IMPROVING WAYFINDING THROUGH DESIGN IN PROPOSED PAEDIATRIC HOSPITAL, KADUNA.

By

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By

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Declaration

I declare that the work in this Dissertation entitled 'IMPROVING WAYFINDING THROUGH DESIGN IN PROPOSED PAEDIATRIC HOSPITAL, KADUNA.' has been carried out by me in the Department of Architecture. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this Dissertation was previously presented for another degree or diploma at this or any other institution

Uzairu Biu BUKAR	_____	_____
Name of Student	Signature	Date

Certification

This Dissertation entitled 'IMPROVING WAYFINDING THROUGH DESIGN IN PROPOSED KADUNA PAEDIATRIC HOSPITAL' by Uzairu Biu BUKAR meets the regulations governing the award of the degree of Master of Science of the Ahmadu Bello University, and is approved for its contribution to knowledge and literary presentation.

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Dedication

This project is firstly dedicated to Almighty Allah who has seen me through the years of my study.

I will also like to dedicate this dissertation to my Mother, Late Hajiya Mairo Bukar Ali, May Allah (SWA) Grant you Jannah and to my Father Alhaji Bukar Dala Biu, whose courage and caring served as one of the weapon of achieving my goals today.

Abstract

Wayfinding in any publicly accessed building has been an issue and over the years this problem has been given a low priority as an unavoidable problem, Wayfinding problems have been linked to stress-related problems and loss of productive staff time. The architecture of our existing hospitals do not adequately capture the needs of way finders, This research aims to take an in-depth study in to wayfinding and provide solution to this problem by proposing a hospital design that reflects an architectural solution to wayfinding (within Kaduna State). Three different methods of data collection were used and that include the use of a visual survey & Check list, Participant observation was used to get first-hand knowledge about the problem and use of a Space Syntax. Three healthcare institutions were selected and examined. Findings from the visual survey on the case studies conducted shows architectural clues which include, the exterior clues and the interior clues; these clues/ element assist users to identifying their waypoint. Assessment of architectural features that aid wayfinding shows that Ahmadu Bello University Teaching Hospital (ABUTH) has high reflections of both internal and external clues, element such as landscape, location of entrance, placement of stairs and the location of information Centre were greatly considered. While the second and third case studies ranked low on the exterior clues some due to dilapidation of these facilities and poor maintenance. Participant observation was able to give the researcher an in-depth viewer of wayfinding problem, and understand the approach that needs to be taken in providing solution at every decision point and destination zone. The field study shows that larger facilities in a pavilion layout prove to be more challenging to navigate, multiple turns and curve destabilizes the orientation of the wayfinder, but opening to the outside and placement of unique land marks and art works helps the wayfinder regain his orientation. Data obtained in the space syntax analysis shows Barau Dikko Specialist

Hospital (BDSH) has the highest level of intelligibility (R^2) of 0.73 Followed by ABUTH with a value of 0.33 and Yusuf Dantsoho General Hospital (YDGH) with the least level of intelligibility 0.064. The study deduce that zoning of related functions, space organization, position of spaces according to departments and providing clues within the interior and exterior of the facility is important in guiding any user of the facility. This research highlights the necessity of incorporating unique features to inform users of this environment and also suggest methods used to improve wayfinding in healthcare facilities.

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List of Abbreviations and Glossary

A&E	Accident and Emergency
ABU	Ahmadu Bello University
ABUTH	Ahmadu Bello University Teaching Hospital
BDSH	Barau Dikko Specialist Hospital
DOH	Department of Health
ENT	Ear Norse and Throat
FMH	Federal Ministry of Health
GOPD	General Out Patient Department
LGA	Local Government Area
NDHS	Nigeria Demographic and Health Survey
NHIS	National Health Insurance Scheme
NSW	New South Whales
NYSC	National Youth Service Corps
OPD	Out Patient Department
PHC	Primary Health Care
R^2	Intelligibility
SMH	State Ministry of Health
WHO	World Health Organization
YDSH	Yusuf Dantsoho Specialist Hospital.

1.0 INTRODUCTION

1.1 Background of Study

Wayfinding was first used by Lynch (1960) where he referred to maps, street numbers, and directional signs etc. as "way-finding" devices. His work, which is seen by many as being important in how we understand environments, was based on the concept of spatial orientation and its prerequisite cognitive map.

Brandon (2008), describes wayfinding as

> *'... The process of using spatial and environmental information to find our way in the built environment''*

Passini (1984), first articulated wayfinding as a spatial problem-solving exercise in which he described wayfinding as a process during which people must solve a wide variety of problems in architectural and urban spaces that involve both decision making and decision executing. Arthur and Passini (1992) opined that wayfinding could be achieved by understanding how people find their way, first the underlying process understood which are the three key processes in spatial problem-solving, information processing, decision making / planning and decision execution.

Many hospitals have developed over a number of years in a fragmentary fashion. They are the most complex of any environment accessed by the public. These are made up of long and confusing corridor systems with bends, turns, and confusing signs. Such settings challenge and frustrate those who visit them. (Ndhlovu, 2012). There are those who will choose to navigate on their own because they are too embarrassed to be seen as lacking in appropriate knowledge. These categories of visitors often end up lost due to the complex layout of the environment with large volumes of signs designed to explain the complex routes to the wayfinders. (Rooke et al., 2010).

People who find themselves in unfamiliar environment need to know where they actually are in such environment, in order to formulate their action plans. Evidence suggests that people often blame themselves for lacking the acumen to navigate complex environments, (DOH, 2005., Rooke et al. 2008). They assert however, that getting lost is an indication of either a poorly designed environment or wayfinding systems/strategies designed to guide people and not inadequacy on the part of the wayfinder. Arthur and Passini (1992) observed that for the above reason, society is increasingly becoming less tolerant of the idea that people's inability to find their way in the built environment is either trivial or unimportant.

The challenges associated with designing for the wayfinding needs of the special groups of users such as the blind, elderly, children and newcomers who visit complex environments such as hospitals are immense. Huelat (2004) observes that these people bring with them 'different levels of knowing' which 'invoke different needs'. The first time visitors, for example, may find the healthcare facility more foreign to them than someone who has visited the complex a number of times. Their lack of experience and knowledge of the setting may lead to greater difficulties.

With such a varied range of needs, abilities and knowledge levels, there is a may need to evolve design that ensures an effective and efficient wayfinding system in buildings that meets the needs of all.

1.2 Problem Statement

In any publicly-accessed site, people can have problems finding their way. Getting lost is so much a part of life that solving wayfinding problems is often given a low comparative priority, ignored, or even dismissed as unavoidable aspect of the site's design. Too many people, given the task of improving wayfinding, limit the solution to developing attractive signs; naturally the cost of poor wayfinding design has resulted in

stress related problems such as: raised blood pressure, headaches, increased physical exertion, and fatigue are linked to wayfinding in complex environments. Other costs include: lost staff time; reduced staff concentration caused by the need to provide directions or other interventions and death during emergency.

The architecture of our existing hospitals do not adequately capture the needs of way finders, complex and confusing sign regularly used which lead to frustration of patient and getting lost in complex building. This study therefore seeks to fill this gap by proposing a hospital design that reflects an architectural solution to wayfinding.

1.3 Aim

This research aims at improving wayfinding through design in a proposed Paediatric hospital Kaduna.

1.4 Objectives

The objectives of this research are to:

i. Identify architectural design element that assist wayfinders in Kaduna State.

ii. Understand how these architectural elements assist wayfinders in hospitals within Kaduna State.

iii. To determine how the user space integration can aid wayfinding in hospitals within Kaduna State.

iv. To demonstrate through design how architectural features can improve wayfinding in designing a Paediatric hospital.

1.5 Research Questions

This research intends to answer these questions:

i. What are the architectural design element that assist wayfinders in Kaduna State Hospitals

ii. How do these architectural element assist wayfinders find their way within a hospital in Kaduna State

iii. How can user space integration aid wayfinding in Hospitals within Kaduna state.

iv. How can wayfinding in design of a Paediatric hospital be improved by applying architectural features?

1.6 Scope of Study

The research scope is limited to the study of the principles of wayfinding in hospitals and architectural tools applied in wayfinding. The study investigates the general problems faced by way finders in hospitals within Kaduna State. It will further outline all recommended architectural spaces required in the proposed design of a paediatric hospital including special treatments to cater for the medical needs of a patient.

1.7 Justification

The Kaduna State Government has set to improve healthcare delivery and reduce child mortality, this therefore highlight the need to provide a specialized hospital which will cater for the medical needs of these children and to improve the care-giver experience through designing a good wayfinding system which uses less staff and volunteer time, assist in alleviating people's stress, frustration and anxiety that has been associated with healthcare facilities that are difficult to navigate.

2.0 LITRETURE REVIEW

2.1 Introduction

This chapter will focus on review of previous literature, establishing what has been done in the areas of wayfinding in healthcare facilities. It evaluates the challenges faced by wayfinders with emphasis developments, importance of good wayfinding design solutions such as; theories, guidelines and principles that have been developed over the years.

2.2 Wayfinding

Wayfinding can be defined as a process in which people navigate an environment using information support systems such as architectural clues, lighting, sight lines and signage. Wayfinding is a consistent use and organization of definite sensory cues from the external environment (Lynch, 1960). Kuipers (1978) opined that the space in which human wayfinding usually takes place is called “large-scale” space. This is because objects cannot be moved, they are larger than people and people have to navigate them example of these large-scale space are landscape, cities and buildings.

Wayfinding system is designed to move people through space to their destinations. For this to be achieved, a visitor needs to navigate a logical progression of orderly information, which becomes more detailed as they approach their destinations. Once they reach it, they should also be able to orient themselves and simply navigate to other points of interest or need (Corbin Design Team, 2014)

2.3 History of Wayfinding

Wayfinding was first used by Lynch in 1960, where he referred to maps, street numbers, and directional signs etc. as "way-finding" devices. Lynch carried out a research by asking the residents of four cities in the United States to draw sketch maps

of different cities from memory. By comparing the sketch maps to the actual layout of each city, he found that respondents organized their city images using a set of common images and features such as paths, landmarks, regions, edges and nodes. His work was based on the concept of *spatial orientation* and its prerequisite the *cognitive map (*Arthur and Passini, 1992). Lynch reasoned that the five key features (paths, landmarks, regions, edges and nodes are the main components of cognitive maps. (Ndhlovu, 2012)

The historical developments related to wayfinding appear to fall into three eras: the Pre-Passini Era (PrePE) from 1960 to the 1970s. This era sees the inception and conceptualisation of wayfinding. It is dominated by thinkers keen to study cognitive structures responsible for information processing and wayfinding is understood and explained in terms of spatial orientation and cognitive maps (Ndhlovu, 2012., Lynch, 1960.)

The Passini Era (PE) from the late 1970s to 1990s. In this era, Wayfinding is understood and explained in terms of spatial problem solving. It is conceptualised further by extending the concept of spatial orientation. The era is dominated by thinkers keen to study the dynamism of humans in space (Arthur and Passini, 1992)

The Post-Passini Era (PoPE) from the mid-1990s to date. The third era sees an extensive operationalisation of existing concepts, on new research is offered in terms of conceptualization. The era is polarised into two camps: pro-Passinis such as; Huelat 2004, Rooke et al. 2010 and pro-cognitivists such as, (Holscher et al 2005., Ndhlovu, 2012)

2.3.1 Wayfinding processes

There are three key processes in wayfinding:

- Decision making: Deciding to make a journey and developing a plan of action to get there by making a series of connected decisions.

- Decision execution: Putting the plan into action by setting out on the journey. Factors along the route may produce a change in the plan of action and affect decisions made along the route. People will look for information in order to create a mental map of the route and layout of places.
- Information processing: Using the information available to all the senses. People need to understand information, including spatial information, and be able to use it in a particular setting.

2.3.2 Cognitive mapping

Cognitive maps are defined as mental representations of the spaces and layout of a setting (Arthur and Passini, 1992). They are also known as mental maps; mind maps cognitive models or mental models (Brandon 2008). Microsoft Encarta, (2011) defines cognitive maps as the brain's map, a three-dimensional space maintained in the brain.

2.4 Special Users and Special Wayfinding Conditions

Universal design is more critical when responding to users with physical, sensory and cognitive impairment. Good architectural wayfinding design is important to universal design because it facilitates user access, increases satisfaction, and reduces stigma and isolation of users with disabilities. It reduces the confusion of visitors and mistakes by employees, saving time and money and preventing accidents. It also reduces stress, boosting health, and productivity (Evans and McCoy, 1998; Hunter, 2010)

2.4.1 Physical, sensory and cognitive impairments

The evaluation of buildings in terms of wayfinding performance has shown that people in wheelchairs may have physical problems accessing information such as map-displays and in operating lifts or simply opening doors. Major Wayfinding difficulties, however, tend to occur in buildings which have a special entrance for wheelchair users.

Quite apart from the discriminatory meaning associated with 'special entrances' previous research found that those routes usually required many more decisions and contained less information. Public buildings should be accessible by wheelchair users in some countries this requirement is a law and they should be accessible through the main entrances.

Sensory impaired, particularly visually impaired users do have wayfinding difficulties in public settings. Their difficulties derive not from their own cognitive limitations but from limited access to relevant information. Wayfinding ease can, therefore, be improved by appropriate means of environmental communication.

Given that perception in blind people is essentially proximal, they will typically make more wayfinding decisions than their sighted counterparts. They will require more units of information on a given route. They will also prefer to plan a route in more detail. These requirements are not in contradiction with the requirements for the general population. They simply indicate the necessity for a more articulate architectural expression including textures and sounds. A building that functions well for the general population will also improve wayfinding for the visually impaired population; however, there remain some special considerations. The crossing of large open spaces is particularly difficult for blind travellers and requires some directional guidance.

Special care should also be taken to ensure that the key architectural wayfinding features such as entrances, landmarks, horizontal and vertical circulation can be perceived by non-visual means. Universal design has the great advantage of not creating artificial barriers between user groups and not ostracizing the impaired population.

2.4.2 Special wayfinding conditions

Wayfinding may be affected in stressful conditions. Emergency evacuations are probably among the most characteristic. Research in this field has resulted in a number of interesting observations. People in emergency situations tend not to panic and do not behave as irrationally as is sometimes thought. They are therefore still in control of their wayfinding abilities. They tend to move towards the familiar, which, for the occasional visitor means that they try to exit a setting from where they entered. In wayfinding language, they try to execute a decision plan they know functions rather than trying out a new route which implies developing a new one. This behaviour has a certain undeniable logic in cases of emergency, when no wayfinding chances should be taken. Stress, nevertheless, can be an inhibiting factor. Wayfinding under stressful conditions should not require the development of complicated decision plans. Familiarity of routes, direct visual access to exits or directional signage, which can be seen as a decision plan spaced out along a route, are required under these special conditions.

2.4.3 Users with different needs

Designing good wayfinding information in a healthcare facility needs to take into account the requirements of patients that are likely to use the facility and their ability to understand the information provided to them.

A broad approach should be taken to ensure wayfinding information addresses the different capabilities of patients and limitations, recognising that no single medium will be suitable for everyone. The majority of users do not speak English or only have English as their second language. This needs to be taken into account when deciding how wayfinding information should be presented. (NPFC, 2011)

2.5 Wayfinding Design Principles/ Guidelines

Design principles/guidelines have been developed over the years on methods of improving wayfinding design, with relatively little conceptualization. Carpman and Grant (2002) contend that evidence-based principles of wayfinding must be translated into built and graphic form through spatial planning and environmental communication. However, Peponis and Weiseman (2002) warn that wayfinding principles tend to vary on a very different scale. They assert that these should reflect the: differences in interior and exterior wayfinding, wayfinding differences between first time and regular users, and differences in strategies used by significant population groups. For this study three set of design principles/guidelines chosen.

2.5.1 Heulat's principles

Heulat's principles is the first principle being studied, it integrate most of these features towards improving general wayfinding (Figure 2.1). It is accompanied by a comprehensive list itemizing specific guidelines for design. The system adopted explains how each system works better if the previous system is well designed. She also states that good design is possible for hospitals environment, with each building having its natural circulation system based on paths selected by its users. A good wayfinding system takes advantage of that, and such a system consists of numerous components that, like stacked building blocks, rely on each other for a solid foundation (Huelat, 2007).

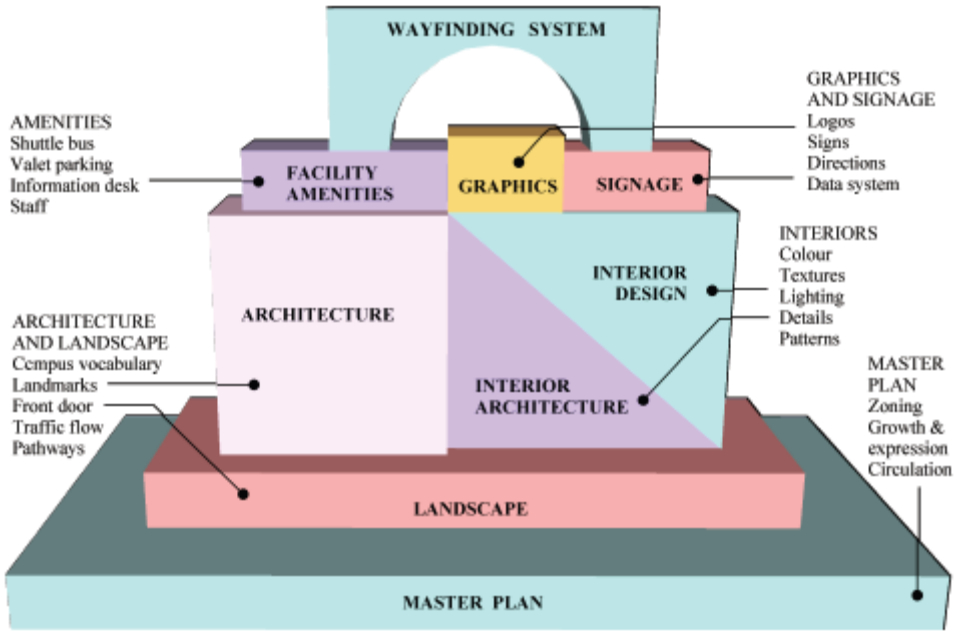


Figure 2.1: Building block model for successful wayfinding.
Source: Huelat, 2007 in Maina & Umar, 2015

2.5.1.1 Master plan

The master plan of a complex setting such as hospitals, starts as a simple building and later tend to expand. This expansion usually functions independent of the previous buildings. This problem can be avoided by providing a good master plan considers the facility's growth, expansion, circulation pathways and zoning. With the help of a good master plan, wayfinding is still easy for wayfinders even after expansion.

2.5.1.2 Landscape

Trees, plantings, flagpoles, water features, and outdoor furnishings when placed to lead to a building or other desired destinations. Such elements can also provide memorable landmarks to the facility.

2.5.1.3 Architecture

The Architecture block includes; windows in corridors to aid in visitor orientation, entrances that are easy to identify, clear pathways, easy-to-see visitor elevators, stairs, ramp, and landmarks that create visual cues at decision points.

2.5.1.4 Interior design

Interior design, interior architecture, and architectural blocks work together to optimize a wayfinding system colour palettes, materials, and lighting support a good wayfinding system. Interior finish materials, colour palettes can varying with departments or floors and can facilitate wayfinding. While lighting makes signs more visible.

2.5.1.5 Facility amenities

Visitor information centres, like the concierge desk in hotel lobbies, can provide a variety of functions. The centres must be centrally located and the first thing visitors see when they enter the facility. It is the identifiable place where visitors and patients can ask questions. Visitor information centres need to provide basic information about services, procedures, and locations of departments, bathrooms, and restaurants. (Huelat, 2007)

2.5.2 Rooke's principle

Rooke (2012) developed a tri-Platte concepts of addressing wayfinding concept this concept include physical features like the physical properties of the built environment, coded information i.e. typography such as words, letterforms & digits and social practices such as the verbal instructions given by volunteers, members of staff and other visitors to the setting.

She noted that the confusion caused by misleading and/or ambiguous signs, inconsistent use of colour or too much use of it and information overload or lack has been articulated taking extra caution to ensure that the methods used by wayfinders in the social production of these wayfinding settings described are represented with minimal distortion. Effective use of the researcher's own experience, the observed behaviour of other wayfinders and spontaneous conversations occurring in various wayfinding settings is apparent.

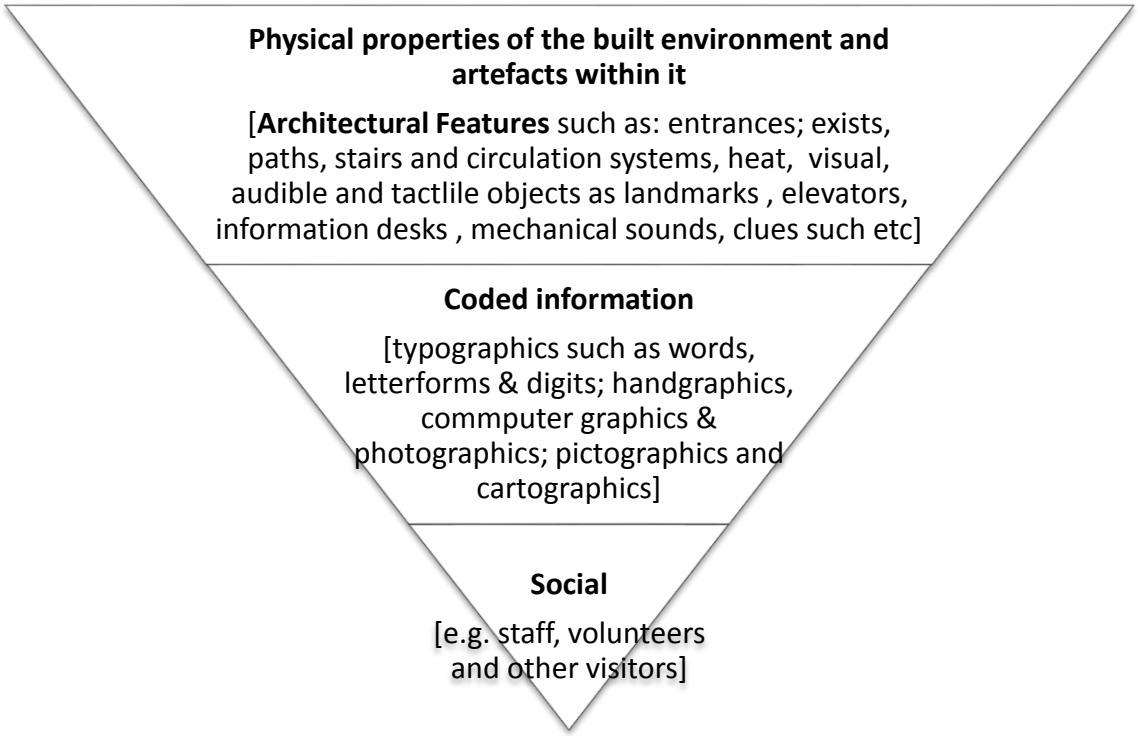


Figure 2.2: Rooke tri-plated framework.
Source: Rooke, 2012

The pyramid's order of priority moves from top to down (figure 2.2). The framework gives priority to communication through physical properties of the built environment which is the architectural features over coded information and social practice as cues for wayfinding in complex environments. Communication by majority of users is largely done visually. In addition, the study provides a simple tool in form of a wayfinding wheel for decision-making in design or improvement of complex environments. The framework was however evaluated within hospitals where access is easily granted and pedestrian routes largely predefined.

2.6 Architectural Wayfinding Tools

A wayfinding system uses an array of tools to create a good wayfinding environment. Good tools are the key to intuitively navigating the environment, telling people what they need to know, when and where they need to know it, table 2.1 names the various

elements associated with each tool. Wayfinding tools help people determine where they are in relation to their destination, inform them about their journey, and direct them to and from their destination with minimum effort.

Table 2.1: Architectural Wayfinding Tool/Components

Tool	Elements	Objectives
Shaping site and setting	Landscaping, beaming Roadways, entrances/exits Pedestrian routes sidewalks, pathways	Clear articulation and coherent grouping of exterior and interior spaces
Building form and architectural features	Building form, Building volumes Physical separation or clustering of Components, Roof design Placement of openings Cladding (skin) - textures, materials, Colours, Decoration, ornamentation	
Articulating interior spaces	Programmatic organization Defining spatial units Defining destination zones Interior design	
External and internal circulation systems	Design concepts (paths, markers, nodes/ intersections, edges/links) Approach from street, Roadways, Parking, External paths and walkways. Entrances and exits Connection to mass transportation	Creating legible circulation systems design
Level change devices	Elevators, Staircases, Escalators	
Internal transportation	Mobility aids, People movers Fixed rail systems	
Information wayfinding Design	Environmental graphics Sign systems, Orientation devices You are there maps Real-time information devices	Integrating communication systems

Source: Hunter, 2010

2.7 Wayfinding in Hospital Environments.

Ulrich, Quan, Zimring, Joseph, & Choudhary, (2004) emphasise the importance of carefully considering the signs and cues that lead to the hospital, especially to the parking lot because they are the patient's first point of contact with the hospital.

The studies by Werner and Schindler, (2004) and Ruddle and Peruch, (2004) looked at properties of building layout that facilitate or impede movement. The former found that environments with perpendicular intersecting hallways gave better wayfinding performance than those with angled intersections. The latter, came to the conclusion that well-designed signs are likely to be quite ineffective in a building that is highly complicated and does not provide simple cues that enable natural movement.

Carpman and Grant, (1984). Suggest that directional signs should be placed at or before every major intersection, at major destinations, and where a single environmental cue or a series of such cues (e.g., changes in flooring material) convey the message that the individual is moving from one area into another.

Good architectural wayfinding design is important to universal design because it facilitates user access, increases satisfaction, and reduces stigma and isolation of users with disabilities. It reduces the confusion of visitors and mistakes by employees, saving time and money and preventing accidents. It also reduces stress, boosting health, and productivity (Evans and McCoy, 1998).

2.7.1 Wayfinding in a paediatric hospital.

Way finding in a paediatric setting helps the caregivers, patient family and the children themselves navigate the complex smoothly. Their for Healthcare architects found ways to fundamentally rethink hospital design and the manner in which healthcare is delivered in an attempt to reduce staff stress and fatigue, increase effectiveness in care

delivery, improve patient safety, reduce patient and family stress while improving patient outcomes, improve overall healthcare quality, and improve overall hospital operating performance (Shoemaker, Kazley, & White, 2010).

The improvement of wayfinding offers several potential benefits for hospitals, including increased patient, visitor, and staff satisfaction and an increase in overall efficiency (Pati, Harvey, Willis, & Pati, 2015). Improved wayfinding in an organization that increases the satisfaction of patients, family members, and friends leads to significant cost savings because it reduces waste and increases efficiency (Shoemaker et al., 2010). Care givers and staff who are travelling to meetings in various locations of the hospital are often stopped in the hallways to provide directions. This interruption in movement may cause delays for them. Reducing or eliminating this hurdle creates time-savings and helps hospital employees avoid tardiness, resulting in increased job satisfaction, productivity, and cost savings (Harris, 2014).

2.7.2 Design and planning in wayfinding

The architectural and spatial design of healthcare settings can provide intuitive cues to assist people orientate themselves and navigate through campuses and buildings. Design factors such as form, the layout of buildings, arrangement of roads and pathways, and the alignment of corridors and location of clinical settings all contribute to a positive wayfinding experience for patients and visitors.

2.8.1.1 Architecture and planning

Healthcare environments are complex buildings with many competing planning requirements. Architectural design informs the shape, size, scale, light and volume of the hospital environment it also addresses the specific needs of clinical planning. This

planning process establishes the sequence of spaces which patients and visitors experience within the building.

The planning of healthcare spaces should be seen as hierarchical ranging from major circulation systems and spaces to secondary systems and spaces and finally to individual clusters of corridors and rooms. Being able to visualise the entire structure and layout is important in enabling visitors and patients to establish their mental map of the facility. Entrance should be well defined so as to avoid confusion, example of a poor approach design i.e. the main entrance is not well defined and this will lead to confusion for any visitor of the facility. This can be assisted by incorporating internal vistas and atrium spaces and clearly visible public thoroughfares. The mental map should be complemented by a logical arrangement of horizontal and vertical circulation systems. Horizontal systems such as corridors and public thoroughfares are best aligned with memorable landmarks either within or outside the building. Vertical systems such as lifts, stairs and escalators are best located at key points on these thoroughfares with connections to reception, welcoming and information points.

2.8.1.2 Interior design

Colours, materials and furniture selected for healthcare interiors assist in producing memorable experiences and marking particular places within a hospital setting. These experiences are often associated with particular places, like a clinic, inpatient area or waiting room. They characterise a place and are helpful in creating a mental map'. The selection of colour such as the orange clinic or blue waiting space can assist wayfinding by readily identifying places within the hospital. The marking of thresholds can also be a useful strategy in establishing and reinforcing people's mental maps. Thresholds mark the transition from one place to another and to signify that a destination has been reached. Clear thresholds can be achieved using high contrasts of colour, or different

scales or material types on either side of an entry point. These changes can be used to signal a destination point along the journey and to announce that a threshold has been crossed. Plate I shows the use of form, colours and patterns in the reception area of Lady Cilento children hospital



Plate I: Reception in Lady Cilento Children Hospital
Source: Archdaily

2.8.1.3 Colour coding

Colour coding can simplify decision making and reduce the amount of information on signs. Colour is now universally used to identify and distinguish different sign functions e.g. safety signs, site elements, such as floor levels, buildings, departments and routes. Despite universal acceptance colour coding by itself is not a complete solution, and on some sites it may even prove to be an inappropriate strategy. The use of colour as a wayfinding device should be always used with care. Plate II show how energetic colours are repeated in the hospital corridor of HITO clinic.



