AN ASSESSMENT OF THE IMPLEMENTATION OF UNIVERSAL DESIGN PRINCIPLES IN THE PROVISION OF BUILDING SERVICES IN MULTI-STOREY BUILDINGS IN ABUJA, NIGERIA

BY

MACLEAN, WALSHAK DIKWAL

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

JULY 2014.

AN ASSESSMENT OF THE IMPLEMENTATION OF UNIVERSAL DESIGN PRINCIPLES IN THE PROVISION OF BUILDING SERVICES IN MULTI-STOREY BUILDINGS IN ABUJA, NIGERIA

BY

MACLEAN, WALSHAK DIKWAL
M.SC./ENV-DESIGN/14431/2011-2012

A THESIS SUBMITTED TO THE POSTGRADUATESCHOOL, AHMADU BELLO UNIVERSITY, ZARIAIN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE DEGREEIN BUILDING SERVICES

DEPARTMENT OF BUILDING FACULTY OF ENVIRONMENTAL DESIGN AHMADU BELLO UNIVERSITY, ZARIANIGERIA

JULY 2014.

I hereby declare that the Thesis titled óAn Assessment of the implementation of universal design principles in Multi-Storey Buildings Principles in Abuja, Nigeriaô was carried out by Maclean, WalshakDikwal (MSc/Env-Design/14431/11-12) under the supervision of Dr A M Stanley and Dr D W Dadu.

The information derived from the literatures has been duly acknowledged in the text and list of references provided. No part of the work has been presented for another degree or diploma in another institution.

é é é é é é é é é é é é é é é é é

Maclean, WalshakDikwal

CERTIFICATION

This project work titled óAn Assessment of the implementation of universal design principles in Multi-Storey Buildings Principles in Abuja, Nigeriaô by Maclean WalshakDikwal meets the regulation governing the award of a Master of Science Degree in Building Services (MSc Building Services) of Ahmadu Bello University Zaria.

…… ……

Dr A Mhya Stanley **Date**
(Major Supervisor)

…….. ……

Dr Danjuma W Dadu **Date**
(Minor Supervisor)

…….. ……

Prof KabirBala **Date**
(Head of Department)

…….. ……

Prof Adebayo A Joshua **Date**
(Dean, PG School)

DEDICATION

This theses is dedicated to God the giver of life, wisdom and saviour of the world

ACKNOWLEDGEMENT

I wish to express my profound gratitude to almighty God for His special grace upon my life and also to appreciate all those whose effort and support made this report a successful one. My special appreciation goes to my supervisors Dr A M Stanley and Dr D W Dadu for their guidance, tutelage, thorough supervision, constructive inputs and patience through this research, without which this report would not be a success.

I want to appreciate my family for the love, care, support and prayers which has kept me and given me encouragement to date, your immense and unquantifiable contribution to my life has made me a better person. My family in Zaria (Prof P PBarjesô family), words cannot express how grateful I am for the love, care, support (academic, financial, moral) and encouragement.

A big thank you to all the staff of Building Department, Ahmadu Bello University Zaria, your efforts to make this work a success will be blessed bountifully.

To all my wonderful friends for your support and love, I will not trade you guys for anything in the world. To all my course mates, the past two years have been a wonderful experience.

ABSTRACT

Universal design (UD) can be described 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, thus bridging the gap between housing and disability though the concept of Universal Design or ôDesign for allô has been neglected in most developing countries including Nigeria. This study assesses the implementation of universal design principles in the provision of building services in multi-storey buildings. It also seeks assess conformity of the design of building services in multi-storey buildings to Document M (disability standard of the United Kingdom) and establish if Statutory Authorities check designs to ascertain its conformity to universal design principles. Questionnaires were distributed to building designers and a checklist structured using disability standard of the United Kingdom was used as a guide to assess these buildings services for conformity to universal design. Also, Statistical Package for Social Sciences (SPSS) was used to analyse the data generated from the questionnaires. It was established that most designers of building services became familiar with UD through personal study or on-the-job trainings as very few of the building services designers in Abuja learned about UD in the university. Development control agencies have equally added to the non-implementation of UD as most designs are rarely or never checked for conformity to UD. In conclusion, Persons living with temporal or permanent disabilities have been segregated or stigmatized by architectural and building services designs, there is a of shallow knowledge of UD by professionals in the construction industry and most building services provisions have shown low conformity to UD principles.

TABLE OF CONTENT

Title pageé i

Declarationé ii

Certificationé ...iii

Acknowledgementé iv

Dedication é .v

Abstracté ..vi

Table of Contenté ...é vii

List of Tablesé ..x

List of Figuresé xi

List of Appendices...é .xii

List of Abbreviationsé ...é é xiii

CHAPTER ONE

INTRODUCTION 97

1.1 BACKGROUND 97

1.2 STATEMENT OF RESEARCH PROBLEM 99

1.3 SIGNIFICANCE OF THE STUDY 101

1.4 AIM AND OBJECTIVES 102

1.4.1 Aim 102

1.4.2 Objectives 102

1.5 REVIEW OF RESEARCH METHODOLOGY 103

1.6 SCOPE AND LIMITATIONS 104

1.6.1 Scope 104

1.6.2 Limitations 104

LITERITURE REVIEW 105

2.1 BUILDING SERVICES AND PROVISIONS 105

2.1.1 Ramped access 107

2.1.2 Passenger Lifts 109

2.1.3 Sanitary Facilities 112
2.1.4 Light Switches and Sockets 117
2.1.5 Automated Teller Machine (ATM) 118
2.2 UNIVERSAL DESIGN (UD) 22
2.2.1 Concept of Universal Design 121
2.2.2 Evolution of Universal Design 123
2.2.3 Principles/Elements of Universal Design 123
2.2.4 The 95TH Percentile Illusion 124
2.3 DISABILITY AND DISABILITY STANDARDS 130
2.3.1 Disability Standards 131
2.3.2 The National Building Codeé é é é é é é é é é é é é é é .é é é é é é é 35
2.3.3 Comparison Between Disability Standards of Different Countries 133
2.3.4 The Document M Building Regulation of United Kingdomé é é é é é é ...é 38
2.3.4 Disability in Nigeriaé 40
RESEARCH METHODOLOGY 139
3.1 RESEARCHDESIGN 139
3.2 QUESTIONNAIRE SURVEY 139
3.3 PHYSICAL ASSESSMENT 45
DATA PRESENTATION AND DISCUSSION 144
4.1 THE PERCEPTION SURVEY 144
4.1.1 Respondentsô Profile 144
4.1.3 Building Services, Components and Space Requirement 147
4.1.4 Designing to Incorporate Universal Design 51
4.1.5 Contribution of Development Control Agencies to the Implementation of Universal Design Principles. 150
4.1.6 Challenges in Design to Incorporate Universal Design 151
4.1.7 Aspects of Universal Design Principles Attended to by Designers 152
4.2 PHYSICAL ASSESSMENT/INSPECTION 156
4.2.1 Access to buildings 156
4.2.2 Vertical Circulation within Buildings Using Lifts 157
4.2.3 Sanitary Facilities 62

4.2.4 Lighting points and Sockets 162
4.2.4 Automated Teller Machine ATMs 162
4.3 DISCUSSION 164
4.3.1 Respondentsô Profile 164
4.3.2 Measuring Building Services & Components against UD Principles & Document M for conformity 165
4.3.3 Role of Statutory Authorities in the Implementation of UD 167
4.3.4 Building Services & Components that require the most Attention when Designing é 69
4.3.5 Challenges in Designing to Incorporate UD 167
SUMMARY, CONCLUSION AND RECOMMENDATION 168
5.1 SUMMARY OF FINDINGS 168
5.2 CONCLUSION 171
5.2 RECOMMENDATION 172

LIST OF TABLES

Table 4.1 Respondentsô Profileé é é é é é é é é é é é é é é é é é é 45

Table 4.2 Perception of Universal Designé é é é é é ..é é é é é é .é 46

Table 4.3: Ranking Building Services, Components and Spaces Requirement...48

Table 4.4 Disabilities and its consideration in designé é é é é é é é é .49

Table 4.5 Development Control Agencies (DCA) and the Implementation of Universal Design (UD)é ...é é é é é é é é é é é ..é é é ..50

Table 4.6: Challenges faced when designing to incorporate UDé é é é é .é 51

Table 4.7 Aspects of Universal Design Principles Attended to by Designers....54

Table 4.8 Access to Buildings (Ramped Access and Handrails)é é é é ...é ..56

Table 4.9 Lift Installation & Space Provision Characteristics for Disablesé 58

Table 4.10 Sanitary Facilities (WCs)/Shower Rooms & Space Provision Characteristics for Disablesé é é é é é é é é é é é é é é é ..60

Table 4.11 Lighting Points, Sockets and ATMsé é é é é é é é é é é é ..62

LIST OF FIGURES

Figure 2.1: Typical Passenger Lift showing dimensions é é é é é é é é é 13

Figure 2.2: Typical bathroom incorporating a corner WCé é é é é ..é é é 19

Figure 2.3: Typical height for reach and operation of electrical servicesé ...é 21

Figure 2.4: Reach, Height and operation of ATMsé é é é é é é é é é 22

LIST OF APPENDICES

APPENDIX I Questionnaireé é é é é é é é é é é é é é é 82

APPENDIX II Checklisté é é é é é é é é é é é é é é é é é 89

LIST OF ABBREVIATIONS

DCAs	Development Control Agencies
WHO	Word Health Organization
SPSS	Statistical Package for Social Sciences
UD	Universal Design
ATMs	Automated Teller Machines
RII	Relative Importance Index

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

There has been an increasing focus on the interface between housing and disability, as community attitudes and physical barriers in the built environment have prevented people with disabilities from fully participating in society (Zola, 2006). Access to education, employment, housing, recreation, cultural events, and transportation has been denied many people due to designs that do not put the needs of people with disability into consideration (Shapiro, 1994). Along with the growth in the disabled population, the quest for independence and equal rights has grown, as well(Shapiro, 1994).

Universal design (UD), which entails the designs of products that are universally accommodating and cater for all their users (Bone, 1996), is an important and integral aspect

of building design. Seven principles of Universal Design have been identified by Saville-Smith (2006) as: flexibility in use, simple and intuitive use, perceptible information, tolerance of error, low physical effort, and size and space for approach and use, provide a framework for cost-effective policies and strategies to increase physical accessibility for people with disabilities. The aim is to ensure that no one is unable to or finds it very difficult to use a building or its features on account of the way it was designed (Goldsmith, 2000).This seems to have been neglected in Nigeria and advocates of universal design recognize the legal, economic, and social power of a concept that addressed the common needs of people with and without disabilities (Miji, 2009). Access to buildings, spaces and the services therein, can be set at different levels of functionality for disabled people. Welch and Palmers (1995) identify a continuum of accessibility for domestic buildings that ranges from Negotiable, Visitability, Liveable, Adaptable and Universal. Accessibility of services is essential if the goal of fostering functional independence is to be achieved in people with disability. Accessibility to building services is currently very poor in many developing countries (Lang and Upah, 2008; Miji*et al.*, 2009). This shows the importance the society attaches to people with disability.

According to the World Book Encyclopaedia (2004), some people are born with disabilities, while others develop them later in life. However, there are many types of challenges or disabilities, both physical and mental, and they vary greatly in causes, degrees and treatments. The World Health Organization (1997) adopts a social model of disability. It considers that disability is created when a person ñinteracts with an environment that does not support his or her performance in a desiredactivityò. A person is therefore rendered

disabled by the inaccessibility of their built environment and by negative attitudes and stigma, rather than their physical or other impairment (Joseph Rowntree Foundation, 1995).

In the United-Kingdom, Document M of British Standard is one of the series that has been approved and issued by the Secretary of state for the purpose of providing technical guidance with respect to requirements of building regulations 2010 for Wales and England (Sylvester, 1996). This document covers the requirements for access to and the use of new buildings, including dwellings, for everyone. It also includes access and sanitary conveniences to extensions of buildings other than dwellings. The document includes many useful diagrams on how to show compliance with the regulations, along with details on access statements (Ghaem, 1991). Whilst the requirement of the Building Regulations is for ñreasonable provision to be made for people to gain access to and use the building and its facilitiesò, Approved Document M is very clear in recommending a lift in all buildings of two storeys or more to provide inclusive vertical circulation for all buildings users. As such every effort should be made to provide means of access that allows a person with disabilities to move between different storeys of a building (Malone, 2001).

1.2 STATEMENT OF RESEARCH PROBLEM

The provision of equal access to built-environments is integral to the fulfilment of the global commitment to equalizing opportunities for disabled people (Alder, 1999). Okoli (2005) has shown that about 20 per cent of Nigeriaôs population suffers a form of disability, thus the need to harness the potential of disabled persons by eliminating design barriers in buildings to allow this population to contribute its quota to national development. Poor access to buildings and its services generate direct economic costs to society by reducing the economic and social output of people with disabilities (and other special needs users).

Economic costs are also incurred caring for disabled people who are unemployed or under-employed due to inaccessible built environments (Steinfield*et al.*, 1979).

The Government of Nigeria signed the UN Convention on the rights of Persons with Disabilities; yet, no disability discrimination legislation has been enacted within Nigeria despite the fact that two bills have been introduced into National Assembly (Okoli, 2005). The common view held by policy makers and the public at large, is that disabled people and disability issues are Charity and Welfare matters and not Human rights (DFID 2008). Findings by Okoli (2005) also collaborated this and revealed that disabled people in Nigeria are living in an environment that is hostile to their yearnings and aspirations. Thus, there is a need for standards to be designed to meet the needs of Nigerians with disabilities or the enforcement of existing standards in the BS code or adopt the use of the American Disability Discrimination Act which are the basis for universal design.

An assessment of building services provision in some public high rise buildings like; Institute for Peace and Conflict Resolution in Abuja, Yakubu Gowon house in Abuja and Senate Ministry of Finance headquarters, to mention a few is envisage in this study. Some of the problems the study seeks to address are; lifts provisions and the condition of services for disables, toilets and bathrooms space constrains for wheelchair users, provision of grab-bars in bathrooms for unassisted transfer from wheelchair to WC and bath tubs or shower trays, light switches beyond the reach of wheelchair bound persons and Automated Teller Machines (ATMs) with staircases thus inaccessible by people with disability. The criteria used to design such service systems in high rise buildings with respect to the accessibility needs of disables will also be studied from the designersô point of view to establish the level of its conformity to Universal Design principles.

These constrains can make people with disability to have no privacy in sanitary areas, poor access to educational facilities and reduced equal competition for opportunities in the society. Thus the need to exclude these types of obstacles to circulation in buildings from future projects, while studying, investigating and presenting the solutions that would provide possibilities for removing the barriers in existing conditions for better consolidation of Universal Design in Nigeria.

1.3 SIGNIFICANCE OF THE STUDY

There is an underlying ideological belief in Nigeria that disability issues should be addressed through "charity and welfare" hence, social policy issues in Nigeria are categorically not perceived in terms of human rights (Zola, 2006). Consequently, from a public-policy perspective, there is a prevailing attitude that disabled people should be "cared for" and unfortunately, the disables have embraced this same idea (Shapiro, 1994). Thus, the need for implementing disability standards in the design of buildings in Nigeria.The research will be of significance to the designers of buildings within Nigeria, people with disability, clients or owners of buildings and those caring for the people with disability, shedding light on the need for conformity to Universal Design principles and the rights people with disability have to unassisted access to buildings and the services in these buildings.

Proponents of the universal design principles argue that todayôs inaccessible built environments are the result of inattention to the needs of people with disabilities, not cost considerations, and that they tend to create unnecessary costs for society by artificially creating a class of ñspecial needs usersò requiring costly special provisions (Robert, 2000). Such special provisions tend to exacerbate the social isolation and economic dependency experienced by disabled people and identifies them with high costs, government intervention,

and annoying ugly and incongruent additions to structures. In contrast, structures that incorporate universal design principles tend to welcome people with disabilities and other special needs users into the mainstream of society and identify them with design ingenuity, functional beauty and commonality of purpose (Robert, 2000).

