DESIGN PROPOSAL

FOR KOGI STATE UNIVERSITY MODERN LIBRARY ANYIGBA, WITH FOCUS ON FIRE PREVENTION AND PROTECTION

M.TECH THESIS (ARCHITECTURE)

BY

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M.TECH/SET/1409/05/06

A THESIS SUBMITTED TO POST GRADUATE SCHOOL

IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF

MASTER DEGREE IN ARCHITECTURE (M.TECH)

DEPARTMENT OF ARCHITECTURE

SCHOOL OF ENVIRONMENTAL TECHNOLOGY

FEDERAL UNIVERSITY OF TECHNOLOGY

MINNA, NIGER STATE.

SEPTEMBER, 2008

CERTIFICATION

This thesis titled Design Proposal for Kogi State University Modern Library Anyigba Focus on Fire Protection by Yakubu Ukwe-Nya Sunday. (M.Tech/set/1409/05/06) meets the regulations governing the award of the degree of M.Tech of the Federal University of Technology, Minna and is approved for its contribution to scientific knowledge and literary presentation.

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DECLARATION

I, Yakubu, Ukwe-Nya Sunday, a Postgraduate student, in the department of Architecture and with Reg.No. M.tech/set/1409/05/06 declare that this research work is prepared in the course of my research undertakings for the Award of Master of Technology in Architecture. The work embodied in this thesis report is original and has not been submitted in part or full for any degree of this or any other University. All quotations are indicated and the sources of information are specifically acknowledged by means of references and bibliography.

Yakubu, Ukwe-Nya Sunday

Date

DEDICATION

This research work is dedicated with love to my parents. Late Mr. Yakubu, Sani and Late Deaconess (Mrs.) Adama, Yakubu (Omeyi) for their contribution for my success in Education.

ACKNOWLEDGEMENTS

The author acknowledges with gratitude God Almighty for his divine guidance, and good health, provision in the cause of my study.

I am indebted to my supervisor Arc. R.E Olagunju (MNIA), who's encouragement, correction and prolong support kept the wheel of progress in motion.

My appreciation goes to Dean of Postgraduate school Prof. J.A Abalaka, Dean of School of environmental technology Prof. T.C Mogbo, Head of Department of Architecture, Dr. A.A Muhammad-Oumar, Dr. (Mrs.) S.N. Zubairu, Arc B.N Mohammed (co-ordinator M.tech Arch) and all my Lecturers who where there whenever I was in a dire need, all non-academic staff of the departments and post graduate school.

My appreciation goes to Mr. & Mrs. Yabuku A. innocent for being a source of immense inspiration to me highly learned but an epitome of humility, may God reward you abundantly.

All my course mates for their contributions and my friends both within and abroad are not left out of this acknowledgement.

ABSRACT

Fire incidents in buildings have been on the rise in Nigeria although not limited to this country alone. The technology of fire protection in buildings involves being able to prevent the occurrence or rather reduce the loss of lives, damages to properties of the buildings and protecting building fabric. The aim of this research is to prevent the start and spread of a fire, stop the spread of smoke and lessen the difficultly of evacuation of persons and properties during fire. The research used both the active (protection) and passive (prevention) precautions to achieve this aim. The study source of secondary Data is through the various study and literatures of different authors and the source of primary Data is by visiting various University library (case studies) design to asses the building to see how the passive or active precaution is being structured to combat the fire incidents in buildings. The study concluded by emphasizing the need for passive means of fire prevention by the architects in the choice of their building material. Specification, provision of exists, access for firefighters, compartmentation design and refuge area before evacuation and the active means by using the appropriate fire fighting equipment to limit the start or spread of fire.

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DEFINITION OF TERMS

I. Library- A library as defined by Microsoft encyclopedia Encarta is a repository (place of storage) for various forms of recorded information. The earliest in ancient time date back as early as 2200BC. Amongst the various types of libraries, the academic library is of vital important for academic advancement, hence the choice of this project.

Oxford Advanced Learner Dictionary look at library as room or building for a collection of books kept there for reading and research.

ii. Fire – Condition of burning

iii. Fuel – Something that will burn

iv. Air – Oxygen

v. Heat – Sufficient to start combustion

vi. Combustion – Process of burning, destructing fire

vii. Flammable – Liable to catch fire

viii. Inflammable – Easy to set on fire

ix. Non – flammable – Not easy to set on fire

x. Incombustible – Will not burn

xi. Ignition- The process of setting something on fire

(Source: www.wikipedia.org. retrieved 17th Nov 2006)

xii. Carrel – These are enclosed spaces for single study in the library.

xiii. Catalogue –This is the system of arrangement that guides the library users in accessing or searching for materials easily.

xiv. Acquisition – This is the acquiring of new books or materials either by legal deposits or by donations to the library

xv. Accession – This is the process of giving identification number to the newly arrived books

xvi. Serials – These are journals, seminar papers, term papers and periodical such as new papers and magazines

xvii. Circulation Counter – This is the counter at the reception where books are been issued and returned.

xviii. Audio-Visual – This is the part of the library that deals with photograph and anything that has to do with audio and visual perception. E.g. Audio and video tapes, microfilms, microfiche.

xix. Bibliography – This is the list of published materials in a country usually compiled on yearly basis

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

The more important a building is such as libraries the greater the need to provide facilities to protect and prevent it against fire hazards. Fire has been one of man's greatest aids to his advancement; it gives him a source of both heat and light. Today fire is still of great benefit of man's well being if it is controlled and protected but if allowed to start and spread without strict protection it turns to be one of the greatest enemies man has to face.

Fire, despite all its benefits has always been one of the major ENEMIES of man the world over. This can be testified by the building in history of the damages of fire worldwide. The building industry and the government of different countries have tried to legislate for certain standards of fire protections in buildings, but that seems not being implemented because every few minutes of everyday another tragic occurrence is on records in which properties worth of millions is burnt before our eyes and lives destroyed in the scene.

However, a reduced personal hazard and fire damage can be ensured by early consideration by the architect, early detections and extinguishing.

The early consideration by architects includes.

I. Access for fire fighters.

Ii. Provisions of adequate exist.

Iii. Specify incombustible materials

Iv. Use of self-closes doors and fire resistance materials.

V. Provision of refuge area before evacuation

Vi. Compartmentation designs. While the early detection and extinguishing is the use of fire fighting equipment such as such detector, fire extinguishing, sprinkler installation.

This research have now led to both active and passive precautions that have to be taken to protect the library expensive archives from fires and as well to combat personal hazards to individuals because immunity from fires cannot be guaranteed, this being the fundamental reason for having fire protection systems buildings.

1.2 STATEMENT OF PROBLEM

The rising fire waste in this country with its tremendous sacrifice of life and destruction of property is a staggering natural problem. The loss of life resulting from fire is appalling, annually the property loss has steadily increased and it now appears that unless prompt action is

taken to reduce this needless waste the figures for the year ahead of fire destruction will be much greater.

Even a nation prodigiously endowed with natural resources and with the wealth and economic stability of the country cannot continue to absorb, without permanent impairment, the enormous loss year after year of irreplaceable material resources. In this present era, where there is great scarcity of food, cloth and shelter globally, fire destruction becomes not only tragic but also completely inexcusable.

1.3 AIM AND OBJECTIVES OF THE STUDY

1.3.1 AIM

The aim of this study is to prevent the start and spread of fire through active and passive precaution means in a library.

1.3.2 THE OBJECTIVES INCLUDES

i. To eliminate or limit fire growth and spread in the library through the passive and active precautions means

ii. To install by default fire protection systems such as fire detector devices

iii. To provide comfortable spaces for reading and learning that is both physically and structurally.

iv. To safeguard life and properties against fire risk by the provisions of adequate exists, building compartmentation to control fire for a while and the use of primary fire fighting systems.

1.4 SCOPE AND LIMITATION

1.4.1 SCOPE OF WORK

This study covered the selected area of research alone, but deemed suitable for any building which are similar to the one of study within the State University. This study therefore, covered all systems for fire protection in building, especially library.

1 4.2 LIMITATIONS

1.4 In research of this nature, many factors posed one form of handicaps or the other is the scarcity of relevant information. The federal fire service stations approached for Nigeria fire code of building materials and building Regulation could not lay their hands on any since Nigeria is yet to bring out one, so I therefore went a head to use the British standard fire coding for building materials and building Regulations. This serves as one of the research's limited factor.

1.5 JUSTIVICATION

Havoc fire causes on human lives, public building contents and the building expensive fabric is so devastating, hence the incentives on the study of fire protection and prevention is the University library.

1.6 IMPORTANCE OF STUDY

This study is very significant in many respects. First and Foremost,

i. It is my humble contribution to the growing body of literature on fire protection in buildings

ii. It is also my intension to use this study to create a passive (prevention) culture in the minds of an architect from drawing boards or early stage of design.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 EVOLUTIONS AND HISTORY OF LIBRARY

The word Library is gotten from a Latin word 'liber' meaning 'book' (*Microsoft Encarta Encyclopedia 2002*). The history of libraries parallels the history of writing. For about 5,500 years, people have made written records of their ideas, their relations with others and the world around them. They have kept their records on a variety of materials, bone, clay, metal, wax, wood papyrus, silk, leather, parchment, paper, film, plastic and magnetic tape. At almost every stage in the development of these materials, people have assembled collections of their records into libraries.

Libraries of Clay were established in ancient Mesopotamia, a region that covers part of Iraq, Syria and Turkey. The people of Mesopotamia discovered that lasting records could be made by making marks on wet clay, which was then dried or baked. Thousands of these clay tablets still exist. Some of the oldest clay tablets discovered was made more than three thousand years before the birth of Christ by the Sumerians, a people who lived in Southern Mesopotamia. A library of thirty thousand clay tablets has been found at the site of the ancient city of Nippur. Archeologists have found other libraries of clay tablets in excavation of ancient cities in Syria and Turkey.

In the 1850s, a British archeologist excavator of the ancient city of Nineveh discovered a library which contained clay tablets. This library was found during the 700s BC by Sargon II. His great – grandson Ashurbanipal (668 – 627BC) organized trend greatly enlarge the collection. It was a babllyin a temple or a place as were most libraries of the time. Librarians, called men of the written tables; were in charge of these ancient collections. The heavy, durable tablets preserved information about affairs of daily life, especially trade and religion. Many of the tablets were used for record keeping. Others told stories of heroic deeds.

2.2 LIBRARIES OF THE WORLD AND EARLY LIBRARIES

2.2.1 Western Europe

Western Europe has many of the largely oldest and most important libraries in the world. The national libraries of Great Britain and France – the library in London and Bibliotheque Nationale in Paris are world centers of scholarship. The British Library owns about eighteen (18) million volumes and nationale owns about nine (9) million.

Western Europe has dozens of world famous Universities libraries and Cambridge University in England and of the University of Paris.

There are also many important special libraries in Western Europe. Several of them are noted for collections of early manuscripts and books such as Vatican Library in Vatican City.

2.2.2 Eastern Europe and Russia

The countries of Eastern Europe have a long tradition of scholarly libraries. The library of Charles University in Prague, Czechoslovkia and of Jagiellonian University in Krakow, Poland, rank among the oldest in Europe has about five (5) million volumes.

Libraries have traditionally played an important role in the educational system of the East Europe nations and of Russia. The Government of these countries have set up public libraries and reading rooms in large cities and small towns.

The Russian State Library (formerly the Leni Library) in Moscow is Russia's largest library and one of the largest in the world.

2.2.3 The Middle East

It does not have many well – supported modern libraries. The largest library in the Middle East is the Jewish National and University Library in Jerusalem Israel.

2.2.4 Africa Millions of Africans have no public library services. In some African nations, the only important libraries are those connected with institutions of higher education.

The lack of library service is most serious in the more than thirty (30) nations that became independent during the 1950s and 1960s. some of these countries have made good beginnings, however, they include Ghana, Ivory Coast, Kenya, Nigeria, Serria–Leone, Tanzania, Tunisia and Zaire.

Most of the largest and more important libraries are in far northern or southern Africa. The Egyptian National Library in Cairo has over 1.5 million volumes and the Cairo University Library has more than a million.

The Republic of South Africa has several large libraries. They include the Johannesburg Public Library with about 1.5 million volumes.

2.2.5 South and Southeast Asia

Most countries of South and Southeast Asia have national libraries and one or more university libraries. Most of the libraries are small and poorly supported. The chief national libraries are those of the Philippines, Malaysia, India, Singapore and Thailand.

Most of the free public libraries in South and Southeast Asia have been constructed since the end of world War II. One of the largest libraries in Southeast Asia is the Delhi Public Library in India. This library was founded in 1951 with the assistance of the united Nations

Educational Scientific and Cultural Organization (UNESCO) to demonstrate what a modern public library should be like.

2.2.6 Australia and the Far East

The National Library of Australia in Canberra has more than 1.5 million volumes. Australia has many Government libraries and others that serve commercial, research, industrial organizations. Almost every city and town has public and school libraries.

Japan also has a wee-developed library system. The National Diet Library in Tokyo owns more than 7 million volumes with about 30 branches.

2.2.7 North America

The chief library in the United State is the library of congress in Washington Dc. This is probably the largest University system in the United State and in the world is that of Harvard University.

2.2.8 ANCIENT EGYPT

The most famous library of ancient times was the Alexandrian Library a Greek institution of the Hellenistic age. It was located in Alexandria Egypt in the 330BC. Ptolemy I and Ptolemy II developed the Alexandria library into the greatest collection of scrolls in the ancient world.

The Ptolemy borrowed books from libraries in Athens and other cities and had them copied.

The Alexandrian Library had copy of every existing scroll known to the library administrators. It owned more than 400,000 scrolls.

However, not a trace of the library remains today and no one knows for certain what became of it

2.3 RENAISANCE AND REFORMATION

Many of the great university libraries in Europe were founded during the 1300s. By the 1400s and 1500s, national libraries were established on the continent.

2.3.1 FRANCE

The first important national library may the Bibliotheque in France. It was developed from the libraries of such early French Kings as Charles V, Charles VI and Louis XI. Francis I (1494 - 1547) first brought these royal libraries together at the palace of Fontana blear. During the reign of Louis XIX (1638 - 1715), the library was doubled in size by Jean-Baptiste Colbest (1619-1963) and moved to the present site in Paris. The library became national property after the French Revolution. Today, the library's collection includes books. Photographs, prints and audiovisual materials.

2.3.2 England

The roots of the first great university library in England go back to the late middle Ages. In 1444, Humphrey Duke of Gloucester (1391-1447) gave his collection of books to Oxford University. The library itself did not open until 1488.

2.3.3 Italy

In 1440, about the time that Oxford University acquired De'medi (1389-1464) established I tally's first library in Florence, in cloisters of San Marco.

The Vatican Library, the oldest public library in Europe was formed in the 1400_s through the roods bask as far as the 300_s and pope Damascus I. under Pope plus XI (1857-1989), the collections were organized and catalogue for the first time. The library is known for the number of rare books and manuscripts in its collection.

2.3.4 The Western Hemisphere

The San Marcos University Library in Lime, Peru, founded by the Spanish in 1551 is the oldest library in the Western Hemisphere. The first library in North America was established in Canada in Quebec in 1735. In the United States, Libraries such as these at Harvard University in Cambridge, Massachusetts, the College of William and Mary in Williamsburg, Virginia and Yale University in New Haven, Connecticut had considerable collections by the middle of the 1700_s

2.4 Types of libraries

Libraries can be divided into categories by several methods;

A **By the entity** (institution, municipality, or corporate body) that supports or perpetuates them

i. Tribal libraries

ii. School libraries

iii. Private libraries

iv. Government libraries

v. Academic libraries

vi. Historical society libraries

B **By type of documents or materials they hold**

i. Digital libraries

ii. Data libraries

iii. Picture (photograph) libraries

iv. Slide libraries

v. Tool libraries

C **By the subject matter of documents they hold**

i. Architecture libraries

ii. Fine arts libraries

iii. Law libraries

iv. Medical libraries

v. Military libraries

vi. Theological libraries

D **By the users they serve**

i. Military communities

E **By traditional divisions;**

i. Academic library –these libraries are located on the campuses of colleges and universities and serve primarily the students and faculty of that and other academic institutions. Some academic libraries, especially those at public institutions, are accessible to the general public in whole or in part.

ii. School library –Most public and private primary and secondary schools have libraries designed to support the school's curriculum.

iii. Research libraries –these libraries are intended for supporting scholarly research, and therefore maintain permanent collections and attempt to provide access to all necessary material. Research libraries are most often academic libraries or national libraries, but many large special libraries have research libraries within their special field and a very few of the largest public libraries also serve as research libraries.

iv. **Public libraries or public lending libraries** –these libraries provides service to the general public and make at least some of their books available for borrowing, so that readers may use them at home over a period of days or weeks.

2.4 Academic library

An academic library is a library in a higher educational institution, such as a college or a university –libraries in secondary and primary schools are called school libraries. There are two complementary purposes: to support the teaching at the college or university, and to support the research of the university faculty and students.

The support of teaching requires material for class readings, and for student papers. In the past, the material for class readings, intended to supplement lectures as presented by the instructor, as been called reserves. In the period before electronic resources became a available, the reserves were supplied as actual books, or as article photocopies. Traditionally, one copy of a book was made available for each 10 students –this is obvious practical for large classes only if paperback copies are available, and the books reused from term to term.

Thompson G. (2003:15), in his opinions says, as books became more common, the need for chaining them lessened.

But as the number of books in libraries increased. So did the need for compact storage and access with adequate lighting, giving birth to the *stack system,* which involved keeping a library's collection of books in a space separate from the reading room, an arrangement which arose in the 19th century. Book stacks quickly evolved into a fairly standard form in which the cast iron and steel frameworks supporting the bookshelves also supported the floors. Which often were built of translucent blocks to permit the passage of light (but were not transparent, for reasons of modesty). With metal grating to allow air to circulate in multi – story stacks.

Ultimately, even more space was needed, and a method of moving shelves on tracks ("compact shelving") was introduced to cut down on otherwise wasted aisle space.

2.5 Library management

Allan K. (2002:98), Basic tasks in library management include the planning of acquisitions (which materials the library should acquire, by purchase or otherwise), library classification of acquire materials, preservation of materials, (especially rare and fragile archival materials such as manuscripts), the deaccessioning of materials, patron borrowing of materials, and developing and administering library computer

systems. More long-term issues include the planning of the construction of new libraries or extensions to existing ones, and the development and implementation of outreach services and reading – enhancement services (such as adult literacy and children's programming).

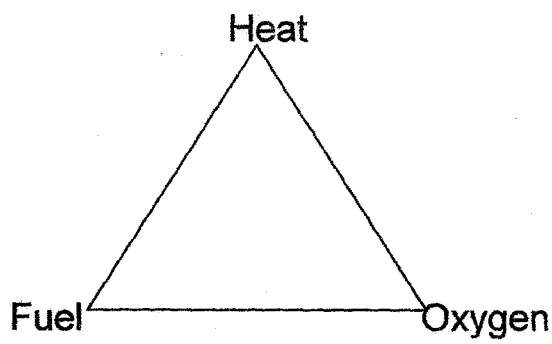
2.6 Fire Protection triangle

2.6.1 Fire Protection.

The serious loss in life and property resulting annually from fires causes' deep concern. I am sure that such unnecessary waste can be reduced, and if substantial process is made in the science of fire prevention and protection in this country is convinced that it will limit this unnecessary fire destruction. Harry S.T (1997:2)

Fire like all other natural phenomena, obeys the laws of nature. Not all fires burn in the same manner, since each has its own environment, however, there are three basic element necessary in all fire, these include fuel, heat and oxygen, which form what is commonly know as fire triangle.

Figure 1.0 Fire triangle



(Source: Management of fire service operations

Massachusetts, 1992)

Heat (suitably high temperature) with fuel (combustible materials) mixed with oxygen can ignite fire.

Further studies of management of fire service operations show that removing any of these three elements will then stop the spread of fire therefore the basis of fire protection in buildings.