Plate II: -HITO clinic-Sordo Madaleno Arquitectos
Source: Arch2O

2.8.1.4 Effective landmarks

Traditionally, landmarks are considered to be objects which are easily seen and recognised from a distance. While this description applies to most ‘landmarks’ we see about town, landmarks as components of a wayfinding strategy require a few additional attributes; they need to be unique, describable, and memorable. Landmarks should not be confused with one another. Ensuring that each landmark has a unique identity reinforces the ability of people to describe it accurately, and recall it later.

Describable objects and treatments are key to a successful land marking strategy. This means that they are recognisable objects, which cannot be confused with something else, and are familiar to the people describing them. Plate III shows a sculpture of a nursing mother, this can used at a certain decision point that has relationship with infants, then any wayfinder heading to that department will certainly have the knowledge of the sculpture in this cognitive map



Plate III: Statue of a Woman and her infant.
Source: Author`s field work, 2016

2.7.2.1 Positioning landmarks

Landmarks, whether they are objects or finishes, need to be positioned where they are going to have the most effect. While this often means putting them near major decision points, there are a number of other locations which benefit from visible landmarks.

This can be solved through creating clear views to the same point, such as a landscaped garden or atrium, so that people can understand how far they have travelled.

2.8.1.5 Arts integration

It is tempting, and understandable, to create land marking objects and features using arts pieces. While this can be effective, there are a number of things to be aware of

when attempting to do so. Many facilities have existing art collections; not all of these will be suitable for use as landmarks.

Placing large and distinctive pieces in some areas can be effective. Alternatively, creating a clear and attractive gallery area, which can use a number of smaller and less distinctive pieces, is also effective. When creating new landmarks using artwork, a clear brief will be required.

2.8 Users of a Healthcare Facility

It is important to understand the users of any healthcare facility, in order to understand how best to explore the usability of the facility. The users can be categorized into Service Users, Visitors and Staff. (New South Wales, 2008)

2.8.1 Service users

Patients are the most recognisable user group in any healthcare facility. When planning a wayfinding system, a comprehensive list of all categories of service users should be compiled all categories. This will identify the destination of people and movement of people within the site, the point of initial reception, the point of completion of service, and the time of day these events take place.

2.8.2 Visitors

This group includes those who are visiting inpatients or accompanying outpatients. Family and friends of people entering the Emergency Department require particular consideration in view of their potentially distressed state. Other visitors to a facility include commercial representatives, service and delivery personnel, ambulance and police officers, fire brigade officers, assorted health and welfare workers and other official representatives.

Visitors should be identified so that the purpose and means of their access can be understood. This will not only assist in identifying wayfinding needs, but assist in a review of security and accessibility

2.8.3 Staff

Facility staff categories will include salaried, seasonal, voluntary and consultant. Of the three facility user groups staff are the most advantaged and most obligated. Frequency of attendance provides the advantage of familiarity with the facility, with a resultant reduction in dependence on wayfinding. However this in turn places an obligation on staff to share their knowledge of the facility with service users and visitors who are lost or in need of assistance.

2.9 Hospitals

A hospital is a healthcare institution providing patient treatment with specialized staff and equipment. Hospitals employ medical, nursing and support staff to provide inpatient care to people who require close medical monitoring and outpatient care to people who need treatment but not constant medical attention. Hospitals provide diagnosis and medical treatment of physical and mental health problems, surgery, rehabilitation, health education programs, and nursing and physical training. Many hospitals also serve as centres for innovative research and medical technology (Shitu, 2015). Hospitals are classified based on their functions and specialization i.e. by ownership and control; by type of service rendered; by length of stay; by size or by facilities and organization provided.

2.9.1 Types of hospitals

Hospitals in Nigeria are classified by the services they provide (general or specialized), the level of care they offer patients (short stay or long-term care), and by their

ownership (not-for-profit, proprietary, or government owned). Although any hospital might fall into several of the above categories.

2.9.2 Sophistication of services rendered

2.9.2.1 Specialist hospital

Specialist hospitals are basically run by consultants. They are either private owned or by the government. Specialized hospitals, in contrast, may concentrate on a particular group of patients, such as children, or a disease, such as cancer. Some specialized hospitals combine treatment and research. Example of services delivered by a specialist hospital may include trauma centres, rehabilitation hospital, paediatric hospitals, geriatric hospital, Paediatric hospitals and hospitals for dealing with specific medical needs such as psychiatric problems, certain disease categories. The consultants are trained to be professionals in the treatment of those particular types of ailments.

2.9.2.2 General hospitals

General hospitals are owned by the government and regardless of their sizes, provide patients with a wide range of services, including emergency treatment, surgery, and medical and nursing care. A general hospital typically is the major health care facility in its region, with large numbers of bed for intensive care and long-term care and specialized facilities for surgery, childbirth, laboratories. Larger cities may have several hospitals of varying sizes and facilities.

2.9.2.3 University teaching hospitals

These are academic medical centres. They are usually massive urban hospitals linked closely with major medical schools. A teaching hospital combines assistance to patients with teaching to medical students, nurses and laboratory specialists. They serve as referral centres for specialized consultation or for advanced diagnostic and therapeutic

procedures for patients in wide regional areas; they have at their disposal extensive diagnostic and therapeutic facilities and systematically carry out research and teaching. (Encarta, 2011)

2.9.3 Level of care delivery

2.9.3.1 Primary healthcare

Primary health structures are unarguably the first points of call for the sick and injured persons. This embodies all healthcare services that are community based and they render services such as immunization, antenatal care, nutritional advice, simple diagnostics and treatment. They are usually operated by a doctor or two, with some community volunteers who are trained and act as part of the medical staff especially in midwifery services. They are designed to care for a small number of people

2.9.3.2 Secondary healthcare

Secondary health centres are involved with not only prevention but also all treatments and management of minimal complex cases. However, the more complicated cases are referred to the tertiary or specialist hospital. Examples of secondary types are comprehensive health centres and general hospitals. They can accommodate 200-300 patient bed space.

2.9.3.3 Tertiary healthcare

A tertiary health institution, also called specialist/teaching hospitals, handles complex health problems/cases either as referrals from general hospitals or on direct admission to its own. It has such features as accident and emergency unit, diagnostic unit, wards units, treatment unit and outpatient consultation unit. All these units are to be equipped with the necessary facilities and staffed by skilled personnel. Teaching hospitals also conduct researches and provide outcomes to the government as a way of influencing

health policies. This explains why this type of health institution is often a university-based. Examples are Ahmadu Bello University Teaching Hospital [ABUTH], The National Orthopaedic Hospital, Dala, Kano, etc.

2.9.4 Ownership

2.9.4.1 Government hospitals

These are owned and controlled by local, state, or federal government. Most general hospital hospitals, primary and tertiary healthcare in Nigeria are owned by the government, but the federal government has the largest ownership. And they are mostly patronized by the average and low income citizens.

2.9.4.2 Private hospital

These are owned by individual or groups; they are not as large as government hospitals. These hospitals are patronized by the medium and high income earners' however those owned by religious groups are relatively affordable to the average income earner.

2.10 Hospital Architecture

According to the World Health Organization, the word hospital is defined as an institution that is built, staffed and equipped for the identification, diagnosis of disease and the treatment, both medical and surgical, of the sick and injured; for their housing during this process; and for certain other procedures.

Care of the sick is a fundamental need of community life and arrangement to deal with illness is present in all societies in some form. As it is a need, care of the sick has always been closely linked with economic and social development of people. The role of hospital cannot be over emphasized. This made it impossible to separate hospital design and architecture which provide different facilities of the hospital. Hospital form is determined by the physical relationship between the following functions.

i. Bed-related inpatient functions

ii. Outpatient-related functions

iii. Diagnostic and treatment functions

iv. Administrative functions

v. Service functions (food, supply)

vi. Research and teaching functions (if applicable)

Fig. 2.3 shows the relationship between these functions listed above how closely connected they need to be. The flow chart helps in the planning stage of the hospital.

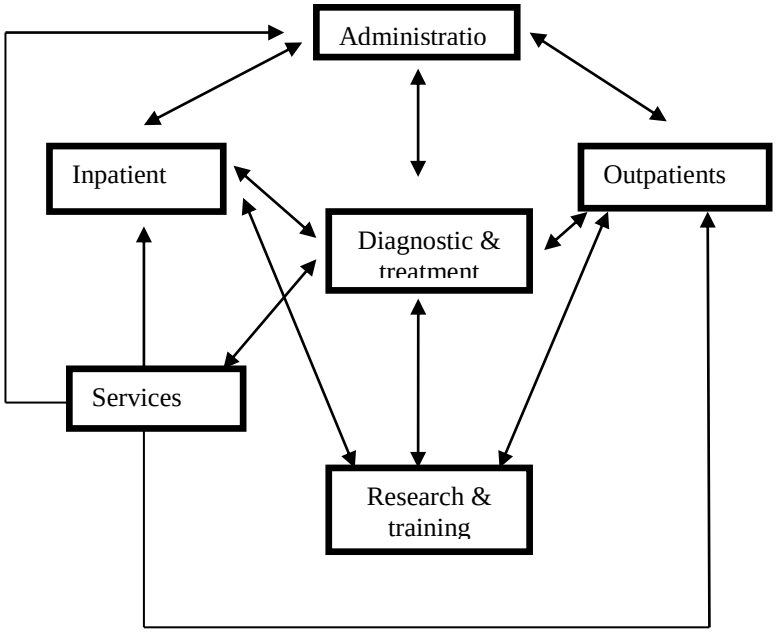


Figure 2.3: Hospital flowchart;
Source: Hospital Health Care Facilities Reception and Registration

The above flow diagram is further broken down and shown in fig. 2.4, certain relationships between the various functions that are required.

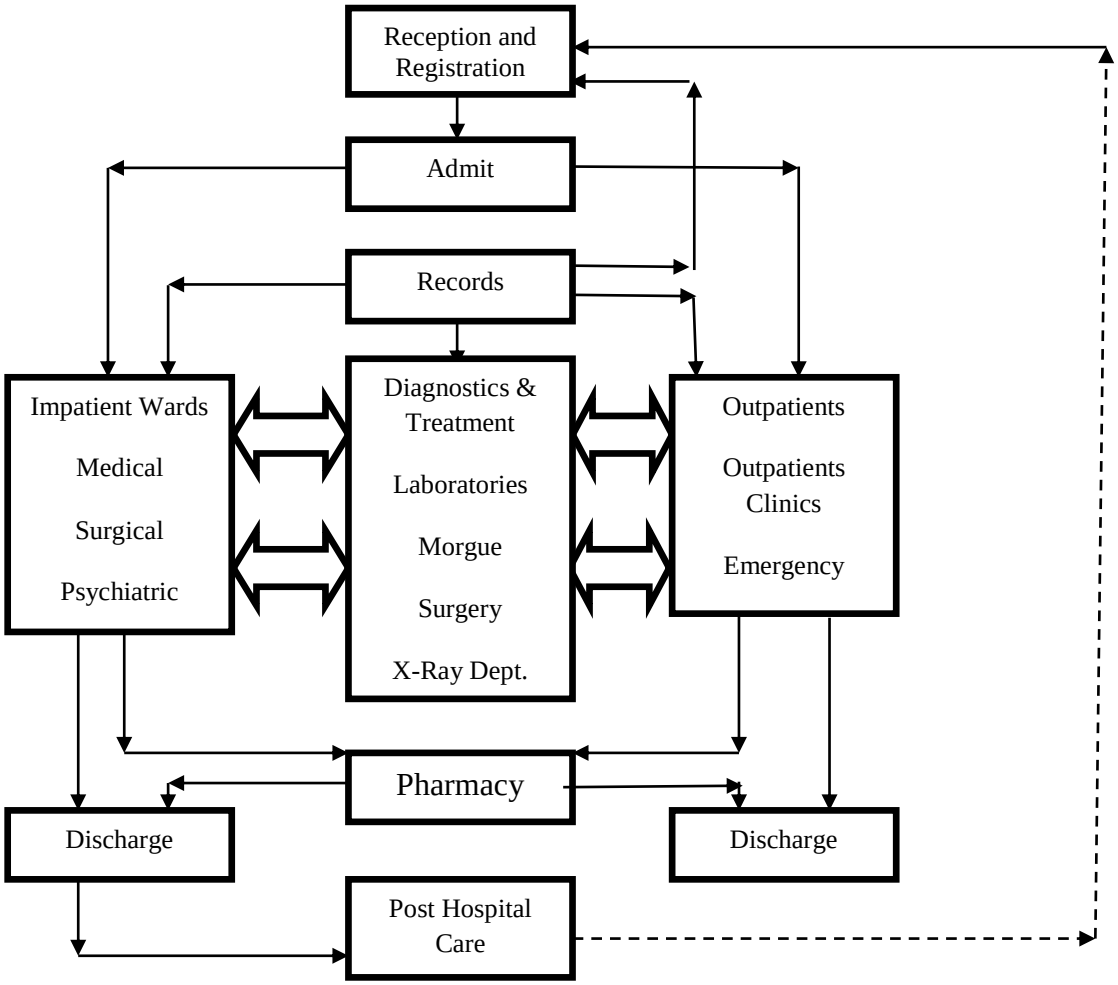


Figure 2.4: Hospital relationship.
Source: Hospital Health Care Facilities Whole Building Design Guide

This flow diagram figure 2.4 show the movement and communication of people, materials, and waste. Thus the physical configuration of a hospital and its transportation and logistics systems are inextricably intertwined. The transportation systems are influenced by the building configuration, and the configuration is heavily dependent on the transportation systems. The hospital configuration is also influenced by site restraints and opportunities, climate, surrounding facilities, budget, and available technology. New alternatives are generated by new medical needs and new technology.

In a large hospital, the form of the typical nursing unit, since it may be repeated many times, is a principal element of the overall configuration. Nursing units today tend to be more compact shapes than the elongated rectangles of the past, Malkin (2002).

Compact rectangles, modified triangles, or even circles have been used in an attempt to shorten the distance between the nurse station and the patient's bed. The chosen solution is heavily dependent on program issues such as organization of the nursing program, number of beds to a nursing unit, and number of beds to a patient room.

2.10.1 Hospital layouts

There are basically 2 concepts in the design of hospitals, which are conspicuously based on floor levels. They are:

- The pavilion concept
- The vertical mono block concept

2.10.1.1 Pavilion Type:

This is usually a low rise building it spread wider usually practiced on a wider piece of land. It brings the patient nearer to the native and harmonizes easily with the environment where the hospital would be sited.

Types of Pavilion Hospitals

- The linear plan
- Rectilinear plan
- Dispersed plan

- *The linear plan*

In this type of pavilion concepts functional spaces are arranged along a corridor at right angles on both sides, in other words it is a singly banking system of planning. It is good for most climates it has adaptability to most sites, effective circulation of people is ensured; efficient services system capacity for variation and expansion through

standardized building method as an advantage. On the other hand (disadvantage) it can cause drainage problem between buildings.

- *The rectilinear plan*

It consists of a separate rectangular block positioned to form a hollow block of building with open space having its circulation along the coordinates of the grid. This makes it flexible and easy to expand but extension of existing ones is difficult. It is also suitable for most climates. A well protected outside space and can accommodate moderate slopes in any direction by using ramps along the circulation space. On the other hand (disadvantage) is that circulation is confusing and it create courtyard that can be landscaped.

- *Dispersed plan*

This is the traditional ancient plan; it was used when land was vast. Circulation routes and the buildings are scattered. It admits natural lighting and ventilation into the building, but it required a large site which creates a long walking distance.

- *The vertical mono block concept*

This is usually a high rise building with all services enclosed in one building it has the advantage of simplified circulation pattern, effective site utilization, saves walking distance, proper coordination of activity, functions are closely related. And on the other hand, disadvantages includes; Over reliance on mechanical means of lighting ventilation lift and elevator which sky rockets the running and operating cost of the hospital and consume a lot of energy.

2.11 Summary of Literature Review

Wayfinding has been defined to be the process in which people navigate their way in a new environment, these people can be categorised as the facility users. The users of this facility should be up to date their cognitive map using information embeds within the architecture of the built environment. Users of any publicly accessed building can be classified into; the physically challenged or impaired physically, wayfinders in cases of emergency or during stressful conditions and users with different needs such as people that cannot understand the general language a specific environment. All the above listed conditions must be taken care of in order to have a good wayfinding system.

Wayfinding principles were developed by various researchers this serve as guidelines use to improve wayfinding conditions. The first principle studied was developed by Heulet this principle laid emphasis on a system which relies on each other to be functional he refer to it as the building block principle, just like the block laying process a principle has to be laid perfectly before the next principle in the sequence can work. The second principle study was developed by Rook. She developed a tinplated principle as a hierarchy. The physical properties of the built environment have the highest order then followed by the coded information and the lowest order is the social activities. These principles together with architectural wayfinding tools were used to develop a check list for the visual survey mainly focusing on the architectural element.

Wayfinding in a paediatric hospital has some peculiar characteristics, the designer has to consider the age group of the main users of the facility, which is children. Even though the children are usually accompanied by adult, the child's ability of store memory in there cognitive map shouldn't be neglected. Wayfinding features used in a paediatric hospital should be in simple forms so that the child can participate in the wayfinding exercise. Primary colours for interior design should be considered,

colourful pods of different shapes and sizes as display for fun provides unique memory for the child, that energy can also be applied to corridors waiting rooms and walkway.

Wayfinding in hospital environment has been reduced to mere use of signage but considering the architectural role one has to consider the building form, shapes scale and requirement for planning of hospital environment. Other element such as interior design and landscaping are also necessary.

3.0 RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the research design, the research method, the population under study, the sampling procedure and the method that was used to collect data. The reliability and validity of the research instruments are also discussed as well as method of data analysis.

3.2 Design Research

According to 1ssa (2004) in Shitu (2015), there are several Research methods used by researchers in conducting research; the method selected by the researcher is strictly due to the nature of the research problem being investigated. This in turn determined the type of data (qualitative data, quantitative data or both) that will be obtained during the course of the research.

Survey research is often applied to ascertain thoughts, opinions, and feelings. It focuses on the population. Data are collected for intensive study and analysis, by selecting a sample from a population using sampling techniques. The manner of sample collection will determine researcher's ability to generalise their findings for the whole population. (Asika, 2010)

3.3 Applied Methodology by Other Researchers

Veal (2006) in Oluigbo (2011) states that case study may be identified due to their inherent qualities which are in consonance with the phenomenon under investigation; they can be information rich, critical or unique features. He further suggested that a case study can be selected to be as a representative sample used in statistical investigation where each building has its features for been selected. Table 3.1 shows a number case study methodology used by other researchers in wayfinding.

Table 3.1: List of Research Case Studies

Researcher	Topic	Selected Case	Data Collection
Rooke (2012	Wayfinding in old and complex hospital environment.	Salford Royal Hospital Lancashire, north-western England	Visual survey Interview
Rooke et.al., (2009)	Wayfinding: Embedding Knowledge In Hospital Environments	Local National Health Service Hospital. north-western, England	Participant observation
Huelat (2007)	Wayfinding: Design For Understanding	Potomac Hospital, Woodbridge, Virginia	Visual survey and check list. Focus Group
Corbin Design (2014)	Wayfinding Strategy	Asheville, North-Carolina. Camden, New Jersey	Interview

Source: Author`s field work, 2015

3.4 Case Study Research

Case study methodology first developed within the social science, it can be referred to as the study of situation, an analysis of a particular situation used as bases for drawing conclusion (Encarta, 2009). Asika (2010) noted that a case study may refer to both research method of a unit of analysis which involves study of an example i.e. phenomenon being investigated. In architectural research case study has become a prevailing methodology, such cases include design process, building section or aspect of the built environment natural and cultural environment for building. (Oluigbo, 2011)

This study; improving wayfinding through design in proposed Paediatric hospital, gears towards collecting information through visual survey, researchers own experience and Computer based simulation

3.5 Population of Study

Kaduna State has five tertiary health facilities belonging to the Federal Government, four of which provide specialized care, while the Ahmadu Bello University Teaching

Hospital (ABUTH) serves as the apex reference tertiary health care facility. All the Federal Government health facilities are based in Kaduna/Zaria. The general hospitals belonging to the state have been categorized as either rural hospitals, general hospitals or specialist hospitals, with range of services and skills available for service delivery improving along as one moves from the rural hospitals to the specialists hospitals.

The population of study comprises of all the Government Hospitals located in Kaduna State. The selection of this population of study is captures the wide range of data required for the study and it facilitates the reliability of the study.

3.6 Sampling Procedure

A non-probability (purposive sampling) was used because, according to Burgess (2006) it can be used to gain insights into people's attitudes, beliefs, motivations and behaviours especially where the sample frame is not known and it is fast considering the time frame. If the study population is homogeneous it yields a very accurate result.

In sampling the hospitals for the study, Government hospitals within Kaduna State were first identified and were categorized based on their Level of Healthcare Delivery which is Primary Healthcare, Secondary Healthcare or Tertiary Healthcare.

The importance of this categorization is the fact that there is a different level of complexity in design. Such categorization also allows for clear understanding of complex dynamics that transpire within the different hospital types taking into account the roles that they play in health care delivery.

To meet the objective of this study, three (3) cases were purposefully selected. Each case is typical representation of the most sophisticated case of hospital design identified to exist within the State: The hospitals are:

- Ahmadu Bello University Teaching Hospital, Shika, Zaria (ABUTH)
- Yusuf Dantsoho Memorial Hospital, Kaduna (YDMH)
- Barau Dikko Specialist Hospital, Kaduna (BDSH)

3.7 Case study Selection Criteria

The cases in this research were Stratified, Asika (2010), described it as stratified sampling, it's an applied random sampling method where the population is grouped into some defined characteristics called strata. From each stratum a sample is selected. This suggests that cases are identified for study due to their inherent qualities which were in consonance with the phenomenon under investigation (Oluigbo, 2011).

Two criteria were considered for the selection of cases for the study. These criteria were applied to each of the three categories of hospital classification as discussed in sampling sections.

The criteria are:

- Classification of hospital type.
- Population of the users of the environment.

3.8 Research Variables

Case study research requires that a phenomenon be studied within its context (Oluigbo, 2010). In this study, the phenomenon to be studied is Wayfinding and the context is the Hospital.

Form the studied literature the following variables were studied in each case.

- Site master plan
- Landscaping
- Architecture element
- Facility Amenities

3.9 Research Instruments

Yin, 2014 (2010) identified four (4) key components of qualitative studies: an emphasis on natural setting; a focus on interpretation and meaning; a focus on how the respondents make sense of their own circumstances; and the use of multiple tactics. To this end a number of instruments of data collection were adopted. These include visual survey and checklist, Participant observation and use of a computer simulation model.

In order to acquire data that will reveal the relationship between wayfinders and spaces, visual survey of architectural elements and observation of user interaction with these spaces. These data were observed and recorded.

3.9.1 Visual survey and check list

Visual survey is a tactic that uses objective visual assessment of physical static objects, such as facilities, structures and building elements through a check list which serves as a visual lens to focus the study on set objectives. The check list is obtained from in-depth study of literature.

A check list was designed to help identify availability or absence of certain wayfinding design elements the hospital. The same checklist is used across the three hospitals being studied. The checklist was developed based on Huelat wayfinding principles identified and explored during the literature review. A sample of the checklist is provided in the appendix segment of the write up.

3.9.2 Participant observation

An ethno-methodologically informed approach has been adopted, which uses participant observation in order to establish the methods which visitors to the hospital actually use in finding their way around. Drawing principally on the researcher's own

experience of attempting to navigate the hospital site, the resulting account seeks to conform to the requirement of Unique Adequacy. This requires:

- That the researcher must know what any member of a research setting would ordinarily know about that setting; and
- That in reporting that setting, theoretical formulations that are not used by members of the setting in the social production of that setting should not be used (Rooke & Kagioglou 2007).

3.9.3 Syntax tools

Space Syntax Tool was built on the theory of the social logic of space (Hillier and Hanson, 1984) which presents a general theory of how people relate to space in built environments and the impact of space on social behaviour and relationships. Since then, Space syntax was developed depending on two formal ideas which try to reflect both the objectivity of space and our intuitive engagement with it (Hillier, B. and Vaughan, L., 2007). Space syntax has been useful in describing and analyzing patterns of architectural space at both the building and the urban level. Such descriptions of spatial configuration then serve as independent variables in various kinds of architectural research.

3.9.4 Depthmap

The different Syntax values of axial lines can be measured by a computer program called *Depthmap*. Assigned values can be displayed both as a table and as a color-coded axial map. In this map the lines are displayed in a range from deep blue to deep red; blue signifying segregation and red signifying integration. Thus an objective measurement can be given to each unit of space within a layout. Consideration of the

top 5% of the integrated areas gives the *integration core*. Also, the average integration value can be used to compare between different configurations.

3.9.4.1 Visibility graph analysis ss.

Theory has three basic concepts; Convex space, Axial line, and Isovist. Among these, the study adopted Visibility Graph Analysis (VGA) which has developed out of isovist. We then interpret definitions of Visual Connectivity, Integration, and Visual Step Depth (VSD) among VGA's indexes.

3.9.4.2 Visual connectivity

Visual Connectivity is "the number of apexes within the graph which can be connected directly from an apex" and means visual range from a point in the space (Garfinkel, 1974). The value is higher if the view is wider or is open to more directions.

3.9.4.3 Integration

A space is said to be *integrated* when all the other spaces of the building are relatively shallow from it. In other words, it is the function of the mean number of axial lines and connections that need to be taken from one space to all other spaces in the system (Hillier 2005). Thus, from a space with a high integration value, fewer changes in direction are necessary in order to move from that space to all other spaces in the system. In this way, *integration* value measures the relative position of any space with respect to the overall building configuration.

3.9.4.4 Intelligibility

A higher order of measure in Syntax is *intelligibility.* This value refers not to individual environmental units, but to the entire system configuration. A system's 'intelligibility' is measured by the correlation between global and local variables, most commonly between global integration and local connectivity. This is expressed by Pearson's

Product Moment Coefficient (r). Intelligibility values can be used to quickly compare between different environments. Intuitively it means that in a layout of high intelligibility, information about local connectivity allows a person moving through the system to comprehend the overall structure of the configuration (Hillier, 2005). The stronger a correlation, the more global configuration of a space may be inferred from its directly observable local connections. Integration value of any space is derived from consideration of its depth from all points within the configuration system. Sometimes it is meaningful to look at particular points to determine how it relates to the rest. For this research purpose, the entry points of the settings were considered important.

3.10 Data Analysis

For spatial analysis of the layout of the stations under study, space syntax analysis method was used to obtain basic syntactic measures of integration and difference factors which were correlated against use patterns observed in the stations.

3.11 Procedure for Data Collection

The procedures for data collection for the local case study involved visit to the case study site and taking visual analysis of their architectural elements which aids wayfinding principles, building were then critically evaluated based on the outlined criteria of analysis.

3.12 Data Presentation

The use of Table, graphs and tables for display of data will be employed along with primitive methods. The data analysis is aimed at noting patterns, themes and noting relationship between variables. Simple descriptions were used to present the data collected from the field work. Figures and plates were used to aid the descriptions.

4.0 RESULTS AND DISCUSSION

4.1 Introduction

This Chapter reports on the data collected during the field work conducted for this study. The reports are presented for each of the case studies. Each part starts by offering a description of the organisation studied followed by overview of the work carried out. A discussion of the key findings is presented last.

4.2 Visual Survey

The data presented under this section is aimed at capturing information that would be used in answering research question 1. Visual survey was used to collect data reported in this section.

4.2.1 Case study one; Ahmadu Bello university teaching hospital

Location: Shika Zaria, Kaduna State, Nigeria

Ownership: Federal Government

Type of services rendered: Teaching Hospital

4.2.1.1 Hospital detail:

Ahmadu Bello University Teaching Hospital (ABUTH) is a teaching hospital affiliated to ABU Zaria. It has different departments from Administrative Department, Outpatient Department, Paediatric Department, Orthopaedic Department, Oncology etc., and the maintenance department. This hospital facility was constructed in phases and there has been a lot of alterations on the originally proposed master plan and the existing structures on site. The site (plate IV) can be described as a rectilinear plan with buildings rising as high as 3 stories most of this buildings are connected with walkways and ramps, that is typical of hospitals



Plate IV: Google image of Ahmadu Bello University teaching hospital
Source: Author`s field work, 2016

4.2.1.2 Landscaping

The ABUTH is well landscaped with tall trees, flowers, plants and shrubs, plants are used within the parking areas, by the walkways and within the courtyard. Plate V shows the some types of plant and trees used as landscaping element in ABUTH. These plants


Plate V: Tall trees and shrubs
Source: Author`s field work, 2016

4.2.1.3 Circulation

ABUTH has well paved access way for both vehicular circulation and pedestrians. Vehicular access starts from the main site entrance leading to various department/ section of the facility parking spaces and drop-off. Plate VI shows the main entrance gate, and gate house which is used as the main access into the hospital. The entrance is well designed and unmistaken. This is excellent for a good wayfinding character.



Plate VI: Main gate Ahmadu Bello university teaching hospital
Source: Author`s field work, 2016

Walkway for pedestrians has been provided form a separated pedestrian access gate, Plate VII shows the walkway leads directly to the General Out Patient department. Users accessing the facility from the pedestrian gate gets a good view of the approach elevation of the OPD even though there is a partial obstruction form a tree planted by the building.