Several countries have regulations covering the requirements for access to and the use of new buildings by people with disability, some of which are; Document M of the BS code-United Kingdom, The American Disability Discrimination Act (DDA) and Disability Standards in Japan. These standards are being enforced in most developed countries which allow disables to function freely in the society, thus It is necessary to develop and enact disability standards in Nigeria to ôôshow the importance the society attaches to the accessibility needs of people with disabilityôô (Poulis, 2007).

1.4 AIM AND OBJECTIVES

1.4.1 Aim

The aim of this research is to assess the implementation of universal design principles in the provision of building services in multi-storey buildings, with a view to improve access by disables.

1.4.2 Objectives

The objectives of this research are;

i. To articulate the concept and criteria of universal design (UD).
ii. To assess conformity of the design of building services in multi-storey buildings to published standards.

iii. To establish if Statutory Authorities check designs to ascertain its conformity to universal design principles before approval.

iv. To identify which building services and disabilities require the most attention when designing.

v. Identify the challenges faced by designers when designing.

1.5 OVERVIEW OF RESEARCH METHODOLOGY

In order to achieve the objectives of this research work, the following research methods were adopted:

a) Field Survey

i. Checklists: A careful survey of sixty six (66) multi-storey buildings guided by the use of checklists (see pg. 84) to establish if the services in these buildings meet the minimum standards specified in relevant documents (Approved Document M of the United-Kingdom being the most advanced of all other standards) while putting into consideration the type of building; hospitality buildings, educational institutions, health centers, recreational centers etc. This helped to achieve the second objective.

ii. Questionnaires: Questionnaires (see pg. 77) were administered to building services designers (consultants) to ascertain if they design buildings while bearing in mind the needs of the disabled and universal design principles.The sampling technique adopted in the distribution of the questionnaires was purposive sampling technique giving designers an opportunity to express their perceptions. This helped to achieve the third, fourth and fifth objectives.

With regards to the sampling size in the distribution of the questionnaire, the sampling size was determined based on the formulas considering the fact that the targeted population was known and 145 questionnaires were distributed.

b) Literature Review: Consultation with relevant materials, standards and internet materials in the field was carried out, which was used to achieve objective one.

1.6 SCOPE AND LIMITATIONS

1.6.1 Scope

The scope of this research is confined to building services in buildings and limited to elevators, utilities/sanitary equipment, ATMôs, handrails, ramped access, electrical lighting and space in the areas of the building that accommodates these services. The research studies only multi-storey buildings that have at least 2 floors within Abuja Metropolis (which includes Central Business district, Asokoro, Wuse, Garki, Maitama and Jabi areas) in Nigeria. This is because there is a higher number of multi-storey buildings within Abuja metropolis than the satellite towns. Also, only multi-storey public buildings were assessed using checklists structured from Documemt M of the United Kingdom.

1.6.2 Limitations

The results of this research was limited by the security challenges in the country which made access to several buildings difficult for evaluation using the checklists, which has reduced the total number of buildings accessed from the targeted 100 to 66.

CHAPTER TWO

LITERATURE REVIEW

2.1 BUILDING SERVICES AND PROVISIONS

Building Services Engineering, technical building services, Building Services Architecture, architectural engineering or facilities and services planning engineering is the engineering of the internal environment and environmental impact of a building (Wikipedia, 2013). It essentially brings buildings and structures to life (Herd, *et al.,* 2003). Building services engineering involves the design, installation, operation and monitoring of the mechanical, electrical and public health systems required for the safe, comfortable and environmentally friendly operation of modern buildings (Wikipedia, 2013).The major services of buildings as shown by QBSA (1991) are lighting, heating and ventilation, the lifts

and escalators, acoustics, plumbing, power supply and energy management systems, the security and safety systems.

Building services influences the architecture of a building and plays a significant role on the sustainability and energy demand of a building as shown by World book encyclopaedia (2002) and goes on to enumerate that within building services engineering, new roles are emerging with some examples in the areas of renewable energy, sustainability, low carbon technologies and energy management. With buildings accounting for around 50% of all carbon emissions, building services engineering plays a significant role in combating climate change (Goldsmith, 2000) and some typical building services areas are:

i. Design: Designing layouts and requirements for building services for residential or commercial developments.

ii. Construction: Supervising the construction of the building services, commissioning systems and on-going maintenance and operation of services.

iii. Environmental: Developing new energy saving methods for construction, designing new and improved energy conservation systems for buildings.

iv. Heating, ventilation and air conditioning (HVAC): Specializing in the design, development, construction and operation of HVAC systems.

i. Electrical technology: Specializing in the design and development of electrical systems required for safe and energy sustaining operation of buildings.

2.1.1 Ramped access

The application of universal design to the planning of ramped access routes requires that a few conditions that must be met for efficient use by all users. If a change in level is unavoidable within a storey a gentle slope should be provided with a gradient of 1:20 or steeper which is considered to be a ramp (Goldsmith, 2000). Ramped access routes should be designed to have the shallowest gradient practical, the preferred maximum gradient is 1:20 but where site specific constraints require it, ramps not steeper than 1:12 may be provided if individual flights are not longer than 2000 mm (Document M, 2010). If the gradient is too steep or an individual flight too long, a person using or pushing a wheelchair may not have sufficient strength to travel up the ramp or to ensure adequate control and braking power. There is also the danger of falling forwards going downhill or backwards when going uphill if the gradient is too steep.

Where a ramped access route is provided (Document M, 2010):

a) The minimum clear width (between walls, upstands or kerbs) should be 1500 mm.
b) Level landings should be provided between ramp flights or wherever a change in direction occurs. A level landing is considered to include gradients of 1:50 or less steep.
c) A level landing should be provided at the top and bottom of the ramp. The top and bottom landings should be at least 1800 mm long x 1800 mm wide and clear of any door swings or other obstructions.
d) Intermediate landings should be at least 1500 mm long and clear of any door swings or other obstructions. Intermediate landings should be at least 1800 mm wide and 1800 mm long to

act as passing places when it is not possible for a wheelchair user to see from one end of the ramp to the other or the ramp has three flights or more.

e) The minimum unobstructed width between handrails should be not less than 1200 mm. Handrails, in accordance with 1.1.3.6 should be provided on both sides. Rationale: People with restricted mobility may be weaker on one side and therefore a handrail on each side of the flight is essential for support when ascending and descending ramps.

f) Edge protection in the form of a 100 mm high (minimum) upstand should be provided on the open side of any ramp or landing. It should contrast visually with the surface of the ramp and landing.

g) The ramped access route may form part of a wider ramped area. The intended ramped access route(s) should be clearly identified and signposted where necessary. Additional handrails should be used to divide any intended ramped access route into channels of unobstructed width not less than 1200 mm and not greater than 2500 mm. Rationale: This permits a person with less strength on one side to be within easy reach of support.

h) A stepped access route should be provided in addition to a ramped access route where the rise of the ramp is greater than 300 mm (equivalent to 2 x 150 mm steps). Rationale: Some people find it easier to use a flight of steps rather than to travel on a ramp e.g. people with mobility difficulties who use certain walking-aids, older people, people with vision impairment.

i) An alternative means of access for wheelchair users should be provided e.g. a platform lift, where the ramp is 1:20 or greater and the total rise of the ramp is greater than 2000 mm. Rationale: Ramps simply become too tiring for wheelchair users beyond this height.

2.1.2 Passenger Lifts

A passenger lift is the most accessible means of vertical circulation and allows people with a wide range of abilities to travel conveniently and without discomfort from floor to floor in order to make use of all relevant facilities. Passenger lifts should be provided in all multi-storey buildings to serve all storeys above and below entry level e.g. basements used for car parking, etc. Consideration should be given to other lifting devices, such as lifting platforms that facilitate vertical travel to facilities (Goldsmith, 2000).

Where an accessible passenger lift is provided (Document M, 2010):

a) It should be approached via an accessible horizontal circulation route in
b) Signs should be provided to facilitate finding the lift.
c) Lift landing and lift car doors should contrast visually with the adjoining walls.
d) There should be a clear unobstructed space for maneuvering at least 1800 mm wide and at least 1800 mm deep in front of every entrance door to the lift.
e) Lift car doors should be power operated horizontal sliding doors.
f) Lift car doors should have a clear opening width of at least 800 mm.

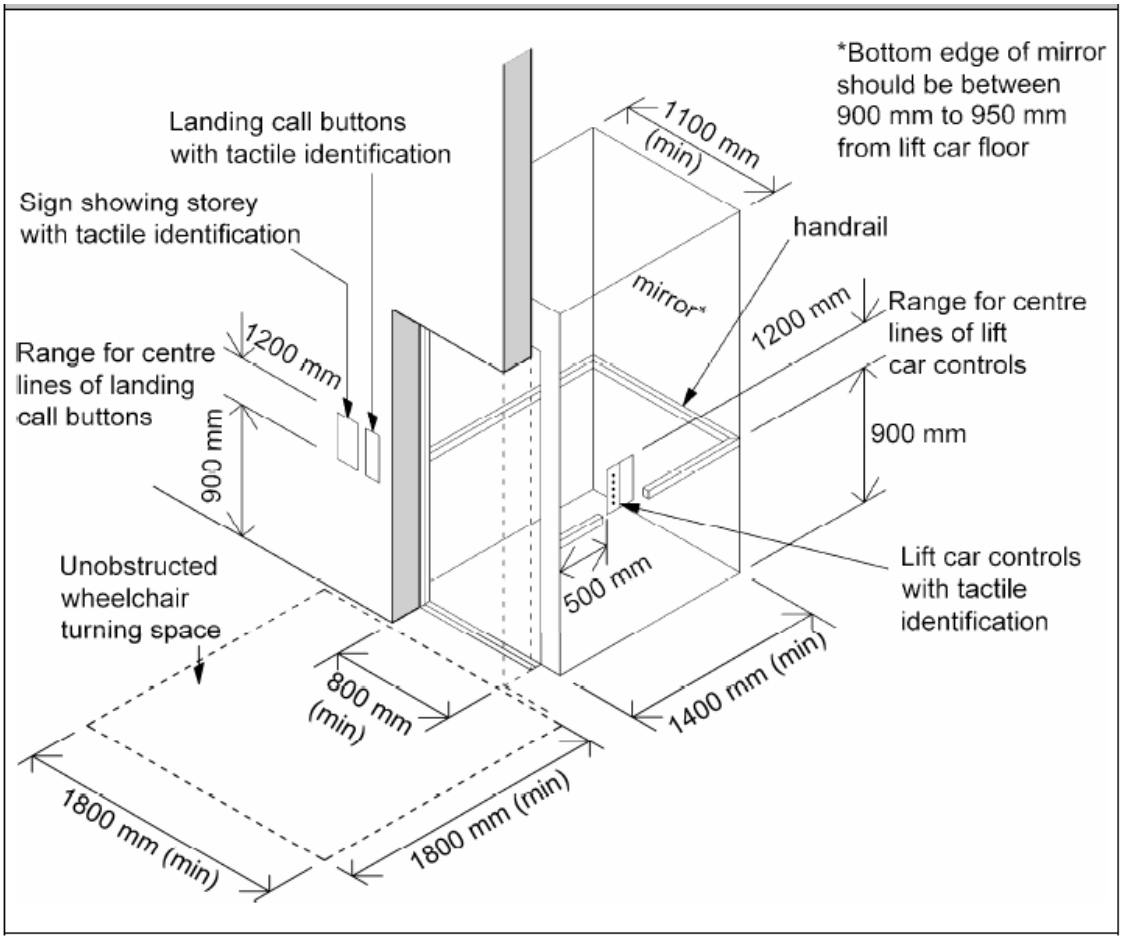


Figure 2.1: Typical Passenger Lift showing dimensions

Source: Document M, approved standard for disability access (2010)

g) Lift car doors should be fitted with timing devices and re-opening activators allowing the doors to stay open for at least 8 seconds. In addition a device should be provided both within the lift car and on the landing to enable the door to be kept open for longer if necessary. Rationale: To allow adequate time for people and any assistance dogs to enter and leave.

h) The minimum internal dimensions of a lift car should be 1100 mm wide x 1400 mm deep. Rationale: This size accommodates manual and electrically powered wheelchairs and one accompanying person.

i) A larger lift car should be provided in the public areas of public facilities such as hotels, cinemas, theatres shopping centres and public libraries, where the public area has a net floor area per floor of greater than 200 m2. The larger lift car dimensions should be 2000 mm wide x 1400 mm deep. Rationale: The larger lift car will facilitate most types of wheelchairs; scooters and buggies, along with several other passengers.

j) The controls in the lift car should be positioned at a height of not less than 900 mm, not more than 1200 mm (preferably 1100 mm) above the car floor and at least 500 mm from any return wall.

k) The call buttons at each landing should not be less than 900 mm and not more than 1100 mm above the landing. Controls should not be located in corners and should be at least 500 mm from any wall or projecting surface. Rationale: This will facilitate a person in a wheelchair reaching the buttons.

l) Suitable tactile indicators for floor numbers should be provided on or adjacent to lift buttons within the lift car and on the landing.

m) The landing call button symbols and control button symbols should be raised to facilitate tactile reading.

n) All call and control buttons should contrast visually with the surrounding face plate and similarly, the face plate should contrast visually with the surface on which it is mounted.

o) The floor of the lifting device should not be a dark colour. Rationale: This can create the illusion, for people with vision impairment, of stepping into an open lift shaft).

p) The lifting device floor should be slip resistant and have frictional qualities similar to or higher than the floor finish of the landing.

q) The lift car and lift lobby should provide both visual and auditory warning of the lift cars arrival and the number of the floor level reached prior to the doors opening.

r) A half-length mirror should be installed on the wall opposite the lift door (where the lift car is not a through lift) with the bottom edge of the mirror being between 900 mm to 950 mm above the lift car floor. Rationale: This avoids confusion for people with vision impairment and to provide a wheelchair user with a rear view to safely reverse out from the lift car.

s) A handrail of contrasting colour with its surroundings should be provided on at least one wall with its top surface at 900 mm above the floor and located so that it does not obstruct the controls or the mirror. Handrails should be terminated in such a way that reduces the risk of clothing being caught.

t) A suitable emergency communication system should be installed. Systems should be easy to use for example intercom and push button activation and contain inductive couplers. Rationale: So that people using hearing aids can make use of them.

u) The illumination in the lift car should minimize glare, reflection, confusing shadows or pools of light and dark. Rationale: Areas of glazing should be identifiable by people with vision impairment.

2.1.3 Sanitary Facilities

For Sanitary facilities in buildings other than dwellings, the objective is to provide independently accessible sanitary facilities that meet the needs of people with a wide range of abilities (Document M, 2010). The number and location of sanitary facilities required in a building will be dictated by the nature of the building, the size of the building, the number of people who will use the building, gender ratio, patterns of use and the ease of access, in the case of places of work, designers should also have regard to the Safety, Health and Welfare

at Work (GAATES, 2003) bearing in mind that these provisions are made for customers, visitors, or staff working in the building. It does not create a requirement for the provision of sanitary facilities in a building or for different user groups e.g. for visitors where provision has only been made for staff. The following represents the minimum provisions to ensure that sanitary facilities where provided for a particular user group, are accessible to all in that group e.g. customers and/or staff.

The guidance is based on providing a minimum clear turning space of 1800 mm x 1800 mm for a wheelchair (Document M, 2010). This space provision will be adequate for many wheelchairs, however some powered wheelchairs and scooters may require larger turning spaces. A wheelchair accessible unisex WC is designed to meet the needs of independent wheelchair users, but it is also equipped to suit ambulant disabled people (Bizrate, 2010). In addition it may be used by people who require additional space, the support of grab rails or integral hand washing facilities. A unisex facility enables assistants of either sex to assist a person with a disability.

