SCHOOL OF ARCHITECTURE, UNIVERSITY OF ILORIN

(Achieving Cohesive Form through Spatial and Functional Integration in Academic Building Design)

By

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CERTIFICATION

This is to certify that **ANIMASHAUN, Saheed Babatunde (ARC/09/9215)**, a Master of Technology student in the Department of Architecture carried out this project under the supervision of Dr. T. O. Odeyale and meets the regulations stipulated by the governing board of the said degree in Federal University of Technology, Akure and is approved for its contribution to knowledge.

DR. T. O. ODEYALE ……

Project Supervisor Signature and Date

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Ag. Head of Department Signature and Date

DEDICATION

I dedicate this project to Almighty God for the grace, mercy, wisdom and strength he gave me and being my only inspiration in my pursuance of fulfilment in life.

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ABSTRACT

Education is the major bedrock on which the blocks of development in any part of the world are built. Architecture structure spaces in which we live and through which we relate to each other just as society can be re-organized spatially, so space can be re-socialized. Architecture is therefore, a powerful means of directing and redirecting our attention, feelings, and thoughts to certain points through the organization of spatial structures in large complexes like school building and shopping centres are of course an excellent example of this organization. This study seeks to explore the architectural space and then focuses on the "study of Achieving Cohesive Form through Spatial and Functional Integration in Academic Building Design" .It reveals series of spatial configuration and planning systems such as the linear, centralized, radial, grid and clustered pattern with their various navigable circulation system which are workable to decode a functional layout of spaces in large complexes. The school of architecture, University of Ilorin was chosen as a case for possible evaluation and implementation of research findings. Case studies were carried out on existing schools of architecture and school of environmental studies as the case may be, with a view to understanding the building type and various spatial requirements. Findings from the case studies include recent trends in schools of architecture and design elements and techniques which facilitate space-function resolution and general user comfort.

CHAPTER ONE

1. INTRODUCTION

Architecture structures the spaces in which we live and through which we relate to each other (Hillier and Hanson 2007). Just as society can be re-spatialized in its organization, so space can be re-socialized. As Hillier and Hanson state, the chief obstacle to better design is the lack of understanding of the precise nature of the relation between spatial organization and social life. Architecture is a powerful means of directing and redirecting our attention, feelings, and thoughts to certain points through the organization of spatial structures large complexes like school building and shopping centres are excellent examples of this organization.

First, there is the form, properly designed; then we fill it with functions, appropriately conceptualized, Markus (1993) argues that the power of space can materialize itself in three different types of buildings: buildings that shape people (such as schools or prisons), buildings that produce knowledge (such as libraries and museums), and buildings that produce and exchange things (such as workshops and markets). In organizations, these three types intermingle and their boundaries blur. Power through buildings is exercised through the way people are defined as different kinds of members and strangers; in the way that they meet; through the control of the interface between inhabitants and visitors; through the location of persons and things; and through control of their paths of movement and visual, acoustic, and communicative paths (Markus 1993: 96).

1.1 BACKGROUND TO THE STUDY

Architectural design is ultimately about the configurations, connections, shape, and orientations of physical forms. Even the most abstract design diagrams are early efforts to explore and resolve spatial layout concerns. Architectural diagrams represent not only physical elements, but also forces and flows (e.g., forces of sun and wind and flows of people and materials). Thus arrows, lines, and other symbolic representations of forces and flows appear in architectural diagrams conveying spatial characteristics such as magnitude and direction.

In the early phases of designing, architects draw diagrams and sketches to develop, explore, and communicate ideas and solutions. Design drawing, is an iterative and interactive act, involves recording ideas, recognizing functions, and finding new forms and adapting them into the design. Thus drawing is not only a vehicle for communication with others; it helps designers see and understand the forms they work with (Alexander 2001).

People have been organising, planning and building for a long time, but, was it architecture? As civilization and development unfold, it was common to distinguish between architecture and mere buildings. Environment as well as all human artefacts is designed in the sense that they embody human decisions and choices and specific ways of doing things.

A person clearing a forest, putting up a roadside stand, or laying out a camp is as much a designer and as an architect because such activities change the face of the earth and create built environments. All environments therefore, result from choices made from among all possible alternatives. The function of a building is the spatial organization to accommodate various activities and functions. In public or institutional buildings, such as schools, museums, etc., both the relationship between physical and spatial forms consist a key aspects. Buildings are planned to suit a particular social organisation and activity, which implies that individuals and groups with different roles and status occupy different places. (Lawson, 2001).

It is according to how both forms and spaces are elaborated into patterns, spatial layout, that the socio-cultural function may occur. The spatial layout embodies the social nature of the building through which it localises people and modulates their interaction as well as their experience of the place. Hence, the spatial component must not be disregarded but considered as a significant factor of how the socio-functional processes are generated (Hillier, 2007).

Such specialised type of public buildings like schools, Conference Centre and hospitals etc, are designed to make use of space as an educational tool regarding both the transmission of (socio-cultural-scientific-technical) knowledge and the promotion of the learning capacity. They represent the physical place where to meet, search for information, and study. A place where youth can get together with other age groups, associate with each other, and take part in things together; a place of vital importance for their social growth (OECD, 2001:pg 103).

The proposed School of Architecture block for the University of Ilorin, is a complex that will house the various constituent departments as well as other non- academic activities. The major department making up the School include: Architectural design, Interior Design and Architecture, Urban Planning Architecture and Landscape Architecture.

Therefore, the School of Architecture is a multi-disciplinary faculty that deals with the study of the environment and how it can be best analysed and designed physiologically, psychologically, aesthetically and structurally to meet the yearning aspiration of man (Ukpong, 2010). The discipline in the school is an art and science based structured programme that cuts across various aspect of architecture with respect to the study of man and its environment both natural, built

(man-made) and social environment as well as other factors for the general sustenance of the environment.

The concept of gaining and sharing knowledge is encouraged through interactive spaces. during the course of this thesis work, study shows that the deplorable state and spatial pattern of most school of Environmental studies in Nigerian Universities lack basic planning and adequate facilities in terms of space to accommodate the various departments in the School, hence, the research interest arose. The problem of make-shift studios, staff offices and lecture theatre as well as other specialized spaces that promote social interaction and transfer of scholarly knowledge pose a serious challenge to the study of spatial system of planning to integrate and organise these various constituent departments in a single complex.

The traditional school design following a (functional) zoning strategy where teachers, students and classrooms were standing apart given the separation between classrooms and other specialised spaces such as laboratories and libraries, the circulation system, is no more suitable. Hence, building should be reconfigured to support changes in the societal context of education and re-engage students with learning, (Fisher, 2004). A building therefore is a community of its own; Space syntax modelling has been used to understand how existing cities, urban areas and buildings are working, and to simulate the likely effect of new interventions, and help integrate information about other socio-economic factors into the design and planning process.

The proposed School of Architecture building to be located at the University of Ilorin campus site in Ilorin Local Government, this will enhance harmonious relationship between the various departments within the School through careful analysis of different spatial systems of planning to solve and integrate these constituent department together to promote effective learning, proximity, growth and easy access to the various units within the School building. The most prevalent problems associated with spatial planning are:

i. Spatial and functional relationship between the various spaces in a building.

ii. The centrality, proximity, accessibility and permeability between functional areas and shared spaces within a building.

This study therefore, will ensure that communal spaces are centrally located for easy access to every department.

1.2 STATEMENT OF THE PROBLEM

In Nigerian Universities, a faculty is formed with a minimum of three Departments. At the 2012 Architects Colloquium, the Faculty project was ratified, Departments of Architecture were encouraged to establish at least two programmes which will transform into disciplines and subsequently Departments. The task of this study is a proposed model for the School of Architecture building due to careful assessment of existing conditions and inadequate spatial planning problem of most School of Environmental Studies building in Nigerian Universities.

The need for a planned and managed approach cannot therefore be over emphasized. With focus on the School of Architecture Building complex for University of Ilorin that has its core design principles based on the study of "Achieving cohesive form through spatial and functional integration in academic building design".

1.3 AIM AND OBJECTIVES

The primary aim of this study is to explore architectural spaces based on Space syntax theories and spatial system of planning and their impacts on human activity in designing a building for the school of architecture, University of Ilorin.

The objectives include the following:

i. To analyse and identify spatial and functional issues as they affect spatial activities in public or large building complex.

ii. Analysing the different spatial organisational systems and how they affect a public space.

iii. To investigate spatial quality and to explore how they can be combined into a single common framework for formulating and evaluating school physical conditions of a building.

iv. To organize functions in spaces, thereby leading to good proximity of related activities to increase effective configuration and flow in circulation to a wide range of users and understanding of the factors promoting specific types of spatial activities, as well as effective and efficient approach to critically analyse, harmonize and integrate such functions.

v. Finally, to carry out case study of existing buildings in order to appraise and analyse their spatial qualities in both international and local School of Architecture and Environmental Studies.

1.4 SCOPE AND LIMITATION OF STUDY

The scope of this project will be limited to the study of spatial analysis and integration of functions in order to enhance human activities in large complex building with particular reference to the School of Architecture, based on space syntax theory and spatial pattern of planning and configuration.

1.5 JUSTIFICATION OF STUDY

The significance of this research seeks to reveal some spatial problems associated with the design of public spaces and integration of functions in large complex buildings in the built environment as these do not allow for effective functioning of spaces in the building and its related activities.

This project will broaden the understanding of the following:-

i. Specifically, to student it will be a resourceful material for further research in this area of work.

ii. And also an earnest contribution to the existing body of knowledge of Spatial and functional systems of planning, layouts strategies, integration and organisational cultures of any building type. Additionally the ideas of space syntax illustrate how building form and the design space can work hand in hand in creating a conducive environment that can promote learning process and transfer of acquired knowledge in various field of study within the school.

1.6 EXPECTED CONTRIBUTION TO KNOWLEDGE

This study promises to be a resourceful material to student and as well provide a range of theoretical and practical reflections that could be of use to Universities which intend to remodel their environments.

It will also contribute to the already exiting research on space syntax and spatial planning systems of architectural literature, and will serve as a body of reserved knowledge to be referred to by other researchers willing to carry out in depth research in this area.

1.7 RESEARCH METHODOLOGY

Information for this study was garnered through the process of qualitative research and case studies to gain a holistic overview of spatial system of planning so as to understand the socio/physical phenomena within its context. The methods to be adopted are:

i. Perception-based approaches to analysis of space syntax by examining patterns of connections and analysing perceived spatial relations (geometry-based) in the graph-based system, the integration of a space, a measure of its accessibility or centrality, expressed as distance, so that a more integrated space is less distant from other spaces.

ii. Spatial organizational pattern to understand the behavioural impact of space and spatial relationships separately from their use, accessibility and function.

iii. Producing diagrams to analyse their spatial system of planning and taking of photographs of existing case study.

iv. Such sources included a variety of publications including books and journals on space syntax and various planning systems.

v. Other sources are from encyclopaedias and web sites.

1.8 DEFINITION OF TERMS

Space- It is a defined expanse, set apart for a specific purpose with extent measured in two or three dimensions, i.e. distance, area or volume.

Function- In other words Functionalism, in architecture, is the principle that architects should design a building based on the purpose of that building.

Architectural design- Architectural design is the concept that focuses on the elements or components of a system or structure, unifying them into a coherent and functional whole. It adheres to a particular approach in achieving the objective under the given limitations or constraint.

Zoning- The act of dividing or partitioning; separation by the creation of a boundary that divides or keeps apart.

Space syntax: A theory about space and human behaviour, with tools and methods for analyzing human interaction in the built environment.

CHAPTER TWO

2. LITERATURE REVIEW

2.1 DEFINITION AND GENERAL OVERVIEW OF UNIVERSITY EDUCATION

A university is an institution of higher education and research which grants academic degrees in a variety of subjects and provides both undergraduate education and postgraduate education. The word "university" is derived from Latin universitas magistrorumet scholarium, which roughly means "community of teachers and Scholars (Encyclopedia Britannica, 2010).

The original Latin word "universitas" refers in general to "a number of persons associated into one body, a society, company, community, guild, corporation, etc". At the time of the emergence of urban town life and medieval guilds, specialized "associations of students and teachers with collective legal rights usually guaranteed by charters issued by princes, prelates, or the towns in which they were located" came to be denominated by this general term. Like other guilds, they were self-regulating and determined the qualifications of their members. The original Latin word referred to degree-granting institutions of learning in Western Europe, where this form of legal organization was prevalent, and from where the institution spread around the world.

2.2 HISTORICAL BACKGROUNDS OF UNIVERSITY EDUCATION

Universities generally consist of groups of schools, faculties, or colleges. They arose in the 12th and 13th century as a means of providing further training in the professions of law, theology, and medicine, and as centres of study for the rediscovered works of Aristotle and the Arab scholars of the earliest universities, Salerno (9th century) and Montpellier (13th century) specialized in medicine; Bologna (1088) in law; and Paris (12th century) in theology. Students and faculty were originally organized in guild like groups. The student groups, known as "nations" and comprising students from particular localities, gradually diminished in power, however, as the faculty, which controlled both teaching and graduation requirements, became more powerful.

In the middle Ages, universities were usually begun through royal or ecclesiastical initiative or through migrations of students from other universities. The migrations were sometimes influenced by political events. The University of Oxford, for example, was founded (12th century) by English students from the University of Paris who were forced to leave that institution as a result of conflicts between England and France; similarly, the university at

Leipzig was founded (15th century) by German scholars who were driven out of Prague by John Huss's Czech national movement. Medieval universities often had many thousands of students and played an important role in public affairs. Among the famous institutions founded were Salamanca (1230), Prague (1348), Vienna (1365), Uppsala (1477), Leiden (1575), and Moscow (1755). The oldest universities in the New World, both founded in 1551 are Mexico University and San Marcos of Lima.

2.2.1 UNIVERSITY EDUCATION IN THE NINETEENTH-CENTURY

In the 19th century, many governments reorganized and nationalized universities, as in Italy after unification (1870), in Spain (1876), and in France, where 17 autonomous regional universities were established after 1876. By 1900 many universities were secularized in administration and curriculum, and religious tests had been largely eliminated (in England by act of Parliament in 1871). Through the centuries, the majority of women were educated in separate institutions; however, since 1870 the benefits of coeducation have impelled nearly all universities to admit both sexes. In the United States, modern universities developed during the late 19th century from the expansion of private colleges and the establishment of state tax-supported universities. Largely as a result of the Morrill Act (1862), public lands were granted to the states for the formation and support of state agricultural and mechanical schools (see land-grant colleges and universities). Another important influence at that time was the founding of institutions (e.g., Johns Hopkins University.) devoted to graduate study and research. They were modelled on the German universities, with their separate graduate and professional schools each devoted to a particular area of study.

2.2.2 TWENTIETH AND TWENTY-FIRST CENTURIES

Since the early 20th century universities have played an increasingly important role in scientific and technical research, largely as a result of social and governmental demands for these services. The nationalization and bureaucratization of research functions has been especially marked in the United States, where various government agencies dispense large amounts of money to both public and private universities for research purposes. The federal government also provides direct aid to various categories of students, such as veterans and disadvantaged students.

Since World War II there has been worldwide proliferation of new universities, expansion of old ones, and merging of small institutions into larger university systems. As former colonies gained independence during the 1960s and 1970s, each struggled to define its specific

educational needs and establish a university system. In Africa, for example, universities were established in Ghana and Nigeria in 1948, in the Côte d'Ivoire in 1959, and in Congo (Kinshasa) in 1971. Further proliferation has occurred as a result of the desire for political equality. Educational reforms in Japan, for example, have decreed that there must be at least one national university in each of 47 sections of the country, so that there are now 86 such institutions. Similar pressures operated in Great Britain, where seven new universities were established in the 1960s alone, and in the United States, where the State University of New York grew from a small group of teacher training colleges in 1948 to a multi-campus system with some 460,000 students in 2010.

The rise of the Internet has led to the development of online instruction, one result of which has been the rise of educational institutions that teach most of their classes online.

2.3 EVOLUTION OF UNIVERSITY EDUCATION IN NIGERIA

The government has majority control of university education in Nigeria. The Federal Government of Nigeria has adopted education as an instrument for national development. First year entry requirements into most universities in Nigeria include: Minimum of SSCE/GCE Ordinary Level Credits at maximum of two sittings; Minimum cut-off marks in Joint Admission and

Matriculation Board Entrance Examination (JAMB) of 200 and above out of a maximum of 400 marks are required. Candidates with minimum of Merit Pass in National Certificate of Education (NCE), National Diploma (ND) and other Advanced Level Certificates minimum qualifications with minimum of 5 O/L Credits are given direct entry admission into the appropriate undergraduate degree programs. Students normally enter university from age 18 onwards, and study for an academic degree (Wikipedia, 2015). Historically, there is a distinct degree among universities, these include:

2.3.1 FIRST GENERATION UNIVERSITIES

Five of these Universities were established between 1948 and 1965, following the recommendation of Ashby Commission set up by the British Colonial Government to study the needs for university education for Nigeria. These universities are fully funded by the Federal Government. They were established primarily to meet the manpower needs of Nigeria and set basic standards for university education in the country. These universities have continued to play their roles for manpower developments and provisions of standards, which have helped to guide the subsequent establishments of other generations and states

universities in Nigeria. Such universities include the University of Nigeria Nsukka and the University of Ibadan.

2.3.2 SECOND GENERATION UNIVERSITIES

With the increasing population of qualified students for university education in Nigeria and the growing needs for scientific and technological developments, setting up more universities became imperative. Between 1970 and 1985, 12 additional universities were established and located in various parts of the country.

2.3.3 THIRD GENERATION UNIVERSITIES

The need to establish Universities to address special areas of Technological and Agricultural demand prompted the setting up of 10 additional Universities between 1985 and 1999.

2.4 THE SCHOOL OF ARCHITECTURE

The overall philosophy of the training programme in the School of Architecture is usually to produce competent, skilled and versatile graduated capable of understanding the society's need for shelter and translating this need into an appropriate built environment. The Architect is seen as an "organization man" rather than an individualist and heroic designer. Accordingly he has to think and act comprehensively, more so than any other member of the environmental design team to create a total work which can be defined as an amalgam of intent, skill, technology, material, personal insight and special moment in time; in doing this, his basic tools are a set of clearly defined ends and an effective command of means plus the skill to achieve determine ends, in specific cases, aptly and economically in the design context agreed. The programme also seeks to ensure the technological capability of the graduates to face a broad spectrum of challenges of the environment for human and other activities especially through self-reliance. The products of this programme would be capable of practicing on their own or be engaged in the industry and the public sector.

2.4.1 AIMS AND OBJECTIVES OF ARCHITECTURAL EDUCATION PROGRAMMES

An Architectural Education programme should be committed to:

a. A high-quality of professional education aimed at producing Architects capable of understanding and solving complex technical and environmental problems as well as applying the knowledge to tackle and co-ordinate other related professional inputs in the development of the environment;
b. The infusion in the student of an understanding of the context of the design and construction in physical, cultural, social, economic and technological terms;

c. Equipping the student with adequate knowledge, creativity, specialised skills and leadership capabilities that will enable the graduate to co-ordinate and control the design and construction processes and inputs thereto by allied professionals and executors;

e) Producing Professional Architect, capable of undertaking the whole range of Architectural design activities from schematic design through working and drawing to construction detailing and workshops drawing production.

2.5 SPACE SYNTAX

Space syntax is a theory about space and human behaviour, which, together with tools and methods for analyzing human interaction in the built environment, examines the impact of accessibility in spatial layouts on behaviour, communication and interaction (Hillier, 2007).

2.5.1 EVOLUTIONAL BACKGROUND OF SPACE SYNTAX

Space syntax originated as a research method in the 1970s at the University of London as a way to record movement and interaction within cities and buildings. The set of analytical techniques called “syntactic” were used by Hillier and Hanson in The Social Logic of Space (1984) to explore the impact of space on social behaviour and relationships. Since that time, it has developed into a coherent body of literature about human social interaction in the built environment.

Research and publication shows that earliest space syntax works focused on real environments and tried to identify the intrinsic nature of built environments. By developing consistent techniques for the representation and analysis of spatial patterns, recent space syntax works attempt to simulate spatial design proposals and arrive at a basis for predicting how they would work. "Space syntax research is reason based, but it has effectively led to the study of architectural intuition through its creations. In practice, design proceeds by mixing intuition and reason. Space syntax makes the deployment of non-discursive intuition more rational and therefore more discursive "(Hillier and Hanson, 1984).

Space syntax methods were first developed to compare the similarities and differences between built environments at both building interior and urban neighbourhood scale. Research using these techniques has found that both pedestrian and vehicular movement rates are strongly correlated with certain measures of the graph of the line map

Since the representation captures nothing except the geometry of the configuration of space in the environment, its ability to predict movement rates brings into question the degree to which the location and strength of attractors or generators of movement are central to observed movement behaviour patterns. Hillier et al. (1987) argued that the logical view is that configuration leads to a pattern of movement.

In response to this problem of obtaining a rigorous axial map, Hillier joined with A. Turner and A. (Penn, 2005) proposed an algorithmic definition of the axial map which articulated a definition and methodology to obtain a unique map. The new approach establishes an all-line axial map based on the research done by Penn et al (1999)

Space syntax methods use shape recognition to generate a topological or theoretic formal model of spatial configuration. Spatial configuration is simply the space where people can walk and that is always represented on plan. By decomposing the space on plan to its constituent units of analysis and giving these units numeric tags, the method helps identify both patterns and their variations in order to decode spatial ordering and relate these codes to underlying social and economic logic (Kerstin and Penn, 2007)

It should be kept in mind that space syntax does not reduce to a set of design guidelines nor is it a design method or generator. In this context, it is a way of testing design hypotheses insofar as these take spatial form. It has also been applied to a wide variety of building and urban spatial types including urban design, health care facilities, factories, housing, neighbourhoods, research laboratories, and schools, corporate and professional offices. It has been used to analyze shopping centres (Brown, 1994).

The basic premise of space syntax is that it is possible to identify certain underlying structures of space that are linked to observable patterns of behaviour and that these patterns, in turn, create social function, whether generative or reproductive (Peponis and Wineman: 1998.p. 272). The distinctive characteristics of societies are expressed in spatial systems. Knowledge is conveyed through space itself, and through the organization of spaces. So spatial configurations not only "generate social interactions in built environments," but they "express a social or cultural meaning".

The property of accessibility is critical in space syntax, and suggests the common spatial foundation upon which diverse social effects rest. At the foundation of space syntax are premises concerning how boundaries and connections of built space define the way people behave and relate to one another. Built space is to be understood as a relational pattern, a pattern of distinctions,

separations, interfaces, and connections; a pattern that integrates, segregates, or differentiates its parts in relation to each other. (Peponis and Wineman: 1998. p.271). Space has a 'social logic' inasmuch as these relational patterns affect every day behaviour, contributes to structuring social relationships, "and the way in which society and culture become intelligible through their spatial forms." (Peponis and Wineman: 1998, p.271). Analysis to date suggests that the social meaning of space is carried by topological rather than shape-specific relationships.

The physical layout of rooms, corridors and vertical connections exerts a strong influence over patterns of movement in large complexes, environments, museums and galleries. Understanding the effects of spatial layout on visitor activity allows design proposals to be generated that facilitate accessibility people. Space syntax is a growing theoretical interest with many practical design applications. It reveals hidden design barriers in older spatial layouts and in architectural education. As Sonit Bafna describes, space syntax is 'best described as a research program that investigates the relationship between human societies and space from the perspective of a general theory of the structure of inhabited space in all its diverse forms: buildings, settlements, cities, or even landscapes (Bafna, 2003, p. 17-29).

2.5.2 THEORETICAL PERSPECTIVE OF SPACE

The earlier works of Hillier and Hanson defined two basic theorems to illustrate how space works socially. The first, which views space as "generative" because social rules and practices do not need to be invoked to account for movement according to spatial configuration, deals with linear spaces of circulation and movement. The second theorem describes space as "reproductive," and applies to use spaces, component spaces of building types that contribute to on-going reproduction of social relations.

The first theorem states that a building is a system carrying movement within and between all spaces it contains. Those spaces most directly connected to every other space in the system will have higher density of movement: The first corollary, the theory of "natural movement", states that the spatial configuration governs the distribution of movement (Hillier et al, 1993).