Plate VII: Pedestrian walkway from pedestrian gate
Source: Author`s field work, 2016)

Vertical circulations include lift, staircase, and ramps. They are used to connect different floors and to link different sections of the hospital. Plate VIII show image of ramp connecting different floors of the ward section, it help in moving people, wheelchairs, gurney and other wheeled devices



Plate VIII: Ramp linking various levels
Source: Author`s field work, 2016

4.2.1.4 Architectural Characteristics

All the buildings within ABUTH were design and constructed with Morden construction technique and materials. Landscaping, Roof, Walling materials, openings, floor finishes will be discussed

i. Roofing material

Roofing material used in ABUTH include long span corrugated Aluminium roofing sheet, parapet wall are used in some of the building such as the administrative building while other building use the facia board. Reinforced concrete where used in covered walkways and other building.

ii. Walling materials and finishes

Walling material used includes Sandcrete block and mortar finished with cement sand mortar and paint; these were mainly used as partition walls. Other department such as the administrative section used wood for the partition of office spaces. Screen wall can be seen in some are mainly for solar ray control. Plate IX shows a view from the main entrance, public area finished with cement sand mortar and paint



Plate IX: Main waiting area.
Source: Author`s field work, 2016

iii. Openings

The doors and window to public area such as waiting area and main entrances are made with glass and aluminium frames, this admits natural light to these spaces, and flush doors were used and can be found in the entrance to other department, consultation rooms and offices

iv. Floor finishes

Terrazzo floor finishes can be found in all the public areas including corridors, as seen in plate IX . External walkways (Plate X) were finished with concrete slabs. In the non-public areas such as offices within the administrative section unpolished floor tiles and carpet are used.



Plate X: Walkways.
Source: Author`s field work, 2016)

4.2.2 Case study two: Barau Dikko specialist hospital,

Location: Tudun Wada, Kaduna State, Nigeria.

Ownership: State Government

Type of services rendered: Specialist Hospital

4.2.2.1 Hospital detail

Barau Dikko Specialist Hospital is run by the Kaduna state government it also served as a teaching hospital for the Kaduna state school of nursing. It has various departments

such as the Administrative department, G.O.P.D, specialist section. The site has about 4 main structures which include the administrative building, the general outpatient department, the inpatient department and paediatric department; the site has 4 different access gates leading to the above named departments. This site, plate XI can be characterise an a rectilinear plan with buildings rising as much as 3 story structure, most of this building are connected with walkways and ramps.

The paediatric department was initially designed as the main hospital but with the new structures on site it was then later modified to be the present children section. It has 2 ward of 10 bed each, am emergency room, 1 immunisation room, 2 consultation room an administrative section of 3 offices, and a surgery room.



Plate XI: Google Image of Barau Dikko specialist hospital.
Source: Author`s field work, 2016

4.2.2.2 Landscaping

Barau Dikko specialist is landscaped with trees, flowers and shrubs, plate XII is a view from the parking area were the asphalt road and concrete interlocks are used.



Plate XII: Parking area with paved sidewalks.
Source: Author`s field work, 2016

4.2.2.3 Circulation

This facility has well paved access way for both vehicular circulation and pedestrians. Vehicular access starts from the main site entrance leading to parking area. Sidewalk has been provided for pedestrians from the access gate this can be seen in Plate XII above, other department are linked through walkway, stair case and ramps

4.2.2.4 Architectural characteristics

The building materials such as; roofing, walling materials, openings, floor and finishes use in Barau Dikko Specialist hospital Children's unit., will be discussed in this section.

i. Roofing material

Roofing material used in the facility include corrugated Aluminium roofing sheet with facia board and particle board for the soffit. Reinforced concrete where used in few part of the building. This is shown in plate XIII



Plate XIII: Paediatric unit building.
Source; Author`s field work, 2016)

ii. Walling materials and finishes

Walling material used include Sandcrete block and mortar finished with cement sand mortar and paint, burnt bricks were used in the facade of the building see plate XIII above. Wood partition was used in few sections and office spaces also shown in plate XIV.



Plate XIV: Wall material include wood partition.
Source: Author`s field work, 2016

iii. Openings

The doors in this hospital are double leaf single swing; steel frame and door leaf with glazed panel, wooden frame and door leaf with glazed panels, wooden frame and leaf without glazing and steel box section doors in the administrative area. as shown in plate XV Windows include louvers with steel frames, and glazed cement windows.



Plate XV: Access door to ward.
Source: Author`s field work, 2016

iv. Floor finishes

Terrazzo floor finishes was used in all part of the buildings including offices consultation rooms and walkways, plate XVI shows the floor finishes in the reception.



Plate XVI: Floor finishes
Source: Author`s field work, 2016

4.2.3 Case study three: Yusuf Dantsoho general hospital.

Location: Tudun-wada, Kaduna.

Ownership: State government

Type of services rendered: General hospital

4.2.3.1 Hospital detail

Yusuf Dantsoho General Hospital is a state government run hospital, located in Tudun-Wada area of Kaduna state. The site can be characterise by it rectilinear pavilion layout with each department connected through covered walkways. Plate XVII below shows a satellite image retrieved via Google earth software,



Plate XVII: Google image of Yusuf Dantsoho general hospital.
Source: Author`s field work, 2016

4.2.3.2 Landscaping

The facility is well landscaped with tall trees, flowers and shrubs, open lawn are provided in between buildings and are used as green areas. The parking areas, walkways paths are also landscaped with plants.



Plate XVIII: Courtyard within the building.
Source: Author`s field work, 2016

The courtyard in plate XVIII is located within the main consultation building, it used as a green area and helps in admitting light air circulation in to the building but no land mark was used and it was shrubs where poorly maintained.

4.2.3.3 Circulation

A paved Vehicular access has been provided form the entrance gate, leading to parking areas and drop off of various Unit of the facility shrubs and small trees were used in-between the road and sidewalks as seen in Plate XIX.



Plate XIX: Vehicular access road access.
Source: Author`s field work, 2016

As for Pedestrian's access, shown in plate XX, covered walkway was provided linking all the other department within the hospital site.



Plate XX: Covered walkway.
Source: Author`s field work, 2016

4.2.3.4 Architectural characteristics

All the buildings within ABUTH were design and constructed with Morden construction technique and materials. Landscaping, Roof, Walling materials, openings, floor finishes will be discussed

i. Roofing material

Roofing material used in the hospital include long span corrugated Aluminium roofing sheet, with wooden facia board, parapet wall is used in the entrance poach of the OPD plate XXI is a view of the main entrance from the parking lot.



Plate XXI: Main entrance.

Source: Author`s field work, 2016

ii. Walling materials and finishes

Walling material used include Sandcrete block and mortar finished with cement sand mortar and paint. Screen was also used in some areas.

iii. Openings

The doors and window to in the facility consist of double leaf single swing with glazed panels, double leaf single swing without glazing, single leaf flush door in the offices. Plate XXII shows steel door used in ward section of the building. The windows consist of steel casement with glazing, louvers with steel frame



Plate XXII: Access doors and windows.
Source: Author`s field work, 2016

iv. Floor finishes

Terrazzo floor finishes can be found in all parts of the facility areas. But walkways were finished with mass concrete. Plate XXIII shows the floor material in the reception area



Plate XXIII: Main reception/ waiting area.
Source: Author`s field work, 2016

4.2.4 Summary of visual survey

Landscaping element such as shrubs, flowering plants and trees are used within all the hospitals studied, they were used by the walkways, access road and some open lawns. Vertical circulation such as stairs were placed for easy access to the users of the facilities ramps and lift were also provided even though the lift in ABUTH was not been used by the general public when this case study was conducted.

Architectural element such as door types, walling materials and floor finishes were used in the first case study ABUTH to distinguish between public and non-public zones, Wall paint colour was used in some areas of ABUTH to define destination zone. These principles were not applied in the second and third case studies. Interior design of the first case study ABUTH indoor plant was used and different wall materials especially in the administrative section but there is no effort in the use of colours and art works especially in the second and third case studies, the checklist used for assessment of wayfinding element in the case studies conducted is shown in table 4.1a and 4.1b

Table 4.1: Checklist used for the assessment of Wayfinding element in the healthcare building

S/n	Variables	Check list	Level of application			Remark
			ABUTH	BDSH	YDSH	
1	Shaping site and setting	Landscaping,	H	H	H	Good landscaping is available within the site access road was also provided together with well defied pedestrian walk path
		Roadways,	H	M	M	
		Pedestrian routes sidewalk.	H	L	H	
2	Building form and architectural features	Building form,	H	M	L	Complexity of design/morphology of the structure and Architectural expression and building concept can be seen more in ABUTH There is no clear Composition of form in relation to massing separation between department in BDSH and YDSH. All roofing material was consistent in each facility. The doors and window to public area such as waiting area and main entrances are consistent Walling material used includes Sandcrete block and mortar finished with cement sand mortar and paint; these were mainly used as partition walls. Cladding materials include wood for the partition of office spaces.
		Physical separation of Components,	M	-	-	
		Roof design	M	M	M	
		Placement of openings	H	M	M	
		Cladding (skin) - textures, materials, Colours,	M	M	M	
3	Articulating interior spaces	Programmatic organization	L	H	L	There is poor relationship between related department which is as a result of the pavilion concept design in YDGH Destination zones were not clearly defined is some part of the facilities studied. Different unit are identifiable by name tag and signage placed by the door.
		Defining spatial units	M	L	L	
		Defining destination zones	√	√	√	
		Interior design	L	-	-	
4	External and internal circulation systems	Approach from street	M	H	H	Both the external and internal circulation system are present in the cases studied they connect the hospital to the external community Parking space were provided in all the Facilities but its insufficient in the case of BDSH and YDGH, users had to result to parking by the access road during peak hours. There is a well-defined entrance in all the facilities
		Roadways, External paths	H	M	H	
		Parking,	H	L	M	
		Entrances and exits	H	H	H	
		Connection to mass transportation	H	H	H	
	Level change devices	Elevators, Staircases, and Ramps	H	H	-	All the Level changing devices are present in ABUTH and BDSH but absent in YDGH due to the fact it's a pavilion Hospital Design.
	Internal transportation	Mobility aids, People	-	L	-	Mobility aid and fixed riling
		Fixed rail	-	-	-	

Source: Author`s field work, 2016

4.3 Participant Observation

Although it is clear that some effort has been made to create an integrated wayfinding system such as that emphasized earlier (Carpman and Grant, 1995., DOH, 2005), the current system falls short of solving the wayfinding problems experienced by the users of the setting. This method will therefore be used of answer the second research question which is to: *how do these architectural features assist wayfinders in hospitals within Kaduna*

The current way finding system in most of our medical facilities in this country makes use of staff, volunteers and graphical information such as signs. The most notable wayfinding techniques employed in the facility include signs placed at the entrance to each departments, and large numbers of staff/security personnel strategically positions at entrances and major decision point as in Ahmadu Bello University Teaching Hospital. The negative aspect includes use of ambiguous languages (medical terminologies) in which most of the users of the facilities do not make senses of. Another aspect is that the staff trained in giving direction have and inconsistent approach, they sometimes get confuse when the wayfinder do not know the specific name of the department he is going.

Confusion arises at certain decision point which makes the user of the facility requesting for help from staff or any competent user of the facility. At this point when a staff is noticed and he offers help there is an immediate sense of relief from the wayfinder, but as the way finder moves on there is a rise in anxiety due to the facts that he is trying to recall all the direction dictated to him.

4.3.1 Case study one: Ahmadu Bello university teaching hospital



Figure 4.1: Floor plan Ahmadu Bello university teaching hospital.
Source: Author`s field work, 2016

4.3.1.1 Section A exterior clues

ABUTH has a well-designed main gate, with soft landscaping. The entrance to the main building can be easily identified from the parking lot; separate parking has been provided for the staff and other facility users. A walkway was provided leading to the main entrance of the facility and also to the other department within the hospital facility. Figure 4.1 shows the ground floor plan of ABUTH it shows the different department.

4.3.1.2 Section B interior clues

Once inside the main building the first thing one observes is the waiting area on the right, directly forward is the nurse unit. The floor covering, wall finishes within this part of the building are consistent, the same floor covering materials were used and the wall painting in all the waiting areas of the various departments, plants in flower pots were arrange within corridors this arrangement of floors helps as a visual information. As you move further the form the waiting area, the general outpatient department and

information centre are identified then the stair case is noticed behind the information centre, on the first floor, is mainly the administrative department, side walkways area open to aid light and ventilation but it also aid visual orientation providing views to other buildings within the site. The offices on the first floor were design as a double banking concept, the corridor was walling material used was plywood and the floor are covered with carpet.

4.3.2 Case study Two: Barau Dikko Specialist hospital

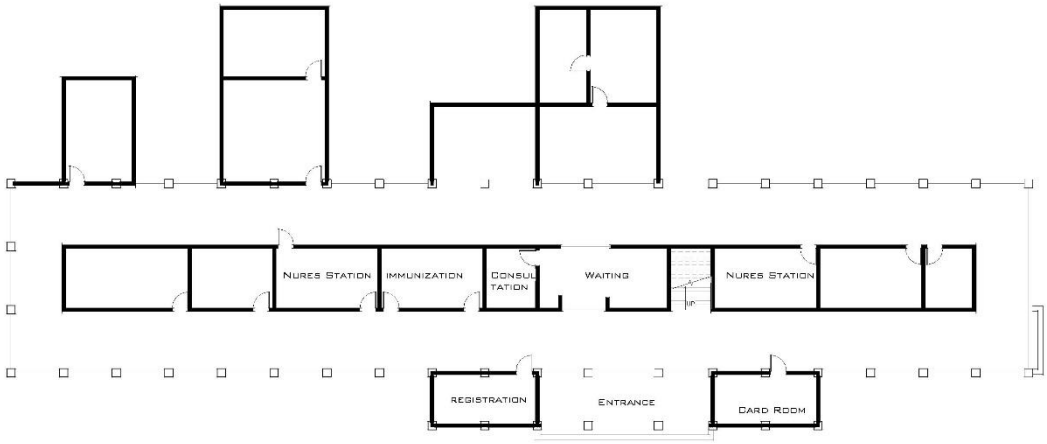


Figure 4.2: Ground Floor Plan Barau Dikko Specialist hospital
Source: Author`s field work, 2016)



Figure 4.3: First Floor Plan Barau Dikko Specialist hospital
Source: Author`s field work, 2016

4.3.2.1 Section A: exterior clues

Barau Dikko Specialist hospital site has 3 separate entrances to the site excluding emergency gate, these gate leads to the main building which are the administrative building, general OPD, and the children department (paediatrics) which is the main building of study. The paediatric department figure 4.2 and 4.3 was not designed as a children hospital it was converted after new structures were erected to accommodate the main hospital activities. The main entrance of the paediatric department can easily be identified from the entrance gate and also from the parking area which is adjacent to the building which is a single story structure. Figure 4.2 and 4.3 the ground floor plan and first floor plan of BDSH

4.3.2.2 Section B interior clues

The entrance hall is the first part of the building and the card room is located in this section by the left side and directly forward is the waiting area and the nurse unit the next unit is the consultation room which is an adjoining wing to the main structure, the entrance hall is connected to a veranda, form the veranda we can access the immunization room, emergency room, matrons office and the staircase to the first floor.

On the first floor the left wing is the surgical section and the right wing houses the ward, administrative department, and some offices. There is no distinction in terms flooring material in all this section; the restricted zone was mainly the surgical ward which a plywood partition board was used to segregate the area. But the wall colour was consistent throughout the building.

4.3.3 Case study Three: Yusuf Dantsoho general hospital

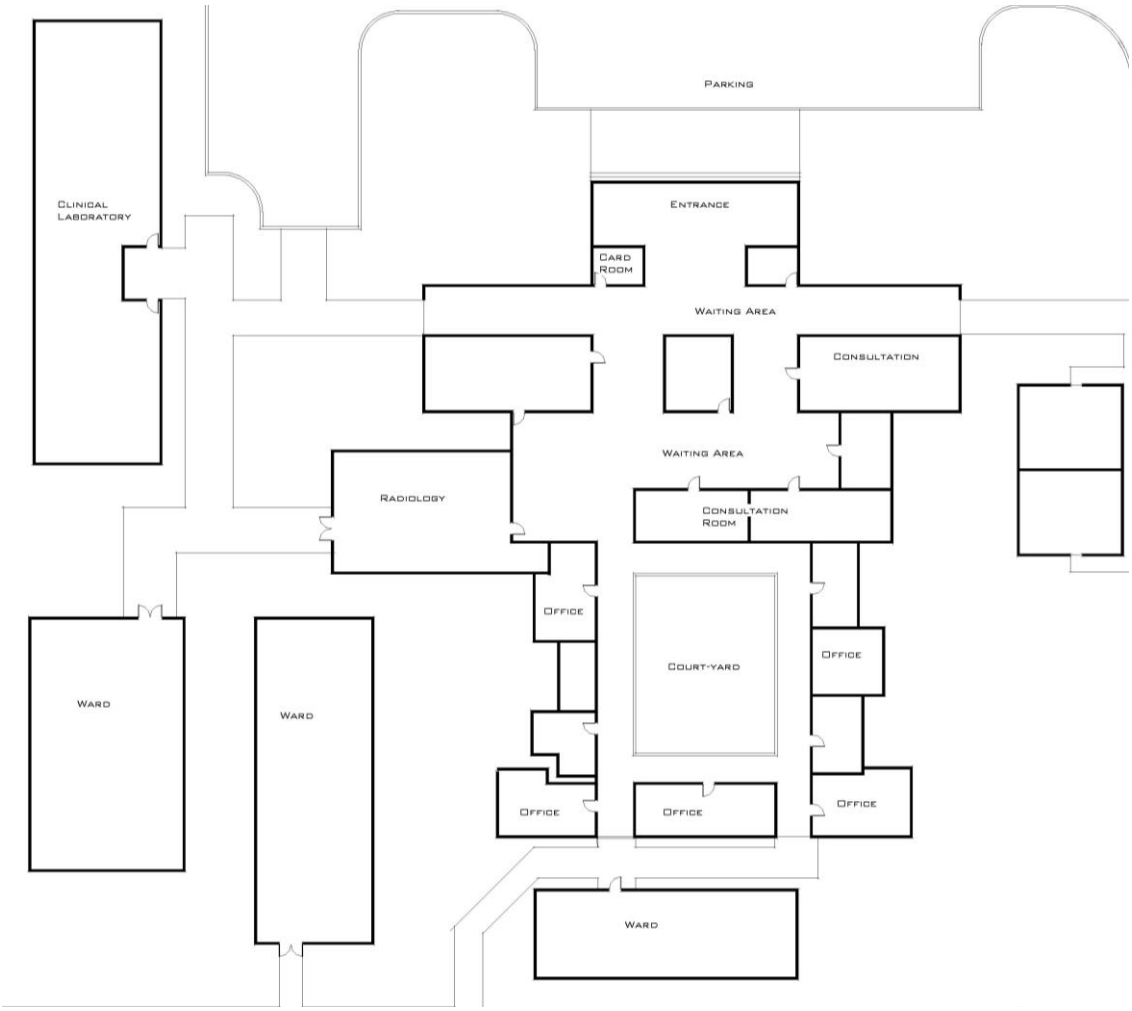


Figure 4.4: Floor Plan Barau Dikko Specialist Hospital
Source: Author`s field work, 2016

4.3.3.1 Section A exterior clues

Yusuf Dantsoho General Hospital site was design with a pavilion concept, figure 4.4 the main entrance to the outpatient department can be identified from the entrance gate as well as form the parking lot, there is no visible separate parking for the people with disability but the parking space directly in front of the OPD is reserved for emergency case. A walkway was provided from the gate leading to the main entrance of the OPD and also to the other department within the hospital facility.

4.3.3.2 Section B interior clues

Inside the main building are the first the card room, then the waiting area, nurse unit and consultation rooms. same flooring materials in all the department and the wall painting was also consisted in all the waiting areas of the various department, there is no information centre in this facility but the nurses in the facility assist all the users. The admin section of the facility is an isolated building in the north-east side of the site.

4.3.4 Analysis of the participant observation checklist

i. Main entrance:

The main entrance to all three cases studied were well designed, but the case of ABUTH there was visual obstruction when viewing from the main gate, at this point a wayfinder accessing the site for the first time through the main gate will have to request for direction from the security men at to gate.

ii. Parking

Onsite parking is available in ABUTH there are parking for the visitors /outpatient section, staff, emergency and for people accessing other part of the hospital. In Yusuf Dantsoho General Hospital and Barau Dikko specialist hospital the parking space is insufficient, users result to using the lawn for parking and outside the hospital gate in the case of Yusuf Dantsoho General Hospital and Barau Dikko specialist hospital respectively. The main entrance can be viewed from the parking in all three cases.

iii. Accessible walkway

Covered walkway has been provide in all the hospitals this walkways link various department from the entrance gate to the main entrances of each department.

iv. Inbuilt communication system

Inbuilt communication system were not included in the design of the building only fire alarm system are available in ABUTH, public address system was not noticed in these facilities not at the entrance hall or waiting area.

v. Consistency of architectural element in public spaces

The same architectural elements were uses within all the public spaces there was no indication of destination zone or boundaries using architectural element.

vi. Presence of landmarks.

Landmarks where basically absent the cases studied except in the case of ABUTH which plants serve as visual information. Land marks can be in any of these form; Visual information, Olfactory (smell) information, Audible information, Kinaesthetic (bodily motion) information, Tactile (touch) information

vii. Visibility of entrance from decision point

At most decision point an entrance to a specific department of section can be notice except in few cases where three or four walkway.

viii. Open public waiting area

The waiting areas area the first point of contact once you are inside these facilities, they are usually visible and unmistaken but in Barau Dikko specialist hospital the waiting area is not been utilized due to its small size, The veranda is the main place people use as a waiting area.

ix. Distinguished public area from non-public area through finishes

The non-public area in ABUTH uses different carpet and ceramic tile on the floor and uses wooden petition as walling materials as to the public area terrazzo floor finishes

and Sandcrete block finished with mortar and paint in the public area. Barau Dikko specialist hospital uses different paint colour in it non-public building, wooden railing were uses on the stair case and glass and aluminium petition in other areas. The non-pubic area of Yusuf Dantsoho General Hospital has no difference in terms of finishes the same type of material ware used in all the department of the hospital

x. Visibility of level changing device from main entrance

Level changing device such as stairs or lift are supposes to be within the visibility limit of the wayfinder within the entrance hall, that of ABUTH is visible but slightly obstructed by a wall but as the wayfinder moves forward it can be noticed within the clear view. The stair case in Barau Dikko specialist hospital is enclosed one have to search for it.

xi. Presences of tactile ground surface indicators (TGSI)

Tactile ground surface are used to guide people with visual impairment but this was not provided in any of the hospital studied.

xii. Presence of shorelines' and 'trails' at major destinations and information areas.

Shorelines and trails were not used in any of the building studied; walls were only used to give an indication of a particular destination point.

Table 4.2a and 4.2b shows ranking of key element that assist users in wayfinding , element at major decision point that serve as guide to next destination were ranked, the same ranking criteria was used in all the hospital studied.

Table 4.2a: Ranking of participant observation

S/No.	Aspect	Ahmadu Bello University Teaching Hospital	Yusuf Dantsoho General Hospital	Barau Dikko Specialist Hospital	Remark
1	Main entrance	3	4	4	The view to the main entrance of ABUTH from the main gate is obstructed by trees which makes first time users of the facility ask for directions. No obstruction of any sort to the view from the main gate to YDGH and BDSH
2	Parking	4	3	3	Sufficient parking available in ABUTH but in YDGH and BDSH parking space are in sufficient. In all three hospital main entrance can be viewed from the parking.
3	Accessible walkway	4	4	4	There are assessable walk from the entrance gate leading to various department of the hospital
4	Inbuilt communication system	0	0	0	Inbuilt communication system that aids the visually impaired to identify their destination zones were not present in any of the facilities
5	Consistency of Architectural element in publics spaces	4	3	4	Architectural element were consistent throughout the building but in YDGH the administrative building was distinctive in its design the elements used in other building were not applied to it
6	Presence of landmarks	1	0	0	There is Minimal use of Land mark in ABUTH which is the ABU Logo. Landmarks were virtually absent in BDSH and YDGH
7	Entrance visibility form decision point	3	4	3	Most decision point include intersections, halls, staircase landings, usually entrance to various section can be noticed, not necessary the ones you are searching for.
8	Open public waiting areas	4	4	3	
9	Distinguish public area from non-public area through finishes	3	1	3	The non-public area in ABUTH uses different carpet and ceramic tile on the floor and uses wooden petition as walling materials as to the public area terrazzo floor finishes and wall paint. Barau Dikko specialist hospital uses different paint colour in it non-public building, wooden railing were uses on the stair case and glass and aluminium

Table 4.3b: Ranking of participant observation

S/No.	Aspect	Ahmadu Bello University Teaching Hospital	Yusuf Dantsoho General Hospital	Barau Dikko Specialist Hospital	Remark
9					Petition in other areas. The non-pubic area of Yusuf Dantsoho General hospital has no difference in terms of finishes the same type of material ware used in all the department of the hospital
10	Visibility of level changing device from main entrance	3	-	2	Level changing device such as stairs or lift are supposes to be within the visibility limit of the wayfinder within the entrance hall, that of ABUTH is visible but slightly obstructed by a wall but as the wayfinder moves forward it can be noticed within the clear view.
11	Presences of tactile ground surface indicators (TGSI)	0	0	0	Tactile ground surface are used to guide people with visual impairment but this was not provided in any of the hospital studied.
13	Presence of shorelines' and 'trails' at major destinations and information area	0	0	0	Shorelines and trails were not used in any of the building studied;

Key: Absent-0, low-1, average-2, high-3 and very high-4
Source: Author`s field work, 2016

Figure 4.1 below show a graphical representation of data obtained from the participant observation check list.

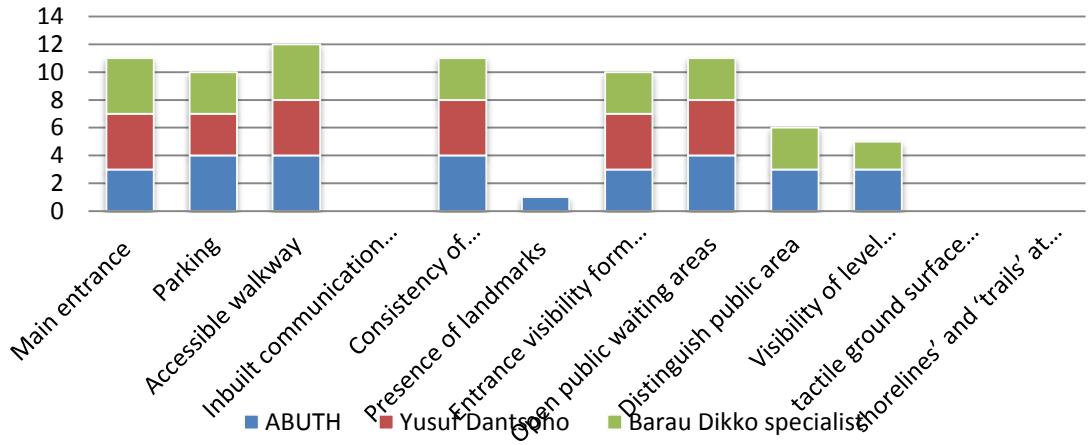


Figure 4.5: Bar-chart representation participant observation
Source: Author`s field work, 2016

4.3.5 Summary of participant observation

On arrival to the site of all three case study one can notice the general parking area he can get a view of the main entrance to the O.P.D. a defied walkway with shrubs, flowing plant and some trees were provided leading to the main entrance of the building. Once inside the building he noticed the reception/ information centre and the general waiting area no visible artwork or landmarks in the public space wall painting varies in some areas in Ahmadu Bello University Teaching Hospital but not in Barau Dikko Specialist Hospital or Yusuf Dantsoho general hospital.

Problems encountered during the participant observation include understanding description of route from one department to another example is going from the paediatric outpatient department to the paediatric ward in Ahmadu Bello University Teaching Hospital i.e. this department are located far away from each other. And there is no specific directional guide; secondly Absents of landmarks makes it difficult to associate a unique characteristic to a particular department or zone. Departmental limits were not clearly specified in Yusuf Dantsoho General Hospital this makes it difficult for users to know when move from one zone to another.

Considering the section all the three case studies studied; Yusuf Dantsoho General Hospital can be considered are most complex to navigate for a first time user, this is because of pavilion layout of its site, and the same colour and type of building materials were used all around the site. Ahmadu Bello University Teaching Hospital is considered less complicated, the entire outpatient department is located within one Building structure which has a rectilinear design but as a teaching hospital it is rather large and with the number of clinics and also many specialization units it can get complicated once a person gets out a particular zone. Barau Dikko Specialist Hospital is regarded as the simplest in navigation because of it rectilinear nature and the facility

is not large the walkway open to the surrounding makes it easy to identify zones and users can quickly become familiar with its environment on first visit.

4.4 Space Syntax Data

The data obtained using space syntax will be used to answer the third research question which is to determine how user space integration can aide in wayfinding.

4.4.1 Visibility graph analysis

Using visibility graph analysis (VGA) the various spaces within the main building of the hospitals under study were analysed and the data obtained were documented base on the sections associated to the users of the facility. Table 4.3, 4.4 and 4.5 shows spatial attribute data for all the case studies, it shows minimum and maximum connectivity between spaces and also the minimum and maximum visual integration

Table 4.4: Spatial Attribute summary for Ahmadu Bello University Teaching Hospital Zaria

Attribute	Minimum	Average	Maximum
Connectivity	47	1020.52	2743
Visual Integration [HH] (global)	2.68104	5.63284	10.4063

Source: Author`s field work, 2016

Table 4.5: Spatial Attribute summary for Barau Dikko specialist Hospital,

Attribute	Minimum	Average	Maximum
Connectivity	50	1405.33	3456
Visual Integration [HH] (global)	3.38687	7.75385	13.591

Source: Author`s field work, 2016

Table 4.6: Spatial Attribute summary for Yusuf Dantsoho General Hospital

Attribute	Minimum	Average	Maximum
Connectivity	22	706.446	2023
Visual Integration [HH] (global)	1.46159	3.25296	5.32702

Source: Author`s field work, 2016

4.4.2 Relationship between space integration values and primary user spaces

The primary user spaces for in hospital include main entrance, reception/information desk, card room, waiting room, consultation room, pharmacy, treatment room.