In like manner Stollard P. and Johnson L. (1991:25) discovered the following as natural causes of fire.

a. Rain

b. Lightening

c. Wind and

d. Rays of the sun

According to stollard (ibid), in heavy down pour of rain, rain water is known to leak into buildings short out electrical wires and causes fires, he also said lightening which usually strike building at its highest point will travel through the building, following the path of least resistance to ignite combustible materials when sufficient heat is produced. He further expatiated on the sun rays, that when the sun's ray pass through a window and heat a concave mirror, the rays of the light coming off the mirror are now concentrated and where these rays are incident on

In the same vein British department of labours occupational safety and health administration (1910 sub part E APP 2002:3) state that the emergency action plan should be prepared to address emergencies that the employer may reasonably expect in the work place such as fire's, toxic chemical releases. The regulation states that the employer should list in details the procedures to be taken by those employers who have been selected to remain behind to care for essential properties until their evacuation becomes absolutely necessary.

British standard on fire prevention (1910 sub part E APP 2002:43) further stated that the designation of refuge or safe areas for evacuation should be determined and identified. In a building divided into fire zones by firewalls, the refuge area may still be within the same building but in a different zone from where the emergencies occurs.

British fire prevention house keeping standard also calls for the control of accumulation turn of flammable and combustible waste materials.

It is the intent of this standard to assume that hazardous accumulations of combustible waste materials are controlled so that a fast developing fire, rapid spread of toxic smoke, or an explosion will not occur

In the statement of Soudki H. (2004:115), Certainly oil soaked rays have to be treated differently than general paper trash in office areas. However, large accumulations of waste paper or corrugated boxes can pose significant fire hazard. He therefore suggested that such materials, which can cause large fire or generate dense smoke should be treated with care and every igniting source should be removed.

From the perspective of BS476 part 1:1988 combustible materials, which form part of the contents of the building, are responsible for the growth of a fire and its flame spread. To confirm this two test was conducted in that regards

i. Combustibility test to see weather the material will burn and

ii. Surface spread of flame to see the extent of flame spread along surface. In the end it was gathered that when combustible materials combine exothermically with oxygen it will burn and during considerable heat they flame or glow. However, people should be trained to manage initial fire .

Arale A. (2004:8) senior instructor of the federal fire service training school Lagos buttress the safety drills as being compulsory for every employer in a built environment and even for our domestic use. He said that people get consume in a fire incidents because of panic and not

having adequate knowledge on what to do in the case of fire. He suggested that each home and offices should have fire training and drills at least twice a year to be able to combat fire during occurrence; He also said that fire regulations should be part of domestic design.

To take this study further, fire regulation standards and codes in building is presented below

Building Codes: A building code is a set of rules that specify minimum acceptable level of safety for constructed objects such as building s. The aim is to protect the public health, safety and general welfare as it relate to buildings.

The practice of developing, approving and enforcing building codes may vary widely from country to country. In some countries building codes are developed by the government agencies or quasi-governmental standards organizations and the enforced across the country by the central government. Such codes are known as the national building codes. There are instances when some local jurisdiction choose to develop their own building codes.(British government Building regulation 2006:4).

British building regulations are statutory instruments that seek to ensure that the policies set out in Building Act 1984 are carried out on the construction of buildings. From 6th April 2006, The Building

Regulations were extended by amendments. New Regulations were introduced to require the calculation of a building fire protection.

There are currently 14 sections to the buildings Regulations and each are accompanied by an Approved Document. The approved documents usually take the form of firstly stating the legislations and then providing a number of means which are "deemed to satisfy" the regulations (BGBR 2006:5).

The Approved documents include

Part A ---------- structure

Part B ---------- fire safety

Part C ---------- site preparation and resistance to moisture

Part D ---------- Toxic Substances

Part E ---------- Resistance to the passage of sound

Part F ---------- ventilation

Part G --------- Hygiene

Part H --------- Drainage and Waste Disposal

Part J ---------- Combustion appliances and fuel storage systems

Part K --------- Protection from falling, collision and impact

Part L --------- Conservation of fuel and power

Part M -------- Access to and use of Buildings

Part N -------- Glassing – safety in relation to impact, opening and Cleaning

Part P ------- Electrical Safety.

But only part A and B of the Regulation will be considered in this study.

Part A – STRUCTURE.

This part requires buildings to be designed, constructed and altered so as to be structurally safe and not to impair the structural stability of other buildings.

It stipulates design standards that should be adopted for use on all buildings and additionally gives simple design rules for most mansions and timber elements traditional domestic buildings.

Part B – FIRE SAFETY

The Regulations consider 5 aspects of fire safety in the construction of buildings.

B1 Means of escape

That sufficient provision are made in design of the building that in the event of fire , the occupants can escape to a place of safety by their own efforts . This includes incorporating a suitable fire alarm system to give early warning of fire to the occupants and users of a building.

B2 Internal Fire Spread (Lining)

That the internal lining of a building do not support a rapid spread of fire.

B3 Internal Fire Spread (Structure)

That the structure of the building should not collapse prematurely and should slow the spread of fire through the building and in unseen cavities and voids by providing fire resisting walls and partitions where necessary.

B4 External Fire Spread

That the spread of fire between buildings be discouraged by spacing them apart sufficiently and controlling the number and size of openings on boundaries.

B5 Access and facilities for fire service

That the building and the site layout and access roads are designed in such a way to aid the Fire Brigade fight fire and effect rescue of persons caught in a fire.

2.7 BASIS OF FIRE PROTECTION AND ITS CLASSES

2.1.1 Basis of Fire Protection. Coleman R.J (1982:29-35)

Before fire start and spread the following ingredients must be present.

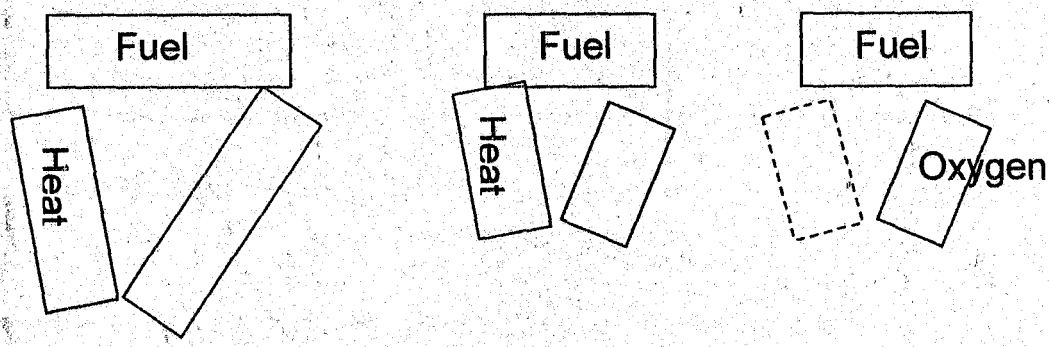
i. Fuel (combustible materials)

ii. Air (oxygen)

iii. Heat (sufficient to start combustion)

If any one of these is absent a fire cannot start and if any one is removed a fire will be unable to continue. This is the ***BASIS OF FIRE PROTECTION AND FIRE FIREFIGHTING***

Fig. 1 a) Combustible triangle



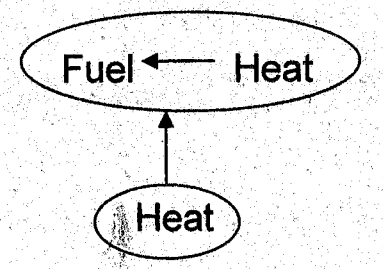
No combustion possible

(Source Coleman: 1982 Massachusetts)

Most burning processes produce a flame. Combustion continues when the heated fuel gives off gases which themselves ignites, heating more fuel to ignition point. Volatile materials like petrol have a high fire and expulsion risk, while a solid timber beam is show to ignite; however, thin sheets of timber are much easier to set a light.

$^{0}2$

gasses given off



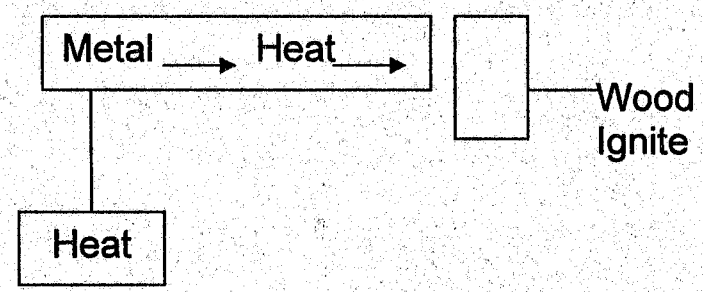
Fuel is heated and gasses

are given off

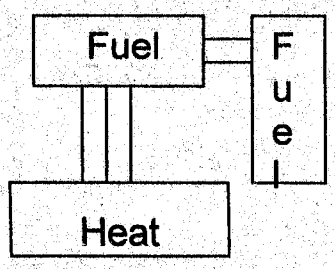
Figure: 2 (a)

Fire spread by the conduction, convection and radiation of heat. Heat travels through metal by conduction and can cause timber with which it is in contact to ignite. Super-heated air rises by convection and can cause fire to spread up lift, shaft and staircases to remote points. Radiation from a fire can raise the temperature of inflammable materials near the fire and cause them to ignite.

Fig.2 (b) Heat transfer by conduction



(d) Heat transfer by radiation



2.8MATRIX OF FIRE SAFETY.

Designing without a proper understanding of a matrix of fire safety causes great havoc in the building industry. Fire precaution is the first of fire prevention and only if this fails then the other tactics can be attempted. If fire prevention is successful that is, by being conscious, the other need not be attempted, however, this is not usually the case hence provision be made for other factors. The provision could be.

A. Ignition prevention

i. Natural phenomenon (Lighting)

ii. Human error (smoking, matches, cooking)

iii. Deliberate fire resin (vandalism, suicide)

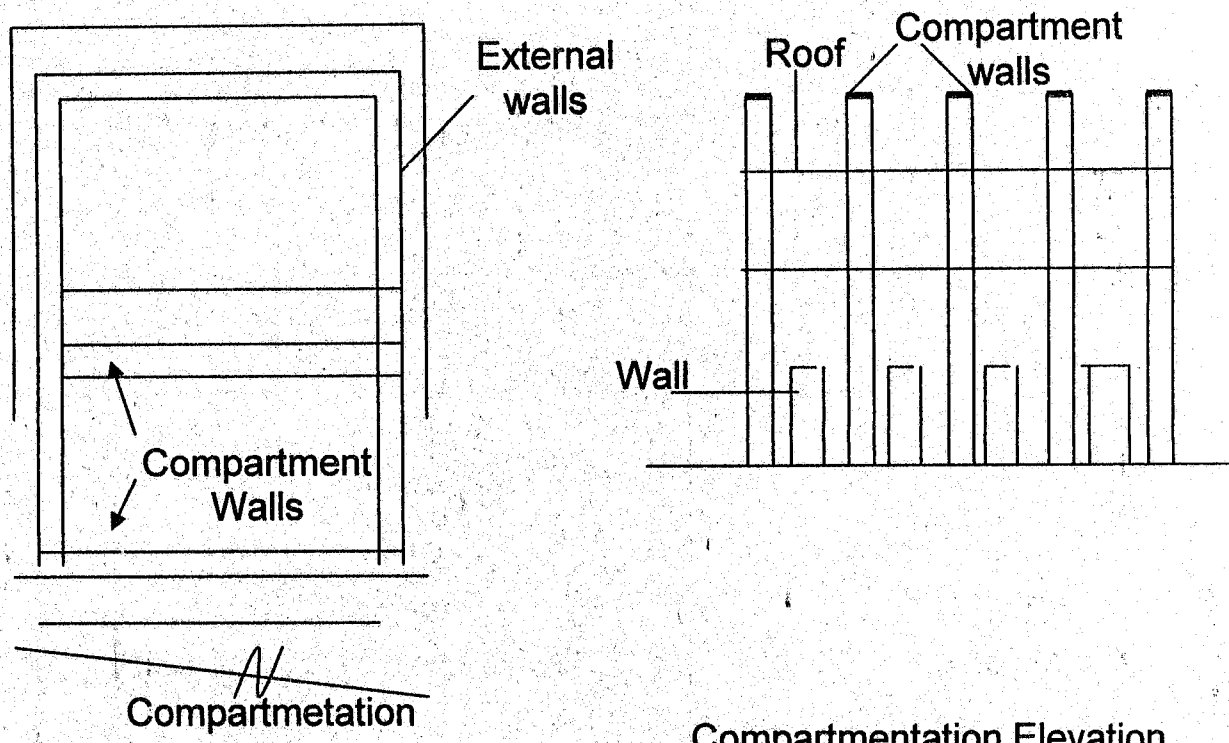
iv. Technological poor installment of electrical wire, (appliances like fan)

i. By setting reasonable standards of fire resistance for the structure elements of a building, the floors, roofs, load bearing walls and frames. An adequate number of exits and protected escape route should be provided so that occupants can be quickly evacuated, place of refuge before evacuation should be provided and access for fire service should also be provided.

ii. The second requirements is meant by dividing large buildings into compartment and requiring higher standard of fire resistance of the walls and floors bounding with compartment, setting standards of non-combustibility and fire resistance for external walls and standards of resistance to fire penetration and flames spread for roof covering.

Openings to compartment walls should be suitably protected by self closing fire resistance doors or shutter. Compartment floors may be pierced by stairwells, or lift shafts and these could result to a vertical spread of fire. This is prevented by a closing stairwell or lift shafts within a fire resisting structure termed a protected shaft. Any opening in a structure enclosing a protected shaft should be protected by fire resisting doors or shutter.

Figure 3.1 compartmentation sketches



(Source: Author 2006)

2.7.2 Active (Protection) means of fire control

This involves the use of extinguishers to stop the spread of fire in buildings.

The portable fire extinguisher in case of fire includes.

i. –Foam fire extinguisher

ii. –Water type of extinguisher

iii. –Carbon (IV) oxide ($C0_2$)

iv. –Dry chemical

v. –Halon gases

Before going into details of the above extinguishers adequate knowledge of classes of fire and the type of extinguisher to use needs be understand.

2.7.2.1 CLASSES OF FIRE

Classes	Material classification	extinguisher
A	Fires in ordinary combustible materials such as wood, paper, cloth and rubber.	Foam, water Dry chemical.
B	Fires in flammable liquids, gases and greases,	Halon gases, $C0_2$, and Dry chemical
C	Fires that involves energize electrical non-conductivity of the extinguishing media is of importance.	Halon gases, Co_2, Dry chemicals. When electrical equipment is de-energize use class A extinguishers safety
D	Fire in combustible metals such as magnesium, titanium, Zirconium, sodium and potassium	Type approved for use on the specific combustible metal hazards.

Having known the classes of fire and the extinguishing method portable extinguishers can now be addressed and their distribution within building.

i. Foam extinguisher.

Foam systems are used for extinguishing fires in building, rooms and outdoors, and they can also be used to form a protective layer over flammable liquids. The foam extinguishant is generated through the action of a water/foaming agent mixture with air. The minimum operating time is 60 – 120 minutes, depending on the type of foam. Precaution must be taken to prevent escape of flammable fluids from the protected area, the floor and spray distance must also be considered.

ii. Carbon dioxide (Co_2) Extinguisher

This is the most commonly used fire extinguisher it can be used whenever open flame fire can be expected and where a residue free extinguisher is also expected. However, it's application to protection object in the outside (open air) is not effective.

iii. Dry Chemical extinguisher.

Extinguishing powder are homogeneous mixtures of chemicals that act as fire suppressants. Dry chemical should not be used in the following installations.

These include area housing, for example

vi. Dust sensitive equipment and low-voltage electrical installation (e.g. telephone systems, information processing facilities, measurement and control facilities)

vii. Material, which are chemical incompatible with the extinguishant (that is, there is the danger of chemical reaction).

iv Halon gases extinguisher

halon is a halogenated hydrocarbon, usually Halon 1305 (BTM) bromotrifloromethane and Halon 1211 (BCF) bromochloro – floride.

Its extinguishing effect is based on the principle that it suppresses the reaction between the burning material and oxygen.

Halon BTM is the most effective and least toxic. Both BTM and BCF halon gases are stored compresses in liquid condition in a steel cylinder.

The possibly of environmental damage cannot be excluded and should be considered where halon systems are proposed.

New technology and research about Halon gases.

It is now discovered that halon gases are harmful to the ozone layers, it has significant effect on ozone layers. Several meetings of scientist's experts brought to an end the manufacturing of halon extinguisher by 2002 and all those already manufacture should be used by the end of 2002. That is why there is no halon extinguisher in circulation now.

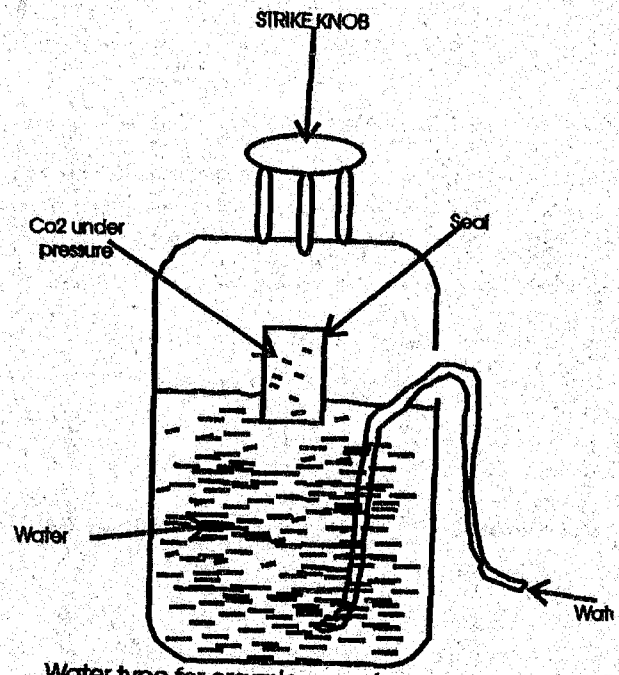
FM 200 extinguisher, which is considered non-harmful to human, and ozone layers, is in the process to replace the halon gases but not yet being approved totally by the scientist. (http/www.harl.com retrieved 20th Nov.2006).

Distribution of Fire Extinguishers.

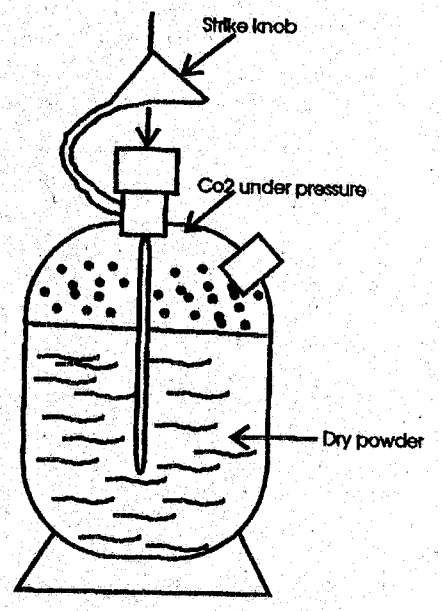
The maximum travel distance is 24m a part in horizontal distance and 3-4m apart in high rise buildings.

Are to be protected per extinguisher is 250m2 minimum. However, for a building where there is extra hazard of fire e.g. Auto repair workshop, wood working factory, Laboratory, warehouses, a greater number of fire extinguisher will be needed depended on the extreme fire hazard of the job there in.

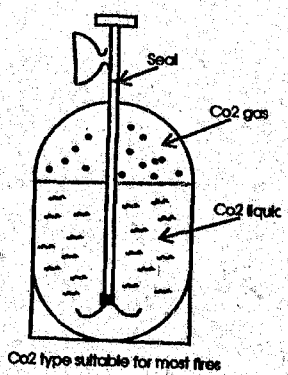
PRIMARY FIRE FIGHTING EQUIPMENT



Water type



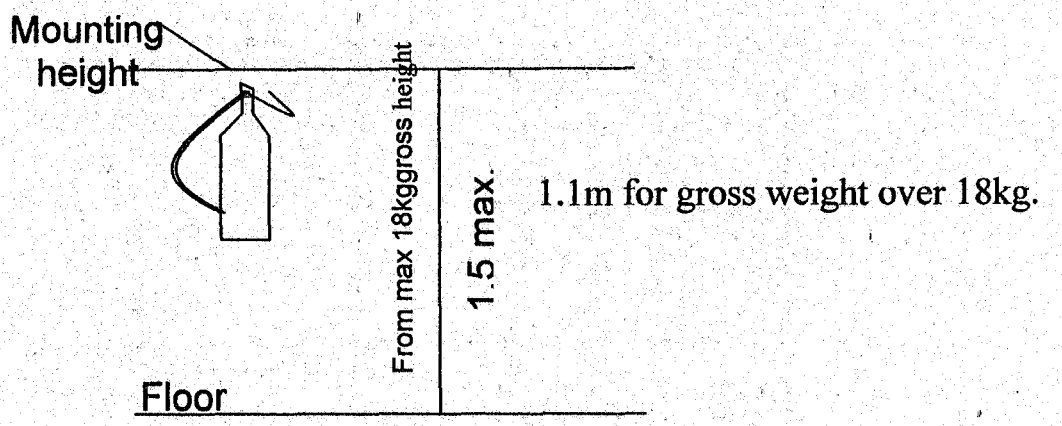
Dry Powder



Co2 type

The maxim height of 18kg extinguisher is 1.5m but where it is heavier than that use 1.1m

Figure 3.3 –Mounting height of extinguisher.