The second corollary, the theory of "virtual community," says that movement within a space generates a pattern of co-awareness and co-presence. The third corollary suggests that types of space use will be located according to their relative dependence on social movement (Hillier, 1998). Spaces like retail businesses must be located in areas of higher movement, while residential spaces need less movement.

The second theorem applies to common components of common building types, defined by activity “dining room”, social rule “private room”, and function “reception area”. The theorem suggests that the labels attached to social programs within spaces inform us of their function and sustains a stable, if abstract, spatial relationship contributes to the reproduction of social schema (Hillier, 2007). The patterns of relationships within these spaces are intuitively known, although they might vary from design to design. According to social expectations, some labelled spaces, or rooms, would be more accessible than others (living room as opposed to bedroom).

Summarily, architecture has several definitions but all describing ordering of space and the built environment where human activities take place. (Hillier, 2007) in his later work defined architecture in this context as the taking into reflective thought of the non-discursive, or configurationally, aspects of space and form in buildings. Spatial and formal configuration in buildings ceases to be a matter of cultural reproduction and becomes a matter of speculative and imaginative enquiry.

It follows from this definition that architecture is an aspiration (Hillier, 2007). To bring to conscious thought the principles that underlie the spatial and formal patterns that transmit culture through buildings. It requires not only the conceptualization of pattern and configuration in vacuous, but also comparative knowledge and reflective thought. This is why architecture is a reflective as well as an imaginative project, one which seeks to replace or at least to add to the social knowledge content of building with an enquiry into principle and possibility.

Architectural theory is the ultimate aim of this reflection. An architectural theory is an attempt to render one or other of the non-discursive dimensions of architecture discursive, by describing in concepts, words or numbers what the configurational aspects of form or space in buildings are like, and how they contribute to the purposes of building. In a sense, theory begins at the moment architecture begins, that is, when spatial and formal configuration in buildings, and their experiential and functional implications, are no longer given through a tradition of social knowledge transmitted through the act of building itself. As soon as building moves free from the safe confines of cultural programming, something like a theory of architecture is needed to support the creative act by proposing a more general understanding of the spatial and formal organization of buildings than is available within the limits of a single culture.

The need for theory becomes greater as architecture advances. Theory is most required when architecture becomes truly itself, that is, when it becomes the free exploration of formal and spatial possibility in the satisfaction of the human need for buildings. For a scientist a theory is a rational

construct intended to capture the lawfulness of how the world is, not a set of guidelines as to how it should be. Scientific theories help us act on the world, but only because they have first described the world independently of any view of how it should be. The essence of science is that its theories are analytic, not normative in intent. They describe how the world is, not prescribe how it ought to be.

Therefore, the difference between architectural and scientific theories, namely that scientific theories are analytic, and about understanding how things are, whereas architectural theories are normative, and about telling us what to do. (Hillier, 2007). Admittedly, architectural theories are normally presented in normative form, but at a deeper level they are no less analytic than scientific theories. Design is of course only a part of the protracted processes by which buildings come into existence. The 'building process' involves formulating a need for a possible building, conceptualizing what it might be like, initiating a process of resourcing, negotiating and organizing, creating some kind of representation, or series of representations of increasing refinement, of what the building will be like, then constructing, fitting, operationalizing, and finally occupying the completed building.

2.5.3 METHOD OF SPACE SYNTAX ANALYSIS

Although Hillier and Hanson first developed syntactic analysis to understand the behavioural impact of space, they strove to describe space and spatial relationships separately from their use. Accessibility is a function of the number of direction changes made, the number of boundaries crossed, or the number of spaces traversed and, in the more recent work, metric properties. Hillier's early work followed Thiel (1970), who coded patterns of behaviour and perception, including Lynch's (1960) parameters of urban space (districts, nodes, edges, paths, and landmarks). Thiel's notational system described the elements defining space, their relational patterns, and spatial connections.

Space Syntax is a spatial analysis theory, (Hillier and Hanson, 1984 & 1987) defines it as a theory and method for investigating and analyzing space relation. The main theoretical assertion is that building forms are embodied in social norms of societies. Thus, according to Hillier (2007), analyzing and interpreting spatial qualities of artefacts reveal the social rules that regulate the interface among people. However, it has a strong philosophical foundation and mathematical base of evaluation tools.

The Space Syntax Theory is a tool for architects to explore the relationship between spatial configuration and social form. It has also been used successfully as a design tool to explore and understand, during the design process, possible effects of design ideas on people interaction with space. The Space Syntax Theory studies how spatial configurations embody social or cultural meanings and how a spatial configuration itself is able to generate or inhibit social interactions in built environments. Its basic concepts forms the raw material for design ideation, as ideas to think with, imaging spaces and understanding how they will really work from the point view of social interactions. Space Syntax is as useful during the design process as for a post evaluation of built spaces (Hillier, 2005) and it has the ability to make the deployment of intuition during the design process more rational and therefore more discursive (Hillier and Hanson, 1997).

There are two approaches to the analysis of spatial syntax: examining patterns of connections (graph-based), and analyzing perceived spatial relations (geometry-based). Graphs consist of nodes (vertices) and edges (lines). In the graph-based system, the "integration" of a space, a measure of its accessibility or centrality, is expressed as "distance," so that a more integrated space is less distant from other spaces. Since the system standardizes these measures, spaces can be compared to one another or to ideal regular patterns known as benchmarks (Hillier, 1998). However, analysis of open spatial plans with ambiguous boundaries is more difficult than cellular plans. Spaces are classified as one-dimensional paths of movement or as places inviting prolonged occupation. Understanding the social information contained in plans links "geometric intuition with our intuition regarding the human dimensions of inhabiting space" (Peponis, Wineman, Bafna, Rashid and Kim, 1998. p.274).

Perception-based approaches to analysis of space syntax include axial maps, convexity, and visibility polygons. Axial maps, or linear representations, describe all the ways to move around a spatial layout to reach other spaces (Batty, 2004; Turner et al., 2001). Lines represent movement within a space (Peponis et al, 1998). Archaea's (1977) early work on visual fields demonstrated behavioural correlates, showing that people position themselves within a space according to their preferences for seeing (visual access) or being seen (visual exposure), so the environment is a place that concentrates or diffuses information.

2.5.4 SPACE SYNTAX-BASED ACCESSIBILITY

Human movement is frequently described in an abstracted form using its topology. Topological description allows researchers to focus on the structural relationship among units of movement while disregarding the details of phenomena. For example, pedestrian movement can be described using network of simple lines without considering the details such as sizes of forms, number of people and speed of movement. Such network configuration is also referred to as graph, which is a way to represent a network by a set of vertices and a set of edges that connects pairs of vertices.

However configuring spaces in space syntax is different from that of street network. In space syntax, when converting the continuous space into a connected set of discrete units, it uses the concept of convex space partitioning or simply axial mapping. The procedure to generate the convex map involves taking a given spatial structure and partitioning it into a set of "fewest and fattest" convex spaces. The procedure for generating the convex maps is iterative, starting with the identification of the fattest of the convex spaces and then progressively identifying the next largest one until the entire area is subdivided into a set of convex spaces. Then, the axial map can be drawn on this convex map by laying down the longest strait lines that passes through theses convex spaces (Figure 2.5). On the other hand, traditional way of abstracting street network follows different procedure. It generally uses centre lines of streets. Whenever two centre lines intersect each other, an intersection is created (Figure 2.5). When representing the configured lines as a graph, space syntax represents each line by a node and each intersection as an edge, while in traditional method, the situation is vice versa, that is, an intersection becomes a node and a line connecting two nodes becomes an edge. The resulting axial lines in the axial map can be regarded as the fewest number of visual paths in the existing space where each intersection plays as a turn of sight, which becomes a depth as described previously.

Thus, in space syntax, only the number of turns along a path rather than actual journey length is counted. The cost such as distance or travel time along an edge is not regarded as significant factor in space syntax. Therefore, the concept of the depth should not be interpreted as the accessibility of a space; rather it is closer to the connectivity. Although accessibility is often used interchangeably with connectivity, network analysis literature conventionally refers to it as an index that measures relative nearness of a place to another while considering connectivity the linked characteristics in the network between places. Accessibility mostly incorporate the concept of costs such as distance and time required to move between places. Some literature uses the term of geometric accessibility to refer to depth-based connectivity of spaces.

2.6 FUNCTIONAL DESIGN APPROACHES TO SCHOOL BUILDING

2.6.1 LINEAR SPATIAL SYSTEM OF PLANNING

It essentially consists of a series of spaces directly related to one another, or linked through a separate and distinct linear space (Dara-Abrams, 2006). It consists of repetitive spaces that are alike in size, form, and function. It can also be a linear space that organises along its length, a series of spaces that differ in size, form and function. In both cases, each space along the sequence has an exterior exposure. Because of it characteristic length, it expresses a direction and signifies movement, extension and growth. To limit its growth, linear spatial system can be terminated by an elaborated or articulated entrance, or merging with another building form or topography of its site.

The system is inherently flexible and can respond readily to various conditions of its site. It can adapt to changes in topography, manoeuvre around a body of water or a stand of trees, or turn to orient its spaces to capture sunlight and views. It can be straight, segmented, or curvilinear. It can run horizontally across a site, or diagonally up a slope, or stand vertically as a tower. Figure 2.1.

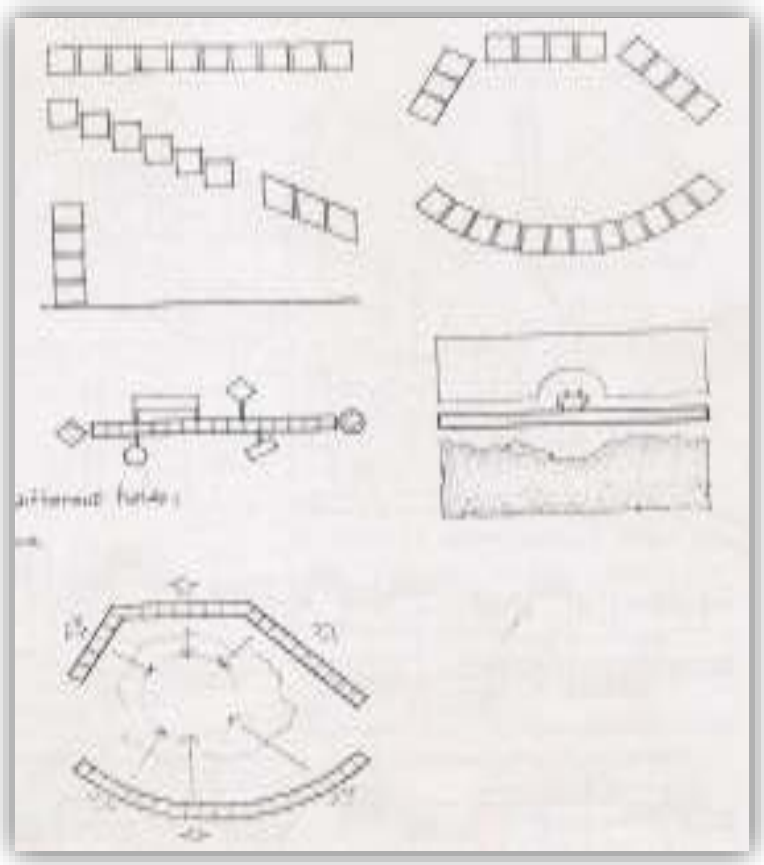

Figure 2.1: Linear System of Planning.

Source: Dara-Abrams (2006).

2.6.2 CENTRALISED SPATIAL SYSTEM OF PLANNING

A centralised organisation of space is a stable, concentrated composition of a number of secondary spaces grouped around a large, dominant, central space (Dara-Abrams, 2006). The central, unifying spatial system is generally regular in form, and large enough in size to gather a number of secondary spaces about a form. The secondary spaces of the system may be equivalent to one another in function, form and size, and create an overall configuration which is geometrically regular and symmetrical about two or more axes. The secondary spaces may be different in form, size as a response to their requirements of function, importance and context. Circulation patterns within a centralised organisation maybe radial, loop, or spiral in form. However, the pattern will terminate in the central space. Figure 2.2 and 2.3.

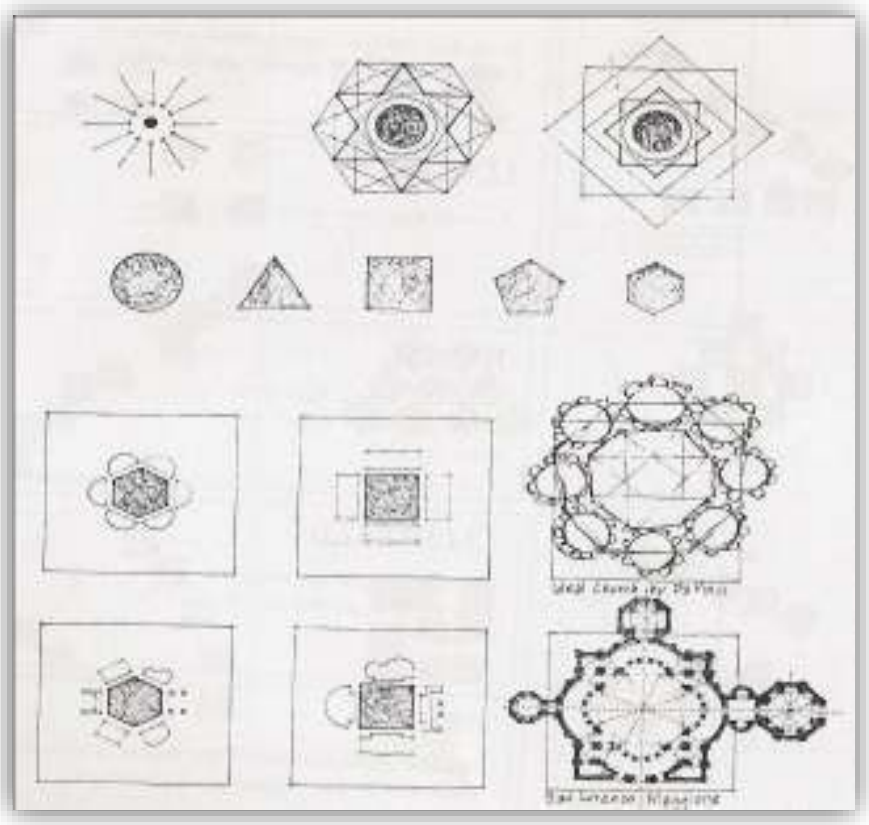

Figure 2.2: Centralised organizational System of Planning.

Source: Dara-Abrams (2006)

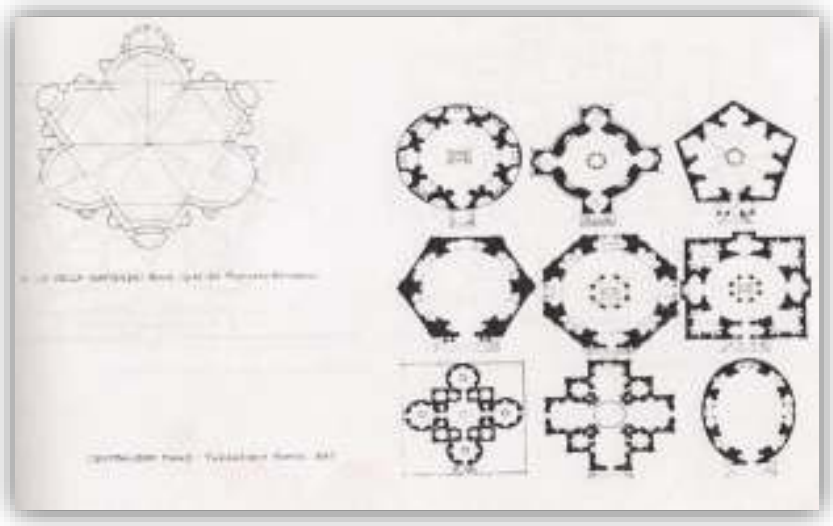

Figure 2.3: Centralised System of Planning.

Source: Dara-Abrams (2006)

2.6.3 RADIAL SPATIAL SYSTEM OF PLANNING

It is a composition of both linear and central spatial system. It has a dominant central space from which a number of linear spaces extend in a radial manner (Dara-Abrams, 2006). Whereas centralised spatial system is introverted, radial is extroverted. With its linear arms, it can extend and attach itself to specific elements or features in the site. The radiating arms can also differ from one another to respond to their individual requirements of function and context (Figure 2.4 and 2.5.)

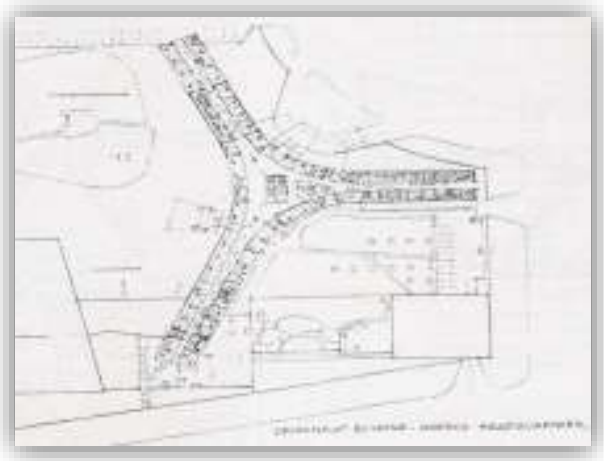

Figure 2.4: Radial System of Planning.

Source: Dara-Abrams (2006)

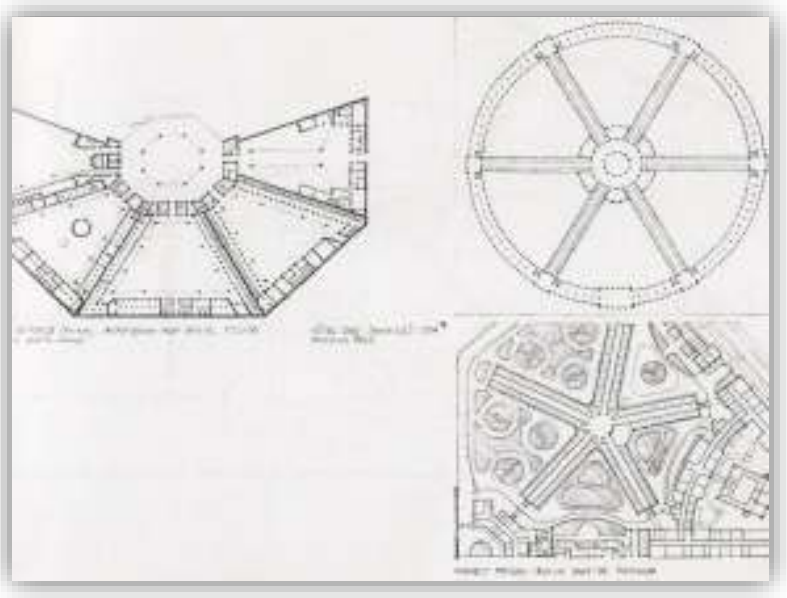

Figure 2.5: Radial System of Planning

Source: Dara-Abrams (2006)

2.6.4 GRID SPATIAL SYSTEM OF PLANNING

It consists of forms and spaces whose positions, spaces and relationship with one another are regulated by a 3-D grid pattern (Dara-Abrams, 2006). It is created by establishing a regular pattern of points that define the intersections of two sets of parallel lines. Projected into the third dimension, the grid pattern is transformed into a set of repetitive, modular units of space.

To accommodate the specific dimensional requirements of its spaces, or to articulate zones of space for circulation, a grid can be made irregular in one or two directions. A grid can also undergo other transformations. Portions of the grid can slide to alter the visual and spatial continuity across its field. A grid pattern can be interrupted to define a major space. A portion of the grid can also be dislocated and rotated about a point in the basic pattern (Figure 2.6).

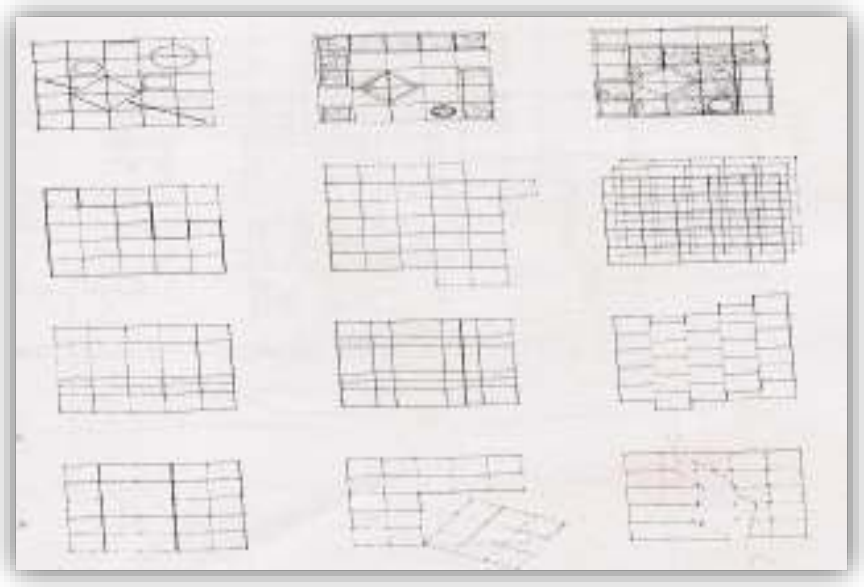

Figure 2.6: Grid System of Planning

Source: Dara-Abrams (2006)

2.6.5 CLUSTERED SPATIAL SYSTEM OF PLANNING

It uses proximity to relate spaces together. To a degree, it consists of repetitive, cellular spaces that have similar functions, and share a common visual trait such as shape or orientation. To another degree, it can accepts within its composition spaces that are dissimilar in size, form, and function, but related to one another by proximity and a visual ordering device such as symmetry or an axis (Dara-Abrams, 2006). Because it does not originate from a rigid geometric concept, the form of a clustered spatial system is flexible, and can accept growth and change readily without affecting its character.

Clustered spatial architecture can be organised about a point of entry into a building, or along the path of movement through it. The spaces can also be clustered about a large, defined field or volume of space. This pattern is similar to that of a centralised spatial system, but it lacks the latter's compactness and geometric regularity. The spaces of a clustered system of planning can be contained within a defined field or volume of space.

Since there is no inherent place of importance within the pattern of a clustered system, the significance of a space must be articulated by its size, form, or orientation within the pattern. Symmetry or axial condition can be used to strengthen and unify portions of a clustered system and help articulate the importance of a space or group of spaces within the system.

