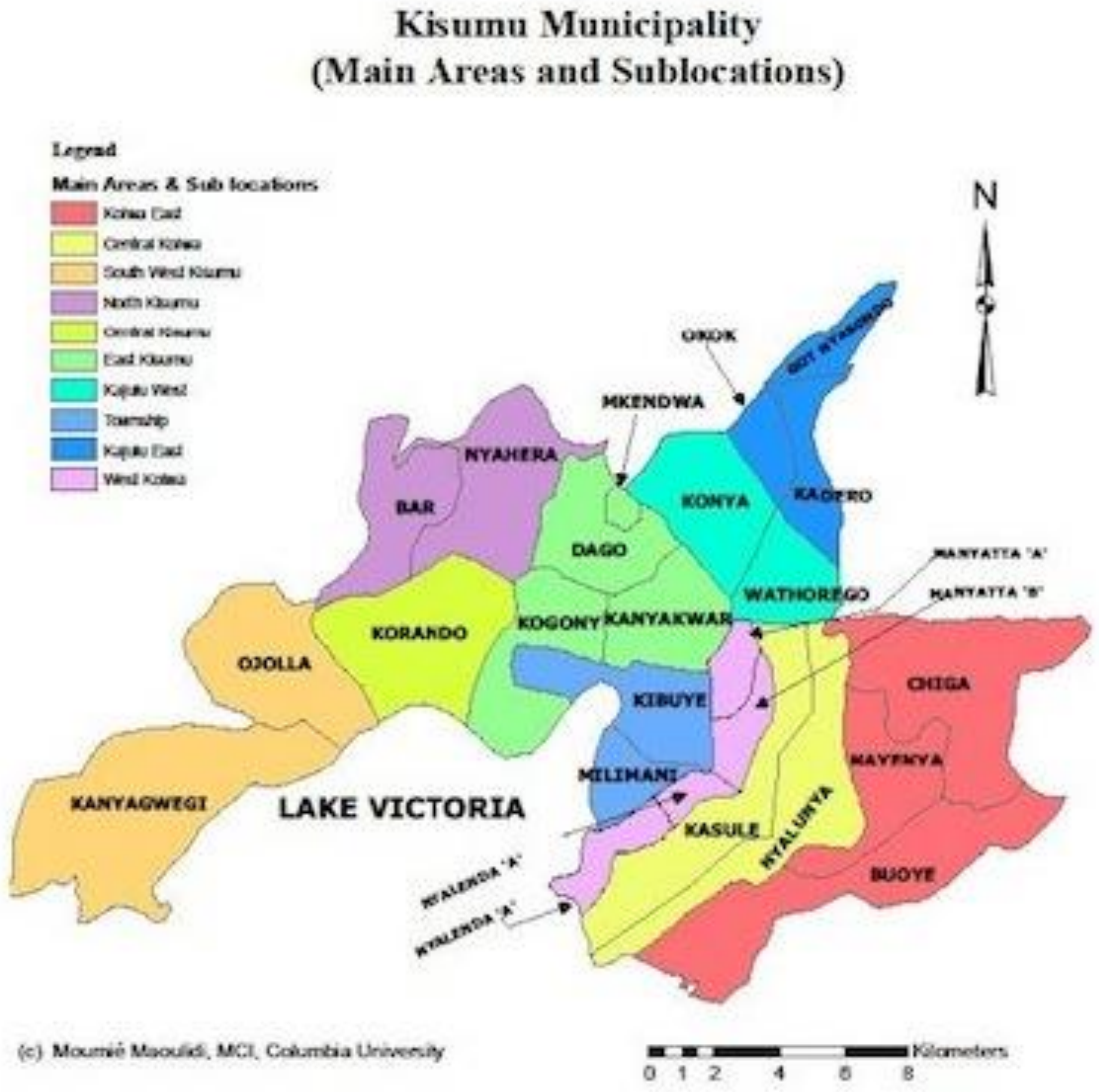
....

....