(Source: Dr S. N Zubairu lecture note, 2006)

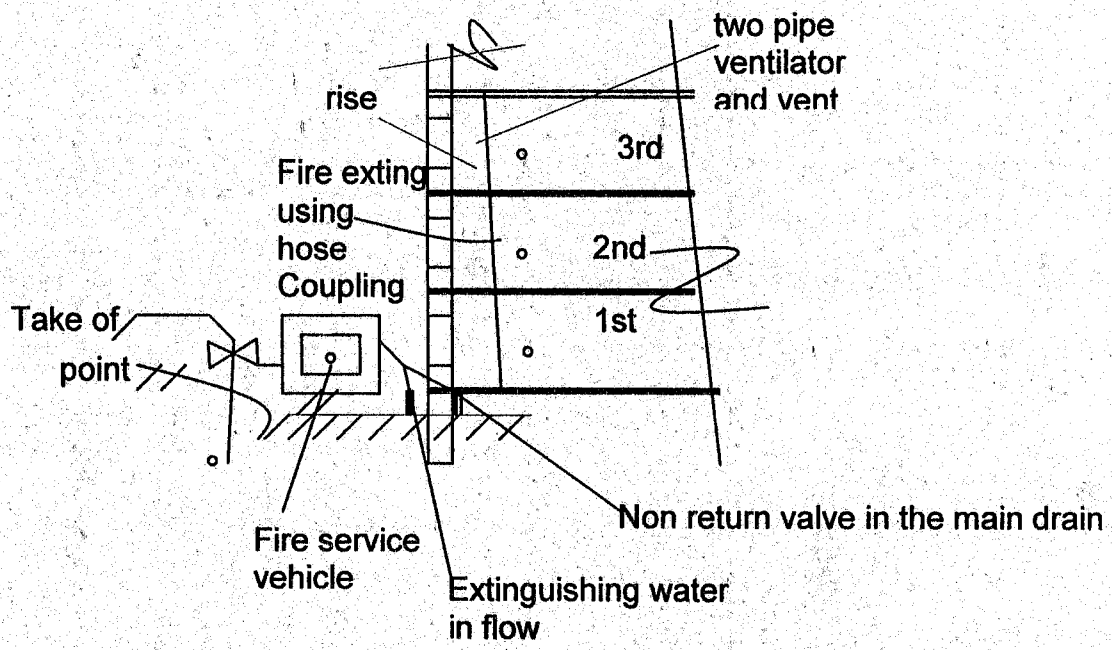
2.7.3 STANDPIPE AND HOSE REEL SYSTEMS IN TALL BUILDING

The regulations concerning the means of fire fighting in tall buildings are often no specific, but certain considerations for the protection of the building and its occupants must be observed. In this system water outlet are provided at strategic positions in which hoses can be attached for the purpose of extinguishing fire. Standpipes system are group into two general classes.

Class I – for use by fire department and those trained in handling heavy fire streams .Ø 6cm or 21/2 '' hose.

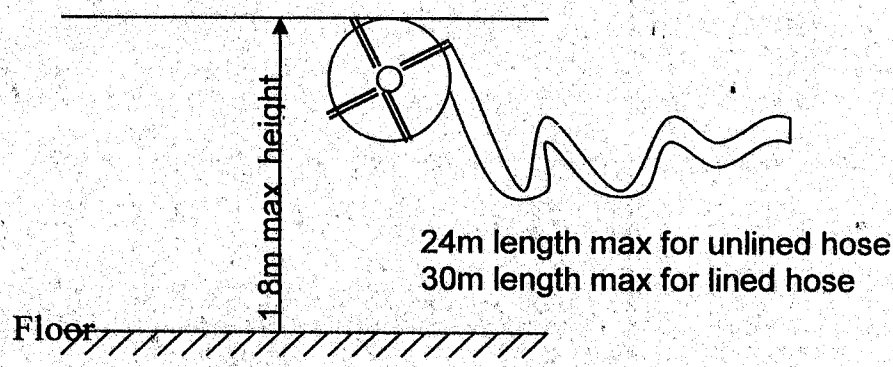
Class II – where there is a smaller hose for use primarily by the building occupants until arrival of the fire departments Ø 3cm or 11/2" hose.

Figure 3.6 – standpipe system.



(Source: Neufert Architects Data, third edition)

Figure 3.5 **Hose reel system**



(Source: S. N. Zubairu lecture note, 2006)

TWO TYPES OF STANDPIPE SYSTEM.

1. The wet standpipe system- this is a system where by the supplied valve is open so that water pressure is maintained all time through the system. Lack of water in Nigeria could be the problem of wet standpipe system. Therefore, provision of reservoir is necessary if using the system.
2. The Dry standpipe system – This comprises of two phase namely automatic and manual system. It is the system arranged through the use of approved devices to admit water to the system automatically by opening a hose valve. The second type is one arranged to admit water to the system through manual operation.

Comments: Automatic Dry standpipe system more effective because of level of education on the use of those devices in the country and there must also be a standby switch over generator plant. The use of manual may not be effective because of panic of people during fire; it may not allow the location and remembering of any devices.

2.7.4 SPRINKLER SYSTEM

A sprinkler system for fire protection purposes is an integrated system of underground and overhead piping design in accordance with

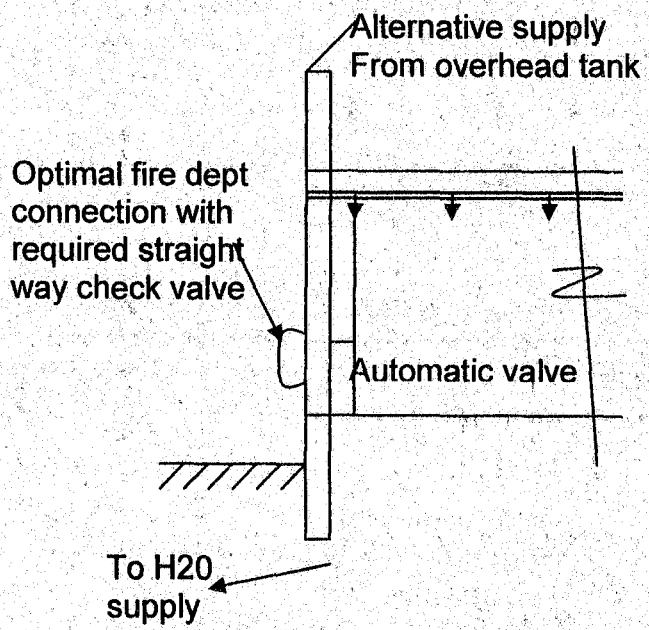
fire protection engineering standards. The system includes suitable water supply such as.

i. Gravity tank

ii. Fire pump

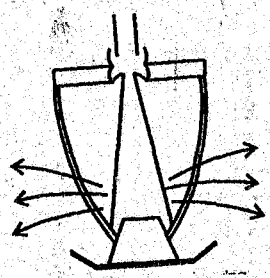
iv. Reservouir or pressure tank and or connection by underground piping to a city main. The portion of the sprinkler above ground is a network of specialist sized or hydraulically despised piping, installed in a building structure general overhead and to which sprinklers are connected in a systematic pattern. The system includes a controlling valve and a device to activate an alarm when the system is in operation. This sprinkler heads contain valves, which are held in position by a material which will fail at the critical temperature (30^0c). The system is activated by heat from fire one type depends on a soldered joint melting at the temperature, which another uses an expansive liquid inside a glass bulb, which fractures. Below the head is a deflector plate, which spreads the water over an area of floor between 5-10m2.

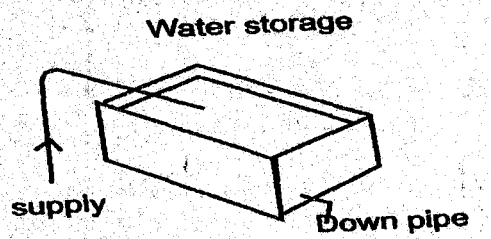
Figure 3.6 sprinkler installation



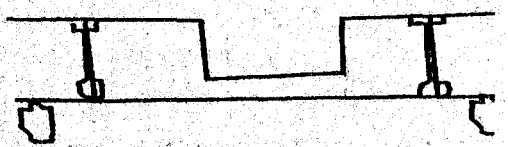
(Source: Neufert Architects Data, Third edition)

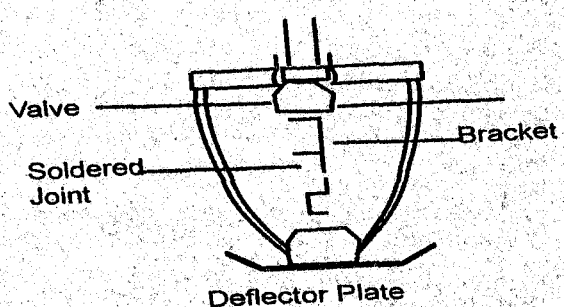
Sprinkler Installation





Sprinkler Head Discharging





Head with soldered joint

2.7.5 FIRE ALARM SYSTEM

The detection of a fire normally precedes the alarm being raised. Deduction by visual observation followed by individual raising is most relied on. Shouting is the simplest method of giving warning then whistle and hand bells.

Fire alarm system are installed to automatically detect fire in the early stage and to signalize this occurrence. A fire alarm system is basically composed of the following

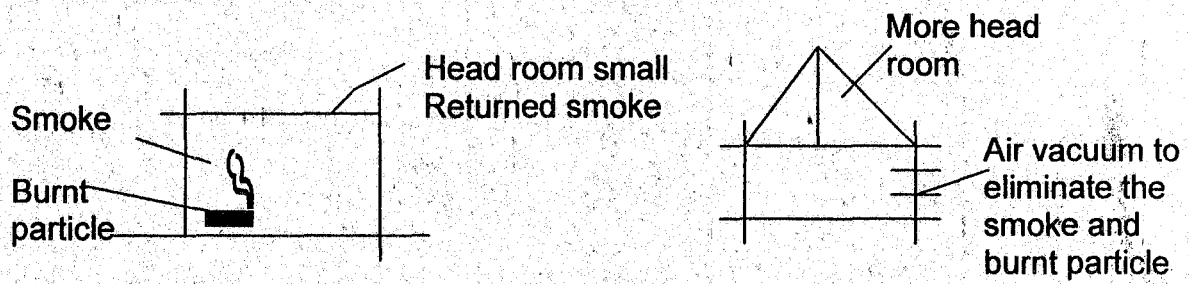
a. Fire detector – A fire detector is a part of the fire alarm system and can trigger a transmitting device that raises the alarm in a remote control center. There are automatic and non-automatic types.

Components of fire detector are:

(i) **Smoke detectors:**

These are used in rooms containing materials that would give off large volumes of smoke in the event of a fire. People die in fire because of smoke and particles of burnt properties.

Figure 3.7 Head room in smoke



(Source: Author 2006)

(ii) **Temperature detectors** –these are useful for rooms in which smoke that wrongly set off other early warning systems is generated under normal working conditions (e.g. workshops where welding work is carried out) max. Detectors – triggered when a maximum temperature is exceeded (e.g. 70^0c).

(iii) **Flame detectors** – these are activated by radiation emanating from flames and are used in rooms containing materials that burn without smoke, or produce very little.

b. Fire Control Panel – this is found in any intelligent building.

A fire control panel is necessary for

a. Receiving the signal of a reporting detector and to visually identifying the reporting zone.

b. The re – transmission of detector signal and to initiate triggering of alarm appliances such as bells, horns or sirens.

c. To control of automatic extinguishing system

d. Monitoring the entire system and to report both usually and acoustically any fault within the system. This fault can be line break, a short circuit, a ground leak or fault in power supply.

c. Power Supply

Energy must be supply to the fire control panel from two independently operating power supply sources. Destruction or a fault of one energy source must not interfere in the power supply from the second source. The power supply unit of the fire control system must not be used to supply electrical power to any other appliances except for facilities necessary to transmit control signal.

d. **Accessories** – This are all signaling devices installed in the detection zone or at some other external location but connected to the recording devices which records all working signal or the main alarm device at the fire brigade office.

2.8 INTERNAL AND EXTERNAL FIRE PROTECTION IN BUILDINGS

2.8.1 Internal fire spread (Linings or surface)

The linings of walls and ceilings can be an important factor in the spread of a fire and its gaining hold. This can be particularly dangerous in circulation areas, where it might prevent people escaping. Two factors relating to the property of materials need to be taking into considerations

i. – The resistance to flame spread over the surface and

ii. – The rate of heat release once ignited.

2.8.2 Internal Fire spread (structure)

There are three factors to be considered under this heading.

a. Fire resistance and structural stability: it is necessary to protect the structure of a building from the effects of fire in order to allow people to escape, to make it safe for fire fighters to enter the building for rescue operations and tackle fire and also to protect nearby people and adjacent buildings from the effects of a collapse.

Fire resistance of structure has three aspects.

a. Resistance to collapse

b. Resistance penetration of fire and

c. Resistance to heat penetration.

b. Compartmentation within buildings: it is often necessary to divide a large complicated building into separate fire –

resisting compartments in order to prevent the rapid spread of fire throughout the building. The following strict rules apply to compartmentation.

i. Careful attention must be taken in openings by using fireproof self – closing doors,

ii. Shafts and with the requisite non-combustible properties and

iii. Openings of pipes and services carefully sealed to prevent fire spread.

Table3.1 Construction materials duration of fire resistance

Construction materials	Specific Duration of fire resistance
21mm T/G Timber boards (or sheets) floor on 37mm wide joists with a ceiling of 12.5mm plaster board with joints taped and filled.	30 minutes resistance
Joists need to be 5omm wide and ceiling plaster board 30mm with joints staggered.	50 minutes resistance
95mm thick reinforced concrete floor with 20mm cover	50 minutes resistance
Internal load-being wall with timber studs at 600mm center	30 minutes

boarded both sides with 12.5mm plaster board with joints taped and filled.	
100mm reinforced concrete wall with 24mm cover to the reinforcement	30 minutes resistance
Doubling the thickness of plaster board on the stud wall to 25mm, and increasing the thickness of concrete wall to 120mm	60 minutes
90mm thick masonry	60 minutes

(Source: Coleman, 1982 Massachusetts)

c. Fire and smoke in concealed spaces.

With modern construction methods there can be many hidden voids and cavities within the walls, floors and roofs, these cavities can aid the spread of fire rapidly. This unseen spread of fire and smoke is a particularly dangerous hazards. Steps must be taken to break down large or extensive cavities into smaller ones and to provide cavity barriers, fire resistant barriers across cavities, at compartment divisions. Fire stops must also be considered. They are seals that prevent fire spreading

through cracks at junctions between materials that are required to act as a barrier to fire and seals around perforations made for the passage of pipes, conducts and cables.

2.8.3 External Fire Spread

The spread of fire from one building to another is prevented by the fire resistance qualities of external walls and roofs. They must provide a barrier to fire and resist the surface spread of flame. The distance between buildings or between the building and the boundary is obviously an important factor. The regulations stipulate the required resistant qualities of external walls and the proportion and size of allowable unprotected areas. (e.g. windows, doors, combustible claddings), depending on the type of building and the distance of the facade from the boundary.

Table 3.2 Required resistance qualities of external walls.

Building type	Allowable unprotect area against fire	% of unprotected area	Protected area against fire	% o protectio
viii. Residential ix. Office	1m	8%	5m	40%

x. Assembly or recreation building				

(Source: Neufert architect's Data, Third Edition)

as can be seen from Table 3.2, it is obtained that distance of 1m between buildings is unsafe in the event of fire the regulation stipulate 5m which is 40% distance apart from each building and from the boundary line.

2.9BEHAVIOUR OF BUILDING MATERIALS IN RELATION TO FIRE AND FIRE GRADING

2.11.1 Fire Grading

The term fire grading has a two-fold application

a. It is applied to the classification or grading of the elements of structure of buildings in terms of their degree of resistance to fire as mention above and

b. With broader meaning, it is applied to the classification of buildings according to the purpose for which they are used, that is, according to occupancy and according to the fire resistance

of the elements of which they are constructed as discussed below in building materials behaviour to fire.

This grading building is considered from two points view.

Firstly, in terms of damage and exposure hazard, for which the protection is mainly provided by structural precautions and secondly in terms of personal hazard for which protection is provided primarily by easy means of escape.

2.11.2

2.11.3 Behaviour of Building Materials in Fire.

Building materials comprise of different components and different materials and the behaviour of those materials can be studied as separate entities under fire conditions

a. Rein forced concrete structural members.

Characteristics

i. Good fire resistance

ii. Non-combustible therefore does not contribute to the spread of flame over their surfaces.

iii. The bond between the steel rein forcement and the concrete will be broken under intense and prolonged heat of a fire.

b. Structure steel member

i. Does not behave well under fire condition

ii. It has negligible ability of spreading fire over its surfaces

iii. Steel loose its useful strength at an intense heat of fire progress temperature of about 5500c above its normal temperature range of 250 to 4000c

iv. Decrease in strength of structural steel members results in the collapse of a member, and the stresses it was designed to resist will be redistributed, this could cause other members to be over stressed and progressive collapse could occur.

c. Timber

Oyetola E.B. (2001), structural timber behaves very well under the action of fire. Large solid sections and laminated timber sections survive longer in building fires than steel members of equivalent strength. The rate of spread of flame can be reduced considerably by fire retardant paints or by impregnating timber with fire retardant chemicals which evolve an inert gas.

In fire –outbreaks the moisture in timber absorbs some heat but most species ignites at 250 to 300^0c and methane and other gases assist combustion. Later Charcoal forms on the outside and this reduces the air supply to the timber and therefore retards combustion.

d. Aluminium

The poor performance aluminium structures are in this respect should also note. Aluminium has a much lower critical temperature than steel and for elements under load this has given as 204^0c against 500^0c

for steel. It will appear that this material is only suitable for buildings of fire risk or where the solution to the structural problem transcends the fire risk.

e. Door Frames.

The following materials (and material combinations) have proved to be suitable for the construction of frames.

i. Light metal sections with fire resistant concrete cover

ii. Combined sections concrete outside (paintable), inside of laminated sections of pre-cast concrete (paintable, hard wood sections)

iii. Steel tube sections within in tumescent protective coating

iv. Plasterboard and wood with light metal LM facings

v. Heat radiation protected LM laminated section.

2.11.4COMBUSTIBLE MATERIALS CLASSIFICATION

Combustible materials are materials, which in their reaction with oxygen considerable heat are evolved, and they flame or glow. Such materials weather forming part of the structure or the contents of the building are responsible for the growth of a fire.

