TOWARDS EVOLVING SUITABLE MODULAR SIZES FOR EFFECTIVE FLEXIBILITY IN ACADEMIC LIBRARY BUILDINGS: A PROPOSAL FOR FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, LIBRARY COMPLEX.

BY

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A Thesis Submitted to the Postgraduate School, Dept. of Architecture, in partial fulfillment of the Requirements for the Award of the Degree of Master of Science (M.Sc.) in Architecture.

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DECLARATION

I, TAUHEED, ISAH ALHAJI, do hereby declare that this thesis entitled, "FEDERAL UNIVERSITY OF TECHNOLOGY (FUT) MINNA LIBRARY COMPLEX, Towards Envolving Suitable Modular Sizes for Effective Flexibility in Library Buildings" has been composed by myself and is a record of my own research/Site work and has not been accepted in any previous publication for a higher degree. All sources of information have been dully acknowledged.

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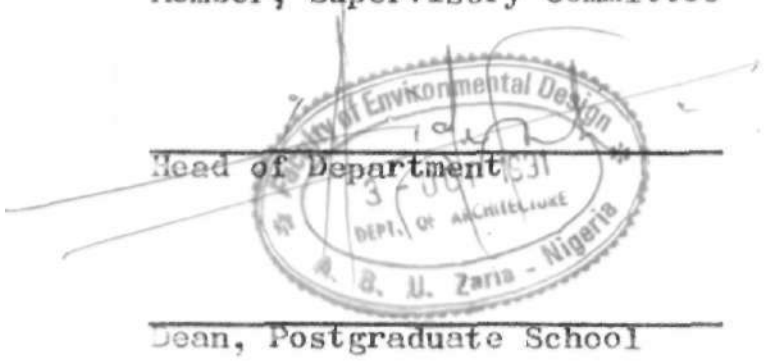
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CERTIFICATION

This Thesis entitled "FEDERAL UNIVERSITY OF TECHNOLOGY (FUT) MINNA LIBRARY COMPLEX, Towards Envolving Suitable Modular Sizes for Effective Flexibility on Academic Library Buildings", by TAUHEED, ISAH ALHAJI meets the regulation governing the award of the degree of Master of Science in Architecture of Ahmadu Bello University Zaria, and is approved for its contribution to knowledge and literary presentations.

Chairman, Supervisory Committee	Date.
Member, Supervisory Committee	Date.
Head of Department	Date.
Dean, Postgraduate School	Date.



DEDICATION

To my late mother. How I wish you are alive today to reap the reward of your labour.

Indeed, from Him almighty we came, and to Him we shall return.

We pray to God to give you enternal joy where you are. Ameen.

ACKNOWLEDGEMENTS

The past eighteen (18) years of my academic pursuit have not been easy. However, self determination and constant struggle have sailed one across.

I am grateful to Almighty Allah for giving me the opportunity to attain this level.

This work would not have come to being without the determinant - and noble sacrifice of my elder brother who has spent every kobo on my educational career. I wish to express my sincere thanks to all the members of my family for the financial and moral support given to me.

I would like to say my special thanks to my dear wife, Madam Asamau for all her unwavering love, especially at this enfant stage of our marriage.

I am indebted to the tax payers of Niger State for their contribution to the State Treasury with which the State was able to give some sponsorship.

The intention to carryout this study occured to me as a result of my specific interest in Library Architecture. At the beginning, the task appeared not easy because of the difficulties encountered while collecting the necessary data. Here I got the helping hand of Professor Olufolalo of Department of Geography/ Metereology, Federal University of Technology, Minna, who gave me the necessary direction on the data collec-

tion exercise and Mr. Kusogi, a Librarian of the same University for his assistance while in their library to collect data.

The complete and reliable data wouldn't have been easy without the assistance of Arc. Rukuba, Director of Physical Planning, National Universities Commission, Kaduna. The other problem lay in the fact that I had little knowledge in research work. Here also I met the assistance of my Supervisor, Arc. M.K. Nabade who showed keen interest in my work and gave me constructive criticisms. I am also grateful to Arc. W.B. Qurix, Lecturer, for sparing his time to give me useful criticisms on technical aspects.

Many thanks to my colleagues with whom we cruised together on the turbulent seas of academic pursuit for numerous years, like Lukman Gwadabe, Mohammed Jalal, Mohammed Suleiman to mention a few. Indeed we have a time to remember for the moments shared.