Where an en-suite sanitary facility is provided in an accessible bedroom for independent use by a wheelchair user e.g. in hotels, guest accommodation, residential accommodation, medical facilities etc., the sanitary facility should meet the provision of accessible bedrooms in hotel, also balanced combination of en-suite bathrooms and en-suite shower rooms should be provided when more than one en-suite bathroom or shower room is provided. If only one accessible en-suite facility is provided, it should include an accessible shower, rather than a bath since many people with disabilities and elderly people may find it easier to use a shower (Document M, 2010). The space provided for manoeuvring and the relative positioning of

WCs, wash hand basins and other accessories is critical to enable wheelchair users or people with mobility impairment to adopt various transfer techniques that allow independent or assisted use of sanitary facilities (Roy, 1991).

Where accessible sanitary facilities are provided, it should meet some conditions as listed below (Document M, 2010):

(a) Accessible sanitary facilities should be located in a convenient and accessible part of the building

(b) Accessible sanitary facilities should be clearly identifiable since people with difficulty communicating may prefer not to ask directions and should therefore be able to rely on.

(c) Any bath, shower or washbasin tap should be either controlled automatically or be capable of being operated using a closed fist e.g. by lever action.

(d) Any door handles or where doors are fitted with a latch, the door opening furniture should be capable of being operated with one hand using a closed fist e.g. a lever handle. All door opening furniture should contrast visually with the surface of the door.

(e) Doors to accessible sanitary facilities should be fitted with light action privacy bolts so that they can be operated by people with limited dexterity.

(f) The floor surfaces should be firm, level and slip resistant when wet and dry.

(g) Accessible sanitary facilities should not be located in a way that compromises the privacy of users. However, the provision of lobbies to accessible sanitary facilities should be avoided where possible as lobby doors may create barriers to easy movement.

(h) The wall construction and fixings used to support grab rails should be capable of resisting the load exerted by users when pulling themselves to a standing or upright position.

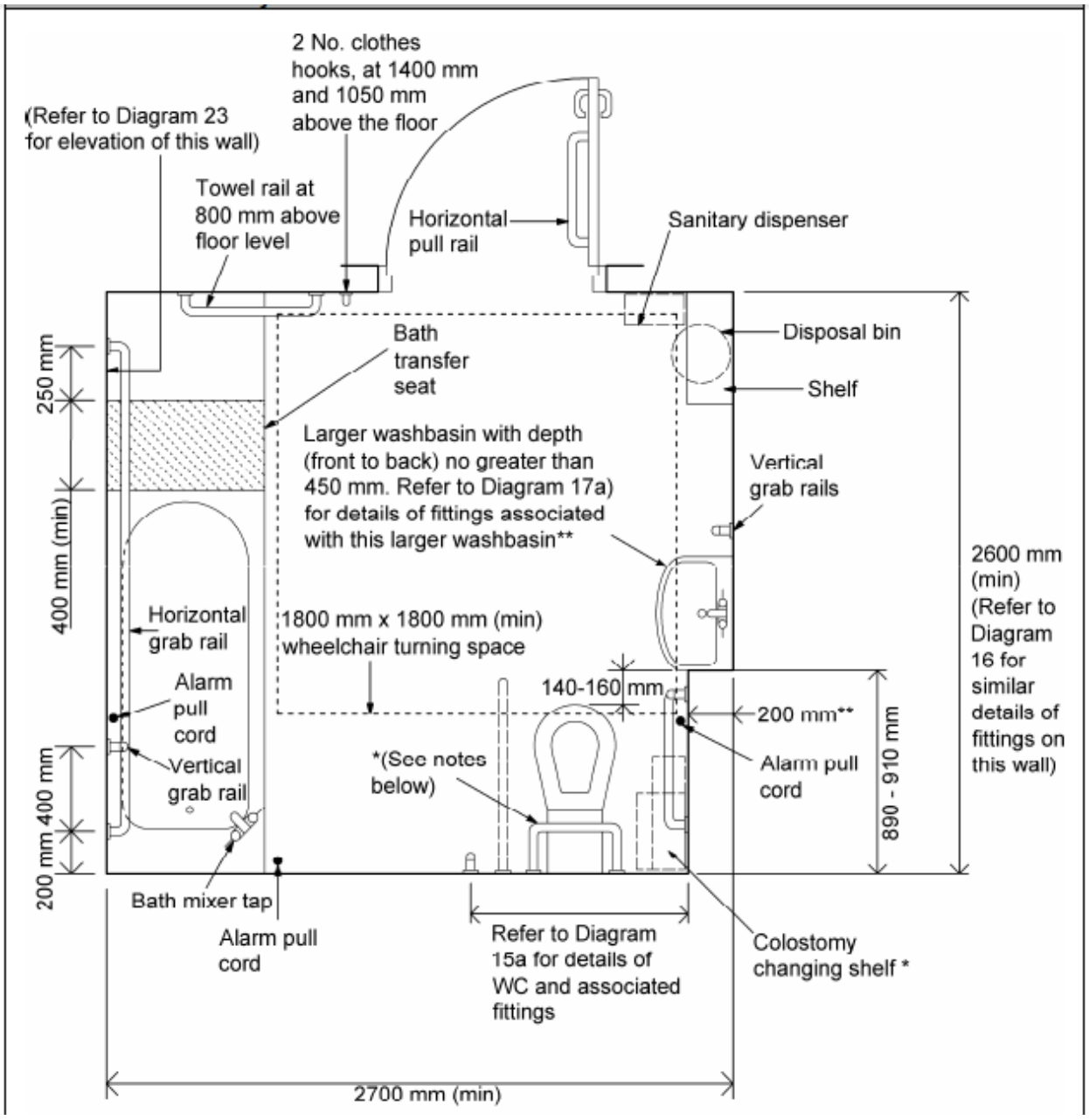


Fig 2.2: Typical bathroom incorporating a corner WC (Document M, 2010)

Source: Document M, approved standard for disability access (2010)

2.1.4 Light Switches and Sockets

Where switches, outlets and controls are provided, Document M (2010) specifies some areas that require attention for the furtherance or universal design:

a. Socket outlets should be located between 400 mm and 1200 mm above the floor, with a preference for the lower end of the range. Examples include wall mounted power socket-outlets, telephone points and TV sockets. Exceptions may be made where floor sockets are provided in open plan areas and the like, or if skirting or dado trunking is required e.g. for safety reasons. These height requirements apply only to convenience socket-outlets used for general purposes and do not apply to dedicated socket-outlets not readily accessible and used for appliances that are intended to be continuously connected in normal use.

b. Simple push button controls that require limited dexterity should be provided and should be located not more than 1200 mm above the floor.

c. Socket-outlets should be located consistently in relation to doorways and room corners, but in any case no nearer than 350 mm from room corners.

d. Light switches for use by the general public should have large push pads and align horizontally with door handles within the range 900 mm to 1200 mm for ease of location when entering a room.

e. The operation of switches, socket- outlets and controls should not require the simultaneous use of both hands except where this mode of operation is necessary for safety reasons.

f. Switched socket-outlets, mains and circuit isolator should indicate visually whether they are on or off.

g. Controls should visually contrast with their backgrounds to facilitate people with vision impairment locating controls also switches on controls should be adequately separated to allow selection of one at a time and avoid the unintended selection of adjacent switches.

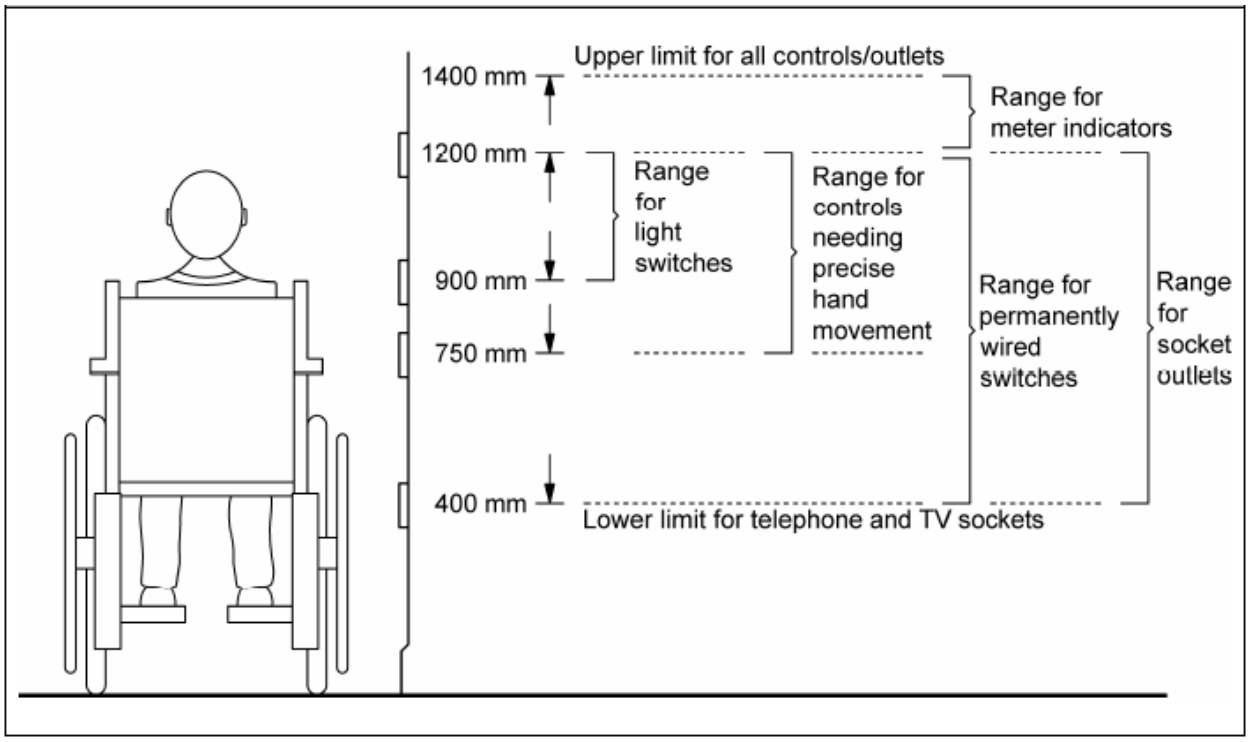


Fig. 2.3: Typical height for reach and operation of electrical services (Document M, 2010)

Source: Document M, approved standard for disability access (2010)

2.1.5 Automated Teller Machine (ATM)

Automated Teller Machines requires high accessibility and should be on an accessible route with Clear Floor Space and located so that clear floor space is provided to allow a

person using a wheelchair to make a forward approach, a parallel approach, or both, to the machine as shown by Goldsmith (1997). Reach depth should not be more than 255 mm, where the reach depth to the operable parts of all controls is measured from the vertical plane perpendicular to the edge of the unobstructed clear floor space at the farthest protrusion of the automated teller machine with a maximum height above the finished floor or grade not exceeding 1370 mm as specified by ADAA (2009).

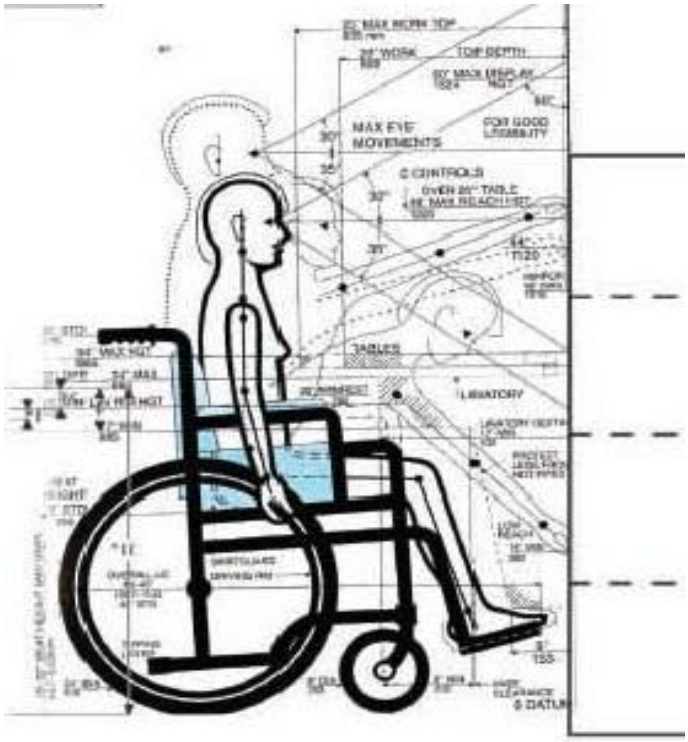


Fig. 2.4: Reach, Height and operation of ATMs (Document M, 2010)

Source: Document M, approved standard for disability access (2010)

2.2 UNIVERSAL DESIGN (UD)

Many nations are becoming more aware of the large number of persons with disabilities and the problems that come with any form of disability. This group includes those born with disabilities and those whose abilities diminish during their lifetime through disease, accident

or aging (Jones and Sandford 1996). The term Universal Design has evolved from Barrier Free Design, Accessible Design, Trans-generational Design, and Adaptable Design (Goldsmith, 1997). It is now considered to be synonymous with "Design for All" and "Inclusive Design". Universal Design as defined by Demesne (2006) is a design approach that seeks to create environments, objects, and systems that can be used by as many people as possible. To this end, Universal Design is the process of embedding choice for all people in the things we design.

i. Choice involves flexibility, and multiple alternative means of use and/or interface.

ii. People include the full range of people regardless of age, ability, sex, economic status, etc.

iii. Things include spaces, products, information systems and any other activities that humans manipulate or create.

Universal Design is a user-centered process that evolves as designers and users broaden their own understanding, perspectives and experience by working with the range of users in a variety of environments. The Centre for Universal Design (CUD, 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 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, 1991), 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.

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 (CUD, 2003). By incorporating the characteristics necessary for people with physical limitations into the design of common products and building spaces and services, these buildings 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.

2.2.1 Concept of Universal Design

Universal Design is an evolving concept, and as such, different people have slightly different definitions. Some of the related definitions from leading Universal Design organizations are;

i. Steinfeld (2012) defines Universal design as a process that enables and empowers a diverse population by improving human performance, health and wellness, and social participation.

ii. ñUniversal Design is a framework for the design of places, things, information, communication and policy to be usable by the widest range of people operating in the widest range of situations without special or separate design (The Institute for Human Centered Design, 2002). Most simply, Universal Design is human-centered design of everything with everyone in mind.

iii. ñUD represents a paradigm for design of the built environment and products to address this diversity and increase use by all by introducing flexibility, choice and accommodating

features to the physical world and business practicesò (The Global Universal Design Commission, 2009)

iv. According to Mace (1991) "Universal Design is 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." Making it clear that the intent of universal design is to simplify life for everyone by making products, communications and the built environment more usable by as many people as possible at little or no extra cost while benefiting people of all ages and abilities.

2.2.2 Evolution of Universal Design

Barrier-Free to Universal Design

Early on, advocates of barrier-free design and architectural accessibility recognized the legal, economic, and social power of a concept that addressed the common needs of people with and without disabilities (CUD, 2003). As architects began to wrestle with the implementation of standards, it became apparent that segregated accessible features were special, more expensive, and usually ugly (Bone, 1996). It also became apparent that many of the environmental changes needed to accommodate people with disabilities actually benefited everyone. Recognition that many such features could be commonly provided and thus less expensive, unlabeled, attractive, and even marketable, laid the foundation for the universal design movement (Goldsmith, 1996).

Rehabilitation Engineering and Assistive Technology

Rehabilitation engineering and assistive technology emerged in the middle of the 20th century. Efforts to improve prosthetics and orthotics intensified with the return of thousands of disabled veterans from World War II in the 1940s (CUD, 2003). During the 1950s, engineering research centers sponsored by the Veterans Administration and other federal organizations were established to address other technological problems of rehabilitation, including communication, mobility, and transportation. Rehabilitation engineering centers expanded during the 1960s and 1970s. Rehabilitation engineering became a specialty that applied scientific principles and engineering methodologies to these problems (CUD, 2003). The label, "assistive technology," was applied to devices for personal use created specifically to enhance the physical, sensory, and cognitive abilities of people with disabilities and to help them function more independently in environments oblivious to their needs (Shapiro, 1994).