Table 2.3 Surface spread of flame classification of materials

Class 0	Class 1
- Asbestos insulting board	- Plaster board

- Asbestos cement sheets - PVC/steel laminates - PVC faced asbestos cement board	- Wood wool slabs - Metal faced (including all edge) plywood - Flame retardant hard board and medium hard board - Flame retardant insulation board - Flame retardant hardboard with wood grain veneering - Melamine faced hardboard - Compressed asbestos class wood fib - fibre board - PVC faced asbestos cement board - Flame proofed decorative veneers on plywood backings - Composite boards of urethane foam/faced both sides with plaster board - PVC/Steel laminates
Class 2	
- Synthetic resin bonded payer and fabric sheets - Standard hard board with certain decorative treatment - Compressed straw slab with painted distemper finish	
Class 3	**Class 4**
- Timber and plywood weighing more	- Plywood and timber weighing his

than 46.25 kg/m - Chipboard - Compressed straw slabs with main11a or impregnated cardboard covering - Blass fibre reinforced sheets - Standard hard board - Medium hard board - Fibre insulating board with certain and decorative treatments	than 416.25 kg/m - Fibre insulating boards - Compressed straw slabs with one or both faces embossed with PVC copolymer - * foil 0.25mm thickness - Acrylic sheets (polymethyl methacrylate)

(Source: Bare, 1979)

2.12 MEANS OF EGRESS.

2.12.1 General Principles

The general principle applied in relation to means of escape is that it should be possible for building occupants to turn away from the fire and escape to a place of safety. This usually implies that alternative escape routes should be supplied. The first part of the route will usually be unprotected (e.g. within an office or room). Consequently, this must be of limited length to minimize the time that occupants are exposed to the fire hazard. Even protected horizontal routes should be of limited length due to the risk of premature failure.

ii. Doors on an escape route should open in the direction of escape, and not in the path of users.

Iii. Escape routes should lead to the open air and not into the people.

iv. The width of escape routes should not diminish.

v. A protected zone should be enclosed by a fire resisting construction.

vi. Doors of protected zone should be fire resistant self closing door.

vii. Fire exits should be sign posted with illuminated signs.

2.12.2 Building and site Design Access for Fire Fighters

The faster the fire service can respond, enter, locate the incident, and safely operate in a building, the sooner they can mitigate an incident in a safe manner for themselves as well as occupants. Therefore in designing site plan of buildings consideration for fire apparatus access must be given.

2.12.3 Considerations for Fire Apparatus Access

Extent of Access - Is the function of the access road reaching to within a certain distance of all portions of the buildings. Buildings without full sprinklered system use 45m (150ft) of the exterior point.

Perimeter Access – As many sides of the building and as much of the perimeter as possible, take advantage of frontage increase.

Turnarounds – Provided for on all dead – ends more than 30m long.

Clear width (excluding parking): minimum 6m but 7.2m preferable to allow passing.

Clear height of fire apparatus is 4.0m

Obstructions – Avoid overhead wires and other obstruction

Gate swing – Away from direction of fire apparatus travel

Speed bumps – Avoid them, or design them for fire apparatus

Turn radius – 15m outside radius minimum.

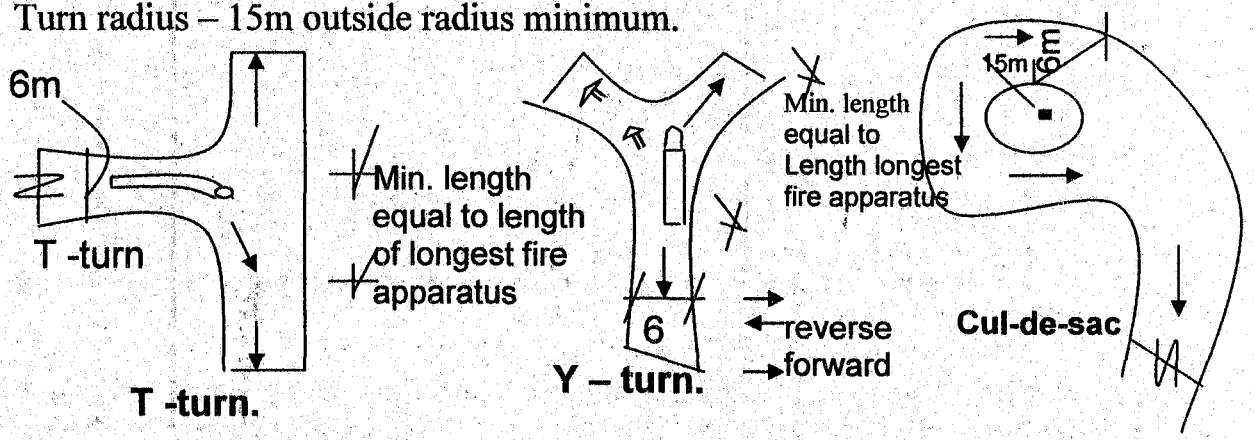


Figure 3:6 Turning Radius access for fire apparatus.

(Source: Personal of fire management available at Internet www.francis&Tarloy.org.accessed on 22nd November 2006 @ Minna, Nigeria)

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 The proposed site

The project site is located approximately on latitude 7° 15"0" North and longitude 7° 35' 15" east, in the reserved area for University library centre. The proposed site is on the north eastern part of the town located inside the campus.

The site is bounded on the northeast by the University senate building and on the south west by an undulated terrain towards the Inikpi hall female hostel, all within the campus.

3.2 Research Method

The research method employed in this study is through descriptive survey method using the following procedures.

i. Literature Review:- Research into documented fact, in relevant literature both local and international, profession and academic materials. Scientist's data collection which include climatologic, geological consideration and energy resources.

iii. Case Study:- This involves a survey of existing fire facilities in some buildings. The advantage of this procedure is to observe feature in an existing project not to repeat errors.

iv. Interview:- Direct personal interview with professional personnel in the library and building industries on the issue of fire protection.

v. Site visitation:- Visitation to site involves the collection of site inventories and community social cultural behaviours and other relevant facts to aid harmonious physical interaction. This is base on oral interview and actual visit to site.

3.2.1 Method of data collection

The study was carried out using the following tools for data collection.

- Observations and
- **Archival sources** – Data was collected by view of related literature journals, magazines and books, also the use of internet was consulted for relevant information.

Hence, the study is both theoretical and empirically in approach.

Observation –involves survey of library, visualization, it also requires photographic or videotaped records. This technique is quite useful for understanding the flows and dynamics of the activities involved.

Interview – open, free or semi-structured (based on a few specific questions). Multiple-choice questions of values were used. Question was applied face-to-face with the targeted users of library.

3.2.2. The method of study area selection.

The selections of the schools were purposive because they are the schools i have access to collect data.

3.3 Introduction of case studies.

In architecture, the choice of case studies are essential aspects of any design, this is so because they serve as the basis upon which the new design is based. Case studies are necessary to enable someone produce a functional and appreciable design than the existing one in compliance with modernization. In this regard critical examination of some university library buildings within the country and outside the country were examined to know the guiding principle in the design and construction of similar projects. The choice of my case studies was guided by the viability and the standards of these Universities to raise the similar in the location of my design.

3.3.1 Case Study 1. FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, LIBRARY, NIGER STATE.

(i) INTRODUCTION

Location: The library is situated at the university temporary site Bosso Campus Minna. The library was established in February 1984, the same time as the university. The library has a seating capacity of about 400 people.

(Source: Library information unit Minna library, 2006)

(ii) Planning and Design

The design of the library is of simple post and beam arrange around a narrow courtyard. The planning has the reserve and the serials at the first floor and only one staircase. The building has three readily areas for students and researchers but not enough to the number of the users.

(iii) Materials and finishes

The structural elements of the library are made of concrete. The post and beams are reinforced elements. The library is finished with emulsion paint both inside and outside; the floor is made up of terrazo floors, the ceiling of suspended ceiling. The staircase constructed of concrete element. The outside compound is made of concrete slabs as foot path round the library with landscape to match. The roof is long span aluminium coverings.

(iv) Observations

(a) Merits.

i. – Goods use of modern building materials

ii. – Adequate natural lighting

iii. – Good functional link between various sections

iv. – Provision of refuge area

(b) De – Merits.

i. – Small entrances door, dangerous in escape in the event of fire.

ii. – Exit door not adequate and the existed permanently closed, this is dangerous during escape in case fire

iii. – No single fire extinguisher in the whole building

iv. – Inadequate stair case, to and evacuation and escape in the event of fire

v. – Inadequate reading room

vi. – No exit for fire fighters.

Plate 4.1: Showing incombustible materials For stair case.

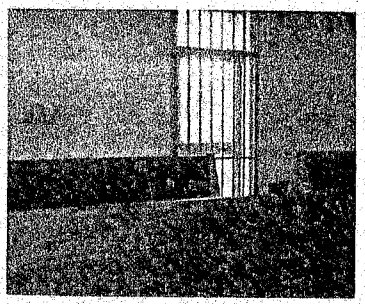


Plate 4.2: Showing locked exit Route.

Plate 4.3: Side view of the library.

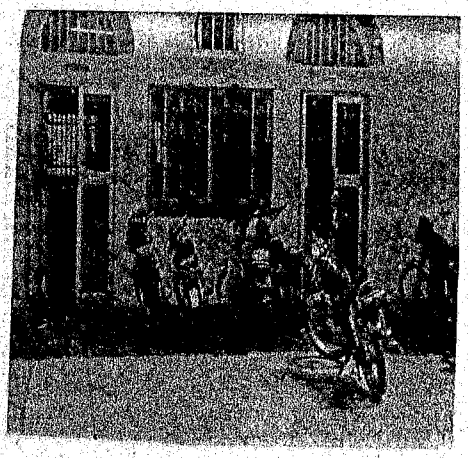


Plate 4.4: Approach elevation Showing small entrance

3.3.2 CASE STUDY 2: Kogi State University Present Library Anyigba

(i) INTRODUCTION

location: The library is situated at the university campus Anyigba. The building was design for an office block but now jointly used as a library and office block. It was constructed in 2000 barely 2 years after the university. It has a capacity of about 200 students.

(Source: Information unit KSU Anyigba, library, 2006)

(ii) Planning and Design

The building plan is simple but unique concept. The design is of post and beam of 3 floors. The last floor is used as an office for the post graduate studies while the 1st ground floor is occupied by the library and the staff of library. It has a ready room on both the ground and 1st floor

and offices on both the ground and first floor. Stacking is done sided of the reading ream but in some cases the books are separately stacks in the control area.

(iii) Materials and Finishes

The library is crusted with sand Crete blocks. The post and beam is of reinforced concrete materials. The staircase is constructed of reinforced concrete, finished with ceramic tiles. Doors are of flush doors and windows of minimum sliding windows, which are not resistant weak concrete slab as front path and well landscaped.

(iv) Observations

(a) Merits

i. – Quality materials for construction where used

ii. – Good landscaping to aid aesthetics of the design

iii. – Good building orientation to combat the failure in building orientation

(b) De – Merits

i. – Small entrance, dangerous in the event of fire.

ii. – Inadequate exit route, for escape in case of fire

iii. – No access for fire brigade to fight fire

iv. – Inadequate reading room for the student

v. – No refuge area before evacuation in the event of fire

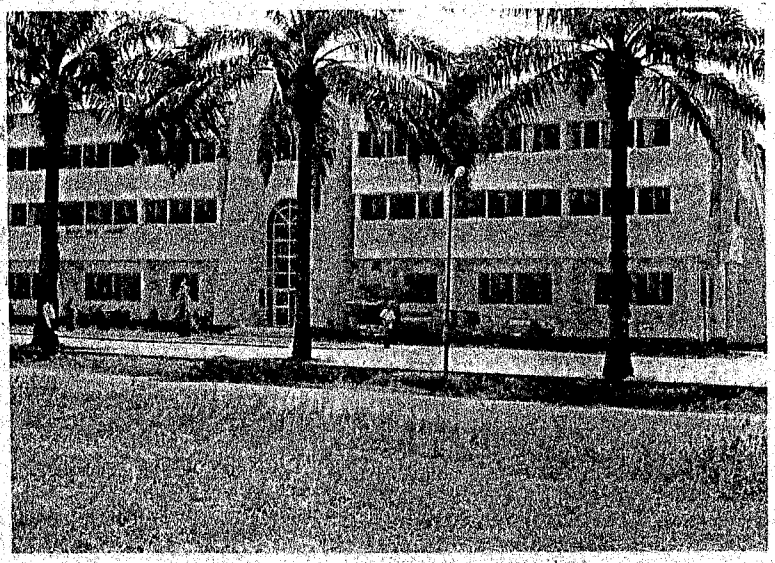


Plate 4.2.1 .small Approach dangerous in fire event.

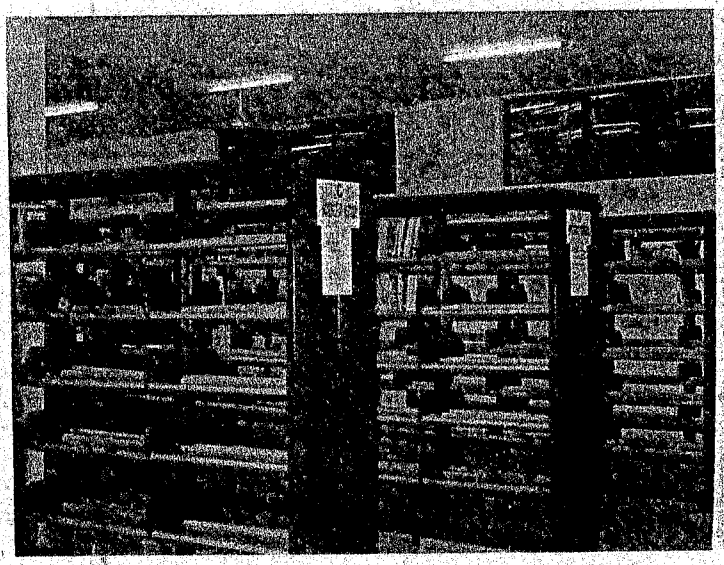
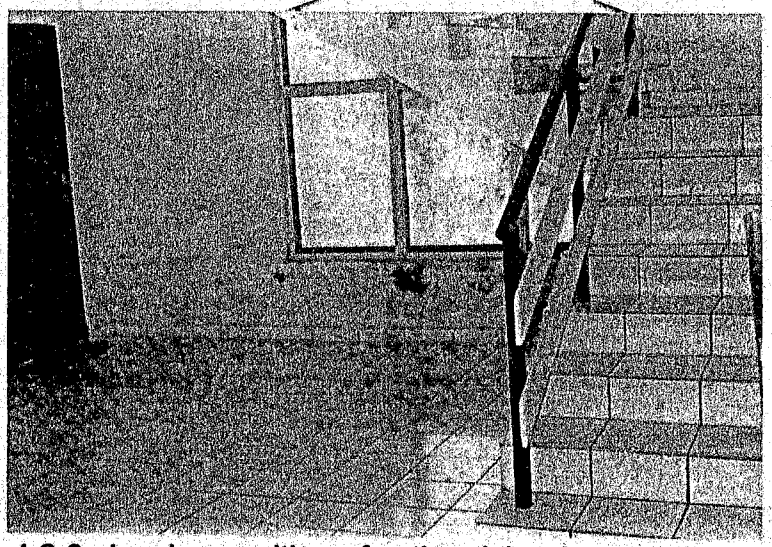


Plate 4.2.2 shelves/stacks.



vi Plate 4.2.3 showing position of extinguisher in staircase but no one present.

3.3.3 Case study 3: Kashim Ibrahim Library A.B.U Zaria

(i) INTODUCTION

Location: The library is situated at the main campus samaru Zaria. It was officially opened in December 1976. Alhaji sir Ibrahim after whom it is named. The building has a capacity of 500,000 volumes of books and 2,000 readers. At present the collection housed by kashim Ibrahim library consists of 170,000 volumes of books 2,000 micro film items and 34,500 volumes of periodicals. The number of journals currently received is 2,880 titles.

(Source: Information services unit kashim Ibrahim library samaru campus A.B.U Zaria November 2006).

(ii) Planning and design

The library structure stands two (2) storey high. The ground floor has the following facilities. Reference section, current serial, information services units, main control desk, cloakroom, serial reading room, technical service areas, photocopy room. First floor comprises of administrative offices, study carrels, Art and science section, sitting room, micro film room second floor: this include document control, African section, rare books and thesis, reserved bookroom, science and technology and librarianship section.

(iii) Material and finishes

The building elements are made of concrete and steel. The horizontal and the vertical members are of reinforced concrete structures. The exterior wall is finished with high quality emulsion paint to match the mixture. The floor is constructed of terrazzo. The roof is of barrel vaults to take care of the large span. The car park is properly landscape with trees, grass and shrubs to complete the mixture with gravel and tell of the wad.

(iv) Observations

(a) Merits

i. – Good use of non-combustible materials

ii. – Good interior finishes the interior of the library is wall finished to aid learning.

iii. –Good stacks and shelves system to ease book location.

iv. –Good shading devices to protect the books and aid reading.

v. –Refuge are in the first floor to aid evacuation.

B. Demerits.

i. In the Event of fire, fire brigade may not hare access to combat fire,

ii. There exits is not adequate for means of escape,

iii. The fire extinguishers found is not adequate

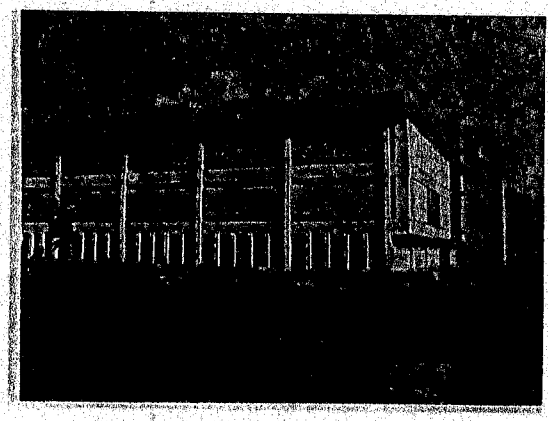


Plate 4.5

showing the perspective view

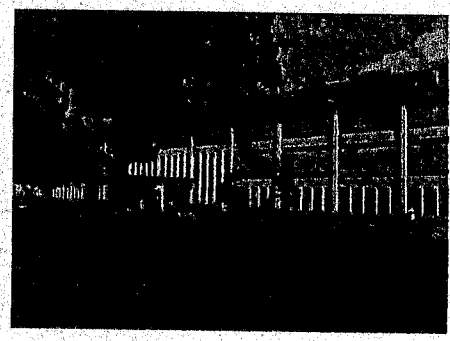


Plate 4.6 Front view from the east side

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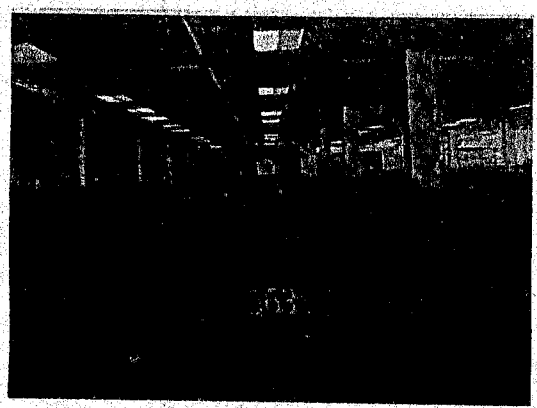
Plate 4.7. Ceiling and lighting

Plate 4.8Arrangement of stacks



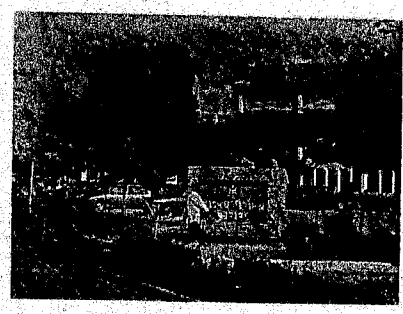


Plate 4.9.Reading room

Approach view showing the car park

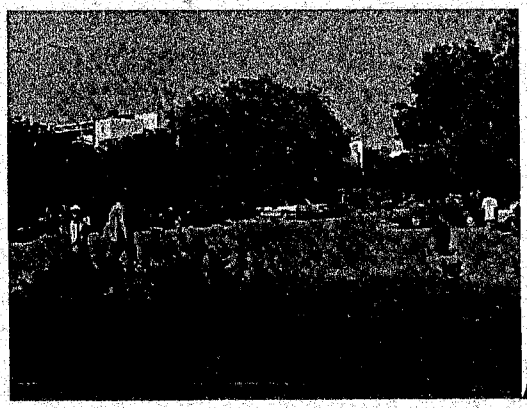
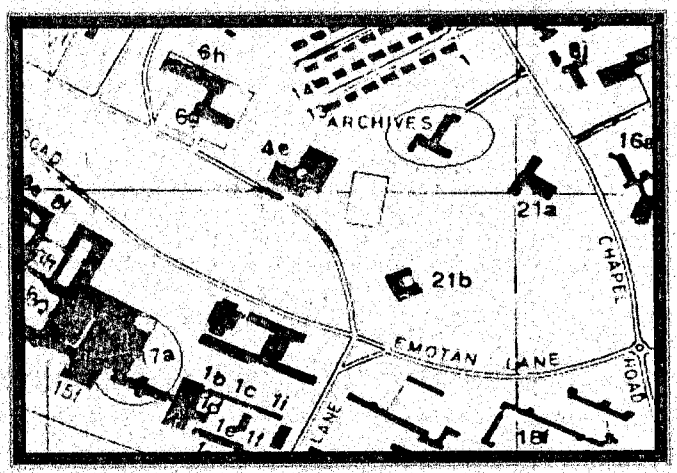


Plate 4.10 Car park

3.3.4 CASE STUDY 4: KENNETH DIKE LIBRARY; INSTITUTE OF AFRICAN STUDIES; NATIONAL ARCHIVES. IBADAN, NIGERIA.

(i) INTRODUCTION

The Kenneth Dike Library, Institute of African Studies and National Archives are all located in University of Ibadan, Oyo State. Nigeria.



