# AN EXAMINATION OF CONFLICTING DESIGN REQUIREMENTS FOR THE MOBILITY IMPAIRED IN THE DESIGN OF A TECHNICAL VOCATIONAL INSTITUTE, KANO

By

SADIQ, Ikram Bello,
P14EVAT8027

DEPARTMENT OF ARCHITECTURE
FACULTY OF ENVIRONMENTAL DESIGN
AHMADU BELLO UNIVERSITY, ZARIA
NIGERIA

MAY, 2018

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**SADIQ, Ikram Bello,** (Bsc. Arch. A.B.U Zaria 2015)

**P14EVAT8027**

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**NIGERIA**

**MAY, 2018**

## DECLARATION

I declare that the work in this thesis entitled AN EXAMINATION OF CONFLICTING DESIGN REQUIREMENTS FOR THE MOBILITY IMPAIRED IN THE DESIGN OF A TECHNICAL VOCATIONAL INSTITUTE, KANO METROPOLIS has been performed by me in the Department of Architecture. The information derived from the literature has been dully acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another degree or diploma at this or any other Institution.

Ikram Bello SADIQ _____ _____

Name of Student Signature Date

## CERTIFICATION

This thesis entitled AN EXAMINATION OF CONFLICTING DESIGN REQUIREMENTS FOR THE MOBILITY IMPAIRED IN THE DESIGN OF A TECHNICAL VOCATIONAL INSTITUTE, KANO METROPOLIS by IKRAM BELLO SADIQ meets the regulations governing the award of the degree of Masters in Architecture of the Ahmadu Bello University, and is approved for its' contribution to knowledge and literary presentation.

| | | |
|---|---|---|
| Prof. M. L. Sagada | _____ | _____ |
| Chairman Supervisory committee | Signature | Date |
| Dr. J. J. Maina | _____ | _____ |
| Member, Supervisory Committee | Signature | Date |
| Dr .A. S. Salisu | _____ | _____ |
| Head of Department | Signature | Date |
| Prof. S. Z. Abubakar | _____ | _____ |
| Dean, School of Postgraduate Studies | Signature | Date |

**DEDICATION**

To the Physically Challenged in Nigeria

And

To all potential designers and architects, I hope this research work will help to guide

Them come up with problem-solving designs.

## ACKNOWLEDGEMENT

First and foremost, my sincere and continuous gratitude to Almighty Allah, the Beneficent, and the Merciful for the grace He bestowed on me, He makes all things possible at His time. Through my quest for knowledge, all my levees were broken; my faith was tried over & over, again & again. Oh Lord! You made it all possible at your time.

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## ABSTRACT

With the increasing world population paralleled by an increasing number of mobility impaired persons, more focus has been on the accessibility needs of people with disabilities in the society to ensure that their specific requirements are not ignored. Widely supported concepts such as universal design brought about by the fight for social inclusion of the disabled has had its own merits and problems. Experience gained by some designers in efforts to design for a wider-user group has revealed some design challenges. This research therefore takes a look at some conflicting design requirements resulting from the use of accessibility features and products by two or more groups within the disability circle which has the likelihood of affecting the mobility impaired person. Data sources to verify the existence of some of these conflicts were gained through case studies of some selected institutions and interviews. Discussions on some manageable solutions to architectural inconveniences which are unconsciously created in attempts to design for wider user-groups of disabled people reveals the significance of a biological, psychological and social approach to designing for the mobility impaired. The studies brought to light a new and fabricated mobility aid which will help in developing the concept and philosophy towards the design of a technical-vocational institute for the mobility impaired in Kano state.

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## LIST OF ABBREVIATIONS AND GLOSSARY

| | |
|---|---|
| ADA | American with Disability Act |
| ADAAG | American with Disability Act Accessibility Guide |
| BS | British |
| CAE | Centre for Accessible Environment |
| DD | Disability Discrimination Act |
| DO-IT | Disabilities, Opportunities, Internetworking and Technologies |
| NBC | National Building Code |
| PHCN | Power Holding Company of Nigeria |
| PWD | People with Disability |
| UN | United Nation |
| WHO | World Health Organisation |

GLOSSARY

Accessibility: This refers to the concept for which equality in term of access to equipment and facilities, circulation, for the people with disabilities (PWDs) are considered.

Mobility Impairment: This refers to the state of being unable to walk normally without any pain or help. This include those with lower limbs challenge, the blind, small children and the aged.

Mobility Aid: This refers to the assistive devices used by people with mobility impairment

Mobility Impaired: This is a person suffering from mobility impairment.

# 1.0 INTRODUCTION

## 1.1 Background of Study

Physical disability is very unpredictable because once vibrant able-bodied person can become physically disabled overnight due to an accident or as a result of the side effect of treatment of an illness (Sadiq, 2014). An estimated 10% of every population is likely to be disabled, and up to one in five of the world's poorest has a disability (Mont, 2007). For reasons such as these, the UN Convention on the Rights and Persons With Disabilities (PWD) adopted on the 13th of December, 2006 estimates that the day to day life of around 25% of the world's population is affected by disability (UN, 2015). A preamble to the World Health Organization report on disability estimated that 600 million to 650 million persons making 10% of the total world populations of whom approximately 80% live in developing countries, are persons living with various forms of disabilities or impairments. This reduces their ability to effectively or safely use many building facilities (Organization, 2007).'

Nigeria is estimated to have a population of 169 million; although it is argued that the country had not had any credible census since 1816 (UN, 2015).Based on the World Report on Disability, approximately 25 million Nigerians have a disability, with 3.5 million of these having very significant difficulties in social and physical functioning. These disabilities include physical and intellectual developmental conditions. Regardless of the large number of people with disabilities in Nigeria, little support, if any is given to individuals living with disabilities. These individuals are often excluded from social, economic and political affairs in the society. The most common avenue of

social aid for people with disabilities is usually through families, non-governmental organizations and religious organizations (U.N, 2014)

“Disabilities are an umbrella term covering impairments, activity limitation, and participation restrictions. An impairment is a problem in the body function or structure; an activity limitation is a difficulty encountered by an individual in executing a task or action; while a participation restriction is a problem experienced by an individual in involvements in life situations”(Weisman, 1991). With the current fight against insurgency and security threats that Nigeria as a country has been going through, her population of disabled people has significantly increased by 30 percent (Miji, 2015)

Unfortunately, the built environment has been designed for the young, able-bodied, which fits only a small percentage of the entire population of the world where in actual fact there is no guarantee for one becoming able for a lifetime (Dobkin, 2006).This therefore has resulted to the creation of barriers for the rest who do not fit the description of an able-bodied person. For reasons such as these, the 2006 UN Convention on the Rights of Persons with Disabilities does not explicitly define disability but rather describes disability as an evolving concept which results from the interaction between persons with impairments and attitudinal and environmental barriers that hinders full and effective participation in society on an equal basis with others (UN, 2015). Thus, disability is a complex phenomenon, reflecting an interaction between features of a person’s body and features of the society in which he or she lives.

## 1.2 Problem Statement

A key advantage of universal design is the fact that it addresses the scope of accessibility and suggests making all elements and spaces accessible to and usable by all people to the greatest extent possible (Mace, 1990). Shifting away from former

misconceptions where rather isolated people with disabilities will now be given universal and inclusive recognition has exposed some possible conflicts resulting from incompatible demands placed in a single environment by all its potential users (Kyei-Dompim, 2010).

The design of facilities for skill acquisition for mobile impaired individuals involves the knowledge not only of the various disabilities but also usually various design considerations for the disabilities in use of buildings which are not usually considered by designers. However information on these accessibility conflicts tends to be scattered and not given much attention because they are silenced or overshadowed by the zealous attempt to implement accessibility laws and concepts (Kyei-Dompim, 2010). To ensure proficiency and better application of Universal Design Principles (UDP), these conflicts must be sought out and resolved or halted thereby necessitating this research.

The eradication of poverty has been a continuous battle for Nigeria as a country and with the current situation of poverty and unemployment in Nigeria, the fight against insurgency has further driven it back and Government counter-insurgency operations have also contributed to insecurity and displacement, both in the north-east and in neighbouring countries. Poverty level has risen and a lot of people have been displaced; number of disabled persons have increased, many have lost their lives, means of livelihood, others have suffered injuries that will prevent them from returning to their former way of lives, in terms of means of livelihood. Thus the vicious cycle of disability and poverty has been recognized, which led the United Nations to promulgate rules for equal opportunities for people with disabilities, with rehabilitation as one of the tenets for achieving an optimal level of independence (United Nations, 1993)

However, despite many disability initiatives, accessibility to rehabilitation is far from being achieved for people with disability in Africa in general and Nigeria in particular. The poor perception of disability and people living with it has fuelled the lacklustre attitude of government in terms of policy direction and action. This is unfortunate because the extent to which a society provides and indeed funds rehabilitation is probably a good measure of how much interest it has, and importance it attaches to the well-being of its citizens (Poulis, 2012).

As stated earlier, disability can be an occurrence in the later part of an individual's life, therefore the rehabilitation of disabled individuals cannot be over emphasized because it is through that process that they can develop skills; for those that cannot go back to their former means of livelihood. For those that are born with their disabilities, it enables them an opportunity to choose either to learn a skill or go through the school system.

A number of skill acquisition facilities or buildings have been developed over the years in an unsystematic manner without due consideration given to disabled individuals resulting in complex structures made up of high, difficult to access building for people with disabilities(Kyei-Dompim, 2010). This prevalent setting has challenged and frustrated many disabled people who use these buildings. Most designers give little consideration to disabled people seeing them as a minority group of people when designing (Peloquin, 1994).

### 1.3 Aim and Objectives

The aim of this research is to identify and assess conflicting design requirements and standards of UD principles militating against optimal use of buildings by mobility

impaired individuals with a view to develop a design model of technical and vocational institute in the Kano metropolis.

The objectives of this research therefore are:

i. To study different forms of disabilities, disability in Nigeria and how it has been addressed architecturally.
ii. To identify and examine the accessibility requirements of various mobility impaired people and some of their functional limitations.
iii. To examine conflicting situations resulting from the use of accessible features in the built environment by different ambulant impaired persons which affect their comfort.
iv. To establish the development of a better and /or alternative means of reducing or eliminating accessibility design conflicts which result from designing to suit a wide range of people with various forms of mobility impairments.

## 1.4 Research Questions

i. What are the forms of disabilities and how have they been addressed architecturally in Nigeria?
ii. What are the accessibility requirements of various ambulant impaired persons and what are their functional limitations?
iii. What are the conflicting situations resulting from the use of accessible features in the built environment which affect the ambulant impaired persons?
iv. Is there a better means beyond UD concepts to eliminating accessibility design conflicts to suit wide range of people with mobility impairment?

## 1.5 Justification

The up-surge of road and industrial accidents as well as the emergence of large number of displaced persons in Nigerian, paralleled by advancement in the field of medicine is increasing the possibilities of a lot more people who would have rather died than to become physically challenged. This therefore justifies the need to research and identify better ways to design the built environment to meet the needs of the increasing physically challenged if all the above factors are to continue to increase the population of the physically disabled in the society (Kyei-Dompim, 2010).

Most designers also conceive disabled bodies as wheelchair users, with little perception of the wider range of physical and/or mental impairments which need to be catered for in producing inclusive design (Imrie, Disability and the City, 1996). Little attention is paid to the role played by disabled people in the built environment. Thus In response to mobility impaired people being neglected and forgotten to be catered for in design considerations, there is need to gather as much information as possible for design, thus this research could be seen as a revival of a forgotten group.

Way finding safely around a building by persons with disabilities is of great importance. People with disabilities often blame themselves for not being able to cope. However the blame is not on them but on the designer (Peloquin, 1994). Not being able to get about and around a building comfortably as a mobility impaired person is an indication of a poor design.

## 1.6 Scope and Delimitation of the Study

The groups of people that have mobility difficulties include the blind, the aged and people with lower limb challenge. For the purpose of this research, only people with

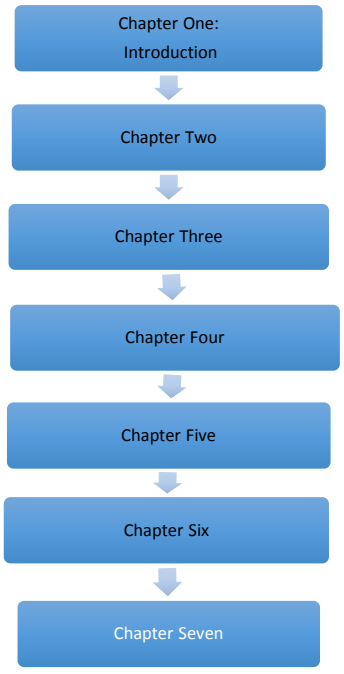
lower limb physical challenges such as those on wheelchair and other assistive devices would be considered in the research and the proposed design.

The Study will be carried out in Kano and Kaduna State and the project will be sited in Kano State. The facilities to be provided will depend on the client's brief which will be subject to consultation.

The application of findings in the research will be limited to those found in the course of the research.

## 1.7 Thesis Structure

This study is divided into six chapters as illustrated in the figure below.




Chapter one consists of background of the study, statement of the problem, aim and objectives of the study, research questions, justification, scope, limitation and thesis structure.

Chapter two consists of literature review under the following sub-topics: History of technical schools in Nigeria, Forms of disability, Limitations caused by disability,

Education and access to rehabilitation, Career opportunity for the mobility impaired, Inclusive design and potential conflict causes and summary.

Chapter three describes research methodology used in the study with the sub-topics; research strategy, research design, population, sample and sampling techniques, case study selection criteria, sources of data collection, instruments for data collection, procedures of data collection, data analysis and presentation and summary.

Chapter four consists of data presentation and analysis. This will present the case study findings and analysis.

Chapter five gives a summary of research findings, conclusions, recommendations and suggestions for further research in the area.

Chapter six gives the design report. This will present all the design procedures from preliminary designs, presentation drawings to working drawings.

## 2.0 LITERATURE REVIEW

Architectural and environmental barriers have gained increasing attention in recent years in the wake of efforts made to improve the accessibility of the environment for people living with disabilities of all ages. In this literature review, laid-down measures to include the physically challenged in Nigeria's education as well as issues that go into the design of schools are discussed. Functional limitations caused by various forms of mobility impairments together with some accessibility conflicts which could arise naturally when incompatible demands are placed on a single environment by two or more groups are examined and discussed. This will encompass studies on possible conflicts encountered while designing accessible features from urban design perspectives to the design of schools. Statistics on Internally displaced persons are highlighted

### 2.1 History of Technical Schools for Special Education in Nigeria

Atolagbe (1995) described disable people as innocent people, who are members of the human society, having no other world to live in, than the one we jointly own. Hence, the Federal Government of Nigeria had made some efforts in taking care of the students with disabilities for them to have sense of belonging. Oyewo (1999) reported that the initiative of the Missionaries led to the development of positive attitude of Non-Government Organizations and Governmental Agencies toward the establishment of various Institutions to take care of the needs of the disabled people. Such Institutions include Cheshire's Homes, Ibadan School for the Deaf, Wesley School for the Deaf as well as the Pacelli School for the Blind among others. The Federal Government of Nigeria also recognizes the importance and relevance of the disabled when in the Third National Development Plan, decreed that 'Educational services for the disabled shall be the joint efforts of all tiers of government'. To this end, the Federal Government

directed that two percent of positions in their establishments be allocated to qualified disabled persons. It said further that State governments should set up Vocational Training Centers for the disabled as a matter of priority (Oladejo, 2011).

Another effort of the Federal Government on the disabled persons is the establishment of National Council for Special Education in 1976, with the aim of looking into the issues of the disabled and advice the government from time to time. Furthermore, the Federal Government established a College of Education called Federal Government Advanced Teacher Training (Special) Education, Oyo in 1977 (now Federal College of Education (Special) and saddle it with the responsibility of producing teachers for the handicapped as well as the gifted and the talented students(Oladejo, 2011). A Special Unit was also created at the Federal Ministry of Education while Special Education Section was also created in all the State Ministries of Education in response to a directive from the Federal Government. Finally, some Federal Universities namely the Universities of Ibadan, Calabar and Jos, offer courses in Special education to both the undergraduates and the post-graduates .

This goes to show that several initiatives have been put in place for rehabilitation and training to cater for special students but the link is lost when the schools do not go beyond UDP to solve the issues specific to our own natural setting.

### 2.2 Design of schools and its challenges

Education and its exemplification in buildings and environments have always been concerned with radical ideas set in new and stimulating settings. The blossoming of exciting new forms of school architecture has not only transformed the image of education but also affected the perceptions and pedagogical needs of all who inhabited those new structures(Dudek, 2012).This is because the system of mass education is

constantly reinventing itself to provide more and more educational places of an ever-improving quality.

This implies that it is of fundamental importance that any school designer should anticipate the evolving nature of life within the society and make provisions for it in their architecture.

This therefore calls for a type of architecture sensitive to both able-bodied and disabled people in all needs. Basic anthropometrics, color, texture, acoustics and the principles of defining safe, secure territories within the overall structure of the institution are all concepts which should apply to educational settings (Dudek, 2012).Unfortunately, in many schools of architecture in Africa, no design assignments are planned and integrated into the academic programs to specifically address the accessibility factor (Wellington, 1992).

Wellington further reveals that anthropometric studies, which form part of the basic first year architecture design studies, do not take into consideration the fact that there exists in many African communities a sizeable percentage of the population with physical disabilities. The architectural designs of most of the Institutions where the education of students with disabilities take place do not take into consideration, the disability nature of these people. It appears that only the Federal College of Education (Special) takes note of this architectural consideration. This greatly hinders the education of these categories of people.

School buildings are routinely built with stairs, or far from community centers, making them inaccessible to those with mobility impairments (Groce, 2003). Students with physical disabilities often benefit from the use of technology designed to increase their capability to participate in classroom activities and hostels. The Medical Model holds that disability results from an individual person’s physical or mental limitations, and is

largely unconnected to the social or geographical environments. (Leadership, 2005). Fallon (2014) asserts that the medical model of disability is one that is primarily concerned with the justification of disability because a disabled person is seen as faulty and in need of fixing or curing. Brisenden, (1986) also cautions us not to confuse 'disability' with 'disease', thus, emphasizing the removal of barriers which rather cause disabilities.

Although some people cite the medical model as unintended social degradation of disabled people, it must be noted that medical treatment of the disabled person to some extent is an indispensable factor of rehabilitation and should not be abandoned. The mobility impaired must be taught how to use available assistive devices to enable them use their environment effectively. Thus, it is necessary for Architect to see the issue of "disability" mainly as an unequal relationship within a society in which the needs of people with impairments are often given little or no consideration (Carson, 2009).

### 2.2.1 General planning consideration for technical school

According to Coleman (2007), planning considerations, principles are general rules and guidelines, intended to be enduring and seldom amended that inform and support the way in which the design is set to perform. The fundamental principle in planning a technical school may be defined as a rational determination of all the activities, functions, and requirements to be provided for to achieve a predetermined goal.

## 2.3 Definition of Disability

According to the Advanced Oxford Dictionary, it is a physical or mental condition that limits a person's movement, senses, or activities.

It is also defined as 'A disadvantage or handicap, especially one imposed or recognized by the law (Oxford Dictionary, 2010)

Definitions of disability vary widely. In some nations, only individuals with significant disabilities are identified; in others, even those with mild disabilities are included in surveys and census reports (Groce, 2003).Though 2016 United Nations Convention does not explicitly define disability, the preamble of its Convention states: *'Disability is an evolving concept, and that disability results from the interaction between persons with impairments and attitudinal and environmental barriers that hinders full and effective participation in society on an equal basis with others*'. Article 1 of the 2006 UN Convention on the Rights of Persons with Disabilities states: 'Persons with disabilities include those who have long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others(UN, 2015).For instance, persons using wheelchairs might have difficulties gaining employment not because of the wheelchair, but because there are environmental barriers such as inaccessible buses or staircases which impede access(UN, 2015).

Although it is hard to attach any operative definition of the concept of disability and handicap, however, since the people concerned in this thesis work can be regarded as those unable to use the building because of their disability, an architectural definition could be of help. Disabled people are those who because of their disability are handicapped in the use of building due to lack of suitability. While handicap is the cumulative result of obstacle, which lack suitable facilities in building, interposes between an individual and his maximum functional level.

### 2.3.1 History of legislation on disability

The United States of America's Congress' response to the problem of discrimination against the disabled was the passing of the Americans with Disabilities Act (ADA) in 1990. It was followed by Australia and the United Kingdom in 1992 and 1995,

respectively, with their versions of legislation called the Disability Discrimination Act (DDA) (Otmani, et al, 2009) One of the major aims of all these pieces of legislations was the removal of barriers in the built environment to allow People with disabilities (PWDs) to participate in everyday life activities in their societies. Their main goals includes providing people with disabilities access to buildings, equal employment opportunities equal access to public transportation, the opportunity to attend school and the chance to be eligible for social security support (Little, 1995). The United Kingdom pushed further the frontiers of its legislation by introducing Part M of the 2004 Building Regulations, which established the concept of mainstream access provision to buildings. It was followed by the Disability Equality Duty (DED) which was born out of the Disability and

Discrimination Act (2005) and seeks to compel all who design, manage and maintain the built environment to ensure that PWDs play a full part in benefiting from, and shaping an inclusive built environment (Duggan, 2006).

In Nigeria, civil society and the Nigeria Federation of the Disabled (NFD), the national umbrella organization for PWDs, whose members include the Nigerian Association of the Blind (NAB), Nigeria National Association of the Deaf (NNAD), Nigeria Society of the Physically Disabled (NSPD) and Parents Association of Children with Intellectual Disability (PACID) joined the struggle for the rights of PWDs. Yet, the government is yet to make provisions in its constitution that protects the rights of PWDs. In 2008, the Disabled People's Bill was sent to Parliament to be deliberated on, which aims to provide disabled people with accessibility topublic places, equal employment opportunities, transportation at free or reduced prices, free, general and specialized medical care, etc. (Persons with Disability Bill, 2008).

1. *International and local building instruments*

Apart from the legislations, various statutory building instruments, such as International Standards, Building Regulations and Guidelines, Codes of Practice and so on have also been developed by several countries and organizations to achieve designs and features that are usable by persons with disabilities. Their main goal is to provide guidance as to how the built environment can be designed to anticipate and overcome restrictions that prevent disabled people from making full use of premises and their surroundings. Examples of such instruments are: British Standards Institution (2001); Design of Building And Their Approaches To Meet The Needs of Disabled People (BS8300, 2001); Americans with Disabilities Act Accessibility Guide (ADAAG) (2004) and Accessibility for the Disabled, A Design Manual for a Barrier-Free Environment, Urban Management Department of the Lebanese Company for the Development and Reconstruction of Beirut Central District developed by the UK, USA and the UN respectively to provide guidance on good practice in the design of domestic and non-domestic buildings and their approaches so that they are convenient to use by disabled people. According to Solidere, (2004), their recommendations relate, not only to the elements of construction and accommodation, which are common to different types of buildings, but also to those that are specific to building types. They also deal with ways in which their management and maintenance can affect safe access and use of facilities by disabled people. Research by the author on National Building Code (NBC) (2009), which regulates the construction of buildings in Nigeria, revealed that they have not been revised to incorporate barrier-free designs. This means, Nigeria, as a nation, does not have a policy framework that regulates and obliges the stakeholders in the building industry to design and build structures that are mobility impaired friendly.

Despite the various attempts in terms of legislation and the design of statutory building Instruments, the built environment of many countries has remained largely inaccessible (Imrie, 2002). According to Imrie (2002), this situation is explained by the fact that the statutory and legal provisions underpinning the construction of barrier-free environments are feeble or absent in most countries. Imrie (2002)maintains that, in the UK, the building regulations, which are the main mechanism in requiring developers and designers to provide access to buildings for disabled people, is feeble and ineffectual, in that it only require developers to make 'reasonable provisions' for disabled people and only in new public buildings and major renovations. This development has led to the situation where, even when the attempts are made, the so-called 'reasonable provisions', which have not been clearly defined, have not been adequate in removing the barriers in the built environment. It is evident, therefore, that, even in developed countries, such as the UK, designers and developers of facilities in the built environment have not been sufficiently "pinned down" by the building regulations, and as long as the situation continues, the quest for a barrier-free built environment will continue to be a mirage.

Type of disabilities

According to Beatrice (1997) among the various indices used to classify people with mobility impairment, the most efficient and reliable is that of according to nature and extent. Various, disabilities which have been considered are broadly classified under two main categories:

### 2.3.2 Form of mobility impairment by nature

a) Ambulant Impaired: This group of impairment mostly uses sticks, crutches, braces and other walking aids. They can even move without aid.

b) Semi Ambulant Impaired: This group of impairment mostly uses external aids such as sticks, elbow crutches, armpit crutches, tripod or wheel chair. Due to their impairment, they are often unable or hardly able to stand by themselves or sit down.

c) Non-Ambulant Impaired: this group is unable or hardly able to walk or stand by Themselves without any aid. Such are mostly wheel chair propelled.

### 2.3.3 Form of mobility impairment by extent

Beatrice (1998) groups the impairment by extent and describes them below: -

a) Temporary Disability: This type of disability is in the sense that chances for the disabled person involved to recover fully is rare, and mostly a residual effect is seen after treatment. Accident, diseases, injuries etc mostly cause temporary disabilities.

b) Permanent Disability: These types of disability are so severe that chances of person recovering are slim. Natural aging, congenital malformation, trauma etc. mostly cause them.

Mobility impairments are physical constraints that substantially limit movement and fine motor controls, such as lifting, walking, and transportation (Bullet, 2013).Mobility impairments can be permanent or temporary. A broken bone or surgical procedure can temporarily impact a person's ability to walk independently and travel between classroom buildings in a timely manner. Likewise, some persons may be ambulatory with a walker for short distances within a classroom, but may need a wheelchair or scooter for longer distances (DO-IT, 2012)

Apart from mobility impairments incurred as a result of domestic, vehicular and industrial injuries and diseases such as poliomyelitis and strokes, physical disabilities resulting from congenital deformities may be the result of;

1. Quadriplegia-Paralysis of all four limbs
2. Hemiplegia- Paralysis of one side of the body either left or right

3. Monoplegia- Paralysis of one limb e.g. a leg or a hand
4. Poliomyelitis-Paralysis of the trunk of the body due to viral infection affecting the motor neurons
5. Muscular dystrophies- a medical condition in which there is gradual weakening of the skeletal muscles (National Institute for Nuerological Disorders, 2010)
6. Spinal bifida - abnormal development of the spinal cord resulting in final or full paralyses of the legs and difficulties with bowel and bladder control.(National Institute for Nuerological Disorders, 2012 updated).

### 2.3.4 Bone and joint deformities

1. Cerebral palsy - damage to the parts of the brain which control movement during the early stages of a baby's development, birth and from brain injuries resulting in weakness and poor muscle movement (Medical Association of America, 2007)

Different forms of cerebral palsy are hemiplegia which involves muscle movements and weakness on one side of the body, diplegia which involves muscle movements and weakness in the lower part of the body, quadriplegia which involves muscle movements and weakness in both arms and both legs and ataxia which involves problems with balance and coordination.

2. Mobility impairments could also be caused by Arthritis (painful joint condition: a medical condition affecting a joint or joints, causing pain, swelling, and stiffness) and multiple sclerosis (loss of myelin in the brain or spinal cord and causes muscle weakness, poor eyesight, slow speech, and some inability to move (Very Special Arts VSA, 2003).