Universal Design vs. Accessible Design

The term "Universal Design" has evolved from "Barrier Free Design" and "Accessible Design"; design processes that focus specifically on addressing the needs of people with disabilities. Universal Design goes further by recognizing that humans exist somewhere on a wide continuum of human ability. Everyone, even the most able-bodied person, passes through childhood, periods of temporary illness and injury, and old age (CUD, 2003). By designing for the more limited abilities on the continuum, environments, products, and services can be created that will be easier for all people to use, regardless of their abilities, age or current state of health. Universal Design supports accessibility when something can be used "straight out of the box" by people with different abilities, or when something is

compatible with various adaptive and assistive technologies (Lawler, 2001). For instance, a wider hallway can support the use of mobility devices.

Intersecting Paths between Universal Design and Assistive Technology

Though coming from quite different histories and directions, the purpose of universal design and assistive technology is the same: to reduce the physical and attitudinal barriers between people with and without disabilities (GLA, 2006). Universal design strives to integrate people with disabilities into the mainstream and assistive technology attempts to meet the specific needs of individuals, but the two fields meet in the middle. In fact, the point at which they intersect is a gray zone in which products and environments are not clearly "universal" or "assistive," but have characteristics of each type of design (Goldsmith, 1996). A number of products have enjoyed crossover success, often starting as assistive devices and becoming mainstream products, such as the kitchen utensils with thick grips. A few products have moved the other way, typically conceived as high-tech devices for small markets that find new application in the rehabilitation arena, such as voice recognition software (Chirikos, 1989). **Changing Social Climate**: Throughout history as noted by Shaw (1971), community attitudes and physical barriers in the built environment have prevented people with disabilities from fully participating in society. Access to education, employment, housing, recreation, cultural events, and transportation has been denied many people. Along with the growth in the disabled population, the quest for independence and equal rights has grown, as well. Buyers of assistive technology now demand that products be designed with concern for their impact on the image, as well as the function, of the user (Steinfield, 1979). Devices are expected to be appropriate for use at the office or school, at home, in the community, and on vacation. Similarly, aging members of the baby-boom generation (those born between the

years 1946 and 1964) have begun to see the usefulness of products conceived for people with limitations (American Association of Retired Persons, 1992) and Universal design provides a blueprint for maximum inclusion of all people.

Economics and Feasibility of Universal Design

Experience so far has shown that consideration of disabilities and functional limitations in mainstream design is very definitely feasible from both an economic and practical standpoint (Herd, 2003). In the majority of cases, universal design can be added toa product's design for little or no cost.

i. **Universal Design Can Sometimes Decrease Costs**: In some cases, creating a design which is more accessible can in fact decrease the costs involved in manufacture or maintenance/support of a product. One example is to be found in elevator design. Individuals in wheelchairs or on crutches had great difficulty with the large banks of elevators present in many buildings (CUD, 2003). Often the elevator door would open, but before the person in a wheelchair could get to the correct elevator, the door would close (Kroemer, 1987). An obvious solution would be for the elevators to stay open for a longer period of time. However, building codes required that a building's floors be visited by the elevators with a specified frequency (Malone, 2001). If the doors were made to stand open longer, additional elevators would need to be installed in the building to meet the level of service standards. On examining the problem more carefully, however, it was noted that the problem was not that individuals in wheelchairs or on crutches were unable to enter an elevator within the time the door normally remained open (Malone, 2001). The problem was identifying which elevator was coming so they could position themselves in front of its door. By simply reprogramming

the elevator's controlling computer it was possible to have the elevator activate the signal tone and light for the proper elevator in advance of its arrival at the floor (Kroemer, 1987).

Adopting this advance warning as a standard for elevators solves the accessibility problem without increasing costs (Kroemer, 1987). In addition it was found that both disabled and able-bodied persons were able to board the elevator much more rapidly when this advance warning was given. As a result, it was then possible to either decrease the number of elevators or still provide the same level of service to the floors, or to increase the level of service, since the time the elevator is open on a floor could be reduced (Holmes-Siedle, 1996). Thus, the more accessible design turned out to be less expensive overall.

ii. **Universal Design Can Increase the Functionality for Able-Bodied Users**: It is very common for accessible designs also to prove beneficial for individuals who do not have limitations (Newell et al, 1987). In the elevator example above, the advance warning not only increased the speed with which the elevators could service the floors, but also made it much easier for normal passengers to manoeuver their luggage and board the elevator as shown by Goldsmith (1996) (i.e., without having to grab one bag and throw it into the elevator door while they retrieved their other bags from in front of the wrong elevator). Probably the most common example of accessible design is the ramp. Although the curb cuts are put in for persons in wheelchairs, it is estimated that for every individual in a wheelchair using a ramp, somewhere between ten and one hundred bicycles, skateboards, shopping carts, baby carriages and delivery carts use the curb cut (Holmes-Siedle, 1996). It is also not uncommon to see individuals walk slightly out of their paths in order to walk up a ramp rather than stepping up onto the curb, indicating a preference for the ramp even when walking (Newell et al., 1984).

In general, when products, environments or systems are made more accessible to persons with limitations, they are usually easier for more able-bodied persons to use. Some of the potential benefits include lower fatigue, increased speed and lower error rates.

iii. **The Consequences of Not Providing Accessible Designs**: The benefits above are only half of the economic justification for more accessible design. A second and perhaps more significant economic benefit would be reduction of the costs to society which result from individuals being unable to effectively function independently in the world as it is currently designed (Kroemer, 1987). These costs take the form of benefits paid out of tax dollars for special assistance due to a disabled person's unemployment or non-independent living. In addition, there is the loss to society of these individuals' productivity (meaning loss of tax revenues, creation of wealth, and contributions to society).

Overall disability expenditures in the U.S. rose approximately linearly from 50 billion dollars in 1975 to 170 billion dollars in 1986 (Berkowitz et al, 1989). Assuming this trend continues, the outlays for 1990 are estimated to exceed 200 billion dollars. Approximately half of the 1986 cost was for medical treatment, while the other half was for direct transfer payments. (Transfer payments are the actual funds allocated each year to people because of disabilities.) Other economic losses from disability (not including transfer payments) are estimated to have been in excess of 177 billion dollars in 1980 as shown by Chirikos, (1989).

2.2.3 Principles/Elements of Universal Design (UD)

The term Universal Design was coined by Ronald L. Mace collaborated with a group of architects, product designers, engineers and environmental designers to develop the Seven Principles of Universal Design which are as follows (Goldsmith, 1996):

1. **Equitable Use:** The design is useful and marketable to people with diverse abilities. This includes; the provision of the same means of use for all users,Avoid segregating or stigmatizing any users, Provisions for privacy, security, and safety made equally available to all users andMake the designs appealing to all users.

2. **Flexibility in Use:** The design accommodates a wide range of individual preferences and abilities. This includes; providing choice in methods of use, accommodate right- or left-handed access and use, facilitate the user's accuracy and precision and Provide adaptability to the user's pace.

3. **Simple and Intuitive Use:** Use of the design is easy to understand, regardless of the userôs experience, knowledge, language skills, or current concentration level. Some guidelines governing this are;Eliminating unnecessary complexity, being consistent with user expectations and intuition, accommodating a wide range of literacy and language skills, arrange information consistent with its importance and provide effective prompting and feedback during and after task completion.

4. **Perceptible Information:** The design communicates necessary information effectively to the user, regardless of ambient conditions or the userôs sensory abilities. This includes; Use of different modes (pictorial, verbal, tactile) for redundant presentation of essential information, Provision of adequate contrast between essential information and its surroundingsôMaximize "legibility" of essential information, Differentiate elements in ways that can be described (i.e., make it easy to give instructions or directions) and Provide compatibility with a variety of techniques or devices used by people with sensory limitations.

5. **Tolerance for Error:** The design minimizes hazards and the adverse consequences of accidental or unintended actions. This includes; The arrangement of elements to minimize hazards and errors, most used elements, most accessible; hazardous elements eliminated, isolated, or shielded, Provide warnings of hazards and errors and Provide fail safe features discourage unconscious action in tasks that require vigilance.

6. **Low Physical Effort:** The design can be used efficiently and comfortably with minimum fatigue. This includes; Allowing user to maintain a neutral body position, Use reasonable operating forces, Minimize repetitive actions and Minimize sustained physical effort.

7. **Size and Space for Approach and Use:** Appropriate size and space is provided for approach, reach, manipulation, and use regardless of userôs body size, posture, or mobility. This includes; providing a clear line of sight to important elements for any seated or standing user, make reach to all components comfortable for any seated or standing user, Accommodate variations in hand and grip size and Provide adequate space for the use of assistive devices or personal assistance.

2.2.4 The 95th Percentile Illusion

It should be clear that even if elderly and disabled persons are included in the mainstream design process, it is not possible to design all products and devices so that they are usable by all individuals (Holmes-Siedle, 1996). There will always be a group of individuals who are unable to use a given product. In order to include a sizeable portion of the population in the category of "those who can use a product with little or no difficulty," the 95th percentile data are often used (Kroemer, 1987). The problem is that there are no "95th percentile" data for specific designs. Rather, there are only data with regard to individual physical or sensory

characteristics. Thus there is 95th percentile data for height, a 95th percentile for vision, hearing, etc. As a result, it is not possible to determine when a product can be used by 95% of the people (Kroemer, 1987). It is only possible to estimate when a product can be used by 95% of the population along any one dimension. Since people in the 5% tail for any one dimension (e.g., height) are usually not the same people as the 5% tail along another dimension (e.g., vision) (Kroemer, 1987), it is possible to design a product using 95th percentile data and end up with a product that can be used by far less than 95% of the population. On the other hand, there is a much wider range of different individual types of disability. In addition, the data from which the 95th percentiles are calculated often exclude persons with disabilities (Kroemer, 1987); making the percentage that could use the design(s) smaller than one would first calculate.

2.3 DISABILITIES AND DISABILITY STANDARDS

People with disabilities, otherwise known as People with special needs are those people with one form of disability or the other, capable of limiting their involvement and participation in the regular activities, and subsequently affect their performance and functionality in the society (Osakwe, 2005). These can be classified into eight, with respect to the type and nature of their disability problems and the classifications are as discussed in turn below (Oyewo, 1999):

The Hearing Impaired: These are people with little or no ability to hear sounds through one ear (unilateral impairment) or both ears (bilateral impairment). They can be totally deaf or hard-of-hearing.

1. The Visually Impaired: These individuals have difficulties in one or more functions of their visual system. They are also either totally blind or partially sighted.
2. The People with Speech Disorders: People with speech disorders are those that experience lack of development and stimulation which affect the effective mental formation of words or their physical production.
3. The Emotionally Disorder: These are the people that have problems in their emotional development. They are not usually emotionally stable.
4. The Mentally Retarded: People with mental retardation are those whose mental ability, growth and development are hindered by biological, environmental or hereditary factors that prevent them from adapting and adjusting to the normal environment. They could be the moronics, the imbeciles, the idiotics, the trainable and the educable based on the degree of their retardation.
5. The Physically Disabled: The physically disabled people are physically disadvantaged due to conditions that permanently prevent them from exercising normal body control and movement.
6. The People with Learning Disabilities: These people have disorders in one or more of the fundamental physiological processes involved in the understanding, speaking and writing of language, which include wrong pronunciation of words, spelling, reading and so on.
7. The People with Multiple Disabilities: People with multiple disabilities, as the classification implies, are those with more than one form of disabilities.

2.3.1 Disability Standards

Most developed countries across the globe have detailed and advanced Disability Standards that are extracts from their building codes and sheds more light on areas that require detailing, expatiation and illustrations using diagrams. These standards give

minimum standard of work for building and activities within them. Nigeria has no disability standard though some aspects of the National Building Code give sparse details on certain areas that touch on disability access and UD. The National Building Code as compared to Document M of the United Kingdom has no diagrams and tends to be descriptive rather than prescriptive.

2.3.2 Nigeria National Building Code

The importance of Building Code cannot be over emphasized, for it sets the minimum standards on building pre-design, design, construction and post construction stages with a view to ensuring quality, safety and proficiency of our building industry. According to Snelling (1997) building regulations are designed to secure the health, safety and convenience of people in or about buildings and of who may be affected by buildings or matters connected with them Anderson et al(2004) noted that building codes are needed in every society to take care of risks posed by lack of uniformity, victims of poor construction, lack of enforcement of other legislations and billions of annual loses, of which could be avoided.

This is particularly important in the case of Nigeria where human activities in the built environment were haphazardly carried out, and this led to the deplorable condition of the built environment, besides that there is serious abuse in the built environment due to careless human activities, evidenced by the unsightly, decaying and dilapidated buildings that become the common features of our national building stock within the built environment, both in cities and villages (Abiola*.,* 2005). Other problems are the rampant building collapses and fire infernos that continuously claim lives and properties, and make the environment very unsustainable (Mbamali, 2007).These problems received the attention of the government and

stakeholders in the construction industry which led to the first ever, National Building Code (2006) which, is aimed at sanitizing the building industry and protecting the environment.

There is no doubt that the promulgation of the National Building Code (2006) is very important development in the building industry in Nigeria, however, to legislate is one thing and to enforce such an important legislation is quite another. For many measures must be put in place in order to make the National Building Code (2006) workable. This include among others, creation of an enabling environment for its operation, enlightenment campaign, provision of all the necessary legal frame works for its operation, etc. This explains the reason why many experts have done alot of work on various issues relating to the National Building Code (2006). These include: Ademoroti (1992) on the need for laws to control buildings in Nigeria, Bamisile (2000) wrote on the need for National Building regulations in Nigeria. Lamoreaux (2002) has undertaken work on understanding building codes and housing codes.

2.3.3 Comparison between Disability Standards of Different Countries

Guideline and relevant policy documents of 9 countries were reviewed: the United Kingdom (UK), the Netherlands, Sweden, Norway, Denmark, New Zealand (NZ), Australia, Canada and the United States of America (USA). All countries have legislation in place to protect the rights of people with disabilities, from the Canadian Charter of Rights and Freedoms established in 1982 (Canadian Office for Disability Issues, 2006) to the Prohibition of Discrimination Act published more recently in Sweden (Government of Sweden, 2003). The majority of countries enacted their disability legislation in the 1990s and base their disability strategies and policies on the United Nations Standard Rules on Equalisation of Opportunities for People with Disabilities (UN, 1993).

With respect to disability strategy, The UK appeared to have the most developed strategy for people with disabilities and for their maternity care, with a requirement for each primary care trust to publish a Disability Equality Scheme that is reviewed at 3-year intervals (Council of Europe, 2008). Published examples of good practice include 2 hospitals that have appointed a disability advisor to support both patients attending the services and all staff working in the organisation, and to act as an advocate as required (NDA, 2009).

All countries reviewed possessed legislation relating to the care of people with disabilities, and the 4 English-speaking countries discussed (UK, New Zealand, Australia and Canada) also had guidance from their professional bodies on this area of care. Three of those 4 countries (UK, New Zealand and Australia) had a country-wide disability strategy, and 3 countries (Canada, Australia and New Zealand) had a national strategy but only 2 of the strategies (from Australia and New Zealand) referred to persons with disabilities. The UK, in particular, has a number of well developed policies and guidelines in this area. In general, persons with intellectual disabilities were the least recognised group included in the available plans in all countries (NDA, 2009).

With the exception of the UK, Ireland appears to have better-developed plans than all other European countries and many of the states in the USA and Canada. However, there is no room for complacency, as the Irish policies are not specific to the care of women with disabilities during pregnancy, childbirth and early motherhood, nor are they implemented universally or completely (NDA, 2009).