APPENDIX v: SAMPLED PUBLIC BUILDINGS FOR STUDY

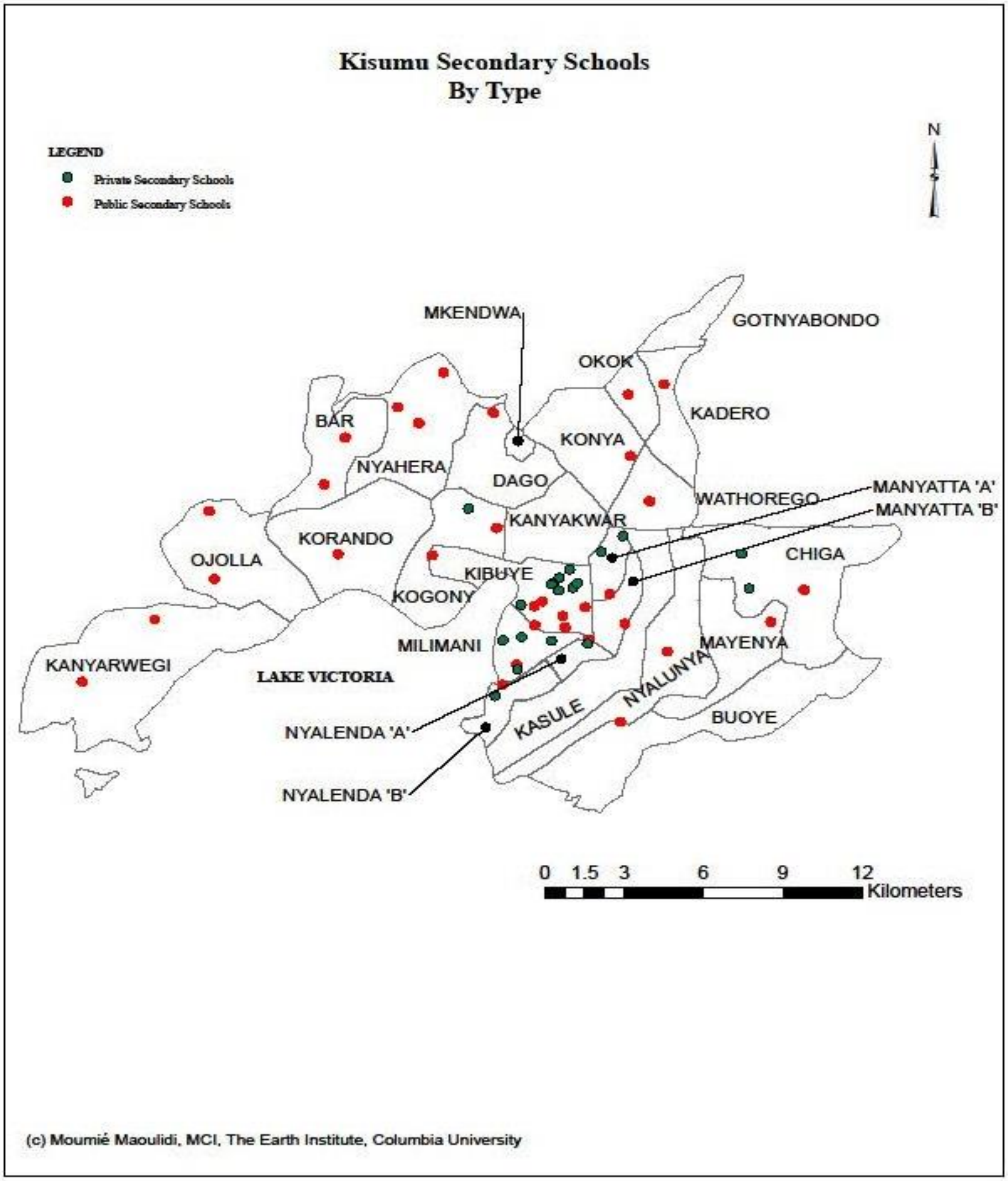
HEALTH FACILITIES	EDUCATION BUILDINGS	COMMERCIAL BUILDINGS	PUBLIC OFFICES
Lumumba HC	Kisumu Boys High School	Pramukh Supermarket	Tivoli Center
Migosi HC	Lions High School	Yatin Supermarket	Electricity House
Chiga Dispensary	St. Teresa's Girls Sec School	Ukwala Supermarket	Chekmulla House
Town Hall Clinic	Kasagam Sec. School	Kondele Supermarket	Jubilee Insurance House
Airport Dispensary	Joyland Special Sec. School	Mjengo Super mart	Guilds House
Kisumu D. Hospital	Ramogi Institute of Advanced Techn.	Nakumat Nyanza	Telecom plaza
Nyalenda H C	Kisumu Girls	Chronicle Tours	Alpha House
Port Florence	Nyamasaria Sec. School	Anvi Emporium	Kiwasco
Dunga Nursing Home	Kisumu polytechnic	Ramogi Chemists	Rahemtulla Punja
Gurunanak Harambee Dispensary	Bishop Ojola Girls	Brilliant	Anyange Plaza
Kodiaga Prison HC	Highway sec. school	Temudo Center	Municipal offices
Railways Dispensary			Office of County Commission
Kibos Sugar Dispensary			Amex Building