## 2.4 Mobility Aid Used by Mobility Impaired

The commonly available and most used mobility aids are briefly discussed below: -

### 2.4.1 Walking stick

Perhaps the simplest way to reduce stress on a sore knee or hip is to use a walking stick. The stick is held in the hand on the opposite side to the affected hip or knee. The stick transmits some of the weight of the body to the ground and reduces the load on the affected hip or knee, and this lessens the pain. Sticks are not used as often as they should be, because some people fear they may make them seem older than they are, but they can greatly increase independence, confidence and mobility, while reducing pain when walking (Glanze, et al, 1990) Examples of walking sticks are:

1. Single Point
2. Tripod
3. Quadruped

### 2.4.2 Crutches

A crutch also transmits loads to the ground through a shaft, but has two points of contact with the arm, at the hand and either below the elbow or below the armpit. This allows significantly greater loads to be exerted through a crutch in comparison with a cane (Glanze, et al, 1990). Example of Crutches includes: -

1. Auxiliary Crutches.
2. Elbow Crutches.
3. Forearm Bearing.

### 2.4.3 Frames

A walker (also known as a Zimmer frame) is the most stable walking aid and consists of a freestanding metal framework with three or more points of contact which the user

places in front of them and then grips during movement. The points of contact may be either fixed rubber ferrules as with crutches and canes, or wheels, or a combination of both. Wheeled walkers are also known as rollators (Glanze, et al, 1990).

### 2.4.4 Wheel Chair

Wheelchairs and mobility scooters substitute for walking by providing a wheeled device on which the user sits. Wheelchairs may be either manually propelled (by the user or by an aide) or electrically powered (commonly known as a 'Powerchair'). Mobility scooters are electrically powered, as are motorized wheelchairs. Wheelchairs and Scooters are normally recommended for any individual due to significant mobility/balance impairment. Other forms of wheel chair include: -

- Self- propelling folding wheel chair
- Self-propelling non-folding wheel chair
- Attendant propelled wheel chair
- Powered indoor wheel chair
- Hand propelled tricycle

Plate I below shows a simple attendant propelled wheel chair, this is one of the most common type of wheel chair used in the developed countries as such the anthropometric data of this type and similar to it are the most available and well documented. Plate II shows the self-propelled tricycle, which is used mostly by the developing countries. In countries like Nigeria, it is one of the most widely available.



Plate I Showing a wheel chair

Source: Google image 2016



Plate II : Showing a tricycle

Source: Google image 2016

## 2.5 Functional Limitation Caused By Mobility Impairment

There is a wide variety of disabilities and specific diagnoses of orthopedic or nuromuscular impairments that can impact mobility such that it is impossible to generalize about the functional abilities of students with mobility impairments (DO-IT, 2012). Mobility impairments range from lower body impairments, which may require use of canes, walkers, or wheelchairs, to upper body impairments which may include

limited or no use of the upper extremities and hands (Carlton & Hertzfeld, 2009).Of the persons using technical aids such as crutches, canes, wheelchairs, etcetera, wheelchair users often face the greatest barriers (Roy, 1991)

Problems faced by individuals with mobility impairments include poor muscle control, weakness and fatigue, difficulty walking, bending, lifting objects, climbing up on step stool, sensing or grasping due to pain or weakness (Bullet, 2013). People with spinal injuries may have difficulty reaching things, and difficulty doing complex or compound manipulations (push and turn). Twisting motions may be difficult or impossible for people with many types of physical disabilities such as cerebral palsy, spinal cord injury, arthritis, multiple sclerosis and muscular dystrophy (Thorpe, 2008). Individuals with spinal cord injuries may be unable to use their limbs and may use "mouthsticks" for most manipulations. Electric buggies or scooters can be significantly larger than the standard wheelchair range so openings and spaces based on conventional wheelchair dimensions may not be adequate (Neufert & Ernst, 2002).

Some very severely disabled wheelchair users who cannot make unassisted transfers onto beds and toilet facilities require the assistance of an attendant who may lift the person or use several transfer techniques such as a mechanical lift for safety (Mace, 1991). These are supplemented by other assistive devices come in the form of stair lifts, portable ceiling lifts, mobile floor hoists, wall lift hoists and wheelchair platforms lifts. Some mobility aids used by the mobility impaired persons are canes, crutches, walkers, wheelchairs and scooters and rollators.(Mobility Aids, 2010).

## 2.6 Disability in Nigeria

Disability is both a cause and a consequence of poverty. There is a strong relationship between disability and contribution to the development of the society at all or optimally. It is increasingly being recognized that bringing people with disabilities

into the development mainstream will have a significant effect in any plan to cut poverty in the developing world (Amusat, 2015). Poverty with a cyclical tendency makes people more vulnerable to disability and disability reinforces and deepens poverty. Disability is an important factor, along with gender, race and caste, which interacts to impoverish people and keep them poor (Miji, 2015). People with disability are often excluded from the mainstream of society, and hence, may not contribute to the development of the society at all or optimally. t is increasingly being recognized that bringing people with disabilities in to the development mainstream will have a significant effect in any plan to cut poverty in the developing world (Wolfensohn, 2013). This is especially true, given that disability affects not only the individual, but also the family and the larger society. In Africa, previous efforts to put disability in the forefront of the development agenda has not yielded all the expected results. This was as a result of poor resources, blamed partly on the lack of commitment on the part of governments (Miji, 2015).

Disability is very common worldwide. The World Health Organization (WHO) estimated that about 500 million people live with disability worldwide, with about 75% living in the developing countries (Michailakis, 2003). In Nigeria, WHO estimates put the number of people with disability at 19 million or approximately 20% of the country's population (Lang, 2008). According to Disability association of Kano State, it reveals that there are about 2,567 people registered with the association that have different type of mobility Impairments. However there are no credible and robust statistics in Nigeria about most things, including disability. There is therefore a big knowledge gap that needs to be bridged.

Having access to health and rehabilitation services is a precondition to equal opportunities, as outlined in the United Nations (UN ) standard rules for equal

opportunities (United Nations, 2012), and an essential component of being a valued and productive member of the society. As a result of the UN standard rules on the equalization of opportunities for people with disability, some countries have tried to develop strategies to address disability in the process of overall development strategies. However, even where government commitment and the policy environment are favorable, majority of the people with disability may not experience significant changes in quality of life, access to equal rights and level of community integration. Disability, therefore, continues to be a concern, leading to many international initiatives like those by the United Nations Educational, Scientific and Cultural organization (UNESCO), International Labor Organization (ILO) and the World Health Organization (WHO).

The Nigerian government supported the UN standard rules on the equalization of opportunities for people with disability. There was also a decree promulgated in 1993 to enhance the social and societal position of people with disability. Nigerians living with disability are no better off when compared with others living in other parts of the developing world, in terms of the challenges they face - they are poor, marginalized and excluded (The Guardian, April 12, 2009;(Lang, 2008). Despite the declaration of full participation in the disability agenda of the United Nations by the Nigerian government, Nigerians with disabilities are still faced with these challenges (The Guardian, April 12, 2009; (Michailakis, 2003)

A recent review of disability issues in Nigeria identified many factors why the disability agenda continues to suffer. Notable among them were: the absence of disability discrimination laws, lack of social protection, poor understanding of disability issues by the public , and poor access to rehabilitation services. The

report recommended, among others, the collection of robust and reliable data, and advocacy for the passage of the disability bill into law (Lang, 2008).

### 2.6.1 Education and disability in Nigeria

For the vast majority of young people who have been born with a disability, their initiation into their own cycle of poverty begins early when they are unable to access needed medical and rehabilitation services, and when they are denied admission to school (Groce, 2003) Access to education for many persons with disability in Nigeria is practically an urban phenomenon, which is even quite recent (Annor, 2011).

### 2.6.2 Accessibility to rehabilitation services

Accessibility of services is essential if the goal of fostering functional independence is to be achieved in people with disability. Accessibility to rehabilitation services is currently very poor in many developing countries (Lang, 2008). This shows the importance the society attaches to people with disability (Poulis, 2012). Rehabilitation is usually considered as a sort of optional extra to the more 'important' medical care. The fact that it is through rehabilitation that functional independence is restored, makes it liberating to people with disability and indeed important to the society that cares to have a productive citizenry.

### 2.6.3 Career opportunities for the Mobility impaired in Nigeria

Disability is one of the important causes of dependency. It is not known how many disabled persons in Nigeria are self-supporting through living on saving, income from saving or investments, pensions or insurance payments. Neither is information available as to the number of disabled persons who are supported wholly or in part by their families, relatives, friends, or private social charitable and religious organizations. It is however certain that disability reduces productivity and is a drain on the wealth of the community, the state and the nation as a whole (Adima, 2012). The effect of disability

on the manpower resources of the nation is, for the most part, concentrated in the 18 to 60-year age group (Adima, 2012). Adima (2012) opined that, about 1.5 million disabled Nigerians of working age need vocational rehabilitation services if they are to become employable. This view is in line with McGowan (1967) who stated that disability not only prevents people from working and receiving an income, thus contributing to the productivity and purchasing power of the community but it requires taxes and voluntary contributions to carry on the programs needed to help maintain disabled persons who are in need.

The disabled person frequently experiences a deterioration of his basic skills and a loss of self-confidence, resulting in despondency. Unable to participate in the normal life of the family and the community, he may become maladjusted because of a feeling of inequality, lack of prestige and other concomitants of "not belonging". In spite of the seemingly gloomy existence of the disabled, there are numerous career opportunities for them in our nation.

In the determination of eligibility of the disabled for employment, it is necessary to establish the existence of an employment handicap. Substantial disability to career opportunities means that a physical or mental disability (in the light of attendant medical, psychological, vocational, educational, cultural, social or environmental factors) impedes an individual's occupational performance, by preventing his obtaining, retaining or preparing for gainful occupation consistent with his capacities and abilities.

Freeman (1962) stated that a disability may constitute an employment handicap in either of two way. In one, the employment handicap may be the direct result of the disability. In the other, the employment handicap may be related to the disability in the light of attendant medical, psychological, vocational, educational or other

environmental factors. Every Nigerian including the disabled has a right to a gainful employment. This right is guaranteed in the National Policy on Education (1977) where it is stated by the Federal Government that "adequate education for all disabled children and adults will be provided in order that they may fully play their roles in the development of the nation" (page 23). Regrettably however, most disabled persons in this country have not taken advantage of the kind gestures of the government. This state of in-action and hopelessness on the part of the disabled in our society may be due to lack of information on career opportunities for them. Blatt (1961) stated that "the ultimate goal of training programs for disabled persons is employment". In Nigeria, disabled persons are educated but hardly ever trained. Adima (2012) emphasized that the professional worker in education and rehabilitation who is genuinely concerned about the end result of his effort should equally be concerned about job or career possibilities for the disabled. The disabled can obtain and hold any of these career opportunities provided the necessary attitudes and work habits have been developed both in school and rehabilitation centers. Through observation, evaluation and counselling, the disabled may find the career for which he would be best suited. The disabled person has proved to be a dependable worker, one who tries hard to please and takes pride in his work, and one who excels at established routines which others find monotonous.

Attitudes concerning the disabled in Nigerian society, reveal the derogatory view taken by the general population toward physical and mental abnormalities. The doors of career opportunities are in most instances shut against the disabled because of misinformation about disabilities. Adima (2012) lamented that there are many negative attitudes emanating from our culture and religious practices on the disabled individuals. For example, the causes of illness and consequent disability are attributed to "sins"

committed by the individual or his close relations. Fear of disability is widespread even among the so-called enlightened members of our society and also stems directly from cultural and religious practices. Disability is seen to be contagious. This attitude results in segregating the disabled from career opportunities and rehabilitation centers. Relationship to needed skills and where possible, a training plan may be devised to remediate any deficiencies.

## 2.7 Towards Universal Design

The Centre for Universal Design (2003) describes universal design as the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. While accessible or adaptable design requirements are specified by codes or standards for only some buildings and are aimed at benefiting only some people, the universal design concept targets all people of all ages, sizes, and abilities and is applied to all buildings (Mace, 1991).

Universal design is relevant to a wide range of design disciplines including the design of environments, products and communications. A working group of architects, product designers, and environmental design researchers has identified seven universal design principles for use in evaluating existing designs and guiding the design process (Centre for Universal Design, 2003).

The seven principles of universal design presented here in the following format: name of principle, intended to be a concise and easily remembered statement of the key concept embodied in the principle; definition of the principle, a brief description of the principle's primary directive for design;

1. Principle One: Equitable Use
2. Principle Two: Flexibility in Use
3. Principle Three: Simple and Intuitive Use

4. Principle Four: Perceptible Information
5. Principle Five: Tolerance for Error
6. Principle Six: Low Physical Effort
7. Principle Seven: Size and Space for Approach and Use

Universal Design may include design attributes such as the incorporation of kitchen counters in different heights for different users with ample leg room to accommodate a seated user, the use of lever handles in place of round door knobs (Mace, 1990), accessible cupboards and drawers with devices that enable easy use of appliances and tools, installation of sinks with electronic eyes to detect movement and under counter space to accommodate a seated user, placement of grab bars discreetly but conveniently next to toilet and tub or shower to enable limited mobility users, the use of remote devices to lock and unlock the house and design areas for all activities to occur on one level, just to mention a few (Demesne, 2009).

Creative application of the universal design knowledge results in products, buildings and facilities that are usable by most people regardless of their level of ability or disability (Centre for Universal Design, 2003). By incorporating the characteristics necessary for people with physical limitations into the design of common products and building spaces, they can be made easier and safer for everyone to use and more widely marketable and profitable. This implies that universal design approach goes beyond the minimum requirements and limitations of accessibility law.

### 2.7.1 Barrier free environment

Barrier free environment is one which enables people with disabilities to move about safely and freely and to use the facilities within the built environment.(Kyei-Dompim, 2010). The goal of barrier free design is to provide an environment that supports the independent functioning of individuals so that they can get to, and participate without

assistance, in everyday activities such as procurement of education, community living, employment, and leisure. Barrier free design standards should satisfy anyone who is hampered in his mobility or functioning (as compared with a nondisabled person) as a result of obstacles put in his way by the design of a building, the choice of hardware and equipment, and the arrangement of outside space.(Introducing Accessibility and Disability: Considering Disabled People, n.d.)

Therefore, people with disability are people with impairments who are disabled by barriers in society. The central theme in this definition is that disability is external to the individual and is a result of environmental and social factors ( Physical Disability Council of Australia, 2004).

## 2.8 A Review of Potential Conflict Areas

In spite of the numerous merits of the universal design concept, some designers have been able to discover a few weak points in its application. The underlying revelations discuss some conflicts which could results from design of accessibility requirements to suit various types of mobility impairments in a single environment such as a school.

### 2.8.1 The real number of building and product users who are disabled

The anticipated number of users of a particular building poses a major challenge to designers and even clients or developers. To Goldsmith (2010), fallacies come with the trick of extension. One is bound to stipulate that if about 10% of the total population is disabled, it may suppose that 10% of users of many public building have to be disabled people. This inference, according to Goldsmith is false as it is not the case that all disabled people use all kinds of public buildings and are uniformly spread around. This could also be augmented by providing unisex or separate toilet facilities in any public

rest room, so that at least one unisex compartment should be accessible to a wheelchair user who depend on someone else.

It is quite agreeable that women spend almost twice as much time in lavatories and will therefore need much more sanitary facilities than their male counterparts (Goldsmith, 2010). In institutions like the university where the number of males exceed females, a key problem in picking or setting a number is deciding who to leave out. The reason for discussing accessible design in the first place is that the standard design process currently only targets "most" of the people and then stops even if they could just have easily gone a bit further (Peloquin, 1994).To the designer, this is important to take note of since no product can be made completely accessible. Tough to accept or deal with, but a fact of life. The secret, then, is to go as far as one can in making the design accessible. Designers could also make estimate of the real number of building users to draw inferences from the map of a locality who make the highest on the disability chart and provisions made for them in buildings used (Goldsmith, 2010).

### 2.8.2 Car Parking and Setting Down Point

The provision of suitable car parking close to the building serves essentially for the disabled, both as drivers and passengers of private vehicles (Centre for Accessibile Environment CAE, 2012). Parking bays should be illuminated as well designated via the use of contrasting colour marking (A Guide fo Assisted Living, 2011)

### 2.8.3 Horizontal Circulation

This includes the overall layout of routes within and outside the building as well as specific features such as corridors, passageways, aisles and internal lobbies (CAE, 2012). The width of circulation routes is important, but should be considered in the context of the building type (Mace, 1991).

### 2.8.4 The design and use of ramps

Vertical circulation includes ramps, steps, lifts and platform lift. Ramps and steps in the external and internal environment are key to overcoming natural man made change in levels (CAE, 2012). The United Nations Manual on Accessibility recommends that ramps be provided wherever stairs obstruct the free passage of pedestrians, mainly wheelchair users and people with mobility problems (UN, 2015). Though highly in favor of the universal design, Mace, (1991) recommends the avoidance of ramps as much as possible for reasons such as difficulty to incorporate sloping handrails into the design of a house as well as conflict of interest arising when ramps with their handrails become very notable elements. This, according to Mace (1991), tends to label a residence as 'accessible' or as 'a house for people with disabilities, such that able-bodied people might prefer not to live in such a house.

Although his point might have been as a result of past misconceptions about disability, recent worldwide education and outreach programs is increasing awareness on disabilities and accessibility for all, thus, reducing misapprehensions on visual impression created by ramps and their accessories. Furthermore, modern development in the building industry has made the design and installation of ramps and handrails easy and anesthetized. It is also obvious that the construction of very gently sloping ramps may not necessarily necessitate the use of handrails, thereby preventing this conflict of interest.

Mace,(1991) further asserts that ramps could be dangerous for many people especially the mobility impaired people who use crutches, walkers and canes. Ramps have also been found to be dangerous for everyone in ice and snow conditions such that where climates warrant, snow melting equipment or long roof over ramps will have to be considered which hence, adds to the overall building cost. In tropical parts of the world

such as Nigeria, accidental slips caused by accumulation of dry sand on ramps and wet ramps during rainy seasons could be linked to such a problem. This is aggravated by smooth ramp surface finish on steep ramp gradients. It is in this direction that stairs with proper handrails are recommended alongside with ramps so walking people are not forced to use it (UN, 2015).

Curb ramps are critical to providing access between the sidewalk and the street for people who use wheelchairs (Federal Highway Administration (FHWA), 2007).Curb ramps are most commonly found at intersections, but they may also be used at other locations such as on-street parking, loading zones, bus stops, and midblock crossings. The use of flush curb ramps especially at crossroads and road-crossing zones for the benefit of the wheelchair user has also been found to pose a dangerous threat to those with visual impairment (Goldsmith, 2010). This is because upstanding curbs serve as demarcation for mobility for the visually impaired especially the independent cane user and dog owners. At road-crossing points, these tactile cues help the visually impaired from walking across roads without their knowledge. A problematic situation is therefore created in such an instance with regards to satisfying the wheelchair user and the independent blind without causing accidents.

One major problem found with ramps is steep gradient. Steep ramps gradients are difficult for people who use walking aids and manual wheelchairs to negotiate because significantly more energy is needed to begin and travel on sloped surfaces; conversely, gradual grades are problematic for people with vision impairments because the transition between the sidewalk and the street is difficult to detect (Federal Highway Administration (FHWA), 2007)

In view of this, the United Nations manual on accessibility recommends the maximum lengths and rises for various ramp slope ratios minimum and maximum ramp slopes. It

is recommended that, rather than using 8.3 percent for designing curb ramp grade, a grade of 7.1 percent is recommended to allow a construction tolerance. This is shown in Appendix I.

### 2.8.5 Issues with stair positioning

Of all the normal features that the architect designs into a building, it is steps and stairs that pose the most common threat to the safety of users (Goldsmith, 2010). The positioning of stairs in the way of getting to frequented places such as public toilet pose a major disadvantage to wheelchair users, ambulant disabled people, pregnant women and people with luggage (Goldsmith, 2010). It has been the norm for some designers to place toilet facilities quite close to stairways to make it more visible and easily accessible. To Goldsmith, (2010), the creation of stairs in locations to avoid this conflict is very important because although these stairs might not pose inconveniences for most able-bodied people, it has the likelihood of creating accident prone proximity especially when the lobby is narrow and improperly lit.

### 2.8.6 Details of Tactile Pavement

The characteristics of the surface finishes can assist or impede orientation, way finding and may significantly affect the ease of passage for all users (CAE, 2012). Tactile paving is a system of textured ground surface indicators found on public environments to assist blind and visually impaired persons to distinguish locations and directions, identify potential hazards, and then to move and reach expected destinations (Lu, et al, 2009).The tactile paving necessary for people with visual impairments can cause discomfort and difficulties for wheelchair users (Fraser, 2010; Goldsmith, 2010).

Goldsmith (2010) further states that while sight-impaired people may be helped by distinctive coloring but not as a rule by tactile surfaces and given that tactile surfaces could be uncomfortable for them, blind people, contrarily, may be helped by tactile

surface which should be detectable and have to be knobbly, but not as a rule by colour distinctions. Bearing in mind that tactile surfaces need to be knobbly and distinguishable to be readily detectable, the issue here is to ensure their good performance without causing discomfort to its user's especially ambulant disabled people. It could be discovered that this type of conflicting situation does not only exist between the sight-impaired and the blind but rather, the able-bodied person in high-heel shoes, the toddler who is learning how to walk and users of crutches might find it uncomfortable walking on tactile pavements with high, detectable knobs (Goldsmith, 2010; Newell, 2000).

The reasons for the change are the unsafe and slippery nature of the dome-shaped dot tile especially for the disabled persons, the indistinguishable nature of the oval-shaped bar tile by the blind and the difficulty in distinguishing zigzag arrangement dot tile is similar to the parallel arrangement of dot tile by the blind and visually impaired (Lu et al., 2009).

A general concern here could therefore be raised about means of compromising in such an instance without threading on the comfort to either party. This calls for in depth study, usage and assessment of some of these solutions adopted by the developed countries.

For instance, Lu et al, (2009) remarked that only the United Kingdom and Japan have specially established tactile paving product standards. Many other countries and cities such as the United States, China and Hong Kong take tactile paving as only one part of documents related to barrier-free regulations and matters. Conducted experiments by the Transport and Roads Research Lab (TRRL) in Berkshire, to assess how textured surface could be used to assist blind pedestrians locate zebra and pelican controlled crossings proved helpful in assessing this hypothesis. The results of the experiments

conducted with different tactile surfaces led the shaving off of patterns of round domes on tactile surfaces due to its uncomfortable nature to even pregnant mothers, walking toddlers and ambulant disabled people who use crutches and canes (Goldsmith, 2010). An example of tactile paving patterns and details adopted by the United Kingdom is shown in Appendix V.

Uneven paving stones are also a great hazard particularly for people who are being pushed in a wheelchair .In our local settings, pedestrian pavements are one of the most neglected and poorly constructed sectors in road constructions. Cobbles, loose gravels, stones as well as wet and smooth floor finishes are disadvantageous to the mobility impaired person (Mace, 1991). Though its use might be of an advantage to the visually impaired, it has the potential of causing accidents to the mobility impaired especially when used on sloppy grounds and should be avoided in public grounds as possible.

### 2.8.7 Sanitary Facilities

The visual contrast between fittings and surfaces in the accessible toilet should be effective and the overall room size meets current standards (CAE, 2012). Mace (1991), suggest that it would be preferable for the toilet paper dispenser to be lowered and for paper hand towel to be provided within reach of water Closet (WC).

## 2.9 Space Analysis

### 2.9.1 Non-ambulatory disabilities

Persons restricted on wheel chairs should use the facilities within the built environment, alone without a helper's assistance

I. Wheelchair users

A wheelchair may be operated by the user alone or with a helper's assistance. However, wheelchair design must assume that the user should be able to operate the wheelchair

without help. The width and length of the wheel chair, its control and the diameter of the casters decide the following. Figure 2.1 shows image of it.

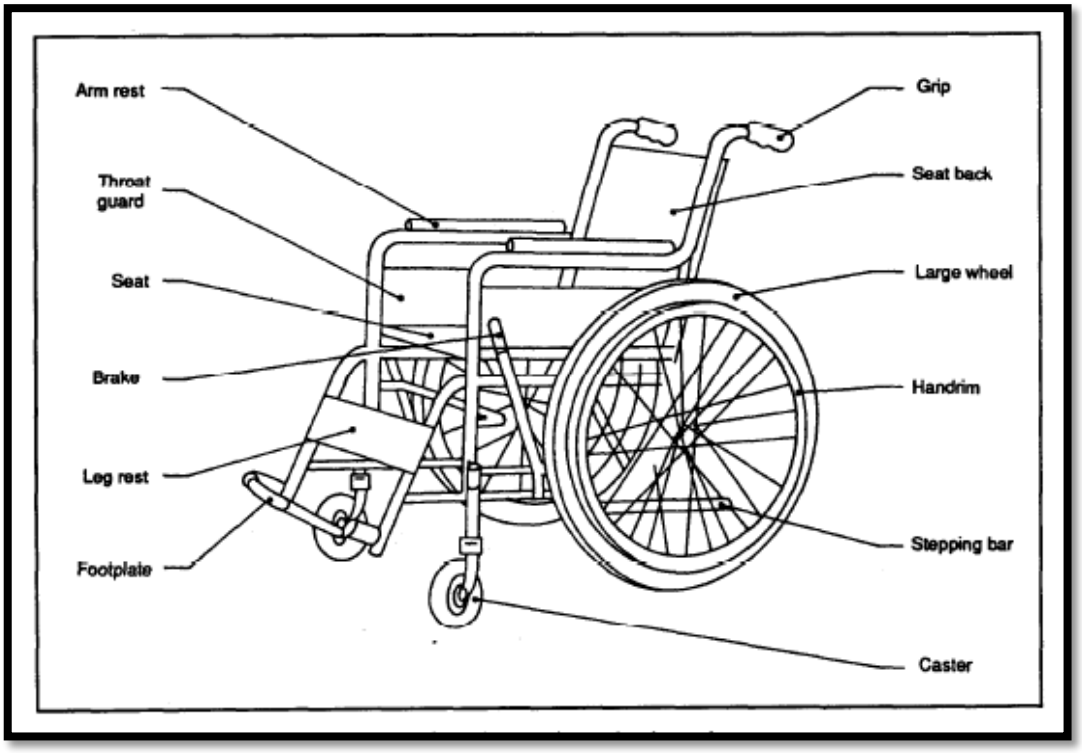



Figure 2.1 Structure of a wheelchair and name of each part (standard type).

Source: (Central Public Works Department, Ministry of Urban Affairs and Employment (CPWDMUAE), (2013)

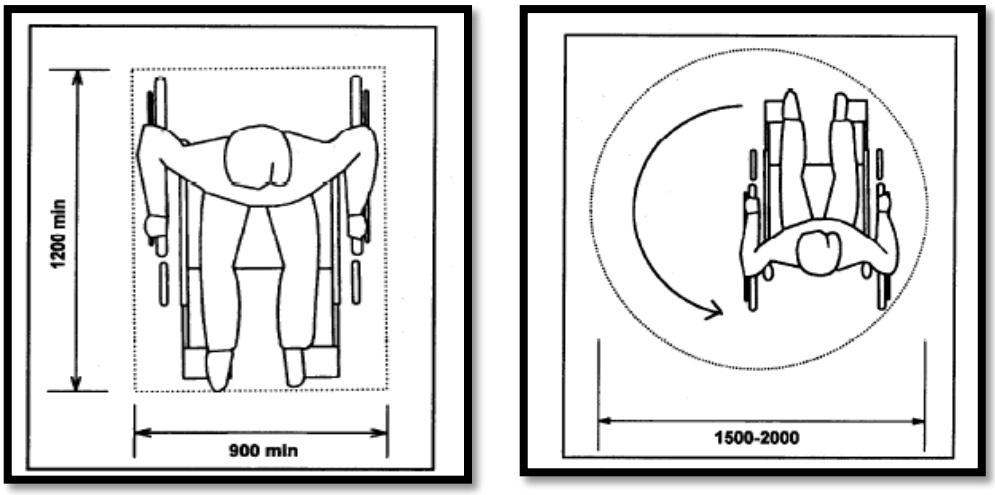



Figure 2.2 Space allowance for a wheelchair.