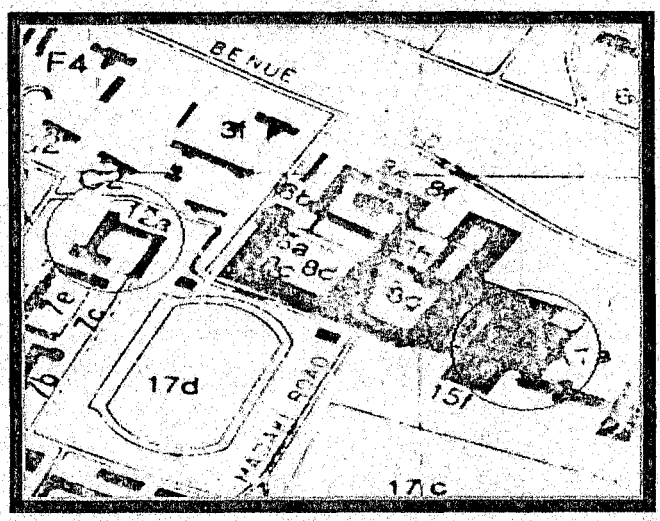
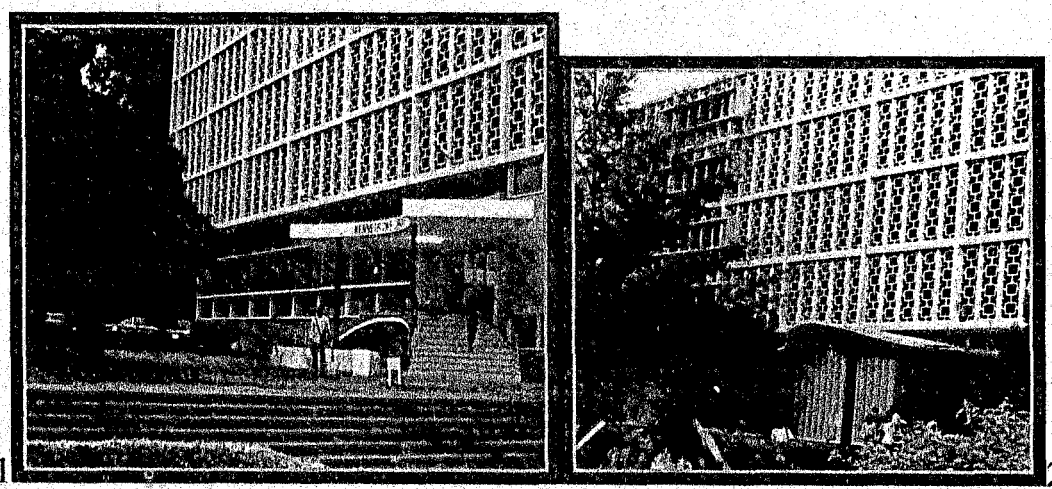


FIG 4.6: ABOVE ARE EXTRACTS FROM THE GUIDE MAP OF THE UNIVERSITY OF IBADAN SHOWING PLAN VIEW OF DIFFERENT LOCATIONS; THE KENNETH DIKE LIBRARY (17a), THE INSTITUTE OF AFRICAN STUDIES (12a) AND THE NATIONAL ARCHIVES. BELOW IS AN EXTRACT OF THE KEY TO GUIDE MAP WHICH IS FROM THE SAME MAP OF THE UNIVERSITY.



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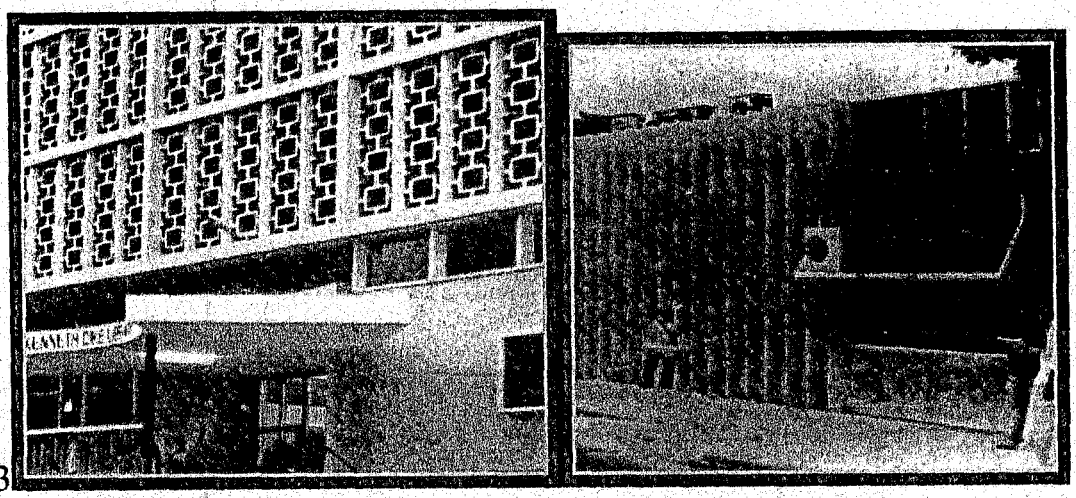

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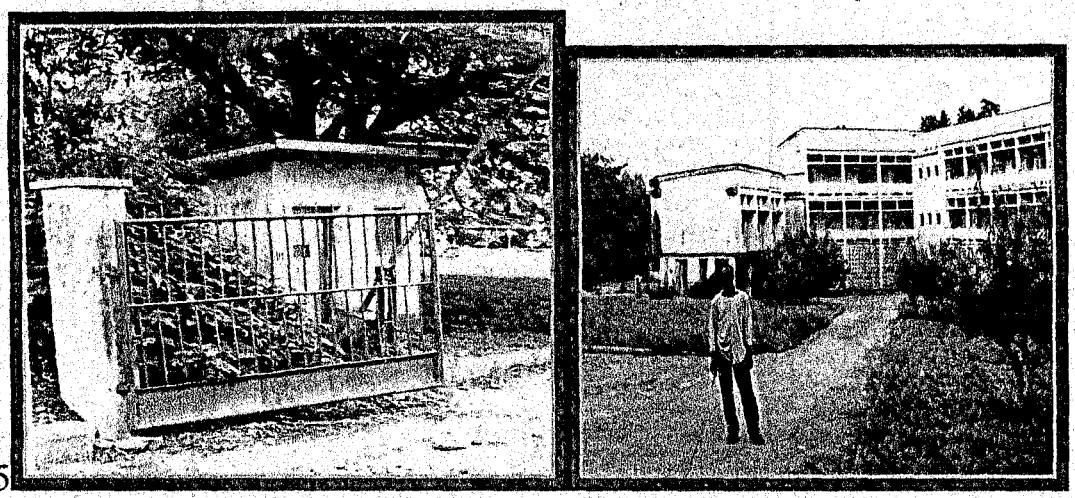

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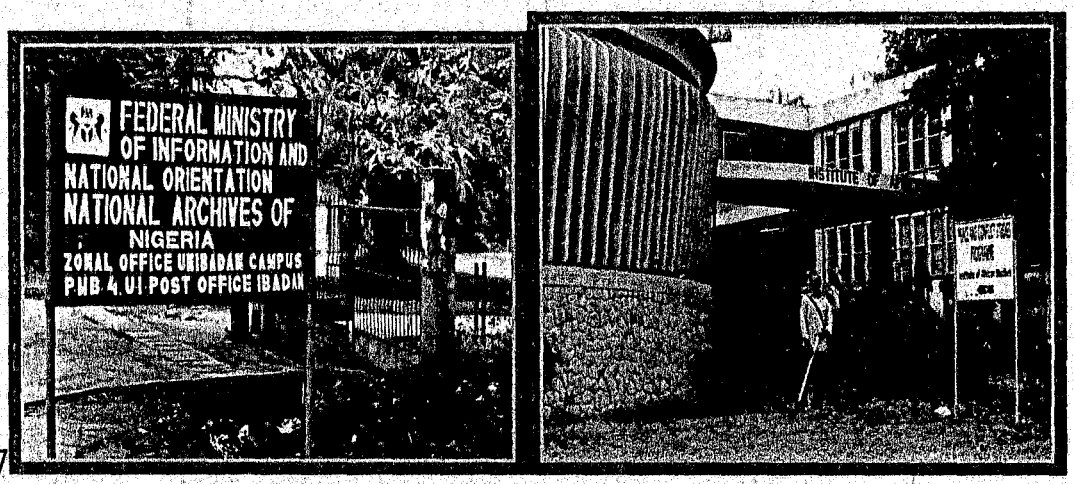
FEDERAL MINISTRY
OF INFORMATION AND
NATIONAL ORIENTATION
NATIONAL ARCHIVES OF
NIGERIA
ZONAL OFFICE UNIBADAN CAMPUS
PMB 4, U.I. POST OFFICE IBADAN

7

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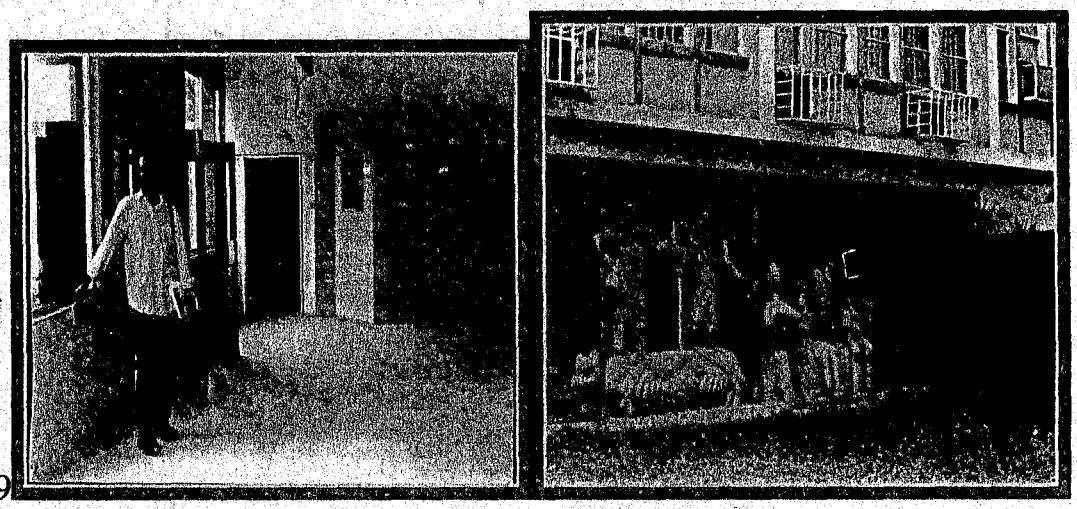

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PLATE 4.2: 1. APPROACH OVERVIEW OF KENNETH DIKE LIBRARY, UNIVERSITY OF IBADAN. 2. REAR OVERVIEW OF KENNETH DIKE LIBRARY, UNIVERSITY OF IBADAN. 3. A VIEW OF THE CONCRETE SCREEN/SECURITY OVER THE WINDOWS. 4. REAR VIEW OF A SECTION OF THE KENNETH DIKE LIBRARY, UNIVERSITY OF IBADAN. 5. A VIEW OF THE SECURITY/GATE HOUSE AND GATE OF THE NATIONAL ARCHIVES. 6. NATIONAL ARCHIVES: APPROACH OVERVIEW. 7. ENTRANCE GATE TO NATIONAL ARCHIVES OF NIGERIA, UNIVERSITY OF IBADAN, OYO STATE, NIGERIA. 8. APPROACH OVERVIEW OF THE INSTITUTE OF AFRICAN STUDIES, UNIVERSITY OF IBADAN. 9. LOBBY/GALLERY AT THE INSTITUTE. 10. VIEW OF THE COURTYARD AT THE INSTITUTE.

(ii) PLANNING AND DESIGN

Kenneth Dike Library, University of Ibadan contains approximately 400,000 volumes and receives over 6,000 separate journals and other serials. It was planned and designed as a research library with due consideration to securing the documents within the library complex. On the ground floor of the main building there is the *CARRELS* section, the *MICROFILM ROOM, STACKS FOR BACK FILES OF PERIODICALS AND NEWSPAPERS, MAILING SORTING AREA, COFFEE ROOM, OFFICES/GENERAL OFFICE, CONFERENCE ROOM,HEAD READERS SERVICES, REPROGRAPHIC SECTION* and DARK *ROOM.* On the basement floor of the main building there is the *BINDERY, DUPLICATING ROOM* and *AIRCONDITIONING PLANT.* On the ground floor and first of research library are CARREL ROOMS, AFRICANA and P.O. SECTION, REFERENCE STACKS, ORDERS and *CATALOGUING SECTION, BIBLIOGRAPHIC HALL, MAIN READING AREA OF RESEARCH LIBRARY, CONTROL DESK, CIRCULATION DESK, CATALOGUE HALL, INFORMATION SERVICES, CHECK POINT, GENERAL READING ROOM, CIRCULATION LIBARIAN OFFICE, CIRCULATION WORK ROOM, LIFT, TIOLET, STAIRCASE and AMERICAN STUDIES COLLECTION.* On the first floor of the main

building there is the *READING AREA* and *STACKS* to the east and to the west there is the *READING AREA, STACKS, CIRCULATION LIBRARIAN, And NUCLEAR SCIENCE ROOM.* On the second floor of the main building to the east there is the *READING AREA, STACKS* and CARREL *ROOMS* and to the west there are the *READING AREA, STACKS, GIFT* and *EXCHANGE SECTION* and *BOOK SELVES* On the third floor, there to the East *READING AREA, CARREL ROOMS* and *STACKS* with escape/service stair case and to the west there is the *UNIVERSITY LIBRARIANS SECRETARY'S OFFICE, LIBRARIAN'S OFFICE, EMAIL SERVICES, STORAGE* and stair case. On the fourth floor, there is the *READING AREA(S)* and *STACKS* to the east and to the west there are *ARABIC MAPS* and *MANUSCRIPTS READING AREA, MAP SECTION, ARABIC SECTION, MANUSCRIPT SECTION and WORK ROOM.* Kenneth Dike Library is open to Senior Staff, Research Students, and to others with special permission.

(iii) Material and finishes

The building elements are made of concrete and steel. The horizontal and the vertical members are of reinforced concrete structures. The exterior wall is finished with high quality emulsion paint to match the mixture. The floor is constructed of terrazzo. The roof is of barrel vaults to take care of the large span. The car park is properly

landscape with trees, grass and shrubs to complete the mixture with gravel and tell of the wad.

(iv) OBSERVATIONS.

a. Merits.

i. –Wide entrance door which aid easy escape in the event of fire

ii. -Many exits routes, and escape stairs but girded by staff to check exits people.

iii. The use of fire resistant materials for the construction of the building.

b. Demerits.

No access for fire brigade entrance in the event of fire.

Inadequate fire extinguishers to aid in extinguishing

i. The fire alarm in the staircase of the entrance is not conspicuous therefore; hiding the fire alarm is just like not providing it at all.

3.4 DATA COLLECTION ON ANYIGBA, KOGI STATE

3.4.1 Background of Location

Kogi State lies between longitudes 05° 18 °E to 07 ° 54 E. and between latitude 06 ° 30N. It shares common boundaries with Niger, Plateau and the Federal Capital Territory to the north, Benue State to the east and Enugu, Edo, Ondo and Kwara States to the south and west.

Lokoja the state capital is approximately 162km away from Abuja, the Federal Capital Territory.

Dekina Local Government Area was created in 1969 in the then Kwara State.

Dekina Local Government shares common boundaries with Ankpa/Omala Local Government to the East, Oguma Local Government to the North; Ofu/Ajaokuta Local Government to the south and to the West is Bassa Local Government Area. Anyigba, is the biggest town in Dekina Local Government Area and the centrally located town among the Igala speaking tribe of Kogi State. It is the city of Kogi State University Anyigba.

Kogi state is the most centrally located state of the federation. Kogi state came into existence on 27th August 1991. The state was carved out of the former Kwara and Benue states with Lokoja. The former Northern Nigeria colonist Governments' administrative headquarters of Fredrick Lord Lugard.

The ancient city of Lokoja which is the town where the two major rivers in Nigeria (River Niger and Benue) meet is now the capital of state, has been a commercial centre since 1800 with the trading of slaves and agriculture produce which later brought inter-tribal settlement between Nupe/Bassa Nge, Hausas, Igalas, Egbiras and Oworos who were the first settlers in the Lokoja.

In 1865, Bishop Samuel Ajayi Crowther established the First Anglican Church and school in Northern Nigeria at Lokoja. However, in 1875,

Sir George Tubman Goldlied a British merchant in Northern Nigerian brought together the European companies in Lokoja that is, Royal Nigeria Company, and John Holt UAC. (Source: Kogi State Information Centre Lokoja, 2006)

3.4.2 TOPOGRAPHY AND ECOLOGY

Anyigba, Kogi state like other tropical parts of the country contains a remarkably comprehensive sample of the types of geology and landforms to be found in the western or lowlands Africa. Ancient metamorphic rock (the basement complex) out crop very widely intruded by various igneous masses in the north by continental sedimentary of tertiary age.

The basement complex rocks (metamorphic rocks) are exposed from the Republic of Benin to Lokoja and also are half of country north of the Niger and Benue Rivers. Anyigba has a varied gentle undulating with occasional isolated granite terrain, but relatively flat to east of site location gradually rising at a contour of 50m – 60m. Therefore finding good platform in the building.

3.4.3 VEGETATION

The vegetation of the area consists of the rainforest on the western part and the typical wooded savannah and grassland to the eastern part of the site. Some of the notable economic trees include the Iroko, Mahogany,

locust beans, obeche, baobao and neams that are used for medicinal purposes. It is classified as high savannah with trees of moderate height. The tree stratum is less dense than that of the savannah woodland,but more substantial than that of the shrub savannah. Shrub vegetation occurs on flatter plains and insulating terrain.

3.4.4 CLIMATIC CONDITIONS

Oyediran. O (1997:213), Says that Nigeria as a big country comprises of so many climatic regions.