Many thanks also to all those who have contributed in one way or the other to make this work a reality.

Finally, I would say praise be to Allah, the supreme, who gave me the power and courage to achieve this work.

Ameen.

T.I. Alhaji

THESIS ABSTRACT

The trend of Library Architecture from the ancient history reveals the metamorphosis it has undergone. This trend can be likened to the trend of human knowledge right from the stone age (Primitive age) to the age of iron and steel and finally up to our present day age of Computer.

The advancement in knowledge has resulted in seeking new dimensions of portraying library architecture. This, in modern day, is the evolution of the grid system design (the modular design system).

This thesis is virtually a study of the use of this system in academic library buildings. The first chapter proposes and defines the area of concentration. The second chapter looks at library architecture from history to date. The third chapter picks on case studies of existing academic libraries both abroad and at home - their problems, and possible solutions were made.

The fourth chapter which is the research chapter looks at the modular design system in library. What factors should guide module size selection,, the problems associated with uniform grid and attempts were made to evolve grid sizes for certain areas of the library. Chapter five studied the site and chapter six which is the design proposal is where the application of the precee-

ding chapters is seen.

My own contribution in modern academic library design vis-a-vis the modular system concentrated on, is the proposal of outdoor rending areas, provision snack bars on the roof top and informal reading areas.

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CHAPTER ONE

THESIS PROPOSAL

1.1 Introduction/Motivation

In recent years, Nigeria has realised its statistical position in technology even among the third world nations. In view of this, Nigeria has gone on the creation of institutions where indigeneous technology could be evolved. This institutions include Universities of Technology, among which Federal University of Technology, Minna was created.

Since the motive of creating Universities of Technology is directed at evolving an educational system that will work towards creating an indigeneous technology for the country, the supporting facility to house the research materials is necessary.

It is therefore obvious that the erection of a library complex to act as a repository for large and organised collections is required.

Federal University of Technology (FUT), Minna will be moved to its permanent site soon where this proposal will be needed. The library will provide services to the entire University including those Departments to be created in future.

1.2 Statement of Problem/Intent

Modern technology has given birth to an advancement in building design.

This includes the modular design system. The modular system simply consists of bays (columns arranged at regular

intervals, otherwise called the module) to act as the load bearing elements instead of the walls in the building.

This is found to have great applicability in the modern library design.

The fundamental objection to this system is that one column spacing or bay size almost perfectly adapted to one function, such as the book storage, will not be equally well suited to another.

This thesis hopes to study and attempt to resolve this problem. Attempts will also be made to evolve satisfactory and workable bays to suit each unit of the library functions.

1.3 Aims and Objectives

1. To design a library that will accommodate both present and future needs.
2. To create an environment that stimulates reading for academic and recreation.
3. To provide quarters that will as far as possible ensure the preservation of collections.
4. Space utilisation: To provide sufficient space for a given number of readers, services and collection of materials.
5. To design a comfort-oriented library for reader and staff. This will reduce matters like temperature, humidity, insufficient lighting, visual and auditory distractions.

1.4 Research Methodology

(a) Visits to existing academic libraries were made to be acquainted with the prevailing situations. Facilities and services offered by those libraries were assessed with a view to improving on them.

(b) Personal interviews were carried out with library staff and students to ascertain the nature and the extent of their library services, problems and proposals.

(c) Seminar papers, Annual Reports of libraries, Readers' guides, Newspapers, Journals and textbooks were all researched into and relevant information deduced have been fully acknowledged.

(d) Case studies of existing libraries were carried out both locally and internationally. Foreign case studies were carried out mainly for the purpose of seeking the most modern concepts of academic library design with a view to making a proposal within the modern content.

1.5 Scope and Limitations

(a) Case studies will be carried out only on academic libraries.

(b) Users of the proposed library complex will mainly be academic students and researchers.

(c) In view of level of technology available in Nigeria, this proposal is not made to take effect in full phase but gradual.

(d) The diversity in climatic regions worldwide, makes this project limited to the tropical climate.

1.6 The Client/User

The client of the project is the Federal University of Technology, Minna.

The motive of establishing the library complex conforms with the philosophy of the University, which is directed at evolving an educational system that will gear towards creating technological manpower that will serve the state and the country as a whole.

It is therefore obvious that the facilities in the design will carter to some degree the needs of the University.

1.7 Viability of the Library Project

The Library Complex has a duty to support and facilitate the achievement of the educational programme of the University by procuring, organising and making available its resources that are vital to the achievement of the afore-mentioned goals.