Source: (CPWDMUAE), (2015

a) Width of entrances and exits (clear)

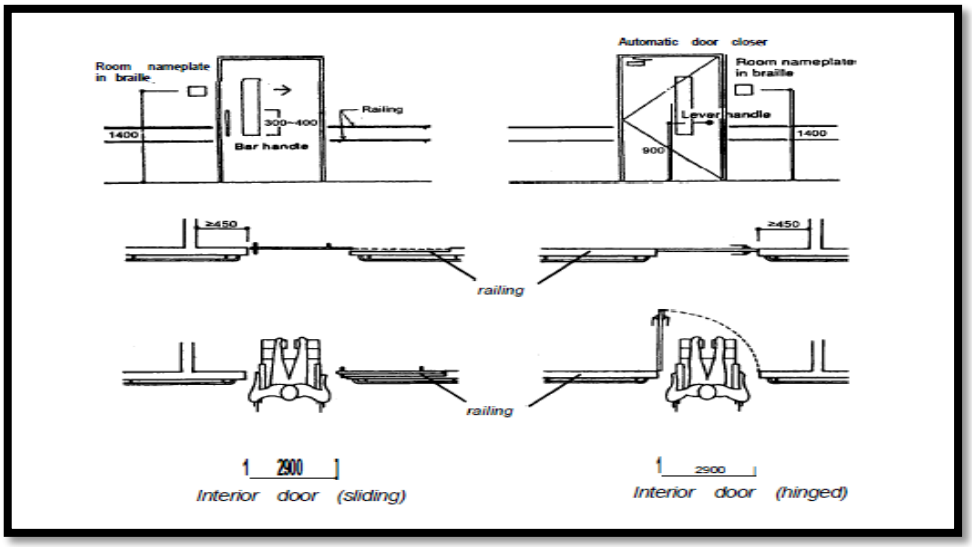



Figure 2.3 Entrance Clearance

Source: (CPWDMUAE), (2015)

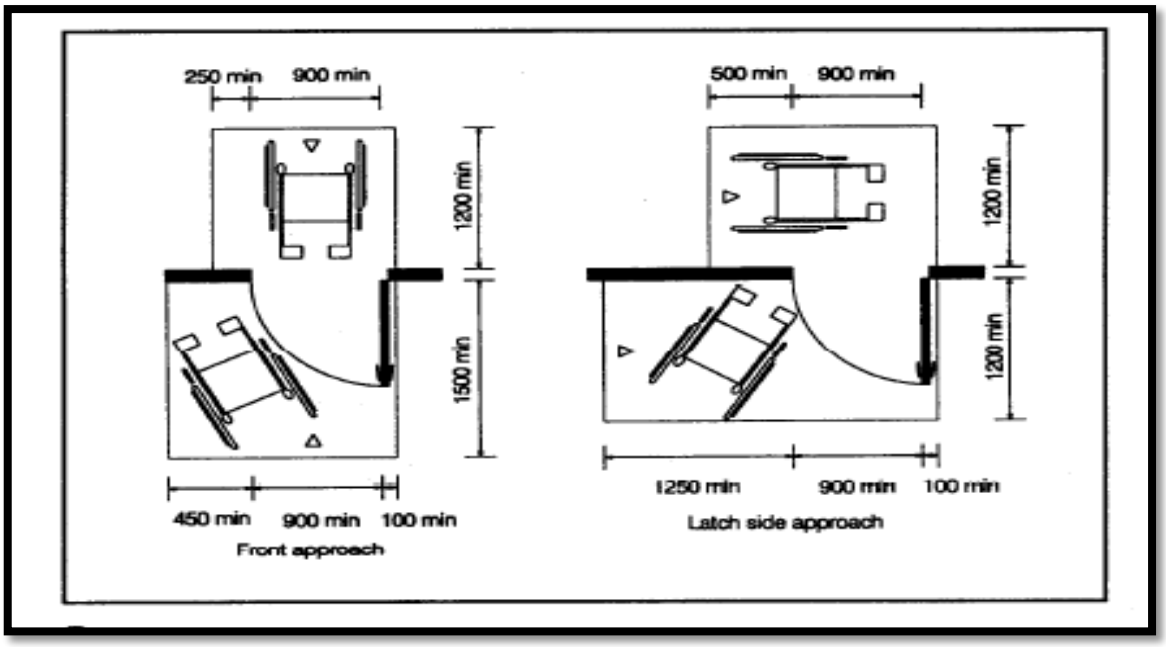



Figure 2.4 Width of Door Entrance

Source: (CPWDMUAE), (2015)

b) Width of the passage / corridor (min. 900mm)

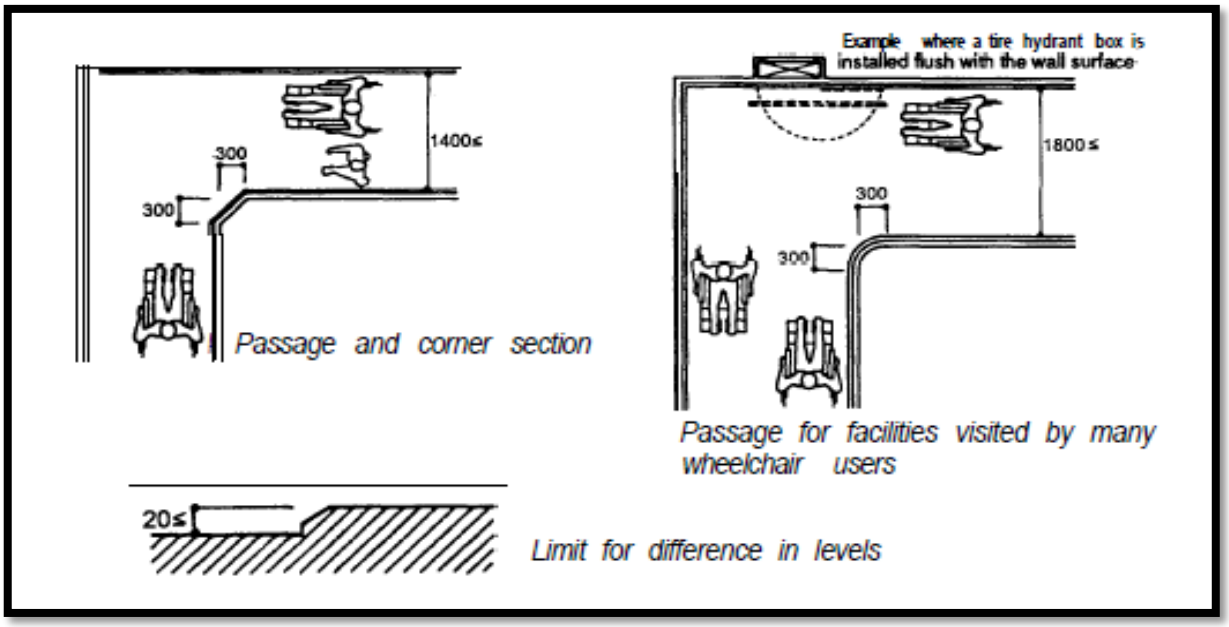



Figure 2.5 Corridor width

Source: (CPWDMUAE), (2015)

c) Slope of the climbing (min. ramp slope 1:12)

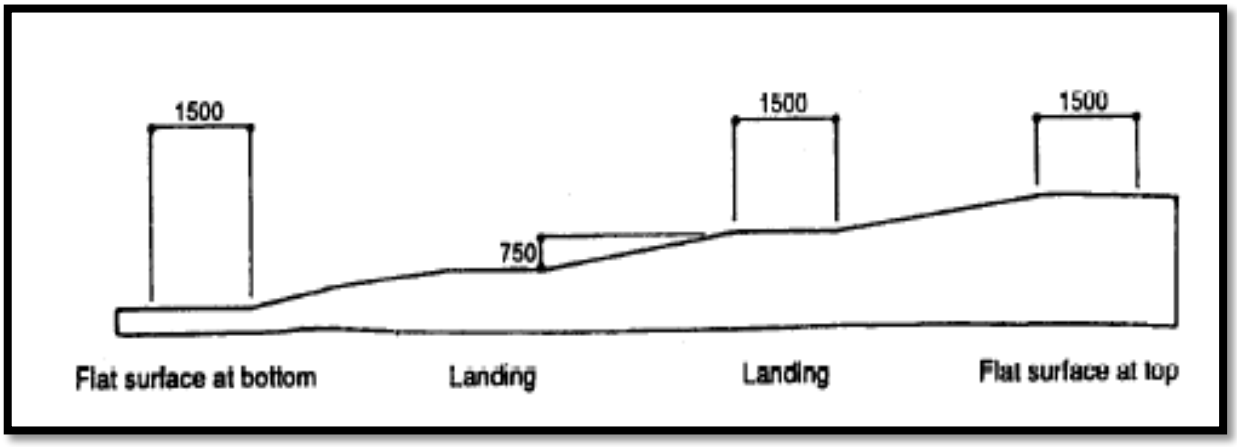



Figure 2.6 Ramp Slope Requirement

Source: (CPWDMUAE), (2015)

Passing over different levels and grooves (Grating with narrow slots in the direction of movement and level difference to limit to 2cm or less). Transferring from wheel chair (adequate space is required to transfer from wheel chair to toilet seat and bed.

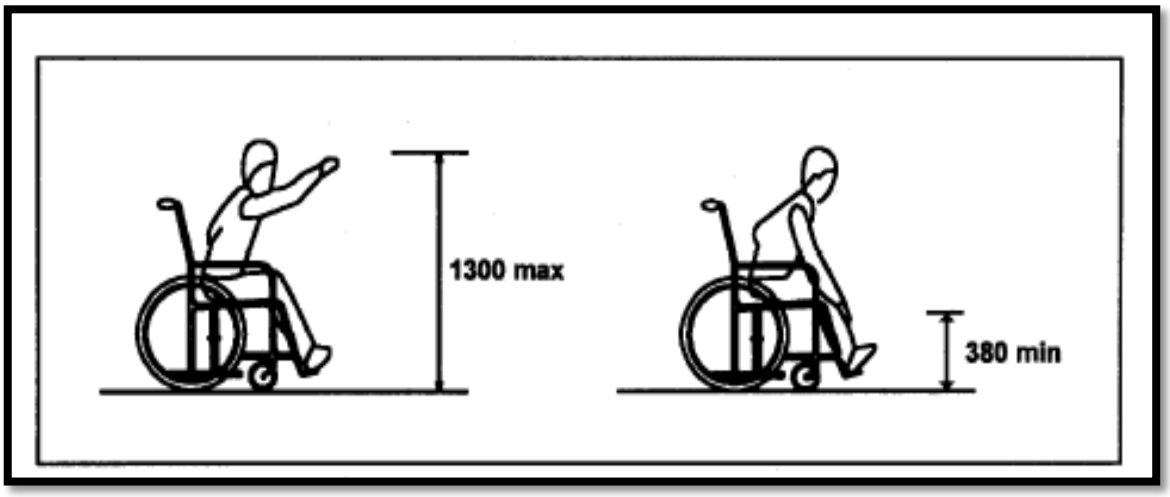



Figure 2.7 Height Requirement

Source: (CPWDMUAE), (2015)

d) Lift size

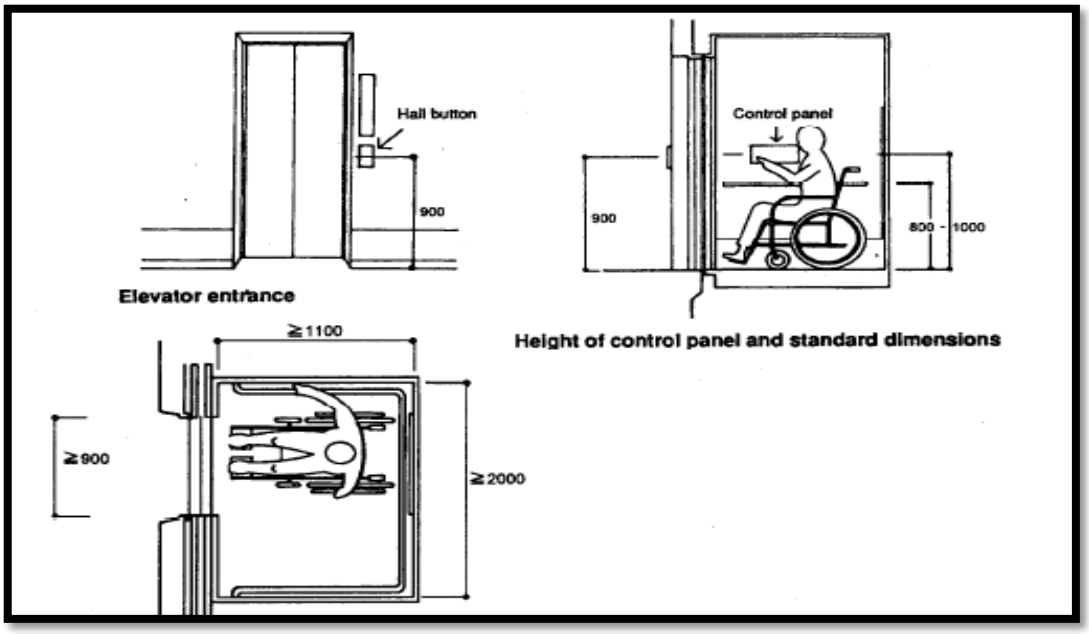



Figure 2.8 Lift Space Requirement

Source: (CPWDMUAE), (2015)

e) Toilet size

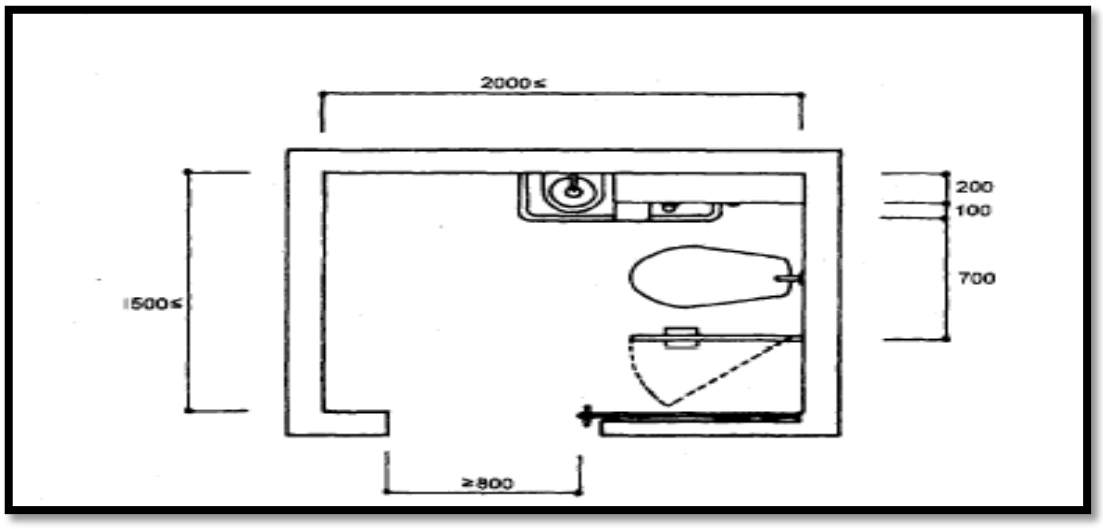



Figure 2.9 Toilet Dimension

Source: (CPWDMUAE), (2015)

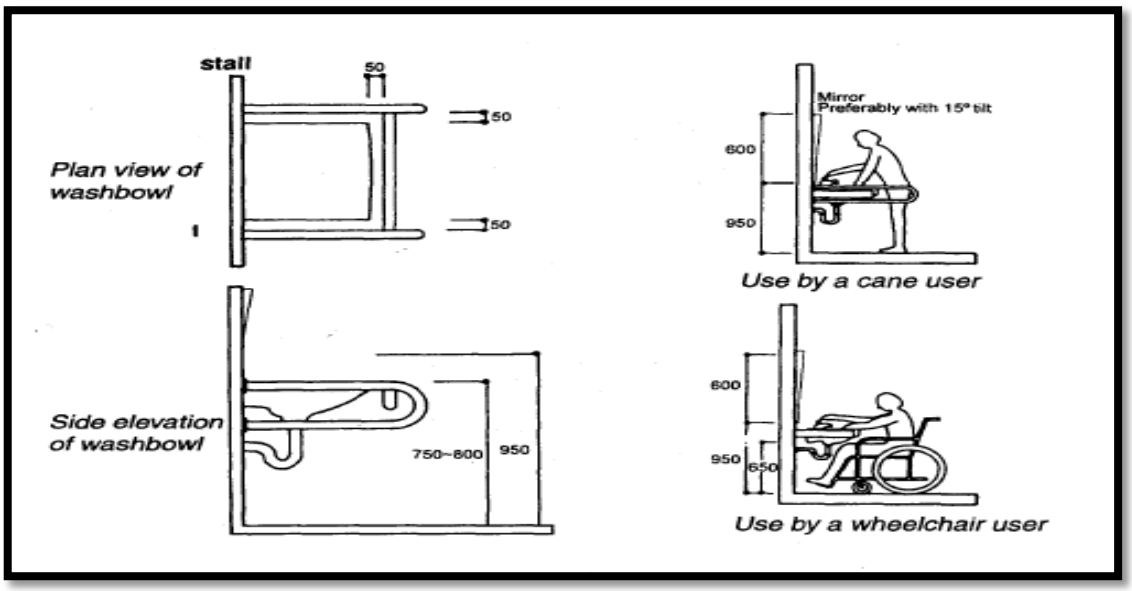



Figure 2.10 Toilet Features Height

Source: (CPWDMUAE), (2015)

f) Window heights and requirement

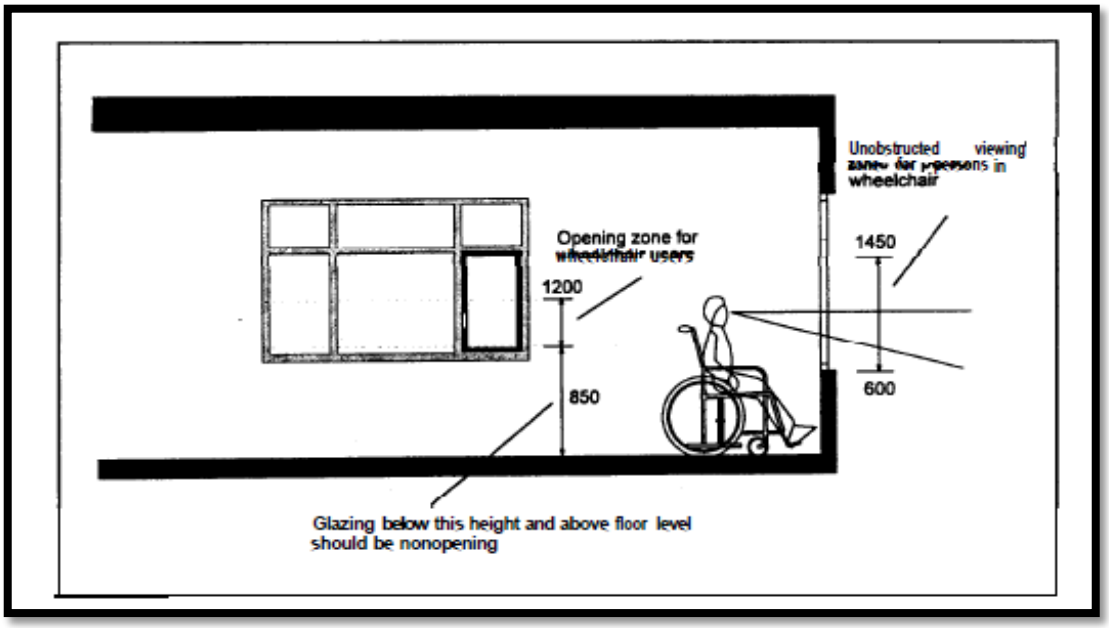



Figure 2.11 Window Height requirement

Source: (CPWDMUAE), (2015)

g) Finishes of floor surface with non-slip floor material.

Installation of handrail to support the body weight at the critical places e.g. staircase, toilet, ramp, passage with a change of level (800-850 mm).

Extension of handrail on the flat landing at the top and bottom of the stairs (300mm).

To prevent slipping off the cane or crutch from the side of the stairs or ramps (20 mm high lip on the exposed edge).

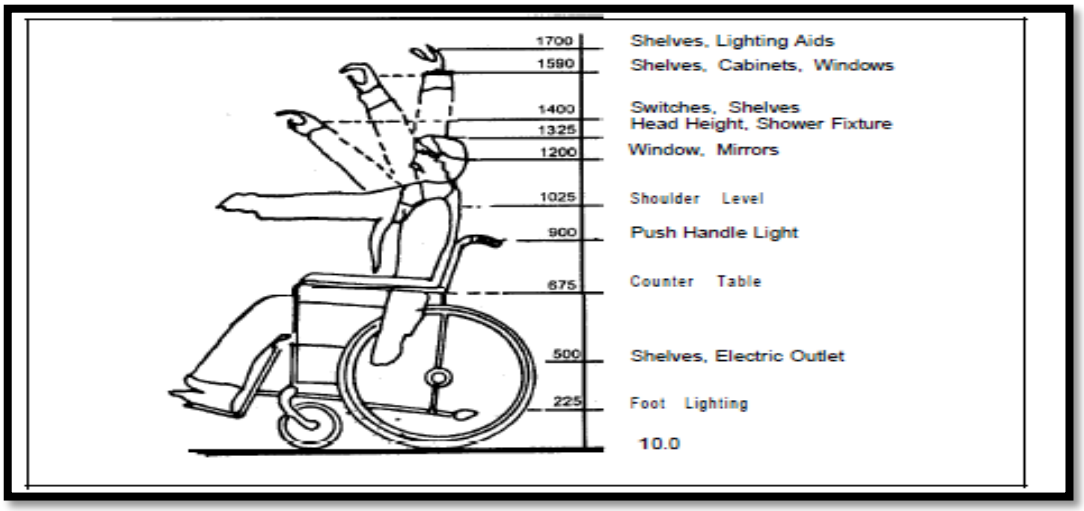



Figure 2.12 Arm Length Dimension

Source: (CPWDMUAE), (2015)

### 2.9.2 Semi-ambulatory disabilities

II. Persons with impaired walking

Persons in this category include users of walking aids such as crutches or canes, who are amputees, who have chest ailments or heart disease. The persons in this category include those who cannot walk without a cane and those who have some trouble in their upper or lower limbs although they can walk unassisted.

**Design requirements**

a) Width of passage for crutch users (min. 900 mm)

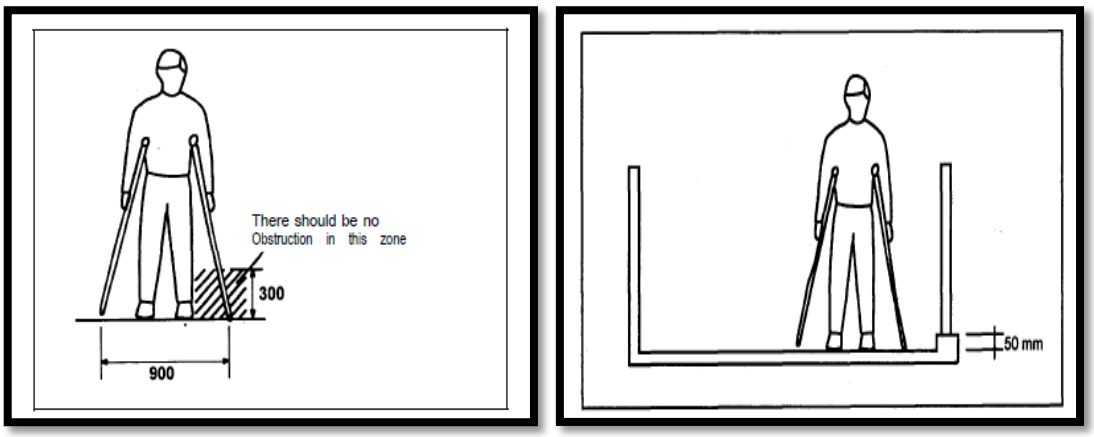



Figure 2.13Space for Crutch User

Source: (CPWDMUAE), (2015)

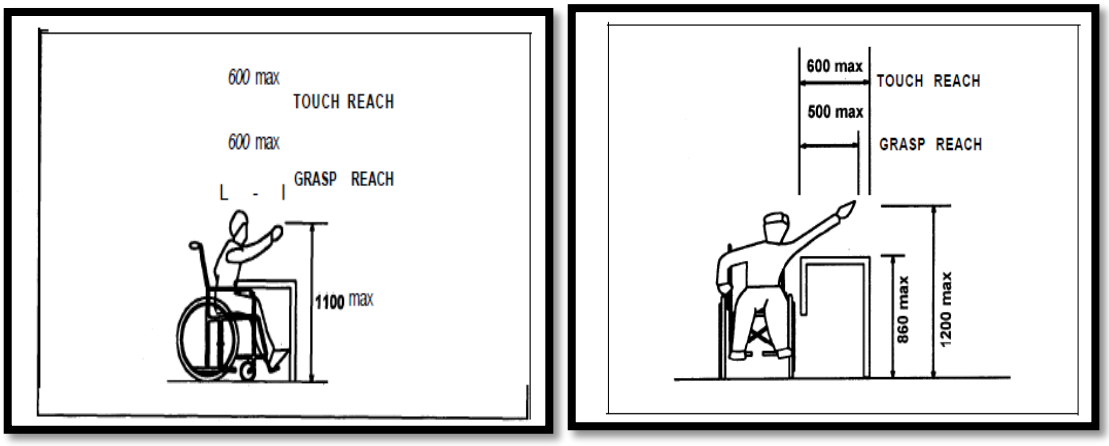



Figure 2.14 Arm Reach of a Wheelchair user

Source: (CPWDMUAE), (2015)

## 2.10 Review of Studies on Design for Disability

Ezeukwu et al. (2011) carried out a study titled " Accessibility of a Person With Mobility Disability to Public Buildings in Enugu Metropolis, Nigeria". Two hundred and forty-six Public buildings were surveyed. The linking routes (door width, thresholds, width of route, door opening mechanism) and entrances (ramp length, width and slope) were observed, measured and computed. Accessibility was determined using an abridged form of the Americans with Disabilities' Act Accessibility

Guidelines. The results show that most accessible buildings were public buildings (76%), while private buildings were most inaccessible (92%).

Amongst the 246 buildings in the study, most (110, 44.72%) had fair accessibility.

Professionals involved in building in Nigeria should recognize that being a social art, public structures should be designed and built to accommodate all strata of persons in the society especially those with mobility disability.

Hamzat & Dada (2005) a study titled "Wheelchair Accessibility of Public Buildings in Ibadan, Nigeria" used a descriptive survey research involving a physical observation of the building. The purpose of the study was to determine the level of wheelchair accessibility of public building in Ibadan using an abridged form of Americans with Disabilities Act Accessibility Guidelines (ADAAG). Thirty-eight (38) public building were surveyed. The major finding of the study was that accessible routes did not link most of the accessible entrances, and this shortcoming ultimately rendered the building inaccessible. In conclusion, Hamzat and Dada emphasize on the need for Nigerian government to lead the way in making accessibility of public building as a priority and enacting law that mandate accessibility.

Useh, et al, (2001) conducted a study titled "wheelchair Accessibility of Public building in the Central Business District of Harare, Zimbabwe". The main aim of the study was to identify architectural barriers faced by wheelchair users in public buildings. Descriptive statistic of simple percentage and means were used to determine the level of compliance to the guidelines of the instruments and wheelchair accessibility to the surveyed buildings. The study reveals that there is a poor compliance score for items such as parking areas, ramps for wheelchair users is probably because the physically challenged person were not considered in the design and construction of the buildings.

In all the studies mentioned above, the researchers in carrying out the studies employed survey research method. This has shown that it is a suitable method for accessibility and Circulation assessment and would therefore be employed in conducting this study.

## 2.11 Examples of Facilities incorporating Universal Design

### 2.11.1 The jachie sheltered employment center

**Background information**

Jachie Sheltered Employment Center, established in 1984 and located on a 3.8 hectare land at Jachie-Pramso in the Ashanti Region of Ghana is one out of the four major rehabilitation centres in the region. The Project, funded by the Norwegian Society for the Physically Disabled was conceived as an African village, where wheelchair, crutch, and cane users live, work and train in industrial skills under micro-accessibility conditions.

**Activities and Facilities**

The institute has a parking forecourt, administration block, accounts office, storerooms, and workshops for orthopedic, leatherworks, tie and dye, carpentry, dressmaking and weaving purposes. It also has accommodation facilities for staff and students as well as ancillary facilities like common hall, gardens, showrooms, computer rooms and a multi-purpose hall.