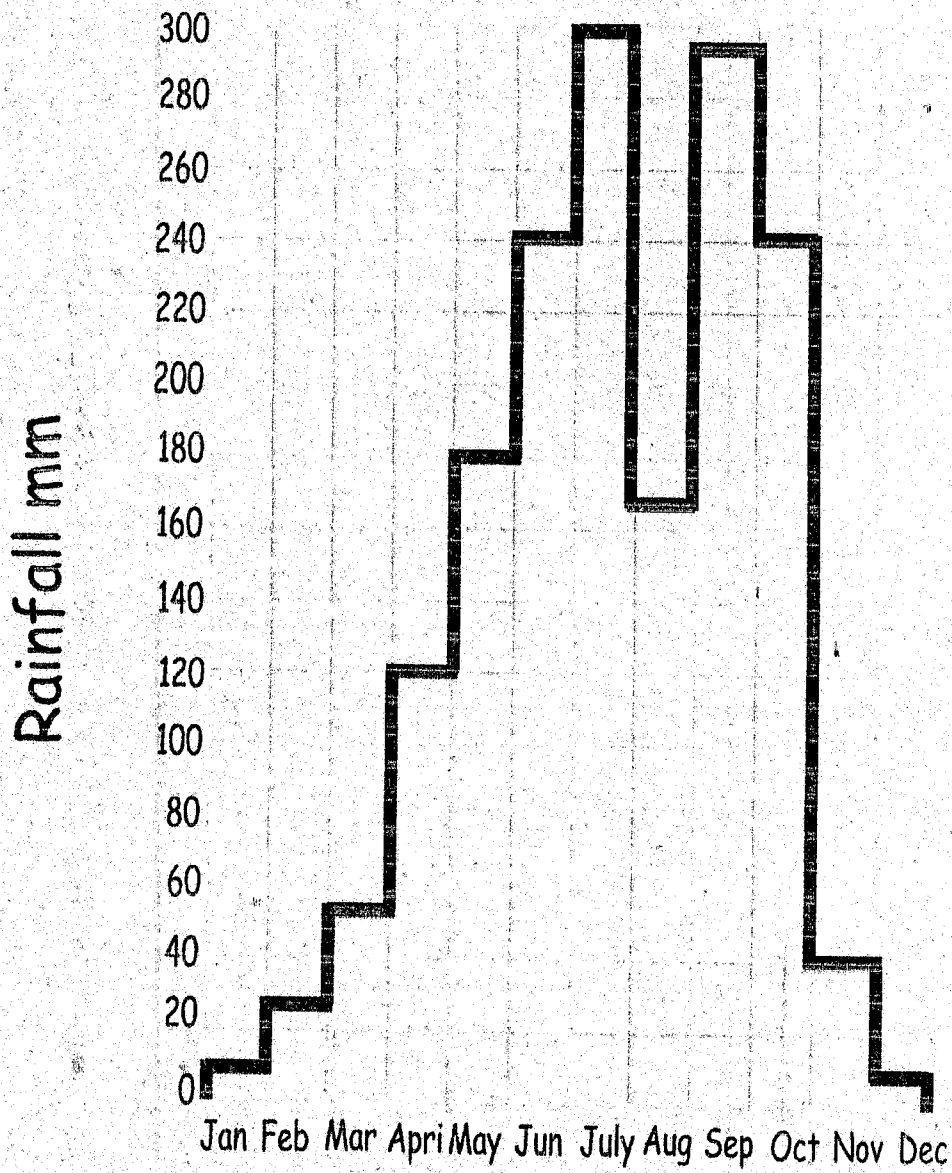
Anyigba, in Dekina Local Government Area of Kogi State lies within the tropical hinterland. Anyigba has both dry and wet seasons. The dry season begins from November – March. December and January are usually cold months due to the influence of the northeast trade winds that marks the beginning of harmattan. While the wet season spans the months of April – October.

3.4.5 RAINFALL

Tropical hinterland is known with a characteristic of its violent rainfall, accompanied by thunderstorm and lightening. The rainfall is seasonal and starts from the month of March spanning to October. The distribution of the rain within these months varies. Meteorological records have shown that rainfall is at its peak between the months of July and September with a two or three weeks break in August.

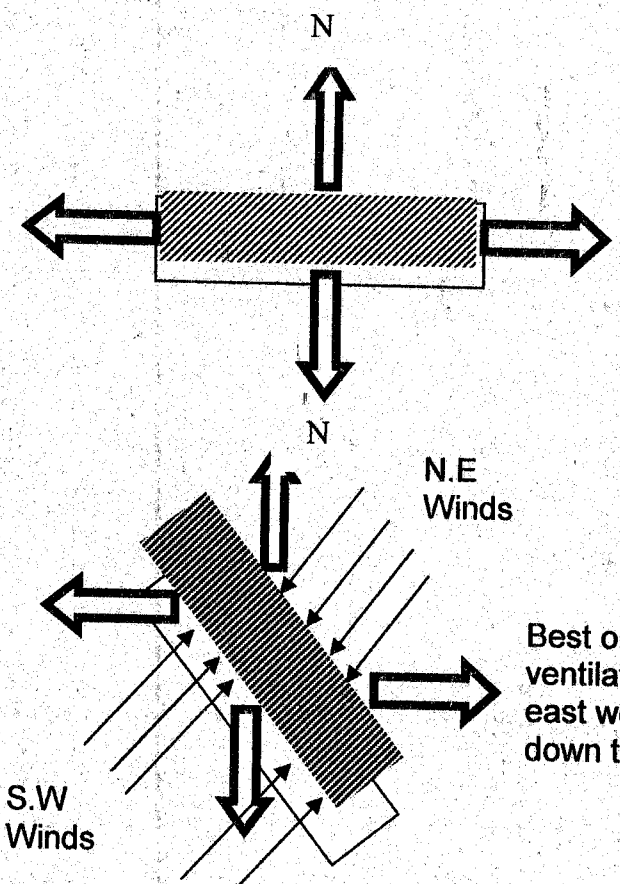
Mean Monthly Rainfall Record up till 1988

Jan	Feb	Mar	Apri	May	Jun	July	Aug	Sep	Oct	Nov	Dec	
8.0	25.5	50.5	120.5	185	250	300	175	298	248	49	8.0	mm



3.4.6 TEMPERATURE

Tropical hinterland climate is very associated with very high temperature. Mean monthly maximum temperature range from 28°C – 32°C. The early months of the year and later parts of the year are hotter than the middle months. The long dry season months are generally hotter than the rest of the seasons.



Best orientation for tropical setting for minim solar radiation, heat transmission and glare radiation.

Best orientation for effective and though breeze ventilation. Orientation however suffers form slanting east west sun. Sun shading is required hot this cots down thus passage of breeze

Fig. Effective orientation and ventilation.

(Source: Author 2006)

3.4.7SUNSHINE SOLAR DATA

All heat energy is the sun. Sun intensity varies in the tropical climate from time to time. The sun rises from the east during the day and the rays at a very low angle, penetrating directly into the interior of the building. The sun getting hotter at noon because it is almost directly overhead and the rays fall directly being more intense and penetrating less. The angle of the sun reduces from afternoon, while the sun is setting in the west.

3.4.8 ECONOMIES AND COMMERCE

The life cycle of people revolves around the trade in palm oil, foodstuffs and other items such as cloth, pots and locally made knives, petroleum products (highly rating).

The position of the oil palm in the Igala economy is very different from its position in the economy of the Ibo or Ibibio farmer of the forest belt. Amongst the latter, palm produce is the major source of income and an important factor which permits the survival of as many as possible. In Igala, however, there is abundant farmland and a ready market for other produce so they do not depend on the oil palm. In Igala the oil palm trade is carried by women and young stars still struggling for economy independence.

3.4.9 DEMOGRAPHIC DATA

Anyigba has a land area of about 142,005km^2 and a population of approximately over 360,000 people according to 1991 population projection.

The population comprises of the adult male of 20%, adult female of 30%, old men and women of 10% and children of 40%. The citizens are civil servants while others are involved in commercial activities and farming. There was a population explosion of the city of Anyigba since 2000-2001 that University was created.

3.4.10 HUMIDITY

The amount of water vapour in the atmosphere in the tropical hinterland climate is high. It is higher generally in the evenings and early mornings, reducing considerably in the afternoon.

There is much water in the air during the rainy season than the dry season. The reason is not far fetched from the fact that southwest prevailing wind during the raining season brings water from the Atlantic Ocean. This makes the atmosphere uncomfortable.

The prevailing wind comes from across the Sahara desert during the dry season in the northeastern direction. The wind is dry and dust carrier, very dry and causing skin dryness and cracking. Preventing much laughter. Use of artificial ventilation is to be used in the design to keep the dry weather out of the interior during and uncomfortable wind.

Deductions

The windows of the design must be protected by adjustable shading device from the varying degrees of penetration ability of the sun's rays at different times of the day. Fins and adjustable louvers will be used to achieve this.

3.4.11 SOCIO-CULTURAL LIFE

Socio-cultural life of Anyigba people varies from business (market selling) to farming. Each person goes to his or her own market or farm at the break of day and retired home in the evening time. Their cultural life is also reflected in their colourful festival and ceremonies such as Egungun festivals, Ote-Egwu festival and Epa festival. The cultural life of the people can also be described in their mode of dressing and lifestyle. The people of Anyigba are always dressed in native attires called 'Atampa'.

Others amongst the marketers and farmers run the government agencies in the area. The type of life of those educated ones differs from the illiterate traders and farmers. Thus causing a division among the people because the educated elites interact with each other and the illiterate interact with each other.

After retirement from a day's job, every one of them goes to a cool spot where they obtain their local drinks called 'oburukutu' which is normally prepared using guinea corn by women.

3.4.12 TRANSPORTATION AND TRAFFIC FLOW

Anyigba is highly populated and a centre for business activities and stop over joints for travelers from east to north and visa-visa. Intra and Inter services by Government and private participation in transport service alleviate transportation problems of the city.

Studies by Ruth A. U. (2001), have shown high traffic flows on all main roads in the town. The most densely trafficked section of the road is Enugu-Abuja road passing through the town between Anyigba main round about. Within this road a total flow of about 12,400 was recorded during the working day. The total hourly flow was about 1,400 vehicles, while slightly lower flow was found at market road over to Dekina. It was recorded that, the lower.

Efforts are being made by the local government chairman to divert the attention of Lorrie's from passing through the main town due to death record over the years by big lorries passing through the town.

3.4.13 EXISTING LAND USES AND FUTURE TRENDS

Anyigba is divided up into layouts. Despite that mixed land uses still exist. The houses are almost prototype in nature. They are built of

bungalows for both residential and shops using the garage for storage facilities.

But with the emergence of technology and advancement, the new layouts are better planned and uses strictly adhered to such layouts include: commercial layout, industrial layout, G. R. A. market, school, religion organization, office complex. But part of these residential areas offices still exists. Commercial avenues are found along Enugu-Abuja road and market in Anyigba - Dekina road and places like Anyigba Abejukolo road served mostly for schools and residences.

Expansion of Ankpa - Anyigba road also gives rise to office development in that area. The land uses pattern is quite defined within the existing town.

The new industrial area is found at Anyigba-Idah road.

Recent trends show that development has commenced along Ankpa-Anyigba that will extend towards Egume town and towards Anyigba – Idah road. The land opposite the State University has also commenced proper development of residential and commercial buildings. From the above expansion of the construction with planning authority of Anyigba the place is well coordinated. But some failures still exist if nothing is being done about it. Some villages round the town are still building without adhering to regulations of local authority. If it continues, danger of traffic congestion will come up again.

3.5 SITE ANALYSIS

3.5.1 Introduction

Site analysis is an inventory completed as a preparatory step to site planning, a form of urban planning which involves research, analysis, and synthesis. It primarily deals with basic data as it relate to specific site.It is an element in site planning and design.

3.5.2 CRITERIA FOR THE CHOICE OF SITE

- Location due to the demand for its services by the university authority as indicated in their proposed master plan.
- Interesting architectural features of the site is always an irresistible attraction to architects.
- Nearness to all academics activities in the campus influences the site selection.
- Easy transportation and access to the site by staff and students.
- A virgin land with spacious surrounding for parking, outside activities, landscaping and necessary infrastructural facilities also contribute to the choice of the site

- Proximity to basic amenities like electricity, telephone, banks and financial institution, sewer and drainage.

3.6 LOCATION OF SITE

The project site is located approximately on latitude 7° 15"0" North and longitude 7° 35' 15" east, in the reserved area for University library centre. The site is on the north eastern part of the town located inside the campus.

The site is bounded on the northeast by the University senate building and on the south west by an undulated terrain towards the Inikpi hall female hostel, all within the campus.

3.6.1 SITE CHARACTERISTICS (Survey)

- The land is not marshy and therefore good for building.
- It consist of a variety of vegetation types ranging from fringing forest to grass savannah
- 5 – 10m high tree stratum which are to be uprooted before construction; shrub and grasses stratum of 2 – 5m high.
- Site height above sea level is approximately 100 – 150m.
- The soil texture is hard and solid good for any type of foundation.

3.6.2 ACCESSES AND CIRCULATION

There is proper circulation around the site, very easy since it is not among the congested areas of the town that normally carry heavy traffic. The site is under development and therefore sparsely populated. The main access road to this project site from outside is the Enugu/Ankpa-Anyigba road which joins with Anyigba - Lokoja/Abuja road. Traffic going into the site will terminate at the main Anyigba IGALA UNITY SQUARE round about.

Alternative route to the site is through Anyigba-Lokoja express road which leads to the University back gate entrance.

Should in case of preferred water transport, the visitor gets into Ankpa River from the main source of the river from its confluence of River Benue. The preferred means of transportation should be ferry or small boat and large sea vessel should be discouraged before getting to Anyigba from there by car 20minutes drive.

In case of air transport, the visitor gets to Enugu Airport or Makurdi Airport and takes Anyigba-Enugu or Anyigba-Markurdi route respectively. In conclusion, the site is accessible by land sea and air transport.

3.7 UTILITIES

Utilities can be explained as the most essential architectural assets of an academic library location. Therefore, their qualities are considered early in the planning stage of an academic library complex.

- Basic infrastructures such as communication, electricity, water, good roads are all around the site and can easily be connected with little expense to the site.
- Large area provided for the library complex will enhances proper site planning for parking, landscaping and good access for fire fighters.
- The undulated terrain also provides a good environment for easy construction of the project and in locating the septic tank and soak away pit.

3.8 PLANNING REGULATION OF DEKINA LOCAL GOVERNMENT AREA AS REGARDS ANYIGBA.

There are so many statutory provisions affecting building work within the local government. This regulations outlines restriction that, will maintain minimum standards setup by the building department of the community for safe guarding life and health. The law help to control design, construction, materials, maintenance, location of structure, use of structure by the occupants.

Acceptable standard of local authority

i. There should be a set back of 12 metres from the Federal road to the building line.

ii. The proposed building should be located in the designated area

iii. Any complex within that zone should meet the health standard of the local authority (There must be effective waste management section).

iv. All regulations as approved for the University master plan must be strictly adhere to.

(Source: Dekina local government and town planning and control unit Anyigba Kogi state 2006)

3.9 DEDUCTIONS

i. Proper knowledge of the site characteristics shall guide the academic library functional organisation.

ii. The Planning regulation of Anyigba 12m set back minimum from Federal road shall be incorporated in the design.

iii. The gentle slope of the site towards the east shall guide the location of soak away pit.

The easy access and circulation around the site shall help in planning the site for proper fire fighters apparatus access.

ii. University Libraries workspaces provision depends on

(a) the number of students and time

(b) the distribution of individual subject groups

iii. The building should be free of fire disasters through

(c) provision of adequate Exits

(d) proper marking of Emergency routes

(e) through design compartmentation

(f) provision of refuse area before evacuation of persons and properties in each floor.

vi. Good knowledge of Buildings Regulations concerning fire before starting the design.

iv. Special people (disable) should be provided with equal opportunity to access the Library.

v. Proper site planning for easy access to the site in my design.

(viii). It is observed that library construction is structurally of Posts and beams therefore will be incorporated in the design.

(ix). There must be an adequate escape route in my design.

(x). The choice of materials and finishes should not aid combustion.

(xi).The number of students designing for must be bear in mind

to adequately provide facilities that will be enough especially at the peak period of learning.

(xii) The stacks of books and shelves system should be such That ease location of books.

(xiii) Provision for the physically challenge persons should be Incorporated in the design.

CHAPTER FOUR

4.0 RESULTS

4.1 Design Report.

The Library design usually is of posts and beams and this study design is of no exception. Critical analysis of the best practices to the prevention and protection of fire were done and adequate measures through the selection of building materials were used. The Design Concept.

Architectural designed is usually carried out with varies perception and conception and there are some known forms of those conceptual analysis but for the purpose of this study a concept called ESSENCE is being choosing for this design.

ESSENCE is the perfect or idealized form of something, especially when embodied in a person or It is the most important element or feature of something or It is the quality or nature of something that identifies it. From the definition of essence above Library is known with BOOKS therefore the OPEN BOOK is used as the concept for the Plan Development.

4.2 Schedule of Accommodation.

The Ground floor will consists of the following accommodation

- Card/on-line catalogue
- Circulation/ main control
- Conference hall
- Online literature for Disable persons
- Delivery/ store
- Staircases
- General staff room
- Photocopying/computer center
- Courtyard
- Conveniences and
- Offices.

First/Second Floor plan

- On-line research
- General reading
- Carrels
- Offices
- Newspapers/periodicals

Pent Floor Plan.

- Chief Librarian
- Asst Librarian

- Offices
- Reserve books and other journals
- Conveniences.

4.3 Design Brief.

- The design shall contain the following Facilities
- Card/on-line catalogue, Circulation/ main control, Conference hall, Online literature for Disable persons, Delivery/ store, Staircases, General staff room, Photocopying/computer center, Courtyard, Conveniences and, Offices, On-line research, General reading, Carrels, Offices, Newspapers/periodicals, Chief Librarian,Asst Librarian.
- Capacity of about 2500 resource person in all per time.
- Other necessary facilities.

4.4 Materials and Construction.

4.4.1 Construction

The design construction shall be of materials that has high resistance to fire for maximum prevention and protection of the books.

The structural elements of the library are made of reinforced concrete. The post and beams are reinforced elements. Doors shall be self closing and openings shall be in the direction of flight, and windows shall be constructed with high fire rating materials that could resist fire for a long period. The library will be finished with high

quality fire resistant paint both inside and outside; the floor will be made of terrazzo floors, the ceiling of suspended ceiling. The staircase constructed of concrete element. The outside compound is made of concrete slabs as foot path round the library with landscape to match. The roof is reinforced concrete slab cover

4.5 Landscape and external works

To enhance the appearance of land by altering its contours and planting of trees and shrubs for aesthetics effects.

The outside compound is made of concrete slabs as foot path round the library with landscape to match. The roof is reinforced concrete slab cover. Drainage shall be probable alteration of site contour ditches and pipe systems (including culverts, manholes, inlets.) to lead water to the nearest water course (river, drainage channel). Some types of drainage structures return the water directly to the water table.

4.6 DESIGN SERVICES

4.6.1 ELECTRICITY AND LIGHTING

The nature of academic library makes it important that electricity have to be part of the design from the onset.

Particular attention and consideration must be given to the effects achieved with lighting in reading areas, conference rooms, kitchens, computer rooms and offices. There should be at least one socket outlet to each system, incorporated with the lighting control panel, should in

case of staff or student using any portable appliances. Sockets should also be provided in the bathroom, kitchens, conference and reading areas.

Power holding Company of Nigeria (PHCN) cannot be relied upon in services like an academic library; therefore provision is also to be made for a standby power-generating machine.

External lighting is an important factor in creating interest and required atmosphere in the evening. Illuminating of the landscape, to obtain the best effects, without glare and confusion should be considered as part of a coherent scheme.

4.6.2 VENTILATION and Air- conditioning.

Factors of consideration in designing thermal installation

a – The basic energy supply

b – The central plant which converts the energy into positive or negative heat

c – The heat transfer medium and distribution which conveys this potential heat to the individual spaces within the building and

d – It is transformed into useful heat and supplied at the correct rate for the particular office or space by terminal units.

Heating

There is no much problem in the heating of interiors in the tropical hinterland. So referring to the space and location for boilers and hot

water storage in a building is what is heating. Attention is given to the noise and heat from boiler rooms, relation to fuel storage, accessibility for maintenance, degree of control of heat levels and economy in service, ventilations and flue runs.

The boiler plant may be at the top of the building, basement or sub-basement whichever choice you make. Putting the boiler on the building is an extra load on the building. It is advisable to use two boilers should in case one is taking for maintenance.

Cooling and Ventilation

Air extract systems are essential in

- Kitchen services for us to remove fumes and steam
- Lavatories (WCS and bathroom) for us to remove odour and steam

The extraction ducts is either connected to a central plant (boiler plant) or have individual far unit discharging direct to the outside. Provision is therefore made for air to enter to balance the rate of air removal.

The Mains fresh air intake is preferably at roof level, where air conditioning, refrigeration and cooling plants may also be conveniently grouped together. Alternative systems of distributing using lower high velocity airflow are available. They are:-

Induction System – Pre-conditioning air is supplied at high pressure to various rooms and mixed with air circulation directly from the rooms, through induction units.

Dual duct system – these provide for full circulation of heated and cooled air in separate ducts to mixing boxes filtered in each space. A third duct is used for the air returning for treatment and re circulation. This method is commonly used in large spaces and conference halls.

Fan coil units or self-container – these have no ductwork other than short branches conveying fresh air direct from the exterior. This is mixed with re circulated air from the inside and is filtered, heated or cooled and discharged by fan incorporated in the unit.