APPENDIX vi: MAP OF KISUMU MUNICIPALITY

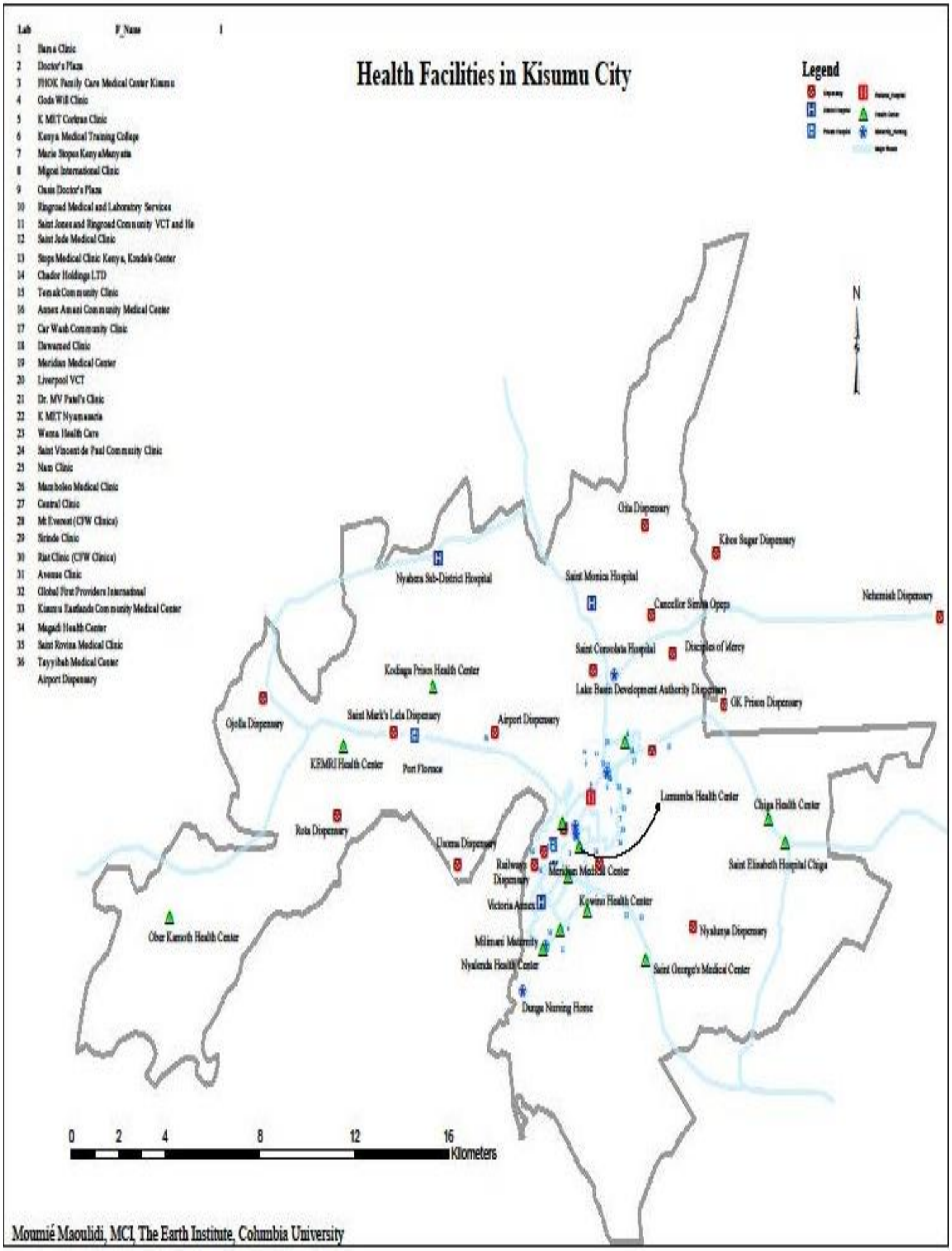


(c) Moumié Maoulidi, MCI, Columbia University