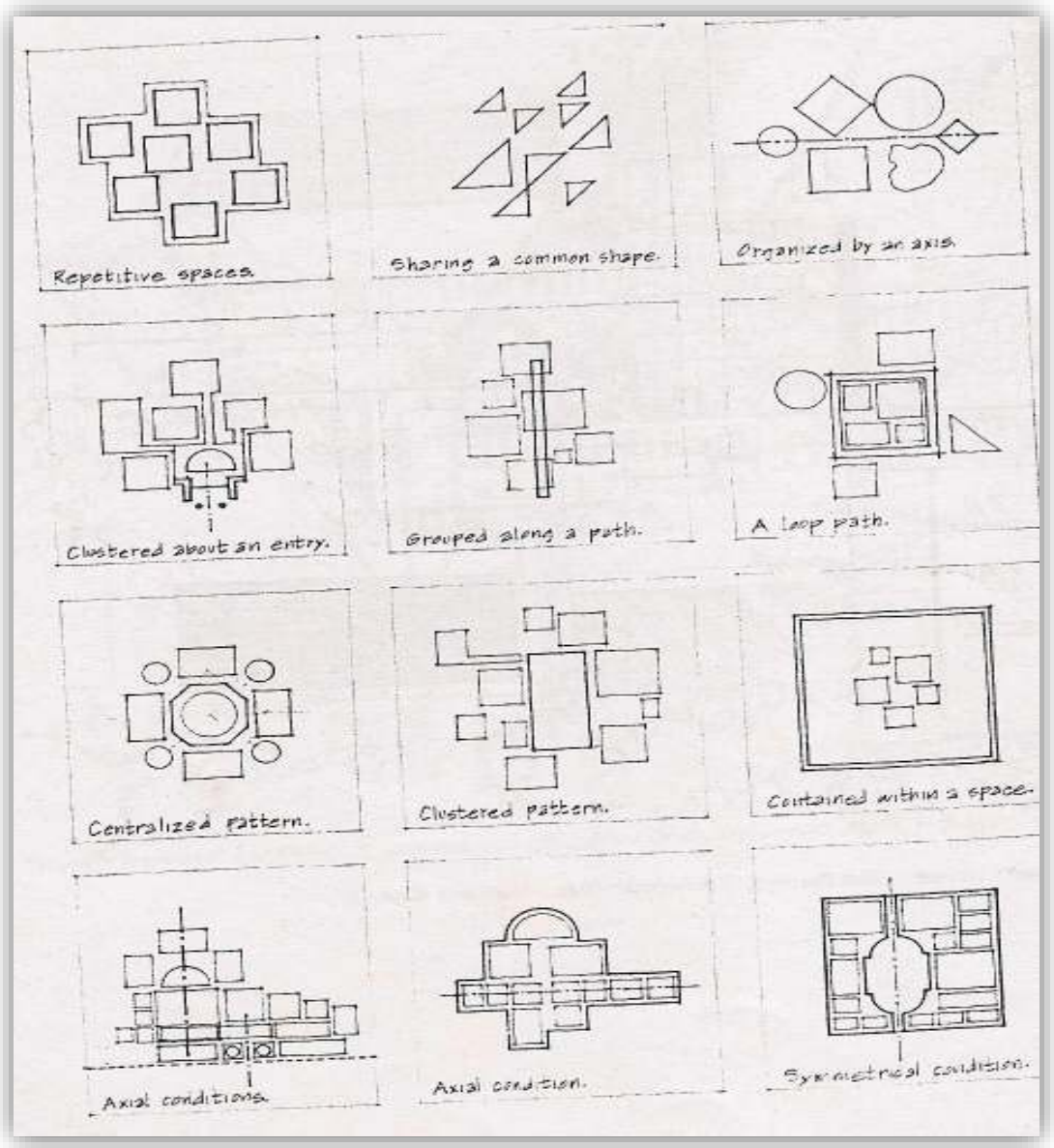

Figure 2.7: Clustered System of Planning.

Source: Dara-Abrams (2006)

CHAPTER 3

3. CASE STUDIES

For the purpose of this research, four case studies are carried out on some existing faculty of environmental sciences in three different Nigerian Universities and one foreign University. The case studies carried out are to serve as existing example or as a guide towards achieving a realistic design and also to learn through their analysis, the merits and demerits of their design so that the proposed design might inculcate some of these merits and then improve on the demerits especially in attaining a Neolithic unit designed form.

The Case studies are however carried out on school (faculty) of Environmental Studies of the following universities;

i. Faculty of Environmental Design, Ahmadu Bello University. Zaria.
ii. Faculty of Environmental Studies, University Of Nigeria, Enugu Campus
iii. Faculty of Environmental Studies, University of Uyo, Uyo, Akwa Ibom State.
iv. Harvard Graduate School of Design, Architecture and Planning, Harvard University, Cambridge, Massachusetts

3.1 CASE STUDY ONE: FACULTY OF ENVIRONMENTAL DESIGN, AHMADU BELLO UNIVERSITY, ZARIA.

Architectural education in Nigeria did not start until 1952 in at the then College of Technology, Ibadan. It was later transferred to Zaria and integrated into the Amadu Bello University, Zaria in 1955. The programme of instruction in Zaria was until 1969, modelled along the Royal Institute of British Architects (RIBA) pattern of architectural education (Olotuah and Adesiji, 2000).

The school was founded during the period when architectural education in Europe was undergoing a serious setback, and it became increasingly difficult to resolve the educational objectives of the new department of architecture. It was obvious, however, that there was no serious intention behind the objectives to train architects to the professional level.

In the 1960/61 session, the first generation of Nigerian architects were produced. At the end of the 1968/69 session, connection with the RIBA was severed and replaced by the Nigerian Institute of Architects (N.I.A.) in its professional field, and as a result, the educational schemes was restructured so as to meet the countries demands (Amole, et al., 2000). The educational programme being run has from year to year been updated to meet the changing needs of both the

students and the society. Today, the school has grown to the level of having architecture, urban/regional planning, estate management, surveying, and building under the faculty of environmental studies.

The departments within the faculty are Architecture, Building Technology, Urban and Regional Planning, Industrial Design and Fine Art. The initial planning concept was not to accommodate all the various departments, the department of Architecture and Building was the major consideration because they take group courses in structures, building law and services. The building also served department and students of Acoustics and Electrical installation. The other relationship is between Fine Arts and Industrial Design departments. Their students take combined courses in Art Education and Art History. These two departments are housed in one building. The sculpture garden in front of the department is a constant source of attraction to the students and visitors, even though the works have overcrowded the garden. The overcrowding of the departments is also evident in the various studios, due to the increase in the number of students and the introduction of new specialised courses which were not considered in the original plan of the building design.

3.1.1 DESCRIPTION OF THE BUILDING

The building is constructed of reinforced concrete. The floors are of precast concrete rib flooring elements. The columns of the main building structure are flared towards the ground while taper towards the upper floors. The roof is of the same precast flooring elements due to the fact that the main painting studio is on the roof top of the building. The studio does not cover the whole expanse of the floor area, and thus. There is a roof terrace where painting students can use for outdoor painting of landscapes of the university environment.

The department of building technology and urban and regional planning share the same building. The building structure is that of a double cantilever frame structure of reinforced concrete. The floor is also of reinforced concrete spanning one way between the cantilevered frames. The roof structure is of steel angles roofed with aluminium sheets. The building also houses the project office of the faculty on the top floor.

3.1.2 MERITS

1. The faculty has a 70% functional relationship grade. An important thing is that all the departments in the faculty are located with a zone. It juxtaposes linear and clustered spatial systems.

2. The building is structurally balance considering the quality of materials used for the construction.

3. There is good ventilation and adequate illumination in the spaces provided.

3.1.3 DEMERITS

1. The entrance to the faculty is not well defined.

2. Staffs and students are exposed to inclement climate condition, if they have to move from fine and industrial art department to architecture and vice versa.

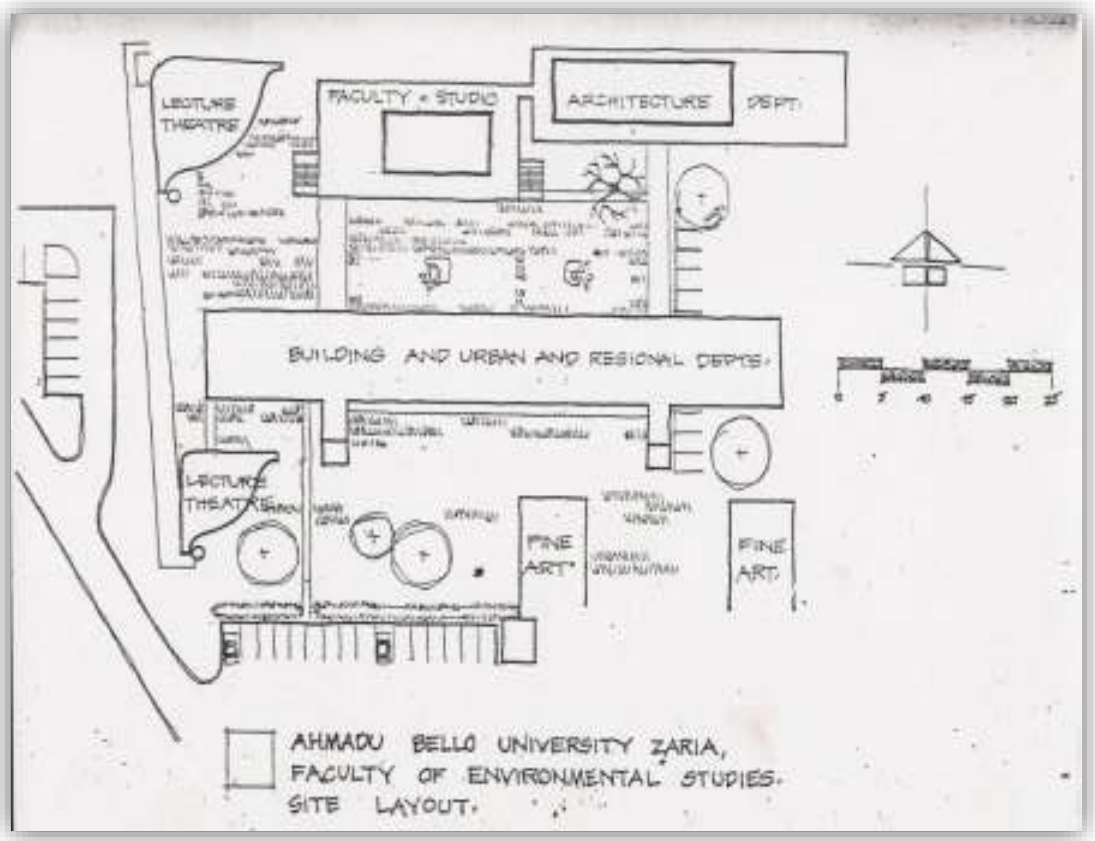

Figure 3.1: Site plan of the faculty of environmental studies, ABU, Zaria

Source: *Researcher's Field work (*2015)

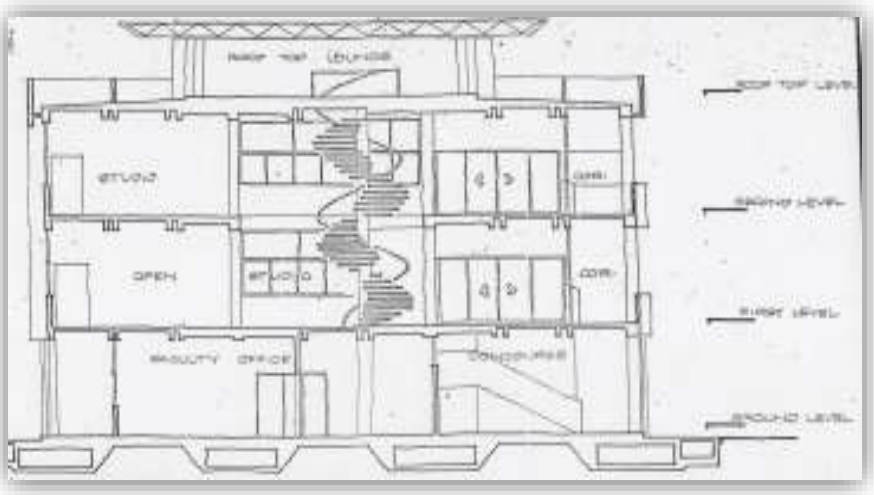

Figure 3.2: Section 1 through the faculty building, ABU, Zaria

Source: Researcher's Field Work (2015).

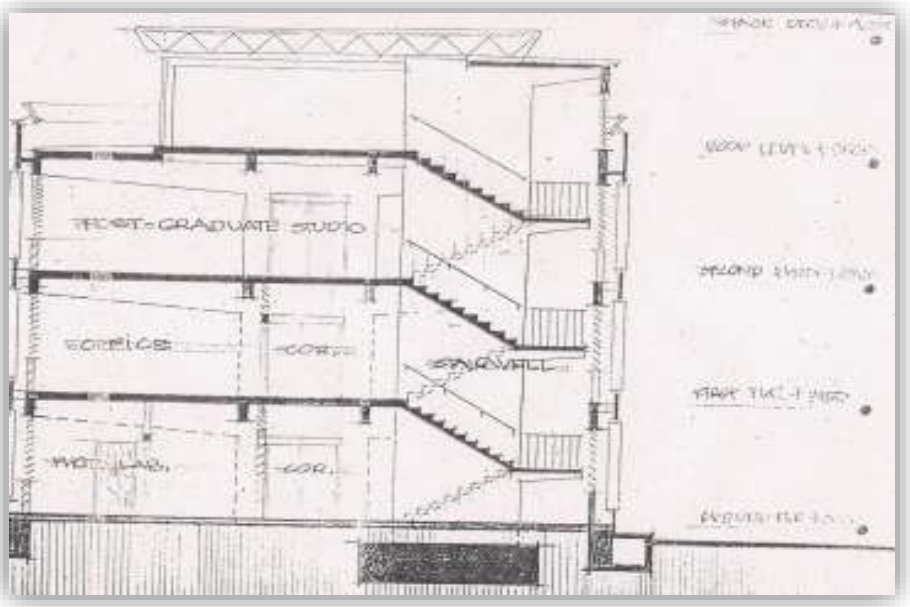

Figure 3.3: Section 2 through the faculty building, ABU, Zaria

Source: *Researcher's Field work (*2015)

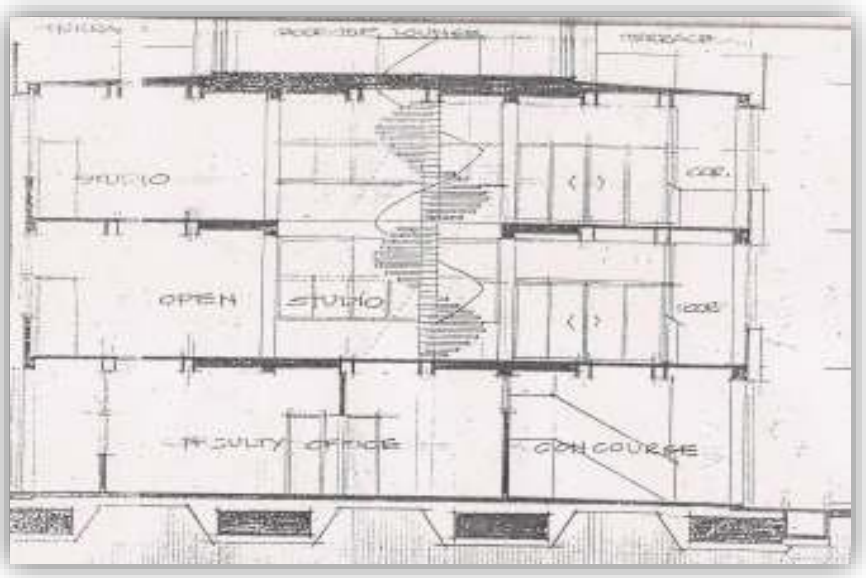

Figure 3.4: Section 3 through the faculty building, ABU, Zaria

Source- *Researcher's Field* work (2015)

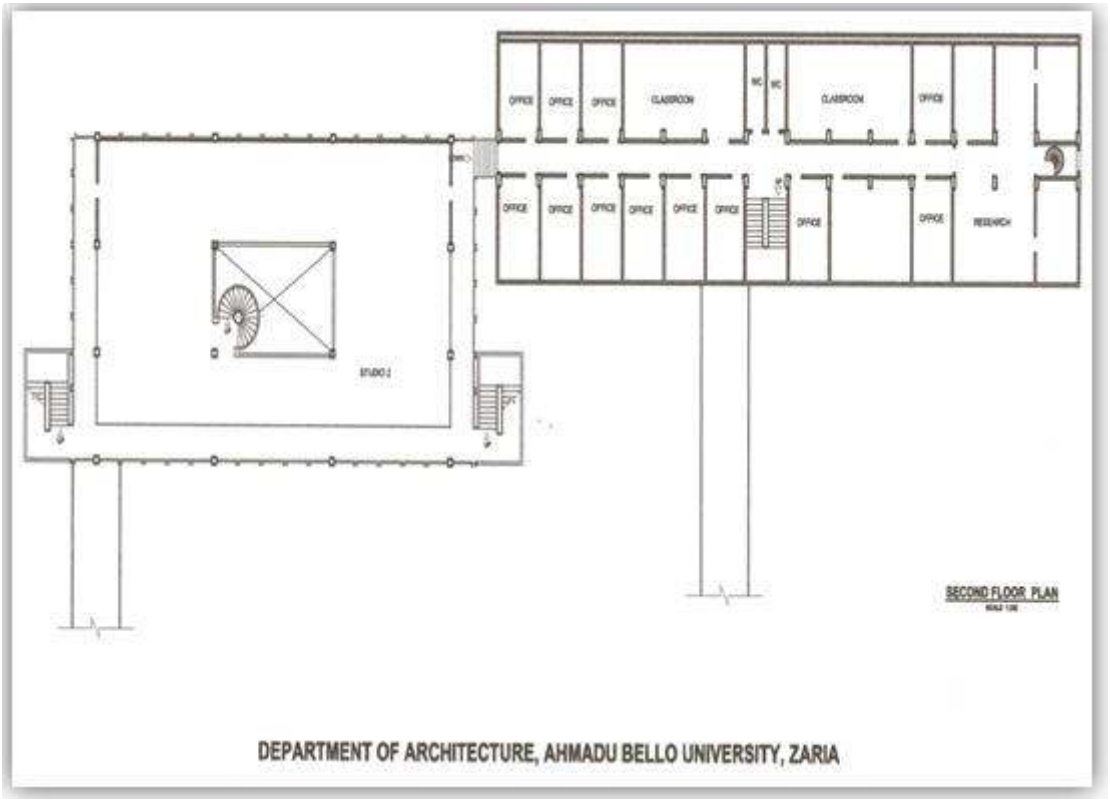

Figure 3.5: First floor plan of department of architecture, ABU, Zaria

Source- *Researcher's Field work (*2015)

Plate 3.1: Sculpture at Department of Fine Arts ABU Zaria

Source: Researcher's Field work (2015)

Plate 3.2: Department of architecture, ABU, Zaria

Source: *Researcher's Field work (*2015)

Plate 3.3: Studio interior of different design classes on different levels

Source: *Researcher's Field work (*2015)

Plate 3.4: Studio balcony that provide a place for creative social encounters

Source: *Researcher's Field work (*2015)

Plate 3.5: Studio balcony that provide a place for creative social encounters

Source- *Researcher's field* work (2015)

Plate 3.6: Bridged walkway that connects two wings of the department

Source- *Researcher's field work (*2015)

3.2 CASE STUDY TWO: FACULTY OF ENVIRONMENTAL STUDIES, UNIVERSITY OF NIGERIA, ENUGU CAMPUS

The University started full academic pursuit in 1956 and in 1966 the Faculty of environmental studies was established and shortly after the war in 1970 the department continued. The department then celebrated her new lecture offices, studios, and was the pride of the eastern region. The departments however have since experienced many constructions and reconstructions to bring it to what it is presently.

The school offer architecture at B.Sc., M.Sc., and Ph.D. levels. Architecture has six studios for the different levels. Four studios for B. Sc. I, II, III and IV, and two for M. Sc. I and II levels. The school also offer courses in Urban/Regional Planning—B. Sc. (URP), M. Sc. (URP), Ph.D. Estate Management- B. Sc. (ESM), M. Sc. (ESM), Ph.D. Surveying, geodesy and photogrammetry- B. Sc. (SVY), M. Sc. (SVY), Ph.D. Councils established under the laws of the Federal Republic of Nigeria. Following the rationalization of programmes and units in the University in 1986, the Faculty of Environmental Design was not only restructured but was also re-designated Faculty of Environmental Sciences with the following departments: Architecture and Design, Building, Estate Management and Geography & Planning. With further reorganization occasioned by the transfer of the academic programme in Geography to the Faculty of Social Sciences in 1997, the Faculty now consists of the following four departments: Architecture, Building, Estate Management and Urban & Regional Planning. University of Lagos started the study of architecture in 1972.

3.2.1 DESCRIPTION OF BUILDING

The building material for the wall is monolithic concrete blocks. It has mono-pitch roof. The building has effective sun shading devices. Building department of Architecture is made up of prefabricated materials. This helps in cooling the interiors of the building. The wood used is non-conductor; therefore, heat is not transferred, thereby cooling the interior. The challenge seen in the building is that, it is poorly lit. By 5.00pm, the studio is dark.

The amphitheatre in department of architecture is good for reading in the evening, as a rallying point for the students, but would have been better located with proximity to students in other departments. The use of courtyard in the design is excellent because it forms a means of checking excessive unfavourable environmental conditions. It helps in effective cross ventilation, natural lighting and a means of communicating with nature.

The circulation pattern is very cumbersome; students and lecturers travel too long distance to access facilities within the faculty. The main faculty building does not have enough parking spaces which results in casual and unwanted parking which results in the smaller drive way. The use of an amphitheatre to provide a place for out-side social interactivity is very unique.

The incorporation of the landscape into the design provided interest and a dramatic play of levels. The faculty has sufficient studio spaces and effectively uses courtyards for ventilation. The faculty has a scattered layout of offices and studios that are too far apart to connect. Studios are not properly naturally lit. Cross ventilation is a major challenge especially during the hot period of the year.

3.2.2 MERITS

1. Adequate landscape that provides interest and dramatic play of levels.
2. The form of the building makes it very easy for accessibility of the different spaces provided on all the floors.
3. Sufficient studio spaces within the faculty.
4. The form of the courtyard provided at the centre of the design increase circulation as all the corridors stems out of it.

3.2.3 DEMERITS

1. Inadequate illumination in architectural studio.
2. Inadequate parking lots within the faculty.
3. Scattered layout of offices and studios that are too far apart.
4. The circulation pattern is cumbersome, students and lecturers travel long distance to access facilities within the faculty.