2.3.4 The Document M Building Regulation of United Kingdom

Britainôs national building regulations are functional, they ask for something such as ventilation, means of escape in the event offire, drainage, sanitary conveniences andwashing facilities to be provided at anadequate or reasonable level (Cheek, 2004). The design standardsprescribed in the 2010 Document M ApprovedDocument are shown in many diagrams and are the yardstick against whichuniversal design options are measured.

For access provision in newly designed public buildings, a narrow interpretation of Document M requirements can for three reasons hinder the realization of universal design as shown by Beresford (2000);

i. Exclusive attention to the needs of disabled people ignores many other building users who are prone to architectural discrimination, for example women in respect of public toilet facilities.
ii. The top-down form of Document M comes with minimum design standards that present cut-off points, meaning that disabled people who are not accommodated by the minimum standards are liable to be excluded.
iii. The conflicting methodologies of designing for the disabled versus designing for everyone.

The worldôs first-ever set of design standards for accessibility were designed by Tim Nugget (Goldsmith, 1996) when teaching a group of handicapped children and then went on to demonstrate how the university and public buildings in Champaign and Urbana could be altered so that they were accessible to wheelchair users. Architectural barriers, he recognized, were the obstacle that stood in the way of their being able to realize their full potential for achievement and compete successfully with others for the material rewards that America offered. He became Americaôs national expert on the subject, and was asked to prepare the

draft of what was to be the seminal document in access-for-the disabled (The 1961 A117.1 American Standard Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped). In America, and then in Britain and elsewhere around the world, the 1961 A117.1 set the mould for access standards. This standard developed by Tim Nugget drew on four propositions, which were flawed, but which in the context of the administration of regulatory controls for accessibility has effectively remained undisturbed (Goldsmith, 1996). These are;

i. That architectural barriers in and around buildings are a threat to disabled people, but not to able-bodied people.
ii. That all disabled people ï all those with a physical, sensory or cognitive impairment ï can be disadvantaged by architectural barriers and can be emancipated where they are removed.
iii. That for accessibility purposes, whatever suits wheelchair users will generally serve for all other disabled people, allowing there to be a single package of access prescriptions with a common set of design specifications.
iv. That design specifications for disabled people can be precise and definitive ï that there are órightôsolutions.

With universal design the aim is that buildings should be convenient for all their users, with architectural discrimination being avoided (Mace *et al*., 1991). There are occasions where discrimination is unavoidable. Adherence to Document M design standards always serve to reduce discrimination, the operative factor being that they are geared to meeting the needs of independent wheelchair users.

2.3.5 Disability in Nigeria

The disabled are a diverse population within our society. They vary in characteristics to as large an extent as the non-disabled. Classifications of the disabled are sometimes used as arbitrary labels to describe those with similar disabilities. Thus, the word "disable" means to make unable or unfit; cripple; incapacitate. The disabled in our society are therefore those persons who are unable, unfit, crippled or incapacitated by multitude of factors such as congenital defects, hereditary influences, accidents, infections, diseases and other environmental concomitants. For anyone to qualify as a disabled an important characteristic must be manifested and that is a major limitation of activity must be present. In other words, the condition must be such that the victim is unable to carry on his primary duties (Michailakis, 1997).

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 (Mickailakis, 1997; Lang et al, 2008). In Nigeria, WHO estimates put the number of people with disability at 29 million, approximately 20% of the countryôs population (Lang *et al*, 2008) though there are no credible and robust statistics in Nigeria about most things including disability issues as there was 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 ð they are poor, marginalized and excluded (Lang et al, 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 (Michailakis, 1997).

A recent review of disability issues in Nigeria identified many factors why the disability agenda continues to suffer. Notable among them are: the absence of disability discrimination laws, lack of social protection, poor understanding of Universal Design issues by the public, and poor access to rehabilitation services (Lang *et al*, 2008). The report recommended, among others, the collection of robust and reliable data, and advocacy for the passage of the disability bill into law.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 RESEARCH DESIGN

Multiple research methods were used for the study; the first was an intensive study of literatures on the subject matter, which was exhaustively discussed in chapter two. The second source of information was the questionnaire survey using structured questionnaires designed and administered to Building services designers/professionals within Abuja metropolis. Thirdly, a physical inspection/assessment was carried out using checklists developed from existing standards (Document M Regulation of the United Kingdom).

3.2 QUESTIONNAIRE SURVEY

Questionnaires were administered to building services designers. The questionnaire sought information in aspects pertaining to the implementation of UD in the provision of building services in multi-storey public buildings, which includes;

i. The designersô knowledge of Universal Design.

ii. The type of standard the designer uses and the type of disability that requires more consideration when designing.

iii. Role of Statutory Authorities as regards the furtherance of Universal Design.

iv. Challenges faced by designers when designing to achieve Universal Design.

Other questions in the questionnaire entail ranking some identified variables on a five (5) point likert scale that assessed either frequency of use, significance of the factor and availability of inputs. For example with frequency of use;

1. = Always
2. = Very often
3. = Sometimes
4. = Rarely
5. = Never.

Purposive sampling technique was used for the distribution of questionnaires. Purposive sampling is the use of a subset of the population to represent the whole population. As regards the sampling size in the distribution of the questionnaire, the sampling size was determined based on the formula below bearing in mind that the targeted population is known (Bill, 2002).

Sample Size - Infinite Population (where the population is greater than 50,000)

$$SS = \frac{Z^2 \times (p) \times (1 - p)}{C^2}$$

Where:

SS = Sample Size

Z = Z-value (e.g., 1.96 for a 95 percent confidence level)

P = Percentage of population picking a choice, expressed as decimal

C = Confidence interval, expressed as decimal

A Z-values (Cumulative Normal Probability Table) represent the probability that a sample will fall within a certain distribution.

The Z-values for confidence levels are:

1.645 = 90 percent confidence level

1.96 = 95 percent confidence level

2.576 = 99 percent confidence level

Sample Size – Finite Population (where the population is less than 50,000)

$$SSô = \frac{SS}{[1 + (\frac{SS ï 1}{Pop})]}$$

Pop = Population of registered professionals in Abuja.

Note: Calculate the sample size using the infinite population formula first. Then use the sample size derived from that calculation to calculate a sample size for a finite population

Using a 95% confidence level,

$$SS = \frac{Z^2 \times P \times (1-P)}{C^2}$$

$$= \frac{(1.96)^2 \times 0.1 \times 0.9}{(0.05)^2}$$

SS = 155.27

Therefore: New SS = $\frac{155.27}{[1+ (\frac{155.27-1}{2240})]}$

= 155.27/1.07

= 145 Questionnaires

The data collected for this study was subjected to descriptive statistical analyses using the computer based software ñStatistical Package of Social Sciencesò (SPSS) where means, frequencies Relative impotance index (RII) were gotten. The results of the analysis are presented in the forms of table for the purpose of easy comparison and clear expression of the findings**.**

3.3 PHYSICAL ASSESSMENT

This research also focusses on assess building services provisionsô conformity in multi-storey buildings to universal design principles, thus the selection of Abuja metropolis for the purpose of this research. Abuja is a city that is fast developing and has quite a number of multi-storey buildings and a high influx of people from different parts of the country including disables. Public buildings ranging from hospitality, institutional, office, shopping malls, Health Centres to recreational buildings were assessed and questionnaires distributed to professionals and building services designers while checklists were used to check the conformity of the services contained therein to published standards.

The checklist was also prepared in accordance with the requirements of Document M of the United Kingdom and seeks to collect relevant information on the multi-storey buildings under study. Information such as; the presence functional lift systems, height of switches and sockets from finished floor level, presence of ramps at the entrance of buildings, effective slope of ramps, presence grab-bars in bathrooms and toilets for unassisted transfer from wheelchair to WC or shower, space requirement in these areas and so on were gotten.

Percentages were used to analyse the data generated from the checklists and rate them for conformity or disconformity according to the building services components that were accessed.

CHAPTER FOUR

DATA PRESENTATION AND DISCUSSION

4.1 THE PERCEPTION SURVEY

This chapter analyses data collected from secondary sources using questionnaires and check lists and the results obtained are presented and discussed to infer their meaning to this study. Questionnaires were distributed to professionals and designers of building services in the construction industry to get their views on the design of building services and its conformity to Universal design principles. A total of 150 questionnaires were distributed and 142 were returned adequately filled thus yielding a response of 94.66%.

4.1.1 Respondents' Profile

The profile of all respondents from the analysis conducted is tabulated and presented in Table 4.1 below. From the table, it can be seen that there were more Electrical Engineer respondents (31.0%) followed by Architects (21.1%) and then Mechanical Engineers (19.7%). The highest years of working experience was 16-40 years with frequency of 48.6%;

this was followed by 10-15 years with frequency of 24.6%. It was also observed that the highest qualification of the respondents was MSc/B.Tech with a frequency of 40.8%. Professionals that are into design and those in the academia yielded a response of 45.1% and 35.0% respectively followed by those involved in the construction of buildings (19.7%).

Table 4.1 Respondents' Profile

S/N	Variable	Option	Frequency (No)	Percentage (%)
1	Profession:	a. Architects	30	21.1
		b. Builders	14	9.9
		c. Civil Engineers	9	6.3
		d. Estate Managers	17	12.0
		e. Mechanical Engineer	28	19.7
		f. Electrical Engineer	44	31.0
		Total	**142**	**100**
2	Years of experience:	a. 0-5	18	12.7
		b. 6-10	20	14.1
		c. 11-15	35	24.6
		d. 16-40	69	48.6
		Total	**142**	**100**
3	Qualification:	a) HND	17	12.0
		b) BSc/BTech	58	40.8
		c) M.Sc.	53	37.3
		d) PhD	14	9.9
		Total	**142**	**100**
4	Area of specialization:	a) Design	64	45.1
		b) Project Management	6	4.2
		c) Facilities Management	-	-
		d) Construction	28	19.7
		e) Academics	44	35.0
		Total	**142**	**100**

Source: Field Survey, (2013)

4.1.2 Perception and Knowledge of Universal Design (UD)

The perception and knowledge of UD by professionals is shown on table 4.2 below.

Table 4.2 Perception of Universal Design

S/N	Variable	Option	Frequency (No)	Percentage (%)
1	Knowledge of Universal Design:	a) Yes	129	90.8
		b) No	13	9.2
		Total	**142**	**100**
2	How the respondent came across Universal Design:	a) Taught courses	18	12.7
		b) On-the-the job	58	40.8
		c) Personal Study	51	35.9
		d) Seminars and Conferences	- 13	- 10.6
		e) Not at all		
		Total	**142**	**100**
3	Designing with Universal Design in mind:	a) Yes	79	55.6
		b) No	63	44.4
		Total	**142**	**100**
4	Disables have right to unassisted access:	a) Yes	142	100
		b) No	-	-
		Total	**142**	**100**
5	The Standards used to Design:	a) Document M	58	40.8
		b) American Disability	39	27.5

	Acts		
	c) Disability Acts of Australia	14	9.9
	d) Nigeria Building Code	10	7.0
	e) Architectural Data	11	7.7
	f) None	10	7.0
	Total	**142**	**100**

Source: Field Survey, (2013)

Table 4.2 shows that 9.2% have no knowledge of Universal Design, while 90.8% of the respondents have knowledge of Universal Design. Most respondents came across UD through on-the-job trainings with frequency of 40.8%, while personal study had a response rate of 35.9%. The study also showed that 55.6% of the respondents design services in buildings bearing in mind the needs of disables and UD principles while 44.4% of the respondents design without giving due consideration to UD principles. All the respondents (100%) however feel disables have the right to unassisted access to public buildings. Most of the respondents with frequency of 40.8% use Document M of the United Kingdom when designing, followed by the American Disability Act with frequency of 27.5%.

4.1.3 Building Services, Components and Space Requirement

Relevant standards give minimum requirements for services and building components so as to meet the accessibility needs of disables and Universal Design principles. Some areas that require special attention when designing are ranked in Table 4.3 which goes on to show which component requires more attention when designing.

From the table, it can be seen that Space requirement in bathrooms requires the highest attention with RII of 0.98. This was followed by location of bathrooms/toilets with RII of 0.97 and lighting points/sockets with RII of 0.9 thus a need for consultation with relevant standards when designing while elevators require the least attention (with RII<0.6). With the

mean of all the services and components being >4.4, it shows that the design of these services and components requires high precision and consultation with standards to achieve easy access and reach by both disables and able bodied persons.

Table 4.3: Ranking Building Services, Components and Spaces Requirement

SERVICES & COMPONENTS	FREQUENCY					($\sum f$)	$\sum fx$	MEAN	RII	RANK
	1	2	3	4	5					
Ramps	-	-	23	81	38	142	584	4.11	0.82	4TH
Lighting points and sockets	-	-	06	24	112	142	675	4.75	0.95	3RD
Location of bathrooms and toilets	-	-	02	20	120	142	686	4.83	0.97	2ND
WC location and height	-	19	22	80	21	142	530	3.73	0.75	7TH
Wash-hand basin position and height	02	14	28	77	21	142	527	3.71	0.74	8TH
Space requirement in bathrooms	-	-	-	19	123	142	692	4.87	0.98	1ST
Provision of handrails in showers and by WCs	-	-	20	100	22	142	569	4.01	0.80	5TH
Elevators	-	-	64	65	13	142	517	3.64	0.73	9TH
Escalators	-	-	82	53	7	142	493	3.47	0.59	10TH
ATMs	-	-	52	69	21	142	537	3.78	0.76	6TH

Source: Field Survey, (2013)

Where: 1= Strongly disagree, 2= Disagree, 3= Uncertain, 4=Agree, 5=Strongly agree

4.1.4 Designing to Incorporate Universal Design

Universal design is hinged on the implementation of several disability standards to achieve ease of access and use of buildings and the services there in, thus the need to consider different kinds of disabilities and the possibility of meeting the needs of disables as shown on Table 4.4.

Disables with mobility impairment face a higher challenge as regards access and use of buildings (63.4%), visually impaired persons are second with 24.6% challenge while those with mental impairment face the least challenge (3.5%), though these designers consider mobility and visual impairments mainly (68.3% and 23.3% respectively) when designing. Most respondents (84.6%) think that all the needs of disables cannot be met when designing and only 66-80% of these needs can be met as shown by 59.4% of the respondents followed by 86-90% of these needs (25.4%).

Table 4.4 Disabilities and its consideration in design

S/N	Variable	Option	Frequency	Percentage (%)
1	Challenge as regards access and use of buildings by disables:	a) Visually impaired	35	24.6
		b) Hearing impaired	12	8.5
		c) Mobility impaired	90	63.4
		d) Mental impaired	5	3.5
		Total	**142**	**100**
2	Disability considered when designing:	a) Visual impairment	33	23.2
		b) Hearing impairment	-	-
		c) Mobility impairment	97	68.3
		d) Mental impairment	-	-
		e) None	12	8.5
		Total	**142**	**100**
3	Possibility of meeting all disability needs when designing:	a) Yes	22	15.5
		b) No	120	84.5
		Total	**142**	**100**
4	% of disability needs that can be met:	a) 35-50%	5	3.5
		b) 51-65%	18	16.2
		c) 66-80%	73	54.9
		d) 81-90%	31	25.4

e) 91-99%	-	-
f) None	-	
Total	**122**	**100**

Source: Field Survey, (2013)

4.1.5 Role of Statutory Authorities in the Implementation of Universal Design Principles.

Statutory Authorities/Development Control Agencies (DCAs) are saddles with the responsibility of checking designs for inconsistencies and digression from published standards before approval. Table 4.5 shows the contribution of DCAs from the perspective of designers and professionals in the construction industry.