Figure 2.15Showing a tailoring section



Figure 2.16 Showing a semi closed carpentry section

Source: Authors work, 2017

**Climate Modification Measures**

With the facility's location in the tropical rainforest zone, some provisions that has been made to ensure micro-climate modification in the facility include the adoption of open courtyard system which facilitates free flow of air into room interior, the use of honeycombs walling for the common hall and around corridors to permit more ventilation and light into interior spaces; the use of artificial ventilation systems to supplement natural ventilation systems and the use of glass louvres that is easy to control.



Figure 2.17 Showing Honeycomb walls of common room

Source: Authors work, 2017

**Resource Utilization**

Materials used in the construction of the center comprise sand crete blocks for walling, wood for ceiling, glass for windows, steel reinforcement for the structure, porcelain tiles for finishes, stone chipping for external courtyard and cement mortar for floor and wall finishes.

**Facilitation of Activities**

All facilities in the center have been planned on the ground floor thereby reducing the cost of providing ramps to upper floors. In addition, the center has enough space serving parking and circulation purposes. The center also has macro-accessibility provisions like ramps, balustrades and grabs bars in sanitary areas.





Figure 2.18 Toilet with grab hold Figure 2.19 : Showing Triple wood-strip rail

Source: Authors work, 2017

Water, sewage, fire prevention, electricity and telecommunication services have been provided in the center. The facility also has 10000 gallon water reservoir also serving as indirect water supply in addition to water supply from boreholes. Fire prevention equipment in the form of fire extinguishers has been strategically positioned in the facilities. A three-phase electricity distribution line supplies electricity to the center and it is supplemented by a standby generator.

**Merit**

Basic macro-accessibility provisions were considered especially in the planning and design of interior spaces.

**Demerits**

There are no covered walkways linking each facility to the other thereby exposing the disabled persons to the mercies of the weather.

Lack of recreational and therapeutic facilities like playing courts and swimming pools respectively has created imbalance in the Centre's curricula.

Some newly constructed block have ramp with no standard gradients.

### 2.11.2 Fukushima Prefectural Koriyama School for the physically handicapped, Japan.

**Background information**

With a design concept as flexibility and adaptability, the award winning design is an elementary and secondary school for children with physical disabilities. The school covers a gross land area of 13525 square meters and offers training to 170 students. Features such as light-courts, top-lights and clerestories have carefully integrated into the facility configuration to facilitate communication and interaction through visibility. Furthermore, the entire facility operates on a sequence of hierarchy form a small group size to a large school company.



Figure 2.20 Library with curvilinear indoor ramp



Figure 2.21 Showing Extensive use of glass and steel

(Source: http://www.aij.or.jp/aijhome.htm)

**Construction Materials**

Materials used for construction were glass for windows, clerestories and roof lights, steel and wood for structural members and finishes, and porcelain and ceramic tiles for finishes.

**Merits**

The Centre provides excellent safe learning environment with innovative circulation. Planned with and understanding of the diverse needs of children with disabilities, the facility has small classrooms with only three to eight students. As they move from classrooms to workrooms to a playroom or gymnasium, they can increase their size at will. This is to enable them develop human relationship with one another.

**Demerits**

The use of circular ramp though aesthetically catchy occupies a relatively ample space in some room interiors.

## 2.12 Summary of Literature Review

The literature review provides important information that will be translated into the design application of this research work. Understanding the concept of inclusive design and the importance of mobility impaired people having to be incorporated into the built environment without exclusion. This will be considered when creating the design of a

skill acquisition center for both mobility impaired and mobile people which will mainly incorporate the internally displaced persons and deciding what elements will be included and where. The knowledge gained from the portion of the literature related to disabled persons and their psychosocial needs will also play a large role in the design application. It is key for the design to be sensitive to them and to maintain it throughout.

# 3.0 RESEARCH METHODOLOGY

The purpose of this study is to identify some accessibility conflicts and apply researched conflict control measures in the design of a technical-vocational institute for the physically disabled. The genesis of this research entailed literature study on accessibility conflicts discovered by some designers and accessibility theorists in some developed parts of the world. Existence of some of these accessibility conflicts will be validated through primary and secondary data collection in selected institution for the disabled persons in our local setting. A mixed (qualitative and quantitative) data collection was done through the use of semi-structured questionnaires in a school for the disabled, extended case studies and desk studies

## 3.1 Research Strategy and Design

The research employed a mixed research approach which is a research that uses data that both indicates ordinal values is descriptive. It usually involves fieldwork with the semi-structured questionnaire as the primary instrument for data collection and analysis. Therefore, the researcher must go to the people, setting, site, institution, in order to observe behaviour in its natural setting.

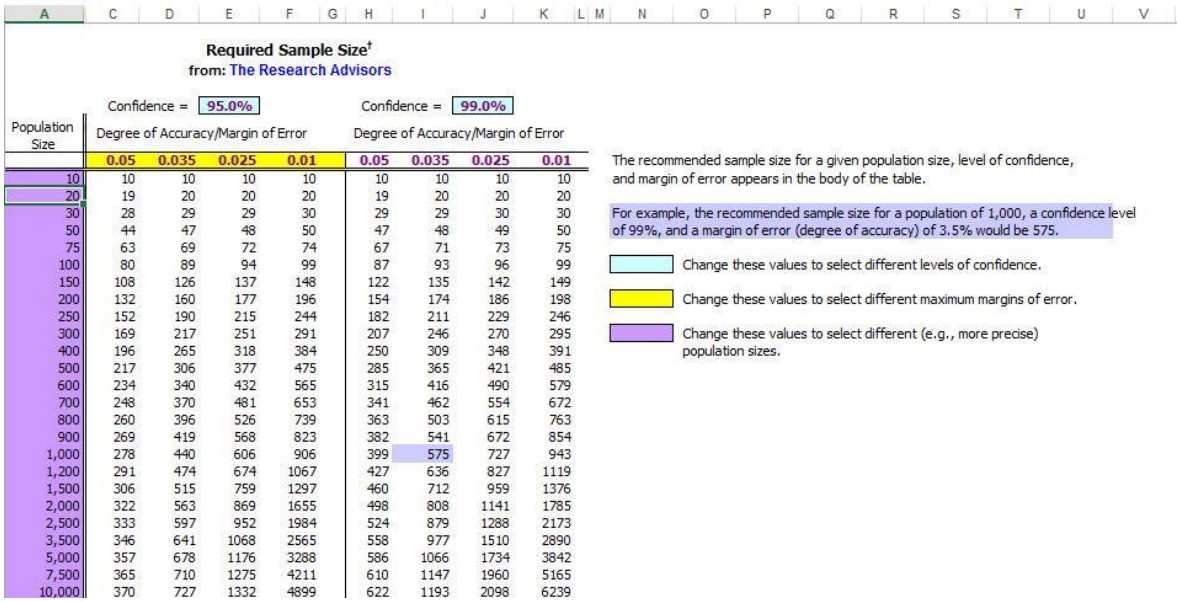
Research design refers to the methods, techniques, procedures and steps taken for data collection and analysis (Ngu, 2004). It is also a framework for the conduct of the research even before the data is collected; research design normally defends not only the type of the research but also the purpose of the research. As an exploratory research, this work incorporates an emergent design, develops and evolves through the research process and each data collection and analysis activity informs subsequent ones. Also, since the research approach is exploratory and focuses on discovery, therefore study does not begin with a set of hypothesis to test, instead it collects data through a variety of techniques and sources in order to identify and characterize

important categories, dimensions and inter relationship of inclusive design patterns with disability and its treatment through a case study approach. The function of research design is to ensure that the evidence obtained enables one to answer initial research questions as unambiguously as possible. Case study research approach was adopted for the purpose of this thesis research which enables an in-depth study of a limited number of cases. According to Yin (2009), case study is an empirical inquiry that investigates a contemporary phenomenon within its real life context using multiple source of evidence such as interviews, observation, archival records and participant observation to collect evidence.

Oluigbo (2010) opined that case study in architecture begins with a documentation of the physical characteristics of the case, which should be carried out under the following headings: history and Background; Site planning and Landscaping; Spatial Organization; structure and materials; and building services. The assessment will be carried out through visual surveys, observation, on the application of these outlined principles of inclusive design under study.

### 3.2 Sampling technique

A sample is a fraction of a population from which it is obtained. Case study selection is comparable to sampling in a quantitative research and that those cases are usually purposively selected (Veal, 2009). This suggested that cases are identified for study due to their inherent qualities which were in consonance with the phenomenon under investigation (Veal, 2009). The Sampling Techniques depend solely on the type or method of sampling adopted. This research will adopt the purposive sampling method which is a technique that allows the researcher to select certain groups or individuals for their relevance to the subject of investigation, based on his knowledge and understanding of the population (Issa, 2004).



**Required Sample Size†**
from: The Research Advisors

| Population Size | Confidence = 95.0% — Degree of Accuracy/Margin of Error | | | | Confidence = 99.0% — Degree of Accuracy/Margin of Error | | | |
|---|---|---|---|---|---|---|---|---|
| | 0.05 | 0.035 | 0.025 | 0.01 | 0.05 | 0.035 | 0.025 | 0.01 |
| 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 | 19 | 20 | 20 | 20 | 19 | 20 | 20 | 20 |
| 30 | 28 | 29 | 29 | 30 | 29 | 29 | 30 | 30 |
| 50 | 44 | 47 | 48 | 50 | 47 | 48 | 49 | 50 |
| 75 | 63 | 69 | 72 | 74 | 67 | 71 | 73 | 75 |
| 100 | 80 | 89 | 94 | 99 | 87 | 93 | 96 | 99 |
| 150 | 108 | 126 | 137 | 148 | 122 | 135 | 142 | 149 |
| 200 | 132 | 160 | 177 | 196 | 154 | 174 | 186 | 198 |
| 250 | 152 | 190 | 215 | 244 | 182 | 211 | 229 | 246 |
| 300 | 169 | 217 | 251 | 291 | 207 | 246 | 270 | 295 |
| 400 | 196 | 265 | 318 | 384 | 250 | 309 | 348 | 391 |
| 500 | 217 | 306 | 377 | 475 | 285 | 365 | 421 | 485 |
| 600 | 234 | 340 | 432 | 565 | 315 | 416 | 490 | 579 |
| 700 | 248 | 370 | 481 | 653 | 341 | 462 | 554 | 672 |
| 800 | 260 | 396 | 526 | 739 | 363 | 503 | 615 | 763 |
| 900 | 269 | 419 | 568 | 823 | 382 | 541 | 672 | 854 |
| 1,000 | 278 | 440 | 606 | 906 | 399 | 575 | 727 | 943 |
| 1,200 | 291 | 474 | 674 | 1067 | 427 | 636 | 827 | 1119 |
| 1,500 | 306 | 515 | 759 | 1297 | 460 | 712 | 959 | 1376 |
| 2,000 | 322 | 563 | 869 | 1655 | 498 | 808 | 1141 | 1785 |
| 2,500 | 333 | 597 | 952 | 1984 | 524 | 879 | 1288 | 2173 |
| 3,500 | 346 | 641 | 1068 | 2565 | 558 | 977 | 1510 | 2890 |
| 5,000 | 357 | 678 | 1176 | 3288 | 586 | 1066 | 1734 | 3842 |
| 7,500 | 365 | 710 | 1275 | 4211 | 610 | 1147 | 1960 | 5165 |
| 10,000 | 370 | 727 | 1332 | 4899 | 622 | 1193 | 2098 | 6239 |



Figure 3.1 Sample size chart

Source: Google, 2017

This is as a result of their being the most disadvantaged group presently in Nigeria and Kano metropolis has the highest number of disabled people in Northern Nigeria, being the proposed location for the centre.

### 3.3 Population and Sample Size of study

For the purpose of research, a population is theoretically a specified aggregation of survey unit about which forms the basis of analysis and from which the samples are actually selected (Ngu, 2004). Population of this study made up of all students comprising of mobile and mobility impaired individuals in skill acquisition centres in Kano and Kaduna States under cases studied. An average of the students in both schools was taken and a sample size of 50 students within the mobility impaired in the selected study cases were administered questionnaires; 25 in each centre. 10 mobility impaired staff were also interviewed; 5 staff from each study centre.

### 3.3.1 Case study selection criteria

The case studies selected for this study would be sampled purposely to at least possess one among the following criteria. This method is economical and ensures extensive study of the selected cases.

1. A Skill acquisition centre with adequate coverage in scope and facilities required to operate as a standard comprehensive centre.
2. A facility that possesses some inclusive design requirements.

Based on the criteria above, the following cases were selected;

i. Sani Abatcha Youth Skills Acquisition Centre, Kano; being a skills centre located in the same geographical location as the proposed design.
ii. Business Apprenticeship Training Centre (BATC) Sabon-gari, Zaria; A skill acquisition centre within the same geographical location as the proposed centre.

### 3.3.2 Criteria for appraisal of case studies

The case studies will be appraised based on the 'Design Objectives of Whole Building Design' (Prowler, 2009). Consideration will be taken of the following;

1. Accessibility: Pertains to building elements, heights and clearances implemented to address the specific needs of disabled people.
2. Aesthetics: Pertains to the physical appearance and image of building elements and spaces as well as the integrated design process.
3. Cost-Effectiveness: Pertains to selecting building elements on the basis of life-cycle costs (weighing options during concepts, design development, and value engineering) as well as basic cost estimating and budget control.

4. Functional/Operational: Pertains to functional programming—spatial needs and requirements, system performance as well as durability and efficient maintenance of building elements.
5. Historic Preservation: Pertains to specific actions within a historic district or affecting a historic building whereby building elements and strategies are classifiable into one of the four approaches: preservation, rehabilitation, restoration, or reconstruction.
6. Productive: Pertains to occupants' well-being—physical and psychological Comfort—including building elements such as air distribution, lighting, workspaces, systems, and technology.
7. Secure/Safe: Pertains to the physical protection of occupants and assets from man-made and natural hazards.
8. Sustainable: Pertains to environmental performance of building elements and strategies.

All these points have been redefined concisely under climate modification, utilization of resources, facilitation of activities and finally meaning and delight.

### 3.4 Sources of Data Collection

Case studies in Architecture begin with a documentation of the physical characteristics of the case, and for theoretical research they may require the use of general methods of data collection (Veal, 2009). However, the method of data collection adopted for this study are from primary and secondary sources. Primary data are the original data obtained from the field work carried out by the researcher; which included; questionnaire, interviews, observation, visual survey and checklist, to assess the level of reflection of patterns of inclusive design on the cases studied. Secondary data on the

other hand, is data collected by other researchers in their respective researches; this includes data from books, manuals, magazines, newspaper, libraries and the internet.

### 3.4.1 Instruments of data collection

Writing a research report is incomplete without describing the instruments and how they were validated (Veal, 2006). There are many different types of instruments which can used to collect data from a case study. The case studies for theoretical research in architecture may require the use of general methods for data collection (Veal, 2009). The use of multiple sources of data in order to capture the complexity of cases is one of the defining characteristic of case study methodology (Yin, 2004).

For the purpose of this study, the instruments that were used for the collection and documentation of data were interview, questionnaire and notes. Photographs were taken of relevant physical elements of the case studies to ascertain the extent or level of application of principles of inclusive design applied in the design, planning, and construction. Sketches of some relevant part of the case study were necessary to further describe some features of spatial organization, or to enhance the quality of some details that were not too clear from the pictures taken during the field visit. As an instrument, notes will also be taken on the field work to outline the account and extent of the independent variables on the case studies as they relate to the considerations and application of principles of inclusive design.

i. Interviews: Staff with mobility impairments from the selected study cases, and members of the Kano state disability association were interviewed to ascertain their response on environmental design pedagogical and accessibility problems encountered in their learning premises and places of work. Interview questions sought information regarding space allocations for various activities,

circulation and accessibility needs and conflicts of interest on the use of accessibility features by the inmates. Additionally, information was also gathered from heads and caretakers of the institutions of these selected schools on the response of its users with regards to physical structures, environmental attributes and general accessibility features found within and outside their premises. Recommendations with specific reference to ways to improve accessibility and reduce or remove some conflicts. A sample of the interview questions to be used is shown in Appendix I.

ii. Questionnaire: A qualitative questionnaire was constructed for students to complete themselves. Questions were semi-structured as appropriate to field research. Sample of the questionnaires administered is shown in Appendix II.

iii. Case studies: The theoretical assumptions underlying this research come from the qualitative tradition, which deals with interpretation of contemporary situation. The research strategy adopted was to conduct case studies in different locations. A case study is an empirical enquiry that investigates a contemporary phenomenon in depth and within a real-life context, especially when the boundaries between phenomenon and context are not clearly evident (Zainal, 2007). Extended case studies were conducted on some local and foreign institutions serving the mobility impaired to help ascertain or disprove the existence of accessibility conflicts in our local settings Case study in architecture begins with a documentation of the physical characteristics of the case (Veal, 2006). The case study took the form of site visits, personal observation and documentation of interior and exterior areas accessed by residents in addition to interviewing of inmates. In this direction, basic circulation features such as ramp gradients, manoeuvring spaces for the motor

impaired in facilities and their safety and comfort will be documented. Notes were also be taken of the ergonomic state of the environment in general. To buttress these observations, measurements and photographic documentation of facilities under studies will also be taken.

### 3.4.2 Procedures for data collection

The Procedures for data collection in the local case study hold numerous techniques used for data collection in research, such as visiting some selected existing skill acquisition centres at various pre-selected locations within the chosen geo-political zone and taking visual analysis of their architectural elements as they reflect these inclusive design principles. An exploration survey of within and around the site of the selected case study areas was carried out in order to get familiar with the study environment for recovered results. The numerous buildings selected were then critically assessed based on the drawn standards of analysis. The foreign case studies however, were be obtained from the internet and evaluated using the same variables as used for the local case studies.

## 3.5 Variables of the Study

The variables are those characteristics which the research sought to utilize as a unit of differential in the data collection process. The variables where chosen to assess their utilization and impact on the buildings under study (Yin, 2004).On the level of reflection of inclusive design patterns, a checklist was employed to assess the magnitude of reflection of each principle on the case studies. The variables which formed the questionnaire and interview are shown in figure 3.2.

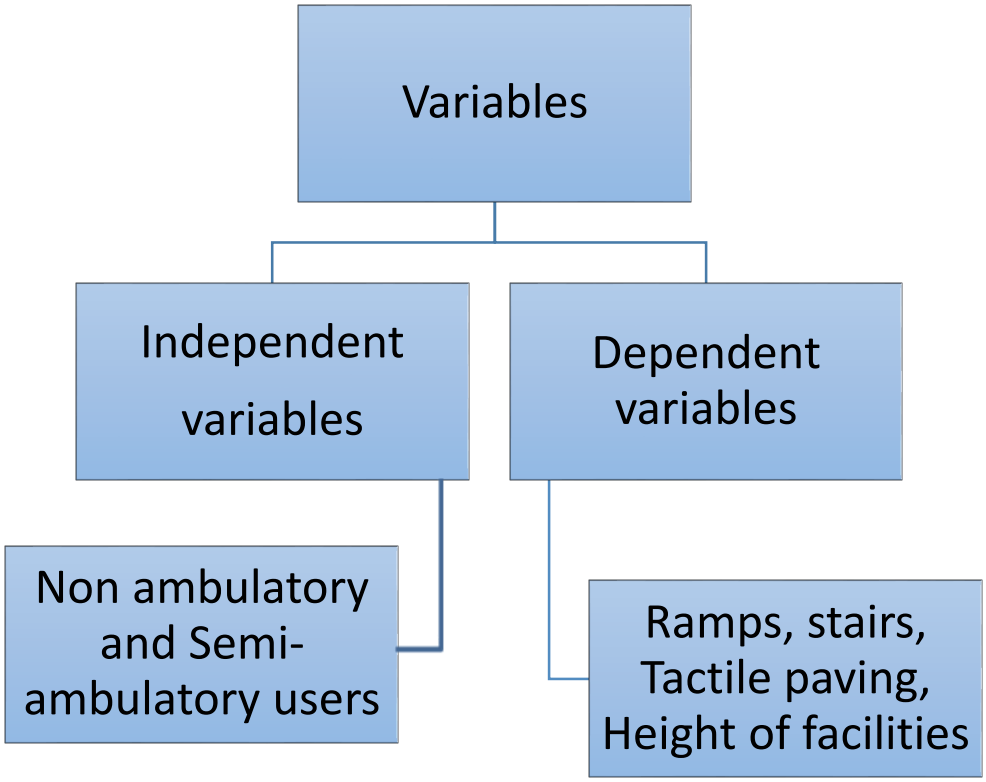



Figure 3.2 Variables of study

Source: Authors work, 2017

### 3.6 Data analysis and presentation

Analysis of data collected on the visual survey and observation is based on the descriptive accounts as observed, and noted via the instruments of data collection (Veal, 2006). Brief introduction, account of independent variables, and checklist on the application of inclusive design principles were used to capture a better perspective of the facilities for more effective evaluation.

To capture complexity of cases the use of multiple sources of data collection were used. In order to achieve the research goal, the following instruments of data collection were used as listed below:

i. **Diagrammatic representation**: proper representation of data were made by the use of sketches and where drawings/ sketches will not suffice or are not available, they will be supported with pictures.

ii. **Figures:** the material obtained as illustrations on the inclusive design strategies obtained from books, the internet and the field survey of the case studies.

iii. **Tables:** comparison of information from case studies; and summary of findings will be all done in tabular form for easement and accuracy.

## 3.7 Research Challenges

Finding literary works on architectural accessibility pertaining to the local settings of Nigeria was a major challenge. Lessons therefore had to be drawn from documentation from developed and developing countries where laws and concepts pertaining to disability and accessibility has been implemented over a long time and Rehabilitation of such persons is done.

In conclusion, this chapter has discussed the qualitative research strategy employed which involves study of phenomena in a real life context. The case study research approach and purposive sampling techniques that were employed by selecting cases based on their relevance to the research. Both primary and secondary sources of data were used, and the instruments of data collection used were field observation, questionnaire, interview and case study. The design strategies adopted from literature were used in assessment of selected cases. Data collected were analysed using thematic analysis and presented in the form of figures, plates and tables. The results obtained using this methodology is presented in chapter four.

# 4.0 RESULTS, DATA ANALYSIS, DISCUSSION

## 4.1 Preamble

The first part of the chapter reveals the findings from conducted case studies on schools for the skill acquisition for the mobility impaired. These institutions were appraised based on standard macro-accessibility design criteria. Case studies were conducted to understand the existing situation which will help to expose problems as well as solutions inherent in existing buildings to serve as guide in design formation. Architectural case studies take into consideration such aspects as function, structures, site and economy, with a view to identifying the complexities essential in them in order to find ways of incorporating some ideas within the proposed project scope. Cases studies were conducted which were selected based on the outlined criteria in chapter three. To this regard, the Government Intermediate Technology BATC, Sabon-gari, Zaria, and Sani Abatcha Youth Centre, Kano were studied. This chapter will answer the following research questions:

i. How does the built environment affect the comfort of mobility impaired individuals?
ii. What design strategies have been applied in the designs for mobility impaired individuals?
iii. How can you integrate the design strategies in the design of Skills Acquisition Centre for people with mobility impairments?

The second part of this chapter deals with data analyses of findings from interview and questionnaires taken from the students of both institutions and members of the Kano State disability association. The main objective of this study was to ascertain the existence of some accessibility problems and conflicts which resulting from the use of accessibility features with others. Finally, findings on a number of restitution measures

recommended by some designers and countries to reduce the mitigating effects of some of the discussed conflicts are discussed. The data collected was coded, tabulated and summarized using descriptive approach, tables and charts. The analysis and findings are arranged in line with the research question.

## 4.2 Case Study One: Business Apprenticeship Training Centre (BATC) Sabongari, Zaria.

### 4.2.1 History and development

Business Apprenticeship Training Centre is a governmental body that was established in 1972. It is located at Sabon-gari along Maje Street Zaria, Kaduna State. It offers certificates in eight trades; comprising of six conventional trades and two non-conventional trades. The conventional trades consist of motor mechanics; electrical and installation; carpentry and joinery; welding and fabrication; plumbing and pipe fitting, radio and television repairs; with training duration of three years. The non-conventional trades consist of tailoring and knotting, which lasts for one year. The basic entry requirement is a minimum of primary school leaving certificate.

The major facilities in the centre are: an administrative block comprising of principal's office, vice principals' office and a staff room, classrooms, workshops and parking spaces.

### 4.2.2 Site planning and landscaping

The Centre comprises of Administrative unit and training unit. The administrative unit consists of three buildings arranged in a cluster form. The training unit consists of two blocks of workshops and a single block of classrooms which are arranged linearly in the west-east direction. The administrative units has significant number of trees, shrubs

and grasses while the training unit has very few landscape elements which include shrubs and scanty grasses.

### 4.2.3 Spatial organization

The administrative block consists of offices of the principal, vice principals staff room and toilets arranged in a row accessed from a veranda. The block on the left houses classrooms for Radio and television repairs; plumbing and pipe fitting; and tailoring and knitting while the third block in the administrative unit houses classrooms for basic general training. The workshops at the training unit comprises of 2 working stations and 2 offices each accessed from verandas on both front and back while the last block comprises of three classrooms.




Plate III Showing classroom and parking

Source: Authors field work, 2016



Plate IV Classroom block

Source: Authors field work, 2016

### 4.2.4 Merits

1. Provision of a learning environment for students

### 4.2.5 Demerits

1. There are no covered walkways linking each facility to the other thereby exposing the disabled persons to the mercies of the weather.
2. Some blocks have ramp with no standard gradients Basic macro-accessibility provisions were not considered especially in the planning and design of interior spaces.
3. Lack of recreational and therapeutic facilities like playing courts and swimming pools respectively has created imbalance in the Centre's curricula.

## 4.3 Case Study Two: Institute for Youth Development; Sani Abatcha Youth Center, Kano State

### 4.3.1 History and Development

The Sani Abatcha Youth Center, Kano State is a governmental body that was established in 1993. It is located at 3 km Madobi road, Kumbotso, Kano State. It offers certificates in eight trades; comprising of six conventional trades and two non-conventional trades. The conventional trades consist of motor mechanics; electrical and installation; carpentry and joinery; welding and fabrication; plumbing and pipe fitting, radio and television repairs; with training duration of three years. The non-conventional trades consist of tailoring, shoe making and knotting, which lasts for one year. The basic entry requirement is a minimum of primary school leaving certificate.



Plate V Approach view of Admin block showing lack of ramps

Source: Authors field work, 2016

The major facilities in the centre are: an administrative block comprising of the manager's office, accounts office, a staff room. The classrooms, workshops, dormitory block, swimming area, multi-purpose hall and parking spaces make up other facilities on the premises.

### 4.3.2 Site planning and landscaping

The Centre comprises of Administrative unit and training unit. The administrative unit consists of one building. The training unit consists of two blocks of workshops and a single block of classrooms which are far apart west-east direction. The Workshop units has significant number of trees, shrubs and grasses around it while the classroom unit has very few tress and a lot of bushes grasses.



Plate VI Entrance of tailoring section

Source: Authors field work, 2016

### 4.3.3 Spatial organization

The administrative block consists of offices of the Manager, Protocol officer, accounts office, staff room and toilets arranged in a row accessed from a veranda. The block to the left of the admin houses the multipurpose hall. To the back of the admin are classrooms and tailoring and knitting block. To the right workshops for Radio and television repairs; plumbing and pipe fitting; electrical works. The workshops at the training unit comprises of 2 working stations and 2 offices each accessed from verandas on both front and back while the last block comprises of three classrooms.



Plate VII Multipurpose hall showing absence of raked floor

Source: Authors field work, 2016

### 4.3.4 Merits

1. Provision of recreational and therapeutic facilities like swimming pools has created a balance in the Centre's curricula.

### 4.3.5 Demerits

1. There are no covered walkways linking each facility to the other thereby exposing the disabled persons to the mercies of the weather.
2. Basic macro-accessibility provisions were not considered especially in the planning and design of interior spaces.