Plate 3.7: Entrance Gate into University of Nigeria, UNEC

Source: *Researcher's Field Work (*2015)

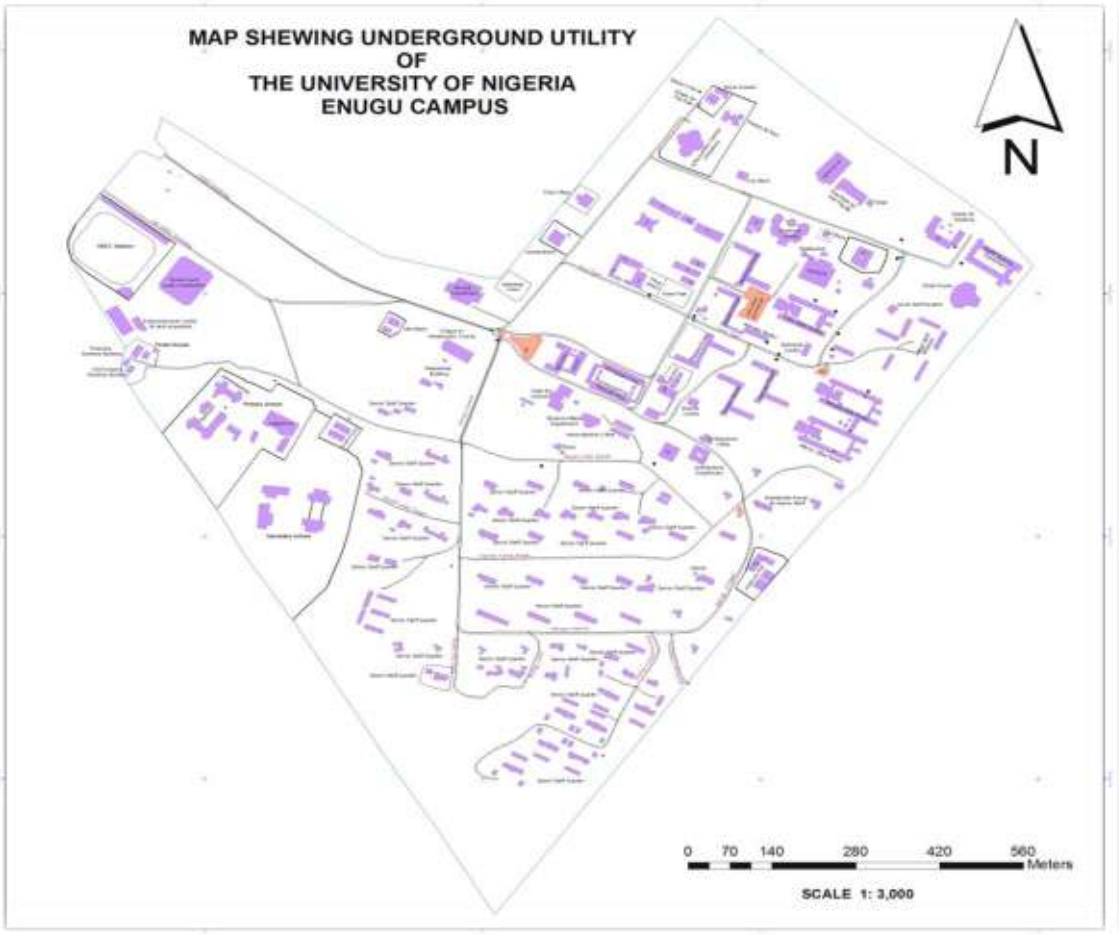

Figure 3.6: Map showing master plan layout of University of Nigeria, Enugu

Source: Survey department, University of Nigeria, Enugu campus 2012

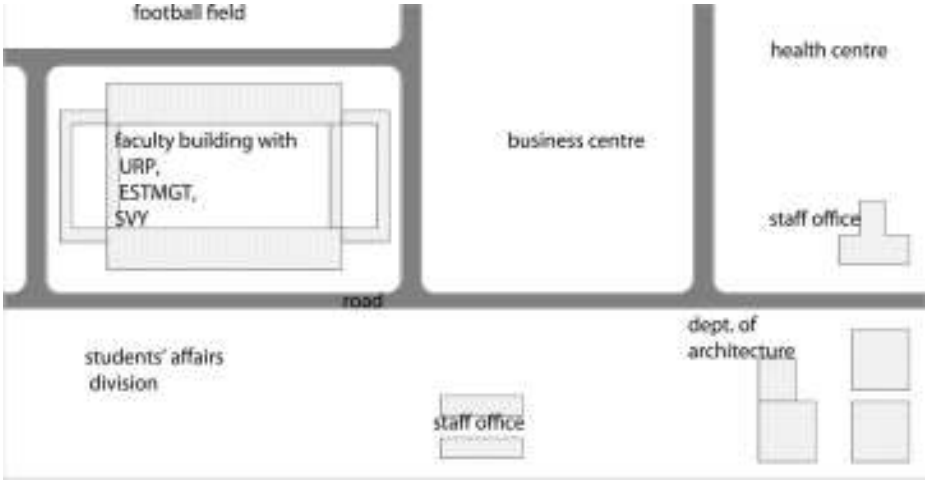

Figure 3.7: Site layout plan of faculty of environmental studies

Source: *Researcher's Field Work (*2015)

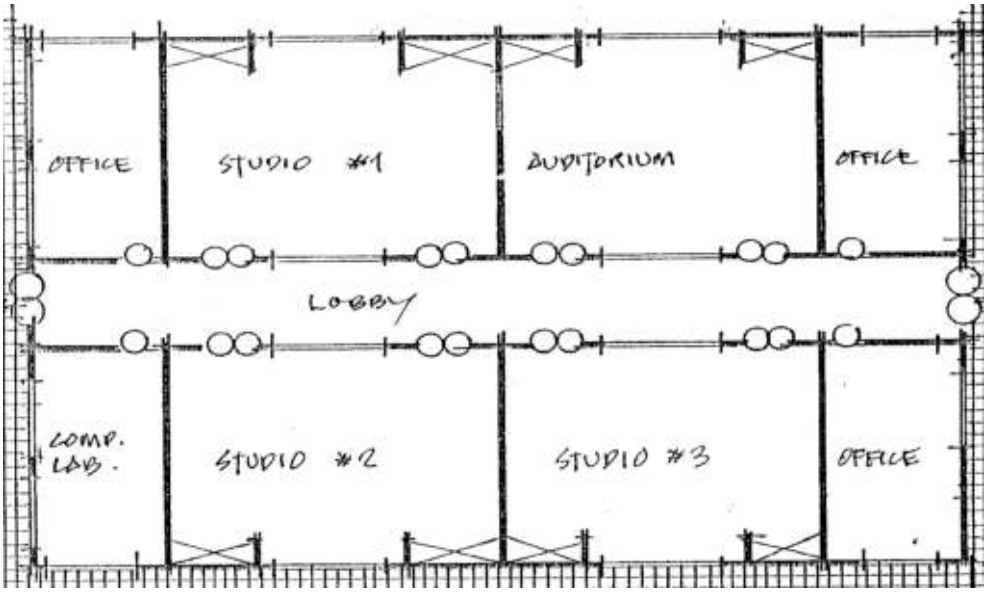

Figure 3.8: Ground floor plan of the department of architecture.

Source: *Researcher's Field Work (*2015)

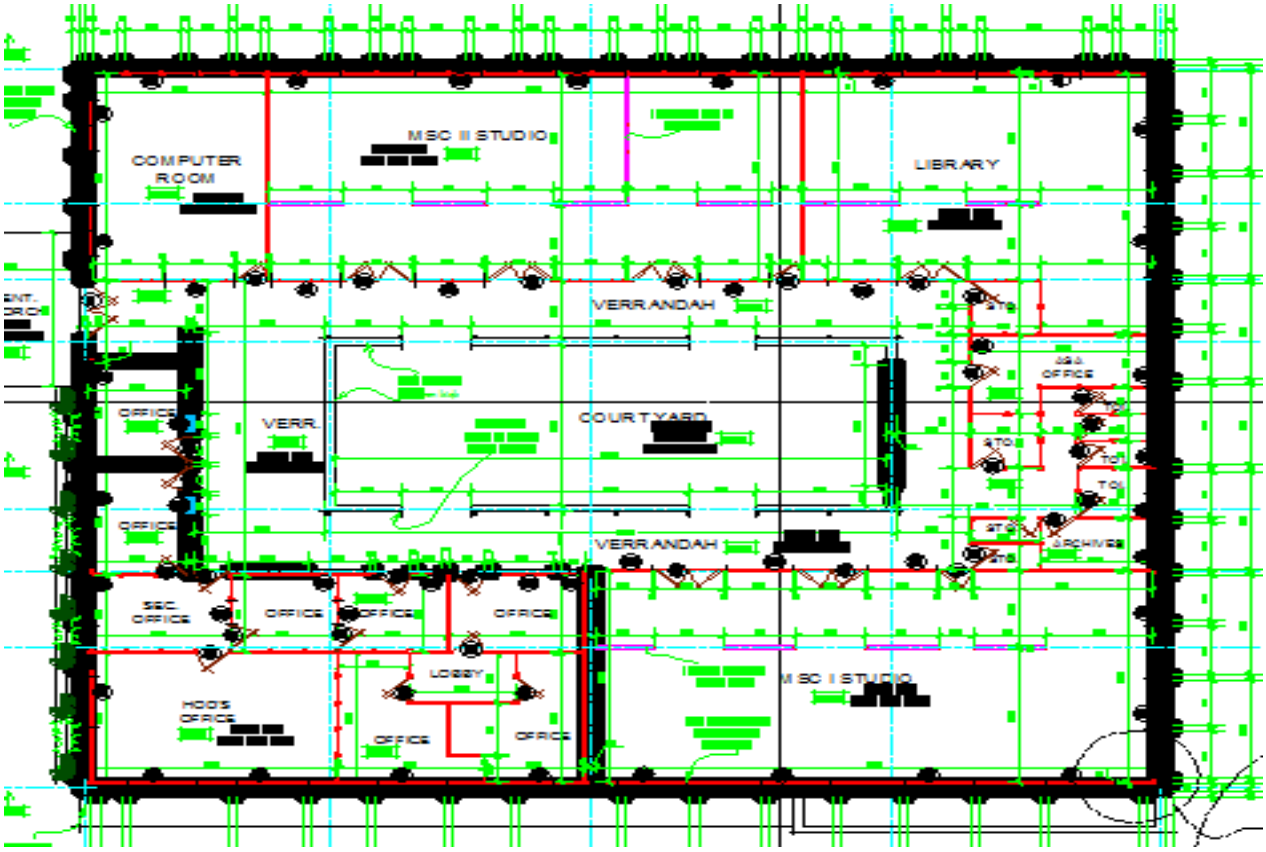

Figure 3.9: Showing Ground floor plan of M.Sc. Studios and Admin. of department of architecture UNEC.

Source: *Researcher's Field Work (*2015)

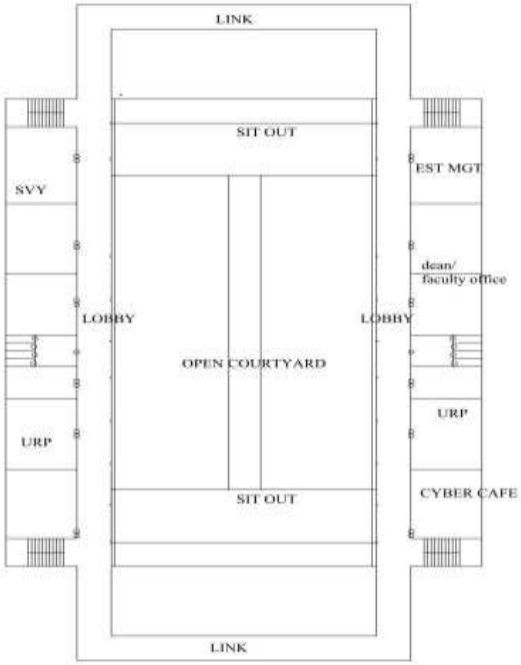

Figure 3.10: Ground floor plan of the faculty of environmental studies showing the faculty office, Surveying department, Urban/Regional Planning department and Estate Management department. Source: *Researcher's Field Work (*2015)

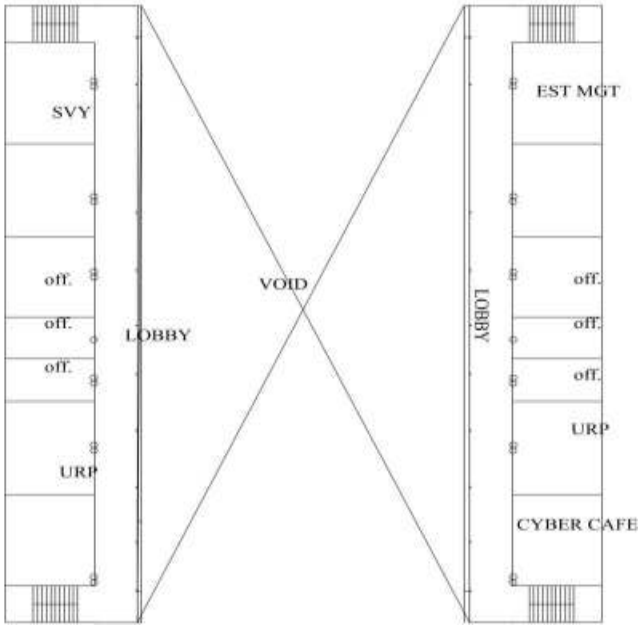

Figure 3.11: Showing First floor plan of the faculty of environmental studies showing the faculty office, Surveying department, Urban/ Regional Planning department and Estate Management department.

Source: *Researcher's* Field Work (2015).

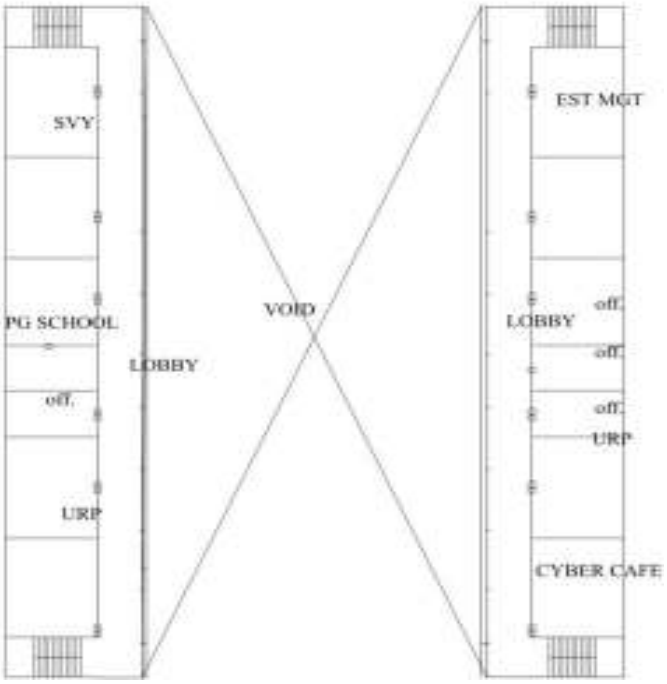

Figure 3.12: Showing Second floor plan of the faculty of environmental studies showing the faculty office, Surveying department, Urban/ Regional Planning department PG school and Estate Management department

Source: *Researcher's* Field Work (2015).

Plate 3.8: A view of the faculty building's showing landscape elements

Source: *Researcher's Field Work (*2015)

Plate 3.9: A view showing staff offices for the department of architecture

Source: *Researcher's Field Work (*2015)

Plate 3.10: Approach view showing administrative block, M.sc.1 and M.Sc. 2 of the department of Architecture

Source- *Researcher's Field Work (*2015)

Plate 3.11: Court-yard, M.Sc. studios

Source- *Researcher's Field Work (*2015).

Plate 3.12: Showing Interior view of M.Sc. studios

Source- *Researcher's Field Work (*2015).

Plate 3.13: showing Interior View of B.Sc. studios

Source: *Researcher's Field Work (*2015).

Plate 3.14: View showing Block housing B.sc. architecture studios and auditorium

Source- *Researcher's Field Work (*2015).

Plate 3.15: View showing exhibition lobby for studio presentations

Source- *Researcher's Field Work (*2015).

3.3 CASE STUDY THREE: FACULTY OF ENVIRONMENTAL STUDIES, UNIVERSITY OF UYO, UYO, AKWA IBOM STATE.

The University of Uyo, was established on October 1, 1991 by the Federal Government of Nigeria. The University of Uyo inherited students, staff, academic programmes and the entire facilities of the erstwhile University of Cross River State established by Cross River State in 1983. Academic activities commenced during the 1991/92 Academic Session. The faculty of environmental studies came into existence in 1995 with the establishment of department of architecture as the first department in the faculty.

3.3.1 DESCRIPTION OF BUILDING

The faculty building is made up of several blocks, of simple stretch of bungalows and units scattered within the annex campus of the University. Over the years, other departments came into the faculty and they include: estate management, building, quantity surveying, land surveying and urban and regional planning. All the departments are waxing strong. The school offers various degrees in the faculty which include:

Architecture B. Sc., M. Sc. (Arch.), Fine and Industrial Arts B. Sc., M. Sc. (Fine/Industrial arts), Estate Management B. Sc. (Est. Mgt.), Land Surveying B. Sc. (Land Svy.), Building Technology

B. Sc., M. Sc., Ph. D. (Bldg. Tech.), Urban and Regional Planning B.Sc., M.Sc., Ph. D. (URP), Quantity Surveying B. Sc. (Qnt. Svy).

The faculty occupies facilities of former engineering faculty. The faculty is spread across the rectangular buildings in annex campus of the school. The unique thing about the overall planning of the faculty is such that the administrative area is on a different block from the lecture halls and the studios. This helps in checking noise transfer from the studio to the offices.

The building material is basically concrete blocks for the walls and gable roof cover with aluminium roofing sheets. The windows are made of louvers with high rise windows to enhance effective cross ventilation and lighting. The floors are made of terrazzo floor finish.

The studios are sufficiently lit and adequately ventilated, this is due to the way the site was planned and how the buildings were oriented on the site to take advantage of both prevailing winds natural daylight from the sun without compromising comfort. The buildings are all ventilated naturally.

3.3.2 MERITS

1. The studios are well ventilated and lighted.
2. There is a strong relationship within different department of the faculty.

3.3.3 DEMERITS

1. The landscape is generally poor.
2. The facilities are also very insufficient.
3. No special consideration for the deenry.

Plate 3.16: View showing the University of Uyo Entrance Gate

Source: *Researcher's Field* Work (2015)

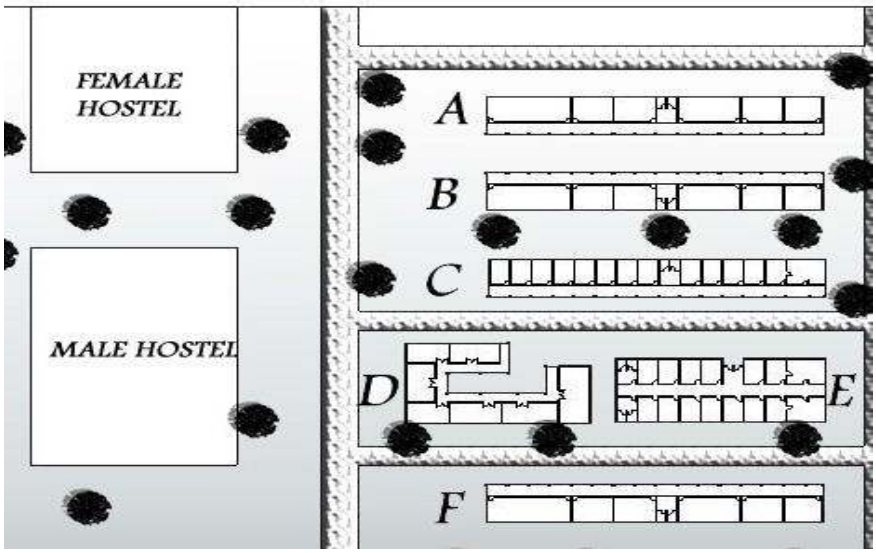

Figure 3.13: Site plan of the Faculty of Environmental studies UNIUYO.

Source: *Researcher's Field Work (*2015)

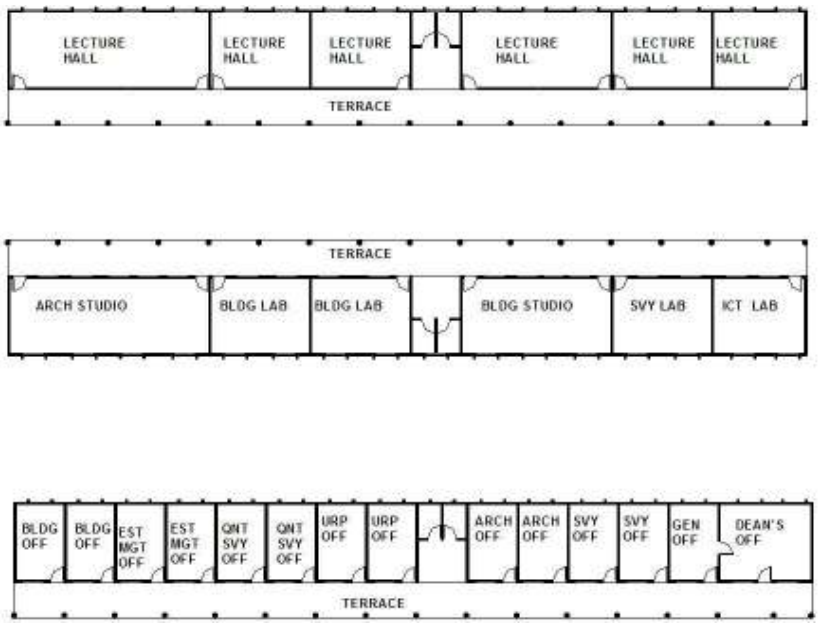

Figure 3.14: Floor plans of Blocks of the Faculty of Environmental studies, (UNIUYO).

Source: *Researcher's Field Work (*2015)

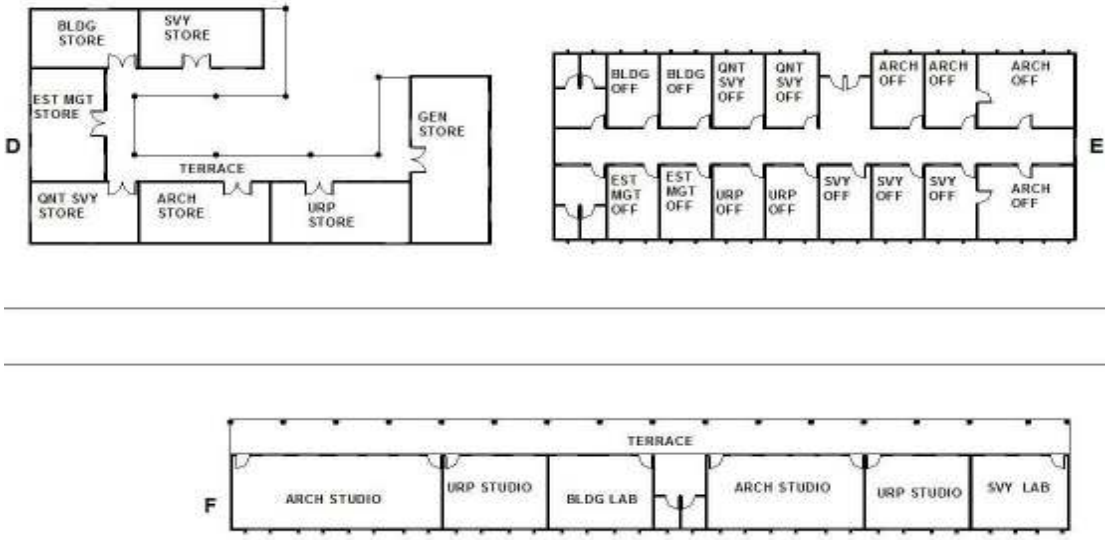

Figure 3.15: Floor plans of blocks of the Faculty of Environmental studies, (UNIUYO).

Source:Researcher *'s Field Work (*2015)

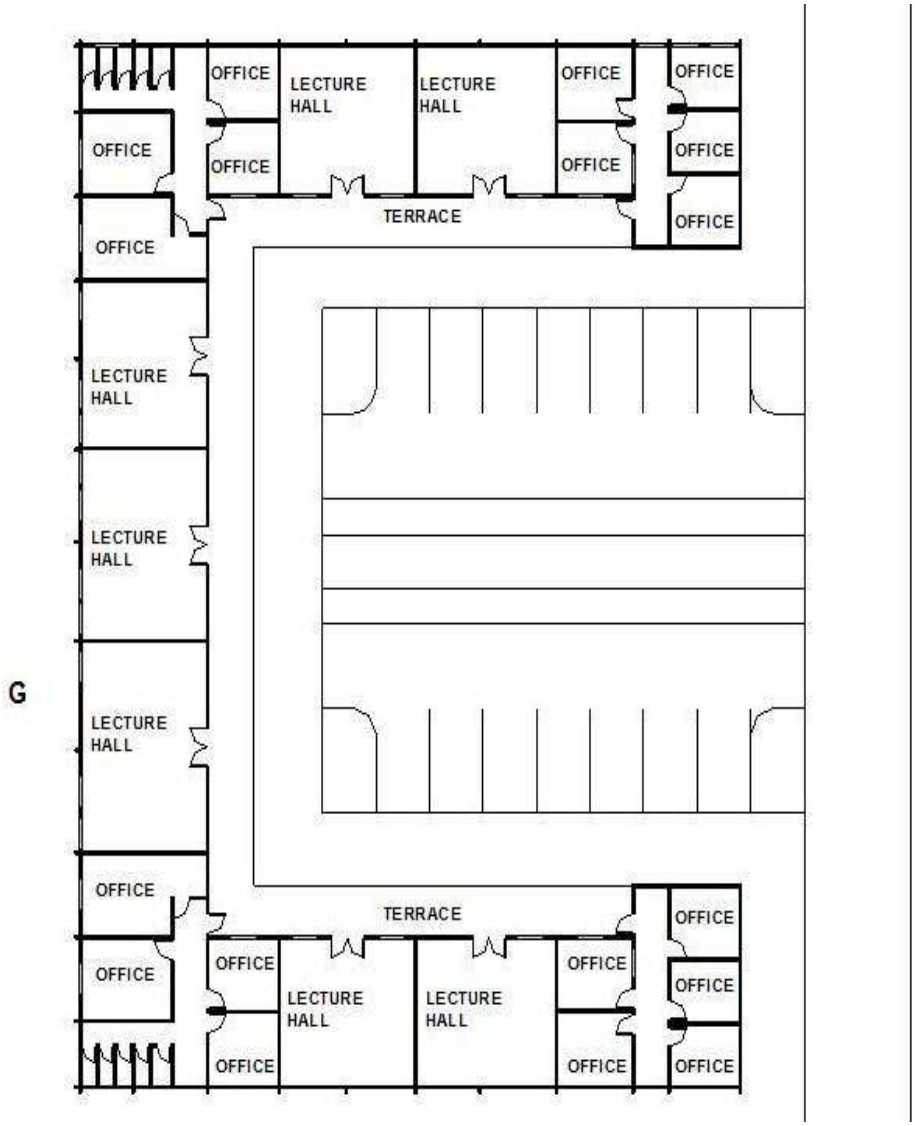

Figure 3.16: Floor plan showing the new block of Faculty of Environmental studies (UNIUYO).