4.4.2.1 Integration [HH] for ABUTH

Figure 4.6 shows the relationship between the waiting areas which has a medium level of integration, high level of integration can be observed mostly in the walkways and links to the various departments this is represented by the red colour zones with low integration include the smaller internal offices located inside the departments, it is represented by the blue colour.

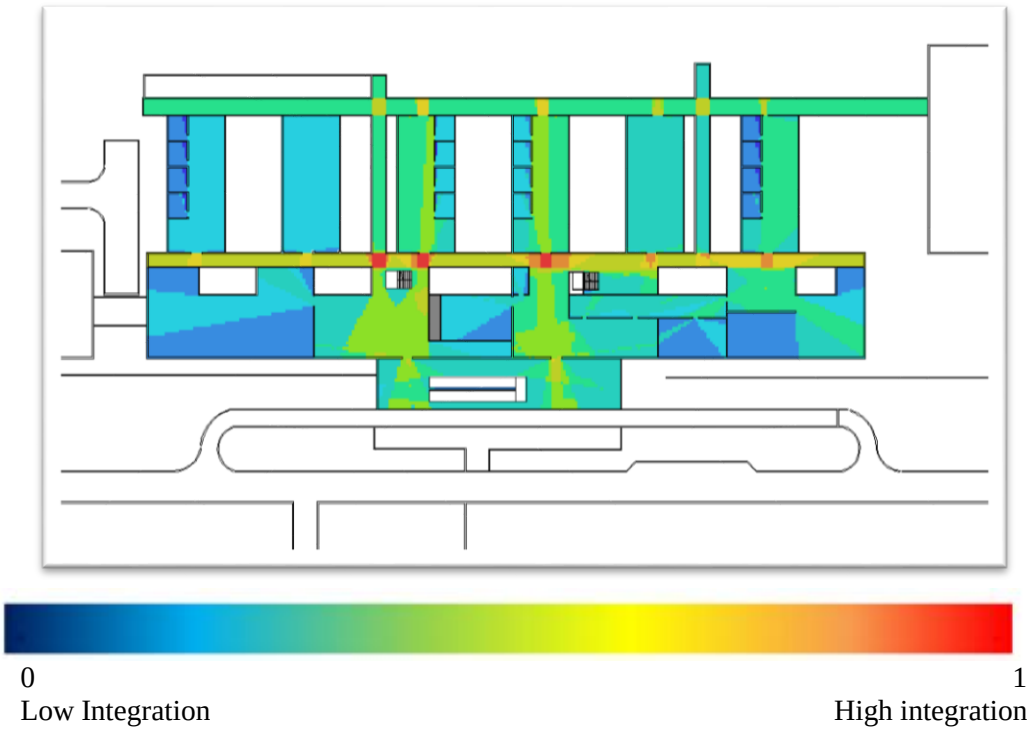


Figure 4.6: Integration [HH] for ABUTH main building.
Source: Author`s field work, 2016

In space syntax analysis the intelligibility of the spatial layout is the R^2 value of the correlation between connectivity and integration [HH] Using the depth map software, the

results obtained from the analysis of ABUTH main building, it recorded a space intelligibility with R^2=0. 2666. as seen in figure. 4.7

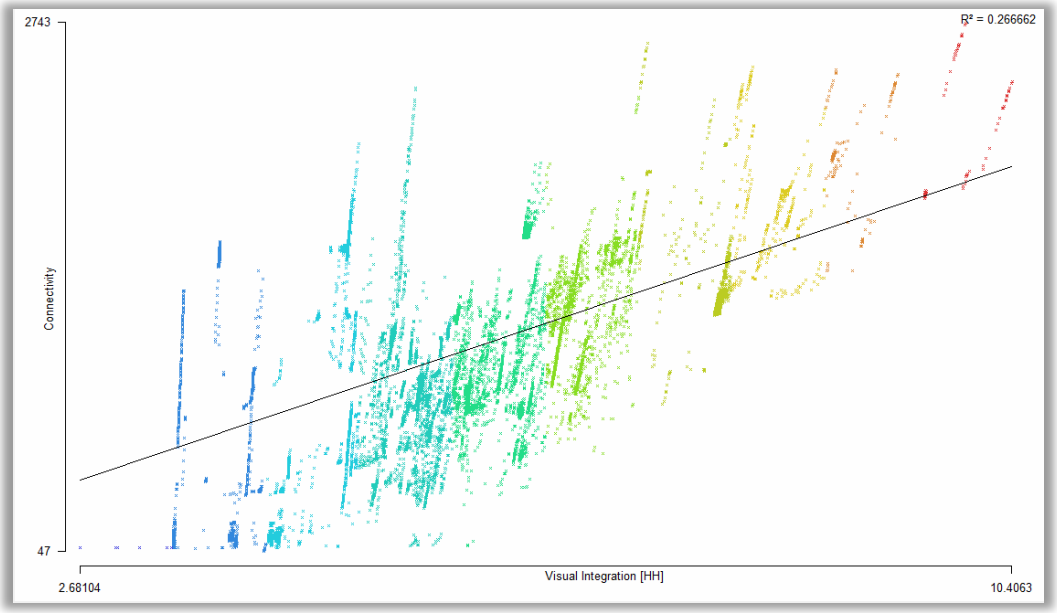


Figure 4.7: Correlation values between visual integration [HH] and connectivity in for ABUTH Main Building.
Source: Author`s field work, 2016

4.4.2.2 Integration [HH] for Barau Dikko Specialist hospital paediatrics unit

The primary user unit for Barau Dikko Specialist hospital paediatrics unit is located on the ground floor an analysis of the ground floor was made Figure 4.8 shows the visibility analysis of the facility has shown that there is a very high level of integration in the waiting area, walkways and the walkway, and the reception which is the first point of contact by the user of the facility, Places that record a low integration levels include the consultation room, nurse unit, card room and auxiliary facility (storage area).

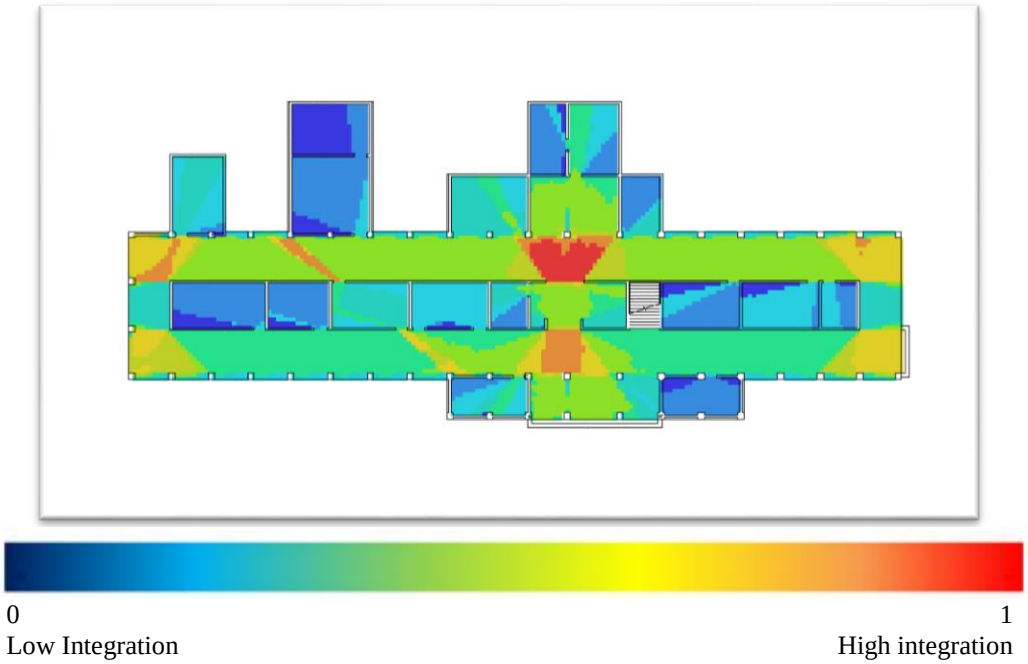


Figure 4.8: Integration [HH] for Barau Dikko Specialist Hospital Paediatrics Unit
Source: Author`s field work, 2016)

Form the scatted plot below; figure 4.9 below the intelligibility of the space R^2 records 0.73368 which is a satisfactory number for a good design.

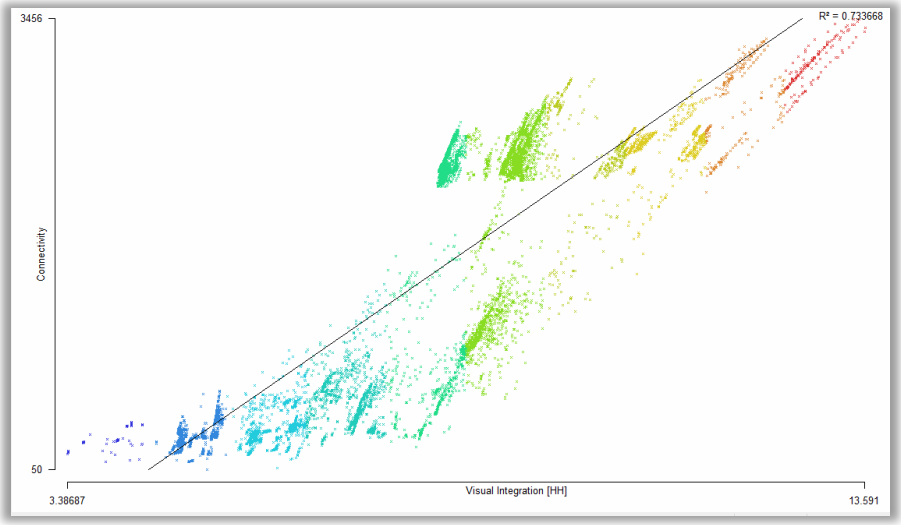


Figure 4.9: Correlation values between visual integration [HH] and connectivity in for Barau Dikko Specialist Hospital Paediatrics unit.
Source: Author`s field work, April, 2016

4.4.2.3 Integration [HH] for Yusuf Dantsoho general hospital.

In Figure 4.10 shows the visibility analysis of Yusuf Dantsoho General Hospital has shown that there is a very high level of integration mostly in the waiting areas of the

facility, followed by the reception which is the first point of contact by the user of the facility, the well-defined walkways also records a good integration level. Places that record a low integration levels include the clinical laboratory and the maternity ward.

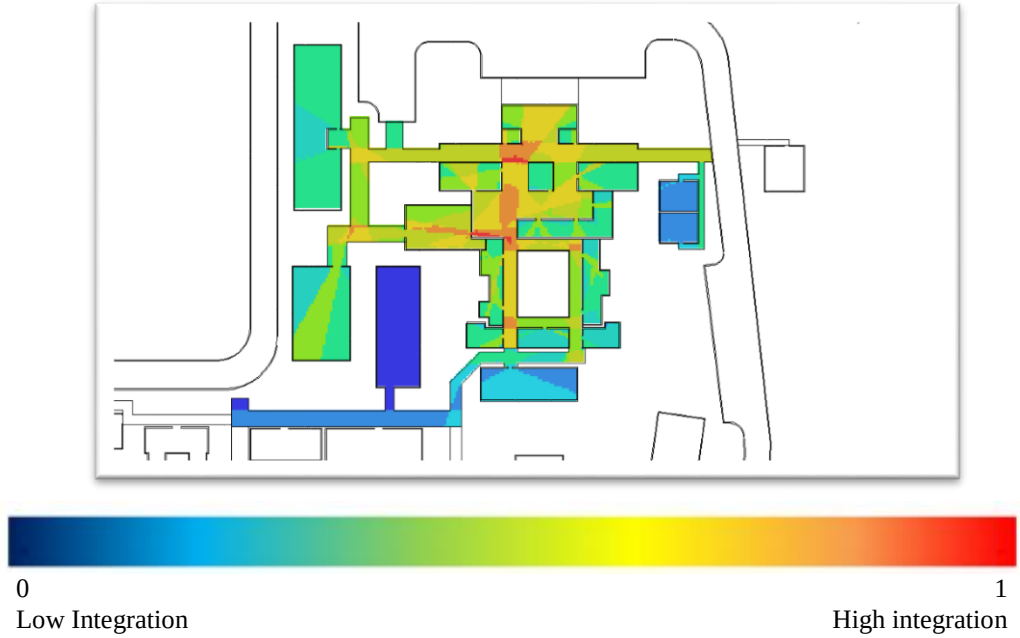


Figure 4.10: Integration [HH] for Yusuf Dantsoho general hospital.
Source: Author`s field work, April, 2016)

Form the scatted plot figure 4.11 below, the intelligibility of the space R^2 records 0.064 which is the lowest obtain in all the cases studied.

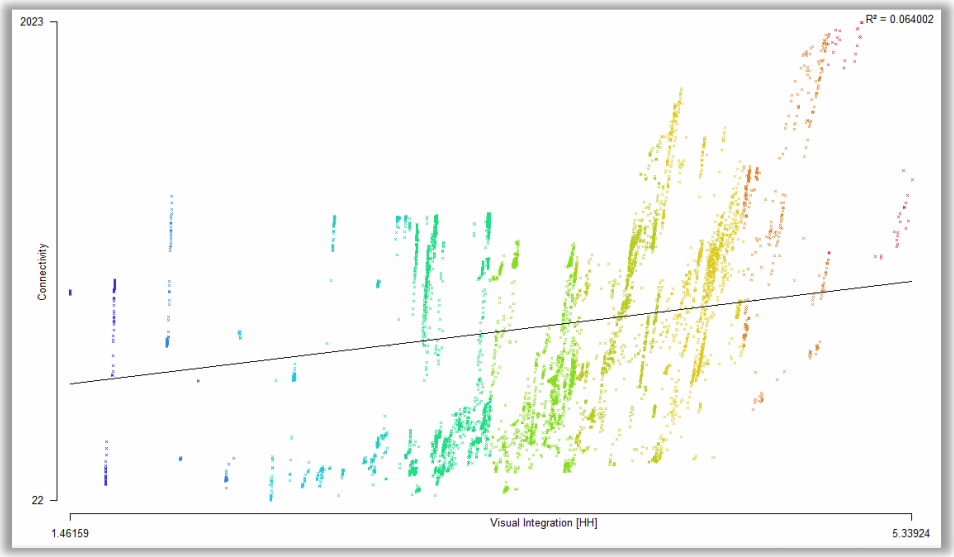


Figure 4.011: Correlation values between visual integration [HH] and connectivity in for Yusuf Dantsoho general hospital.
Source: Author`s field work, 2016

4.4.2 Summary of Space Syntax Analysis

Form the space syntax tool used the R^2 value obtained show that case study two has the highest space intelligibility value of 0.733 followed by the first case study which has an R^2 value of 0.33, the third case study has the least intelligibility value of 0.064, this is due to the fact that the user facility are not located under one roof, they are placed in separate buildings connected by walkways, Users of such facilities will find it difficult in moving around and searching for the various department or unit

4.5 Summary of Results

Visual Survey was conducted to assess how physical element of the environment aid wayfinders, interior and exterior clues assist and guide wayfinders as they move to their destination, both soft and hard landscaping element used within all the hospitals studied updates the wayfinders cognitive memory. Internal and external Circulation systems were identified in all the facilities study, the vertical circulation system were located and ranked base on their relative location to the building entrance. Architectural element and building materials that made up the entire building were also identified and ranked based on their ability to help wayfinders distinguish different zones in the building.

Participant observation enabled the researcher to understand problems encountered by users during wayfinding process, this include understanding description of route from one department to another. If this department are located far away from each other, directional guide, landmarks makes easy to identify a particular department. Departmental limits are also necessary to notify wayfinders when they move from one zone to another. Dispersed Pavilion plan proves challenging for first time visitors, they make wayfinders walk long distance and they take multiple turns which most times

disorient the wayfinder. While in a vertical mono block design each floor or wing are dedicated for a definite department.

Space Syntax Analysis reviled the level of intelligibility (R^2) in design of the primary user space in all the hospitals studied it also shows the degree of integration that exists between all the spaces. The R^2 Value obtained are 0.733, 0.33 and 0.064 for Barau Dikko Specialist Hospital, Ahmadu Bello University Teaching Hospital and Yusuf Dantsoho General Hospital, respectively. This connotes that the best hospital in terms of intelligibility in design with regards to wayfinding is Barau Dikko specialist hospital and the least is Yusuf Dantsoho general hospital.

5.0 DISCUSSION OF FINDINGS

5.1 Introduction

This chapter gives more detailed explanation of issues relating to the data obtained and analysis which helps in articulating those issues emanating from the analysis with respect to their implications on the subject of investigation

5.2 Discussion of Findings

From the case studies conducted Architectural clues include the exterior clues and the interior clues, these clues/element assist users to identifying their waypoint. Assessment of architectural features that aid wayfinding shows that case study one has high reflections of both internal and external clues, element such as landscape, location of entrance, placement of stairs and the location of information centre were greatly considered while the second and third case studies rank low on the exterior clues mostly due to poor Maintenance of these facilities.

Base on the research question; *how do this architectural features assist wayfinders in wayfinding*.

Participant observation was used to answer this question, on how the wayfinder uses architectural information embedded within a hospital to get to their destination. We take a look at some of the architectural clues provided in each of the facilities studied.

Exterior clues: The design of access road and walkway from the entrance gate gives direction to a wayfinder, this shows the path leading in to the facility, the incorporation of plants or landmarks help in providing a unique memory of that particular path, their by updating his cognitive map with this new information. The location of parking lot in relation to the building's main entrance also gives the wayfinder a sense of direction; a well-designed main entrance is usually unmistaken. In a site with multiple numbers on

buildings, unique entrance design might be required for ease of reference and in some cases used of distinct landmarks

Interior clues; the reception should always be the first point of contact once inside the building, where you can clearly identify the information centre, the waiting area and level changing devices such as stairs and lifts. Different section/ department within the building need distinctive features, easily identifiable for users. Such features inform wayfinder that they have entered another zone. Zoning of related department within close proximity enables helps in keeping a wayfinder aware of his environment; he will find it easy in moving from one department to another. Other features such as landmarks, courtyard, wall painting and art work assist the users in identifying a particular zone, windows and opening to outside helps in orientating the users whenever he gets confused.

From the third research question: "*how does user space integration aide wayfinder in wayfinding.*

The space syntax analysis has shown the need to maintain relationship between the walkways, waiting areas and reception with minimal number to turns in all the facility, other spaces that needs integration with this spaces should include the information centre, consultation rooms, pharmacy, treatment room and laboratory Form the space syntax tool used the R^2 value obtained show that case study two has the highest space intelligibility value of 0.733 followed by the first case study which has an R^2 value of 0.33, the third case study has the least intelligibility value of 0.064, this is due to the fact that the user facility are not located under one roof, they are placed in separate buildings connected by walkways, Users of such facilities will find it difficult in moving around and searching for the various department or unit. To address such issues the land scape element i.e. external

wayfinding clues and building form, plays a major role in guiding the wayfinder to this destination

5.3 Findings from Simulation

Using visibility graph analysis (VGA) primary user spaces in the proposed paediatric hospital were analysed. These spaces include reception/information desk, card room, waiting room, consultation room, pharmacy, clinics, and diagnostic unit. Table 5.1 below shows a summary of values obtained during the analysis. It shows the values for connectivity between spaces and also the visual integration between these spaces.

Table 5.1: Spatial Attribute summary for the proposed paediatric hospital

Attribute	Minimum	Average	Maximum
Connectivity	1	246.767	779
Visual Integration [HH] (global)	1.32041	4.1865	7.056

Source: Author`s field work, 2016

5.3.1.1 Integration [HH] for the Proposed Paediatric Hospital Kaduna

Figure 5.1 shows the relationship between the primary user spaces, areas with high level of integration include main entrance hall and waiting areas which has been represented by the red colour, areas with medium level of integration marked with yellow colour include hallways and clinic waiting areas then the consultation rooms. Laboratory and the radiology room were designed to be for limited restricted access so they have low integration value these spaces are marked with blue colour.

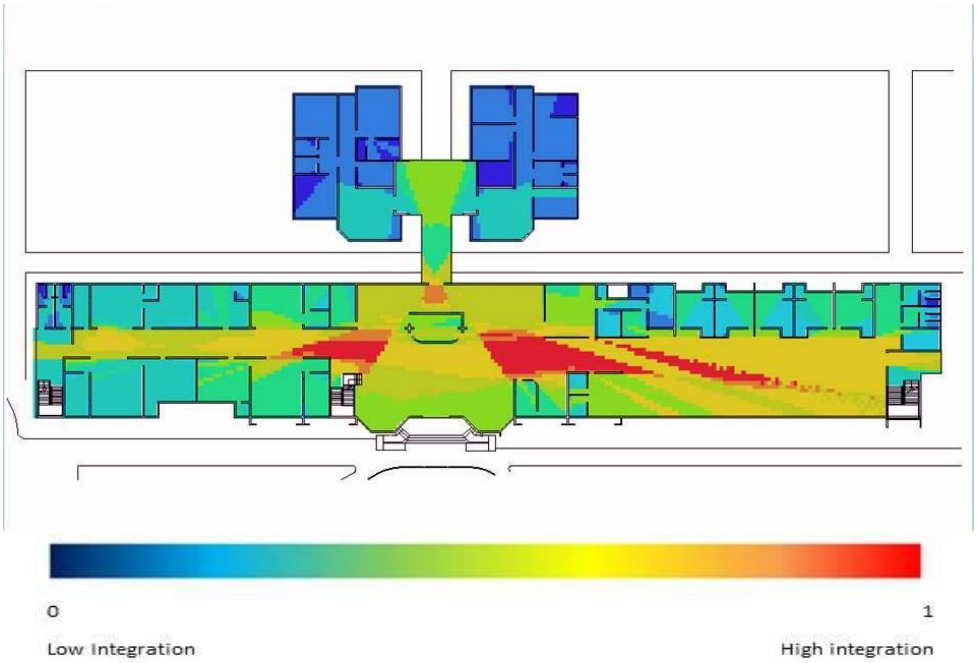


Figure 5.1: integration [HH] for Proposed Paediatric Hospital.
Source: Author`s field work, 2016

In space syntax analysis the intelligibility of the spatial layout of the design is represented by R^2 value which is obtained by plotting the connectivity against the integration [HH]. Figure 5.2 below shows a scattered plot generated Using the depth map software, the results obtained from the analysis of Proposed Paediatric Hospital Kaduna gives an intelligibility R^2 value of 0.755

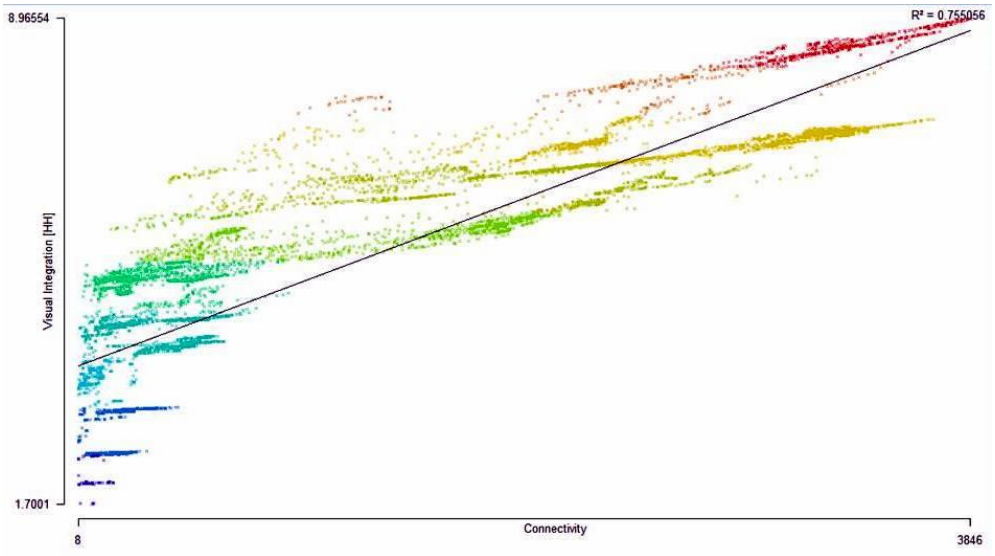


Figure 5.2: Correlation values between visual integration [HH] and connectivity in for proposed Paediatric hospital.
Source: Author`s field work, 2016

5.4 Summary of Findings

Visual Element in any environment are vital key point to identifying their location and help in developing the cognitive map table 5.2 shows a summary of how some of this element are represented in each of the case study carried conducted.

Table 5.2: Summary of visual Survey.

Variables	Ahmadu Bello University Teaching Hospital	Barau Dikko Specialist hospital	Yusuf Dantsoho General Memorial hospital
Shaping site and setting	Good landscaping present on sites access road was also provided with well defied pedestrian walk way	Good landscaping present on sites access road less pedestrian walk way	Fair landscaping present on sites access road and good pedestrian walk way
Building form	Complexity of design/morphology of the structure and Architectural expression and building concept can be seen more in ABUTH	There is no clear Composition of form in relation to massing separation between department	There is no clear Composition of form in relation to massing separation between department
Articulating interior spaces	Destination zones fairly defined in some part of the facilities.	Different unit are identifiable by name tag and signage placed by the door.	There is poor relationship between related department which is as a result of the pavilion concept design
External and internal circulation systems	The circulation system in the hospital is linked to the external community. Parking space were provided in all the Facilities Main entrance easily identifiable	The circulation system in the hospital is linked to the external community. Main entrance not easily identifiable due to the present of 4 entrance gate. Parking space is insufficient in the case, users had to result to parking by the access road during peak hours	The circulation system in the hospital is linked to the external community. Parking space were provided in all the Facilities Main entrance easily identifiable
Level change devices	Level changing device such as stairs, ramps and Lift are present.	Level changing device such as stairs, ramps and Lift are present.	Level changing absent
Internal transportation	Absent	Absent	Absent

Source: Author`s field work, 2016

Participant Observation was able to show how positioning of Main entrance, parking, and Walkways guides a wayfinder from the moment he enters a particle site, these serves as information and together with other building element such as Visibility of entrance from decision point, public waiting are, landmark and positioning of level changing device serves a guide to a wayfinder.

The space syntax analysis has shown the need to maintain relationship between the walkways, waiting areas and reception of all facility other spaces that needs integration with this spaces should include the information centre, consultation rooms, pharmacy, treatment room and laboratory address such issues the land scape element and external wayfinding clues such as building form, plays a major role in guiding the wayfinder to this destination

6.0 DESIGN PRELIMINARIES

6.1 Introduction

This chapter will discuss on the design preliminaries and also outlines site consideration required to answer the fourth research question.

6.2 Design Brief

The proposed “Paediatric hospital” shall be viewed as a dissertation design proposal for the design of a health care facility in Kaduna state which would solve wayfinding problems by improving design. It will improve user experience as he should be able to navigate the facility with less stress. Findings of this research will be incorporated in the proposed design.

The hospital is designed such that the peculiar need of a specialized child healthcare institution is strictly adhered to as well as the need for a user friendly environment that can aid in the healing process. The hospital will have four main sections:

- Administrative Section.
- The treatment section:
- Wards
- Auxiliary section

6.3 Site Location

The site for the proposed paediatric hospital Kaduna is located in the eastern part of Kaduna metropolis, within the new Kaduna millennium city in figure 6.1. Kaduna was created on May 27 1967, It is located in northern Nigeria and lies between latitudes 10°31'23"N and 7°26'25"N, it extends from the upper River Mariga on the foot slopes of the scarp of Jos Plateau. It is bordered by Zamfara, Katsina and Kano states to the

north, Niger and the FCT to the east, Bauchi and Platue states to the west and Nassarawa state to the south.