Table 4.5 Development Control Agencies (DCA) and the Implementation of Universal Design (UD)

S/N	Variable	Option	Frequency	Percentage (%)
1	DCAs check for compliance with UD principles;	a) Often	41	28.9
		b) Rarely	68	47.9
		c) Never	33	23.2
		Total	**142**	**100**
2	Stage DCAs check designs for compliance with UD	a) Design stage	94	66.2
		b) Pre-contract stage	15	10.6

	principles:	c)	Construction stage	-	-
		d)	Finishing stage	-	-
			Total	**142**	**100**
3	Action DCAs take against non-compliance to UD principles:	a)	Demolition	-	-
		b)	Non approval	60	42.3
		c)	Correction	49	34.5
		d)	Stop work	-	-
			Total	**142**	**100**

Source: Field Survey, (2013)

From Table 4.5, only 28.9% of the respondents have their designs checked for conformity with universal design principles while a whopping 47.9% of the respondents rarely have designs being checked when submitted for approval. 66.2% of these are checked by DCAs at design stage, 10.6% at pre-contract stage and 23.2% opine that these designs are not checked for compliance with Universal Design principles. In an event where these designs do not conform to approved standards, it is observed that 42.3% of these designs are not approved and 34.5% are sent back for correction.

4.1.6 Challenges in Design to Incorporate Universal Design

With every solution comes challenges, thus as the world tends towards eliminating disability needs and incorporating UD through the improvement of technology and the use/review of approved standards, some challenges stand out and have deterred the full implementation of UD. Some of these challenges and the impedance to the implementation of these principles as shown on Table 4.6 are ranked.

Table 4.6: Challenges faced when designing to incorporate UD.

FREQUENCY	(∑f)	∑fx	MEAN	RII	RANK

CHALLENGES	1	2	3	4	5					
-Affects aesthetics negatively	-	-	78	64	-	142	490	3.45	0.69	5TH
-Expensive	-	13	102	27	-	142	440	3.10	0.62	7TH
-Unimportant	102	34	06	-	-	142	188	1.32	0.26	10TH
-Includes unnecessary obstacles	-	97	44	1	-	142	663	2.32	0.47	9TH
-Does not improve the movement of able bodied persons	08	97	33	04	03	142	543	2.83	0.58	8TH
-Makes design time consuming	-	24	24	94	-	142	496	3.49	0.69	6TH
-Clients influence decisions made	-	-	21	121	-	142	547	3.85	0.77	4TH
-Lack of Nigeria disability standard	-	-	27	75	40	142	581	4.09	0.82	1ST
-Lack of punishment for non-adherence & reward for adherence	-	01	26	75	40	142	580	4.08	0.82	1ST
-Poor enforcement by authorities	-	-	35	60	47	142	578	4.07	0.81	3RD

Source: Field Survey, (2013)

Where: 1 =Never, 2 = Rarely, 3 =Sometimes, 4= Mostly, 5=Always

The Table shows that lack of Nigeria Disability Standard, lack of punishment for non-adherence/reward for adherence and poor enforcement by relevant authorities (with a RII>0.8) stands out as the major challenges in designing to incorporate UD.

4.1.7 Aspects of Universal Design Principles Attended to by Designers

Among the seven principles of universal design, some aspects tend to be neglected by designers. Each principle is divided in to two (2) aspects as shown by CUD (2009) and rated by designers and professionals in the construction industry as shown on Table 4.7.

Equitable Use:

I. The provision of the same means of use for all users toavoid segregating or stigmatizing any users.

II. Provisions for privacy, security, and safety made equally available to all users andMake the designs appealing to all users.

Flexibility in Use:

I. Providing choice in methods of use, accommodate right- or left-handed access and use.

II. Facilitate the user's accuracy and precision and Provide adaptability to the user's pace.

Simple and Intuitive Use:

I. Eliminating unnecessary complexity, being consistent with user expectations and intuition, accommodating a wide range of literacy and language skills.

II. Arrange information consistent with its importance and provide effective prompting and feedback during and after task completion.

Perceptible Information:

I. Use of different modes (pictorial, verbal, tactile) for redundant presentation of essential information, while providing adequate contrast between essential information and its surroundingsôMaximize "legibility" of essential information.

II. Differentiate elements in ways that can be described (i.e., make it easy to give instructions or directions) and provide compatibility with a variety of techniques or devices used by people with sensory limitations.

Tolerance for Error:

I. The arrangement of elements to minimize hazards and errors, most used elements, most accessible; hazardous elements eliminated, isolated, or shielded.

II. Provide warnings of hazards and errors and provide fail safe features discourage unconscious action in tasks that require vigilance.

Low Physical Effort:

I. Allowing user to maintain a neutral body position, while using reasonable operating forces.

II. Minimize repetitive actions and minimize sustained physical effort.

Size and Space for Approach and Use:

I. Providing a clear line of sight to important elements for any seated or standing user, make reach to all components comfortable for any seated or standing user.

II. Accommodate variations in hand and grip size and provide adequate space for the use of assistive devices or personal assistance.

Table 4.7 Aspects of Universal Design Principles Attended to by Designers

S/N	Principles of UD	Option	Frequency	Percentage (%)
1	Equitable use:	a) I only	28	19.7
		b) II only	07	4.9
		c) I and II	-	-
		d) None	107	75.4
		Total	**142**	**100**
2	Flexibility in use:	a) I only	126	88.7
		b) II only	10	7.0
		c) I and II	06	4.2
		d) None	-	-
		Total	**142**	**100**
3	Simple and Intuitive Use:	a) I only	13	9.2
		b) II only	114	80.3
		c) I and II	15	10.6
		d) None	-	-
		Total	**142**	**100**
4	Equitable use:	e) I only	28	19.7

		a) II only	07	4.9
		b) I and II	107	75.4
		c) None	-	-
		Total	**142**	**100**
5	Tolerance to Error :	a) I only	63	44.4
		b) II only	63	44.4
		c) I and II	4	2.8
		d) None	12	8.5
		Total	**142**	**100**
6	Low Physical Effort:	a) I only	11	7.7
		b) II only	-	-
		c) I and II	-	-
		d) None	131	92.3
		Total	**142**	**100**
7	Size and Space for Approach and Use :	a) I only	15	10.6
		b) II only	117	82.4
		c) I and II	10	7.0
		d) None	-	-
		Total	**142**	**100**

Source: Field Survey, (2013)

From the Table, it can be deduced that no aspect of óequitable use is neglectedô as 75.4% of the respondents confirm that no aspect is neglected, ótolerance to errorô on the other hand tends to be neglected as both I (The arrangement of elements to minimize hazards and errors such that hazardous elements eliminated, isolated, or shielded) and II (Provide warnings of hazards and errors and Provide fail safe features which discourages unconscious action in tasks that require vigilance) have a percentage response of 44.4% each. Option I (Provides choice in methods of use while accommodating right- or left-handed access) of óflexibility in useô suffers neglect as well as option II (Arrange information consistent with its importance to accommodate a wide range of literacy and language skills) of óSimple and intuitive useô. Most designs or services require low physical effort as indicated on the table with a 92.4% response and ñEquitable Useò is usually not neglected as well (75.4%), though option II (Provide adequate space for the use of assistive devices or personal assistance) of óSpace and approach for useô is usually neglected (82.4%).

4.2 PHYSICAL ASSESSMENT

A total of sixty-six multi-storey public buildings [hospitality (12), institutional (18), office (11), shopping malls (7), Health Centres (10) and recreational buildings (8)] with in Abuja metropolis were evaluated. The results fromchecklist survey are presented in five (5) tables (Tables 4.8-12), these tables measure the level to which building services and other building components conform to approved and published standards (Document M of the United Kingdom).

4.2.1 Access to buildings

Standards recommend the provision of ramps and handrails to meet the accessibility needs of ambulant disables, wheelchair users, elderly persons, pregnant women and all persons with any form of temporal or permanent disability which should meet certain minimum specifications as shown on Table 4.8.

Table 4.8 Access to Buildings (Ramped Access and Handrails)

S/N	Building services	Option	Conformity (%)	Non-conformity (%)
1	Ramped access	a) Presence of ramp	79.0	21.0
		b) Width of the ramp (> 1500m)	62.9	37.1
		c) Presence or level landing at top and bottom of ramp	61.2	38.8
		d) Landing (Ó1800mm x 1800mm)	41.9	58.1
		e) Gradient of the ramp (>1:20 steep)	35.5	64.5
		f) Ramp and its landing free of doors	100.0	-
		g) Provision of hand rails on either sides of the ramp	51.6	48.4

2	Handrails:	a)	Vertical height of the hand rail (900-1100mm)	93.6	6.4
		b)	Terminal end of hand rail projecting 300mm beyond the ramp	71.1	28.9
		c)	Terminal end of the handrail reduces risk of clothe being caught	71.1	28.9
		d)	Handrail contrasting visually with its background	83.9	16.1
		e)	Profile being circular or oval and diameter (between 40-50mm)	100.0	-
		f)	Clearance between hand rail and adjacent wall (between 50-60mm)	96.8	3.2

Source: Field Survey, (2013)

From the table, it can be seen that 79% of the buildings assessed have ramps at the entrance to the buildings though the gradient of most of the ramps (64.5%) are too steep and only 51% have handrails on either sides of the ramps. Of the 49 buildings that have ramps at their entrance, 96.8% have a clearance of 50-60mm between the hand rails and the adjacent walls while 83.9% contrasts visually with its background.

4.2.2 Vertical Circulation within Buildings Using Lifts

Document M (2011) recommends the provision of a passenger lift in all buildings that have more than one storey, other conditions the passenger lift should meet are presented on Table 4.9 including responses from professionals. The assessment shows that 93.6% of the buildings have passenger lifts though about 56.4% do not have signs to facilitate locating the lifts. Out of the 58 buildings that have lifts, only 64.5% have an unobstructed area of 1800mm by 1800mm for manoeuvring in front of the lift. The lift doors contrast with the

walls, lifts being power operated/horizontal sliding, lift control buttons being between 900-1200mm high and the floor of the lift being slip resistant all generated a 100% response.

Table 4.9 Lift Installation & Space Provision Characteristics for Disables

S/N	Option	Conformity (%)	Non-conformity (%)
	a) Presence of a passenger lift in the building	93.6	6.4
	b) Presence of signs that facilitate finding the lift	43.6	56.4
	c) Visual contrast of lift door and landing with adjoining wall	100.0	-

d)	Space for manoeuvring in front of the lift (1800 x 1800mm)	64.5	35.5
e)	Type of lift car doors (power operated and horizontal sliding only)	100.0	-
f)	Lift car door opening width(> 800mm)	96.8	3.2
g)	Lifts fitted with timing and re-opening activator	45.2	54.8
h)	Lift doors that stay open for more than 8secs	74.2	25.8
i)	Internal dimension of the lift(> 1100 x 1400mm)	95.2	4.8
j)	Lift control buttons between 910-1200mm height from floor level	100.0	-
k)	Call buttons that contrast visually with surrounding environment	100.0	-
l)	Floor of the lifting device that are slip resistant	100.0	-
m)	Visual and auditory warning of the lift cars arrival	83.9	16.1
n)	Hand rail that contrast with the surrounding wall	54.8	45.2
o)	lift car with a suitable emergency communication system	83.9	16.1
p)	minimal glare, reflection, consulting shadow and pools of light with in the lift car	61.3	38.7

Source: Field Survey, (2013)

4.2.3 Sanitary Facilities

The space provided for manoeuvring and the relative positioning of WCs, wash basins and other accessories are critical to enable wheelchair users or people with mobility impairment to adopt various transfer techniques that allow independent or assisted use of sanitary facilities. Table 4.10 shows the conformity or non-conformity of sanitary facilities in the assessed buildings.

Table 4.10 Sanitary Facilities (WCs)/Shower Rooms & Space Provision Characteristics for Disables

S/N			Option	Conformity (%)	Non-conformity (%)
1	**Wheel-chair accessible**	a)	Turning space in WCs (Ó1500 x 1500 and Ò1800 x 1800 mm)	35.5	64.5

	unisex WC	b)	WC on the ground floor that meets the turning space area	35.5	64.5
		c)	Presence of a wash hand basin in WC	90.3	9.7
		d)	Where there are several WCs, at least one should be wheel chair accessible	51.6	48.4
		e)	WC allows for both left and right handed transfer from wheel chair to WC	21.0	89.0
		f)	Is the WC height (450-500mm)	96.8	3.2
2	**Accessible bath rooms/shower rooms**	a)	Presence of a wall mounted drop down support rail in the shower area	21.0	79.0
		b)	Presence of a wall mounted tip-up seat provided in the shower area	-	100
		c)	The WC is provided in accordance with the conditions for wheelchair accessible WCs	100	-
		d)	WC and wash-hand basin depth and rim height (500mm x 450mm and720 ï 740mm respectively)	100	-
		e)	Shower controls easy to use and capable of being operated using a closed fist	90.3	9.7
		f)	Socket outlets in shower room located between 400-1200mm above floor level	54.8	45.2

Source: Field Survey, (2013)

Some deductions made from the table are, the space limitation for manoeuvring (64.5%) by wheel chair users, though some of the buildings have a bank of toilets, only 51.6% have at least one that is wheelchair accessible. The WC heights are adequate (96.8%) and incorporate wash-hand basins (90.3%) though only 27.4% of the buildings have handrails and allow left and right handed transfer from wheelchair to WC (21.0%).

Also, 79% of the shower rooms do not have wall mounted drop down hand-rails though all the WCs meet the requirement for wheelchair accessible toilets, 90.3% of the shower controls are easy to use and capable of being operated using a closed fist. Also, only 54.8% of the socket outlets are located between 400-1200mm above floor level.

4.2.4 Lighting points, Sockets

Specifications for lighting switches, sockets and Automated Teller Machines are shown on

Table 4.11 Lighting Points, Sockets

S/N		Option	Conformity (%)	Non-conformity (%)
1	**Lighting points and sockets**	a) Sockets located in consistency with doorways and room corners	83.9	16.1
		b) Space left between socket outlet and room corner (Ó350mm)	83.9	16.1
		c) Socket outlets located between 400-1200mm above floor level	100	-
		d) Operation of switches, socket outlets or control that does not require the use of both hands	96.8	3.2
		e) Socket outlets should indicate visually if they are on or off	64.5	35.5
		f) Controls and switches that contrasts with its surrounding	90.3	9.7

Source: Field Survey, (2013)

Conformity of 83.9% was recorded for location of sockets in consistency with doors/room corners while leaving a space of at least 350mm from room corners on the table. Also, 96.8% of the switches can be operated without the use of both hands and all the sockets and light switches are located between 400-1200mm from the floor level though exceptions may be made where floor sockets are provided in open plan areas or if skirting or dado trunking is required e.g. for safety reasons. 93.3% of the switches contrast visually with their background while 64.5% indicate visually too if it is on or off.

4.2.5 Automated Teller Machines (ATMs)

48.8% of the ATMs do not have an accessible route with clear floor space, 45.2% have obstacles and stair cases in front of the machines, 43.6% of the operable parts of the ATMs

are above 1370mm from finished floor level while all the machine have their operable parts not greater than 300mm for reach on the horizontal plane.

Table 4.11 ATMs

S/N			Option	Conformity (%)	Non-conformity (%)
1	**ATMs**	a)	Accessible route with clear floor space to the ATM	51.6	48.4
		b)	Absence of stair cases and obstacles in front of the machine	54.8	45.2
		c)	Is the reach depth for all operable parts of the machines (> 225mm)	100	-
		d)	Maximum height of all operable parts of the ATM from finished floor level (1200-1370mm)	56.4	43.6

Source: Field Survey, (2013)

4.3 DISCUSSION

The results presented in this section are derived from the response gotten from professionals and designers in the construction industry through questionnaire surveys and the assessment of buildings with a checklist structured using Document M of the United Kingdom.

4.3.1 Respondents' Profile

The questionnaires were distributed to registered members of different professional bodies in the construction industry within Abuja, the research sampled the opinion of experienced professionals mainly those with over sixteen (16) yearsô experience and those with 10-15 yearsô experience who either have a BSc or MSc. This is to suggest that their response stemmed from their wealth of knowledge in the field acquired form higher

institutions and period of time spent practicing construction either as a designer or in the academia as shown on Table 4.1. Also, there were more Electrical Engineer respondents than Architects and Mechanical Engineers.