Source: *Researcher's Field Work (*2015)

Plate 3.17: A view of the Administrative store of the faculty (UNIUYO)

*Source: Researcher's Field Work (*2015)

Plate 3.18: A view of the Administrative block of the faculty (UNIUYO)

Source: *Researcher's Field* Work (2015)

Plate 3.19: An interior view of B.sc. Studio (UNIUYO)

Source: *Researcher's Field Work (*2015).

Plate 3.20: A view of the new Environmental studies block for the faculty (UNIUYO)

Source: Researcher's Field Work (2015)

Plate 3.21: An interior view of the Lecture Hall (UNIUYO)

Source: *Researcher's* Field Work (2015)

Plate 3.22: Image showing Building Technology Laboratory and Workshop (UNIUYO)

Source: *Researcher's Field Work (*2015)

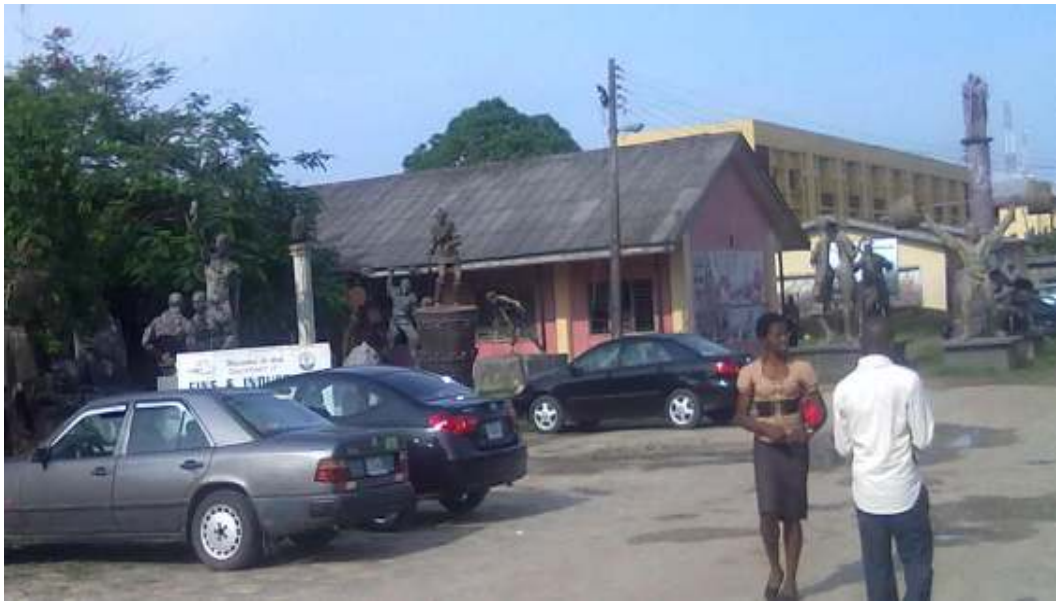

Plate 3.23: Image showing the Department of Fine Arts (UNIUYO)

Source- *Researcher's Field Work (*2015)

3.4 **CASE STUDY FOUR: HARVARD GRADUATE SCHOOL OF DESIGN, ARCHITECTURE AND PLANNING, HARVARD UNIVERSITY, CAMBRIDGE, MASSACHUSETTS**

Architect: John Andrews

Structural Engineer: Le-Messurier Associates

3.4.1 DESCRIPTION OF BUILDING

Gund Hall which houses the Harvard Graduate School of Design, Architecture and Planning (GSD) was designed by rationalist Australian architect and GSD graduate John Andrews. It has a skeleton structure which allows for flexible floor planning. The glazed wall and the sloping clear-span roof (sky light) reveal the shape of the studio for five hundred students. All the students work in the same stepped studio space. The entire studio is evenly and very well lit by the sky lights. There are long space rafters that span across the width of the studio and support the weight of the sky lights. (Harvard Graduate School of Design, 2011).

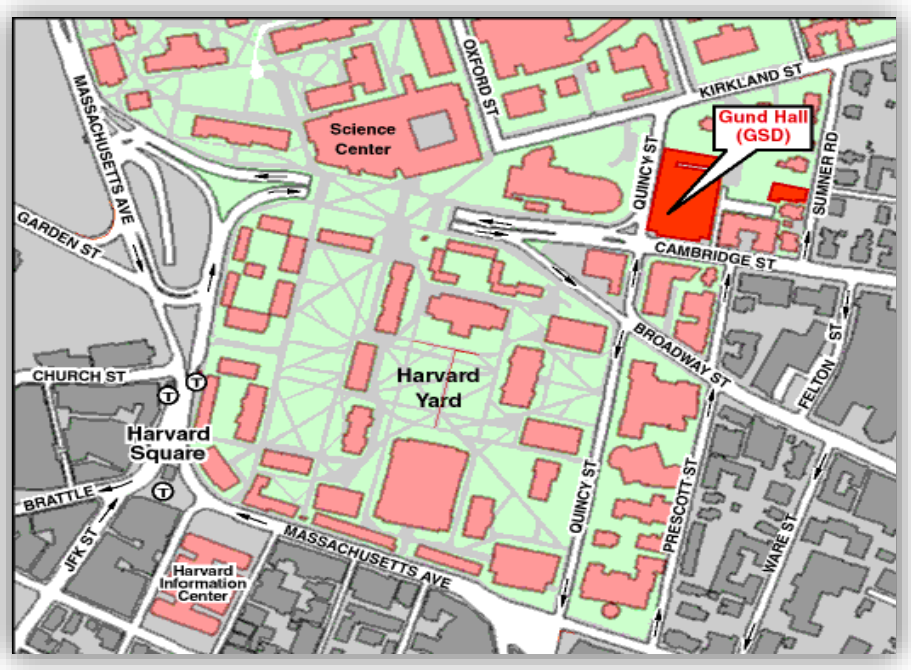

Figure 3.17: Site plan of the Harvard Graduate School of Design, Cambridge Massachusetts. Source: Great Buildings (2012)

Plate 3.24. Harvard Graduate School of Design, Architecture and Planning, Harvard University. Source: Olu Ola and Bogda Prucnal Ogunsote (2006)

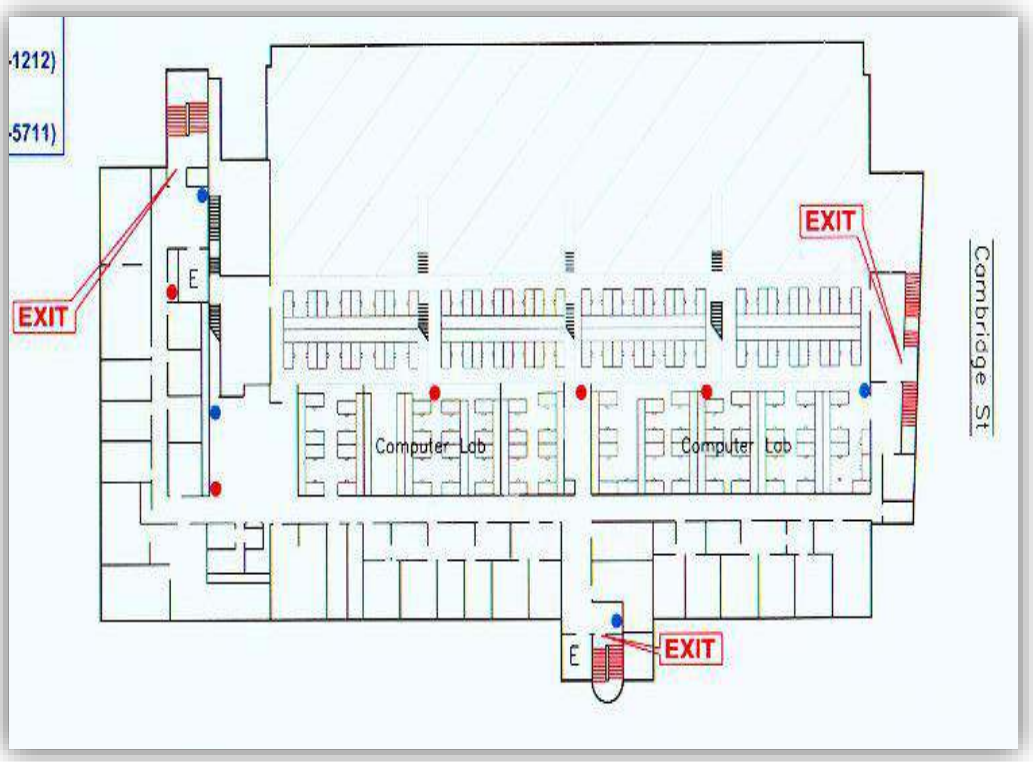

Figure 3.18: Basement plan of the Harvard Graduate School of Design.

Source: Great Buildings (2012).

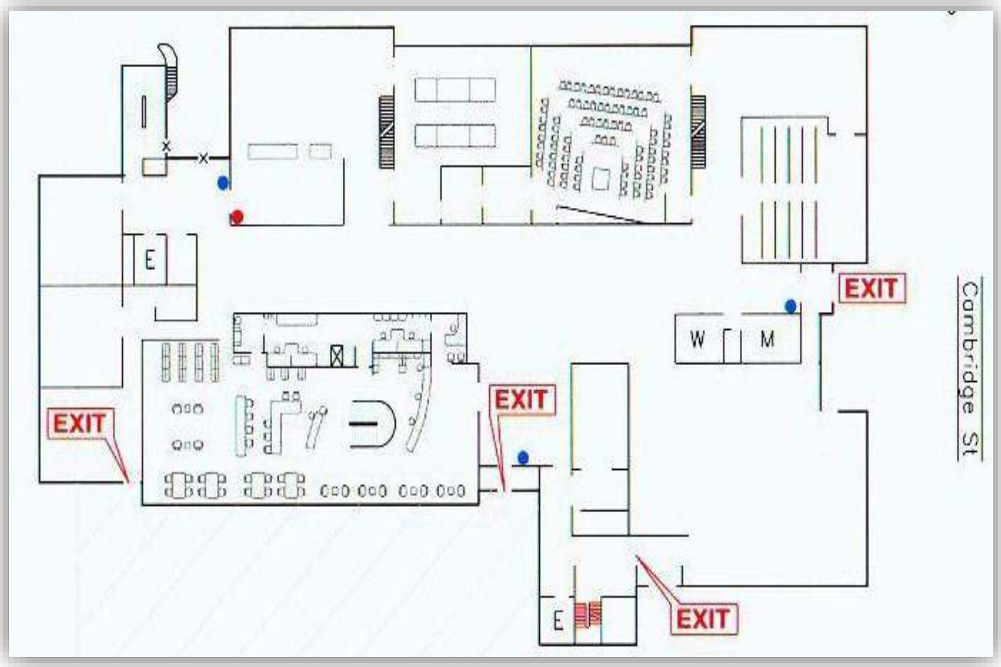

Figure 3.19: First floor plan of the Harvard Graduate School of Design.

Source: Great Buildings (2012).

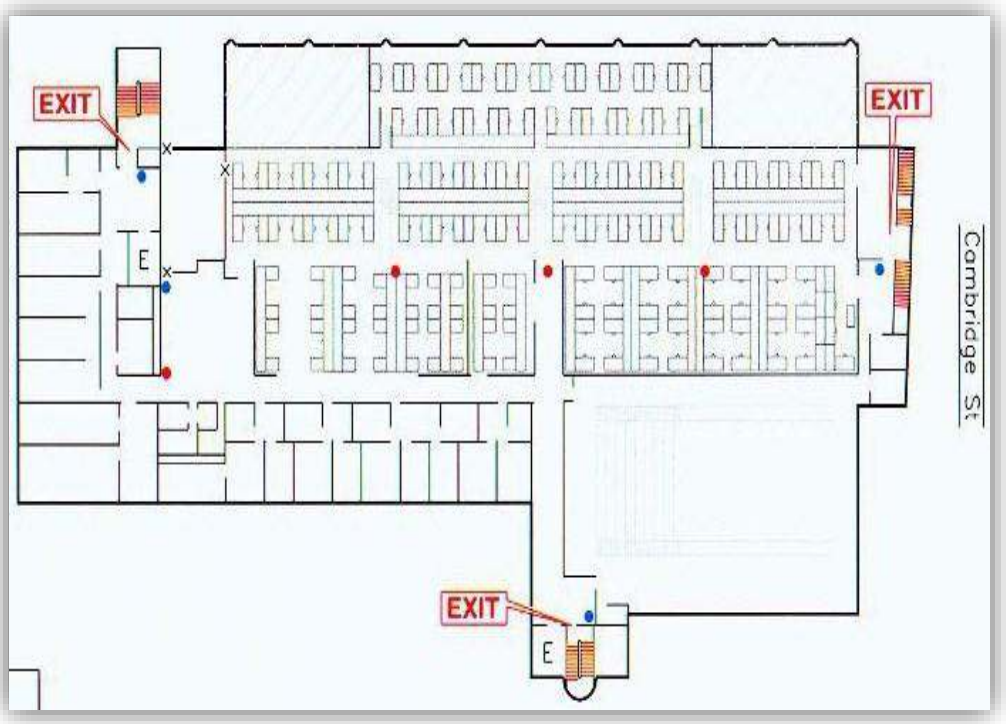

Figure 3.20: Second floor plan of the Harvard Graduate school of Design. *Source: "Great Buildings* (2012).

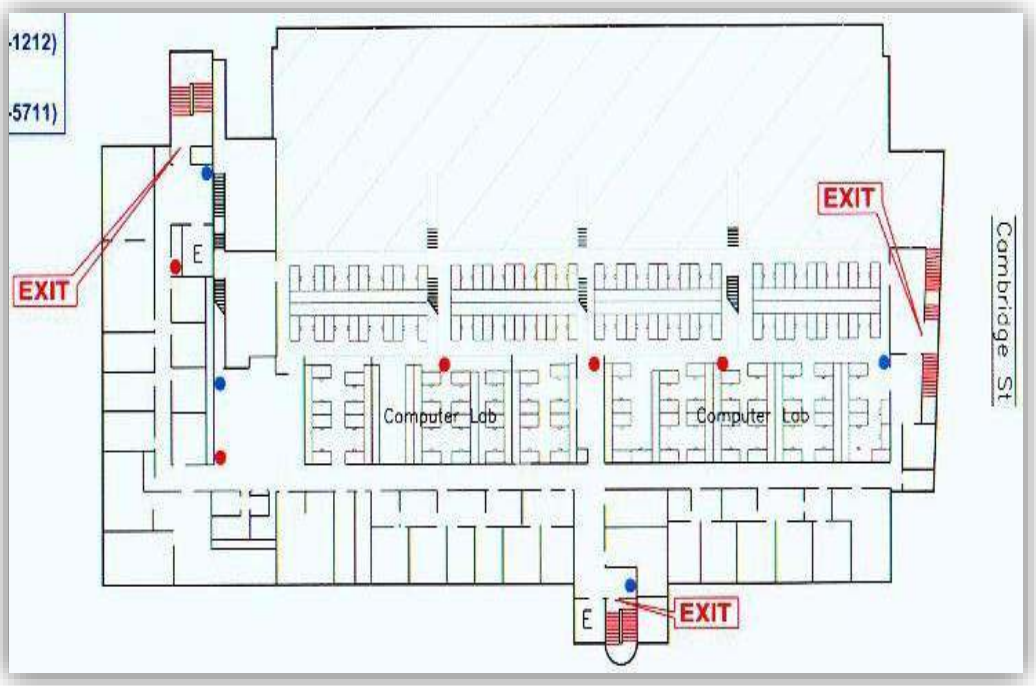

Figure 3.21: Third floor plan of the Harvard Graduate School of Design, Cambridge Massachusetts. Source: Great Buildings (2012).

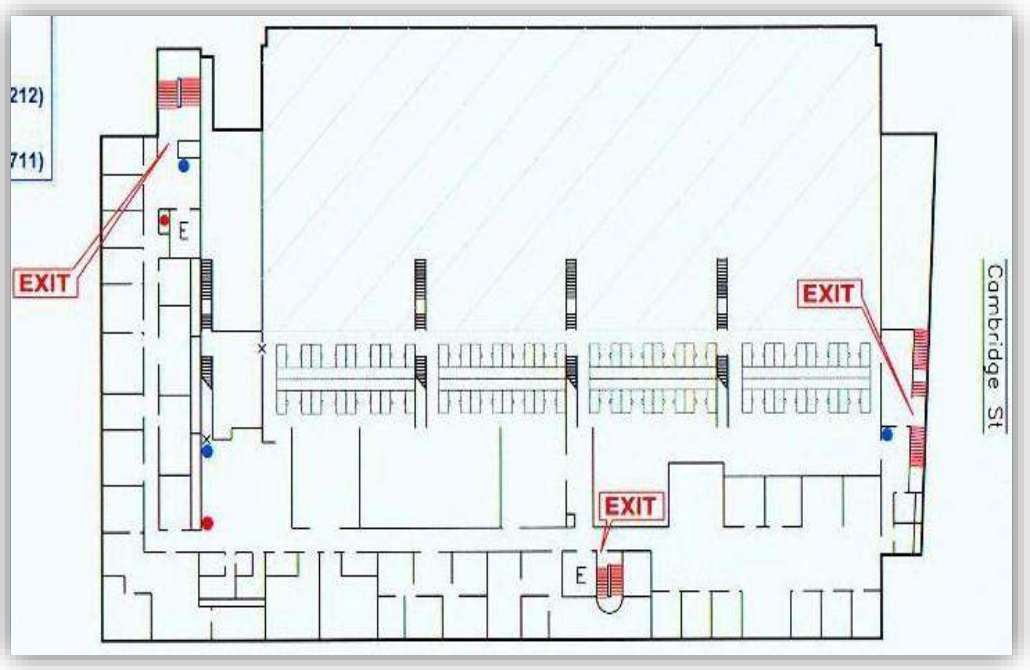

Figure 3.22: Fourth floor plan of the Harvard Graduate School of Design.
Source: Great Buildings (2012).

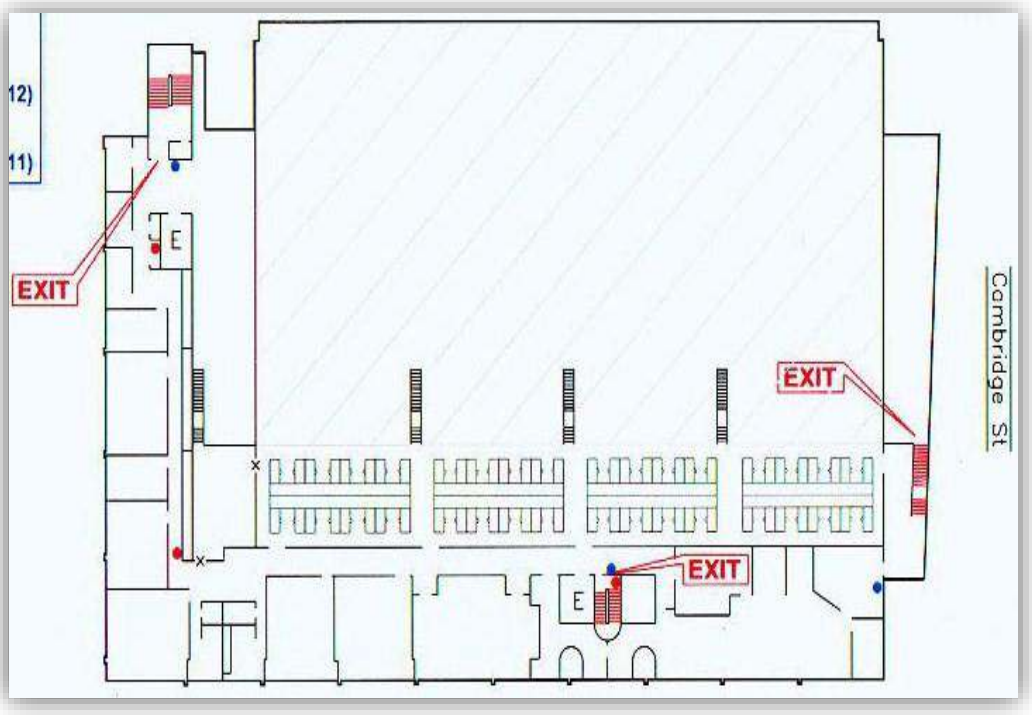

Figure 3.23: Fifth floor plan of the Harvard Graduate School of Design.
Source: Great Buildings (2012).

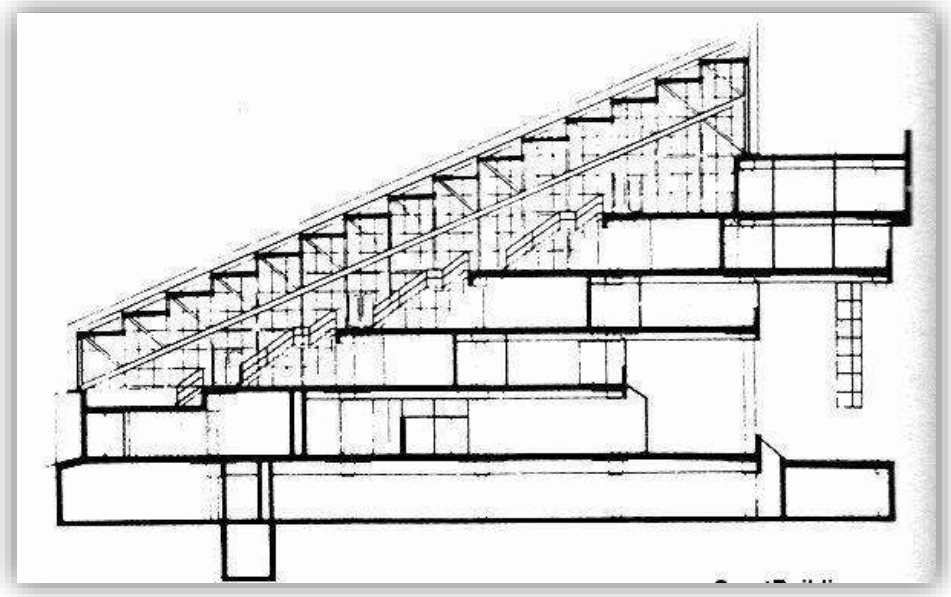

Figure 3.24: Sectional view through building complex of the Harvard Graduate School of Design. Source: Great Buildings (2012).

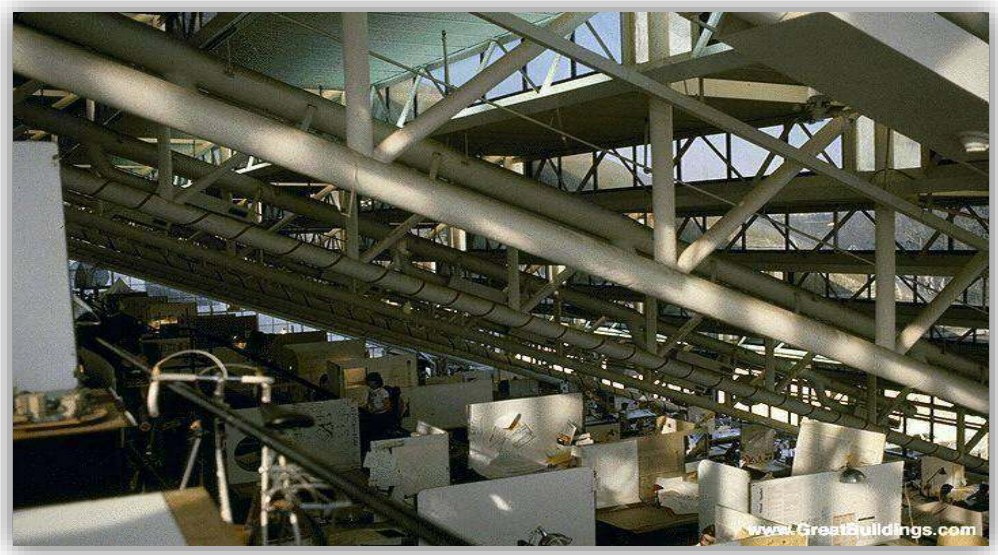

Plate 3.25: An interior view of the stepped studio of Harvard Graduate School of Design Source: Great Buildings (2012).