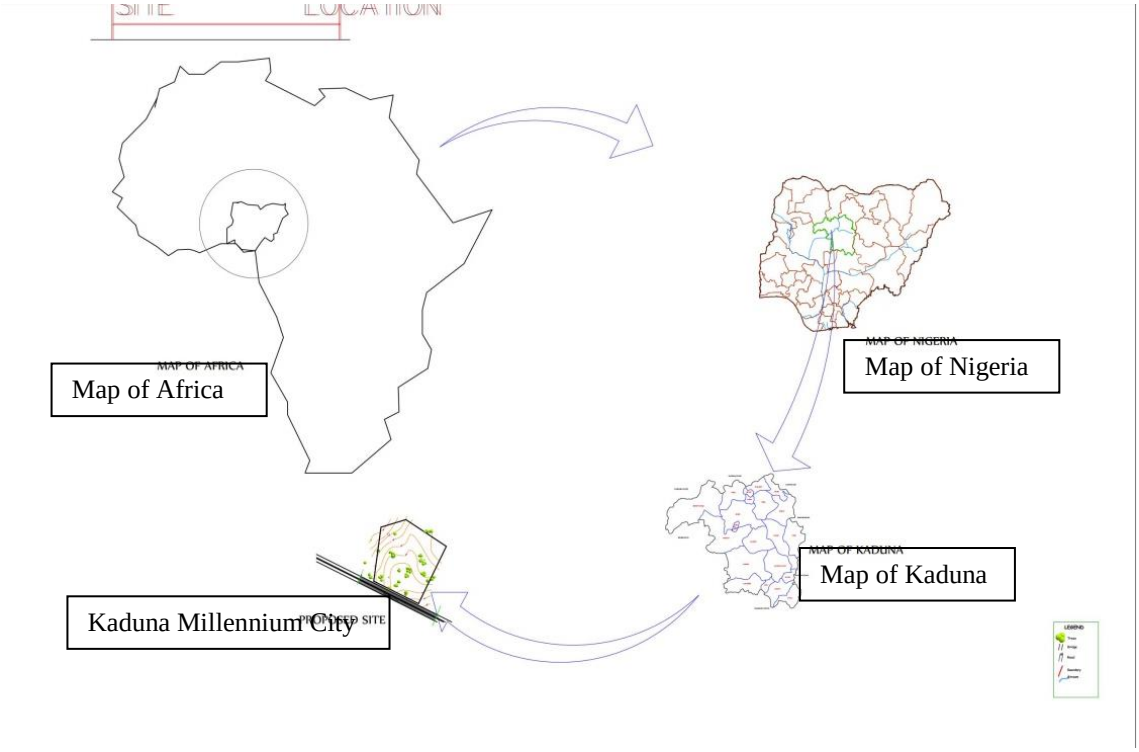


Figure 6.1: Location of proposed site.
Source: Author`s field work, 2016

6.4 Site Selection Criteria

Three sites A, B and C, were identified from the land use map of new Kaduna meant for institutional development. The list of selection criteria is rated on a scale of 0-4 with 0 being absent and larger numbers having higher level of importance this is to determine the most appropriate site to be used. Below are the criteria's considered: the table for data obtained after comparing all site is shown in table 6.1

- Accessibility
- Land use compliance
- Future Expansion
- Proximity to utmost users
- Safety and Security

- Utility Services

6.4.1 Accessibility:

How far is the site from the access road? Type of access road, (The nearer, the better)

6.4.2 Land use compliance:

Are there any land use act restricting the type of development within the site? Is the site located within an Institutional area? Is the site located in a mixed-Use area?

6.4.3 Future expansion:

Is the site capable of reasonably providing for the Building's Future Expansion, and Outdoor Access? Is there space to accommodate safe Vehicular and Pedestrian Circulation, Roads, Parking, and Loading Facilities?

6.4.4 Proximity to utmost users:

How far is the site from the residential areas? (The nearer, the better)

6.4.5 Proximity form Existing hospitals:

How far is the site from existing hospitals? What are the anticipated impacts on existing hospitals? (The further away from the existing hospital the better)

6.4.6 Site physical characteristics:

Is the site flat, rolling, or does it have steep grades? Are the soils well drained? Is there any rock or ledge outcroppings? Does the site configuration lend itself to the proposed development?

6.4.7 Utilities:

Is municipal water and sewer available? Is there adequate electrical service? Is telephone and television cable available? Is there a storm water utility or provisions for municipal storm water disposal?

6.4.8 Construction issues:

Are there existing buildings on site that need demolition? Are there construction impacts on existing facilities? Are there existing facilities that need to be replaced?

Table 6.1 shows ranking of each of the site considered for the proposed design.

Table 6.1: Analysis of the 3 sites based on site selection criteria

S/NO	CRITERIA	A	B	C	REMARK
1	Accessibility	3	5	4	Site 'B' can be accessed through the main road but site 'A' and 'C' have to be accessed through an access road
2	Land use compliance	4	4	4	All three site are within the land use compliance i.e. they have been reserved for institutional development, all 3 site are currently used as farm land.
3	Future Expansion	3	5	2	Site 'B' has an expansion possibility from all 3 side of the site while site 'A' has an expansion possibility from the rear and site 'C' do not have an expansion possibility
4	Proximity to utmost users	2	4	2	Site 'A' is much closer to the settlement but site can be accessible by the general public from different part of the state
5	Distance from existing hospitals	4	3	4	
6	Utility Services	2	3	3	Site 'B' and "C" have power a 33kva power lines right in front of the site, it only requires connection line to the building. Site 'A' will require connection lines and poll to get power to the site, water and gas mains are not available in any of the three site
7	Site physical characteristics	2	3	2	Both the sites have almost same physical features only that site B is more of a table land
8	Traffic Consideration	3	4	3	Site 'B' can be accessed through the main road which reduces traffic into the site but site 'A' and 'C' have to be accessed through an access road
9	Construction issues	3	4	4	Site A has obstructions of buildings that need to be demolished
	Total	23	30	22	Site B is best suited for the intended facility

Weighing scale: Excellent 5, Very good 4, Good 3, Fair 2, Poor 1, Absent 0
Source: Author`s field work, 2016

6.4.9 Site analysis

The analysis of the proposed selected site is discussed showing the physical features existing in the site.

6.4.9.1 Climate

The climate of a place is referred to the average weather variation in a place over a long period of time, the weather of a place which brings changes in the condition of the atmosphere at a particular time in a particular place is described in terms of its temperature, relative humidity, rainfall, winds and sun shine hours. Shown in figure 6.2

The climate thus plays an important role in the design of building in terms of orientation, materials or for building envelope, the roof type, the drainage pattern and effects of wind pressure.

Therefore, to successfully design a comfortable living environment, one has to maximize the aspects of environment which reduce heat and the effect of humidity, and protect from rain and dust. Planning with climate should take place at all scales.

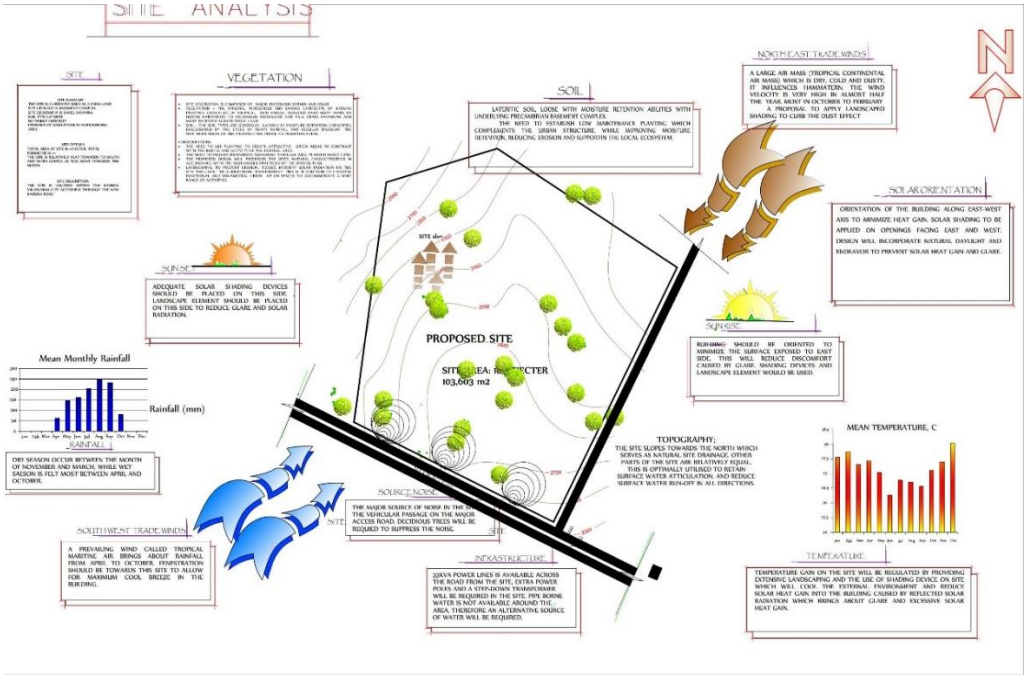


Figure 6.2: Site analysis
Source: Author`s field work, 2016

i. Temperature

In Kaduna state, the temperature is at its highest in the dry season. During the rainy reason, the maximum temperature is lower due to the dense cloud cover. Fluctuations in

November ranges from 16 ^{0}C to 32 ^{0}C maximum temperature occurs in April which reaches 36 ^{0}C but it last for less than three Months.

ii. Rainfall

Rainfall in Kaduna last for an average total of 6 month, it starts in April to the month October. , it increase form 161.5mm in June to 281.6mm in August which is its maximum throughout the year. A mean monthly distribution that shows a tendency for concentration of rainfall shows the need for a drainage system that can evacuate large volumes of water very quickly.

iii. Relative Humidity

At the start of the dry season the relative humidity falls from 70% in October to 36% in November, it further falls to 35% and 20% in January and February respectively. The Mean relative humidity reaches its maximum value of 80% in the month of August which is when the raining season is at its peak.

iv. Sunshine

The sun rises from the east and gently warms up to its maximum heat intensity in the afternoon. As the sun moves over to west its intensity witnesses a reduction till it is finally sets. Highest sunshine hours are achieved in January for up to 9 hours per day, and by the month of August it's at its low of 5 hours per day.

6.4.9.2 Soil and Vegetation

The soil type in this area is lateritic soil; the nature of the site renders it suitable for even the most advanced structural composition. The topsoil is permeable and will permit fast and easy water drain, thus preventing pools of water gathering around the site. The vegetation of the whole surrounding can be characterized as lush green with

trees and locust bean trees and shrubs shrubs which are spread all over. as seen in plate XXIV below.



Plate XXIV: soil and vegetation present on site.
Source: Author`s field work, 2016

6.4.9.3 Visibility and Noise

Major noise origin will be generated from the neighbouring residential communities and also from the moving vehicles from the main road on the south part of the site, shown in plate XXV and figure 6.3. Noise from neighbouring communities can be suppressed by the use of trees to act as a buffer zone.



Plate XXV: Access Road and major source of noise
Source: Author`s field work, August, 2016

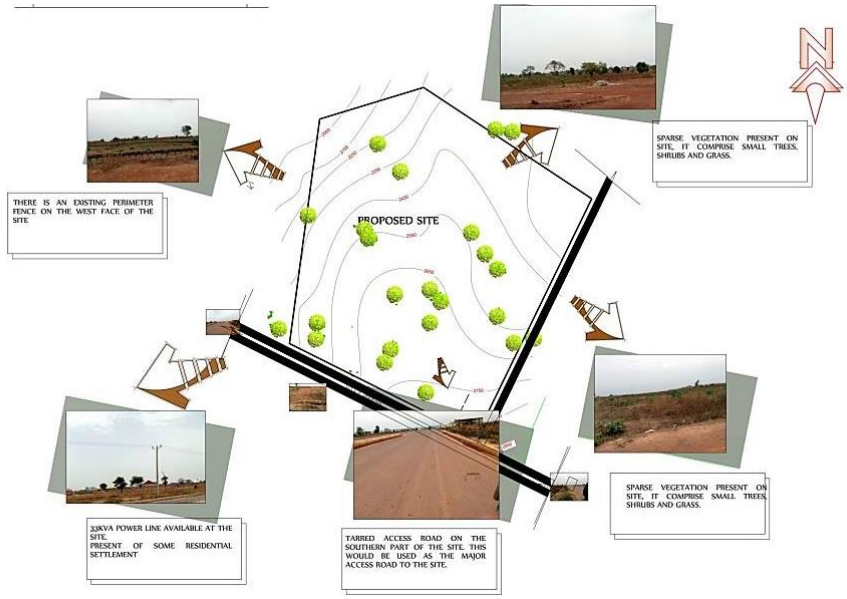


Figure 6.3 Site visibility
Source: Author`s field work, 2016

6.4.9.4 Topography

The site is gently slopes towards the north western corner but flattens towards the middle with gentle slopes radials to the other corners. This makes an elevated hill like centre which will serve as a natural drainage system. The difference between the highest and lowest point is about 500mm. There is a constructed drainage system beside the main access road. Figure 6.4 shows the site section

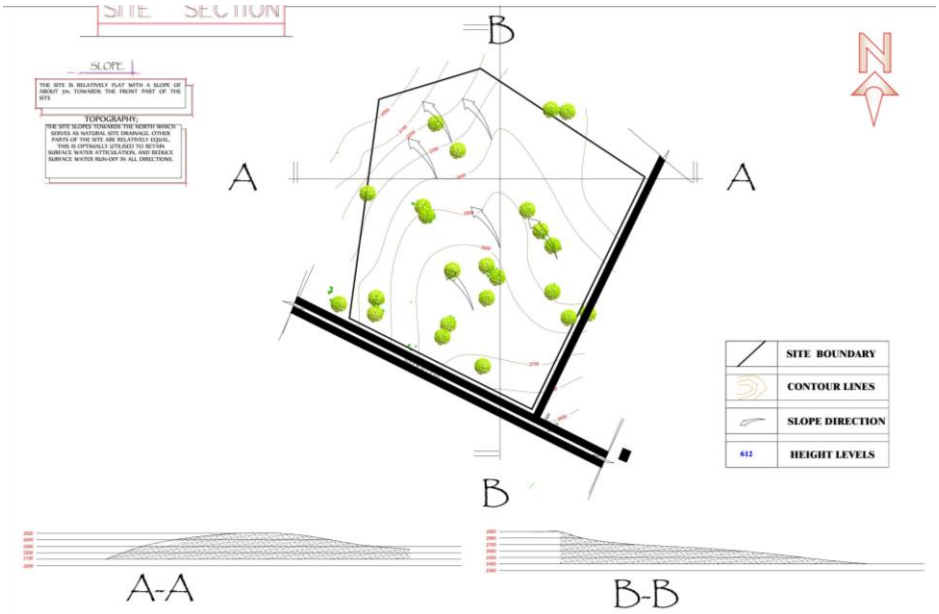


Figure 6.4: Site section
Source: Author`s field work, 2016

6.4.9.5 Land availability

The site chosen is a virgin land it is located a few kilometers away from the surrounding neighborhood and there is enough room for future expansion. There will not be any need to demolish any structure or to pay compensation for structured destroyed.

6.5 Schedule of Requirement

After series of case studies and consultation of related books, articles and medical practitioners; the client's brief was studied and developed thereby forming bulk schedule of requirement and schedule of accommodation.

The Kaduna Paediatric hospital is such that adheres strictly to the needs of a specialized child-healthcare institution while addressing specific needs of pediatric age group, their families and caregivers .The hospital complex consists of the following unit ,also classified as departments according to their different functions:

6.4.1.1 General outpatient department

This is the first point of call to patients as they come to the hospital except for cases of emergency, where they will be taken directly to the accident and emergency department. The GOPD is where the patients register, for first timers or report, consult the doctors and receive their treatments. It must be designed properly so as to make the patient at ease, and ease staff work for maximum staff efficiency, accommodate the highly technical nature of a hospital system. The GOPD is best located within the ground floor in the case of a multistory structure; this is for easy of accessibility for the users of the facility.

6.4.1.2 Accident and emergency

This department is primarily for accidents and cases of emergencies it has two floors, provision for spaces like the treatment rooms, operating rooms ,x-ray waiting rooms, consulting rooms , stretcher storage and doctors call lounge, it also connects to the labs on the ground floor ,and the radiology department on the upper floor.

6.4.1.3 Laboratories

The lab has its own main entrance but has another link to the accident and emergency department, on the upper floor the radiology department is located which houses the cat scan, MRI, and clinical labs.

6.4.1.4 Radiology

This department is on the upper floor of the labs and has a direct link from the accident and emergency department

6.4.1.5 The surgery department

This houses all the operating theatres. It is centrally located to be in close proximity to the wards, the accident and emergency, the laboratories and the GOPD.

6.4.1.6 *Intensive care unit:*

This department is closely located to the labs, radiology and accident and emergency units.

6.4.1.7 Wards:

This unit is for the in-patient and is where the child-patient on admission in the hospital stays, there is the need therefore to design it in a most comforting manner such that the patient and their families will find the environment friendly and not feel stressed out.

The wards have spaces like the patient rooms, nurses' station, children play area and prayer rooms.

6.4.1.8 Other auxiliary units:

These include restaurant, laundry and the mortuary which are located on the site.

6.6 Schedule of Accommodation

Accuracy in allocating the appropriate spaces for activities will depend largely on the number of users at any giving time but there are standards for the minimum allotment which have been considered. Table 6.2 gives the complete schedule of accommodation for the proposed paediatric hospital design

The GOPD (General Out Patient Department) provides consultations investigation, diagnosis and treatment for patients who require little or no recovery services afterwards. Number of consulting and examination room required:

In determining these average weekly attendance and consultation time are employed. The calculations are as follows:

$Y = M \times t/s$

Where, Y = critical number of sessions held.

M = average weekly attendance

T = average consulting time in minutes

S= total length of each session.

For an annual attendance of around 180,000 patients average number of child patients National Primary Health Care Development Agency. Therefore, a weekly number of patients will be 3462.

An average consultation time of 7 minutes, total length of daily sessions to be

420 minutes (between 8:00 am – 1:00 pm)

Y= 3462 X 5 / 420 = app 41 sessions weekly.

Therefore number of consultation rooms c= Y/n

Where n = number of sessions/week. 5 working days

C = 41/5 = 8 consultation rooms.

Therefor a total of 8 consultation rooms are provided including 5 general consultation units and 3 specialty consultation rooms.

Table 6.2a: Schedule of Accommodation

Schedule of Accommodation				
General Out Patent Department				
S/N	**Space**	**Number of units**	**Sizes(m^2)**	**Total Area (m^2)**
1	Entrance Hall	1	48	48
2	Reception	1	9	9
3	Waiting Lounge	1	96	96
4	Consultation Room	8	24	196
5	Pharmacy	1	48	48
6	Nurse Station	1	16	16
7	Consultants WC	8	6	46
8	Cash Point	1	9	9
	Total			
Accident and Emergency Unit				
S/N	**Space**	**Number of units**	**Sizes(m^2)**	**Total Area (m^2)**
1	Ambulance Bay	1	30	30
2	Reception	1	20	20
3	Nurse Station	1	20	20
4	Triage	1	20	20
5	Observation Room	2	20	40
6	Emergency Diagnosis	1	25	25
7	Surgery	1	36	36
8	Anastasia	1	30	30
9	Toilet	2	8	16
	Total			
Clinical Laboratory				
S/N	**Space**	**Number of units**	**Sizes(m^2)**	**Total Area (m^2)**
1	Reception	1	30	30
2	Changing	2	20	40
3	Pathology	1	36	36
4	Micro-biology	1	36	36
5	Hematology	1	36	36
6	Blood Bank	1	20	20
7	Toilet	2	8	16

Table 6.2b: Schedule of Accommodation

Radiology

S/N	**Space**	**Number of units**	**Sizes(m^2)**	**Total Area (m^2)**
1	Reception	1	30	30
2	Changing Room	3	9	27
3	X-ray	1	40	40
4	M.R.I.	1	40	40
5	C.T Scan	1	40	40
6	Dark Room	1	15	15
7	Control	3	15	45
	total			

Intensive Care Unit

S/N	**Space**	**Number of units**	**Sizes(m^2)**	**Total Area (m^2)**
1	Surgical Ward	2	105	210
2	Recovery Room	1	60	60
3	Nurse Station	1	16	16
4	Toilet	6	2.25	27
	Total			

Inpatient Ward

S/N	**Space**	**Number of units**	**Sizes(m^2)**	**Total Area (m^2)**
1	1 Bed Amenity Ward	16	24	384
2	2 Bed Ward	24	35	840
3	General Ward 1	2	122	244
4	General Ward 2	2	122	244
5	Isolation Ward 1	2	30	60
6	Isolation Ward 2	2	30	60
7	Nurse Station	4	42	168
8	Resting Area	3	80	240
9	General Room	4	120	480
	Total			

Auxiliary Services

Central Sterile Unit

S/N	**Space**	**Number of units**	**Sizes(m^2)**	**Total Area (m^2)**
1	Staff Office	2	9	18
2	General Store	2	40	80
3	Sterile Store	1	20	20
4	Clean up unit	1	40	40
5	Total			

Laundry and House-Keeping

S/N	**Space**	**Number of units**	**Sizes(m^2)**	**Total Area (m^2)**
1	Collection /Sorting	1	30	30
2	Washing Area	1	30	30
3	Mending /Ironing	1	20	20
4	Clean Storage	1	15	15
5	Supplies Store	2	20	40
	total			

Kitchen

S/N	**Space**	**Number of units**	**Sizes(m^2)**	**Total Area (m^2)**
1	Store	3	15	45
2	Preparation Area	1	15	15
3	Cooking Area	1	25	25
4	Serving Area	1	15	15
5	Washing Area	1	30	30
6	Outdoor Kitchen	1	30	30
	Total			

Source: Author`s field work, 2017

6.7 Design Report

6.7.1 Site development concept

A site development concept was developed taking all necessary consideration to enable a stress free wayfinding design system. The concept also put into consideration planning of hospital. Figure 6.5 below shows the detailed illustration of the concept.

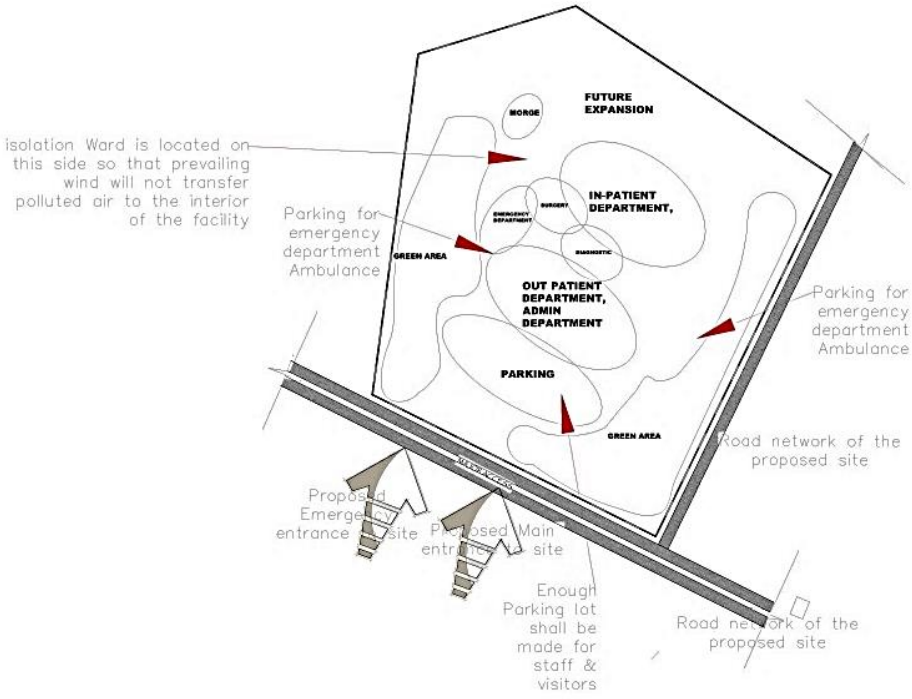


Figure 6.5: Site development concept.
Source: Author`s field work, 2016

6.7.2 Site plan

The site plan of this facility was developed after a careful analysis of the site and the surrounding landscape. The facilities were systematically arranged on the site in order to aid wayfinders that will access the hospitals. The general outpatient department (GOPD) was placed in way that it is clearly visible to patients and visitors. At the same time the internal flow of the hospital planning was maintained. The diagnostic and treatment facilities were placed next to the GOPD. Finally the inpatients and caregivers facilities were placed towards the Northern end of the site. The services facilities were

zoned by the side so that their activities will not interfere with those of the main hospital. Two vehicular entrances were provided; one for emergency services and the other for patients, visitors and the staff. Figure 6.6 shows the site plan.

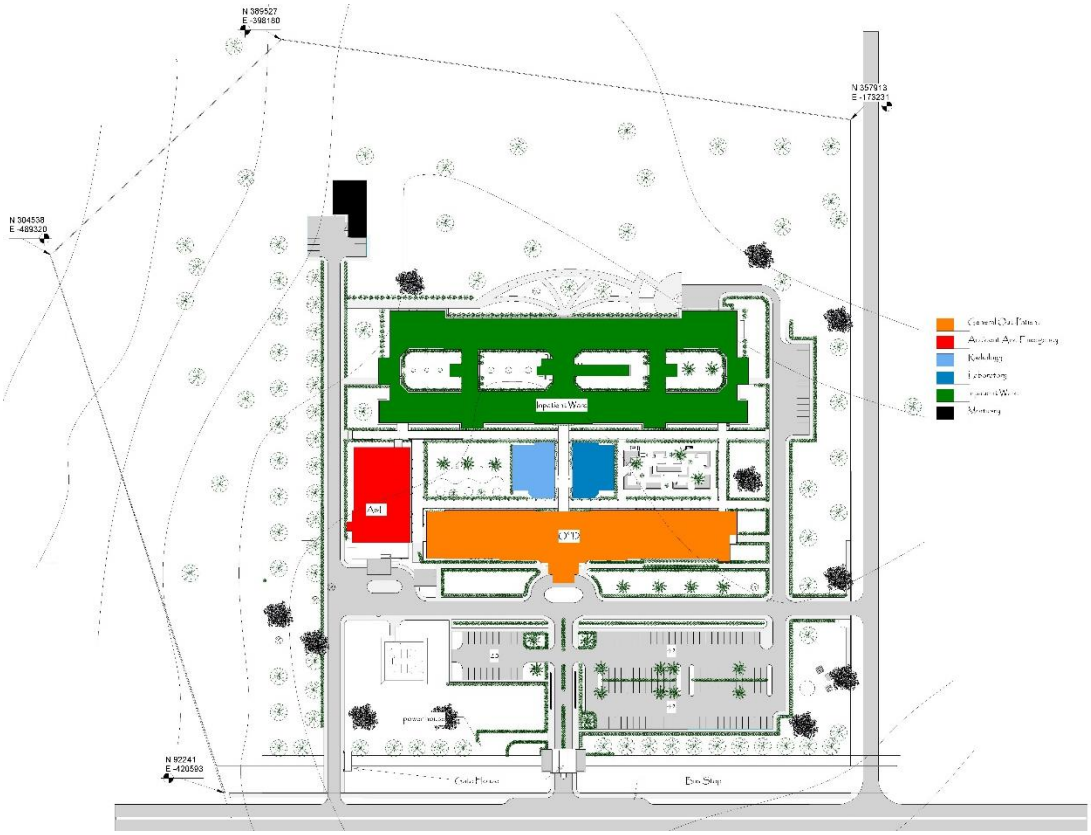


Figure 6.6: Site plan.
Source: Author`s field work, 2016

6.7.3 General out-patient department (GOPD)

This is where patients are treated and if necessary admitted into the hospital as in-patients. It provides consultations/examinations and treatments for patients that require little or no recovery services. GOPD is located in the right wing of the first building as one enters into hospital; therefore it is best positioned at a place that can be accessed directly from the main hospital entrance hall. The GOPD was designed and located in such a way that it can be identified by visitors and patients, be it first time or referred patients. The building has reception and information centre, card rooms and registration, cash point, five consultation/examination rooms, Pharmacy, injection

room, record department, immunization unit, and waiting areas. The GOPD was also designed with enough circulation spaces and with double volume headroom and large window openings for proper circulation of air. The GOPD is shown in the figure 6.7 below.



Figure 6.7: Floor plan of OPD and diagnostic.
Source: Author`s field work, 2016

6.7.4 Clinics

Clinics are provided for patients that require special treatment, those patients need not to go the main OPD, it is located on the left wing of the Main OPD building, and patient can directly go to the clinics from the entrance hall for diagnosis and treatment. The clinics provided are eye clinic, dental clinic and ENT clinic and they are attached to the GOPD due to the fact that the services they render are mostly outpatient the clinics were designed with their own card rooms, consultations/examinations, waiting areas and small theatre for dental operations. The clinics are shown in the figure 6.7 above.

6.7.5 Accident and emergency

This department is primarily for cases of patient patients whose condition requires immediate action and is accessed via an emergency entrance; it consist of emergency treatment room, plaster room, recovery room and other supporting facilities. This department is linked the surgical department. The Radiology department and laboratory can be accessed from this department. Figure 6.8 below show its floor plan



Figure 6.8: Floor plan A&E and operation suite.
Source: Author`s field work, 2016

6.7.6 Theatre

Theatre is a department where surgical operations take place. it comprises of operating suites, scrub-up areas, clean and dirty utility rooms, recovery rooms, anaesthesia office, doctors' and patients' changing, stores, waiting area. In this design, two operating suites were provided, for general surgical cases. The department is located close to the

accident emergency section and the surgical wards so that patients need not to be transported a long distance to their allocated wards. The theatre department floor plan is shown in the figure 6.8.

6.7.7 Radiology department

This department is centrally located whey by it can be accessed form the OPD, Ward and the A&E department, The department handles diagnostic radiology that provides internal images of patients either on film or on cathode ray tube. Facilities provided for diagnostic radiology are: computed tomography (CT) scanning, magnetic resonance imaging (MRI) and conventional X-ray. The department is best planned on ground due to the weight of the machineries. The floor plan is shown in the figure 6.9 below.



Figure 6.9: Floor plan radiology.
Source: Author`s field work, August, 2016

6.7.8 Laboratory

The laboratory is located next to the radiology department it is also centrally located whey by it can be accessed form the OPD, Ward and the A&E department. The Laboratory department is concerned mostly with the preparation and processing of blood, urine and faecal samples. In this design, the laboratory has waiting area, an office for collection of result at the reception hall and easily accessible from the laboratory rooms. It also has sample collection room for both male and female patients. The laboratory room was compartmentalised into units depending on the type of test to be carried out, such units are; haematology which has a blood bank, pathology, and Micro-biology. The floor plan is shown in the figure 6.10 below.