4.3.2 Measuring Building Services & Components against UD Principles & Document M for Conformity

Ramped access routes should be designed to have the shallowest gradient practical and ramps in most of the public multi-storey buildings assessed do not conform to the specifications in Document M, despite the fact that it is ranked highly (RII>0.9) by professionals (Table 4.3) as a component that requires much attention and consultation with standards when designing. Any gradient steeper than 1>20 increases the risk of falling forwards when going downhill or backwards when going uphill if the gradient is too steep. To ensure adequate control and braking power, the ramp gradients should be limited 1>20 else a person using or pushing a wheelchair may not have sufficient strength to travel up the ramp. This does not conform to the 6^{th} principle of universal design (Low physical effort) since the designs cannot be used efficiently and comfortably with minimum fatigue and does not minimize repetitive actions and sustained physical effort.

In sanitary areas, some aspects of UD principles 2 (Flexibility in use) and 7 (space for approach and use) have shown little conformity as shown on Table 4.3 (with a RII>0.9) and on Table 4.7 since it does not provides choice in methods of use while accommodating right or left-handed access and does not provide adequate space for the use of assistive devices or personal assistance. The absence of grab-bars in toilets and shower rooms to assist wheelchair users, pregnant women, elderly or obese people to transfer safely and easily from wheelchair to WC or shower increased the non-conformity of these sanitary areas to

standards (Table 4.7). Also, there are no signs to show the location of toilets and some of these toilets are located in the rear of building which negates principle 3 (Simple and Intuitive Use) as shown on Table 4.7.

Passenger lifts have shown high conformity to standards, which means UD principles are implemented at the factories where the lifts are produced outside Nigeria (Table 4.9). Light switches and sockets have equally shown high conformity to UD principle except aspects where the sockets do not show visually if it is on or off (Table 4.11). ATMs meet all specification which means UD principles were implemented from the production plant, though it is installed poorly on arrival to site. These ATMs either have stepped routes, little or no clear space for manoeuvring in front of the machine or it is installed too high or too deep for reach and use of the operable parts. The poor installation of these machines does not meet the requirements of principle 1 (Equitable Use) since it does not provide the same means of use for all users,avoid segregating or stigmatizing any users, does not provide for privacy, security, and safety made equally available to all users and designs appealing to all users (Table 4.7).

4.3.3 Role of Statutory Authorities in the Implementation of UD

Among the core functions of Development Control Authorities (DCAs) is to maintain good practice and adherence to standards by all professionals in the construction industry but the research shows that most designs submitted for approval are rarely or never checked for conformity to UD principles (Table 4.5). these designs are usually checked at the design stage for conformity to UD principles and in most cases it is not approved if there if non-compliance to UD principles.

4.3.4 Building Services and Disabilities that require the most Attention when Designing.

The study also shows that disables with mobility impairment encounter a higher challenge as regards access and use of buildings and should be considered over other forms of disabilities when designing though only about 75-90% of the needs of disables as regards access can be met as shown on Table 4.4. Despite the fact that most of the respondents have some knowledge of the universal design concept and all the respondents feel disables have right to unassisted unobstructed access to public buildings (Table 4.2), only 55.6% of the respondents design services in buildings while bearing in mind the needs of disable and UD principles thus leaving 44.4% of the respondents designing without giving due consideration to UD principles. This can be traced back to the fact that the need for injecting UD principles in the design of buildings was not buttressed in higher institutions as only 12.7% of the respondents studied it in the university. The building services components that require the most attention when designing to incorporate UD are; space requirement in toilets and shower areas, location of toilets and shower rooms, ramps and the need for grab bars in shower areas and beside WCs to assist people with who are wheel chair bound or the elderly to support themselves while in these sanitary areas.

4.3.5 Challenges in Designing to Incorporate Universal Design (UD)

Challenges are a lack of punishment for non-adherence/reward for adherence, a lack of Nigeria disability standard and poor enforcement by relevant authorities as shown on Table 4.6. It also goes on to show that it eliminates unnecessary obstacles in buildings and improves the movement of ale bodied persons as pregnant or elderly persons tend to hold onto hand rails when walking on ramps or pushing of carts, trolleys and walkers up and down ramps.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 SUMMARY OF FINDINGS

The study focuses on Building Services and other building components that improve ease of access into buildings while measuring them against UD principles and Document M of the

United Kingdom. The study provides useful information on the level of conformity of building services provisionsô to Universal Design principles, while shedding light on areas that stand out as challenges that impedes against the full implementation of Universal Design and the benefits that comes with it. In essence, the project is aimed at assessing the conformity of building services provisions in multi-storey public buildings against Universal Design principles.

Data obtained for this research were secondary data. The data were subjected to simple descriptive analysis to test for statistical significance where means, frequencies, percentages and RIIs generated. Relevant literatures were reviewed shedding more light on Universal Design, Building Services, Document M and disability challenges in the country. A checklist was also structured using Document M of the UK and used to measure the conformity of these buildings.

The following are the summary of the findings:

i. There is a general knowledge of UD by professionals in the construction industry though most professional do not incorporate UD principles into their designs. These professionals know UD by different names like; adaptive design, assistive design, trans-generational design and inclusive design.

ii. UD is not included in the curriculum in most Nigerian institutions and professional bodies in the construction industry have not prepared seminars and conferences to educate their members on this important aspect of construction. Most professionals have learned about UD through personal study or on-the-job training.

iii. Persons with mobility impairment suffer a higher challenge as compared to other forms of disabilities when accessing a building and its services. Hence, most designers consider their needs over others when designing and this is because whatever suits wheelchair users will generally serve for all other disabled peoples accessibility needs.

iv. Development Control Agencies (DCAs) rarely check designs for adherence to UD principles and poor enforcement of this has reduced the number of designers that make reference to it when designing.

v. Lack of a Nigerian disability standard is one of the major reasons for the non-incorporation of UD principles into designs in Abuja, as designers rarely make reference to the Nigeria National Building Code.

vi. The incorporation of UD principles into designs improves the movement and accessibility needs of able bodied persons while eliminating unnecessary obstacles from buildings.

vii. Designers do not use standards when designing ramped access routes as most of these ramps have steep gradients (> 1:20) and increases the risk of falling backward or forward by wheelchair users.

viii. Sanitary areas have shown very low conformity to UD principles as there is little or no space in these bathrooms for assistive devices to manoeuver, no grab-bars in shower areas/toilets for easy transfer from wheelchair to bath-tub/WC, no signage in most buildings to indicate the location of sanitary areas and no tip-up seats in shower areas for the elderly, pregnant women, ill persons and disables.

ix. This study has shown that building services and components have violated five (5) of the seven (7) principles of UD namely;

a) Simple and intuitive use

b) Equitable use

c) Flexibility in use

d) Low physical effort

e) Space for approach and use

5.2 CONCLUSION

The research work, shown through the analysis of data generated from questionnaires, checklists, relevant literatures and interviews with professionals in the field on Universal Design, building services and standards concludes as follows;

The violation and non-inclusion of UD principles is predominantly an issue of shallow knowledge of UD by professionals in the country that glaringly reflects on the poor installation of building services (passenger lifts and ATMs) that are manufactured outside the country and meet world standards for UD.

The inadequacy in checking designs by DCAs is clearly an issue of incompetence, negligence or poor training (on-the-job or through seminars and conferences) of the Development Control officer who need to be kept abreast with emerging trends within and outside the construction industry.

Persons living with temporal or permanent disabilities have been segregated or stigmatized by architectural and building services designs as most of these persons cannot shop in malls, attend certain schools, use certain recreational facilities, cannot be gainfully employed or even visit certain buildings thus making them a liability and mostly considered as an issue of charity. These challenges can be eliminated with the enactment of a Nigerian disability standard or building on aspects of the National Building Code sheds light on disability access and mandate professionals to include the core of UD into their designs.

Most building services provisions have shown very low conformity to UD principles except light switches/sockets and passenger lift which are mainly manufactured outside the country and sometimes poorly installed by Nigerian specialists.

5.2 RECOMMENDATION

1. Universal Design, if not in the curriculum of higher institutions, should be injected into it to give student and graduates a sound knowledge of this emerging concept from an early stage before they are hatched into the labour market.
2. Professional should include UD in their designs by soaring above the challenges highlighted in this research to reduce or even eliminate Architectural or design segregation/stigmatization.
3. Development control officers should be tasked by professional and regulatory bodies to bear in mind the need to check designs for conformity to Universal Design principles. Also, forum within the agency for professionals to parley and discuss latest innovations, peculiar experiences and discoveries that will broaden the knowledge of its members of staff should be encouraged.

4 A Nigerian disability standard should be developed, enacted and introduced by the governing bodies in the construction industry with a sound department to be in charge of its implementation and strict adherence or aspects that cater for disability access in the National building Code be developed and made prescriptive rather than descriptive.

REFERENCES

Accessible thresholds in new housing, Guidance for house builders and designers (1999) Department of Environment, Transport and the Regions. The Stationery Office, The Publications Centre, PO Box 276, London SW8 5DT

Adler, D. (1999): Metric Handbook - Planning and Design Data. Architectural Press, Oxford, United-Kingdom.

American Association of Retired Persons. (1992). Mature America in the 1990s: A special report from Modern Maturity magazine and the Roper Organization. New York, NY: The Roper Organization, 21.

American Standards Association, (1961): A117.1- 1961 American Standard Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped. United States of America.

Beresford, B. and Oldman, C. (2000). Making Homes Fit For Children. Working together to promote change in the lives of disabled children.Community care into practice series.Joseph Round-tree Foundation.The Policy Press, Bristol, United Kingdom.

Berkowitz, M., and Greene, C. (1989).Disability expenditures. American Rehabilitation, Vol. 15, No. 1, Spring, 7-29.

Bill, G. (2002). Sample size formulas [online] Available at http://williamgodden.com/ sample sizeformula .pdf, [Accessed 2013. May 28]

Bizrate, T. (2010). The Adjustable Toilet Seat [Online] Available @ http://www.bizrate.com/accessibility-equipment/raised-toilet-seats-adjustable/, [accessed 2013 February 24]

Bone, S. (1996): Buildings for ALL to use. Construction Industry Research and Information Association, London. United-Kingdom.

British Standard BS5810 (1979): Code for Practice for Access for the Disabled to Buildings (Document M). British Standards Institution, Milton Keynes. United-Kingdom.

British Standard BSI (1967): CP96:1967 Access for the Disabled to Buildings, Part 1 General Recommendations. British Standards Institution, Milton Keynes. United-Kingdom.

Bullet, D. (2002). Usability Glossary: Mobility impairment. [Online] Available @ http://www.usabilityfirst.com/glossary/main.cgi. [Accessed, 2007 October 2]

Carlton, P. and Hertzfeld, J. (2005).Teaching Students with Medical/Mobility Impairments. [Online] Available @ http://ada.osu.edu/resources/fastfacts/Medical-Mobility-Fact-Sheetpdf., [accessed 2012 November 30]

Carson, G. (2009). The Social Model of Disability. [Online] Available @ http://www.saifscotland. org.uk/fileuploads/low-res-saif-social-model-8338.pdf [accessed 2012 November 26]

Centre for Universal Design-CUD (2003). Universal Design hi Housing, Raleigh, NC [online] available at http://www.design.ncsu.edu/cud, [accessed 2013 January 4].

Cheek, M. (2004). Web-based Housing Registers. ADRC-TAE Issue Brief/TheLewin Group. USA.

Chirikos, T.N. (1989). Aggregate economic losses from disability in the United States: A preliminary assay. The Milbank Quarterly, Vol. 67, Suppl. 2, Pt. 1, 59-91.

Citizens Housing and Planning Association. (2009). MASS Access: the accessible housing register. Massachusetts, US.

Commission of the European Communities (1996). Resolution of the Council of 20 December. Resolution of the council and of the representatives of the governments of the member states meeting within the council of 20 December 1996 on equality of opportunity for people with disabilities.

Cornucopia of Disability Information (CODI) (2005). Cerebral Palsy [Online] Available http://www.about-cerebral-palsy.org/definition/index.html http://www.wired.org.au, [accessed 2013 January 14].

Council of Europe, (2008): European Disability Action Plan [Online] available @ http://ec.europa.eu/social/main.jsp?catId=4308langId [Accessed July 24, 2014]

Demesne (2005).Disabled Door Units. [Online] available @ http://www.theautomaticsolution.com, accessed 2013 April 26

DFID (2008). Scoping study: Disability Issues in Nigeria. [Online] available @ http://www.ucl.ac.uk/lc-ccr/downloads/scopingstudies/dfid_nigeriareport

Disabilities, Opportunities, Internetworking, and Technology (DO-IT), (2001). Mobility Impairments.http://www.washington.edu/doit/Faculty/Strategies/Disability/Mobility/[accessed 2012 December 12].

Disability Rights Task Force on Civil Rights for Disabled People. (1999). From Exclusion to Inclusion: (Executive Summary). Wales, www.leeds.ac.uk

Document M: Access to and Use of Buildings (2010) incorporating 2013 amendments. UK

GAATES (2003).Global Alliance on Accessibility Technologies and Environments news [Online] available @ http://www.gaates.org. [Accessed 13 March 2013]

Ghaem, G. (1991): "Public Buildings and the Handicapped", Building and Housing Research Center, Tehran, Iran.

Goldsmith, S. (1976): Designing for the Disabled. Third edition.RIBA Publications, London.

Goldsmith, S. (1997): Designing for the Disabled- The New Paradigm. Architectural Press. Oxford, United Kingdom.

Goldsmith, S. (2000:) Universal Design.Architectural Press, Oxford, United Kingdom.

Greater London Authority. (2006). Accessible London: achieving an inclusive environment. Life time Homes. Greater London Authority, United Kingdom, www.london.gov.uk

Herd, D., Ward, R., and B. Seegar.(2003). Included by design.A national strategy for accessible housing for all. Paper presented at National Housing Conference. Adelaide, Nov 2003 .People with Disability Australia. Australia.

Holmes-Siedle, J. (1996): Barrier-free Design. Architectural Press, Oxford. United-Kingdom.

Innes, G. (2006). An opportunity not to be missed?Human Rights and Equal Opportunity Commission. Australia.

Jones, M. and Sanford, J. (1996).People with mobility impairments in the United States today and in 2010. Assistive Technology, 8.1, 43-53.

Joseph Rowntree Foundation, (1995): "Design Criteria for Handicapped", 2nd.Editition, Building and Housing Research Center, Tehran, Iran.

Kawauchi, Y. (2005). 'The Law of Accessibility in a Rapidly Ageing Nation' in the AARP Global Report on Ageing Special Edition 2005.American Association of Retired Persons.US.

Kose, S. (2004). Japanese Experience Toward Accessible and Usable Built Environment :lessons for the Developing Economies. Paper presented the Designing for the 21st Century 3 Conference, Rio de Janeiro. Dec. 2004.

LaMendola, B. (1998, April 12). Age-old question: How long can we live? The Denver Post, IF.

Lang, R. and Upah, L. (2008): Scoping Study- Disability Issues in Nigeria. [Online] Available @ http://www.ucl.ac.uk/lcccr/, accessed March 3, 2013.

Lawler, K. (2001). Aging in Place: Coordinating Housing and Health Care Provision for America's Growing Elderly Population. Harvard University, www.jchs.harvard.edu

Leibig, P. (1993). Federalism and Suitable Housing for the Frail Elderly: A Comparison of Policies in Canada and the United States, www.fanniemaefoundation.org

Lysack J.T, Wyes U.P; Packer T. (1999) Designing appropriate rehabilitation technology: a mobility device for women with ambulatory disabilities in India. International Journal of Rehabilitation Research 1999.

Mace, R. L., (1991) Accessible Environments: Towards Universal Design. Centre for Universal design, North Carolina State university press, USA.

Malone, D. (2001): Vertical Circulation in Hospitals. Australian Journal of Physiotherapy 47, pp.3-4. Australia.