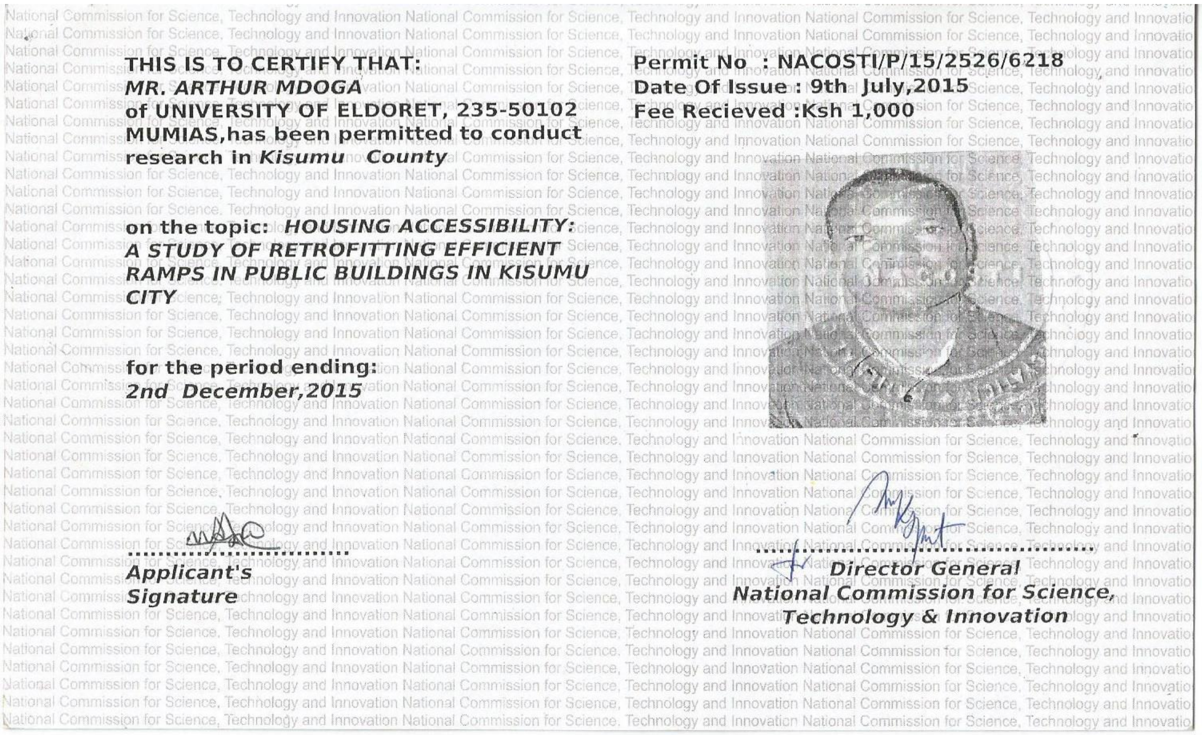
APPENDIX vii: MAP OF DISTRIBUTION OF EDUCATION FACILITIES IN KISUMU CITY.