## 4.4 Interview: The Kano State Disability Association Headquarters

### 4.4.1 History and Background

The Kano State disability association is a non-governmental body that was born in 1986. Their headquarters is located along Murtala Muhd way, Kano State. The association comprises of the deaf, blind, albinos and the mobility impaired. The association has a registered number of members of 2852; 851 who are female and 2001 are male.

The mobility impaired section offers training in welding and joinery and they sell their products as a source of income. The basic requirement to be taught the trade is a commitment to abandon any form of begging in whatever form.

The major facilities in the center are: a *masjid*, display area and workshop area.

### 4.4.2 Site planning and landscaping

The masjid serves as an administrative unit which consists of one building. The training unit consists of an open space. The display area has significant number of trees.

### 4.4.3 Merits

1. Provision of a training for members to earn a living

### 4.4.4 Demerits

1. There are no covered walkways linking each facility to the other thereby exposing the disabled persons to the mercies of the weather.

## 4.5 Data Analysis of Survey

The main objective of this study was to ascertain and gather information on the existence of any accessibility conflicts experienced by the mobility impaired resulting from incompatible use of accessibility features together with other groups of people. Information that was gathered from the survey was carried out based on three main questions which included:

1. Bio data of respondents
2. Knowledge of accessibility features such as stairs, lifts and ramps
3. Knowledge on accessibility design concepts
4. Adequacy of accessibility features in the skill acquisition centres

After the data was collected, the semi-structured questionnaire was structured with responses coded using the Likert scale. It is a psychometric response scale primarily employed in questionnaires to obtain preferences or degrees of agreement with a statement or set of statements (Bertram, 2007).

A format containing 5 options (strongly agree, agree, neutral, disagree and strongly disagree) was used. Respondents were requested to indicate their level of agreement to a given question.

The primary data collected from respondents of questionnaire was analysed and presented in tables and charts.

### 4.5.1 Backgrounds of respondents

Respondents were divided into two main groups: Questionnaire respondents and Interview respondents. These two groups were further broken down to two main categories namely; male and female; Non-Ambulatory and semi ambulatory impaired.

1. Questionnaire

Of all the 100 questionnaires given out, 89 were filled, 63 were male and 26 were female. All respondents questioned were literate. 65 of them had received education up to primary school certificate, 12 had education up to secondary school leaving certificate and 12 had studied to tertiary institutions. 45 respondents are from Kano, 24 from Kaduna, 8 from Jigawa, 4 from Katsina and 2 from Gombe. 5 from Sokoto and 1 from Borno states.30 are married, 35 are single, and 10 widowed and 14 are divorced.

2. Interview

Out of 10 people interviewed, 6 had mobility impairments and 4 were able-bodied respondents. Of all those interviewed, 6 out of 10 had had tertiary education, 3 had senior secondary education, 1 had education up primary school certificate. The number of respondents in the various educational levels mentioned above is shown in table 4.1.

Table 4.1Types and Assistive Devices used by Respondents with Disabilities

| **Respondents** | | **Educational Background of Respondents** | | | | **Total** |
|---|---|---|---|---|---|---|
| | | Illiterate | Primary leaving cert. | Secondary leaving cert. | Tertiary institution | |
| Questionnaire | Mobility impaired | none | 65 | 12 | 12 | 89 |
| Interview | Mobility impaired | none | 1 | 1 | 4 | 6 |
| | Able bodied | | 0 | 2 | 2 | 4 |
| TOTAL | | | | | | 99 |

From table 4.1 it shows that all 89 students who responded to the questionnaire had mobility impairments. Out of the 89 disabled, 53 were traditional tricycle users, 8 roller wheel users, 22 were crutch users, 6 had braced legs, and 2 limped without the use of assistive devices. 6 people interviewed had mobility impairment.

Table 4.2 Assistive devices and limitation of mobility impaired

| S/N | Assistive device used | Number interviewed | Functional limitation |
|---|---|---|---|
| 1 | Wheelchair | 3 | In ability to walk, difficulty in reaching heights, difficulty in mounting toilet facilities without aid |
| 2 | Tricycle | 55 | In ability to walk, difficulty in reaching heights, difficulty in mounting toilet facilities without aid |
| 3 | Crutch user / walker | 23 | Difficulty in smooth movement, difficulty in bending |
| 4 | Braced legs | 6 | Difficulty in smooth movement, difficulty in sitting and bending and reaching heights |
| 5 | Walking stick | - | Difficulty in smooth movement |
| 6 | Roller wheel | 8 | Inability to walk and difficulty in reaching heights |
| 7 | Without assistive device | 2 | Difficulty in smooth movement and reaching heights |

### 4.5.2 Opinion of respondents on adequacy of accessibility features

Four set of question were asked to have an in depth understanding of how adequate the accessibility features provided for in their various schools were.

1. The location of classes and workshop are okay;
2. The position of the stairway is suitable;
3. The toilets are easily accessible;
4. There is an adequate provision of ramps

Table 4.3 Respondents Satisfaction Index

| Question | Respondents satisfaction index (R.S.I) | Percentage of total R.S.I |
|---|---|---|
| Q1 | 0.41 | 41% |
| Q2 | 0.50 | 50% |
| Q3 | 0.32 | 32% |
| Q4 | 0.33 | 33% |

### 4.5.3 Knowledge on Accessibility Design Concepts

The following was obtained when both able-bodied and disabled people were ask about knowledge of some accessibility design concepts such as Universal, Barrier-Free Living, Inclusive Design and Adaptable Design Concepts:

Out of the 89 questionnaire respondents who were disabled, only 23 had knowledge about Universal and Inclusive Design concepts. 8 interview respondent out of the 10 had knowledge about Inclusive Design Concept.

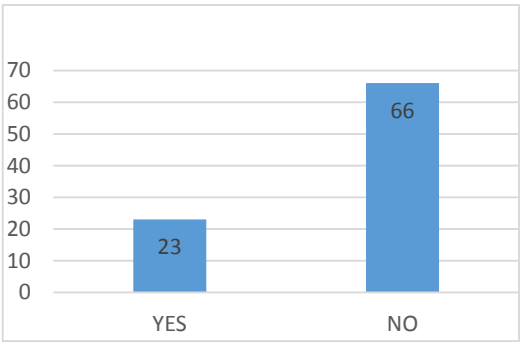



Figure 4.1Questionnaire respondent's knowledge on accessibility concepts

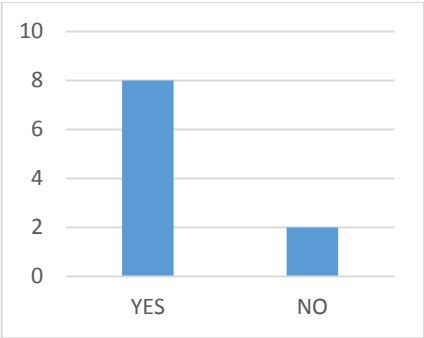



Figure 4.2 Interview respondent's knowledge on accessibility concepts

Source: Authors field work, 2016

### 4.5.4 Awareness and knowledge of specific accessibility features

All the respondents interviewed displayed knowledge about accessibility features and were able to mention a few. These ranged from the use of assistive devices such as wheelchairs, clutches and sticks to the provision of accessibility features such as ramps, stairs, large circulation spaces, and car- parks for the disabled, hand and guard handrails, accessible toilet facilities, bathroom spaces, sinks and faucets.

To answer this the following questions were asked;

Do you know anything about the following accessibility features (lifts, ramps, and stairs)???

Of all the accessibility design features mentioned during the survey, ramp had the highest tally followed by stairs, and then lifts respectively.

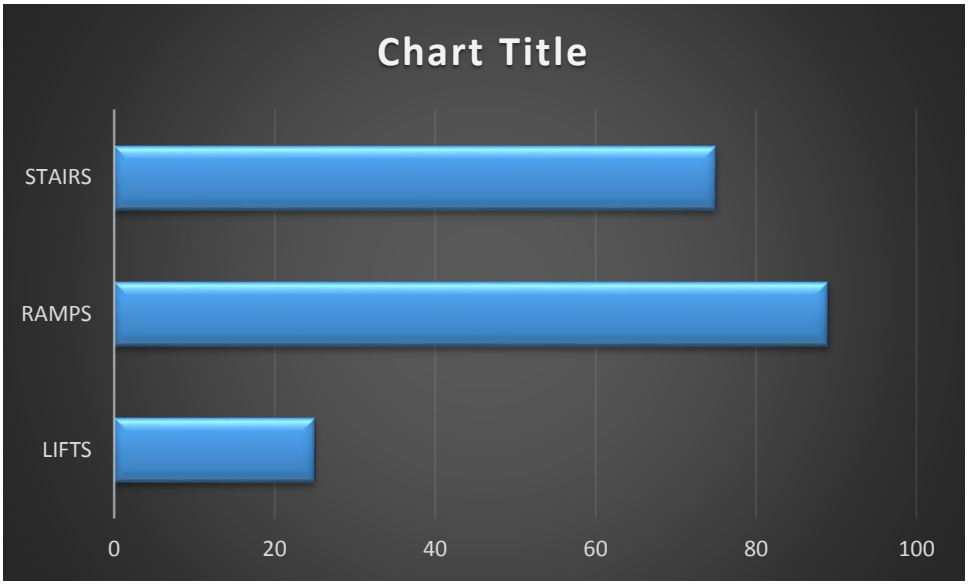



Figure 4.3 Respondents Knowledge on accessibility features

Source: Authors field work, 2016

### 4.5.5 Problems with the use of accessibility design features

Problems with the use of some accessible features given by the respondents were;

1. Difficulty faced by the wheelchair user with the use of improperly designed ramps
2. Problems with broken-down and obsolete features like accessible faucets.
3. Sections of the non-slip tiles on the corridors had undergone wear and tear over the years of exposure to the weather thereby posing movement problems to wheelchair users.
4. No provision of space for helpers to be accommodated in the schools
5. Unhygienic environment for people with roller wheeler because they are in constant contact with the floor
6. Getting to their rooms
7. Getting to other floors
8. Using toilet facilities
9. Reaching heights

### 4.5.6 Type of skill respondents will be willing to learn

Respondents were ask to list the possible areas of trade they would be interested to learn. The following skills were listed;

1. Tailoring
2. Knitting
3. Soap making
4. Shoe making
5. Tie & dye
6. Carpentry
7. Plumbing
8. Computer appreciation and
9. Electrical works

### 4.5.7 Recommendations from Respondents

Recommendations on accessibility features proposed by respondents were:

1. The need for gently sloping ramps,
2. The need for sheltered walkways,
3. The need for more spaces to expand their technical-vocational training scope,
4. The need for funds to rehabilitate broken down facilities.

## 4.6 Discussion of Results

The discussions summarize issues on general findings from case studies and survey research. Recommendations from users of accessible features in the institutions under study, any conflicting accessibility situations as well as lessons to be drawn from the studies are also discussed.

To address Research question one, Quantitative analysis were employed in the form of survey questionnaire soliciting demographics data (gender, User type state of origin,

marital status, Age, occupation, highest educational status, Type of mobility impairment). 100 questionnaires were distributed for the survey; 50 in Kano and 50 in Kaduna states. 89 were returned; 46 were returned in Kano whilst 43 were returned in Kaduna. This produced retrieval rates of 92% and 86% respectively. Specifically, the following statistical procedure was employed to answer the research questions.

For research question two, which addresses issues of user satisfaction of accessibility features, respondents were requested to specify which types of accessibility features were provided for in their schools and how satisfactory they were from documented types of accessibility features observed in the schools using a 5 scale Likert responses. To further address research question two regarding the satisfaction level of respondents with accessibility features, two sets of analysis were carried out. The first was to obtain the Relative Satisfaction Index (RSI) of some functional space. This is computed as a ratio of the sum of actual satisfaction scores (SSac) and the maximum possible satisfaction scores (PSSmax) on a 5-point Likert scale for each functional space (Ibem, Opoko, Adeboye and Amole, 2013). Mathematically, this is expressed as:

$$RSI=\Sigma SSac/\Sigma PSSmax1.$$

A space is considered satisfactory if RSI > 0.5 in this study.

Research question three sought to find out Knowledge of accessibility concepts and features, awareness and knowledge of accessibility features. Results are presented as frequencies and percentages.

Research question four sought to find out the possible conflicts of interests identifiable in instances where two or more physically disabled people are to be catered for at the same time in a particular environment. Possible conflicts of interest identified were

already identified in literature reviewed, so this just went further to prove true that they are a general problem in inclusive design.

### 4.6.1 Research question one

What are the mobility aid devices widely used by people with mobility impairment in Kano?

According to Disability Association of Kano State, it reveals that there are about 3000 people registered; 855 women and children and 2145 men. The association comprises of the deaf, blind, dumb, albinos and the mobility impaired. The mobility impaired are 620 persons. Table 4.7.2 below reveals that 489 people use either a wheelchair or the traditional tricycle that is 68.87%. 87 people use crutches as a mobility aid with 14.03%, followed by walking stick users and roller wheel users with 6.1% and 10.3% respectively. Lastly, 0.7% of the registered people do not use any kind of mobility aid. These findings indicates that majority of those registered with mobility impairments in Kano prefer to use a wheel chair to other assistive devices even if the degree of their disability has not reached a state that require the use of a wheel chair.

Table 4.4 % of Kano registered mobility impaired persons

| Mobility aid used | Number of Registered mobility impaired | % of Registered mobility impaired |
|---|---|---|
| Wheel chair | 489 | 68.87% |
| Crutches | 87 | 14.03 |
| Walking stick | 38 | 6.1% |
| Roller wheel | 64 | 10.3% |
| None | 5 | 0.7% |

The research unveils that the most common mobility aid used by the disabled in Kano State is a wheel chair. The study further reveals that about 90% of the wheel chair users do not use the conventional type, rather they use a modified version of a tricycle which

is fabricated locally in different size. This is to say that the standard accessible features adopted from the United Kingdom, United States and Europe does not fit with the mobility aid used locally by Nigerians



Plate VIII A traditional tricycle

| S/NO | ITEMS | UK BS 8300 | USA (ADAAG) | FIELD STUDY | S.D |
|---|---|---|---|---|---|
| | **STATIC ANTHROPOMETRIC** | | | | |
| 1. | UNOCCUPIED WIDTH | 750MM | 660MM | 650MM | |
| 2. | OCCUPIED WIDTH | 800MM | 760MM | 650MM | * |
| 3. | UNOCCUPIED LENGHT | 1200MM | 1065MM | 1750MM | ** |
| 4. | OCCUPIED LENGTH | 1250MM | 1220MM | 1750MM | ** |
| 5. | TOTAL SEATED HEIGHT | 490MM | 485MM | 450MM | * |
| | **FUNCTIONAL ANTHROPOMETRIC** | | | | |
| 1. | REACH - FORWARD HIGH<br>LOW | -<br>- | 1220MM<br>380MM | -<br>- | ** |
| 2. | REACH - LATERAL HIGH<br>LOW | 1170MM<br>665MM | 1370MM<br>730MM | 1175MM<br>660MM | * |
| 3. | MANEUVERING WIDTH 90 L-TURN<br>CIRCULAR DIAMETRE 360-TURN | 1450MM<br>1600MM | 915MM<br>1525MM | 1700MM<br>2100MM | ** |

Figure 4.4 the comparison the local tricycle and the international standards

The analysis of the anthropometric shown in fig 4.4 show a significant differences between the local tricycle and the standards provided by the BS8300 and the ADAAG.

Imrie (2002) opines that the standards of accessibility features are dependent on the type of mobility aid largely used within a society. Furthermore, findings from conducted interview with the disabled also agree that the standard adopted does not fit for the modified wheelchair use.

### 4.6.2 Research question two

How adequate do the various accessible features meet the need of the ambulant impaired persons in skill Acquisition centres?

#### 4.6.2.1 Studies on standard features of accessibility design

Appraisal of institutions under case studies took the following minimum accessibility guidelines into consideration.

1. Entrances and parking spaces

a. Short route to entrance and covered or protected with any ramps or steps carefully detailed (Mace, 1991)

b. Avoidance of change in levels as possible (Thorpe, 2008)

c. Parallel parking space with outside limits aligned with the outside edge of the adjacent standard size parking space (Peloquin, 1994)

d. Accentuated doors for identification & personalization (Cohen & Weisman, 2013)

e. Accessible entrances should be clearly identified using the international symbol of accessibility including alternate locations of accessible entrances (UN, 2015).

2. Stairs

    a. Circular stairs and stepped landings should be avoided (UN, 2015)

    b. Open risers are not recommended (UN, 2015)

    c. The length of the landing should be at least 1.20 m extending along the full width of the stairs (UN, 2015)

    d. Sharp edges and overhanging nosing should not be used for treads (UN, 2015)

    e. Nosing should be flush or rounded and should not project more than 40 mm (UN, 2015)

    f. On stairways, windows positioned less than 1.00 m from the landing should have railings (UN, 2015)

3. Ramps and Railings

a. The minimum width should be 0.90 m. and the maximum recommended slope of ramps is 1:20 (UN, 2015)

b. The landing should have a minimum length of 1.20 m and a minimum width equal to that of the ramp (UN, 2015)

c. A protective handrail at least 0.40 m high must be placed along the full length of ramps. (UN, 2015)

d. A ramp with drop off that has a vertical change in elevation 2" or greater or a slope greater than 2 in 12 shall require a handrail (Peloquin, 1994)

4. Edge Treatment and Thresholds

a. Thresholds as near levels as practicable, with a maximum overall height of 15mm and with a tapered good section (Thorpe, 2008)

b. Changes in level one-quarter of an inch or less do not require edge treatment (Peloquin, 1994)

c. Changes in level greater than half an inch require ramped surface with a 1:12 maximum slope (Peloquin, 1994)

5. Doors and Doorways.

   a. Wide, passable doorways that provide at least a 32-inch, clear opening as shown in Appendix H (Mace, 1991).

   b. Accessible doors requiring minimal effort to close or open and requiring 30N maximum of opening pressure (Mace, 1991; Thorpe, 2002).

   c. The use of toggle, knurled, roughened or carborundum-epoxy coated round doors knobs are however acceptable for use in restricted or hazardous areas (Peloquin, 1994)

   d. The edges of a glass door should be apparent when the door is open (Demesne, 2009)

e. Added second handle or pulling device (Mace, 1991).

6. Windows

a. An accessible window with a minimum space of about 2'- 6"× 4'- 0" available at each window for maneuvering (Peloquin, 1994)

b. Window sills positioning between 18" (46cm) and 36" (91cm) above the floor so that a seated person can easily open or close the handle as shown in Appendix I (Mace, 1991)

c. Windows to be used as fire exits, with at least 30" (76cm), wide enough to permit a person to go through in an emergency (Mace, 1991).

7. Light and gadget controls

   a. Light switches, thermostats, electrical receptacles, faucets, and other controls should be mounted between 9 inches and 48 to 54 inches above the floor (depending on the direction of approach) and operable with one hand (Mace L. , 1991)

   b. The use of lever type or push-button faucets for especially people with limited use of hands and arms (UN, 2015).

8. Kitchens Worktops, Cabinets and Storage Areas

   a. A minimum clear floor area of 2'-6"×4'-0" (76cm×122cm to be provided in front of every appliance and cabinets to reach the knobs and controls.

   b. Minimum knee spaces of 30" (76cm) wide, 27" (69cm) high and 19" (48cm) deep is needed under sinks, countertop segments, cook tops allow them to pull up under the work surface, sit close enough to reach items and work comfortably (Peloquin, 1994)

   c. Provision of some counter segments at standard heights and some at lower heights.

d. Drawers that are deep, extend the full depth of the base cabinets, and are mounted on full extension slides make the best use of available storage space.

e. Swinging retractable cabinet door hardware can make it possible to conceal knee spaces (Peloquin, 1994)

9. Bathrooms

a. Bathrooms should have slip resistant flooring, flush detailing of drainage and junctions between surfaces and spaces, easily reachable positions of controls and fittings as well as adequate space for manoeuvring(Thorpe, 2008)

b. 3 x 3 foot size with a seat to allow transfer, or a roll-in shower that can accommodate a person in a wheelchair (Mace L. , 1991)

c. Bathrooms with independent transfer units such as grab bars, transfer surfaces, hydraulic seats and renewable seats or assisted transfer units such as boom lifts or overhead track lifts (UN, 2015).

10. Floor finishes

a. The use of flooring materials like solid hardwood, ceramic tiles, vinyl, linoleum, brick and stone (Peloquin, 1994)

b. Carpets should be avoided in places where wheelchairs will be used (Peloquin, 1994)

c. Non-slippery flooring surfaces (Cohen & Weisman, 2013).

11. Bedroom

a. Adequate manoeuvring space around beds as wells as appropriate assistive

devices should be provided to facilitate access to all facilities (Mace L. , 1991).

Firstly, the Sani Abacha Youth Centre was found to have a limited quantity of accessibility features. Accessibility facilities such as walkways linking all building facilities on site and ancillary facilities like basketball playing areas, swimming pool and therapy centers to cater for the health, recreational facilities were found to be nonexistent. There was also the problem of improper design of some accessibility features in addition to broken down accessibility features requiring maintenance.



Plate IX showing ramp not provided



Plate X Showing swampy environment

Most access ways were found not conforming to laid-down standards. Standard sizes of doors where not used, therefore new designs should demonstrate strict adherence to anthropometrical, construction and engineering standards. The need to design accessible spaces with adjustable furniture, accessible equipment and user friendly finishes was also realized. An interview with the administrator revealed inadequacy of funds as the main challenge to the provision of modern accessibility facilities for the institute.

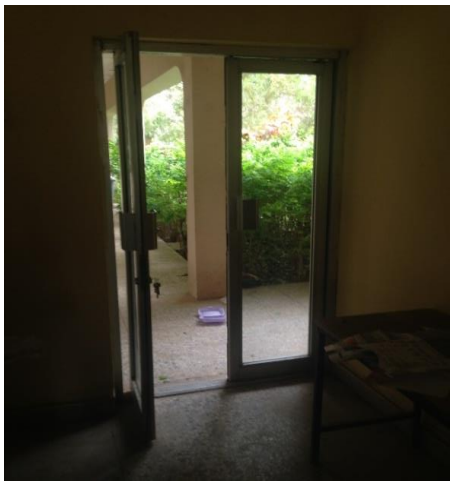


Plate XI Showing access door



Plate XII Showing high platform

Lessons that could be taken from case study of the Fukushima Prefectural Koriyama School for the Physically Handicapped include the use of indigenous materials in our local designs. A survey of the location of Sani Abatcha youth Centre revealed abundance of laterite-soil in the area which could have been used to produce bricks for construction, thereby giving the sheltered centre an organic look. In addition, the involvement of all stakeholders, mainly the design team together with the users of the Fukushima Prefectural Koriyama School for the Physically Handicapped presents another lesson regarding sensitivity to accessibility, ergonomic and pedagogical needs of building users.

4.6.2.2 Opinion of Respondents on Adequacy of Accessibility Features

Research question two aimed at finding out how adequate the various accessible features met the need of the ambulant impaired person ns in skill Acquisition centres. The least satisfactory spaces with RSI well below approximately 0.5 are functional spaces notably location of class rooms and workshops, accessibility of toilets and adequacy.

Table 4.5 Comparism of R.S.I of Accessibility features

| Question | Respondents satisfaction index (R.S.I) | Percentage of total R.S.I |
|---|---|---|
| **Classrooms/workshops** | 0.41 | 41% |
| **Stairs** | 0.5 | 50% |
| **Toilets** | 0.32 | 32% |
| **Ramps** | 0.33 | 33% |

This finding may not be unconnected with results from previous studies that most problematic spaces occur between stairs, ramps and toilets (Kyei-Dompim, 2010). This re-iterates the need for flexible inclusive designs (Imrie, Disability and the City, 1996).

A Respondents Satisfaction Index of 0.39 was gotten which indicates that it is below the bench mark of RSI > 0.5 set for this study. This implies that the users are not satisfied. Interview respondents were asked about their opinion on adequacy of accessibility features. Opinion of the respondents vary in 2 categories. 8 (80%) out 10 (100%) respondents are of the opinion that there are no provisions or concerns in design for people with mobility impairment in public buildings. However, 2 (20%) respondents are of the opinion that there are provisions in some public buildings but mostly they are inadequate or poorly accessible. No respondent had the view or opinion that the provisions if any are adequate

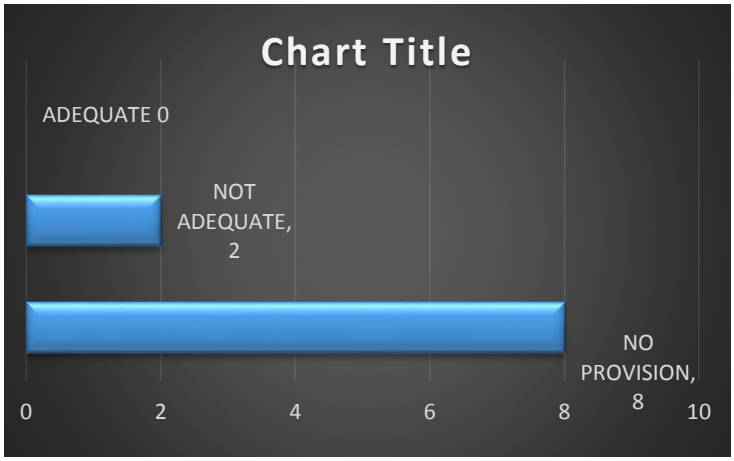



Figure 4.5 Opinion of interview respondents on adequacy of accessibility features

Source: Authors field work, 2016

### 4.6.3 Research question three

What are some mobility-impaired persons' perceptions or responses and experiences of some accessibility features in selected "accessible" buildings or institutions? Questionnaire

First of all, the questions here sought to find out the knowledge base of respondents about accessibility and then their perception and experiences. These were sub divided into two questions to have an in-depth understanding of their responses.

a) Knowledge on Accessibility Design Concepts

The survey research sought to find out the knowledge base of both able-bodied and people with disabilities on accessibility design issues revealed limited knowledge on issues regarding architectural model of accessibility creation. In addition, the fact that most respondents were not aware of accessibility concepts and some standard on design guidelines means that much education on accessibility has to be made. As shown in fig.4.2, 64% of the respondents had no knowledge of accessibility concepts or

were not sure what it entailed. 36% had some knowledge of what inclusive design entailed.

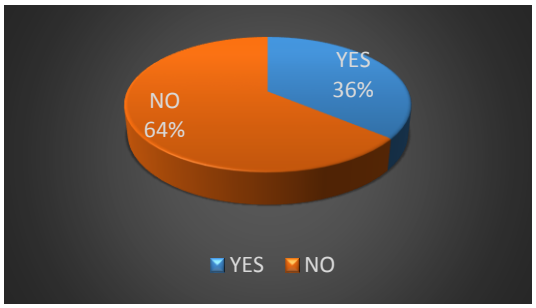



Figure 4.6 Knowledge on Accessibility

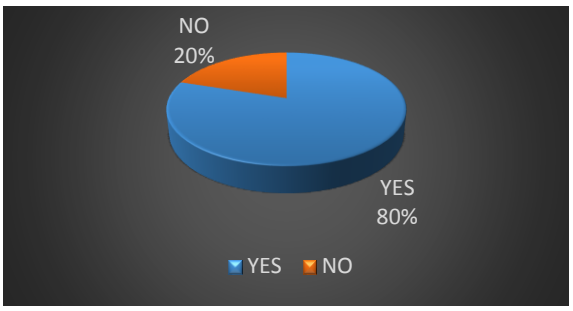



Figure 4.7 Knowledge on Accessibility

Although it is hard to find most accessibility products and design features such as tactile pavements in our developing world, the respondents who were disabled seem to be aware of the few basic ones such as ramps, stairs, guardrails and sanitary facilities which they see around them. The study further revealed that the users had no in-depth knowledge on accessibility facilities. They were able to mention not more than three accessibility facilities that are the most common such as ramps, staircases and lifts.

b) Awareness and Knowledge of Specific Accessibility Features

As was shown in fig.4.3, ramp at 42% was the most known by the respondents, followed by stairs at 37% and lifts at 21% respectively Common accessibility features mentioned by able-bodied respondents were assistive devices such as wheelchairs and crutches.