4.6.3 DRAINAGE AND SEWAGE DISPOSAL

Surface water sewers are usually calculated on the basis of the storm run off accumulating at each section from the highest intensity of rainfall. The storm water run off must be determined for the future impermeability of the area after building and road works have been fully carried out.

The purpose of surface drainage may be listed briefly as follows:

1. To prevent or minimize property damage.
2. To permit the maximum safe use of facilities either during or immediately after a rainstorm.
3. To enhance the beauty of a site.

4. Increase supporting strength of soil.

5. Stabilize road ways.

Foul Water Sewerage

The average dry weather flow at peak periods (midday) was recorded as: "0.01 litres per second per bed minimum, to 0.028 litres per second per bed in seaside hotels".

Sewer capacity must be calculated on the basis of the total number of occupants. The sewer gradients must ensure a self cleansing velocity of 0.75m per sec. – for economy in excavation, sewer lines are planned, where practicable to follow the natural slopes of the ground.

For low-lying property, basements, sewage disposal processes, sewage pumping may be used.

Sewage Treatment and Standards

In Nigeria where there are no central plants on Regional level, local treatment is the only available alternative. Physico-biological processes of sewage treatment include:

a.	sedimentation with anaerobic decomposition of sludge (septic tank) plus percolating filter treatment.	For small developments and isolated Sites with up to 300 populations, and caravan and campsite sanitation. Minimum site area for 100 persons: about 100m (1100 sq. ft).

Location of sewage works is often con

lowest part of the Hotel complex development (river side) is also its greatest asset. To minimize this intrusion, sewage may be pumped to a more suitable place at a higher level.

4.6.4 WATER SUPPLY

Supply requirement for a building include water for domestic purposes, including the accommodation, catering services, laundries, irrigation of gardens, reservoirs for fire fighting.

Minimum individual daily consumption of water varies from 50 litres in campsites or accommodation to 100 litres or more in employees' quarters.

Distribution of water throughout the complex is through a system of mains and sub-mains divided into zones of controlled pressure. Pressure is determined by the heights of the buildings and requirements for fire fighting. Local public storage may be in covered reservoirs at a high level on the Will

4.6.5 WASTE/REFUSE DISPOSAL

Three areas of planning are involved in providing for refuse disposal. They are: Storage Arrangement, Collection arrangement, and Disposal Arrangement.

Storage Arrangement: Wastebaskets are used in the reading rooms and offices. In the Kitchen covered containers are used. There will be two central storage points. One of the restaurant and the other for the library. The two could be merged into one if other factors of planning allow that. The problem of insects and rodents at the central

storage points could be solved by screening and use of sanitation facilities.

Collection Arrangements: The cleaners of the complex convey the refuse from the library and the kitchen to the central storage point. From there refuse is collected directly from premises by vehicles this is reflected in the provision of access and manoeuvring space, and types of refuse containers required.

Disposal Arrangement: A disposal point is to be established distance from collection areas. Treatment will depend on local condition. The use of incinerators may be undesirable as it might cause environmental pollution.

4.6.6 ACOUSTIC

An academic library is a place of solitude. The introduction of a conference hall though functionally important to the centre, might be a source of noise if not properly handled or designed.

First there should be good hearing within the conference hall and secondly, the sound in the hall should not be transmitted or flanked outside.

Good hearing conditions in any kind of auditorium can be assured when the following basic requirements are satisfied.

1. Quiet background

2. Sufficient loudness

3. Proper distribution

4. Adequate blending and separation of sounds

The background noise may come from aircraft, from automotive traffic, or even from wind in trees, air-conditioning systems and fans. When the enclosure is protected against these entire background noises the first basic requirement is satisfied.

Audibility is affected by: shape of room, size of room, room furnishing, and position of source of sound, reverberation period and seating arrangement.

Shape of room: square, circular or oval shapes are acoustically unfavourable. Rectangular or trapezoidal in direction of sound are preferable. Large curved areas produce focal points and large overhangs screen path of sound, stepped and staggered seating is good. So are breaking wall and ceiling surfaces for even distribution. The rear wall should be sound absorbent.

Position of source of sound: should be in front of hard reflecting surface and where room height is excessively reflective sounding boards above sound source are recommended. Where there is more than one source of sound. Each must be sufficiently closed to the other. Loud speakers in same room as source of sound should be 3.4m.

Room Size: Normal speech is audible for a distance of about 20 – 30m in direction of speech to the side of a speaker and 10m behind speaker. Height should not be more than 8m and overall volume 18000m^3.

Sound Transmission

When an incident on a wall, a part sound is absorbed and the remaining part is transmitted. An expression used to describe the noise insulating qualities of an element is the transmission coefficients (t).

The transmission coefficient of the wall of the auditorium should be very high to eliminate or avoid any sound transmission outside.

4.6.7 FIRE SAFETY

The prevention of fire is normally controlled by the government recommended standards, local authority. Necessary escape route, staircases, lobbies, and fire doors are basic to building planning through length of spaces. Wiring is limited by maximum distance occupant must travel to reach a staircase in the event of fire. Lifts and staircase are normally placed together, but stair cases and landings are separated from reading and offices corridors by self closing doors to prevent smoke, every part of the building occupied by occupants should have two independent escape routes in case of fire.

An important aspect of fire protection is through the planning of the building to separate areas of high risk from other parts in which fire is

liable to cause fire-hazards. Escape routes, should enable all occupants to reach safety when their lives are threatened by fire.

4.6.8 SECURITY

An academic library is a vital segment of the University therefore very conscious of its security. There is an established security department of the library. In this department vigilance at the reading room that is of utmost importance and this could be monitored effectively by strict watching of the vital area, checking of students via Hi-tech system.

4.6.9 MAINTENANCE

A more spacious workshop is necessary for running repairs, workshop hand constitute a significant proportion of library employees, as a lot of wear and tear are inflicted on library equipments due to intensity of use.

4.6.10 SOLAR CONTROL TECHNIQUES

How to control solar rays' radiation is the vital aspect of comfort for the library reading areas, book stacks, book storage and offices.

The purpose of solar control is to achieve a climate balance structure and environment that reduces undesirable stresses and at the same time utilizes all natural resources favourable to thermal comfort. Certain factors influence this thermal comfort.

a. Vegetation and trees

b. Orientation of building

c. Sun shading (roof overhang, slabs, balconies)

d. Material and finishing

Vegetation and Trees.

Proper planting and designing of trees give a satisfying thermal comfort performance. The leaves of trees and grasses absorb solar radiation and evaporation process can cool air temperature. Trees and vegetations also provide;

- Good aesthetic environment
- Reduction of air borne sound and noise
- Dust catching and air filtration
- Visual privacy
- Reduction of sun glare.

Materials and finishes

The building fabric performs the role of a filter, between indoor and outdoor conditions to control heat, cool and light. The materials of a building fabric play a very decisive role in the utilization and control of solar rays. On a general role, brightly coloured smooth surface reflect the light and heat and significantly reduce their penetration into the building.

Built-In-Sun Shading Devices

Most effective performance shading device are those built into the building façade, through this both hot season shading and cool season heat gain can be achieved.

CHAPTER FIVE

5.0 DISCUSSION, CONCLUSION ANDRECOMMENDATIONS

5.1 DISCUSSION

All the findings were based on the inferences drawn from the results of the analysis of data collected. Far reaching recommendations were proffered to enable good performance of buildings in terms of fire prevention and protection in order to meet building user's requirement and improve the image of the selected library.

The findings from the research include;

a. The Management of the library visited does not have a copy of the Nigerians fire protection standards. Having a copy will help them to know which of the fire protection standard to place in a particular environment.

b. Electrical faults are the predominant causes of fire in these buildings

c. Combusting materials that aid fire spread in building are used in some places for construction of those building with little or no regard to their fire ratings.

d. Most of the buildings do not have fire safety signs for the public to know easily.

e. Inadequate fire communication system (alarms, detector) in these buildings

f. Inadequate number of fire extinguishers systems

g. Most visitors are not aware of the fire escape routes in most of this building.

h. There are no forms of building compartmentation (division) in case of fire outbreak.

5.2 CONCLUSION.

Important buildings should be protected through adequate involvement of professionals from design stage to construction who have technical and professional know- how of fire prevention. By emphasizing the need for passive means of fire prevention by the architects in specification of building materials, provision of exists, access for firefighters, compartmentation design and refuge area provision before evacuation and builders using non combustible materials for construction, Fire incidence shall be controlled in the selected design.

5.3 RECOMMENDATION

The following recommendations are hereby made as suggestions towards fire problems.

a. Government should promptly as a matter of urgency in the country in general ensure that the fire service, libraryl or buildings alike have a copy of the national fire protection

minimum standards, expected in these buildings and penalties for non – compliance to the standard.

b. The institution of electrical services engineers (IESE) and institute of electrical engineers (IEE) regulators should not be ignored whatsoever in the design of electrical installations in buildings.

c. Fire rating of materials used in the constructions of buildings should be checked before use, and ensured that they are regulation compliant.

d. Fire protection designs and graphic symbols specify the locations of fire protection systems and lines of action to be taken in incidents of fire should be conspicuously placed in all notable buildings.

e. Fire hazardous activities should be prohibited in public and commercial buildings, eg (smoking firewood cooking)

f. Public lectures should be organized by the fire service through television and radio stations to educate and enlighten the general public on fire fighting procedures and fire safety.

g. Building should be design with sufficient fire escape routes to encourage the orderly movements of people from all parts of the building to an open space.

h. Well-trained fire personnel should be employed as staff of the hotel.

i. Fire communication equipment should be selected installed and tested as specified by BS5445, BS 5446 and BS 5839 respectively these include automatic fire detecting, fire alarm systems.

Finally, there should be regular maintenance checks of at least three months (3) interval by experts to ensure the state of readiness of fire safety facilities in buildings.

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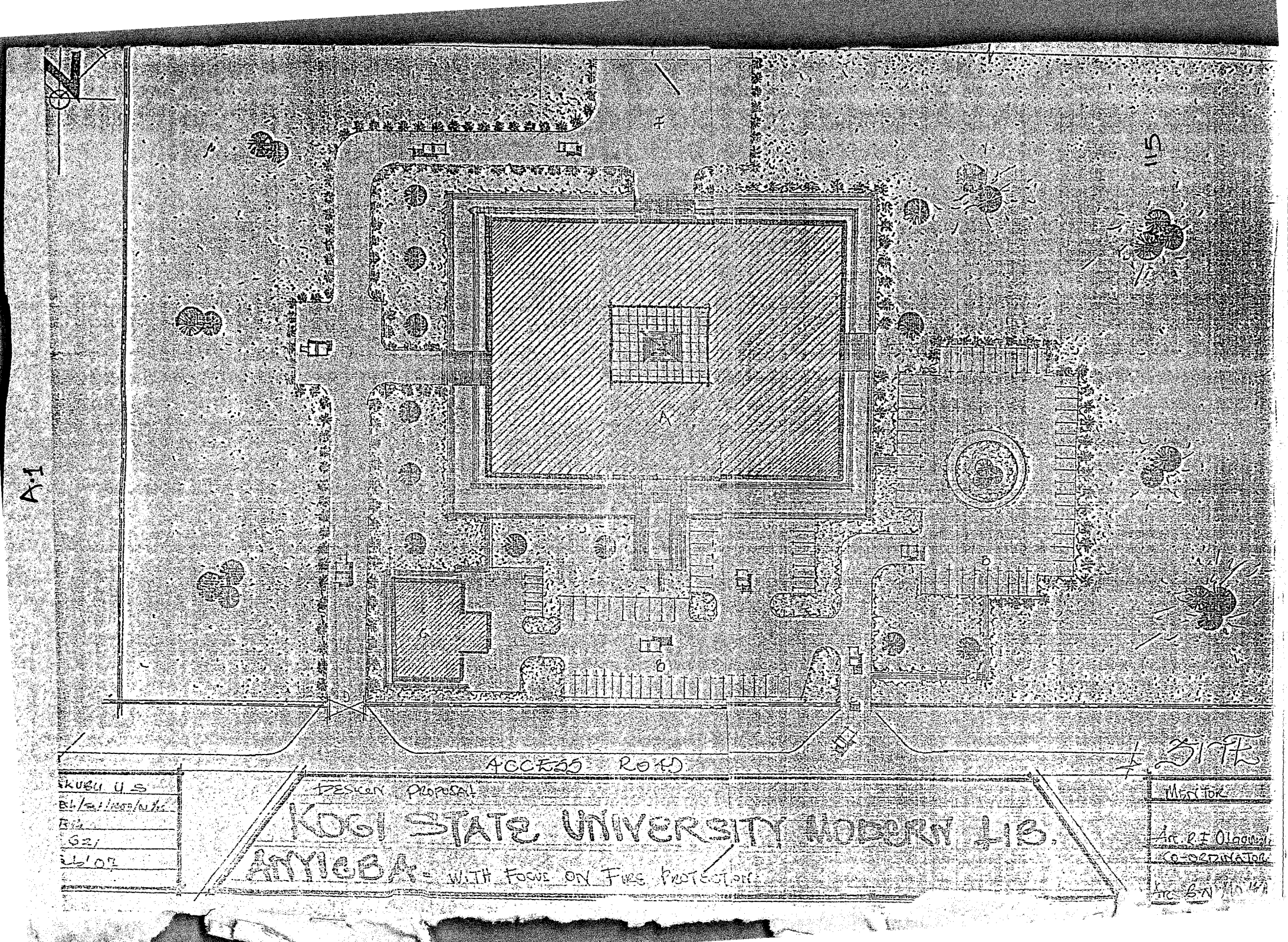
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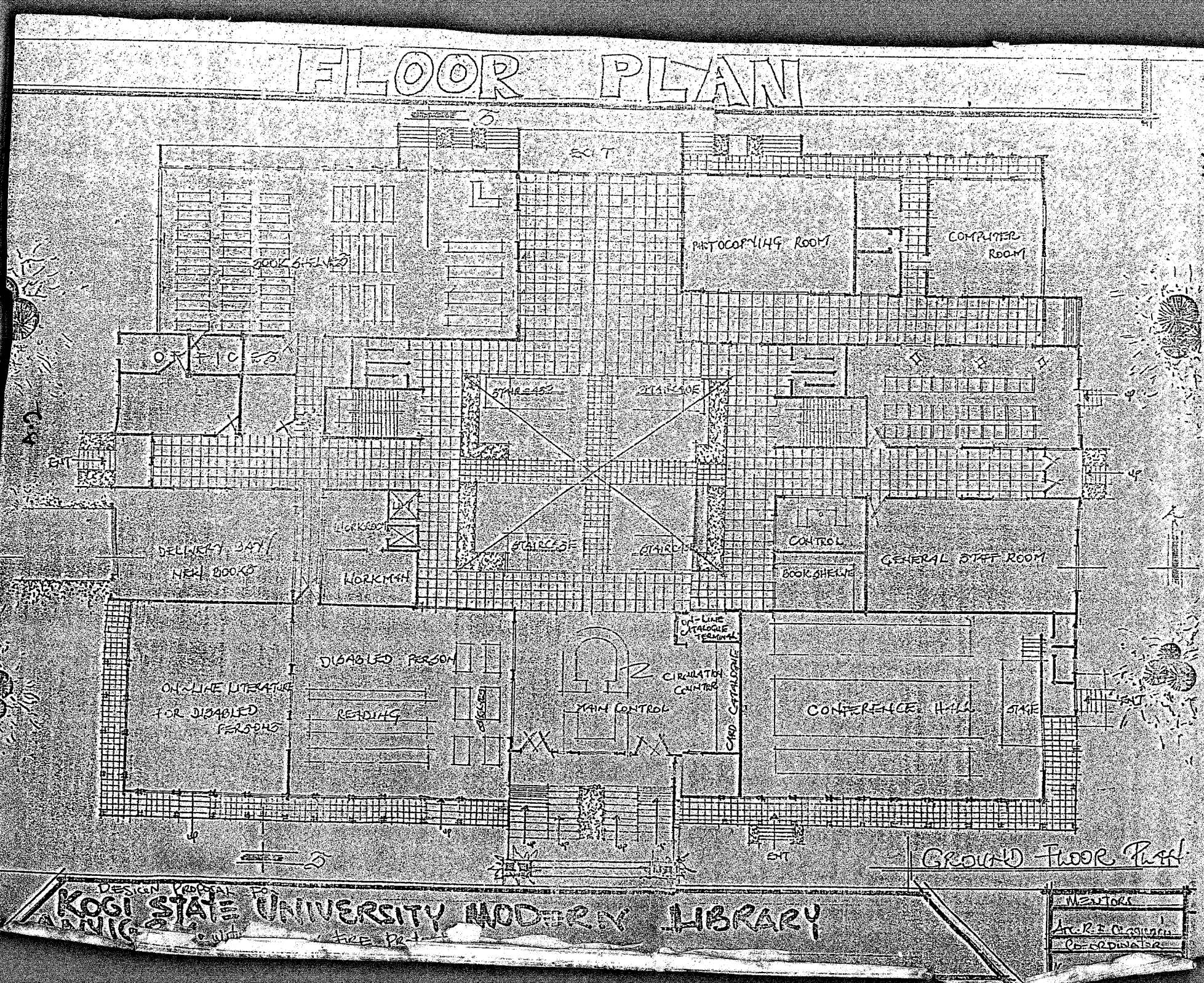
ACCESS ROAD
SITE
DESIGN PROPOSAL
KOGI STATE UNIVERSITY MODERN
AMPHITHEATRE WITH FOCUS ON FIRE PROTECTION
ARC. P.F. OLOGUNJI
CO-ORDINATOR

FLOOR PLAN


EXIT
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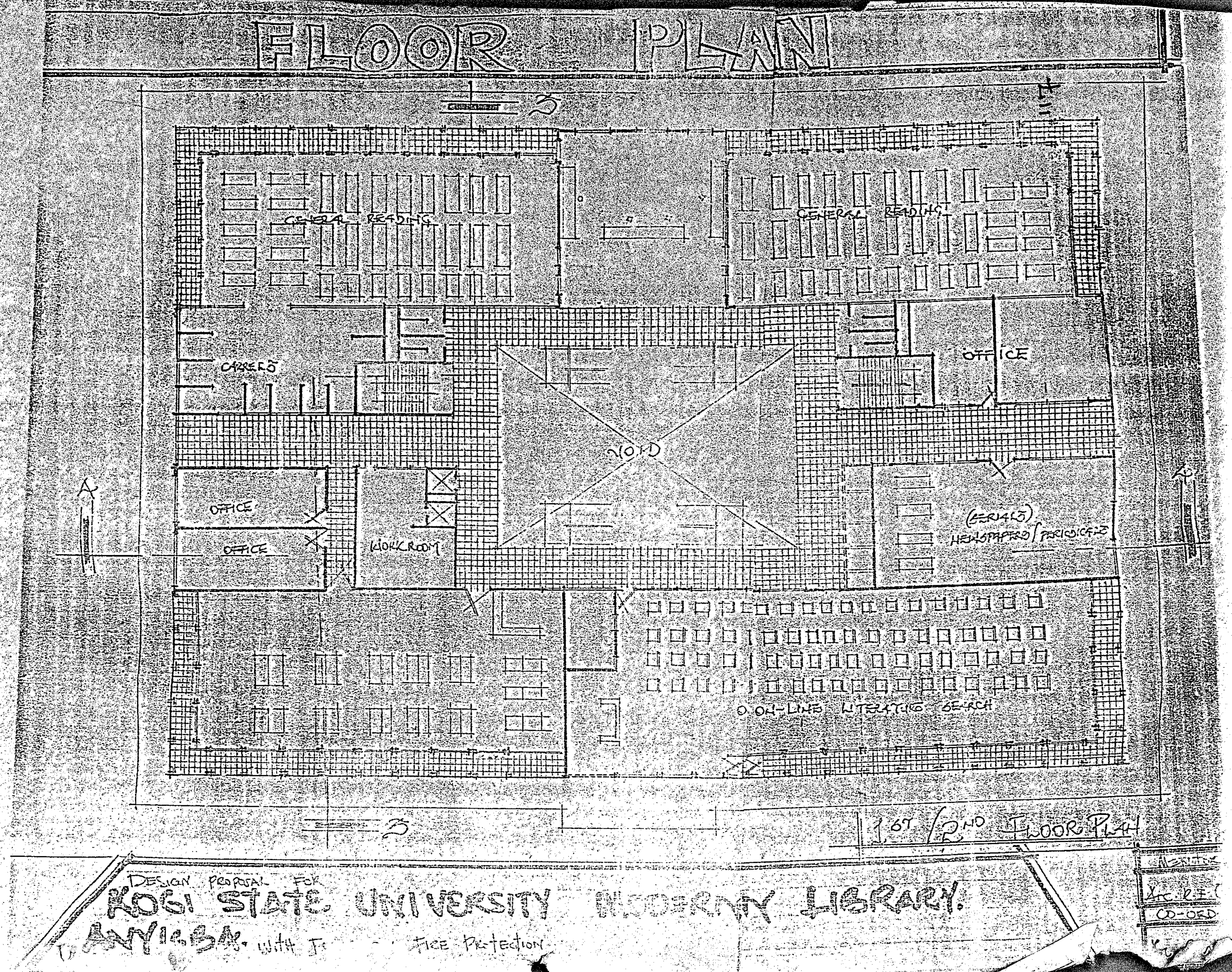
WORKMAN
STAIRCASE
STAIRCASE
CONTROL
BOOKSHELVES
GENERAL STAFF ROOM
ON-LINE CATALOGUE TERMINAL
DISABLED PERSON
ON-LINE LITERATURE FOR DISABLED PERSONS
READING
OFFICES
CIRCULATION COUNTER
MAIN CONTROL
CARD CATALOGUE
CONFERENCE HALL
STAGE
EXIT
EXIT
GROUND FLOOR PLAN
DESIGN PROPOSAL FOR
KOGI STATE UNIVERSITY MODERN LIBRARY
FIRST PHASE
MENTORS
ARC. E. OGUNSEYE
COORDINATOR