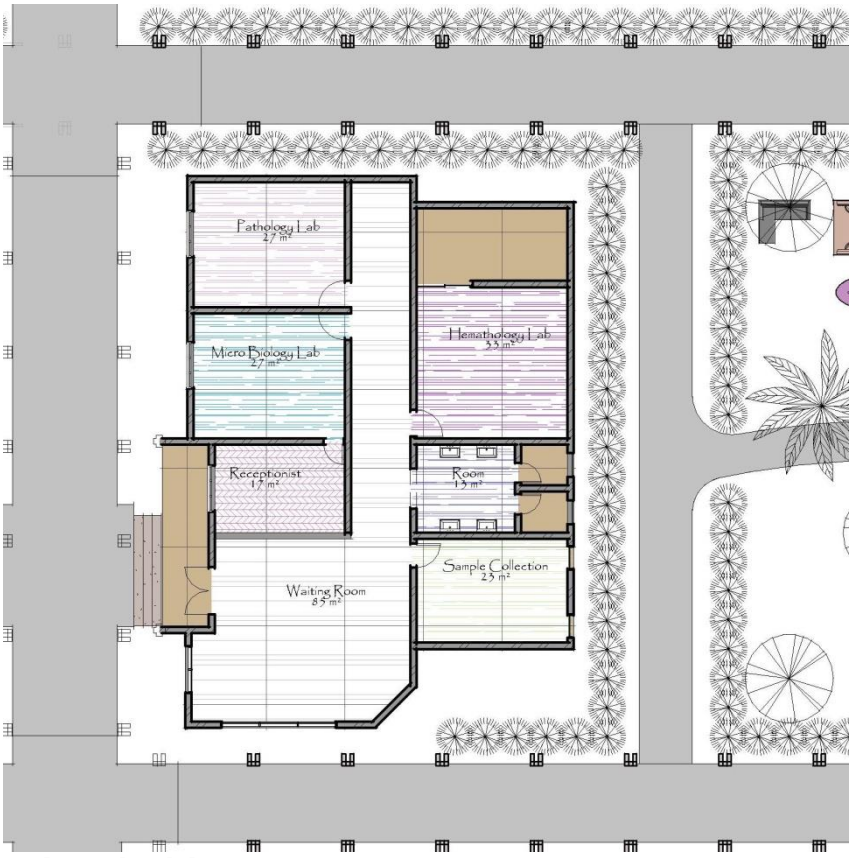


Figure 6.10: Floor plan laboratory.
Source: Author`s field work, 2016

6.7.9 Inpatient wards

The inpatient section was designed in entails different building; Wards are where inpatients are housed the design provided different requirements for inpatients depending on the nature of the patients' ailment. The wards were categorised gender and age wise i.e. the children are housed separately from the adolescent this three floors building consists of male and female wards, isolation units, amenity ward and the ICU. It also houses support facilities for the patients centrally located with spaces like lounge, library and play room. It also houses family support facilities like prayer rooms, care giver room, laundry and a kitchenette. Figure 6.11, 6.12 and 6.13 shows the ground floor, first floor and second floor respectively.

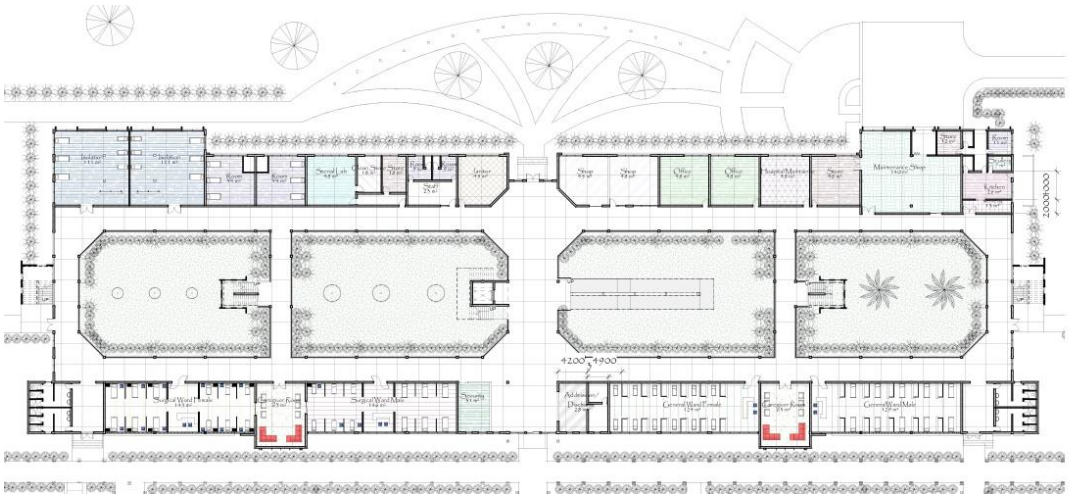


Figure 6.11: Ground floor plan ward.
Source: Author`s field work, 2016



Figure 6.12: First floor plan ward.
Source: Author`s field work, 2016

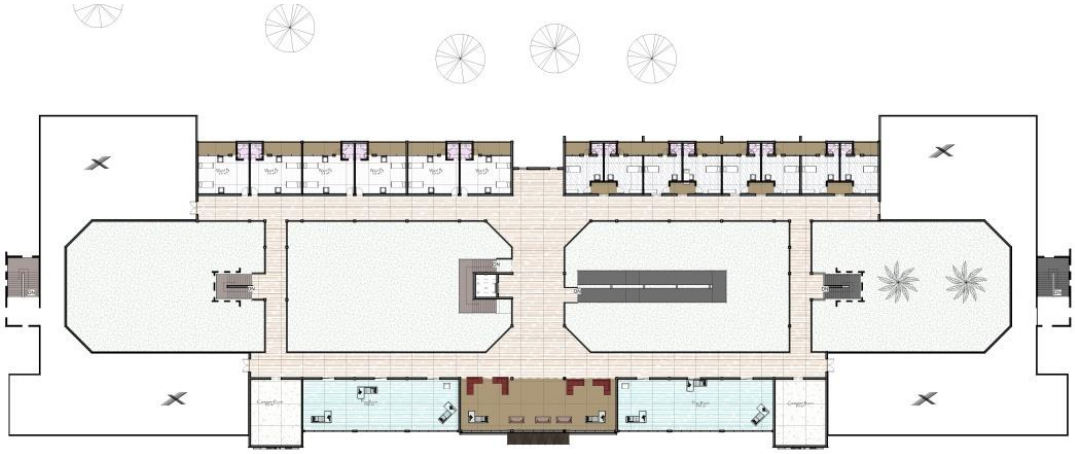


Figure 6.13: Second floor plan ward.
Source: Author`s field work, 2016

6.7.10 The administrative section

This building houses the top administrative officers who generally oversee the running of the complex as one piece. This includes offices in the core like the CMD, Finance department, Clinical services department, library/conference room, departmental heads' offices, general office and staff facilities. They are all on the first floor of the OPD building as shown in figure 6.14.

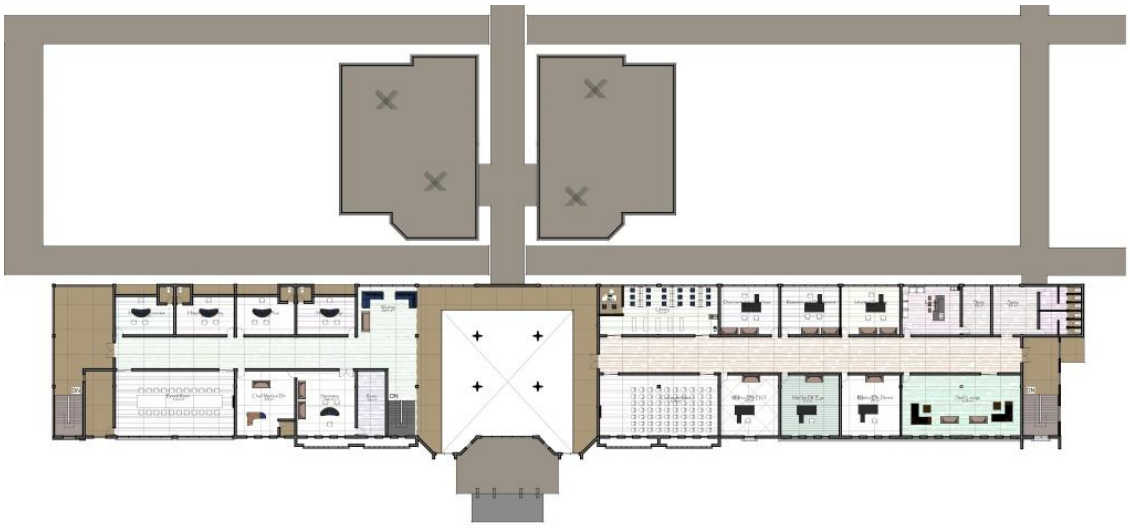


Figure 6.14: First floor plan admin section.
Source: Author`s field work, 2016

6.7.11 The auxiliary section

This section consists of all the other units that do not fall under the above categories discussed. They include the restaurant, mortuary, laundry facilities, mosque, service facilities etc.

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7.0 CONCLUSION AND RECOMMENDATIONS

7.1 Conclusion

The aim of undertaking this research was to understand how architectural features assist wayfinders in hospitals within Kaduna in order to improve wayfinding. The problem statement in chapter one highlighted the effect of poor wayfinding in our hospitals, with the review to relevant literature a gap was identified and based on the identified problem an appropriate method and instrument was selected to be used in carrying out the study.

The result obtained showed an important element in the exterior clues which includes; the relationship between environments, the building and the interior clues. This research observed that the pavilion concept prove to be more challenging in navigation, Participant observation has made the researcher deeply aware of the challenges faced by the wayfinder using these facilities which could have not been expressed if alternative research method such as questioner were employed. Finally this research highlights specific Architectural features which when incorporated into hospital design will provide a good wayfinding experience for any user of the facility.

7.2 Recommendations

As hospital design has completely evolved, it is highly recommended that architects should take into consideration the product of this research into practice in hospital design. This research recommends:

i. Distinctive landscaping elements should be used to serve as exterior clues to users of Hospital facilities.
ii. Employing interior design clues such as colour coding of each zones or department

iii. In a pavilion site setting, building form and unique building features should be emphasized to serve as orientation devices.

iv. An emphasis should be made to maintain a close relationship between the entrance gate, parking and the main entrance to the facility. Also the inside the facility the relationship between information center, level changing devices and the waiting area to the main entrance.

v. Tactile ground trail and shoreline surface should be used to guide people with visual impairment.

The product of this research should be used by architects and other relevant professionals within the country in coming up with a better and functional hospital design that will to a large extent satisfy the need of patients in this part of the globe.

7.3 Contribution to Knowledge

The study "Improving Wayfinding through Design in Proposed Paediatric Hospital, Kaduna" The study also established new bases or facts about wayfinding in Kaduna State:

i. Introduction of courtyard and reduction of blind turns reduce number of decision point and increase the visibility range which makes it easy for users of the facility to identify their destination point from a clear distance.

ii. Central core design in form of an Atrium maximizes flexibility in layout and ties the building together making it central decision point for a wayfinder. Information center and reception are best located in this area.

7.4 Areas for Further Research

There is need for an extensive research to determine other factors that hinders way finding in public spaces, Building typology within the local context of the environment.

The study should go further into taking each architectural element and obtaining it relationship with a public space. Research should be conducted in other part of the country because due to cultural diversification the result in one region may not be applicable to another region. With regards to the design of paediatric hospital architecture research into number of bed for patient and care givers in a single room should done so as to minimize overcrowding.

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APPENDICES

Appendix A

Visual Survey check List

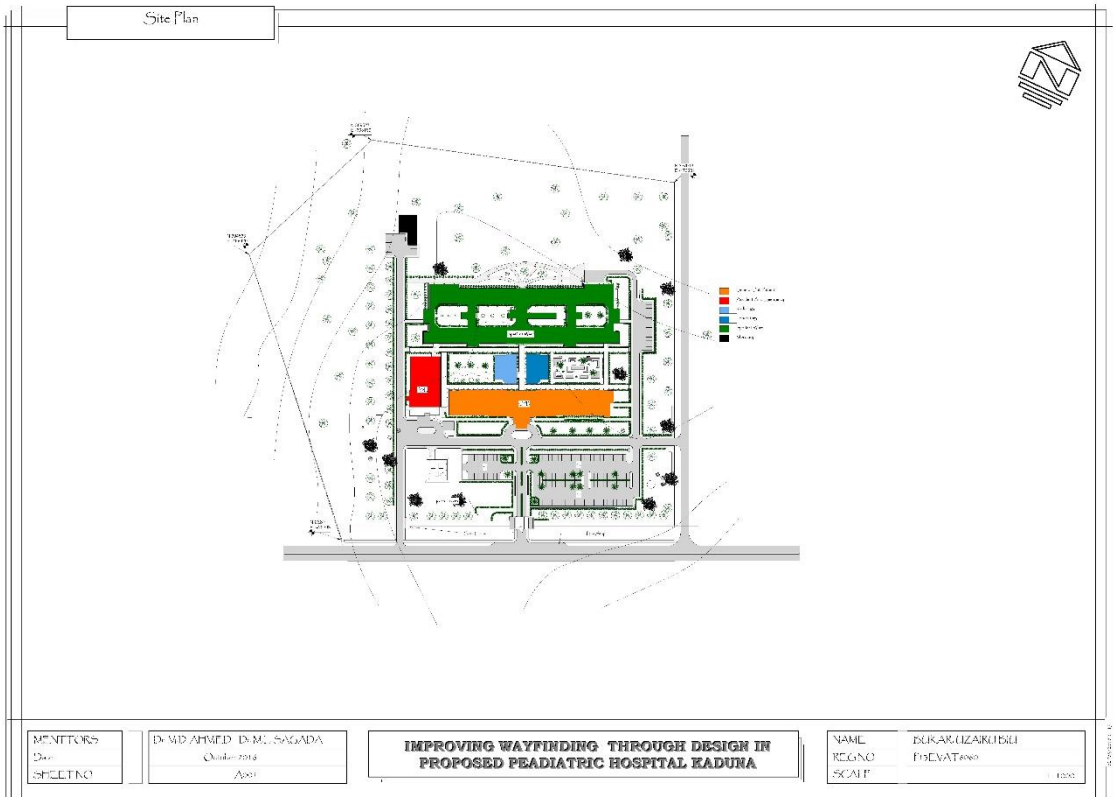
S/n	Variables	Check list	Level of application			Remark
			ABUTH	BDSH	YDSH	
1	Shaping site and setting	Landscaping,				
		Roadways,				
		Pedestrian routes sidewalk.				
2	Building form and architectural features	Building form,				
		Physical separation of Components,				
		Roof design				
		Placement of openings				
		Cladding (skin) - textures, materials, Colours,				
3	Articulating interior spaces	Programmatic organization				
		Defining spatial units				
		Defining destination zones				
		Interior design				
4	External and internal circulation systems	Approach from street				
		Roadways, External paths				
		Parking,				
		Entrances and exits				
		Connection to mass transportation				
	Level change devices	Elevators, Staircases, and Ramps				
	Internal transportation	Mobility aids, People movers				
		Fixed rail systems				

Appendix B

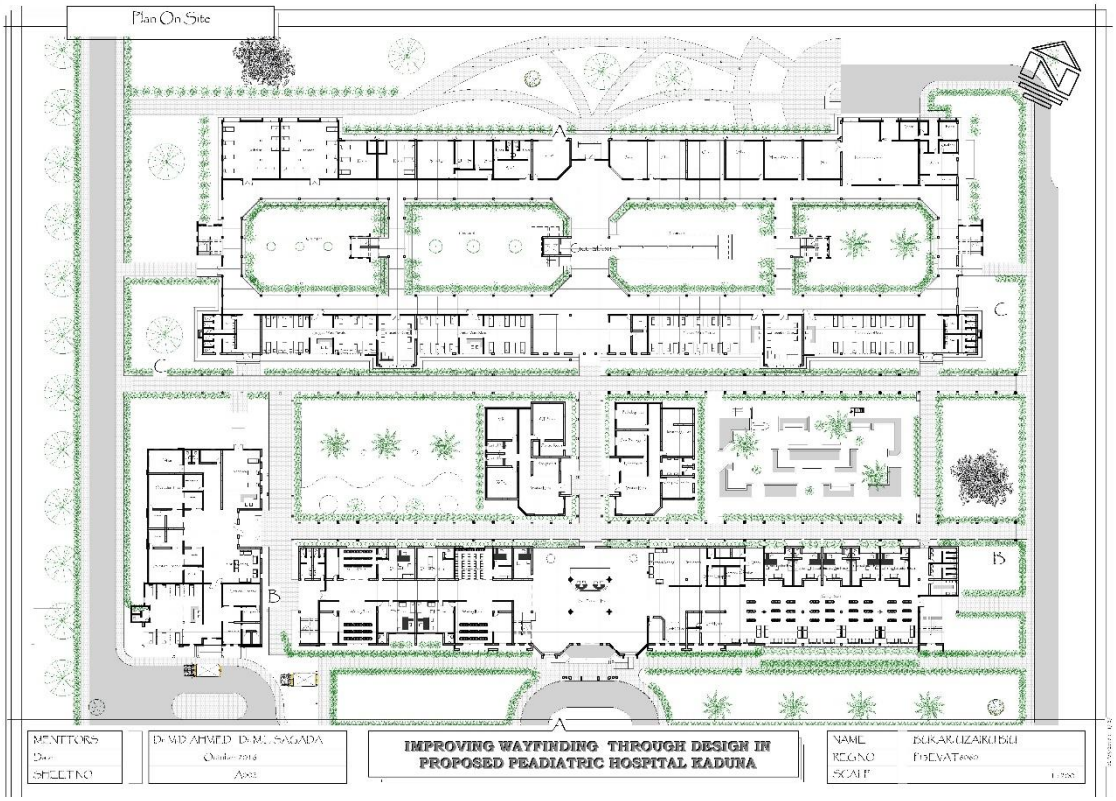
Participant observation check list.

S/No.	Aspect	Ahmadu Bello University Teaching Hospital (ABUTH)	Yusuf Dantsoho General Hospital (YDGH)	Barau Dikko Specialist Hospital (BDSH)	Remark
1	Main entrance				
2	Parking				
3	Accessible walkway				
4	Inbuilt communication system				
5	Consistency of Architectural element in publics spaces				
6	Presence of landmarks				
7	Entrance visibility form decision point				
8	Open public waiting areas				
9	Distinguish public area from non-public area through finishes				
10	Visibility of level changing device from main entrance				
11	Presences of tactile ground surface indicators (TGSI)				
13	Presence of shorelines' and 'trails' at major destinations and information areas				

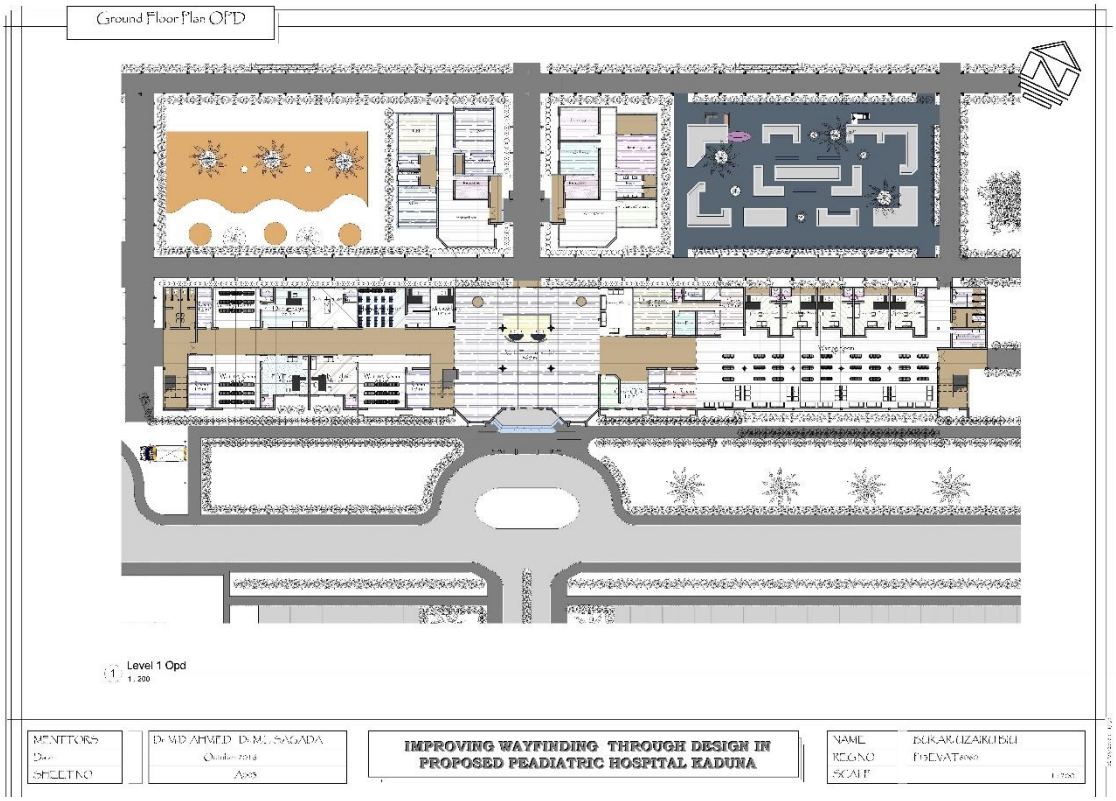
APPENDIX C
Design



Appendix I: Site plan



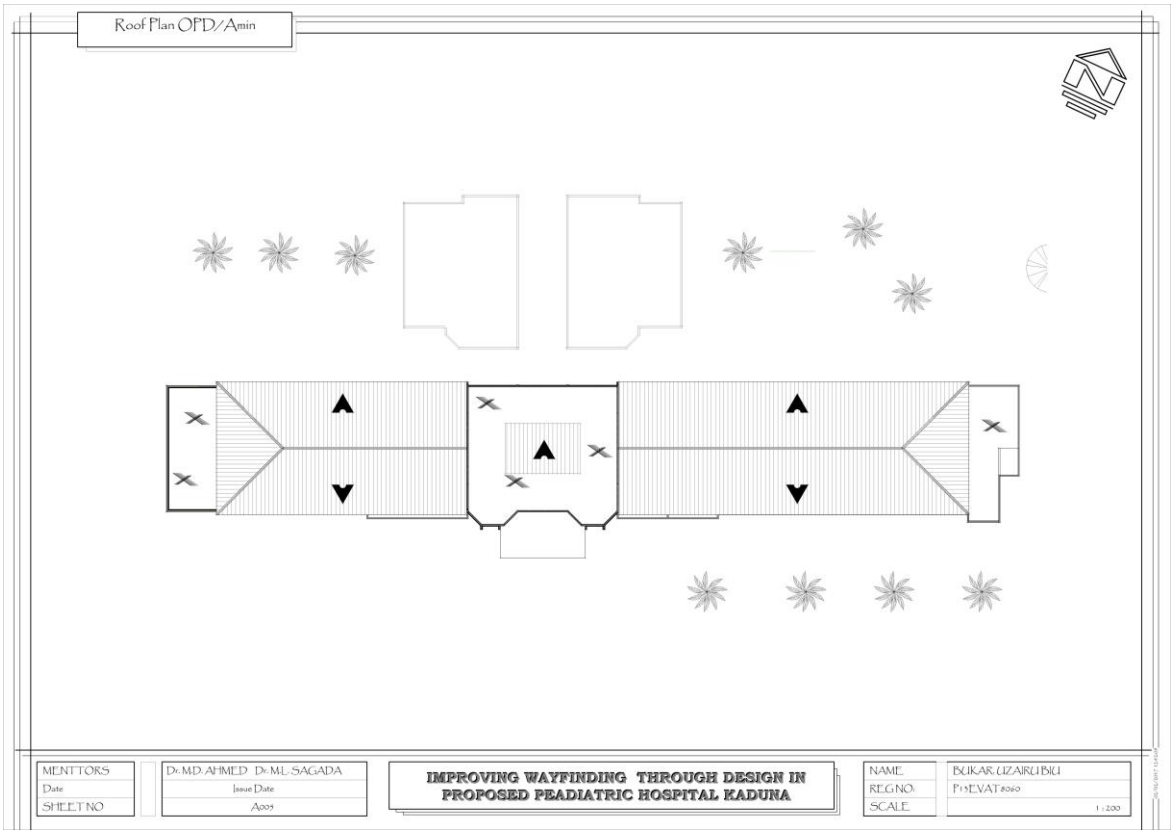
Appendix II: Plan on site



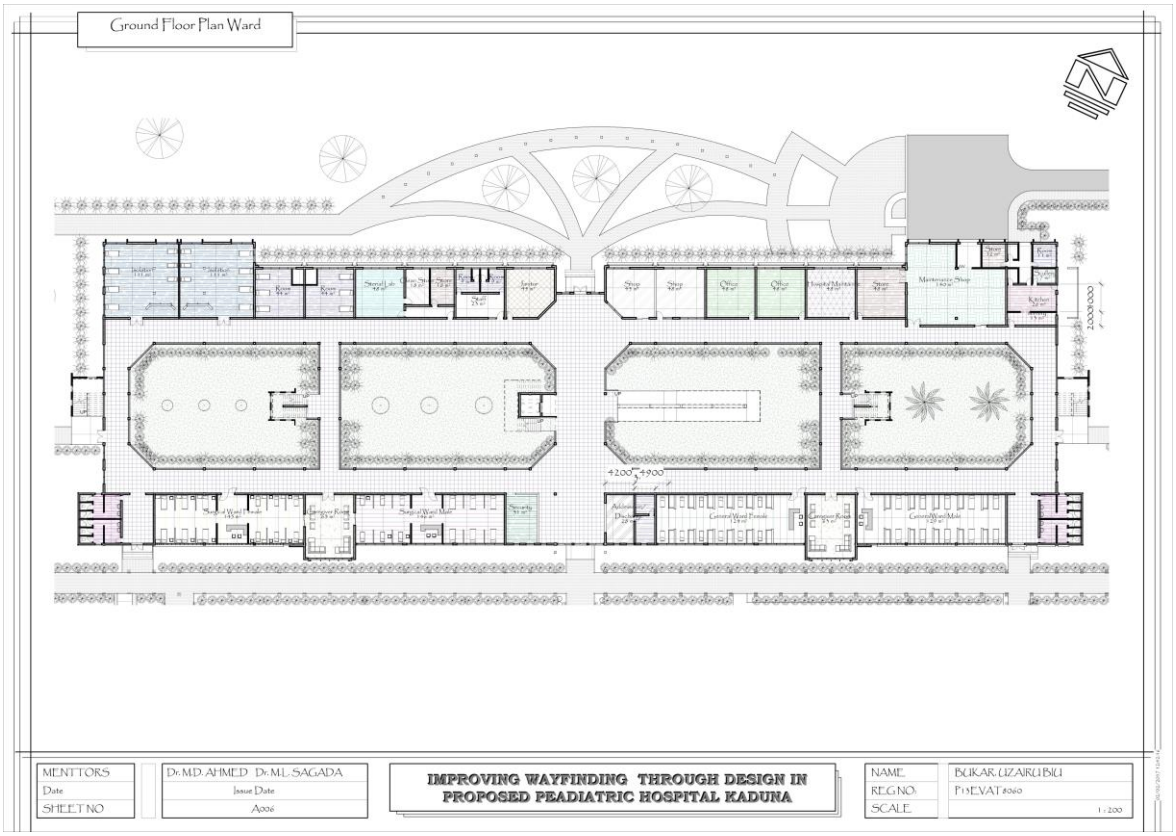
Appendix III: Floor plan OPD



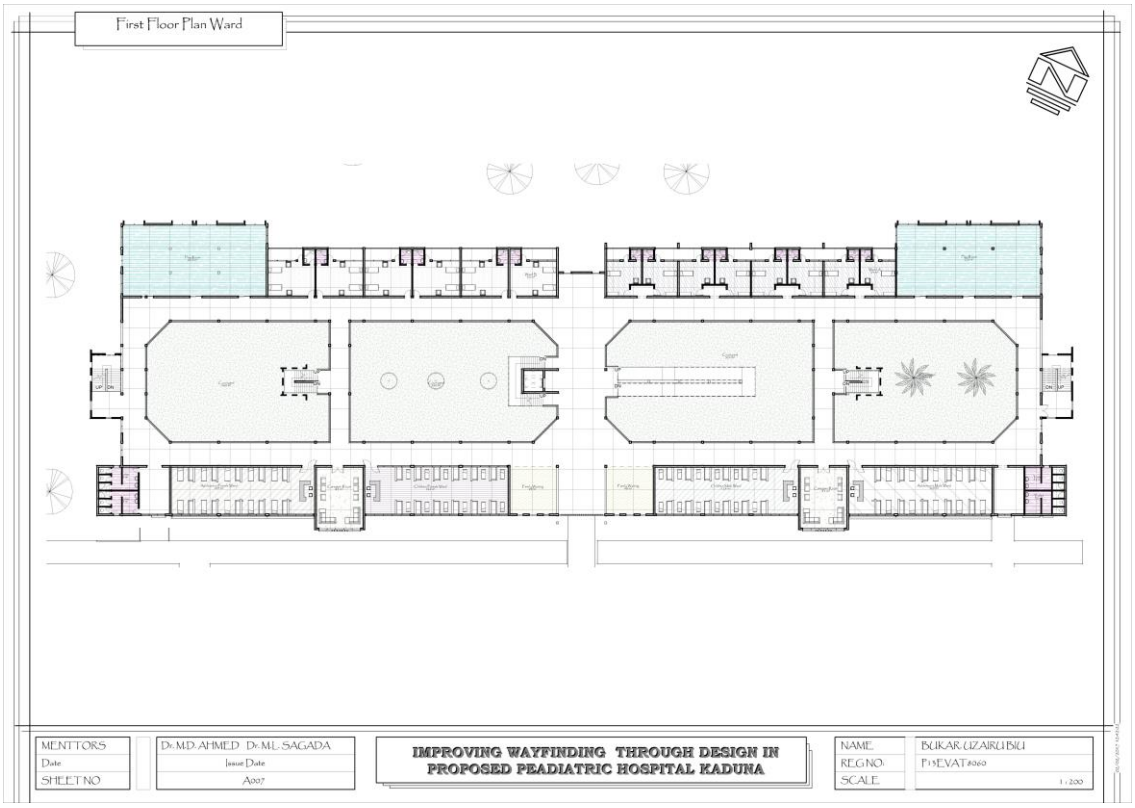
Appendix IV: Floor plan administrative department