APPENDIX viii: MAP OF HEALTH FACILITIES IN KISUMU CITY



APPENDIX ix: RESEARCH PERMIT



THIS IS TO CERTIFY THAT:
MR. ARTHUR MDOGA
of UNIVERSITY OF ELDORET, 235-50102
MUMIAS,has been permitted to conduct
research in *Kisumu County*

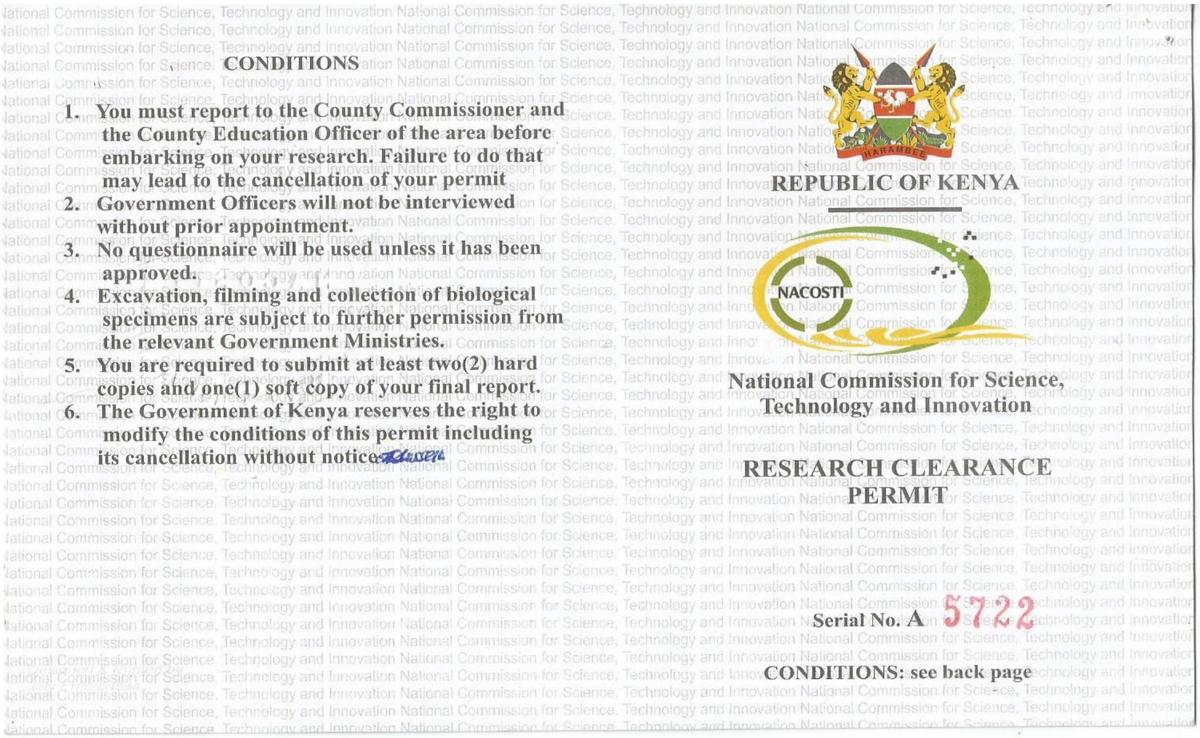
on the topic: *HOUSING ACCESSIBILITY: A STUDY OF RETROFITTING EFFICIENT RAMPS IN PUBLIC BUILDINGS IN KISUMU CITY*

for the period ending:
2nd December,2015

Permit No : NACOSTI/P/15/2526/6218
Date Of Issue : 9th July,2015
Fee Recieved :Ksh 1,000

....
Applicant's Signature

....
Director General
National Commission for Science, Technology & Innovation



CONDITIONS

1. You must report to the County Commissioner and the County Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit
2. Government Officers will not be interviewed without prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2) hard copies and one(1) soft copy of your final report.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice

REPUBLIC OF KENYA

National Commission for Science, Technology and Innovation

RESEARCH CLEARANCE PERMIT

Serial No. A 5722

CONDITIONS: see back page