A.3


FLOOR PLAN
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ROOF PLAN

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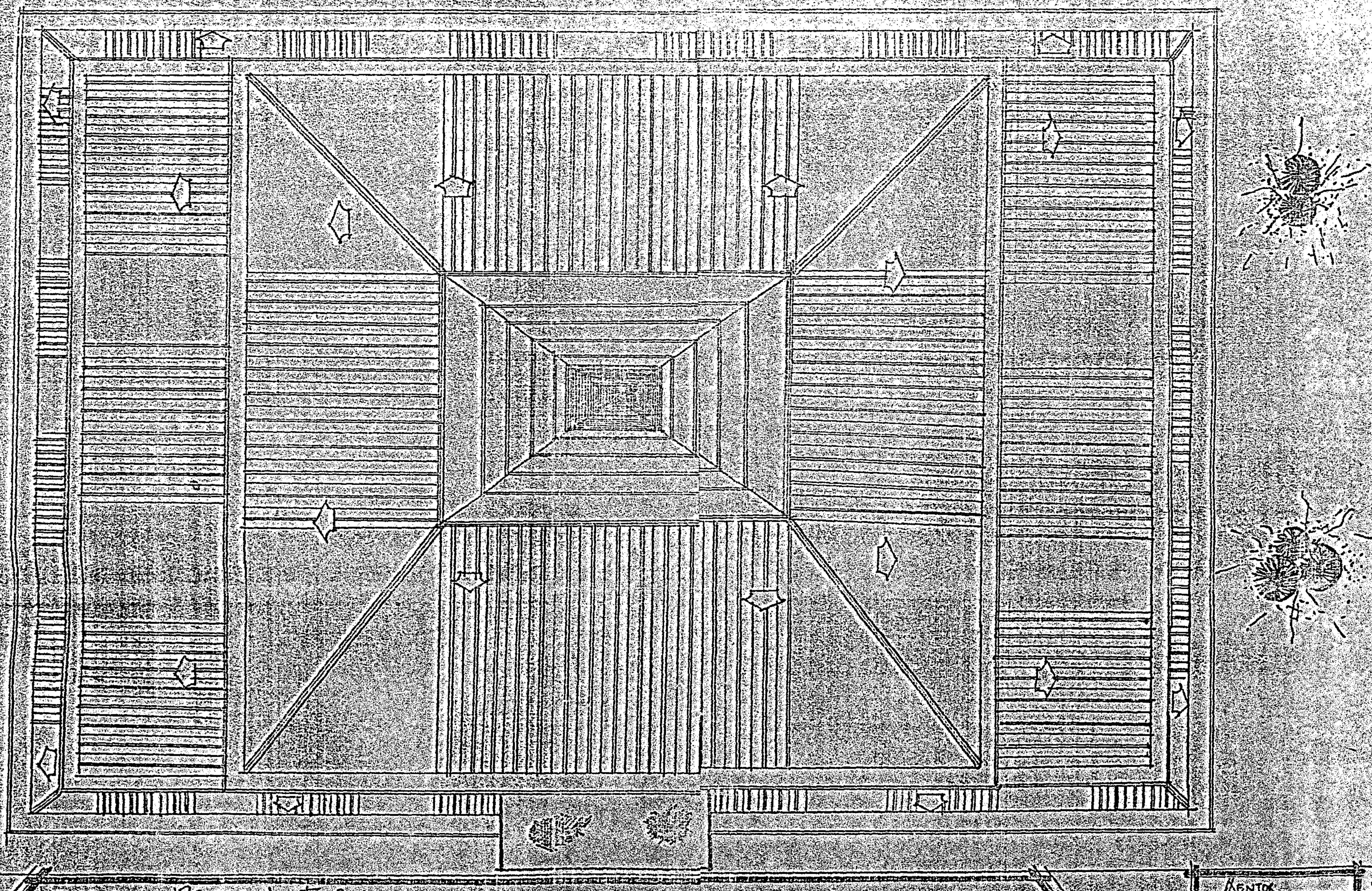

DESIGN PROPOSAL FOR

KOGI STATE UNIVERSITY MODERN LIBRARY

MENTOR

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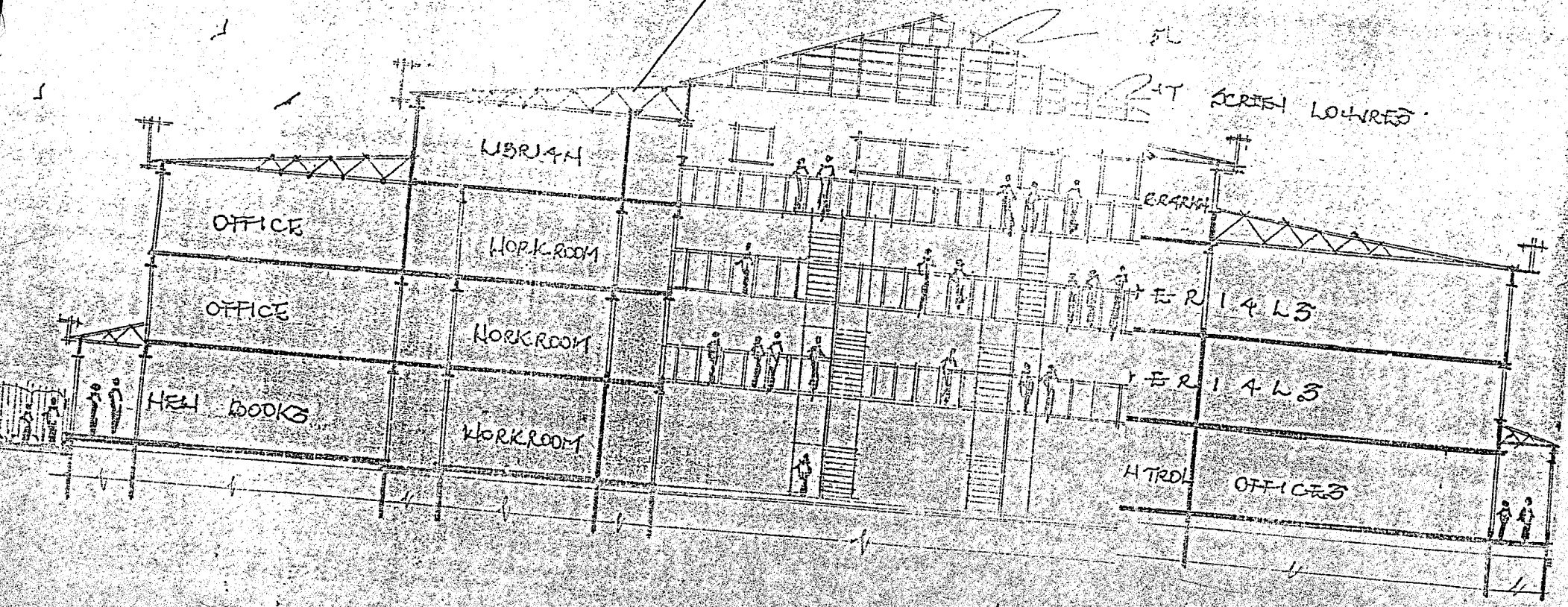

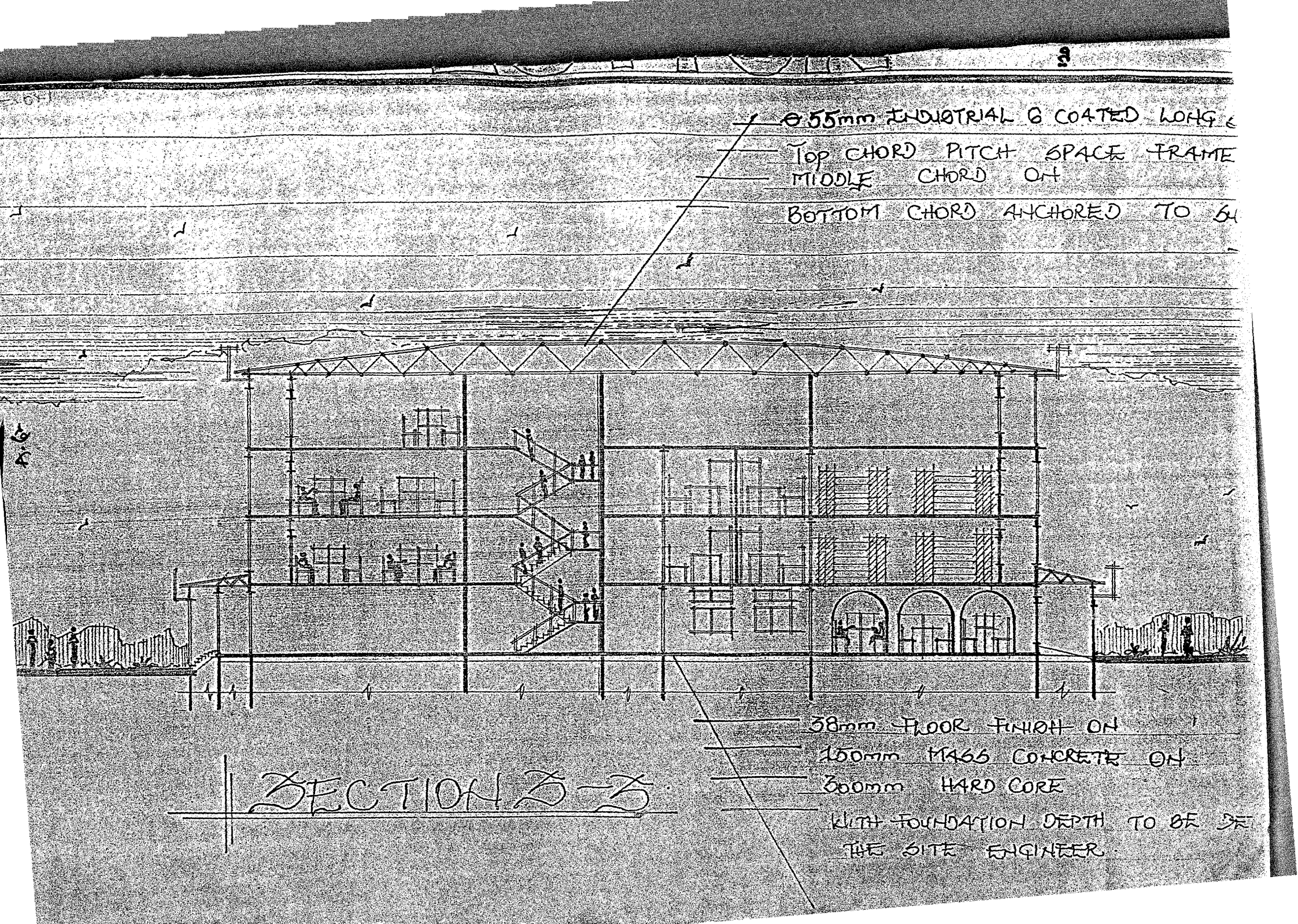
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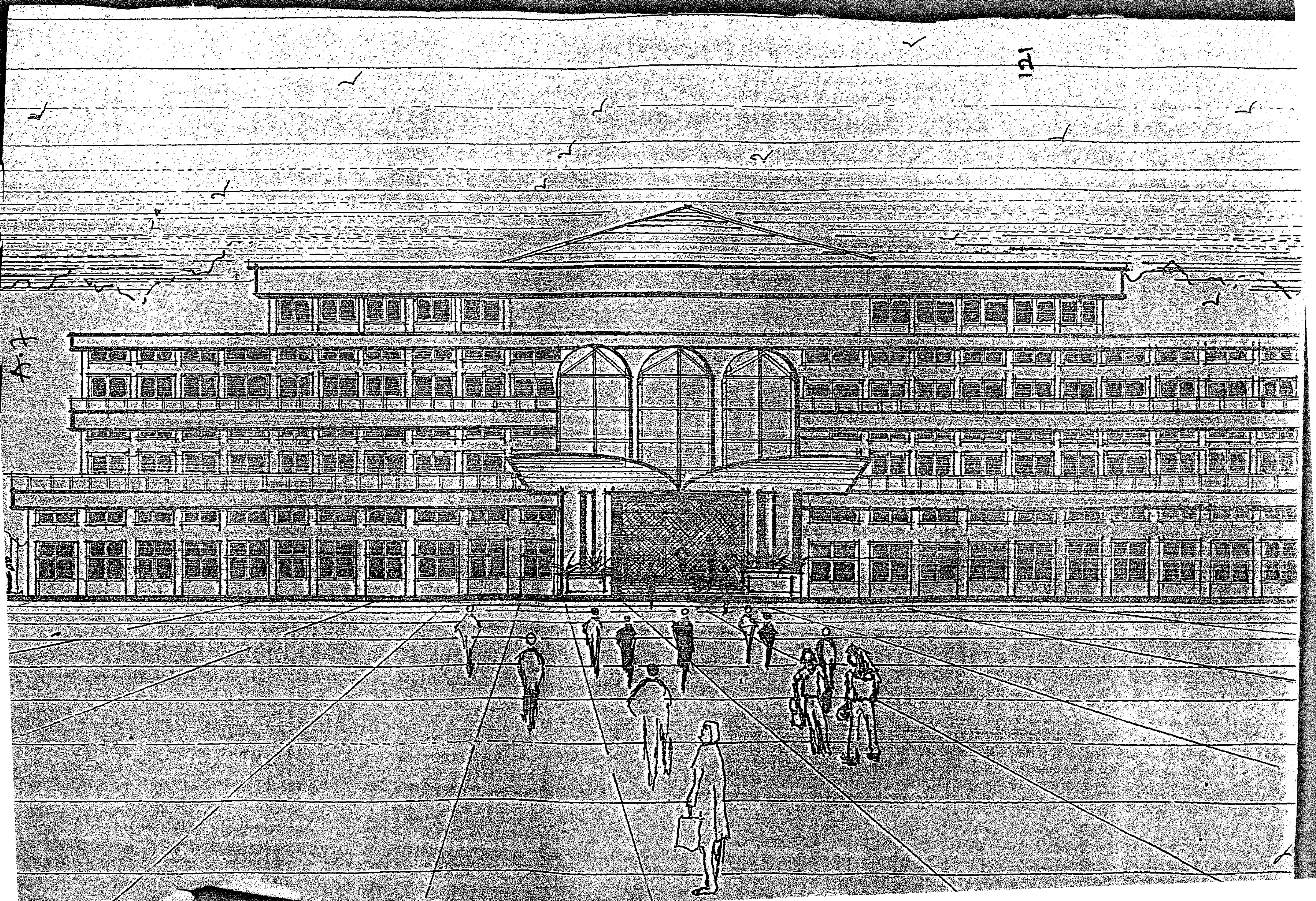
WITH FOUNDATION DEPTH TO BE
THE SITE ENGINEER.
SECTION 2-2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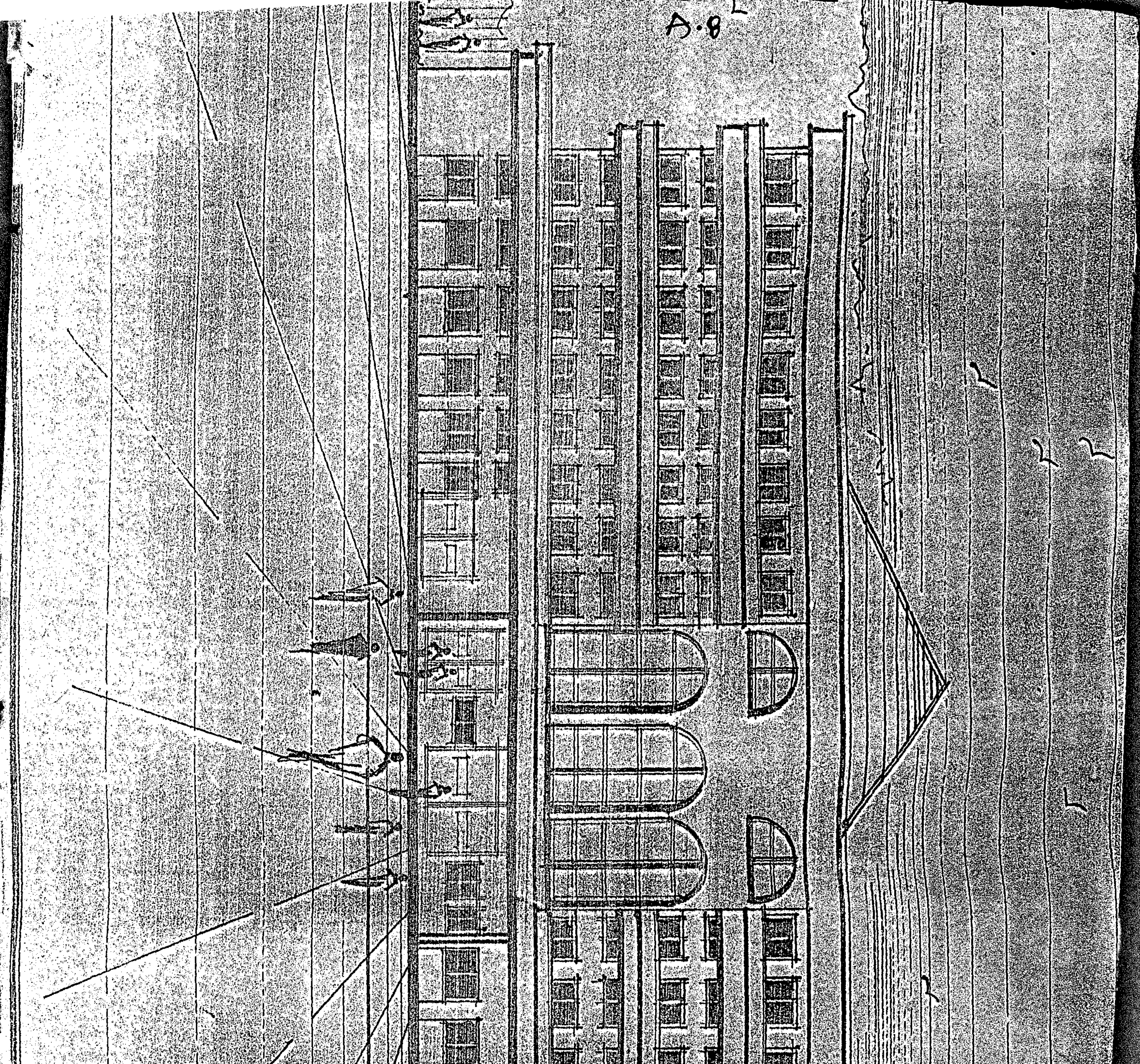
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