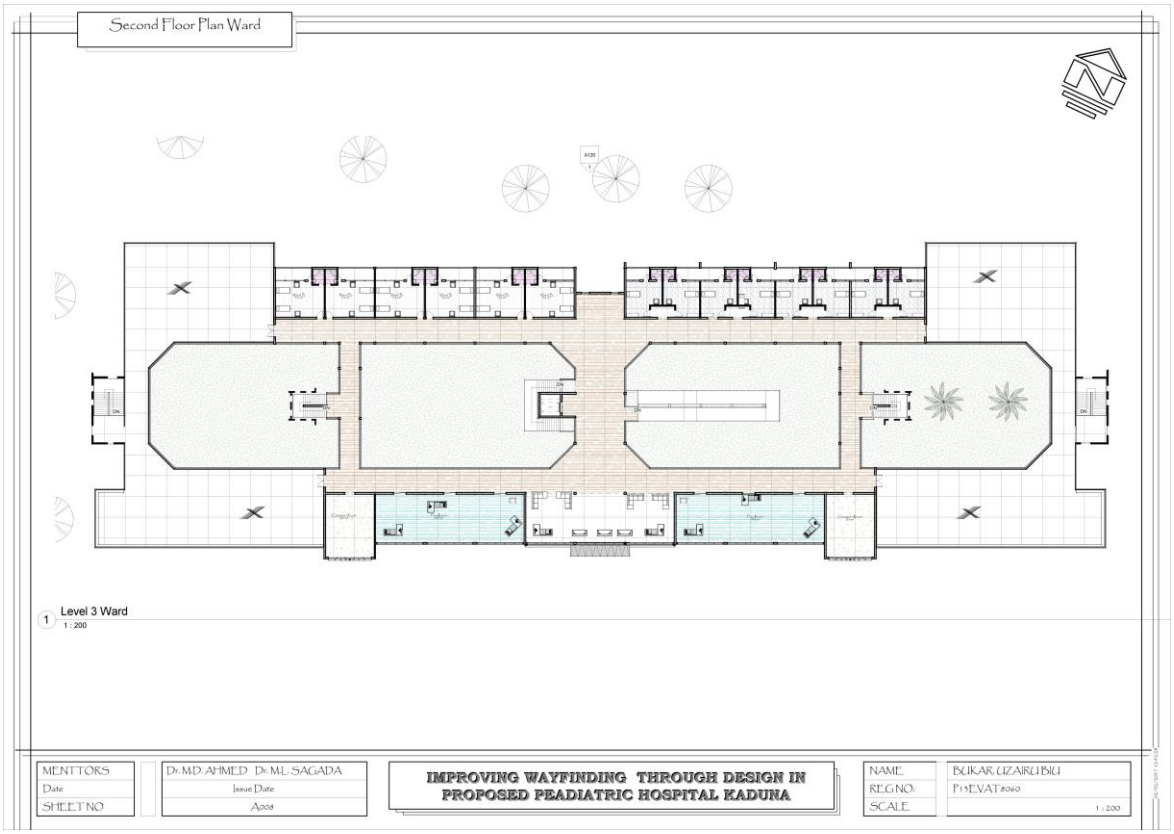
Appendix V: Roof plan administrative department