Marshall M. N. (1996): Sampling for Qualitative Research, Oxford University Press Volume 13, No 8; United Kingdom

McNeil, J.M. (1997). Americans with disabilities: 1994-95. US Bureau of the Census Current Population Reports, P70-61. Washington, DC: US Government Printing Office.

Michailakis, D. (1997) Government action on disability policy: A global survey, [online] available @ http://www.mdependentlivmg.org/standardrales/UN_Answers/UN.pdf Accessed March 3, 2013

Mji, G., MacLachan, M., Melling-Williams, N. and Gcaza, S. (2009): Realizing the rights of disabled people in Africa: An Introduction to the Special Issue. Disability and Rehabilitation 31, pp. 1-6.

National Disability Authority NDA, (2009): Women with Disability: Policies Governing Procedure and Practice in Services Provision in Ireland During Pregnancy, childbirth and Early Motherhood. University of Dublin, Trinity College of Mid-wifery Ireland.

National Institute for Nuerological Disorders (2001) What is Spinal Bifida? [Online] Available @ http://www.ninds.nih.gov/disorders/spina_bifida/spina_bifida.htm, [accessed 2012 November 29]

Neufert, P. and Ernest, C. (2002). Architects' Data: Building for Disabled People/Barrier-Free Living: 299-310. Third Edition. Blackwell Science Ltd. UK.

Newell, A. F. and Gregor, P. (2000). "User Sensitive Inclusive Design - in search of a new paradigm": 39-44. Proc. A. C. M. Conference on Universal Usability, Washington, DC.

Newell, A.F. (1988). A strategy for coordinated research into ordinary and extraordinary human-computer interaction. March 31, 1988. Position paper prepared for the Department of Trade and Industry, United Kingdom.

Newell, A.F., and Cairns, A.Y. (1987).Human interface studies and the handicapped.Proceedings of the British Computer Society Disabled Specialist Group Third Conference. London, 25 November 1987, pp. 285-289. Cambridge, England: Cambridge University.

Nielsen, C. and Ambrose, I. (1998). Lifetime Adaptable Housing In Europe. Danish Building Research Institute. Denmark.

O'Fallon, E. and Hillson, S. (2005). 'Physician Discomfort and Variability in Disability Assessments' in Journal of General Internal Medicine.Vol 20, No.9. pp. 852-854.USA

Okoli, C. (2005): The Plight of Disabled Nigerians and the Need for Mass Enlightenment. Mobility Aid and Appliances Research and Development Centre.

Ontario March of Dimes. (2005). 'Going to bat for people with disabilities' in The Dimes Times, Spring 2005 :14.Ontario, Canada.

Patton M. Q. (1990 Qualitative evaluation and Research Methods (2nd Edition) sage Publications: Newbury park, California

Peloquin, A. A. (1994). Barrier-Free Residential Design; 173-237, McGraw-Hill Inc. United States of America.

Poulis, I. (2007) The End of Physiotherapy. Australian Journal of Physiotherapy 53, pp.71-72.

Prowler, D. (2009). Whole Building Design: The Role of Buildings and the Case of Whole Building Design. [Online] Available @ http://www.wdbg.org/design/, [accessed 2009 July 27].

Ramrayka, L.(2006). The all-inclusive capital city. Innovation and progress, diversity and equality: Greater London Authority. The Guardian. December 5, 2006. United Kingdom.

Robert, M. (2000): Disability Issues, Trends and Recommendations for the World Bank.

Roy, V. H. (1991) Report of the CIB Expert Seminar on Building Non-Handicapping Environments, Budapest 1991: Presentation of the "European Manual for an Accessible Built Environment", [Online] Available @ http://www. http//www.independentliving.org, [accessed 2012 October 13].

Saville-Smith, J. (2006): Enabling the Well-Being of Persons with Disabilities. Toronto: Roeher Institute.

Shapiro, J.P. (1994): No pity: People with disabilities forging a new civil rights movement. New York, NY Times Books (Random House).

Shaw, J. A. (1971): Architectural barriers: A Medical Problem. American Journal of Occupational Therapy, 25,13-15.

Steinfeld, E., Schroeder, S., Duncan, Paste, R., Chollet, D., Bishop, M., Wirth, P., &Cardell, P. (1979): Access to tbe built environments: A review of the literature. Washington, DC: U.S. Government Printing Office.

Steinfeld, E., Schroeder, S., Duncan,J., Paste, R., Chollet, D., Bishop, M, Wirth, P., &Cardell, P. (1979): Access to the be built environments: A review of the literature. Washington, DC: U.S. Government Printing Office.

Sylvester, C. (1996): Philosophy of Therapeutic Recreation: Ideas and issues. Vol II, Page 57-70. Virginia, USA. Recreation and park Association.

The Global Alliance on Accessible Technologies and Environments (GAATES) (2003) The International Best Practices in Universal Design: A Global Review. Washington, DC: U.S. Government Printing Office.

Thorpe, S. J. (2002). The Architects' Handbook: Design for Accessibility; 401-407. Blackwell Science Ltd, UK.

Trail M, Nelson N, Van J.N et al. Wheelchair use by patients with Amyotrophic Lateral Sclerosis:

United Nations (2007): United Nations Convention on the Rights of Persons with Disabilities, 2007. [Online] Available @ http://www.un.org/disabilities, Accessed 2013 March 16.

United States Department of Justice (1991): Americans with Disabilities Act: Accessibility Guidelines for Buildings and Facilities. Federal Register, Washington DC.

Very Special Arts (VSA), (2003).Mobility Impairments [Online] Available @ http://www.vsarts.org/x534.xml, [accessed 2010 November 30]

Voluntary Services Overseas, (2006): A Handbook on Mainstreaming Disability, Voluntary Services Overseas, London.

Welch, P. (1995) Strategies for teaching universal design. Boston, MA: Adaptive Environments Center.

Welch, P. and Palames, C. (1995). A brief history of disability rights legislation in the United States. In Welch, P. (Ed.), Strategies for teaching universal design. Boston, MA: Adaptive Environments Center.

WHO (2007) WHO Report. http://www.WHO.org, [accessed January 15, 2013]. World Book Encyclopedia, (2004): Macdowell Publishers Ltd, London.

World Health Organization, (1997): Report on Disability Prevalence. Geneva.

Zola, E. (2006): "Adaptation Methods of Official Buildings for People with Physical and Movement Disabilities", Building and Housing Research Center, Tehran, Iran.

APPENDIX I

AN ASSESSMENT OF THE IMPLEMENTATION OF UNIVERSAL DESIGN PRINCIPLES IN THE PROVISION OF BUILDING SERVICES IN MULTI-STOREY BUILDINGS IN ABUJA, NIGERIA

Department of Building, Faculty of Environmental Design, Ahmadu Bello University, Zaria.

QUESTIONNAIRE

Section 1

1. Profession
   a. Architect ( )
   b. Builder ( )
   c. Civil Engineer ( )
   d. Quantity Surveyor ( )
   e. Mechanical Engineer ( )
   f. Electrical Engineer ( )
   g.Others
2. Years of experience
   a. 0-5 ( ) b.6-10( ) c. 11-15 ( ) d. 16-40 ( )
3. Respondents higher qualification
   a. ND ( ) b. HND ( ) c. B.SC ( ) d. MSc ( ) e. PhD ( )
   f. Others_____

4.What area of construction are you into?

a. Design ( )
b. Project Management ( )
c. Facilities Management ( )
d. Construction ( )
e. Academics ( )

Section 2

1. Rate your knowledge of Universal Design?
   a. Very High ( )
   b. High ( )

c. Moderate ( )
d. Low ( )
e. None ( )

2. How did you come across Universal Design?
   a. Through taught courses in institutions ( )
   b. On-the-job training ( )
   c. Personal study ( )
   d. Seminars and conferences ( )
   e. Not at all ( )
   f. Others, specify please_____

3. Do you design buildings and its services with the principles of Universal design in mind?
   a. Yes ( )b. No ( )
4. Do you think persons living with disabilities have a right to unassisted and easy access to buildings as any other able bodied person?
   a. Yes ( )b. No ( )
5. In your opinion, do the building components and services listed below require special attention or consultation with standards when designing?
   é ..
   é ..
   (Tick were appropriate)

Where A= strongly disagree, B=Disagree, C=Uncertain, D=Agree and E=Strongly agree.

S/no	Building components and services	Responses				
		A	B	C	D	E
a.	Ramps					
b.	Lighting points and sockets					
c.	Location of bathrooms and toilets					
d.	WC location and Height					
e.	Wash-hand basin positioning and height					
f.	Space requirement in bath rooms					
g.	Provision of hand rails in the shower and by WCs					
h.	Elevators					
i.	Escalators					
j.	ATMs					

Others building services and aspects of buildings that requires special consideration as regards Universal design

_____

6. Which standards do you consult when designing to cater for the needs of people living with disabilities?
   a. Document M of United Kingdom ( )
   b. American Disability Act of USA ( )
   c. Disability Act of Australia ( )
   d. BS code ( )
   e. None of the above ( )
   f. Others specify_____
7. Which disables have a higher challenge as regards access to and use of buildings?
   a. Visually impaired ( )
   b. Hearing impaired ( )
   c. Mobility impaired ( )
   d. Mental impaired ( )
8. Which form of disability do you put into consideration when designing? (Tick more than one where appropriate)
   a. Visual impairment ( )
   b. Hearing impairment ( )
   c. Mobility impairment ( )
   d. Mental impairment ( )
   e. None ( )
9. Is it possible to meet the needs of all disables when designing?
   a. Yes( ) b. No ( )
10. If No, approximately what percentages of these needs are met?
    a. 35-50% ( )b. 50-65% ( )c. 65-80% ( )d. 80-90% ( )
    e. 90-99% ( )f. None ( )
11. How often do Statutory Authorities check designs for compliance to Universal Design principles?
    a. Always( )b. Often ( )c. Rarely ( ) d. Never ( )

12. At what stage does Development Control Authorities check designs for compliance with Universal Design principles?
    a. Pre-contract stage ( )
    b. Design stage ( )
    c. Construction phase ( )
    d. Finishing stage ( )
    e. Not at all ( )
13. What action does the Development Control Authority take hi an event of non-compliance?
    a. Demolition ( )
    b. Non approval ( )
    c. Correction ( )
    d. Stop work ( )
    e. None of the above ( )
14. Do you specify or purchase Services while bearing in mind that there's usually a wide range of users and these services must meet some certain standards?
    a. Yes( )b. No ( )
15. At what stage do you consider disability access?
    a. Pre-contract stage()
    b. Contract stage()
    c. Design stage()
    d. Construction stage()
    e. Not at all()
16. What are the challenges you face when designing to incorporate universal design?

Where A= strongly disagree, B=Disagree, C=Uncertain, D=Agree and E=Strongly agree.

S/no	challenges	Responses				
		A	B	C	D	E
i.	It affects aesthetics negatively					
ii.	It is expensive					
iii.	It is not important					
iv.	It does not removes unnecessary obstacles in					

	buildings					
v.	It does not improves movement of able bodied persons					
vi.	It makes design time consuming					
vii.	Your clients influence your decision					
viii.	Lack of a Nigerian disability Standard affects its implementation					
ix.	Lack of rewards for adherence and punishment for non-adherence					
x.	Poor enforcement by relevant authorities					

17. Other challenges or suggestions not listed above

é ..

é ..

é ..

18. Among the Universal Design principles listed below, tick the areas that are rarely attended to by designers.

A. <u>Equitable, Use.</u> Where;

I=Provides same means of use while avoiding segregation or stigmatization of all users

II=Provisions for privacy, security, and safety for all and Designs appealing to all users.

a. I only ( )
b. II only ( )
c. I and II ( )
d. None ( )

B. <u>Flexibility in Use.</u> Where;

I= Provides choice in methods of use while accommodating right- or left-handed access

II=Facilitate the user's accuracy and precision while providing adaptability to the user's pace

a. I only ( )
b. II only ( )
c. I and II ( )
d. None ( )

C. Simple and Intuitive Use. Where;

I= Eliminating unnecessary complexity and being consistent with user expectations and intuition

II= Arrange information consistent with its importance to accommodate a wide range of literacy and language skills.

a. I only ( )
b. II only ( )
c. I and II ( )
d. None ( )

D. Perceptible Information. Where:

I= Use of different modes (pictorial, verbal, tactile) and provision of adequate contrast between essential information and its surrounding

II= Differentiate elements thus make it easy to give instructions or directions and provide compatibility with a variety of techniques.

a. I only ( )
b. II only ( )
c. I and II ( )
d. None ( )

E. Tolerance for Error. Where;

I=The arrangement of elements to minimize hazards and errors such that hazardous elements eliminated, isolated, or shielded

II= Provide warnings of hazards and errors and Provide fail safe features which discourages unconscious action hi tasks that require vigilance.

a. I only ( )
b. II only ( )
c. I and II ( )
d. None( )

F. Low Physical Effort. Where;

I= Allows user to maintain a neutral body position and use reasonable operating force

II= Minimize repetitive action and sustained physical effort

a. I only ( )
b. II only ( )

c. I and II ( )

d. None( )

G. Size and Space for\approach and use. Where;

I= Provides a clear line of sight to important elements for any seated or standing user making reach to all components comfortable for any seated or standing user

II= Provide adequate space for -.he use of assistive devices or personal assistance

a. I only ( )
b. II only ( )
c. I and II ( )
d. None( )

19. Suggestions and recommendation as regards Universal Design and ease of access to buildings

é é
é é
é é
é é
é é
é é
é é

APPENDIX II

CHECK LIST STRUCTURED USING DOCUMENT M OF UNITED KINGDOM

Name of Building:_____ Year of Construction:_____

Types of Building: a. Instructional building ( ) b. Hospitality building ( ) c. Recreational facility ( ) d. Health centres( ) e. Market/shopping mall ( ) f. Office building ( ) g. Others:_____

No	Aspect	Question	Compliance	Observation	Remark
1	Ramped access route (1.1.3.4)	• Width of the ramp(> 1500m) • Presence of level landing at top and bottom of ramp • Landing(> *1*800mm x 180mm) • Gradient of the ramp(< 1:50 steep) • Ramp and its landing free of doors • Presence of hand rails on either sides of the ramp • If ramp gradient is >1:20, a platform lift is provided			
2	Handrail (1.1.3.6)	• Vertical height of the hand rail (between 900-1100mm) • Terminal end of hand rail project 300mm beyond the ramp • Terminal end of the handrail reduce risk of clothe being caught • Handrail contrasts visually with its background • Profile circular or oval and diameter between 40~50mm • Clearance between hand rail and adjacent wall between 50-60mm urinal • Rim of the urinal must be 380-500mmm high • Vertical grab rails on both sides of the urinal • Grab rails between 600-900mm long • Grab rail 500Mm above floor level • Urinals contrast visually with the walls on which they are attached			
3	Accessible bath rooms/shower rooms (1.4.8)	• Wall mounted drop down support rail in the shower area • Wall mounted tip-up seat provided in the shower area • If a WC is provided, it must be in accordance with the conditions for wheelchair accessible WCs • Transfer seat >400mm deep and its width equal to the bath width • WC and wash-hand basin 500mm x 450mm deep and rim height between 720 - 740mm • Shower controls easy to use and capable of being operated using a closed fist • Socket outlets located between 400-1200mm above floor level • Switches and controls that require precise hand movement located are between 750-1200mm • Simple push buttons with little dexterity used • Controls that need close vision e.g. heating			

		control, are these located between 1200-1499mm			
4	Switches and socket outlets (1-5.7)	• Sockets located in consistency with doorways and room corners • Space of at least 350mm left between socket outlet and room comer • Operation of switches, socket outlets or control require the use of both hands • Socket outlets should indicate visually if they are on or off • Controls and switches contrast with its surrounding			
5	ATMs (4:34)	• Accessible route with clear floor space to the ATM • Stair cases and obstacles in front of the machine • Reach depth > 225mm for all operable parts of the machines • Maximum height of all operable parts of the ATM between 1200-1370mm from finished floor level			