3.4.2 MERITS

1. The architectural design has a skeleton structure which allows for flexible floor planning
2. The adequate planning allows for group discussion, interaction and sharing of knowledge among the students and staffs
3. There is free access around the building allowing easy pedestrian circulation

3.4.3 DEMERITS

1. The designer located the administrative units outside the building across the road.

DEDUCTION FROM CASE STUDIES

In the analysis and evaluation of both foreign and local case studies, result as obtained shows that issues towards effective spatial integration and functional relationship between the constituent departments in the building complex were given greater planning and layout consideration and concern in foreign schools than local ones.

It is based on this knowledge, that this project through the study of space syntax and spatial systems of planning seeks to properly develop a functional approach to solving the design problem in the proposed Faculty of Environmental Sciences building complex for University of Ilorin, in order to integrate all the constituent department in the faculty to promote effective learning experience, interaction, transfer and sharing of ideas amongst student and to ensure realistic balance among the professional groups in the design profession.

CHAPTER FOUR

4. SITE, PROJECT ANALYSES AND PROPOSAL

4.1 STUDY AREA LOCATION

Ilorin is the present day capital of Kwara State in the North central region of the Federal Republic of Nigeria. It is a predominantly Islamic city with people of diverse culture who have come together to live as one in peace and harmony. The entire Ilorin community comprises of five local government areas namely- Ilorin West, Ilorin South, Ilorin East, Asa and Moro. These Local Government Areas are all under one entity known as Ilorin Emirate.

Ilorin community was discovered in the 18th century by the duo of Afonja, Are-Onokakanfo, a Yoruba warlord and Sheik Alimi, an Islamic scholar. These heroes of Ilorin arrived Ilorin at different times and in different circumstances. Sheik Alimi was an islam and its teachings across the land. He sojourned for many through villages and towns across Yoruba land he had followers with whom he moved around to establish the tenets and principles of islam. He was temporarily settled at Kuwo village, Sheik Alimi continued to explore other territories where he could spread and establish his beliefs and settle down permanently.

The tertiary institutions in Ilorin City include:

1. University of Ilorin, Ilorin.
2. Kwara State Polytechnic, Ilorin, Kwara state.
3. Kwara State College of Education.
4. School of Nursing, Ilorin.
5. Al-Ikma College, Ilorin.
6. School of Midwifery, Ilorin.

Figure 4.1: Map of Nigeria showing Kwara State.

Source: Source: Wikipedia, (2015).

Figure 4.2: Map of Kwara state showing the Local Governments

Source: Wikipedia, (2015).

BRIEF HISTORY OF UNIVERSITY OF ILORIN

The University of Ilorin, sometimes known as Unilorin, is a University in Ilorin, Nigeria. It was established by a decree of the federal Military Government in 1975 and a federal government owned tertiary institution of education located in Ilorin, kwara state, north central Nigeria. The ancient city of Ilorin, capital of kwara state, is about 300km from Lagos and 500km from Abuja, the country's administrative capital (Figure 4.2).

The University began as a University college affiliated to the oldest University in Nigeria in 1975 under the leadership of the then principal, Dr. T. N. Tamuno. The first set of 200 students, selected following an entrance examination, were admitted into residence on 23rd of October 1976, while academic work started on 25th of October after the principal's address. The University College started with three academic faculties of art, science and education.

In October 1977, the institution attained full autonomous status with the appointment of the then principal, Professor O. O. Akinkugbe as first vice chancellor. The current vice-chancellor is Prof. Abdul-Ganiyu Ambali. The staff and student populations now stand at 3040 and 20,084 respectively.

The University started off on a portion of the temporary campus of the Kwara State Polytechnic known as the mini campus. This was the site of academic programmes in the faculties of Art, Sciences, Education, Engineering and Technology, Business and Social sciences and Basic clinical sciences of the health sciences faculty. It was the only campus of the University until 1982 when more than 1000 students studying science were moved following completion of new faculty blocks and residences for natural sciences and Engineering on the permanent campus site.

From 1983, the law programme was started as a department in the faculty of Business and Social Sciences. Following a 6-year hiatus, it was re-established in 1993 as a fully-fledged faculty. The University now has 10 faculties; Arts, Agriculture, Business and Social Sciences, Communication and Information Sciences, Education, Engineering and Technology, Law and Science; College of Health Sciences (with two faculties-Basic Medical and Clinical sciences); two institutes (Institute of Education and Unilorin Sugar Research Institute); and the Post graduate School. These faculties have 60 academic departments in total. Undergraduate degree programmes are run for 3-5, or 6 years, depending on entry qualifications and discipline.

4.2 SITE SELECTION CRITERIA

Site investigation/analysis

1. The site was analysed for inherent potentials.
2. To find out factors unique to the site.
3. To find out factors relating to context and region.
4. To determine topography, this will eventually influence the form and shape of the proposed building – which ultimately will lead to building cost.
5. To determine surface drain, pollution.

To determine vegetation cover that will eventually affect micro-climatic conditions of the place.

Factors Influencing Choice of Site

The various factors that influence the choice of site include;

1. Property boundary
2. Land contours
3. Surface drainage
4. Soil condition
5. Rocks and boulders
6. Trees
7. Water
8. Existing buildings
9. Expansion of existing buildings
10. Easements
11. Noise
12. Views from the site
13. Offsite vehicular traffic
14. Existing site vehicular traffic
15. Existing site pedestrian traffic
16. Utilities
17. Building-parking-service relationship
18. Vehicular-pedestrian traffic system
19. Parking systems

20. Approach to building
21. Arrival modes
22. Entry to building
23. Total site zoning
24. Total site system
25. Land forms
26. Landscaping with plants
27. Seating forms
28. Landscaping with water
29. Contribution to neighbourhood
30. Sunlight
31. Temperature
32. Rainfall
33. Wind

4.3 SITE LOCATION/DESCRIPTION

The site is located within the University of Ilorin, main campus. It is located very close to the faculty of education and the school of post graduate studies. It is along the middle belt of the University campus. The site is located within University of Ilorin main campus at their permanent site. The site is about twenty seven hectares of land. The University campus falls within Ilorin south local government, it is specifically located at one of the extreme ends of Ilorin town. The site is trapezoidal in shape.

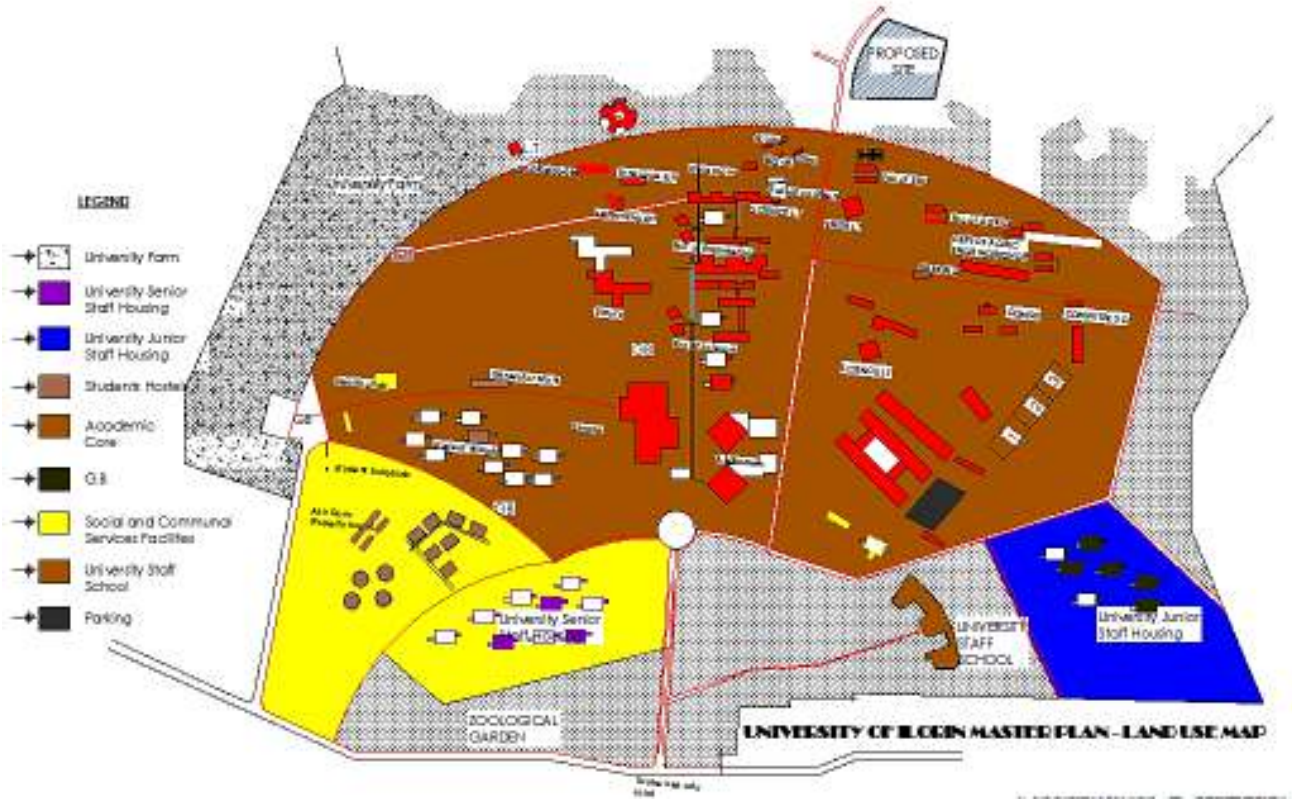

Fig 4.3: Master Plan/ Land Use Map

Source: Physical planning unit, University of Ilorin (2015)

4.4 SITE ANALYSIS OR INVENTORY

The site is a very important aspect of a design proposal being the point at which the tangible percentage of a development emerges or starts making an impact. The site chosen for any project hence goes a long way in determining the final resultant composition of the solution-in-all aspects. The site and its environment determine the solution in terms of contextual appropriateness measured the geographers, geologists, and geometrists. The specific aspect of the site, its micro-climate are thus a complex interaction of any factor, orientation, scope, topography, temperature patterns, humidity, precipitation, vegetation, presence or absence of water, seasonal availability of sunlight especially in urban areas, the influence of other buildings. The success of any design in this case 'Faculty of Environmental Sciences' to a large extent depends on a wise site selection.

The layout of the building on site will greatly be determined by the topography and physical features (such as water bodies, access, trees, local climate, utility lines) seen on site.

The existing in close proximity to the site will greatly influence the character of the building to be built in terms of forms, beauty and economy of the design.

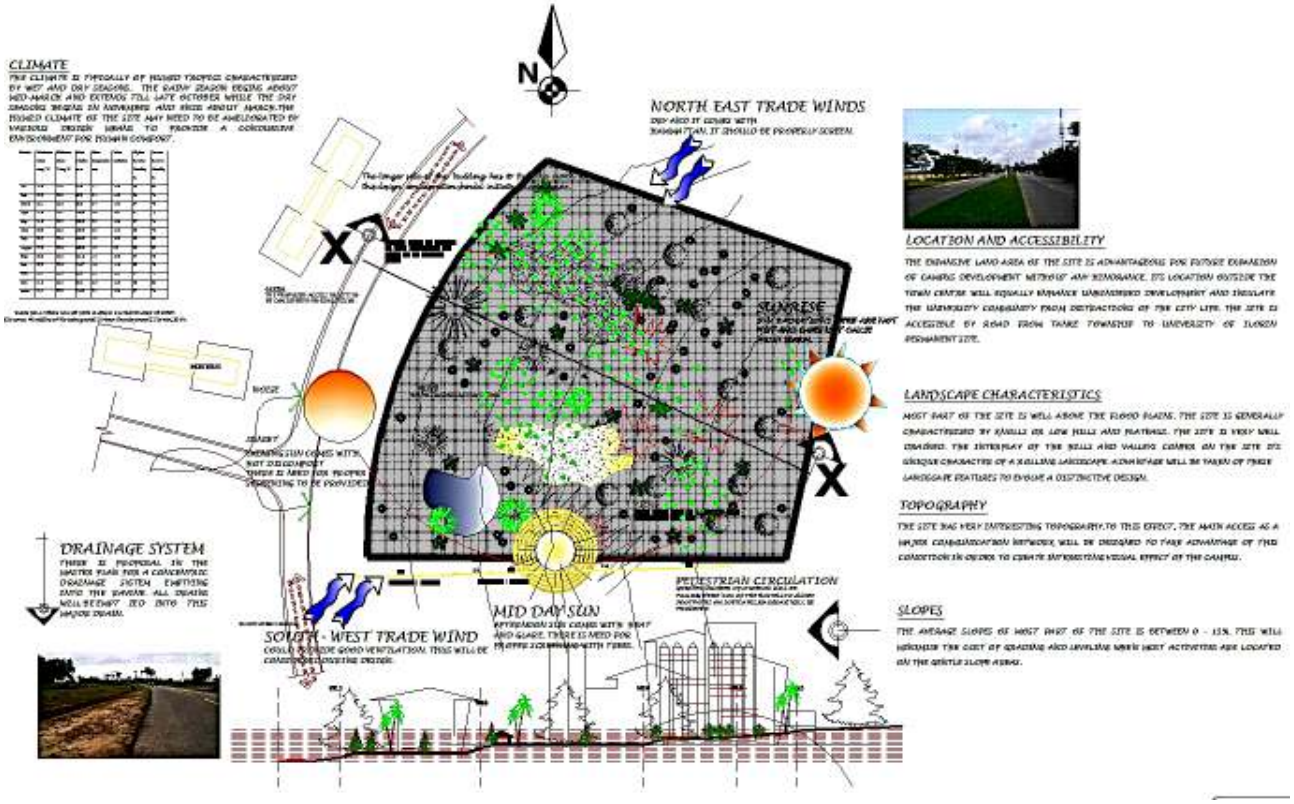

Figure 4.4: Site Analysis

Source: *Researcher's archive* (2015)

4.4.1 GEOGRAPHICAL DATA

Vegetation

The site is covered with shrubs, thick grass, and vegetable leaves and trees. All the vegetables and shrubs are to be removed. At the time of conducting the site investigation on the proposed project site, the site displays a relatively thick vegetation cover that is; there are tall grasses, shrubs as well as big trees. There are portions with simple vegetation cover due to human activities (clearing and farming) that is taken place on the site.

Soil Condition

It has a firm late rite soil with good sub-surface condition for construction and landscaping. It gives satisfactory geological and soil condition with no rock crops.

Topography

It has both gentle slope and steep slope of about 450mm towards the north. It does not undulate. The topography of the proposed development site is relatively low that the topsoil and sub-soil is firm and buildable. The site is therefore free from any natural of physical constraints and rock outcrops

Prevailing winds

The north-east trade wind brings cold, dust, harmattan and these cause discomfort. The south west trade wind brings cold humidity which gives comforting effect to the people. Proper ventilation is considered as part of the building effective arrangement.

The site of the proposed development is located within the university campus, which is predominantly academicals, formal, institutional and administrative use. Therefore, since planning considers the people who are mainly students, staffs and visitors, the need arises for the post graduate hall of residence a little outside the academic area of the University campus.

4.4.2 CLIMATIC DATA

Climate

Ilorin is within the climatic zone known as the equatorial zone which has a climatic type of low wet equatorial. The two major influences on the Ilorin climate are the two major wind currents. The south west trade wind is warm and moisture laden and the north east trade wind is cold and dry. The two winds current bring about the two different seasons called the rainy season and the dry season. The raining season is between April and October. The dry season is between November and March. It is accompanied by cold dust and harmattan.

Rainfall

The type in Ilorin is the convectional type caused by the intense heating by the sun during the day. Rainfall is heavy, between 1542mm and 2699mm and is distributed throughout the year.

Table 4.1: Rainfall records (mm) for Ilorin between 2007 and 2009

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
2007	-	0.0	70.7	253.0	106.6	125.9	155.1	52.0	185.4	74.5	1.2	0.0
2008	0.0	40.7	121.3	130.1	80.6	272.8	255.6	204.2	236.9	125.5	78.8	2.4
2009	1.1	44.5	30.5	87.3	115.3	150.9	-	58.7	320.8	114.0	60.8	0.0
Mean	1.1	42.6	77.4	165.0	107.0	236.3	191.0	128.2	239.9	122.6	40.9	2.4

Source: Nigeria Airport Authority Metrological Station, Ilorin.

Wind

Both tropical continental and tropical maritime air masses affect Ilorin. The town experiences thunderstorm, during the beginning and ending of the raining season. The prevailing wind direction is southwest trade wind, which is rain bearing since it takes origin from the sea in the raining season period and from north.

Table 4.2: Average Wind Velocity Record for Ilorin between 2007 and 2009

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
2007	67.75	85.75	112.90	108.50	97.44	104.70	124.97	147.19	110.74	78.99	97.93	56.80
2008	86.90	96.23	112.17	112.13	95.54	107.63	120.10	131.77	106.59	77.95	56.85	66.12
2009	86.46	97.79	94.51	121.19	108.84	107.65	164.08	144.46	86.48	75.94	62.96	56.57

Source: Nigeria Airport Authority Metrological Station Ilorin

Temperature

The mean monthly temperature of Ilorin is around 27^0C with every little variation, cloudiness and heavy precipitation help to moderate the daily temperature so that the climate is not unbearable. The regular land and sea breeze assist in maintaining equatorial climate.

Table 4.3: Minimum air temperature (WBT) ^{0}C

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
2007	18.1	19.3	22.7	22.4	22.1	21.6	21.8	21.3	21.2	22.0	22.7	21.9
2008	19.5	21.0	23.2	22.8	22.3	21.8	21.8	21.8	21.4	21.3	21.9	18.3
2009	20.0	23.0	23.4	22.9	22.7	21.6	-	21.4	21.5	22.1	21.5	19.4
Mean	19.1	20.5	22.7	22.6	22.3	21.3	21.5	21.2	21.4	27.1	22.2	19.6

Source: Nigeria Airport Authority Metrological Station, Ilorin

Table 4.4: Maximum air temperature (WBT) ^{0}C

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
2007	33.3	35.3	34.8	32.0	31.2	29.7	28.2	27.1	28.3	30.9	32.7	33.5
2008	33.3	35.3	33.3	31.3	31.1	29.9	28.7	27.2	28.7	29.8	32.1	33.1
2009	33.1	34.4	34.6	32.0	31.9	29.7	-	28.2	28.6	31.0	32.1	32.9
Mean	33.2	34.9	34.7	32.0	31.3	29.8	28.5	27.2	28.8	30.5	32.5	33.2

Source: Nigeria Airport Authority Metrological Station, Ilorin.

Table 4.5: Maximum/minimum Effective Temperature and shading Chart

Location: Ilorin	Year: 2009	Nomo gram	ET or CET	Comfort limit	
				Lower	Upper

Notes: Air velocity assumed

	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Mean air velocity(m/s)	0.8	0.9	1.0	1.1	1.0	1.0	1.3	1.4	1.0	0.8	0.6	0.6
Mean max. B. T. ($^{0/}_{0}$)	33.3	34.9	34.7	32.0	31.3	29.8	27.6	27.6	28.8	30.5	32.5	33.2
Mean min R. H ($^{0/}_{0}$)	66	60	74	82	82	85	90	90	87	84	77	67
Mean max. W.B.T (^{0}C)	19.1	20.4	22.7	22.6	22.3	21.3	21.2	21.2	25.3	21.7	22.2	19.6
Max. E. T (^{0}C)	25.2	22.0	27.0	22.0	25.9	24.5	23.0	23.0	24.3	25.3	26.4	25.0
Mean min D.B.T. (^{0}C)	19.1	20.4	22.7	22.6	22.3	21.3	21.2	21.2	21.4	21.7	22.2	19.6
Mean max R. H ($^{0/}_{0}$)	66	60	74	82	82	85	90	90	87	84	77	67
W. B. T. (^{0}C)	19.0	18.5	20.6	22.3	21.3	21.0	20.8	20.8	20.4	21.1	20.5	17.8
Mean E. T. (^{0}C)	18.0	18.8	20.6	21.5	20.4	21.6	19.8	19.4	19.2	20.2	20.3	17.6

Source: Nigeria Airport Authority Metrological Station Ilorin

Humidity

Due to the high annual rainfall, Ilorin's relative humidity is high, ranging from between 64 percentages and 87 percentages. Over 80 percentage humidity was observed to be common in the morning time during the raining season when the temperature is high, coupled with the high relative humidity; the atmosphere could be uncomfortable, creating heat-trap.

Table 4.6: Humidity records for Ilorin between 2007 and 2009

Year	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
2007	65	53	75	82	83	85	89	91	86	84	75	76
2008	50	62	81	82	83	86	93	88	86	80	80	62
2009	76	79	76	81	80	85	-	87	88	78	78	67
Mean	66	60	74	82	82	87	90	87	87	77	77	67

Source: Nigeria Airport Authority Metrological Station Ilorin

4.5 PROJECT ANALYSIS AND DESIGN SYNTHESIS

In a faculty building programme, there are usually requirements for various kinds of spaces, these may be requirements for spaces that:

- ❖ Have specific functions, require specific forms, are flexible in use and can be freely manipulated, or are singular and unique in their function or significance to the building organization. E.g. Auditorium, Library and conference rooms
- ❖ Have similar functions and can be grouped into a functional cluster or repeated in a linear sequence; Academic core of lecture rooms, studios, workshops, laboratories and academic staff offices.

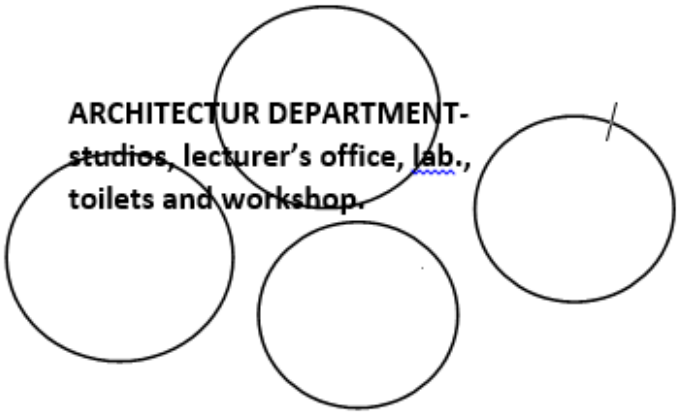

Figure 4.5: Showing Illustration of spatial organization into functional cluster of related spaces

Source: *Researcher's archive* (2015)

❖ Require exterior exposure for, light, ventilation, desired views or some access to particular external features or outdoor spaces; studios, classrooms, workshops and laboratories.

The courtyard type; which works at having a central focus of an inner corridor and central, open-air court with the offices, studios, classrooms, arranged around it.

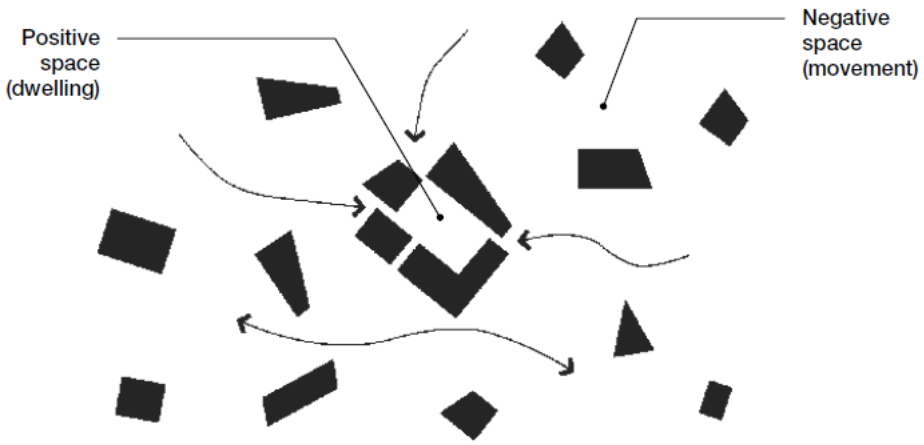

Figure 4.6: Showing space for social interaction and hanging out

Source: *Researcher's* archive (2015)

❖ Must be easily accessible, e.g. offices for various Head of Department in the school. This could be seen as all offices will be zoned to an area, the studio spaces will be zoned to another area, the classrooms and so on.