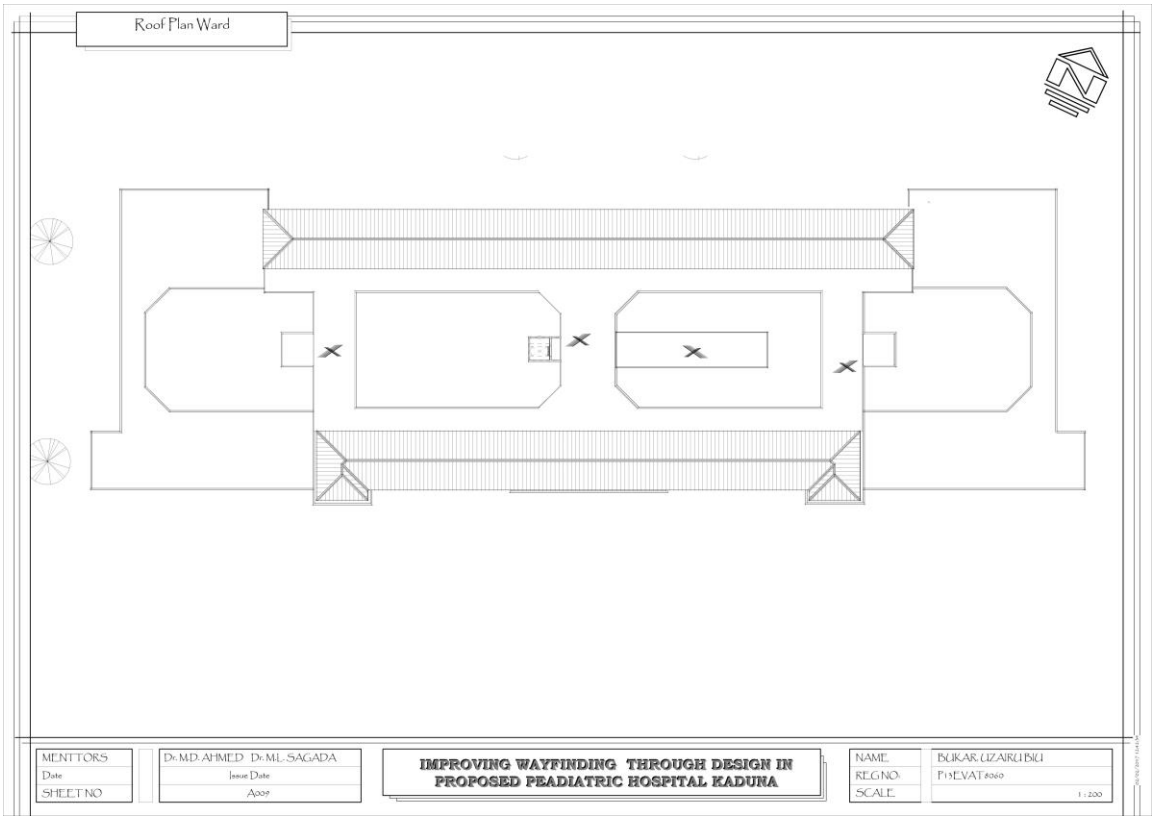
Appendix VI: Ground floor plan ward



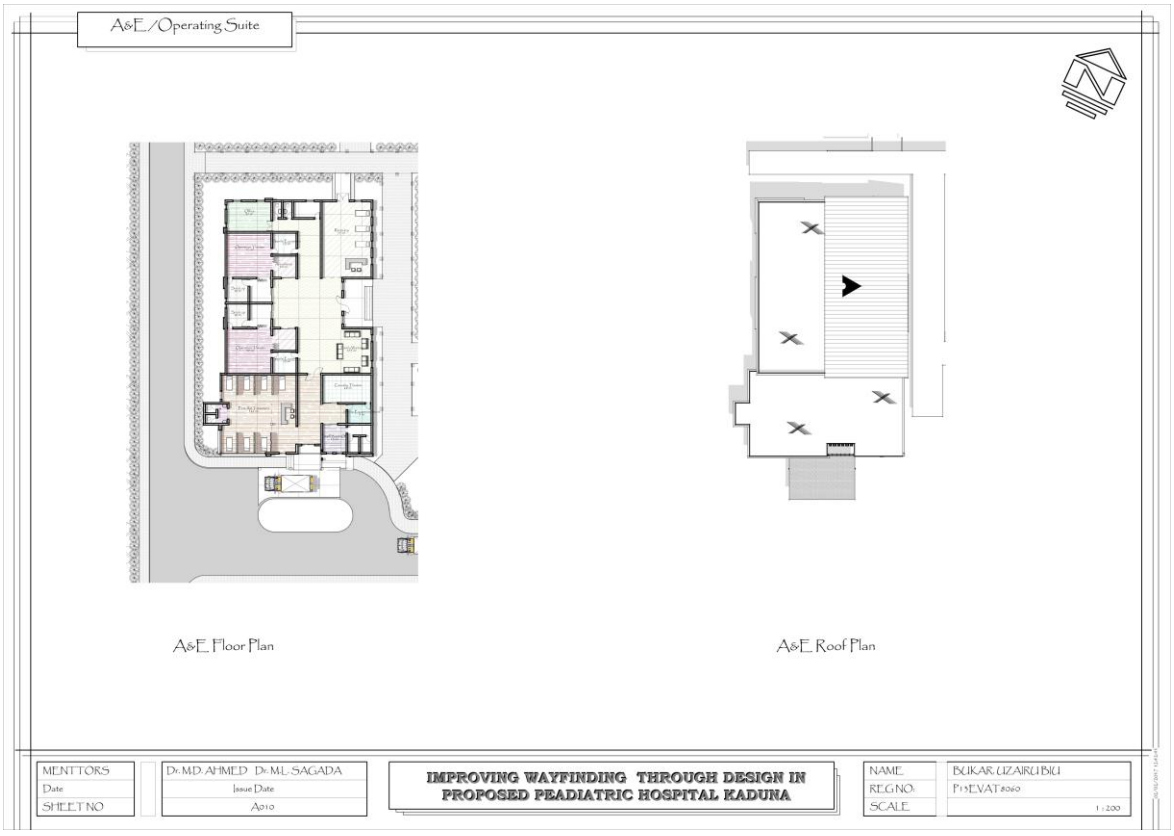
Appendix VII: First floor plan ward



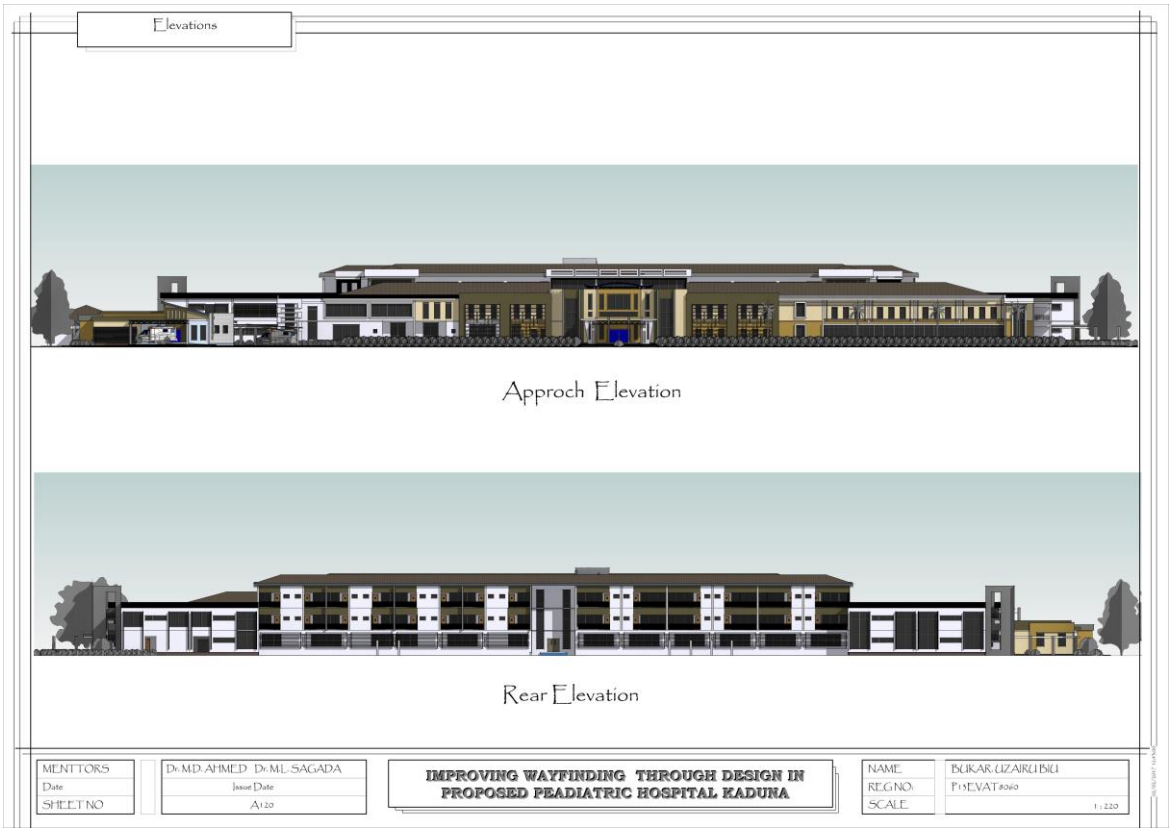
Appendix VIII: Second floor plan ward



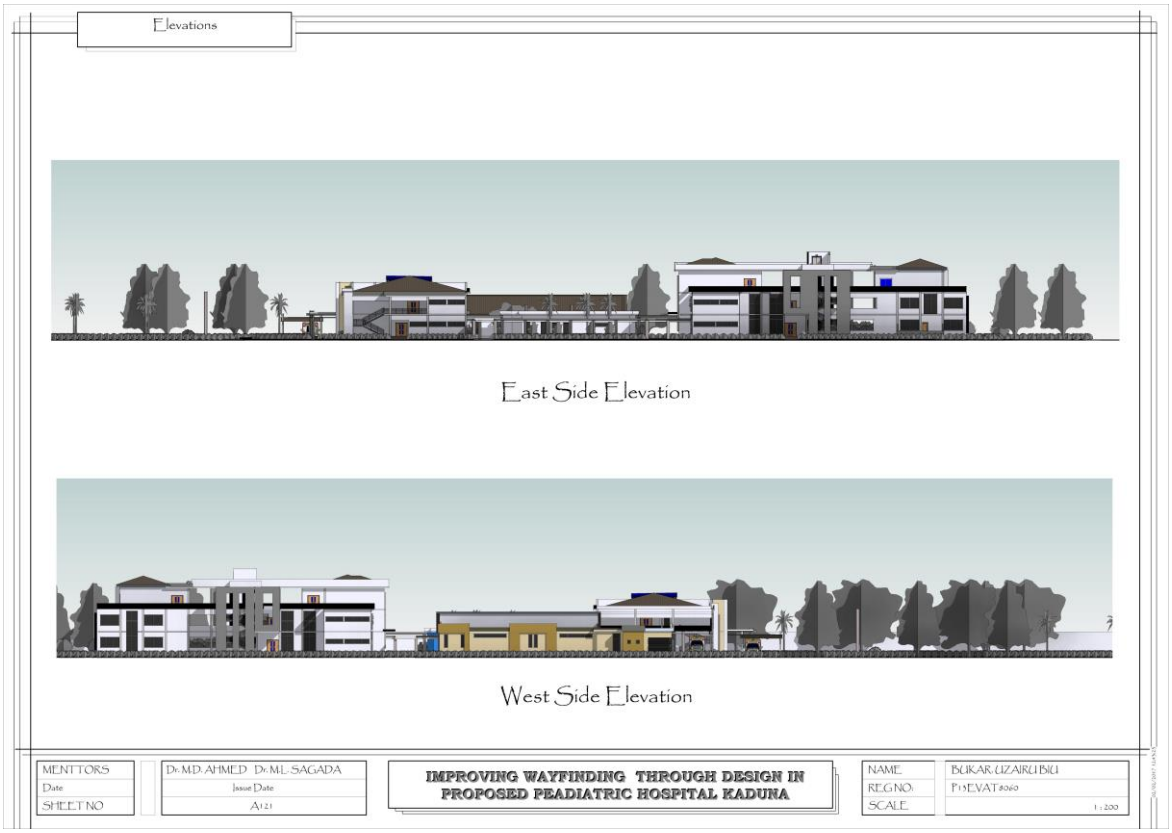
Appendix IX: Roof plan ward



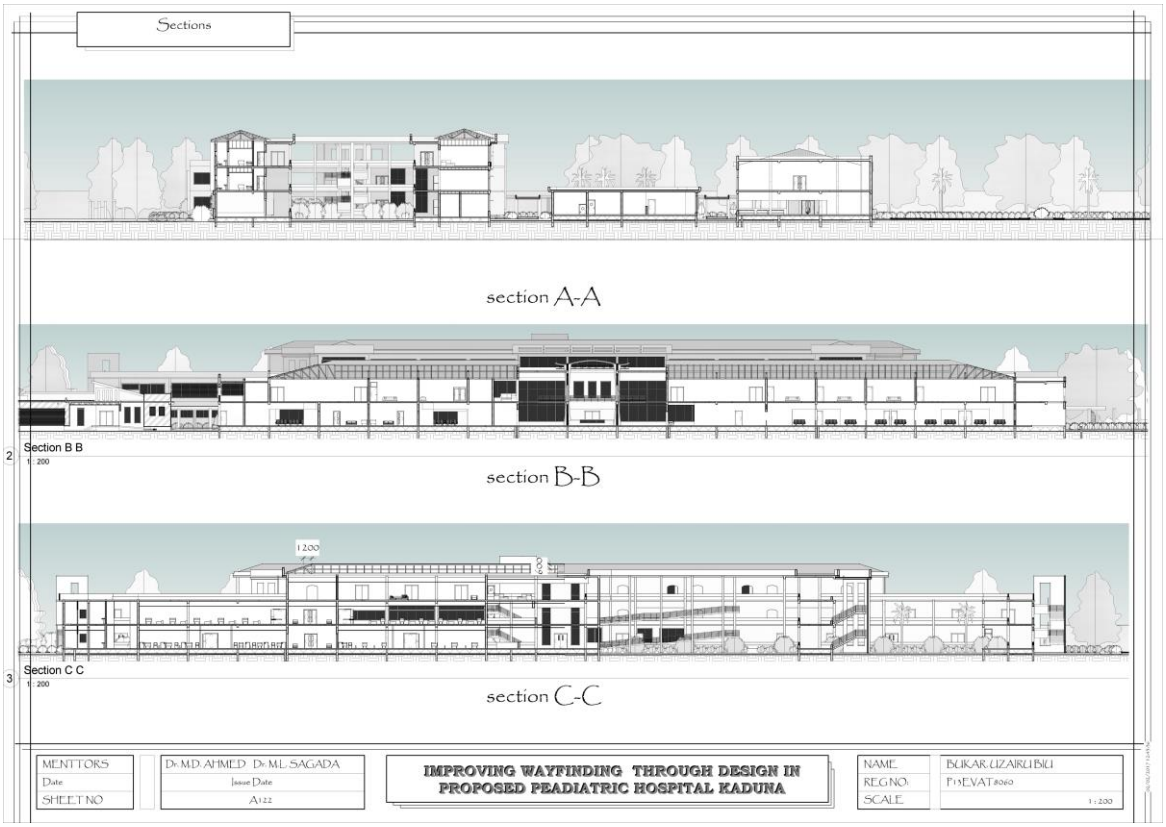
Appendix X: Accident and emergency unit



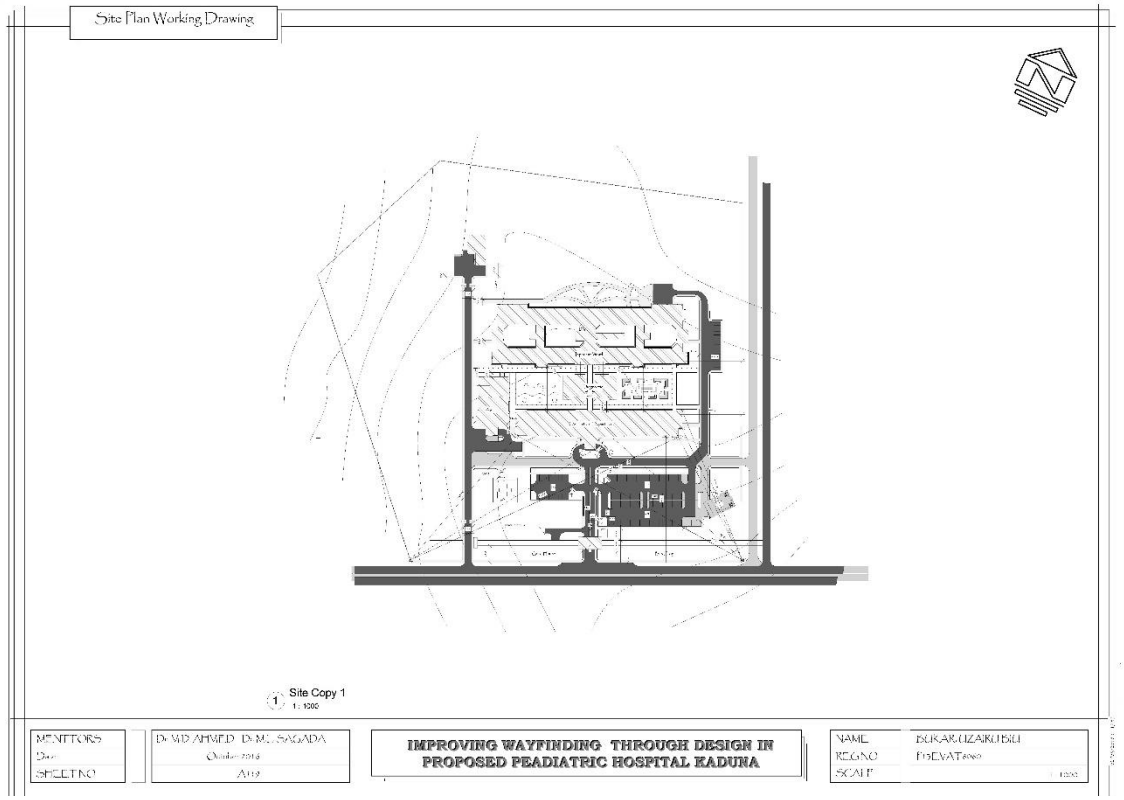
Appendix XI: Elevations



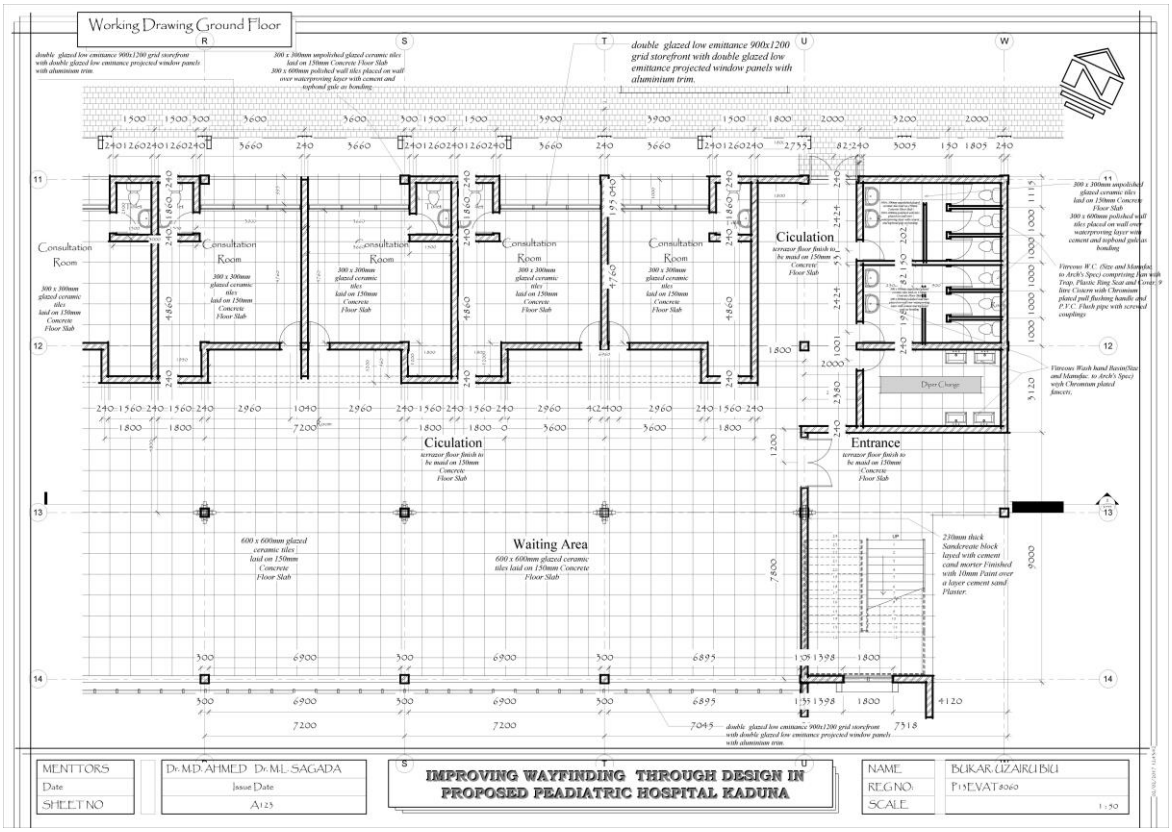
Appendix XII: Elevations



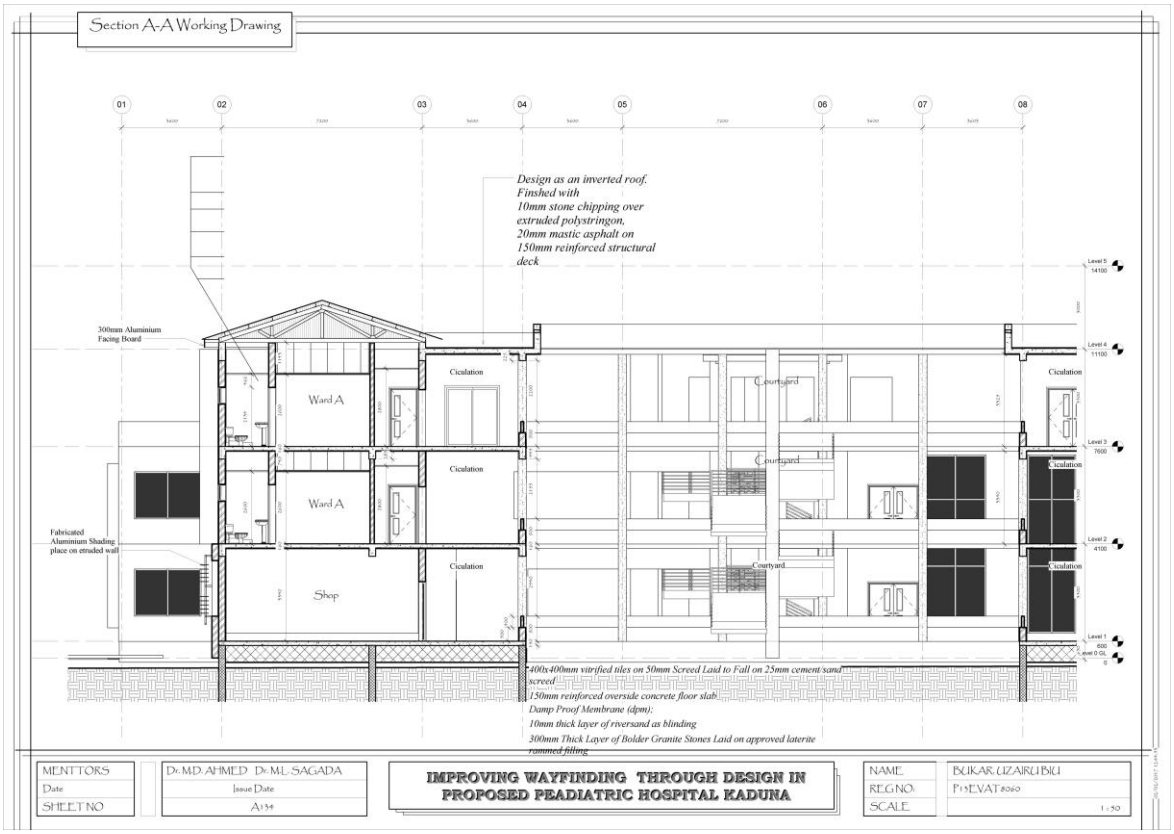
Appendix XIII: Sections



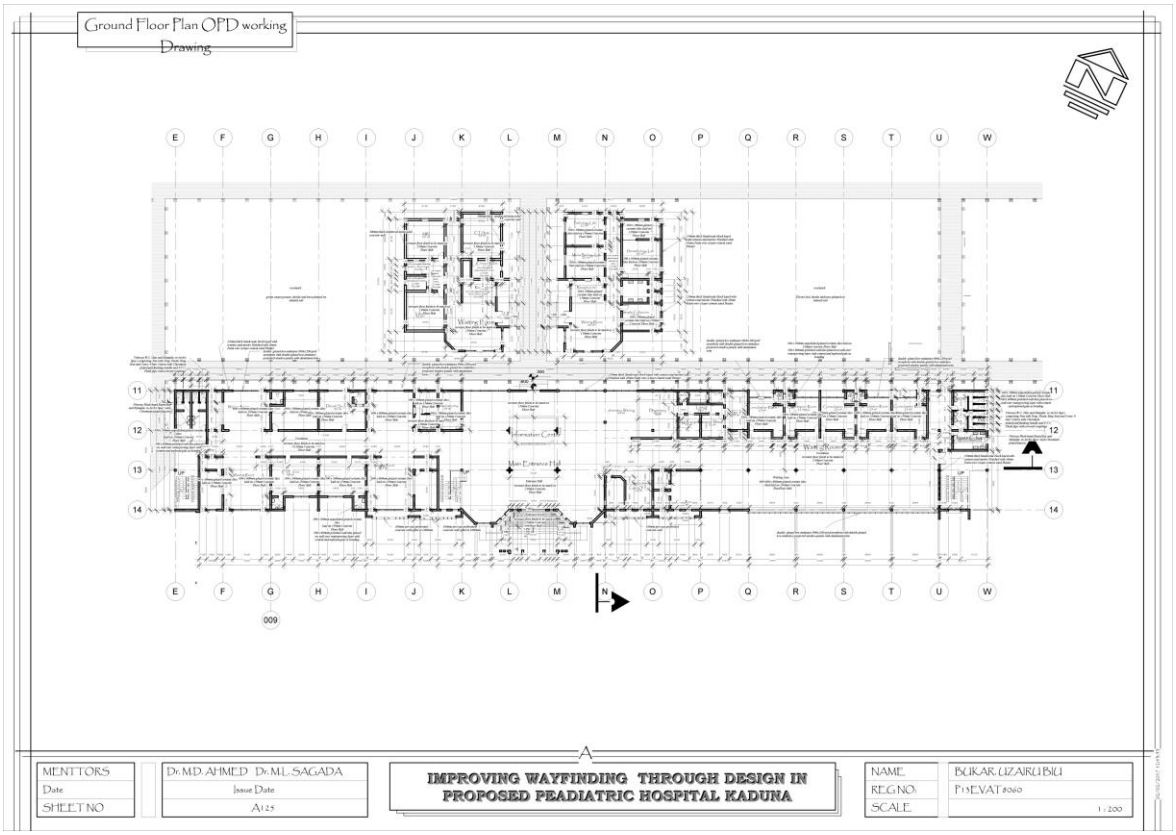
Appendix XIV: Site plan working drawing



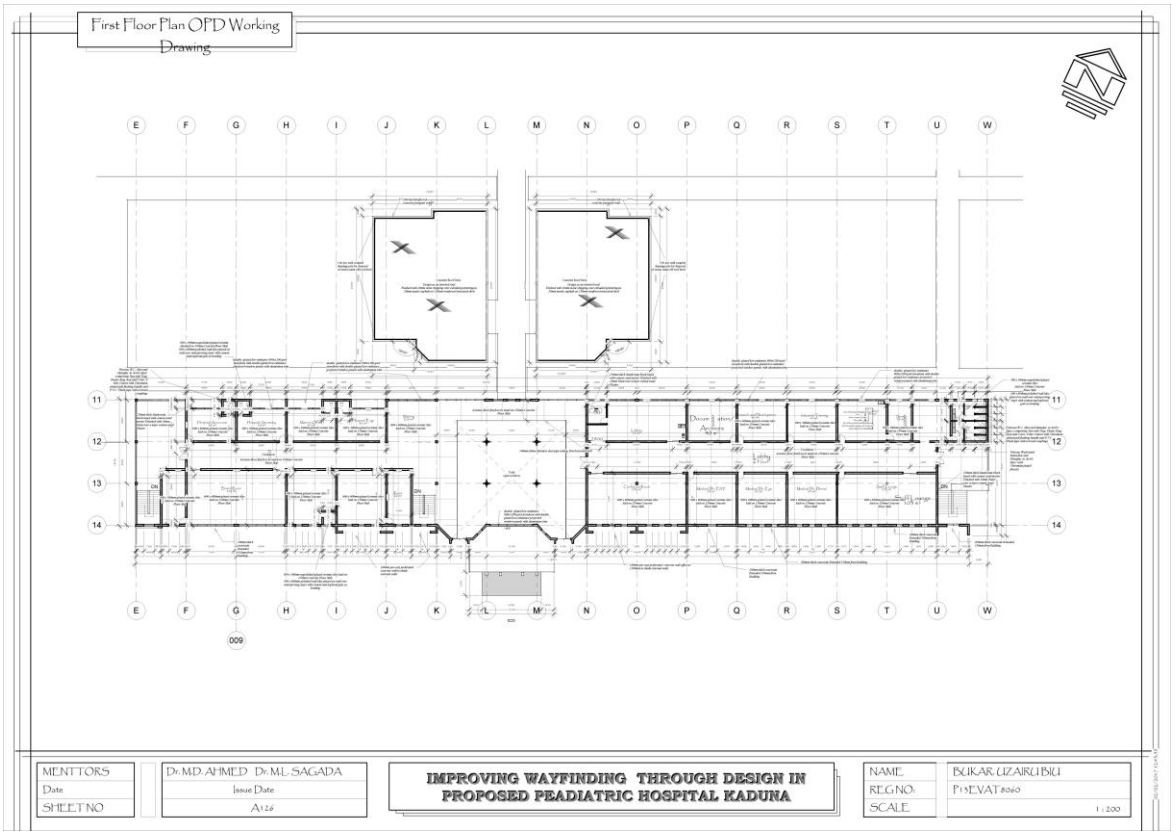
Appendix XV: Working drawing floor plan



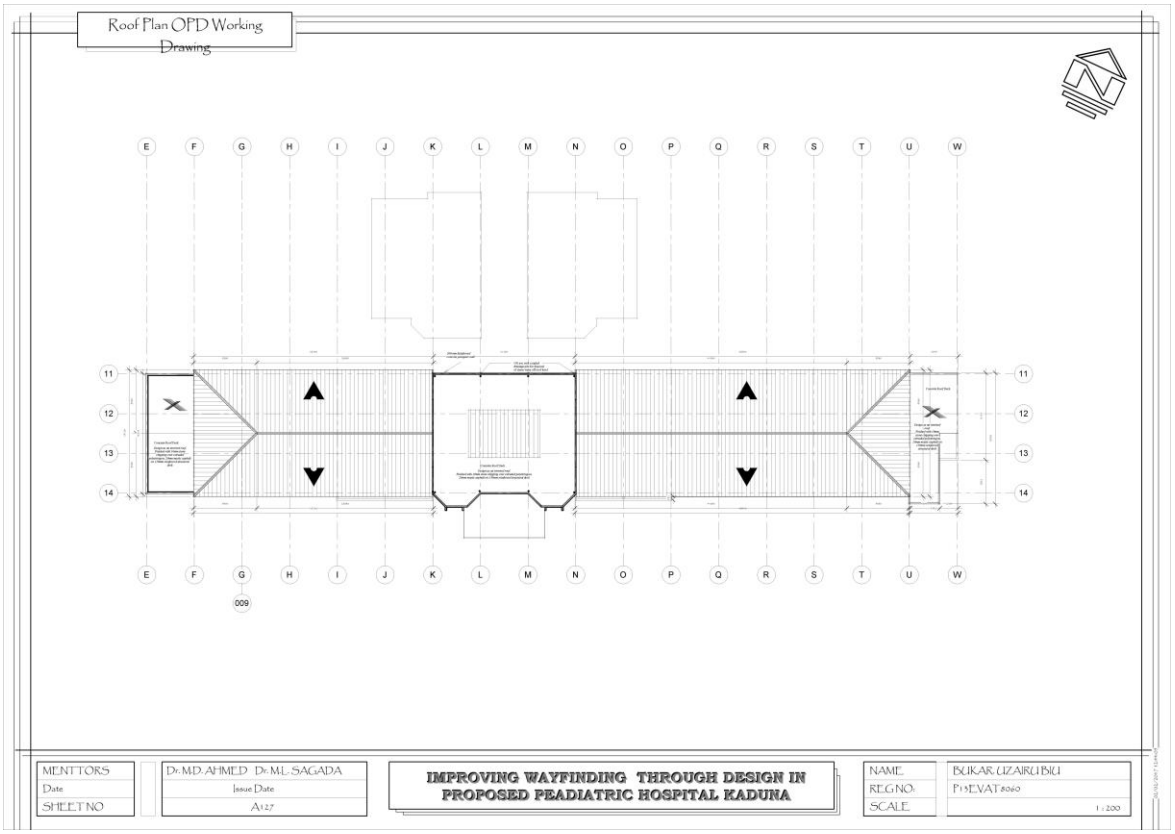
Appendix XVI: Working drawing section



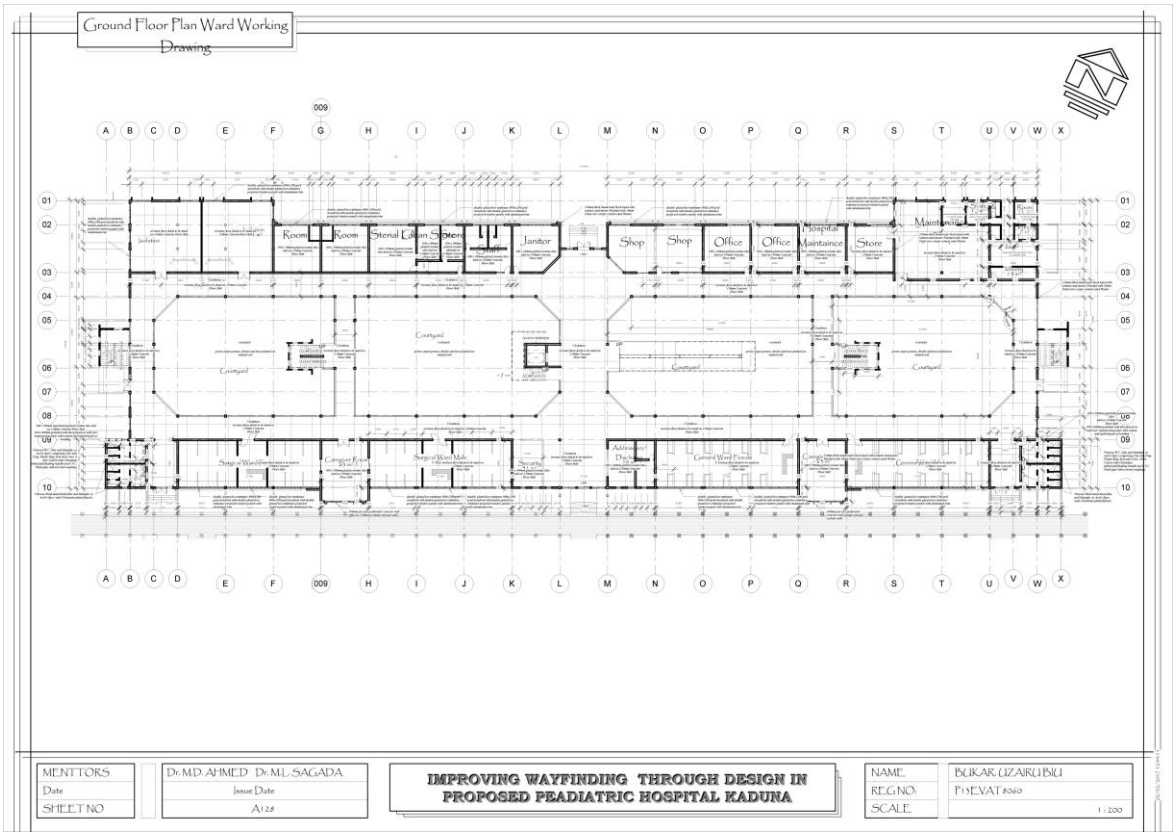
Appendix XVII: Working drawing ground floor plan



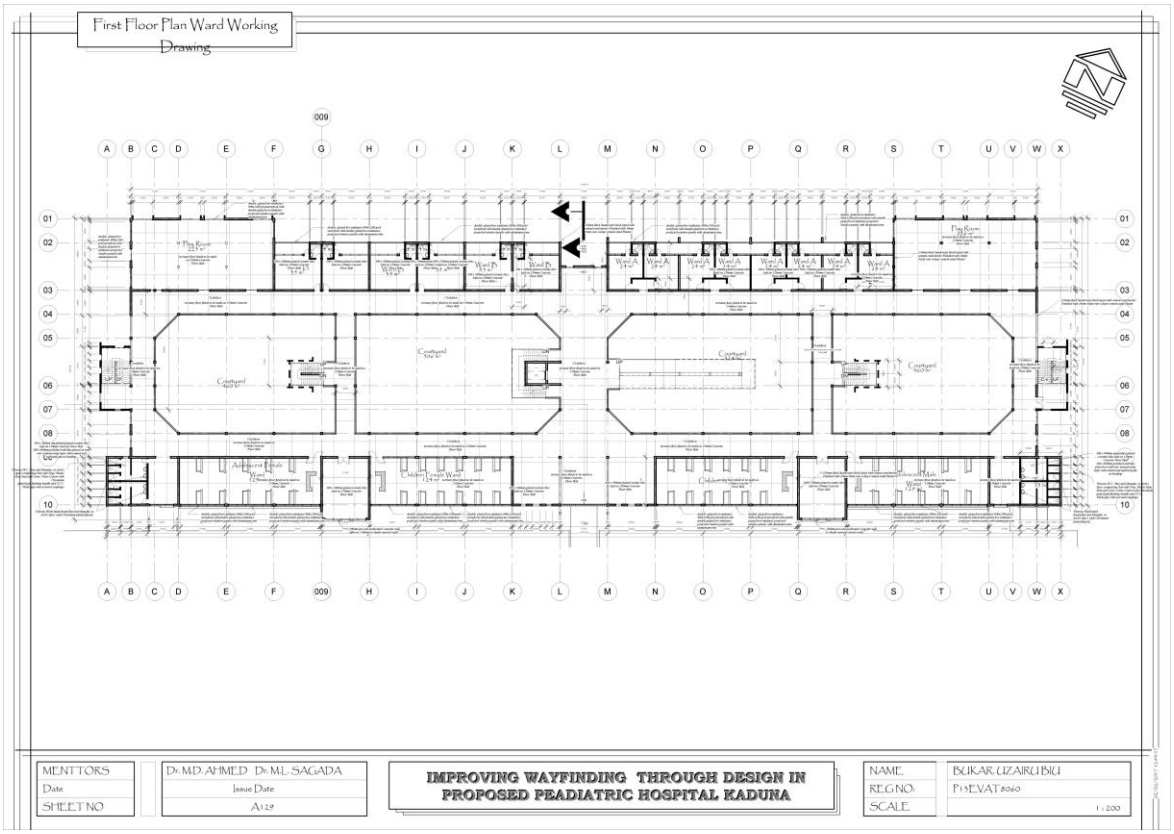
Appendix XVIII: Working drawing administrative section



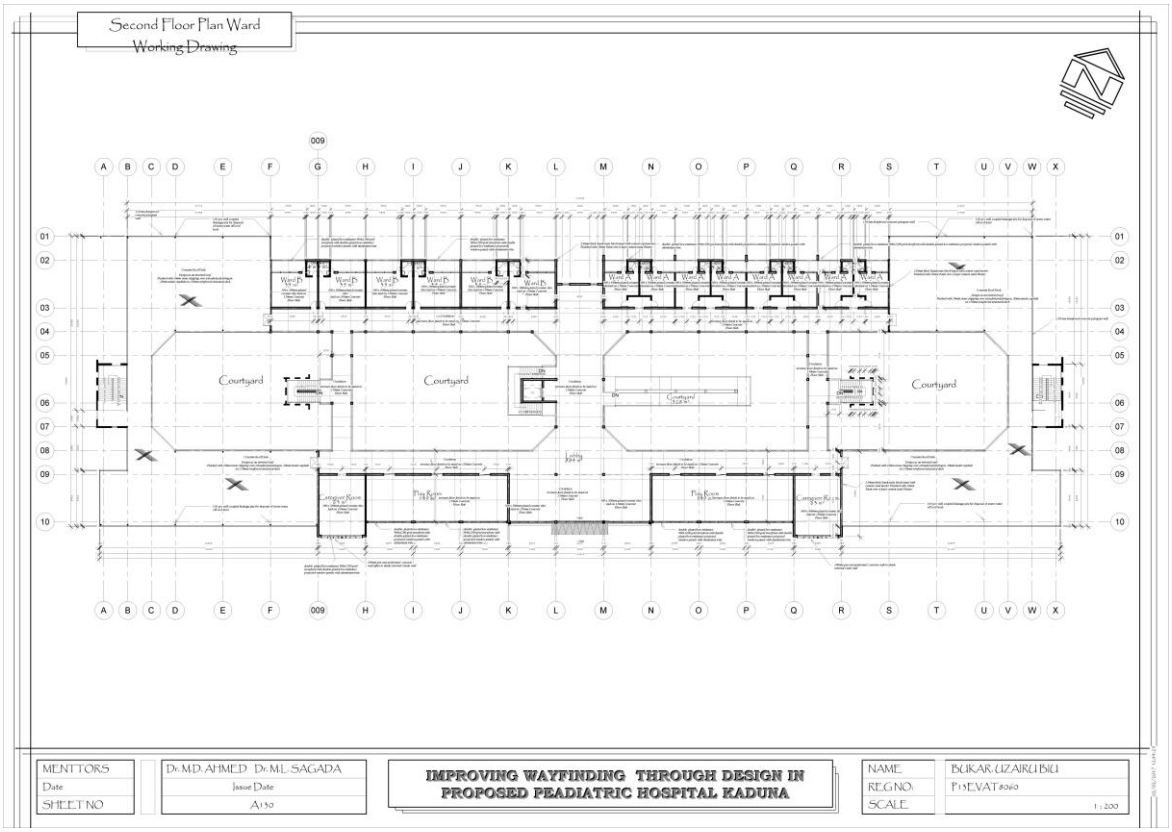
Appendix XIX: Working drawing admin roof plan



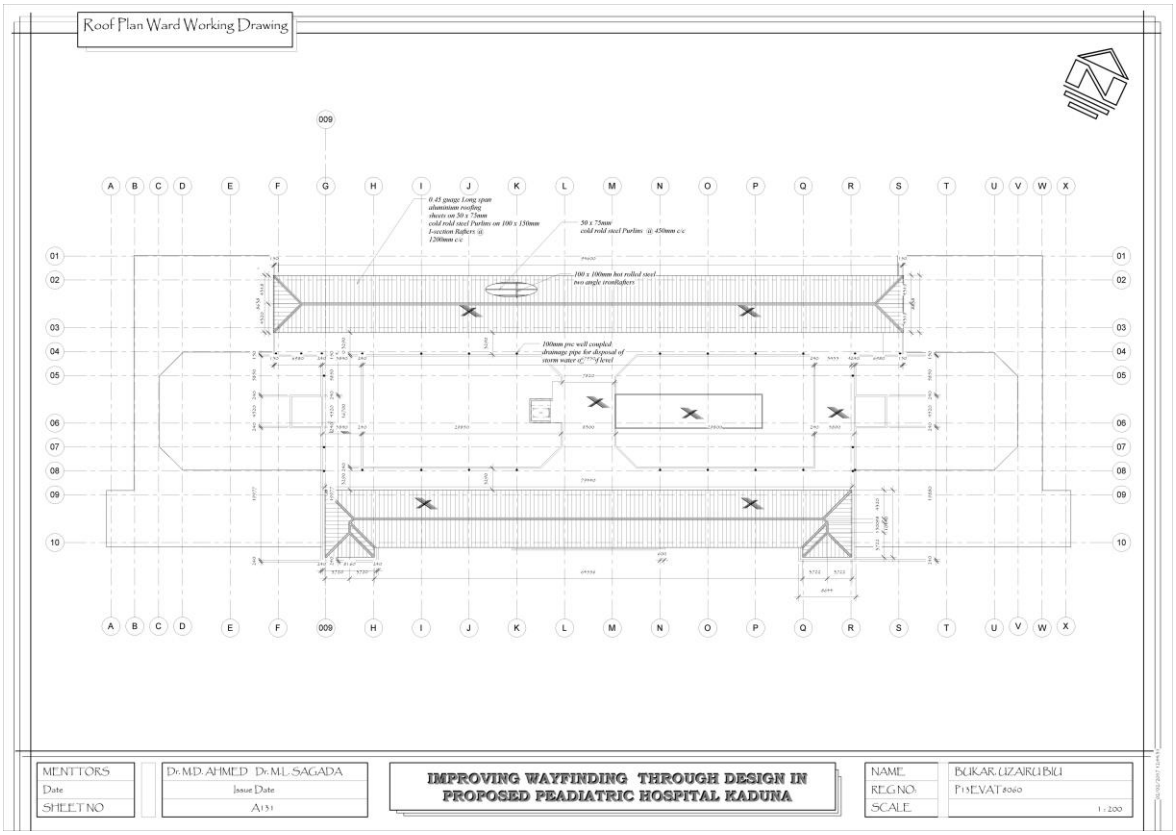
Appendix XX: Working drawing ground floor plan ward



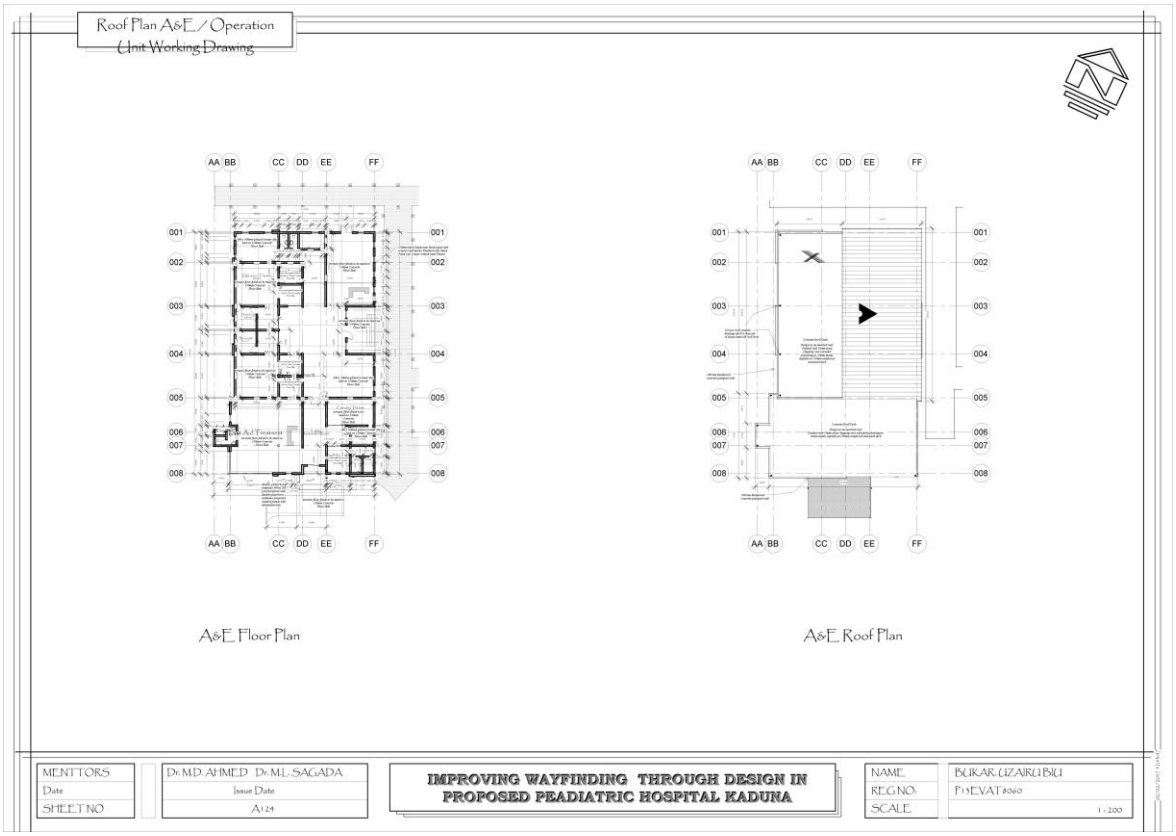
Appendix XXI: Working drawing first floor plan ward



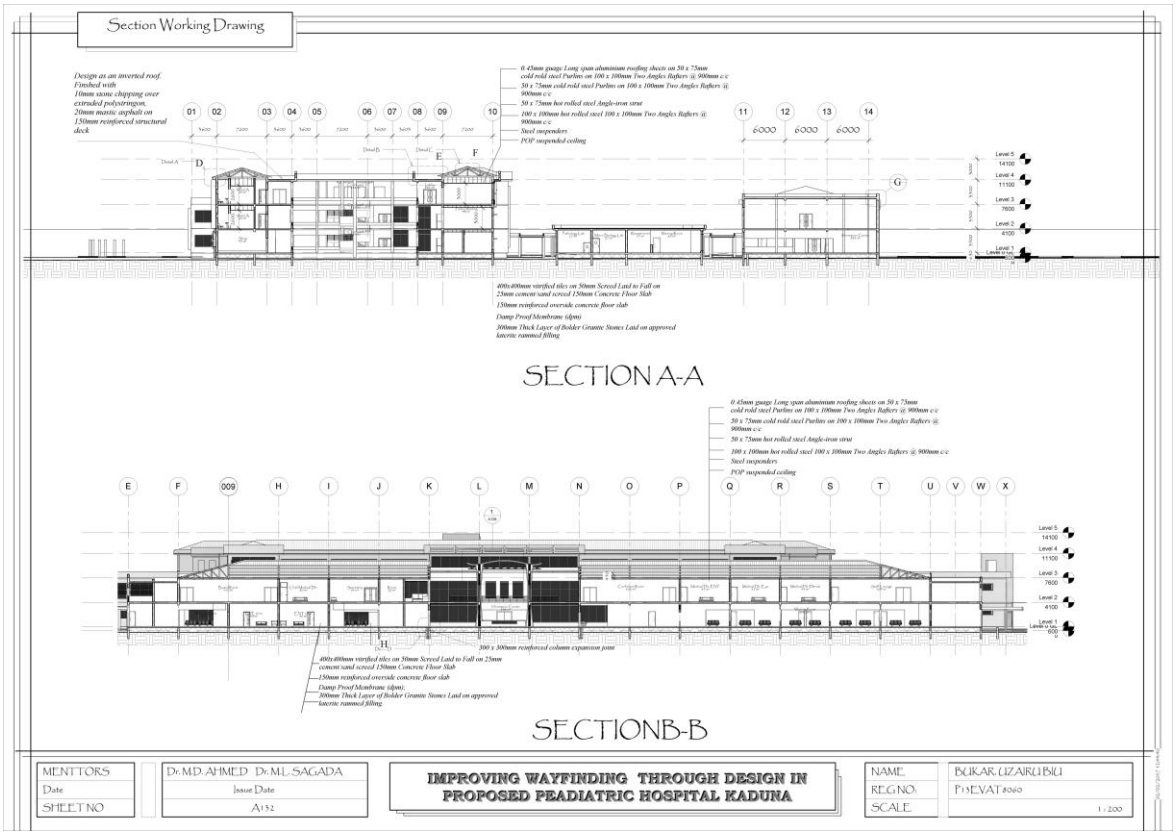
Appendix XXII: Working drawing second floor plan ward



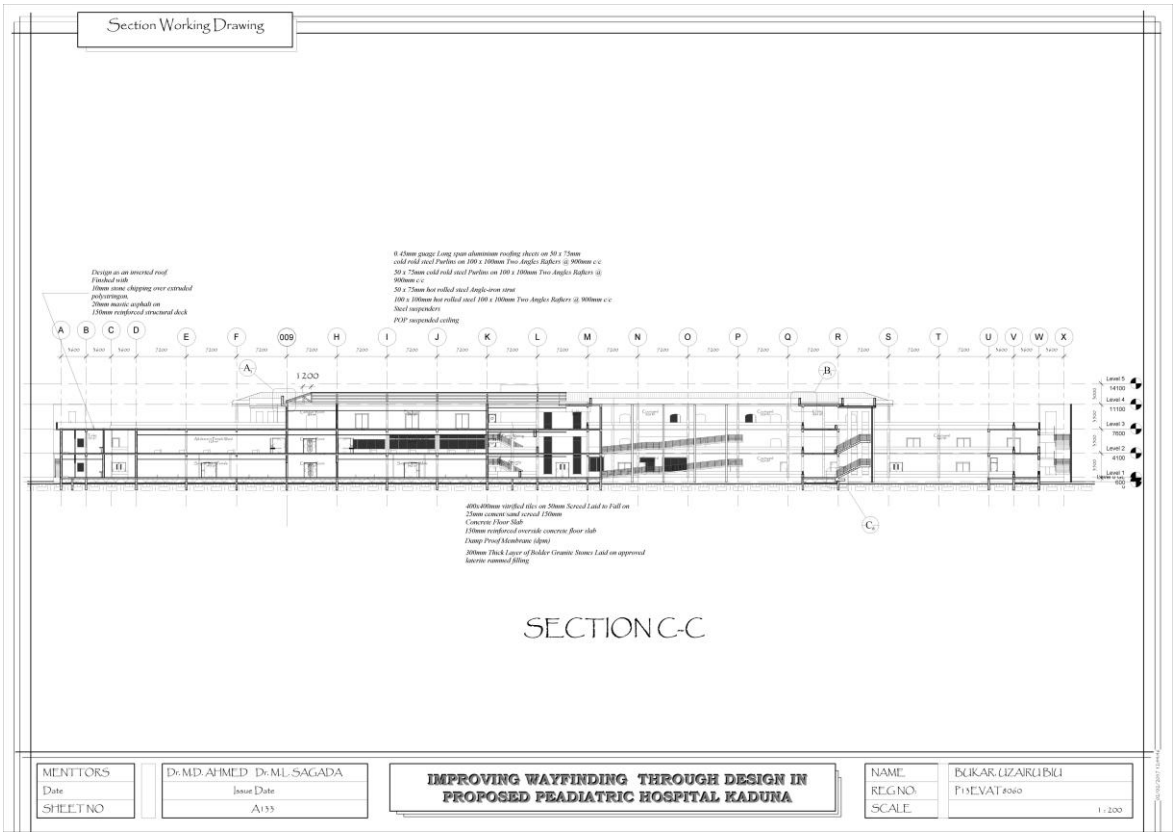
Appendix XXIII: Working drawing roof plan ward



Appendix XXIV: Working drawing accident and emergency



Appendix XXV: Working drawing section



Appendix XXVI: Working drawing section



Appendix XXVII: 3D Perspective



Appendix XXVIII: 3D Perspective



Appendix XXIX: 3D Perspective