Comparatively, over 95% of respondents within the Sani Abatcha Youth center were found to be more informed on issues of accessibility design features while able-bodied interview respondents showed the least knowledge on it. This may be attributed to the fact that most able-bodied respondents received little or no education on accessibility

issues. It was also clear that the type of information received were matters concerning social and ethical issues towards the disabled rather than accessibility features provision oriented.

Patricia (1998) opined that users (disabled) knowledge of accessibility features is increased by how often they physically use or find those features in buildings. In this regard, it is not surprising that this may be attributed to the fact that most able-bodied respondents received little or no education on accessibility issues. It was also clear that the type of information received were matters concerning social and ethical issues towards the disabled rather than accessibility features provision oriented. The findings of the study further reveals that the users are of the opinion no provision or consideration is given to the disabled during design. Patricia (1998), furthermore corroborates this issue where she insist that users (disabled) are mostly not contacted in design of public facilities and that user preferences in changes with respect to time and the mobility aids newly discovered.

### 4.6.4 Research question four

What are the possible conflicts of interests identifiable in instances where two or more physically disabled people are to be catered for at the same time in a particular environment interview?

Data regarding conflicts of interest regarding the use of accessibility design features and products were found to be so meagre to be ignored by the inmates of Sani Abatcha Youth Centre. A few notable ones were related to ramps and height of certain facilities. This could be attributed to the inadequate accessibility features in the institute.

### 4.7 Possible Conflict of Interests from the use of Accessible Features with Others

The conflicting areas revealed by respondents with the use of accessibility features and products are as follows;

1. Steep ramp, which are >1:10 are difficult for the mobility impaired to negotiate but are quite manageable for mobility impaired people whom do not use assistive devices,
2. Access to heights of storage areas and toilets; bending (200mm-400mm), sitting(900mm-1200mm), standing (1200-1500mm) pose problems to the wheelchair while low storage pose problem to the person with spinal deformity.
3. Stone-chippings and exposed loose stones >5mm in front of the administration block and forecourt compels the wheelchair user to exert more energy to gain momentum. At the same time, while able-bodied people and a section of walking mobility impaired find no problem with them, they tend to pose problems to the crutch users who walk on them.

### 4.8 Accessibility Conflicts Resolution Measures

1. Roofed walkways with ramps of gradients as low as 8%
2. creation of ramps with durable non-slip surfaces
3. Avoidance of change in levels as possible
4. Inclusion of stairs with properly design handrails together with ramps
5. Creation of storage room close to sanitary facilities to accommodate adjustable toilet seats
6. Avoidance of loose stones or cobbles as hard landscaping elements at circulation areas
7. Doors and window ways designed slightly above standard

8. Provision of some counter/worktop segments at standard heights and some at lower heights
9. Provision of hardware such as cabinets with adjustable features where necessary
10. Adequate manoeuvring spaces at circulation point
11. Provision of wide and well lit corridors around stair areas

# 5.0 SITE REPORT

This chapter and the subsequent chapters deal with the application of the research findings into the design aspect of the thesis. This chapter discusses the preliminary study on the design and it's arranged under the following headings: the brief; design case study; schedule of accommodation; spatial arrangement; site location and selection; site analysis; and conclusions

## 5.1 The Brief

The proposed skill acquisition centre shall be viewed as a design thesis proposal, which would house facilities to cater for the mobility impaired.

The proposed building shall be units of integrated complex functions, which is hoped to be a manifestation of various enhancing factors to aid the economy of Kano state and to elevate the image of the city in our ever-evolving world. The general objectives of the proposal are:

i. To incorporate the findings of the research thesis in the proposed design.
ii. To increase the productivity by enhancing social interaction within and around the centre.

### 5.1.1 The clients brief

Disability awareness has steadily increased in most part of Nigeria. Researchers have shown that people physically challenged have talents which could be improved by training them to become useful citizens in the society. However, Nigeria is faced with the problem of scarce intervention facilities for people with mobility impairment. As such a Non-Governmental Organization (NGO) has commissioned the design of a skill acquisition Centre in Kano to provide vocational facilities for mobility impaired individuals in the north western region of Nigeria. The centre will provide both

boarding and day facilities for about 100 students with a curriculum focusing on learning skill such as mechanical works, plumbing, tailoring e.t.c.

The Centre will comprise of the following facilities to cater for administration, skill acquisition and accommodation.

i. Reception: a reception and waiting area with display facilities is required for visitors adjoining the main office
ii. Director's office: separate office should be provided for the executive head of the centre.
iii. Asst. Director's office: separate office should be provided for the deputy head of the centre.
iv. Secretary's office: this is a room provided for the secretary who could serve both the director and assistant director. The room also serves as waiting area for visitors
v. Records room: a room for storing confidential documents of students.
vi. Account office: a room where payments are made and documented
vii. Staff room: where staff preparation and resource facilities are provided. It is largely social in character and should be adaptable for meetings and staff conferences.
viii. Training room: a room for staff trainings and seminars to be delivered by specialist to help acquaint them on how to help their students.
ix. Workshops: these are spaces for vocational skill acquisition comprising various trades from which each student could identify their preference.
x. Stores: storage spaces for workshop materials.
xi. Dormitory rooms: these are rooms to be provided as boarding facility to accommodate the users.

xii. Multipurpose Hall:

xiii. Sports facilities

xiv. Library

xv. Cafeteria

xvi. Sick bay

## 5.2 Scheme Definition

The scheme entails a systematic study and analyses of special institutions leading to the design of an Institute for Technical and Vocational Studies for the physically challenged. The proposed project will be located in Kano metropolis. In the North-western region of Nigeria.

### 5.2.1 Project location

Kano state is located in the northern part of Nigeria. It is situated 205 km north of the capital city, Abuja. Kano state borders Katsina state to the north-west, Jigawa State to the north-east, Bauchi state to the south-east and Kaduna State to the south-west. It occupies land area of approximately 20,131 kilometre square. It's composed of 44 local government areas. Kano is a city in Nigeria and the capital of Kano State in Northern Nigeria, in the Sahelian geographic region south of the Sahara. Its metropolitan population makes it the second largest city in Nigeria. The Kano urban area covers 137 km2 and comprises six local government areas (LGAs) — Kano Municipal, Fagge, Dala, Gwale, Tarauni and Nassarawa with a population of 2,163,225 at the2006 Nigerian. The metropolitan area covers 499 km2 and comprises eight LGAs — the six mentioned above plus Ungogo and Kumbotso — with a population of 2,828,861 at the 2006 Nigerian census and a growth rate of 5%.

The study area is located within the Sudan savannah region of Northern Nigeria with two distinct climate as recorded in Northern Nigeria; rainy season and dry season. Rainfall starts from the month of April and ends in October. During this time temperature ranges between 35oC to 45oC in the afternoon and drop down to 20C to 25oC in the night. The dry season begins in the month of November when the northeast wind bring harmattan dust and the temperature falls to about 180C during the day and could be down to 140C to 150C at night. The weather is generally favourable all year round. Vegetation is typically that of the Sudan savannah, characterized by isolated baobab and locust bean trees and shrubs. However, original vegetation has been greatly altered by human activities such as clearance for cultivation, buildings and so on.

## 5.3 Site Study and Analysis

### 5.3.1 Site location

The proposed site for the technical and vocational institute is located at Kano metropolis, a town in the northern part of in Nigeria. The site is located in the eastern part of Kano Metropolis lies within Latitude 11º 57’ 27.26” N and Longitude 8º 36’ 02.00” W. The total land size allocated for the site covers approximately 2900 square meter area. The Google image of the site is shown in figure 5.1.




Figure 5.1Google image of site, Source Google image, 2017

### 5.3.2 Site selection criteria and justification

Reasons why the site is deemed suitable for the proposed project are as follows;

1. The site earmarked for the facility has a very close proximity to the former skill acquisition centre. Its proximity to the centre is seen as an advantage.
2. The topography of the site permits advantageous planning and reasonable economic construction of facilities on site.
3. Infrastructure and utility services such as electricity and water are already available around the site.

**Strengths**

1. The site has a gently sloping topography to facilitate planning of facilities and circulation routes.
2. The site is easy to access from the major Maiduguri road.
3. The site is easy to locate.

**Opportunities**

1. The site is located in an area with infrastructure such as potable water and electricity already developed. It also has good soil for landscaping purposes
2. Advantage could be taken of the slope to discharge sewage.

**Threats**

a) The site is bordered by a major road and could be prone to noise pollution from passing vehicles on busy days.

### 5.3.3 Site's peripheral studies

The site is bounded in the north-west by Frawa quarters and the former Kano state legislative quarters in the north-east, to the south–east of the site is Ibrahim Kunya estate. To the south-western fringe of the site is a stretch of undeveloped semi-deciduous forest. The site is about 200 meters off the east Maiduguri Road. A few meters away

from the site are rapid development of new residential and commercial buildings. The site characteristics and analysis shall be based on the following factors and their associated to the basement complex geology of central Nigeria. The basement complex is dominantly granite but consist of same gneiss, schist and quartzite. The topsoil is rich and good judging from the thieving nature of the plants and trees growing on it. It is classified under the undifferentiated older alluvium and younger laterite.

### 5.3.4 Climatic analysis

For the purpose of this study, it is necessary to make a general study of the environment, thus outlining the climatological influence that affect the design within the locality of the site. Generally, environment could be regarded as the sum total of influence which modify and determine the development of life and/ or character. A good study demands that the environment will be analysed in relation to the climate of the area in question as this will invariably influence the final design. A proper study of the climatic factors that effects an area will equip the designer and enable him adopt new conventional solutions to the prevailing climatic conditions and problems.

The climate of Kano is typical of the guinea savannah. Two different types of air masses passes through Kano, one from the north mostly dry and dusty (continental in origin) blowing from the Sahara desert called the north-east trade winds and the other from the Atlantic in the south, brings rainfall, mostly cool and desirable for human comfort

I. Temperature

Fluctuations in daily November temperature are from 16 ºC to 33 ºC clear skies, visibility becomes poor and the sun's rays do not reach the surface. This lowers the minimum temperature to 13.2 ºC in January. Nights and mornings are cool but temperature increases 13 ºC to 38º C giving a variation of 25 ºC which is the highest

during the year. Maximum temperature occurs in April which reaches 38 ºC but generally does not last more than two to three months.

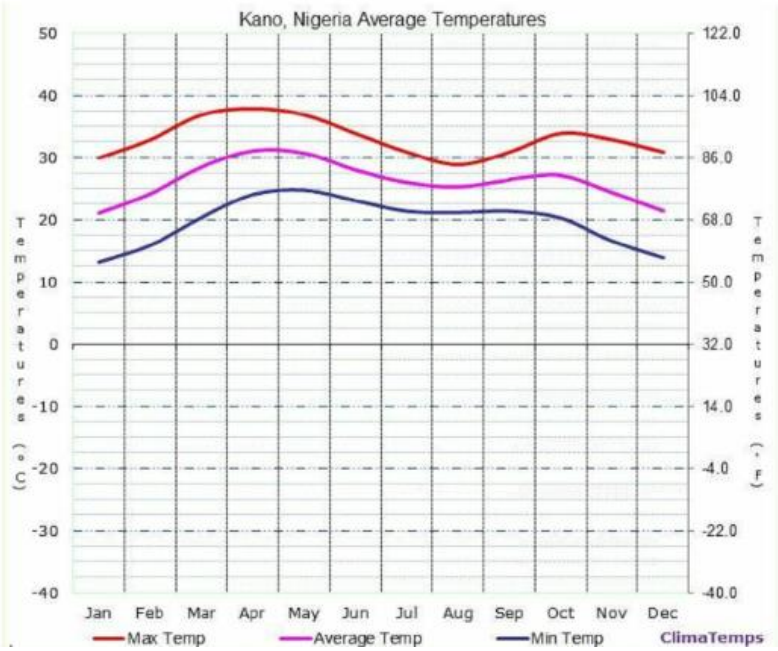



Figure 5.2 Kano Temperature chart

Source: Authors field work, 2016

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average Max Temperature °C (°F) | 30 (86) | 33 (91.4) | 37 (98.6) | 38 (100.4) | 37 (98.6) | 34 (93.2) | 31 (87.8) | 29 (84.2) | 31 (87.8) | 34 (93.2) | 33 (91.4) | 31 (87.8) | 33.2 (91.7) |
| Average Temperature °C (°F) | 21.2 (70.2) | 24.4 (75.9) | 28.7 (83.7) | 31.3 (88.3) | 30.9 (87.6) | 28.2 (82.8) | 26.2 (79.2) | 25.5 (77.9) | 26.6 (79.9) | 27.3 (81.1) | 24.6 (76.3) | 21.6 (70.9) | 26.4 (79.5) |
| Average Min Temperature °C (°F) | 13.2 (55.8) | 15.9 (60.6) | 20.4 (68.7) | 24.1 (75.4) | 24.8 (76.6) | 23.1 (73.6) | 21.4 (70.5) | 21.2 (70.2) | 21.4 (70.5) | 20.3 (68.5) | 16.6 (61.9) | 13.9 (57) | 19.7 (67.4) |

Figure 5.3 Kano Temperature chart

Source: Authors field work, 2016

II. Relative Humidity

At the start of the dry season, relative humidity falls from 68% in October to 36% in November with the stabilization of the easterly winds. It further falls to 35% in January and 20% in February. Mean relative humidity reaches its maximum value of 80% in the month of August.

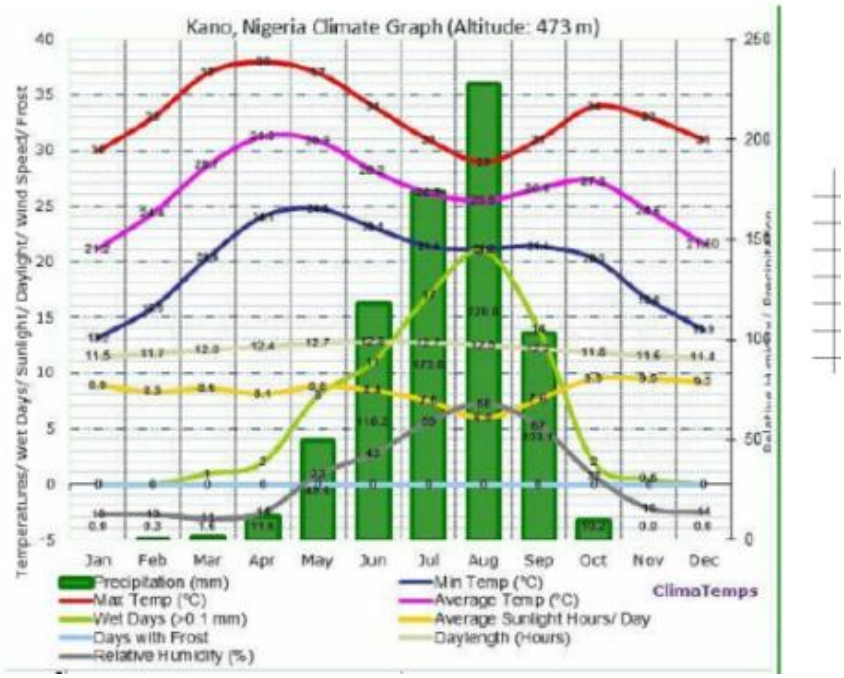



Figure 5.4 Relative humidity in Kano

Source: Authors field work, 2016

III. Sunshine

Kano being in the northern part of Nigeria has its sun movement from east through north to the south. The sun rises from the east and gently warms up to its maximum heat intensity in the afternoon. As the sun moves over to west its intensity witnesses a reduction till it is finally sets.

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average Sunlight Hours/ Day | 08:54 | 09:05 | 08:36 | 08:24 | 08:48 | 08:42 | 07:30 | 06:00 | 07:54 | 09:30 | 09:48 | 09:13 | 08:32 |
| Average Daylight Hours & Minutes/ Day | 11:29 | 11:43 | 12:02 | 12:23 | 12:40 | 12:48 | 12:44 | 12:30 | 12:10 | 11:50 | 11:33 | 11:25 | 12:00 |
| Sunny & (Cloudy) Daylight Hours (%) | 78 (22) | 78 (22) | 72 (28) | 68 (32) | 70 (30) | 69 (31) | 59 (41) | 48 (52) | 65 (35) | 81 (19) | 86 (14) | 82 (18) | 71 (29) |
| Sun altitude at solar noon on the 21st day (°). | 58 | 67.2 | 78.1 | 89.7 | 81.8 | 78.6 | 81.5 | 89.2 | 78.5 | 66.9 | 57.8 | 54.5 | 73.3 |

Figure 5.5 Sunshine chart of Kano

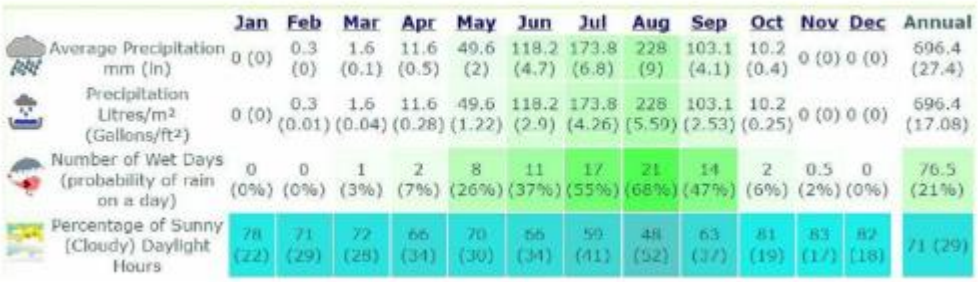
Source: Authors field work, 2016

The yellow section shows the average sunlight hours/day when the sun is up, and how this changes over the year. The average daylight hours/ day, and the sun altitude at

solar noon on the 21st day scale on the top and bottom, shows approximately when sunrise and sunset occur.

IV. Rainfall

Rainfall starts in April and increases from 118.2mm in June to 228mm in August to its maximum throughout the year. Annual total rainfall lies within a range of 505mm to 696.4mm.



| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average Precipitation mm (in) | 0 (0) | 0.3 (0) | 1.6 (0.1) | 11.6 (0.5) | 49.6 (2) | 118.2 (4.7) | 173.8 (6.8) | 228 (9) | 103.1 (4.1) | 10.2 (0.4) | 0 (0) | 0 (0) | 696.4 (27.4) |
| Precipitation Litres/m² (Gallons/ft²) | 0 (0) | 0.3 (0.01) | 1.6 (0.04) | 11.6 (0.28) | 49.6 (1.22) | 118.2 (2.9) | 173.8 (4.26) | 228 (5.59) | 103.1 (2.53) | 10.2 (0.25) | 0 (0) | 0 (0) | 696.4 (17.08) |
| Number of Wet Days (probability of rain on a day) | 0 (0%) | 0 (0%) | 1 (3%) | 2 (7%) | 8 (26%) | 11 (37%) | 17 (55%) | 21 (68%) | 14 (47%) | 2 (6%) | 0.5 (2%) | 0 (0%) | 76.5 (21%) |
| Percentage of Sunny (Cloudy) Daylight Hours | 78 (22) | 71 (29) | 72 (28) | 66 (34) | 70 (30) | 66 (34) | 59 (41) | 48 (52) | 63 (37) | 81 (19) | 83 (17) | 82 (18) | 71 (29) |

Figure 5.6 Rainfall chart for Kano

Source: Authors field work, 2016

V. Wind Pressure

In Nigeria there are two types of wind which prevails: Tropical Continental Air Mass and Tropical Maritime Air Mass. The tropical continental air mass (Harmattan wind) carries little or no moisture with it and therefore dries. This wind blows from northeast and predominantly prevails during the dry season. Its impact is more on the northern region of the country. The tropical Maritime air blows from southwest across the country and carries with it moisture (rainfall) which reduces from southern to northern region. This wind predominantly prevails during the wet season. The speed of both winds in Kano ranges from 93kph for month of March to 43kph for month of December. Higher speeds are sometimes recorded during harmattan period. Micro winds are occasionally generated by local air currents.

### 5.3.5 Site analysis:

I. Views and noise

The major origin of noise is from the neighbouring community, and from moving vehicles on the main road. Trees are to be planted close to these sources to buffer this effect. In planning, distance should be created between the facilities and this region with proper site zoning analysis. The best view of the site is at the east of the site, and the adjacent view to the east and south of the site is a large expanse of land for future expansion of the facility with abundant trees and grasses.

II. Soil, topography and vegetation

Eucalyptus and Mango trees are the predominant types of trees in the region, economically viable and shelter providing. They are to be maintained and planted where necessary but absent. Shrubs are scattered randomly across the site, and are to be maintained unless where it obstruct access, or development.

The soil type on site is Silt-clayed in nature, with clayed deposits at the lower point of the site. It supports all forms of vegetation, and retains water. It should therefore be utilized for plantings and water collection schemes.

The site slopes gently with slight undulations towards its southern and eastern direction. The lowest point on site is about 7 meters below the highest point.

## 5.4 The Effects of Environmental and Climatic Factors on Building Design

Natural climatic factors such as climate, geology and vegetation influence the lifestyle of the occupants and the design of a building landscape. For example, the two prominent trade winds influence orientation and design of buildings. The long span of buildings is oriented in a north and south direction. This is to reduce the effect of intense solar radiation from the east and west directions where sun rises and sets

respectively. The cropping season begins in May at the commencement of the rains. The porous nature of the soil condition dictates special consideration for foundation design and landscape design that considers conservation of natural features on site. To achieve an effective station design considerations on;

### 5.4.1 Temperature

Design should be such that;

1. Shading devices or mechanism should be employed- canopies, covered walkways, wide veranda and balcony
2. Water bodies like pool and fountain around and within the building should be provided for.
3. Shaded windows and openings to encourage good natural ventilation.
4. Minimum use of dark coloured materials outside and inside building to reduces absorption of heat and radiation.
5. Good orientation of building to take advantage of prevailing condition.

### 5.4.2 Rainfall

1. Roof form should encourage effective discharge of rain water.
2. Provision should be made for adequate drainage channel to avoid flooding.
3. Planting and paving should be used to discourage erosion on site.
4. Canopies, eaves, window hoods and veranda should be employed to prevent driving rain from building through external windows and openings.

### 5.4.3 Wind pressure

1. Proper bracing of the building structure to withstand strong wind is necessary.
2. Trees should be planted as buffers to reduce effects of wind on the building.
3. Good orientation of the building in relation to wind flow is necessary.

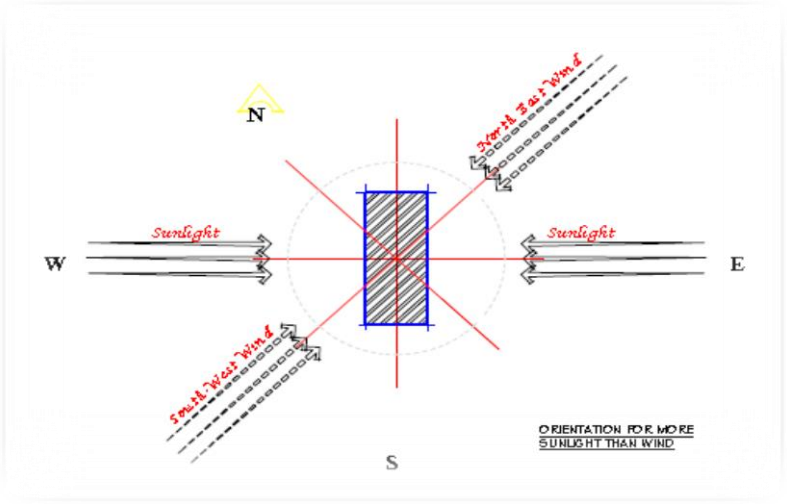



Figure 5.7 Orientation consideration: More wind than sunlight.

Source: Authors field work, 2016

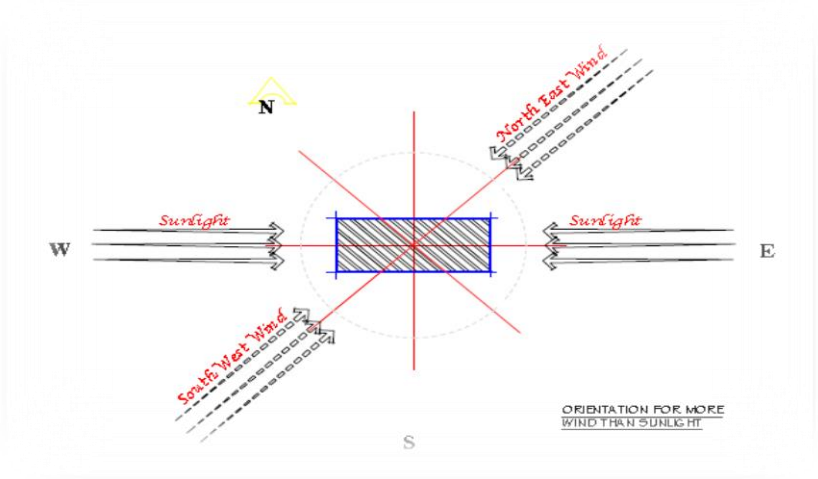



Figure 5.8 Orientation Consideration: More sunlight than wind.

Source: Authors field work, 2016

### 5.4.4 Solar radiation

1. Good landscaping is necessary to reduce solar radiation the outdoor exterior.
2. The use of sun shades and sun breakers is necessary in the building design.

3. Good orientation of the building on site and spaces in the building is important to take advantages of the sun radiation.

# 6.0 DESIGN REPORT

This chapter gives a report on the design of the proposed Technical Vocational Training Institute at Kano metropolis using the framework analysed in the previous chapter. The report will include both preliminaries and the actual design proposal. The report will be organized under the following headings: (a) Design Philosophy and Concept (b) Detailed Design (c) Design Brief (d) Schedule of Accommodation () Proposed Design and (i) Conclusion. It explains the effectives of the framework in three sections. Section one (Introduces the design (Design Brief), documentation of site as well as design requirements. Section two: basically document the features and application of design element and principles on the façade, elevation, finishing structure and fenestration

## 6.1 Design Philosophy

Since the mobility impaired populace constitutes one of the most marginalized groups in the system, there has to be mechanisms to instil the habit of independent living into them and empower them to be able to merge into the mainstream system. There was therefore the need to bring out design layout that corresponds to topographical site features, aesthetically blending macro-accessibility creation with the landscape and creating a visible landmark that will stands out to attract more physically disabled people from accepting the challenge to educate.

Thus, adoption of the design philosophy '***Empowering people through accessible and a socially interactive architectural environment***' will be made visible.

## 6.2 Design Concept

Concept is a guiding principle of a thought or an idea relating to something abstract. Concept architecturally, is a series of intentions or solutions originated in the mind to

solve a particular architectural problem while considering other design factors (Nzekwe, 2006).

Based on the design philosophy, the concept of proximity was adopted. This is depicted by the close linkage of spaces thereby reducing wheeling or walking distances from one facility to the other. The classroom blocks located at the core of the facilities is to serve as a focal and a convergence point for all major activities. On the other hand, the concept of zoning is made visible through efforts to separate likely noisy areas from quiet zones. The core building is meant to act as the frame for the architectural composition buildings in the institute encapsulates. The core building will serve as a central convergence point and relate to the other structures in mass, form and style. The inherent symbolic content of the campus plan further symbolizes the concept of unity through the proximity of buildings close to one another. Safety as one of the concepts is portrayed by firstly adopting classroom layout that ensures the creation of minute lay-bys for safe wheelchair entry and exits to and from classrooms. In other areas, double swing doors in recessed doorways and landscaping elements is being used to ensure safe circulation of especially wheelchair-users.

The design also takes into account the indigenous culture, climate, and construction technology and materials. Culturally, the design is based on the traditional courtyard system. These courts are strategically created to serve as concourse for relaxation, interaction and entertainment. It is also to serve as a climate modification feature or an access point for ventilation and daylight. Lastly, the design concept takes into account measures of reducing possible conflicts affecting comfort levels of the various forms of physical disability as they use common accessibility features. This will be achieved by adopting the recommendations from the study.

The brief for the proposed institution will comprise car parking zones and main reception points, administration block, library block, classroom and workshop areas, dining, staff and students' accommodation, a multi-purpose hall and other ancillary facilities such as infirmary, and recreational grounds. Details of it is shown in Table 3, Appendix C.