Ching (1979) notes further that the manner in which these spaces are arranged can clarify their relative importance and functional symbolic role in the faculty building's organisation. The decision as to what type of organisation to use in a specific situation will depend on demands of the building programme such as: functional proximities or adjacencies of spaces and the relationships amongst those spaces; adequate window openings to enhance user's view towards the surrounding environment and the interior courtyards. Cross ventilation will be ensured in the design through and across the interior spaces. Hence, the use of courtyards and large windows will suffice.

❖ Dimensional requirements of spaces and building elements;

❖ Hierarchical classification of spaces; and requirements for access to light or desired views or other features.

Exterior conditions of the site that might limit the organisation's form or growth, determine direction and pattern of growth, and indeed, encourage the adoption and incorporation of certain features of the site and exclusion of others.

4.6 DESIGN CRITERIA

In other to achieve a functional and cohesive design, several design/architectural factors must be considered with respect to their effect on the design and construction. The factors includes;

a) Site selection
b) Structure- Economical structural spans and spacing modules
c) Ventilation/Air temperature
d) Smoke management- Mechanical system operation
e) Lighting - daylight, bright lit walls with energy efficient technology (solar panel)
f) Acoustic- Sound absorptive materials
g) High performance features (green Architecture)
h) School population and enrolment schedule

4.7 BRIEF ANALYSIS

4.7.1 DESIGN BRIEF

The University of Ilorin, Ilorin, Kwara State aim to become one of the best universities in the world. In this regard, certain key buildings are to be designed and upgrade of some existing facilities is required. Thus, I have proposed a design to serve as school of architecture. The educational programme to be provided for in the facility has the ultimate goal of development of humanity and the built environment accommodating four inter-related disciplines of architecture.

4.7.2 BRIEF DEVELOPMENT

The facility is aimed at accommodating four inter-related disciplines of environmental studies. These are architectural design, urban design, landscape architecture and interior design. Spaces to be provided for in the facility include staff offices, seminar rooms, lounges, presentation halls, postgraduate and undergraduate resource centre, studios, lecture theatres, workshops, drawing offices and exhibition spaces, ancillary accommodation such as libraries, audio-visual rooms/ computer room and parking will also be provided.

4.8 SPACE ALLOCATION/ SCHEDULE OF ACCOMMODATION

The schedule of accommodation prepared is used to calculate the approximate areas and reviewed in relationship to existing conditions and the manner of occupation by users, furniture and functional activities in the building. Usually, space allocation in the design of faculty building is done by considering minimum area or number of spaces per person required for a particular activity which is optimally comfortable. The design programme gives a breakdown of accommodation requirements for the various spaces required by the design proposal. These spaces are derived from space standards in NUC space requirement. However, considering the different environmental situation in Nigeria, certain increases are imminent. As a guide, they provide a basic idea of the spatial requirements. The schedule is as follows by unit and area.

Table 4.7: Schedule of Accommodation for the Ground Floor

SPACE	NOs	DIMENSIONS (mm)	AREA (sqm)
Entrance Porch	1	17000x6000	102
Foyer Reception	1	26000x13000	338
Receptionist Stand	1	6600x3000	19.8
Stair 1	2	5100x3000	15.3
Exhibition Space	1	18000x12000	216
Power Room	1	5100x4800	24.48
Business Centre	8	3000x2600	7.8
Security Office	1	3000x2600	7.8
Bookshop and Stationery Store	4	13000x8000	104
First Aid Section	4	6600x4200	27.72
Students' Lounge	4	9100x7500	68.25
ICT Room	4	11000x9100	100.1
General Lecture Room 1	4	21000x9100	216
Technologist Office	8	4200x3900	16.38
Workshop	4	11000x1000	11
Workshop Store	4	4500x4200	18.9
Convinience	56	1800x1000	1.8
Modeling Workshop	4	11000x9100	100.1
E-Centre Research Hub	4	11000x9100	100.1
Cafeteria	2	15000x9100	136.5
Kitchenette	2	5900x5700	33.63
Kitchen Store	4	3900x3600	14.09
Research Hub Office	2	3900x3600	14.09
Main Court Yard	1	50000x50000	2500
Mini Court Yard	8	18000x8200	147.6
Stair 2	4	8000x3000	24
Escape Stair	4	5000x4000	20

Table 4.8: Schedule of Accommodation for the First Floor

SPACE	NOs	DIMENSIONS (mm)	AREA (sqm)
General Library	1	25000x20000	102
Librarian Office	1	5000x4800	338
Audio Visual/CAD Room	1	10000x7500	19.8
Audio Visual Store	2	5100x4800	15.3
Common Room	1	10000x6300	216
Research Assistant Office	1	6300x5100	24.48
ASA Secretariat	8	6300x5100	7.8
200Level Studio	1	18000x9000	7.8
300Level Studio	4	19000x8000	104
400Level Studio	4	1900x9100	27.72
500Level Studio	4	1900x9100	68.25
PGD Studio	4	19000x9100	100.1
MTech 1 Studio	4	15000x1000	216
MTech 2 Studio	8	1500x1000	16.38
Technologist Office	4	4500x3900	11
Snack Bar	4	6000x5900	18.9
Convinience	56	1800x1000	1.8
Main Court Yard	4	11000x9100	100.1
Mini Court Yard	4	11000x9100	100.1
Stair 2	2	8000x3000	24
Escape Stair	2	5000x4000	20
Main Court Yard	1	50000x50000	2500
Mini Court Yard	8	18000x8200	147.6
Stair 2	4	8000x3000	24
Escape Stair	4	5000x4000	80
Store	1	5000x4000	20

Table 4.9: Schedule of Accommodation for the Second Floor

SPACE	NOs	DIMENSIONS (mm)	AREA (sqm)
Dean's Office	1	9500x8500	102
Sub- Dean's Office	1	5100x4900	338
General Conference Room	1	13000x9500	19.8
Dean Secretary's Office	2	5100x4700	15.3
School Officer Office	1	18000x12000	216
School Officers Secretary	1	5100x4800	24.48
Assistant Lecturer Office	8	6300x4500	7.8
General Office	1	7500x5100	7.8
H.O.D's Office	4	9100x6400	104
H.O.D's Secretary	4	5100x3600	27.72
Departmental Conference Room	4	9100x7500	68.25
Professor's Office	4	6300x5100	100.1
Associate Professor	4	21000x9100	216
Computer Laboratory	8	4200x3900	16.38
Staff Lounge	4	15000x10000	11
Exam Officer	4	7500x4200	18.9
Convenience	56	1800x1000	1.8
Lecturer 1 Office	4	11000x9100	100.1
Lecturer 2 Office	4	11000x9100	100.1
Senior Lecturer office	2	15000x9100	136.5
Utility Room	2	5900x5700	33.63
Store	4	3900x3600	14.09
Research Hub Office	2	3900x3600	14.09
Main Court Yard	1	50000x50000	2500
Mini Court Yard	8	18000x8200	147.6
Stair 2	4	8000x3000	24
Escape Stair	4	5000x4000	20

4.9 FUNCTIONAL RELATIONSHIP

There are various charts and diagrams used to show functional relationships among activities and spaces. The functional relationship chart shows the degree of relationships among the various spaces in the facility. It helps the designer to see at a glance which spaces are or not related to one another. This helps the designer to locate related spaces within easy proximity of each other and isolate those which are not related. It also aids zoning of spaces and functionality of the design. The flow chart is a diagram that shows the relationship between

spaces using boxes to designate spaces, while the bubble diagram uses circles of varying size, depending on the size of the space represented.

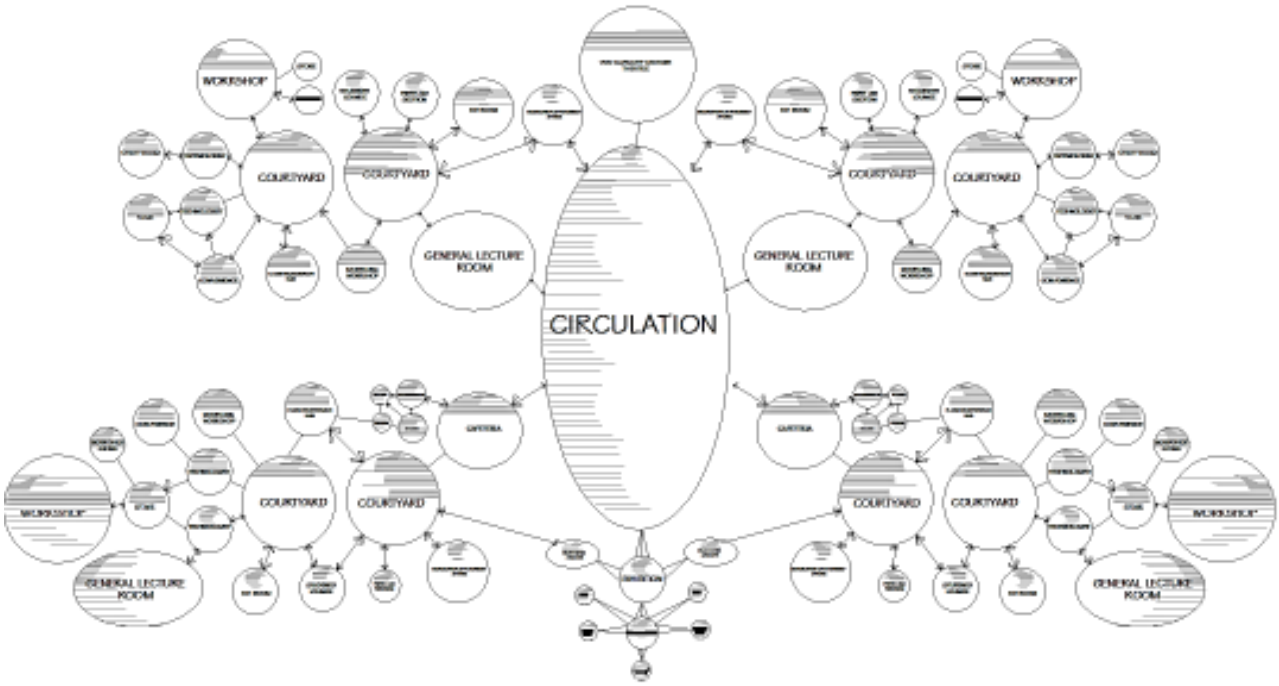

Figure 4.7: Bubble diagram of Ground Floor of the proposed School of Architecture

Source: Researcher's Archive (2015).

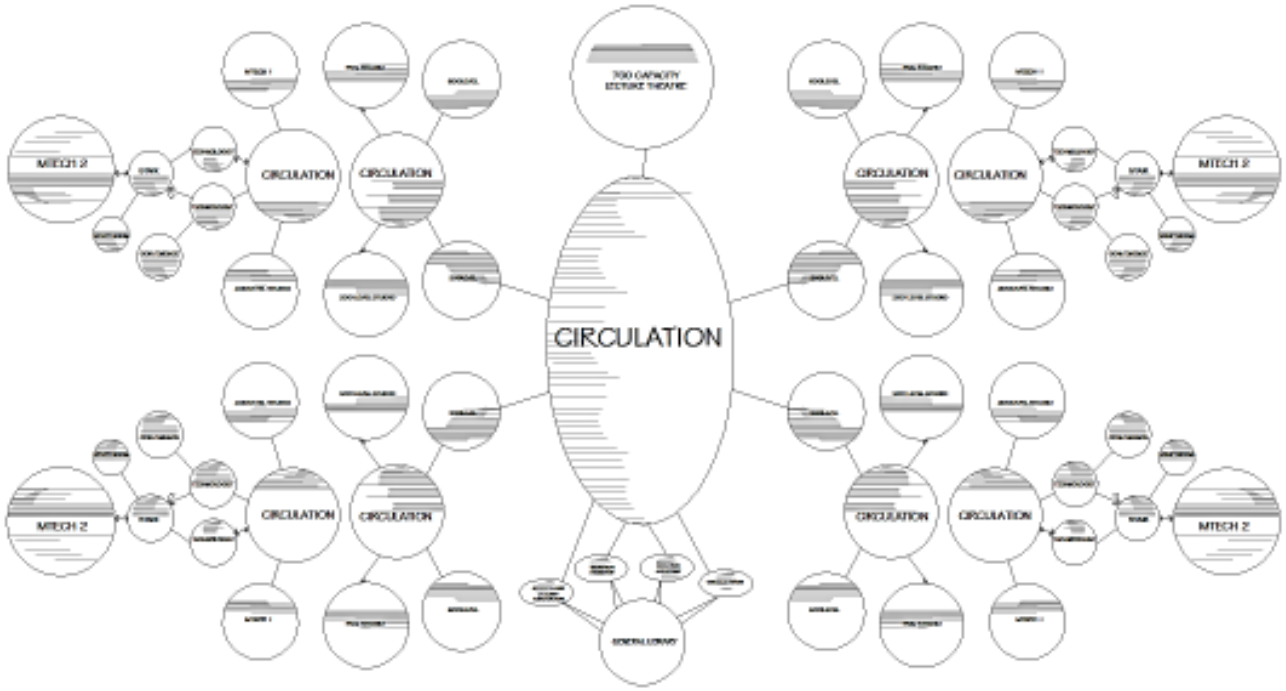

Figure 4.8: Bubble diagram of First Floor of the proposed School of Architecture

Source: Researcher's Archive (2015)

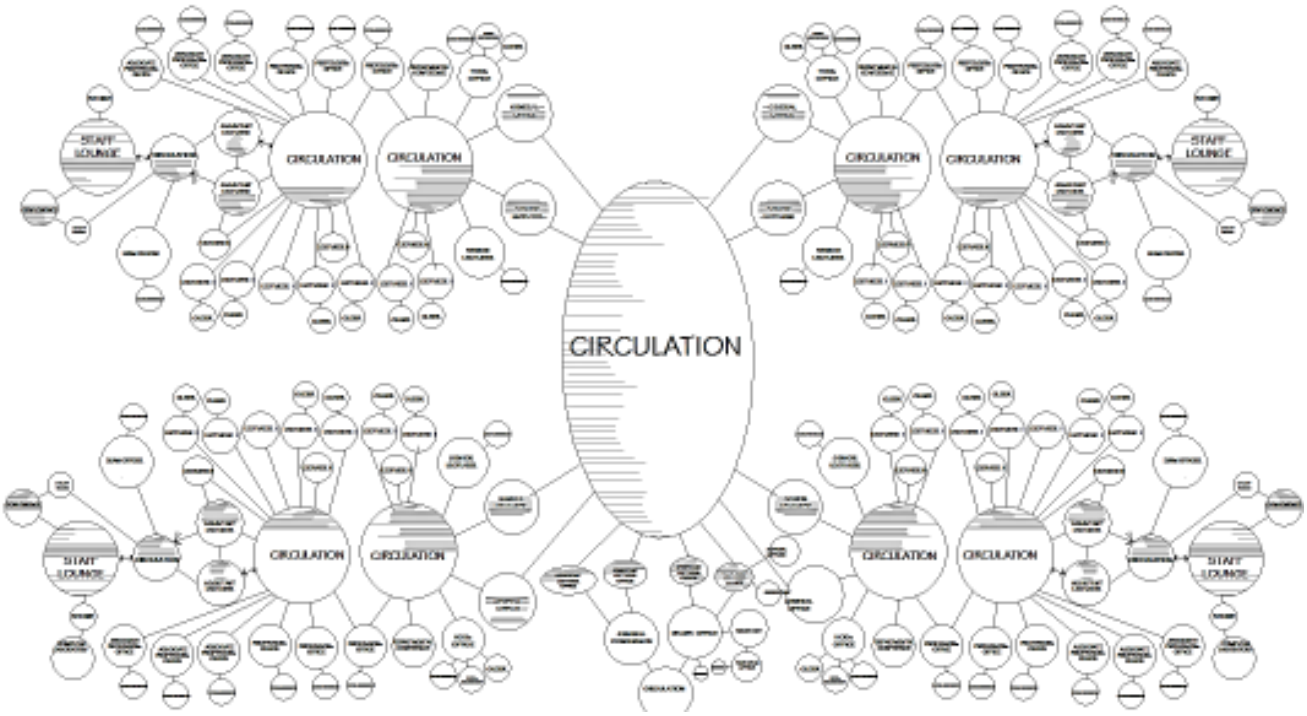

Figure 4.9: Bubble diagram of Second Floor of the proposed School of Architecture

Source: Researcher's Archive (2015)

4.10 CONCEPTUAL DEVELOPMENT

4.10.1 SITE CONCEPT

The site concept deals with the designer's idea behind the initial and overall planning of site activities in relation to the site's existing physical situation. This may be influenced by; existing buildings and the way they have been organized; physical features such as rock outcrops, roads, views to be taken advantage of, among others. The site for the proposed Skill Acquisition Centre has been planned and designed to take advantage of the nature of the surrounding environment as it relates to the winds, the sun, topography and existing services.

4.10.2 BUILDING CONCEPT

A pragmatic approach was taken towards the generation of the building form and arrangement of spaces which emanated from the integration of the four departments, technical requirements for different activities amongst others are considered for the building so as to achieve the desired user capacity. Flexibility in the layout of spaces is also an important consideration since the building has to be functional, this led to the rectangular forms having a generalized central core that serves as common facility provider for the other wings.

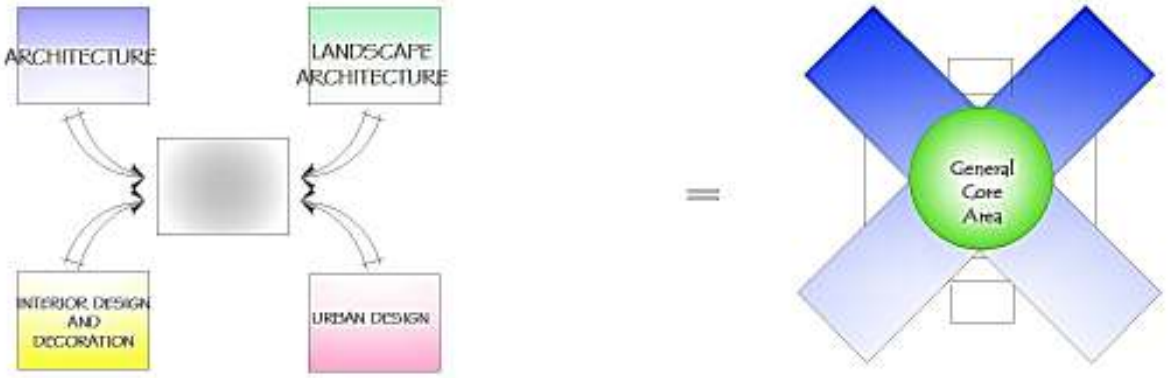

Figure 4.10: Design Concept

CHAPTER FIVE

5.0. PROJECT APPRAISAL

5.1. ARCHITECTURAL APPRAISAL OF PROPOSED SCHEME.

The design of today‘s faculty buildings tends to be different in expression from their early age of design. The proposed development is going to be an implementation of the section of the university master plan that is concerned with the construction of school of architecture for the University of Ilorin with the principal objective of regenerating the campus realm around the study area. The proposed building is going to be iconic and a strong landmark that will change the shape.

The building will accommodates all the functional requirements of a faculty/ school building with emphasis on the core academic spaces, administrative blocks and auxiliary facilities carefully joined or connected by the transitional facilities forming the locus of the building design.

5.2. CONSTRUCTION TECHNIQUES AND MATERIALS

The location of the facility will influence the choice material as well as method of construction. It is expected that modern type of building materials should be used. All structural works and configurations should be handled by a certified structural engineer registered by COREN as designs of columns, beams, and reinforcements and so on will be required. Several analyses will also be required to know the soil safe bearing capacity, effect of wind load among others on the facility. Reinforced concrete and steel shall be main structural elements in the design. The choice of finishes will take into cognizance the acoustic design, the thermal insulation and other factors in finishes. The use of each interior space shall also determine the choice of finishes.

5.2.1. STRUCTURAL LAYOUT AND ANALYSIS

The buildings is frame a structure that transmit load from the columns and beams to the foundation. The external and internal walls are basically non-loading bearing walls. This frame construction system allows for flexibility of spaces. The wall claddings and glazing skin are non-structural in function. The frame steel structure is quite easy to assemble.

5.2.2. SUB-STRUCTURE

The substructure of the building comprise of mainly foundation. The soil within the site is firm, well compacted, with good load bearing capacity and has the presence of rock boulders running underneath the soil layer. Both strip and pad foundation would be employed in this case because of the favourite characteristics of the soil. The quality of the foundation

materials will offer resistance to chemical and pose adequate compressive strength; this will aid in conveying the weight of the building without any form of differential settlement. The operations that are mainly involved in substructure stage are:

i. **Site clearing**: all obstruction on the space to be occupied by the buildings is to be removed to allow for other operations to follow. Trees and other plants that exist on the building site must be removed.
ii. **Site hoarding**: it is the erection of barrier around the perimeter of the site to improve security and protection of equipment and materials. The material to be used for the hoarding is corrugated galvanized zinc sheets nailed on timber frames
iii. **Removal of topsoil:** the removal of the topsoil over the space on the land covered by the buildings. The top soil on the other spaces should be retained to be used for landscape planting. The average depth for top soil removal is 150mm.
iv. **Setting out:** the transfer of dimensions on the building drawings to the site is called setting out. The buildings are to be set out in relation to the existing road that is the reference point for the buildings. The setting out is to be done with the use of theodolite to achieved higher degree of accuracy compared to other methods.
v. **Excavation to trenches:** after the setting out has been completed and certified by the consultants. The trenches are to be done by excavators to the specified depth by the structural engineer. The trenches are to be checked and signed off before the blinding will be put in place.
vi. **Casting of blinding, foundation footing and column bases:** Concrete will be casted deep down the soil. The foundation footing is to be laid to adjust to the slope of the site. The column bases are to be reinforced to structural engineer's specification.
vii. **Laying of foundation block wall:** The foundation block walls are to be 225mm sandcrete block wall laid in stretcher bond. The foundation block walls are to be filled with concrete. The concrete will improve the strength of the foundation block wall.
viii. **Hard-core filling:** the hard-core should be 300mm thick weathered rock. It should be well compacted and levelled.

ix. **Damp proofing:** the damp proofing material should be in 3 plies of bituminous felt laid over the area of the foundation. It is to disallow capillarity of water to the floor slab.

x. **Casting of in-situ ground floor slab:** the ground floor slab is to be constructed to a thickness specified by the structural engineer. The floor slab should be reinforced. It must be checked and signed off by the structural engineer before progress of work.

5.2.3. SUPER-STRUCTURE

1. Floor Slabs

The span of the building are of two folds: firstly from the ground floor to first floor, secondly from the first floor to the second floor. The span of the former necessitates the use of waffle floor while the later utilized the normal reinforced concrete massing.

2. Walls

Generally, walls in this design should be non-load bearing ones of low time lags due to the high daily diurnal temperatures and as such should be generally thin walls. Curtain walls were extensively used in the building with consideration for minimal glazing so as to reduce cost.

3. Roofs

The skin of the glass roof is entirely covered in single-crystal photovoltaic sensors positioned between the two layers of glass. They also act as shading devices, optimizing the comfort of people using this public space in summer and winter alike steel members in this thesis are proposed to be made from hollow circular steel tubing sections, arc welded together and sourced locally.

5.2.4. MATERIALS AND FINISHES.

The selection of materials and finishes for floors, ceilings and walls in contribute to the comfort, safety, and aesthetics of a faculty building. The finish material pattern, textures, and colours, together with the building geometry, help define the architectural quality and identity of building. The building must be operable and maintainable with minimal resources and the material and finish selections must be durable, maintainable, vandal-resistant, environmentally friendly, fire-resistant, cost effective, and visually pleasing.