### 6.2.1 Conceptual site planning

The first stage constituted zoning of the facility into three major zones which are noisy areas comprising workshops, student's accommodation and outdoor recreational areas and dining area, semi-noisy areas comprising the classrooms and multi-purpose hall and quiet areas comprising the library and administration area. At the second stage, issues of circulation and orientation were laid out. Picking the main entry point from the Maiduguri Road, an access road was proposed at the south -eastern part of the site to be linked by the service route located at the lowest part of the site's terrain. This was then followed by the final stage of the conceptual planning which dealt with the linkage of proposed building units to form a unified whole.

## 6.3 The Detailed Design

### 6.3.1 Site layout

Buildings within the core are directly affected by a concentric juxtaposition of the others. Since the core is the most dominant central geometric element on the campus, siting of buildings around the core has naturally been affected by the core's "lines of force. In designing the facility, ways to develop student's full potential through specialized education, therapeutic interventions, family involvement and independent living were deeply considered.

The site plan was designed in regards to the recommendations made from the site

development concept; the site analysis and the proposed design framework developed to provide solution to the aforementioned design problem. The key elements considered are carefully discussed below.

a) Pedestrian Bridge

The pedestrian bridge is located at the main pedestrian entrance to the site. It is designed to convey customers, pedestrian on foot and tricycles to both side of the road. A ramp of about 5% was used as shown in figure 6.3 below

b) Site Entrance and Exits

The site has three main entrances and exits plus the service entrances. The two main entrances are from the main road from the eastern side and the other from the northern side of the site respectively. One of the entrances from the eastern side is strictly pedestrian, it serves as the focal point and the main centre of attraction of the site plan, its 15000mm wide with slight change in level of 5% all through dedicated to the pedestrian and the disabled to have an unobstructed circulation in and out of the facility. The other two entrances from the northern and eastern side of the site are strictly vehicular. The idea is to reduce traffic pressure at the point of entrance and exit due to security situation of the country. The service entrance is tapped from an untarred road from the western side of the site. It provides services to the mall for refuse disposal, offloading of delivered goods to the shops and also provide access to the generator house.

c) Site Circulation

The entire walkway had a change of level of 5% with minimum width of 3000mm while the length is 15000mm. The main pedestrian walkway that leads directly to the admin from the main entrance gate is designed to contain large crowd entering and exiting the facility, to aid movement a travalator is provided on both side to reduce the distance of travel within the vicinity as shown in figure 7.8 below.

The walkways are demarcated using a planted hedge of 800mm high. At the end of each walkway, there is a smooth transition of gentle ramp of 2% leading directly to the entrances of the building. Precast concrete square tiles are used as the surface finishing.

d) Parking

The parking facility is divided into five (5) categories. The first is the main customer parking spaces, 1018 parking lots are provided in accordance with standards (ICSC) with dimension of 2500mm by 5000mm. for the second category 62 parking lots are provided for the wheelchair users with dimension 3200mm by 5500mm including the setting down point as shown in Figure 6.6 below. 50 parking lots are reserved for the staff and official visitors of the mall. 100 parking spaces are provided for 'keke NAPEP' and motorcycle each. 10 parking spaces are provided at the warehouse for trucks. The table below provides a guide for parking in shopping facilities.

### 6.3.2 Construction technology

I. The sub structure

Due to the unknown bearing capacity of the underlying soil, based on the analysis of existing buildings, the foundation should be of strip foundation, otherwise specified by structural engineer, with sufficient depth. Strip foundation will be used for spaces such as the administration, library, multi-purpose hall and students' hostel which occupies more than a single floor. Strip foundation will be used on facilities occupying single floor areas.

II. The super structure

Different forms of structural supports have been used in the design of the facility. The administration block, library and accommodation facilities has reinforced concrete post

and beam structural system.

III. The roof structure

The roof structure for the facilities is made of steel-section purlins on steel truss and wooden purlins on wooden truss members. In areas where roof lights are used, steel roof members are recommended for accurate joints

### 6.3.3 Construction material

To allow ease of construction, without the over-dependence of foreign expertise, the design of the facilities has been simplified to appreciable state. A combination of steel and concrete has been used; for the available construction technology in Nigeria. Reinforced Concrete, Steel, Aluminium and glass shall be the dominant building materials used for the construction of the facility.

The predominant exterior building material throughout the campus is block, occasionally accented by certain architectural elements that are rendered in either stucco, painted or stone faced. Other materials such as wood have been used for roofing structures, doors and window openings and balustrades. Transparent glass has been used for door and window panels to promote inter-space interaction and communication through visibility. Special reinforced but slightly tinted and solar reflective fiber-glasses will be used for roof-lighting purposes thereby creating an illuminated arcade effect in certain spaces.

Asphalt finishes and pavement blocks are used in varied ways for driveways and car parks respectively. Interior spaces will be of finishes that are durable, wear, scratch and stain resistant, comfortable, and cleanable and non-slip. For the safety of wheelchair and crutch users, a non-slip porcelain tiles having slightly textured surface will be used for

all horizontal circulation routes. To minimize the back-movement of wheelchairs during ramp ascents, a slightly textured terrazzo surface is recommended.

Polished wooden tongue and groove (T&G) will be used as ceiling materials for the administration library and accommodation facilities. Suspended acoustic ceiling panels will be used for classrooms, workshops and multi-purpose hall areas to keep sound within the spaces.

### 6.3.4 Landscaping

Soft and hard landscaping elements have been selected to create a sense of arrival at campus entrance, enhance and screen views, act as windbreaks, reduce erosion, improve ventilation and cooling, act as glare control elements and serve therapeutic purposes. Emphasis is placed on ample provision of well landscaped environment to aid relaxation and complement activities of the centre. Tree canopy shaded driveways, hedges are put in place to enhance the micro climate, environmental features and refuge within the centre. The planning of the landscape follows from fractal principles of scaling, self-similarity and infinity. Stone paving as used for the walkways, to emphasis use of natural materials. Gardens were introduced in the interior to enhance experience and to avoid creating a drastic difference between the interior space and exterior space.

Grasses such as Paspalumnotatum and Chrysopogon is to be planted to reduce glare and heat generation in open areas. Selection of site furnishings such as bench, trash receptacle, and light fixture shall consider durability, ease of maintenance, and harmony with the overall campus concept. Bollards for restricting vehicles from walkways are also provided.

### 6.3.5 Services

I. Water supply

Fortunately, proximity of the site to adjoining areas with developed potable water supply will facilitate its supply for drinking, cleaning, cleaning, washing, heating, and fire fighting purposes. This will be augmented by indirect water supply from overhead tanks to be redistributed by gravity.

II. Power supply

Power shall be tapped from the Power Holding Company of Nigeria (PHCN)'s national grid. However, the design shall also cater for its own power needs. A three-phase transformer is to be located on- site by the developer to ease connection of the proposed development. The building will therefore obtain its main power supply from the transformer. Two on site generators with an automatic start and stop equipment has also been provided for to cater for power failure.

III. Refuse disposal

Each facility is to be provided with waste collection bins at vantage points Waste bin should be provided in every space and along circulation routes. A Small incinerator should be provided at a remote part of the site, to cope with all refuse generated on site.

IV. Waste water and sewage disposal

Waste water and soil from water closets should be drained through the central sewer line to the sewage treatment plant for treatment and subsequently disposed by Kano State Environmental Protection Agency. A network of covered gutters, have been provided to take care of run-offs, as well as rainwater from roofs and parking decks.

Intercepted water is channelled into drains that run along the site periphery. The hierarchy of drains is strategically located to take advantage of site topography. A central waste collection point is to be sited at the service yard located at the south-eastern part of the facility. Waste water from kitchen areas and bathrooms are to be channelled through ground drains to the main drain to be located at the site's peripheries. The academic and the students hostel sector are to have their sewage from sanitary areas flow from various levels down by gravity through a100mm diameter pipes into an on-site central receptor tank with soak ways located at the south western portion of the site. Inspection chambers are located at specific centres along the sewerage lines.

V. Fire protection and control

As fire protection measure, fire resistant door will be installed at probable fire-catching areas such as offices, workshops and library. Sprinkler heads and hose reels supplied by water from both direct and indirect sources are placed at strategic location within the facility for fire-fighting purposes. Automatic fire alarm systems and fire extinguishers are located at strategic intervals within the facility. Fire hydrants are also to be strategically located on site, but competent professional should be involved in determining the number and location of the fire fighting system. In addition, fire escape exits have been provided at specific locations with accesses to open spaces. The creation of courtyards is also to serve as an immediate escape point in the event of fire outbreak.

VI. HVAC system

To complement natural ventilation, a central air conditioning system shall be installed for the facility.

### 6.3.6 Circulation and access

The main entrance into the facility is taken from the Maiduguri road located on the eastern part of the site. Separate entry/ exit route have been provided for both vehicles and pedestrians. Access route for services is also proposed at the southern part of the site.

I. Ramp and stairs

Low gradient ramps with handrails and aisle width large enough to accommodate double wheelchairs have been provided to ease access to upper floors. Preferably, stairs with proper handrails have also been provided along some ramps for crutch users and able-bodied people. In areas such as the administration, library, staff and students accommodation facilities, lifts have been provided for use on special occasions.

II. Doors and doorways

For the purpose of speed and convenience, classroom, administration and dining blocks will be provided with glass-panelled see-through doors with double swings. Commuters' safety will be ensured against doors swinging into pathways by adopting recessed doorway systems with level or minimal thresholds. Minimum door width of 900mm will be designed for. Doors requiring minimal operating force of 20N are to be provided with auxiliary door handles.

III. Windows

At least an 80cm wide minimum manoeuvring space has been left around windows for accessibility purposes. Side hung casement windows that are at easy-to-reach heights and are easy to control by wheelchair users are recommended for administration and IT

centres that are likely to be air-conditioned. Transparent glass louvers in aluminium frames are recommended for classrooms, workshops and accommodation facilities.

IV. Cabinets

Cabinetries in the facilities have adjustable storage heights. In kitchens, the arrangement of the storage, preparation, cooking and washing areas have been streamlined and placed close together as possible. Optimal and adjustable working heights ranging from 75cm to 90cm is desirable for reach of wheelchair users.

V. Lavatories

The provision of accessible sanitary areas is a serious concern for many people with disabilities. Different sanitary room spaces have been provided for use by both able and disabled people if the institute. Lavatories have been provided with vertical, horizontal grab bars and adjustable levers for the physically challenged. Adjustable seats for bathing areas have also been catered for. Since it is an institution designed mainly for the mobility impaired, sanitary facilities of varying heights will be installed in all sanitary areas.

## 6.4 Schedule of Accommodation

After a series of case studies and review of related books articles of skill acquisition centre design; in depth analysis of the brief, the brief was developed thereby forming a detail schedule requirement of individual spaces critical to the design. The space to space analysis of each facility provided.

### 6.4.1 The Parking area

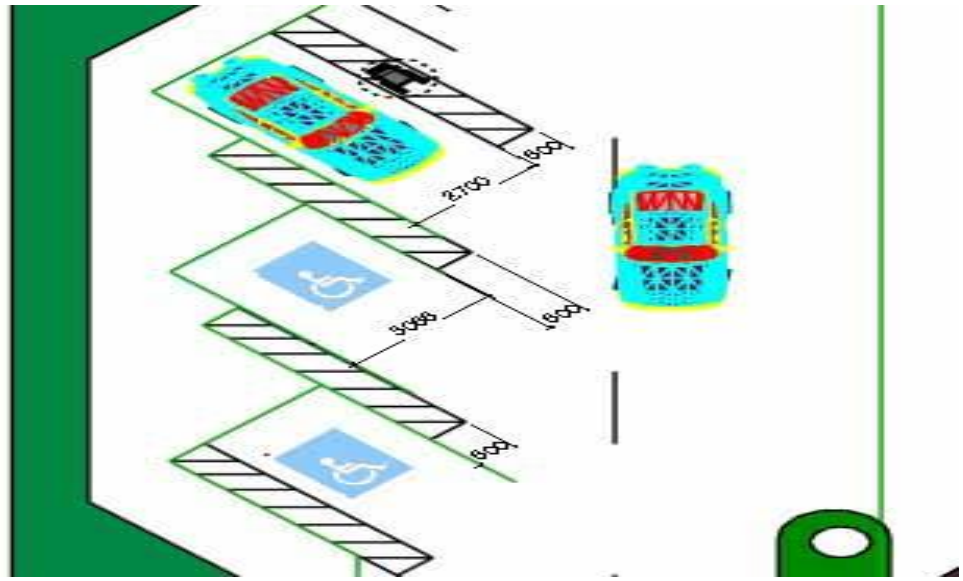


Plate XIII Showing parking area

Source: Authors work, 2017

A wide parking area paved with concrete pavement bricks has been provided for the school with spaces for able and disabled vehicle users. Accessible parking ways for the disabled measuring 4.5m by 6 m have been clearly marked with adequate access aisle for wheelchair users. To ensure safety of wheelchair users and to provide a clear space for incoming and outgoing vehicles, a central walking/ wheeling aisles have been created between opposite parking bays.

6.3.2 The Administration bloc

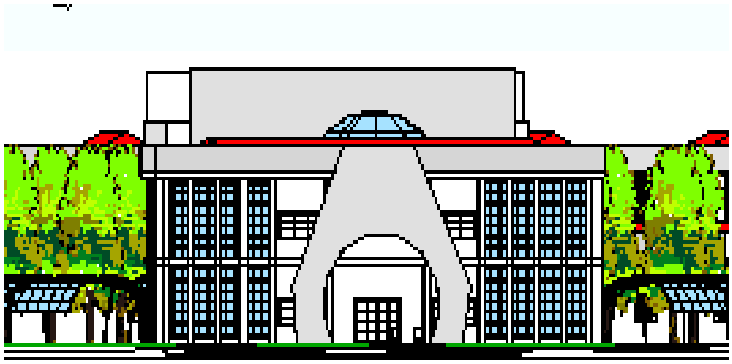


Plate XIV showing admin block

Source: Authors work, 2017

The administration block (as shown in plate X1V above) being the first point of call as one enters the facility form the main entrance has been given an attractive façades offering good views to the surrounding landscape. Facilities in the administration block are offices of the staff, reception hall, ancillaries such as staff lounge, first-aid room, storage areas, sanitary facilities and waiting areas have been provided.

### 6.3.3 The Library

The community library offers spaces for general bibliographies, journals and periodicals, serials, references, and discussions. Ancillaries such as photocopying rooms, sanitary facilities, administration offices, lifts and storage areas have also be provided. Among special features visible in the library is an indoor ramp overlooking a central landscaped court, illuminated by roof-light.

### 6.3.4 Classrooms, Lecture theatres, and Workshops

Wheel chair Student capacity classrooms, sixteen in number have been designed for the institute's academic needs. Classrooms have skewed orientations to create minute lay-bys at their entry point for safer entry and exits onto the main corridor. A large workshop area comprising seven working zones have spaces for fashions and dressmaking, jewellery making, computer and electronics repairs, shoe repairs, carpentry, leatherworks and Auto mechanics. Ancillaries such as a spacious warehouse, sanitary facilities and service spaces were also provided. Facilities attached to the workshop include an infirmary.



Plate XV Showing a class block and workshop

Source: Authors work, 2017

### 6.3.5 The Dining Area

A dining area of optimum size has been provided for use especially during study hours. Facilities for the dining area are store rooms for dry and wet goods, kitchen hall, and kitchen yard, serving area, scullery and pantry, eatery and an office for the matron.

### 6.3.6 The Auditorium

A multi-purpose hall is located at the facility. The hall serves as the central and immediate point of concourse for both formal and informal activities such as exhibitions, fora, general assembly, religious and community gatherings. Facilities in the hall are control rooms, seating hall, changing rooms and storage and sanitary facilities.

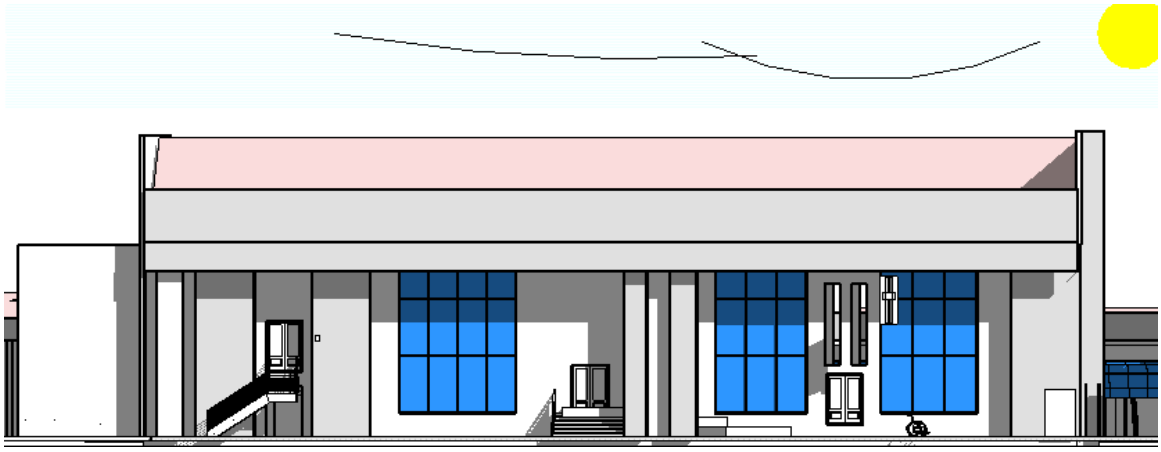


Plate XVI Showing auditorium

Source: Authors work, 2017

### 6.3.7 Student Accommodation

Two hostels to accommodate students both male and female each have been provided close to the academic facility to house students with partial mobility impairments. Each hostel floor has been provided with facilities such as kitchen, laundry and sanitary facilities. Severely disabled people who are partially independent and thus require permanent care have also been catered for. For such people, self-contained apartments have been of provided. Extra spaces have been provided for automated wheelchair manoeuvring and for storage of their lifts have been provided.

For reasons of privacy, the staff accommodation has been separated some meters off the main academic facilities. Three bedroom self-contained block has been proposed for the principal. Whilst a 2-storey flats containing single bedroom self-contained apartments have been provided for junior staff.

# 7.0 CONCLUSION AND RECOMMENDATIONS

This chapter presents highlights of the major findings and inferences drawn from the findings based on the data presented and analysed. It will give some recommendations, listing out ways to solve the identified problems and the major contributions to knowledge. The chapter will be organized under the following headings (a) Summary (b) Conclusion (c) Recommendation (d) Contribution to knowledge

## 7.1 Summary

This research was established on how to integrate conflicting design requirement strategies in the design of skill acquisition centre. It sets out to go beyond UD concepts and how they address the conflicts established when two or more groups of mobility impaired persons are to function in the same environment or setting. Mobility impairment is an evolving concept, and that disability results from the interaction between persons with impairments and attitudinal and environmental barriers that hinders full and effective participation in society on an equal basis with others is very unpredictable and . The prevalence rate of mobility impairments is steadily increasing nationwide however; Nigeria is faced with the problem of low awareness, inadequate care facilities and inadequate rehabilitation services to cater for the mobility impaired. The problem being that too much emphasis is laid the provision of the skill centres and their disabilities without attempt to understand the special needs of all groups that fall under the mobility impaired associated with the disorder.

As such, the need for skill development for the mobility impaired is completely neglected, making them completely hopeless and dependent on their caregivers. Therefore, there is a need to provide facilities to cater for people with mobility impairments to make them useful to themselves, families and the society at large.

Quantitative and qualitative research strategy was adopted using case study research approach. A purposive sampling technique was employed to select two skill acquisition centres and a centre for the mobility impaired centres. Both primary and secondary sources of data were used, and the instruments of data collection used were field observation, questionnaire and interview. Students and staff at the skill acquisition centres were interviewed. The design strategies adopted from literature were used in assessment of selected cases.

As such, the need for a skill acquisition centre to cater for two or more groups of the mobility impaired.

The following points summarize the major research findings:

a. The interviewees at the skill acquisition centres explained that Distraction is the first most common behaviour attributed to an inadequately designed learning environment, followed by lack of students coming to school, and lack of attention to the skill .
b. Literature established that the type of mobility impairments in the mobility impaired individuals determine their reactions to elements of the built environment.
c. Problems faced by individuals with mobility impairments include poor muscle control, weakness and fatigue, difficulty walking, bending, lifting objects, climbing up on step stool, sensing or grasping due to pain or weakness
d. Universal design strategies were adopted from literature as; Equitable Use, Flexibility in Use, Simple and Intuitive Use, Perceptible Information, Tolerance for Error , Low Physical Effort , Size and Space for Approach and Use.

e. Assessments from case study show that climatic consideration creates a sense of coolness within the building; proper spatial organisation reduces distance between buildings. Compartmentalization increases independences and reduces distraction, zoning of activities, provision of transition space, provision of ample user space and storage for the helpers of the students and uncluttered and purposeful working environment.

f. Findings show that people with mobility impairments have great talents which could be developed to make them useful citizens of a society.

g. Recommendation from the students were the need for sloping ramps, The need for sheltered walkways, The need for more spaces to expand their technical-vocational training scope, The need for funds to rehabilitate broken down facilities.

h. Lift was found to be the most known accessibility feature from the assessment carried out

## 7.2 Conclusion

1. The concept of "independent living" is now beginning to trickle into the minds of the government and the population as large. In the future, increased access to educational opportunities will hopefully promote such concepts of independent living in all areas of the country. It is in this direction that architects are to play important role in ensuring the viability of this vision by proclaiming the message on universal barrier-free concept in our designs. Although this design aims at providing accessible spaces for people with mobility impairments in a skill acquisition centre in particular, some disable people interviewed have expressed their concern of universal design not being incorporated in other institutional buildings such as banks, sport centres, and so on. Furthermore,

they predicted that ultimately, universal design which is not about age or ability but about a usable design for the broadest number of users to offer years of increased utility, comfort, and safety will gain the centre-stage in the very near future.

2. The “Design for all” / “Universal Design” movement has been very valuable in raising the profile of disabled users of architectural products, and has laid down some important principles. Nonetheless, skepticism has been expressed by some designers and theorist concerning its feasibility. Though it may be difficult at this early stage, it is however hoped that when designers and manufacturers seize this concept at this early stage, universal design will become common, convenient, more marketable and profitable.
3. Cultural and behavioural trends, global economic change as well as educational and government policy reforms such as democratization and civil society development has affected the educational systems around the world in diverse ways. In developing counties like Nigeria, a head-start towards universal education has been made. This goal is gradually being brought into reality through the help of non-governmental organizations, local and foreign donor agencies, philanthropists as well as through the government’s own initiatives. The proposal of a technical-vocational institute for Skill acquisition in Kano will serve as an important educational facility where disabled students can acquire advanced technical-vocational skills to enable them compete with their able-bodied colleagues in the modern world.
4. Conclusions reached in this study are that the standards used for assessment of accessibility and circulation for those with mobility impairment does not include the local mobility aid used in Kano. This implies that those

standards even when used appropriately cannot serve the needs of our mobility impaired using that type of mobility aid in Kano. It is the author's hope that this discovery will assist disabled people in gaining greater control of their lives and assist them in regaining valued roles in society.

5. Completely tackling issues on barrier-free design is a complex, burdensome and sometimes unreasonable, even for specialist, many in the design professions (Mace L. , 1991). This implies that what is barrier-free for someone in a wheelchair may not be for someone who is blind or deaf. This therefore calls for a revisiting and revision of some design guidelines if barrier-free design is to be achieved.
6. Manufacturers and standards bodies should always involve and consult with representatives of disability organisations and other consumer groups to ensure that users are sufficiently involved in the design process (Research Institute for Consumer Affairs (RICA), 2007). Disability, consumer and other organisations should provide practical help to make it easy for manufacturers to consult with their potential older and disabled customers
7. In view of this difficulty faced by designers, I agree with Newel et al., (2000) who recommend the use of the term "inclusive" rather than "universal" which reflects the view that "inclusivity" is a more achievable, and in many situations, appropriate goal than "universal design" or "design for all". The word "sensitive" replaces "centred" to underline the extra levels of difficulty involved when the range of functionality and characteristics of the user groups is so great that it is impossible in any meaningful way to design a product that truly is accessible by all potential users.

## 7.3 Recommendation

a) Planning to address architectural, physiological, and psychological and service needs of People with Physical Disabilities should adopt a 'bio-psychosocial' approach, emphasizing the importance of biological, psychological, pedagogical and social factors in the management and care of such people. It should entail the combined efforts of resourced personnel such as architects, engineers, psychologists, therapists as well the potential users of the facility who are People with Disabilities (PWDs).

b) The concepts of integration and equalization can only be achieved, if our governments could devise progressive community-based rehabilitation and educational programs that are aimed at changing societal attitude towards disability. There is a great need for the professionals, politicians and the public at large to re-examine our own attitudes, since we seem to spend a lot of time on moulding disabled people to cope with their environments instead of spending more time on changing the attitudes of the able-bodied persons

c) Accessibility principles must be followed when planning, designing and building infrastructure and vehicles. These require full accessibility to approved standards or recognised best practices, with approval by experts, minimum accessibility requirements for wheelchairs, features for people with walking difficulties, and facilities to assist the blind, deaf or hearing impaired people.

d) It is also important to re-echo the advice of Mace (1991), that the demand for accessible housing should be met while still maintaining and demonstrating sensitivity to aesthetics and marketing value. To achieve equality, however, disability does have to be taken into account when providing accessibility requires such changes as architectural modification or program adjustments.

Granting equal access to all members of societies requires acknowledging the differences that exist among these members. (Degener et al., 2001)

## 7.4 Areas of Further Studies

Possible areas of further research should focus more on how the mobility impaired can be made more comfortable in the use of public buildings such as Banks. Similar studies employing additional accessibility features needs to be carried out especially in Northern parts of the country to better inform designs of facilities. Additionally, more research using a larger sample should be carried out to unearth reasons behind the disparity of satisfaction levels in the study area. Further studies also need to be conducted to establish the influence other aspects of quality have on accessibility features and user satisfaction.

## 7.5 Contribution of Study to Knowledge

a) The study contributes by generating a framework for integrating conflicts established where two or more groups of the mobility impaired friendly design strategies in skill acquisition centre design.
b) The study of accessibility and circulation for people with mobility impairment is not the first of its kind. Subsequent studies in accessibility have been carried out, but all these research focus on the facilities on study. This study went beyond the facilities to interact and obtain opinions of the relevant stakeholders involved in the use, management and building of these facilities.
c) It was discovered that the majority of the mobility impaired use a new mobility aid (hand propelled tricycle) for which it's anthropometric should be considered when designing for accessibility in Kano.
d) Comparism between the standard wheelchair and the hand propelled tricycle revealed difference in length (1250mm – 1750mm), total seated height (490mm-

450mm), 90$^{o}$ manoeuvring width (1450mm-1700mm), 360$^{o}$ manoeuvring width (1600mm- 2100mm)

e) Conflict areas established from the research shows that the use of accessibility features and products are:

- Steep ramps which are >1:10 are difficult to access
- Access to height of storage areas and toilets when bending (200-400), sitting (900mm-1200mm), standing (1200mm-1500mm).
- Non-Ambulant Impaired people have problems STRETCHING while Semi Ambulant Impaired have issues with BENDING.
- Stone chippings and loose stones >5mm pose problems with movement.

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## APPENDIX I

Interview Questions

**Interview questions, on the design requirements for mobility impaired individuals**

Hello. I am I.B. SADIQ, A Masters student from the Dept. of Architecture, ABU. This questionnaire is set up to determine the user requirement for mobility impaired and mobile individuals in a skill acquisition centre current. Your individual participation in this survey is voluntary and strictly for research. Kindly append your signature/ date in the spaces provided as a mark of consent for this research. Thank you.

Signature----------Date----------My contact: yayainkam@yahoo.com, 08030965970

What are the mobility aids devices widely used by people with mobility impairment in Kano?

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What are the common accessible features predominantly used by the mobility impaired in Kano?

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What are the possible conflicts of interests identifiable in instances where two or more physically disabled people are to be catered for at the same time in a vocational training environment?

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What are some mobility-impaired persons' perceptions or responses and experiences of some accessibility features in selected "accessible" buildings or institutions?

| | | PERCEPTION | | | | | EXPERIENCE | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S/N | VARIABLES | 5 | 4 | 3 | 2 | 1 | 5 | 4 | 3 | 2 | 1 |
| 1 | Ramp finish | | | | | | | | | | |
| 2 | Ramp slope | | | | | | | | | | |
| | Steep | | | | | | | | | | |
| | Gentle | | | | | | | | | | |
| 3 | Stair positioning | | | | | | | | | | |
| 4 | Step height | | | | | | | | | | |
| | Too high | | | | | | | | | | |
| | Too low | | | | | | | | | | |
| 5 | Width of entrances/exits | | | | | | | | | | |
| | Narrow | | | | | | | | | | |
| | Wide | | | | | | | | | | |
| 6 | Width of corridors | | | | | | | | | | |
| | Narrow | | | | | | | | | | |
| | wide | | | | | | | | | | |
| 7 | Lift positioning | | | | | | | | | | |
| 8 | Window height | | | | | | | | | | |
| | Too high | | | | | | | | | | |
| | Too low | | | | | | | | | | |
| 9 | Door handle height | | | | | | | | | | |
| 10 | Toilet size | | | | | | | | | | |
| 11 | Size Bathrooms | | | | | | | | | | |
| **12** | **Size of rooms** | | | | | | | | | | |

# APPENDIX II

## Questionnaire

**Questionnaire for users, on the design requirements for mobility impaired individuals**

Hello. I am I.B. SADIQ, A Masters student from the Dept. of Architecture, ABU. This questionnaire is set up to determine the user requirement for mobility impaired and mobile individuals in a skill acquisition centre. Your individual participation in this survey is voluntary and strictly for research. Kindly append your signature/ date in the spaces provided as a mark of consent for this research. Thank you.

Signature.....Date..... (My contact: yayainkam@yahoo.com, 08030965970)

**PART I: RESPONDENT BIO-DATAGender:** [ ] Male [ ] Female

**Location**: [ ] Disability Association [ ] Skill acquisition centre
**User type:** [ ] user [ ] staff
State of origin: ———————
**Marital status:** [ ] Married [ ] Single [ ] Divorced [ ] Widowed
Age: [ ] 10-17 [ ] 18-25 [ ] 26-30 [ ] 31-40 [ ] 41-50 [ ] 50 years and above
**Occupation:** [ ] Civil Servant [ ] Self-Employed [ ] Retiree [ ] Unemployed [ ] Privately Employed [ ] Others———
———
**Highest Educational qualification:** [ ] **1st** School. Leaving Certificate [ ] WAEC [ ] Diploma [ ] OND [ ] NCE [ ] HND [ ] Bachelor's Degree [ ] Master's Degree [ ] PhD
**Type of Disability**: None [ ] Non ambulatory e.g. wheel chair user [ ] Semi ambulatory e.g. crutches [ ]
Do you know anything about accessibility?
Yes [ ] no [ ]
Do you know anything about inclusive/ universal design?
Yes [ ] no [ ]
Do you know anything about the following accessibility features?
Lifts [ ] Ramps [ ] Stairs [ ]

**PART II: GENERAL INFORMATION (PLEASE TICK AND FILL-IN WHERE NECESSARY) ONLY FOR SKILL ACQUISITION CENTERS**

**[1- Strongly Disagree; 2- Disagree; 3- Neutral; 4- Agree; 5- Strongly Agree]**

Which of the following features are provided for in the school?
Lifts [ ] Ramps [ ] Stairs [ ]
The location of classes and workshop are okay
Strongly agree [ ] Agree [ ] Neutral [ ] Disagree [ ] strongly disagree [ ]
The position of the stairway is suitable.
Strongly agree [ ] Agree [ ] Neutral [ ] Disagree [ ] strongly disagree [ ]

The toilets are easily accessible.
Strongly agree [ ] Agree [ ] Neutral [ ] Disagree [ ] strongly disagree [ ]
There is an adequate provision of ramps.
Strongly agree [ ] Agree [ ] Neutral [ ] Disagree [ ] strongly disagree [ ]

What functional limitation do you face with your disability?
Getting into the school [ ] Getting to my room [ ] getting to other floors [ ] using the toilet [ ]

Which of the following skills would you prefer to learn? Tailoring [ ] knitting [ ] soap making [ ] shoe making [ ] tie & dye [ ] carpentry [ ] electrical works [ ]

## APPENDIX III

**Table 1: Showing the Maximum Lengths and Rises for Various Ramp Slope Ratios (UN, 2007)**

| Maximum slope | Maximum length | Maximum rise |
|---|---|---|
| 1:20 i.e., 9% | - | - |
| 1:16 i.e., 6% | 8 m | 0.50 m |
| 1:14 i.e., 7% | 5 m | 0.35 m |
| 1:12 i.e., 8% | 2 m | 0.15 m |
| 1:10 i.e., 10% | 1.25 m | 0.12 m |
| 1:08 i.e., 12% | 0.5 m | 0.06 m |

## APPENDIX 1V

**Table 2: Best Practices for Curb Ramp Design (Federal Highway Administration (FHWA), 2007)**

| Best Practice | Rationale |
|---|---|
| Provide a level manoeuvring area or landing at the top of the curb ramp. | Landings are critical to allow wheelchair users space to manoeuvre on or off of the ramp. Furthermore, people who are continuing along the sidewalk will not have to negotiate a surface with a changing grade or cross slope. |
| Clearly identify the boundary between the bottom of the curb ramp and the street with adetectable warning. | Without a detectable warning, people with vision impairments may not be able to identify the boundary between the sidewalk and the street. |
| Design ramp grades that are perpendicular to the curb. | Assistive devices for mobility are unstable if one side of the device is lower than the other or if the full base of support (e.g., all four wheels on a wheelchair) are not in contact with the surface. This commonly occurs when the bottom of a curb ramp is not perpendicular to the curb |
| Place the curb ramp within the marked crosswalk area. | Pedestrians outside of the marked crosswalk are less likely to be seen by drivers because they are not in an expected location. |
| Avoid changes of grade that exceed 11 percent over a 610 mm (24 in) interval. | Severe or sudden grade changes may not provide sufficient clearance for the frame of the wheelchair causing the user to tip forward or backward |
| Design the ramp that doesn't require turning or manoeuvring on the ramp | Manoeuvring on a steep grade can be very hazardous for people with mobility |

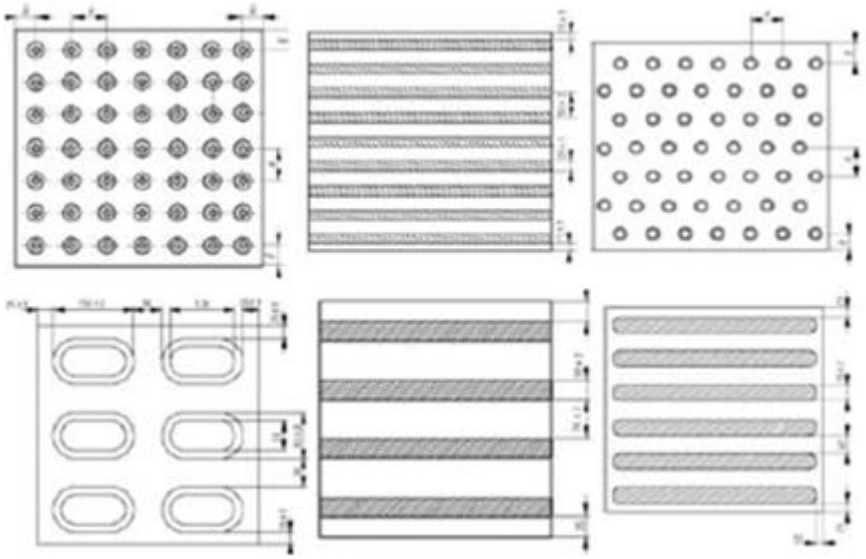
| | |
|---|---|
| surface. | impairments. |
| Provide a curb ramp grade that can be easily distinguished from surrounding terrain; otherwise, use detectable warnings. | Gradual slopes make it difficult for people with vision impairments to detect the presence of a curb ramp. |
| Design the ramp with a grade of 7.1 ± 1.2 percent. [Do not exceed 8.33 percent (1:12).] | Shallow grades are difficult for people with vision impairments to detect but steep grades are difficult for those using assistive devices for mobility. |
| Design the ramp and gutter with a cross slope of 2.0 percent | Ramps should have minimal cross slope so users do not have to negotiate a steep grade and cross slope simultaneously. |
| Provide adequate drainage to prevent the accumulation of water or debris on or at the Bottom of the ramp. | Water, ice, or debris accumulation will decrease the slip resistance of the curb ramp surface |
| Transitions from ramps to gutter and streets should be flush and free of level changes. | Manoeuvring over any vertical rise such as lips and defects can cause wheelchair users to propel forward when wheels hit this barrier |
| Align the curb ramp with the crosswalk, so there is a straight path of travel from the top of the ramp to the centre of the roadway to the curb ramp on the other side. | Where curb ramps can be ahead, people using wheelchairs often build up momentum in the crosswalk in order to get up the curb ramp grade (i.e., they "take a run at it"). This alignment may be useful for people with vision impairments. |
| Provide clearly defined and easily identified edges or transitions on both sides of the ramp to contrast with sidewalk. | Clearly defined edges assist users with vision impairments to identify the presence of the ramp when it is approached from the side |

## APPENDIX V

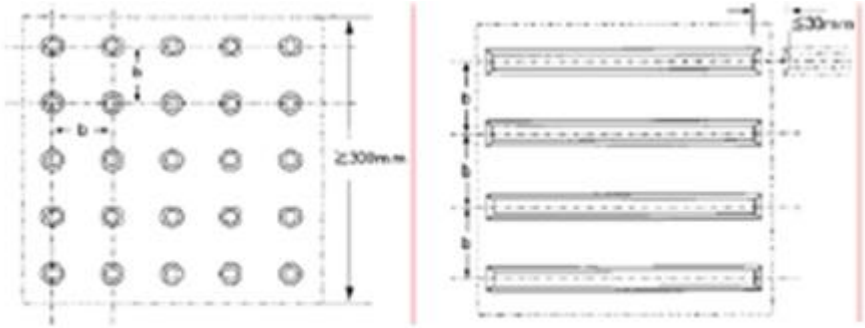
### The Patterns of Some Accepted Tactile Paving in Some Countries

### A) The Patterns of Tactile Paving in the United Kingdom

Lu, J.Y., Siu, K. W. M. and Xu, P.A (2009)

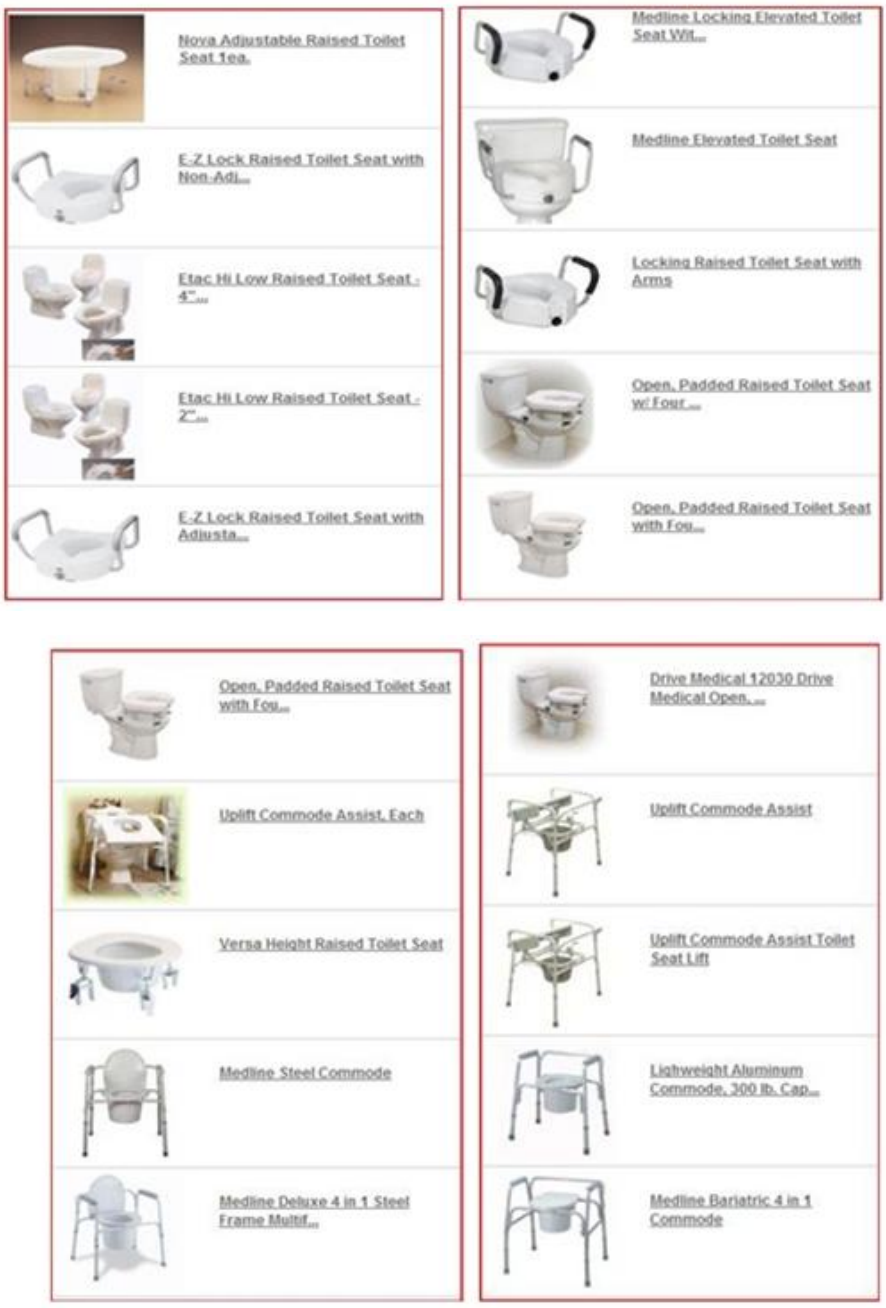


### B) Patterns of Tactile Paving According to Japanese Standards



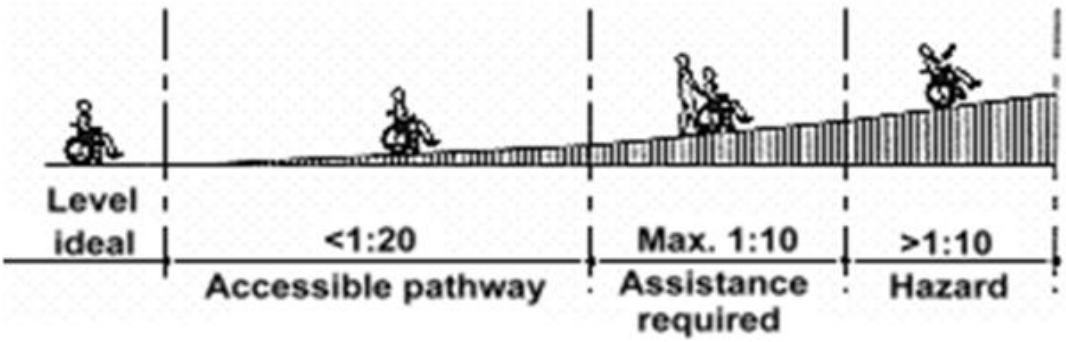
## APPENDIX VI

## Features of Adjustable Raised Toilet Seats (Bizrate, (2010)



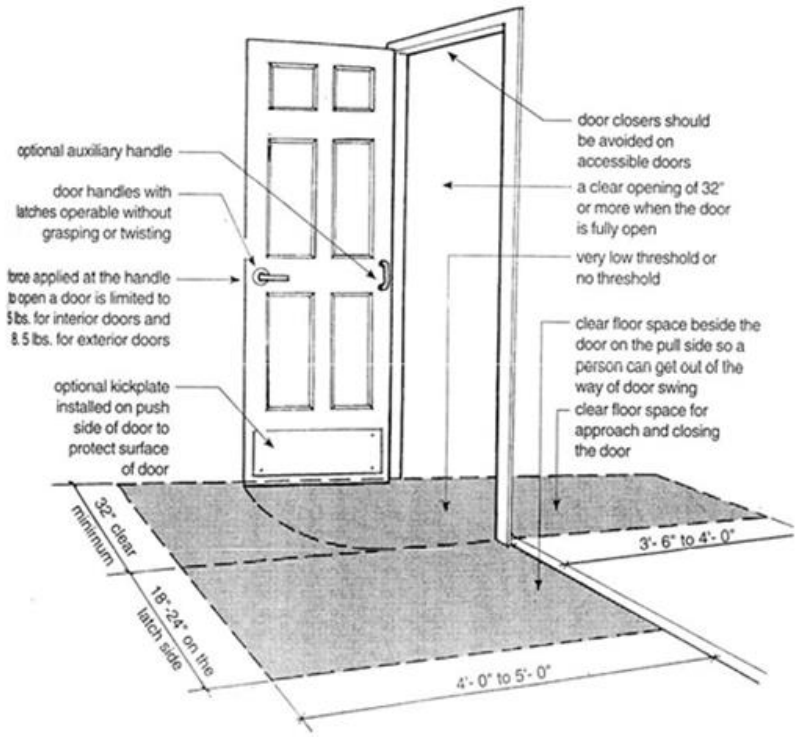
## APPENDIX VII

**Minimum and Maximum Ramp Slopes (UN, 2003)**



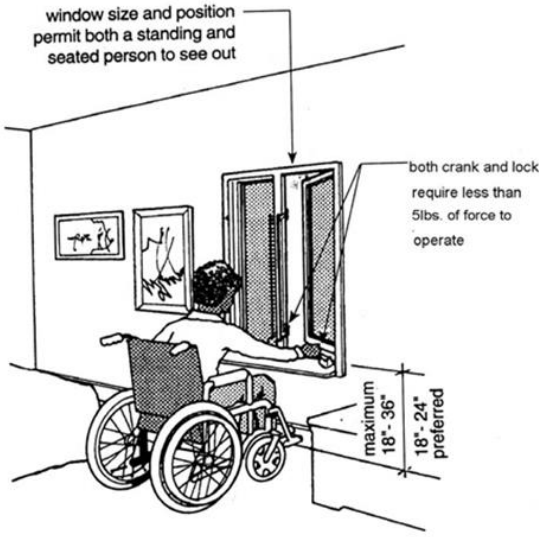

## APPENDIX VIII

**Features of an Accessible Door, (Mace, L. R., 1991)**



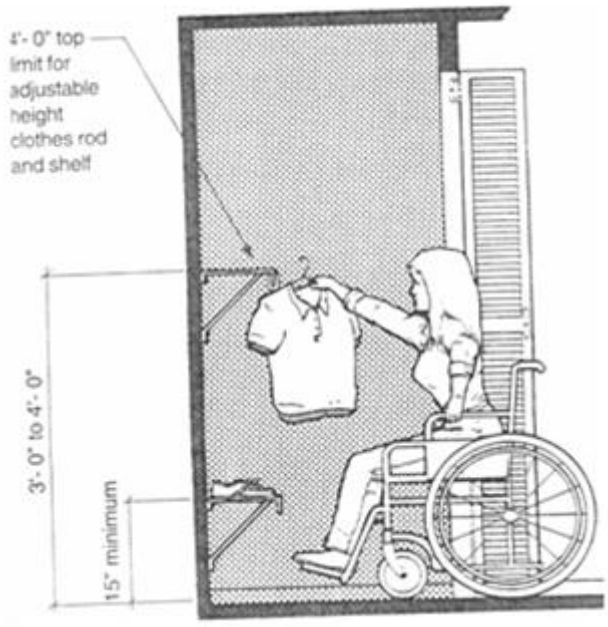
## APPENDIX IX

**Recommended window heights for wheelchair users, (Mace, L. R., 1991)**

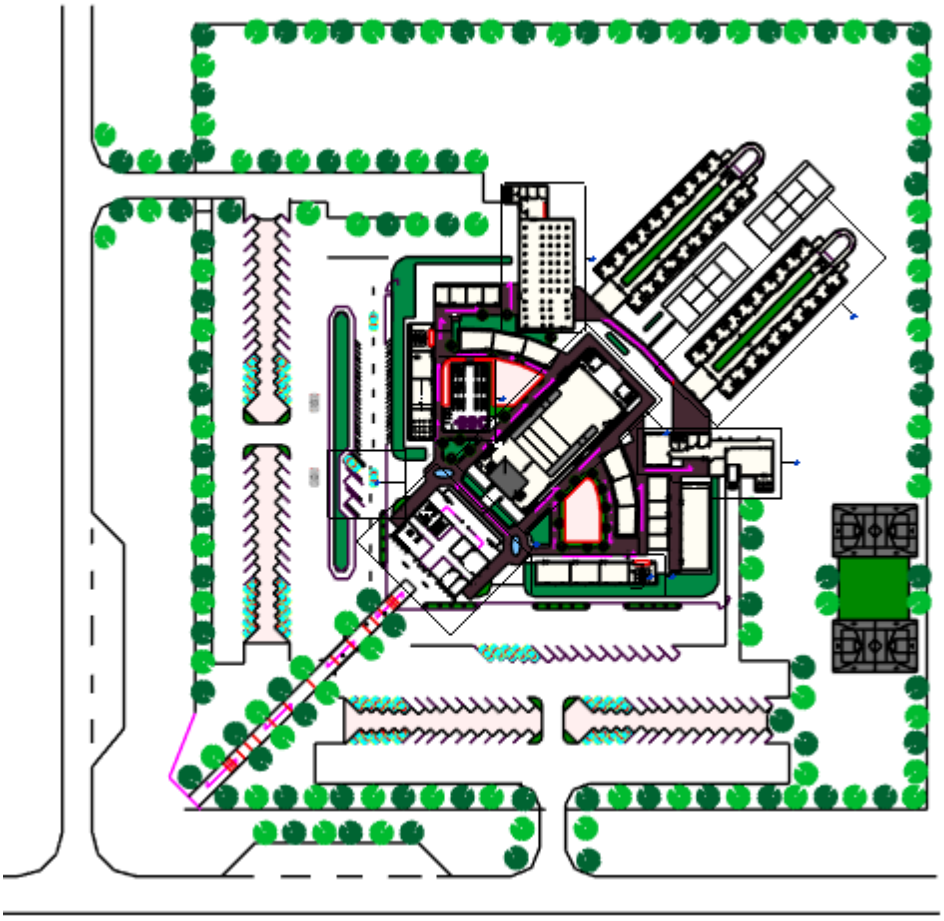


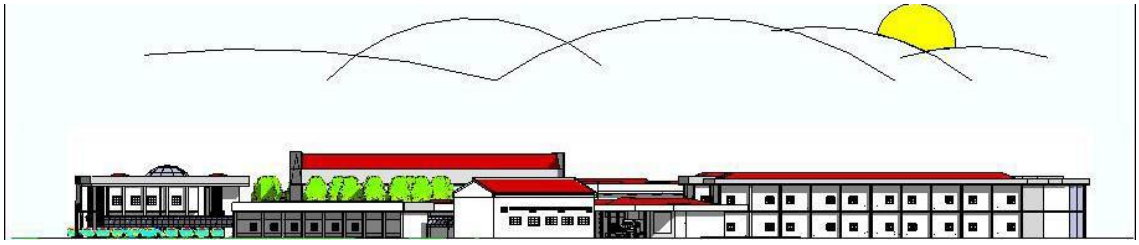

## APPENDIX X

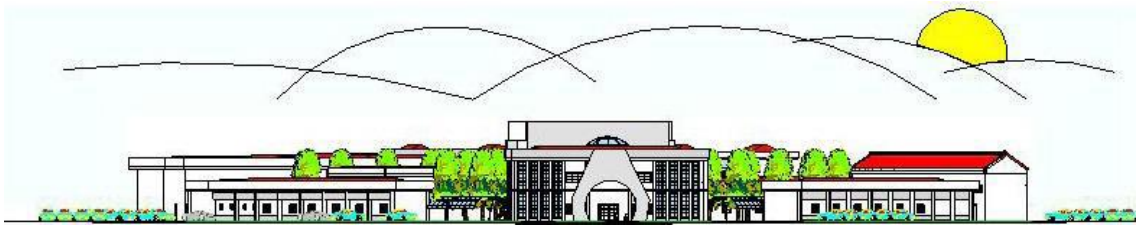
**Storage Height for a Wheelchair User and a Standing Mobility-Impaired Person (Mace, L. R., 1991)**

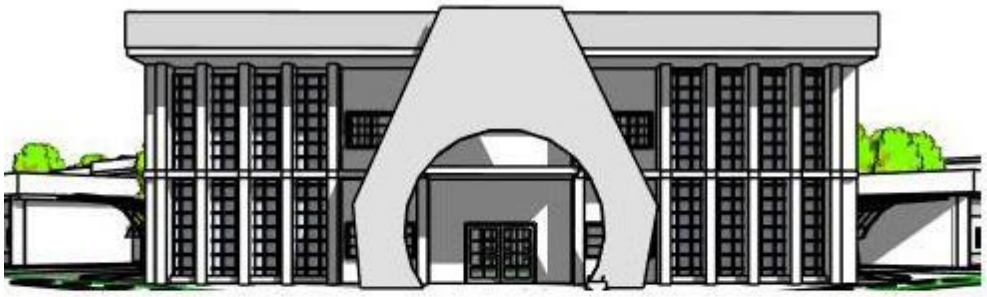


**APPENDIX XI**

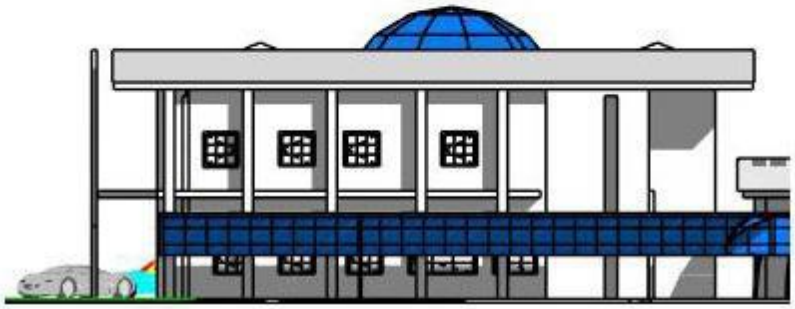




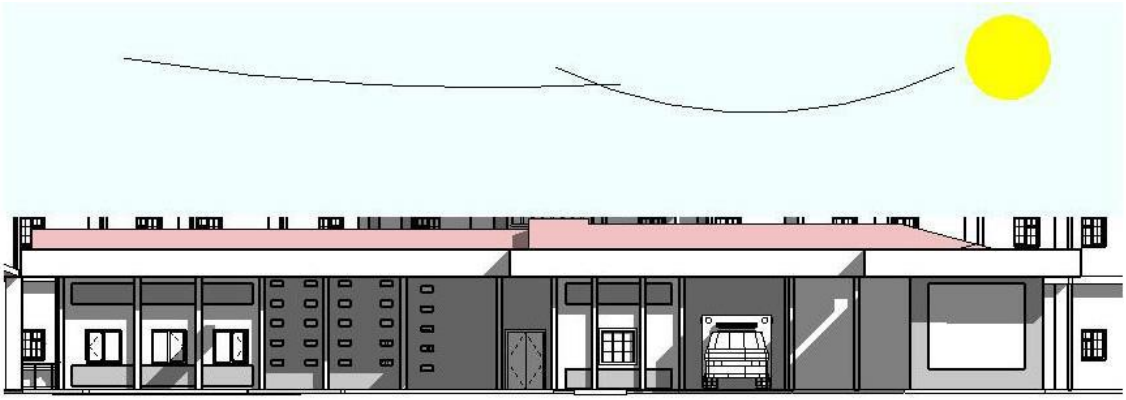




ADMIN APPROACH



ADMIN SIDE



CLINIC APPROACH