Floor Materials: Finish providing non slip-resistant surface.

1. Monolithic Materials

Concrete - with appropriate finish to provide slip-resistant surface in ancillary areas.

2. Unit Materials (large units - min. 200 mm. x 200 mm. x 12.5 mm).

a. Natural granite. Mandatory as platform edge slab.

b. Manufactured granite.

c. Terrazzo - precast only, up to 600 mm. x 600 mm. slip resistant texture, with sealed surface.

d. Quarry tile.

e. Paver brick - dense, hard.

f. Unglazed ceramic tile.

g. Vinyl title - non-public areas only.

h. Cement Terrazzo (special/hard aggregates, abrasive aggregates and installation control); thick set installation.

Wall Materials

1. Monolithic Materials

a. Concrete with sealers (with sufficient surface texture to conceal minor soiling and damage without complicating maintenance procedures, or constituting a hazard toclothing or skin of patrons).

b. Rustication joints in room walls.

2. Unit Materials - min. 150 mm. x 150 mm. unless used for limited feature strips.

a. Unglazed and unglazed ceramic mosaic tile

b. Ceramic facing veneers

c. Glazed and unglazed brick

d. Precast concrete

e. Structural glaze faced concrete masonry units

f. Vitreous enamel steel panel non-combustible assembly

g. Crystallised glass panels

h. Glass Partitions: - These are to be custom designed to suit the building requirements.

Ceiling Materials

1. Monolithic Materials

a. Smooth concrete

b. Acoustic Materials sprayed onto mechanically fastened expanded metal lath.

2. Unit Materials

a. Non-corrosive linear metal panels with applied coating or natural brushed finish with wrapped acoustical material

b. Non-corrosive metal panels with applied coating or natural brushed finish with large perforations with wrapped acoustical material.

Door Materials

1. Flush hollow metal doors and frames:
    a. Public areas - alkyd enamel finish
    b. Non-public areas - alkyd enamel finish.
2. Wire glass at doors with vision panels
3. Stainless steel service gates.
4. Stainless steel doors.

5.3. SERVICES, CIRCULATION, VENTILATION AND LIGHTINGS

5.3.1. CIRCULATION

There must be adequate provision for proper means of circulation between floors, both vertical and horizontal for easy circulation around the building. Escape route requirements must conform with regulations standards of travel distance, occupancy load, and number of exits, which must discharge to the exterior.

5.3.2. VENTILATION

Ventilation in a simple term is a phenomenon that involves air movement – to remove used air to replace with fresh and new air. This process (replacement of still air with fresh air) will help to maintain a steady and healthy supply of oxygen within the lecture rooms, studios and office spaces. With ventilation, thermal comfort (comfortable temperature) will be achieved. Ventilation will also reduce the effect of high level of humidity prevalent in hot-humid zones. Ventilation in the building would be achieved mainly in the design by natural means.

Natural Ventilation.

As deduced from the case study. London, U.K, a careful modelling of the anticipated movement of air throughout the building spaces is necessary, the author would employ the use of a simple solution enabling solar-assisted natural ventilation within. The basic form of the building a generous courtyard spaces which sweeps up to a tall glazed wall – is the optimum shape required to achieve this. Air is drawn through a deep void in the double skin of the roof through the stack effect and exhausted at the highest point. This natural ventilation maintains air movement and keeps summer temperatures at comfortable levels, assisted by solar shading from the large overhanging eaves to the east and west elevations, and louvers along the glazed south elevation.

Other factors like size of openings and their position, building interior plan, design of inlet and landscape may arise from design decisions. When wind pressure is very high, some measure of control can be employed. Natural elements such as landscaping (planting of trees) and the use of structural devise like fins overhang serve as wind breakers.

5.3.3. LIGHTING

Lighting is an integral part of architecture of a school building and as such should respond to the given architectural conditions and be coordinated with other elements of the building. In addition to providing illumination and a sense of security, the lighting system in school halls should be durable, energy efficient and easily maintained. The lighting in office rooms, passages, stairs, open areas etc. shall be provided as per established norms and appropriately positioned.

Lighting design shall provide an appropriate transition from street to spaces. Concepts for lighting design are set forth under the umbrella principles of Safety, Economy and Drama:

a) Integration with architecture and artwork
b) Emphasis at key points of transition and transaction
c) Promotion of the sense of real and perceived security
d) Location of luminaires and system components for feasible maintenance;
e) Introduction of natural light into building volumes wherever feasible
f) Intelligent systems /concepts shall be used for automatic switching on and off of the lighting fixtures. Sensors shall operate as per the lighting levels in different weather conditions. It will be focused to achieve maximum energy savings

5.3.4. SERVICES

Water Supply and Plumbing

A constant water supply in a school building is very important and necessary for the day to day running of the building.

The supply is essential for the following:

i. It will serve special features such as fountains.
i. It will provide water for wash downs of lavatories, toilet facilities and equipment.
ii. To provide water for restaurants.

For plumbing, the design should be such that any section can be shut off in the case of repairs, leakages, vandalism or in a case where sprinkler head turns off accidentally. The supply of water to the building would be from the university central water system. An alternative water source can be from the provision of a water reservoir installed.

Electricity Supply

For a school building, constant electricity supply will be very essential because a wide range of energy source to power various electrical equipment and appliances as well as for security gadgets. Stand-by power supply is necessary to power information display media including audio, visual and tactile to meet with the needs of all school facility users The main source of power to the University is from the power holding company of Nigeria (PHCN) which is not reliable enough to carry the responsibility of power alone therefore an alternative is advised in the case of failures. A power generator should be installed to complement the power source which is on a standby. This is the responsibility of the management of the university.

Waste and Drainage System.

Waste must be properly disposed in a building be it foul or excess water due to precipitation. Foul water wastes would be channelled into a central lavatory why, solid waste would be burnt in an incinerator that would be provided in the design. Waste water coming from rainfall must be collected from the roof level with the aid of roof gutters, with water collected in a reservoir for further uses especially in conveniences, this is an advanced sustainable principles advocated in the design. Adopting such a waste control systems would not only limit damage to the landscaping but also ensures the building is sustainable and cost efficient. A coordinated drainage system of this sort is good for a public building which would be perceived by different users.

Furniture, Fixtures and Equipment.

It is imperative that the furniture and fixtures that facilitate students learning and staffs comfort, convenience and safety must be installed. It must also be durable and designed for minimal maintenance and repair. The design of these objects, therefore, shall in corporate innovative technology and material.

Acoustics

Acoustics of an environment has the ability to affect the way people behave. Excessive noise and poor speech intelligibility may lead to frustration on the part of the students and staffs in a confined area, such as the faculty building. The acoustic design of stations must provide a good aural environment, in which people can communicate clearly and easily, and the build-up of excessive noise is suppressed. Public address (PA) announcements must be easily heard and understood. A comfortable acoustic environment must also be provided for the building users in the non-public area. Selection of the appropriate finishes providing effective sound absorption can control the level of reverberation and provide a comfortable acoustic environment.

Acoustical Treatment/Materials

Acoustical treatment is most effective when applied near the source of the noise. Designers shall take these into consideration in selecting acoustical materials and shall create solutions regarding easy accessibility to the materials for replacement. Options may include:

1. Cementitous spray-applied or trowel-applied acoustic materials.

2. Non-corrosive metal panels (with or without perforations) with wrapped acoustical material. Metal panels may have applied coating or natural brushed finish.

3. Rigid, cellular glass block.

4. Suspended acoustic tile (in non-public areas only).

5. Cellular glass blocks (typically concealed behind metal panels).

6. Glass fibre blankets that are wrapped in close-weave glass cloth or other non-flammable sheeting.

5.4 SUMMARY OF FINDINGS

The design of School of Architecture offers the opportunity for unique solutions, which systematize complex programs within one site. It organize multiple specialized spaces in a way that allows the building to be coherent, as it unifies many diverse architectural disciplines under one single roof. The following points of note have been found to be important;

Space

The unique and diverse program that coincides with university education gives the opportunity for extremely rich spatial conditions. Rather than focusing only on how program affects specific spatial environments, it is always beneficial for designers to also consider how spatial conditions can influence program. Spaces can take on many different forms, giving off many different feelings to its users. This has been considered in the design of the school of architecture, ensuring that spatial experience is satisfactory.

Flexibility

The design must be sustainable enough to accommodate both current and evolving users. Flexibility is generally delivered by having column free space, service pits or trenches, operable walls, air conditioning, high floor loadings and rigging capability. Other items include; catwalks, operable ceilings, operable floors and operable seating.

CHAPTER SIX

6.1 RECOMMENDATIONS

The shapes and qualities of architectural spaces greatly influence human experience and behaviour, for we inhabit the spaces of our built environment and not the solid walls, roofs, and columns that shape it. Positive spaces are spaces preferred by people for lingering and social interaction. Negative spaces tend to promote movement rather than dwelling in place.

The design of an architectural space to accommodate a specific program, experience, or intent is the ultimate design aim which this study has addressed. From study it is clear that the problem of school facilities and large public complexes is a spatial and functional planning relationship problem which was the major task of this study. These problems identified and addressed were as a result of poor spatial planning consideration and conversion in use of such facilities from their original intended purpose.

The following recommendations are posited for development of an effective faculty building;

1. Adequate circulation should be provided and interesting connected to adjoining facilities.
2. The design of future faculty buildings should embrace the principles of sustainability in its diversities.
3. Proper landscaping of the building environment should be encouraged, these if adopted would lower the amount of heat and noise gain into the building interior from the external. The role of a faculty building is for academic activities; therefore the prevailing environmental conditions must aid its success.
4. Sustainable design principles should be encouraged not only for the design of the school of Environmental studies, but a pivot for future projects in the implementation of the university master plan.

6.2 CONCLUSION

Our experience of an architectural space is strongly influenced by how we arrive in it. This study has critically investigated and analyses the various spatial and organizational problems in large complexes in academic environment with particular reference to the School of Architecture and carried out detail study of the program requirements to determine the specific activities that will take place there.

Hence, in conclusion, the combination of the clustered and linear spatial system of planning to produce a design that will accommodate and address these problems and as well enhance the quality of such spaces to accommodate spatial activities effectively. And secondly, an architectural piece that will be a landmark building and indeed define the architectural character and enhance the visual quality of the University environment.

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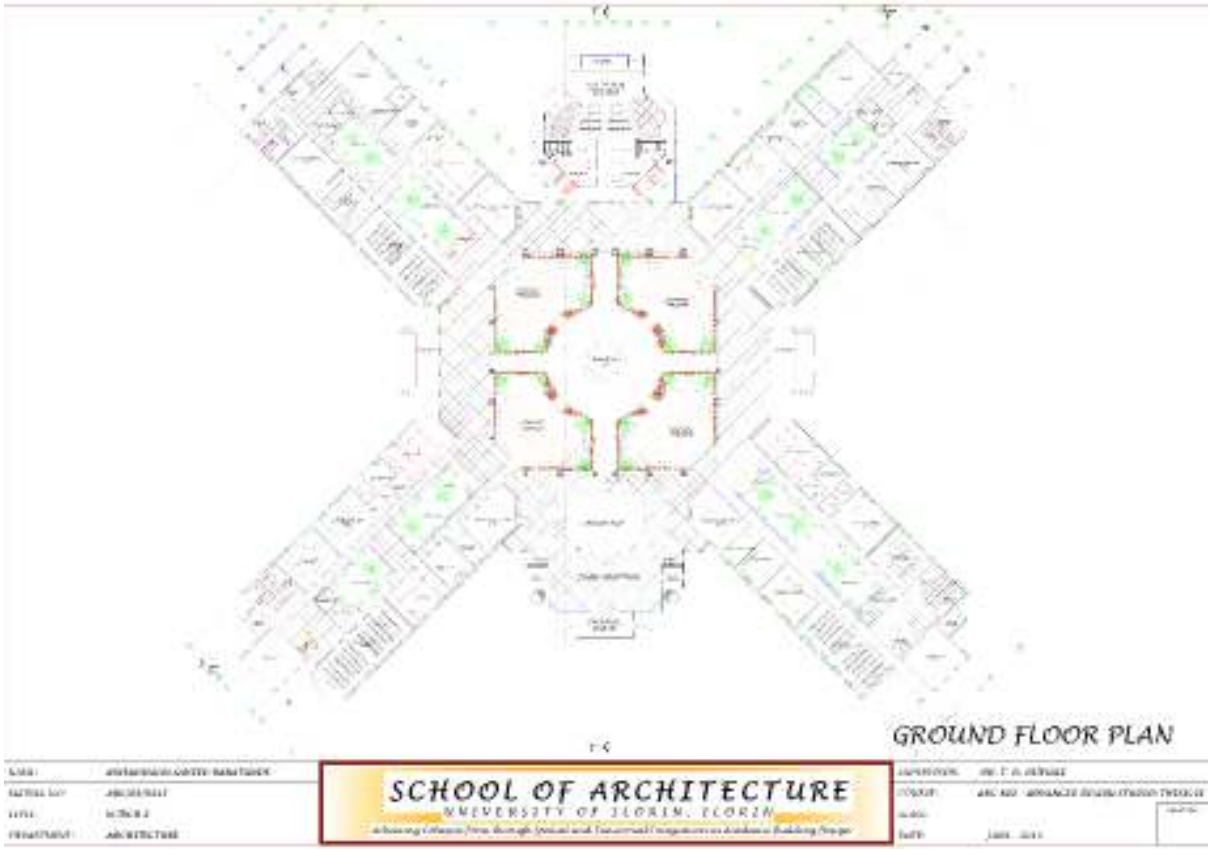
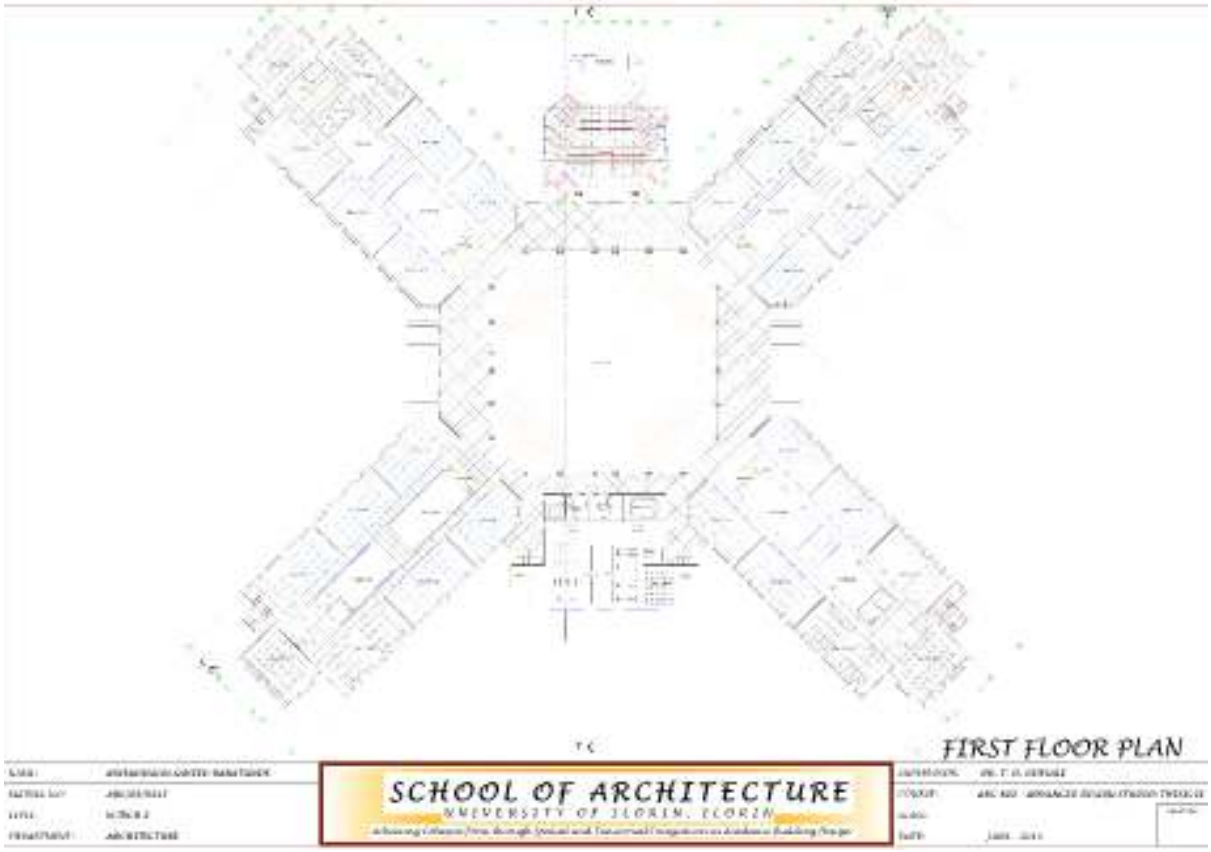
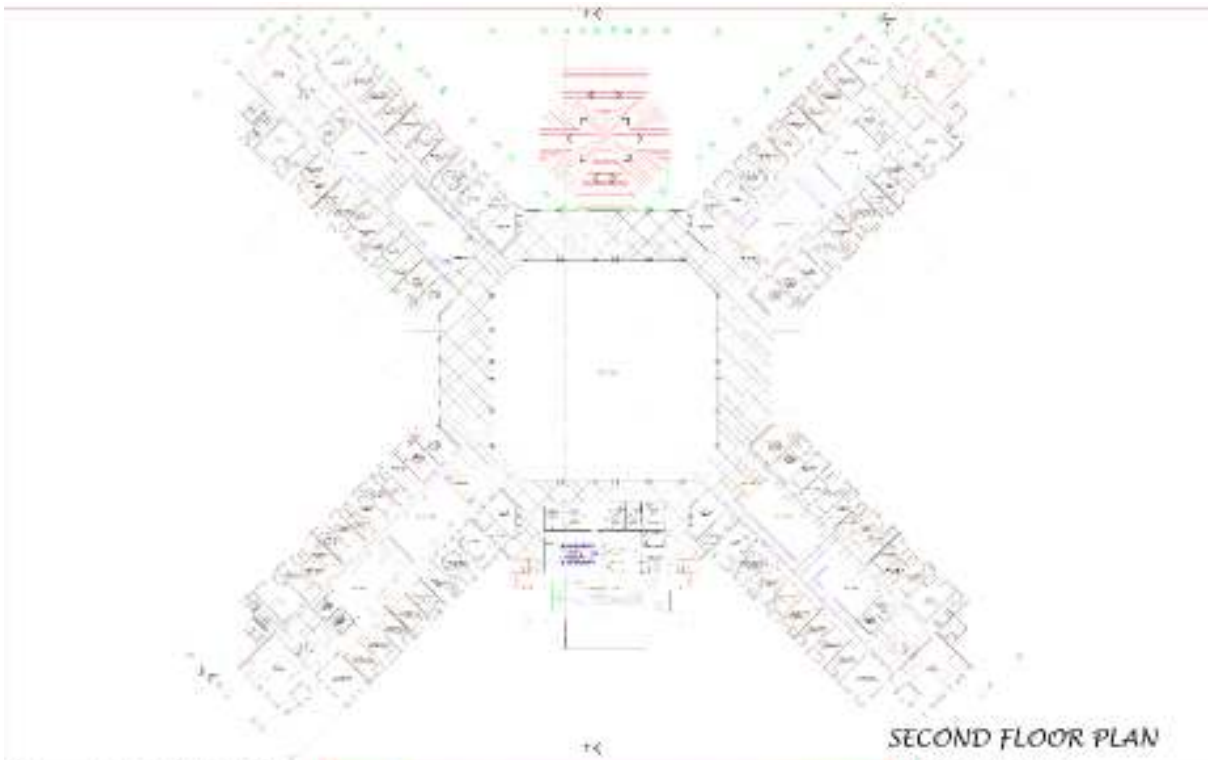
Appendix


N
SITE PLAN
NAME: ANIMASHAUN SAHEED BABATUNDE
MATRIC NO: ARC/09/9123
LEVEL: M.TECH 2
DEPARTMENT: ARCHITECTURE
SCHOOL OF ARCHITECTURE
UNIVERSITY OF ILORIN, ILORIN
Achieving Cohesive Form Through Spatial and Functional Integration in Academic Building Design
SUPERVISOR: DR. T. O. ODEYALE
COURSE: ARC 802 - ADVANCED DESIGN STUDIO: THESIS II
SCALE:
DATE: JUNE , 2015

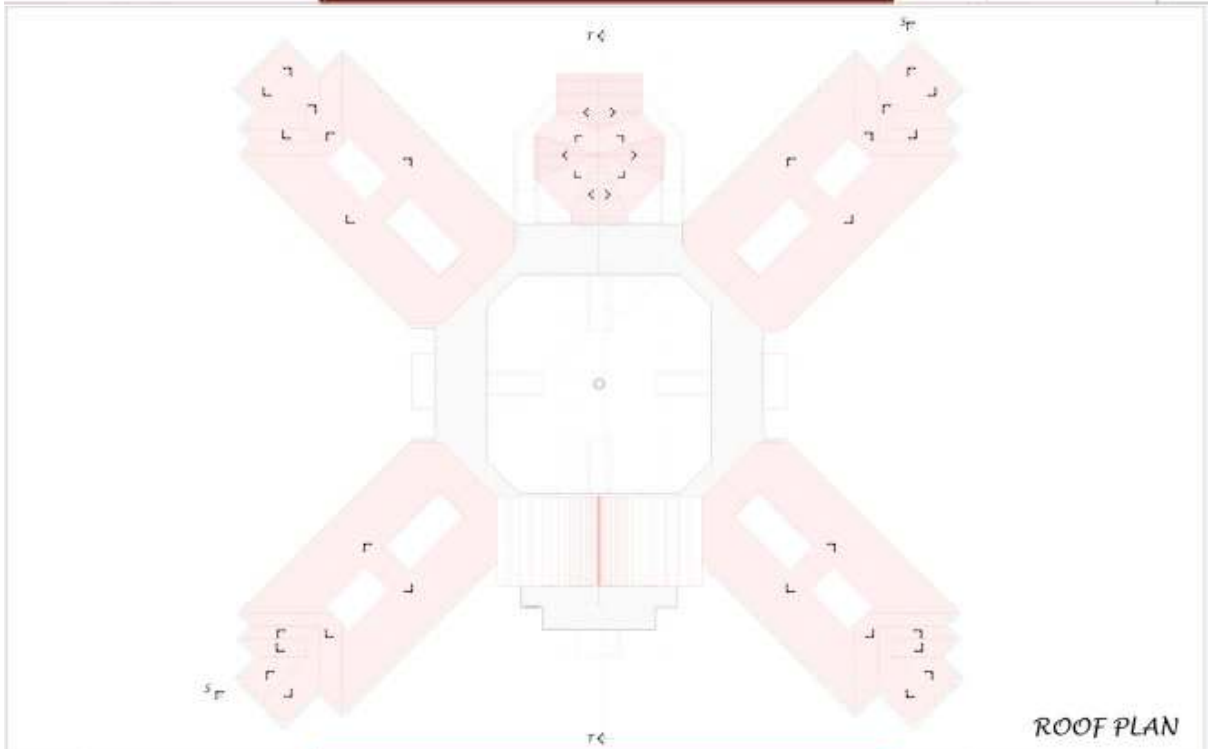

GROUND FLOOR PLAN
SCHOOL OF ARCHITECTURE
UNIVERSITY OF ILORIN, ILORIN


FIRST FLOOR PLAN
SCHOOL OF ARCHITECTURE
UNIVERSITY OF ILORIN, ILORIN



SECOND FLOOR PLAN

SCHOOL OF ARCHITECTURE
UNIVERSITY OF ILORIN, ILORIN
Achieving Cohesive Form through Spatial and Functional Integration in Academic Building Design



ROOF PLAN

SCHOOL OF ARCHITECTURE
UNIVERSITY OF ILORIN, ILORIN
Achieving Cohesive Form through Spatial and Functional Integration in Academic Building Design


SECTION 5 - 5


SECTION 7 - 7


FRONT ELEVATION


REAR ELEVATION


LEFT ELEVATION


RIGHT ELEVATION

PERSPECTIVES