The merits of such a library can further be given as:

(a) Students will be in an environment of a vigorous library service which emphasizes its information, function and has an active research programme.

(b) There will be mutual benefit to both library staff and students. The library staff will have the benefit of expertise and professional interest of the University.

(c) Many common needs can be met by shared accommodation and equipment, allowing a high level of provision for both, whilst maintaining the economical use of resources as indicated below.

(i) Increased bibliographical coverage; since wasteful duplication in separate departmental collection will be unnecessary.

(ii) Shared use of expensive equipments such as video recorders, computer terminals, visual display units, photocopiers, and printer.

CHAPTER TWO

EXPLORATORY STUDIES

2.1 Introduction

In writing this thesis, it was considered pertinent to review the existing literature in library buildings and design. It was also found necessary to look at the trends of library architecture from the time library buildings were first erected to date. The purpose of this was to acquaint the researcher with the knowledge of the changes in trend and how that changes in tune have influenced the architecture as a whole and Nigerian library architecture in particular.

2.2.0 Libraries of Earlier Civilisation

The effects of secularization arising from the french revolution of the 18th Century brought about a freedom of study and research for libraries. Libraries as storehouses for books and other forms of records have a historical background that goes back to the earliest days of recorded civilisation in Mesopotania. Evidences of developed literature were more often discovered in temples and houses of princes or the palaces of kings. Thousands of clay tablets into which were wedged cuneiform letters were found in the palaces of Ashurbanipal (668 - 631BC) in Nineveh with indications of a well developed cataloguing system.

In Egypt every temple had its library and school. In pre-hellenist Greece, the first truly extensive library was credited to Aristotle (384 - 322BC).

In Alexandria, the cheap availability of papyrus and the enlightened rule of the ptolemies provided a great impetus to the translation and editing of books, and libraries were accorded much importance.

In Rome, the first libraries were all private and consisted of booty brought back from foreign wars. The earlier colledtions were kept more often in a special room (tablium) in Roman house and were more archival than anything else.

Gaius Julius Caesar was credited with proposing the first public libraries. The first public library was built sometimes between 39 and 27BC by Graius Asinius Pollio and subsquent ones were built right through the time of the later emperors towards the end of the Roman Empire.

The renaissance period (period of rebirth) marked a revival of learning in the 12th century. The rise of the Cathedral Schools, translation of Scientific and Philosophical works from Arabic, a rebirth of the Roman Law, all fostered by social and economic conditions combined to produce an awakening which found its culmination in the birth of the Universities.

The Monastic libraries in many cases under went a period of decline and yielded supremacy to the Cathedral Schools and episcopal libraries. In France, from 11th to 13th century, Charties, Paris and Orleans were centres of intellectual movements. In the 13th century, the age of scholarsticism, there was emphasis on the production of textbooks.

At the time of the renaissance came the invention of printing and the ensuring shift to the modern conception of library. Containing few scholarly books and were for the most part haphzard; unsystematic libraries.

In the first half of the 20th century, as funds available to American Universities in creased, automatically there was a greater strive towards achieving comprehensiveness in fields specialisation.

The development of the University libraries became high with progress of librarianship in general, and the Principles of education which have shaped them. As concepts of education and library service changes, so also do the concepts of library service within educational institutions and indeed, the architecture.

The architectural form of libraries took shape only in the last half of the 19th century. Earlier or prior to that time, the contents of the library could be accommodated in almost any available building.

The discovery of the rotary printing press gave impetus to library buildings such as Trinity Hall Collog. Library at Cambridge. Such buildings were characterised by high ceilings which permitted the use of multi-tiered galleries along walls.

The first half of the 20th century witnessed greater freedom from the 17th century legacy, enabling, a combination of beauty and utility in the design of library use.

In the design of University Libraries, the need for direct access to books by readers deminated eg. the libraries of Universities of Glasgow and Leeds in Britain. In United States, until recently, most college and University libraries were operated with closed stacks. A general dis-satisfaction grew with this type of library and there was a call for a change.

A break with the old was inevitable to create a new era of library buildings, an open stack (open access type) type of service in a flexible spatial arrangements. The post world war two witnessed a flourish in modern library architecture; with the applicability of modern technology and materials in architectural innovations.

Historic Plan Types

There are four types identified by Anthony Thompson in his book Library Buildings of Britain and Europe (London, 1963). There are as follows:

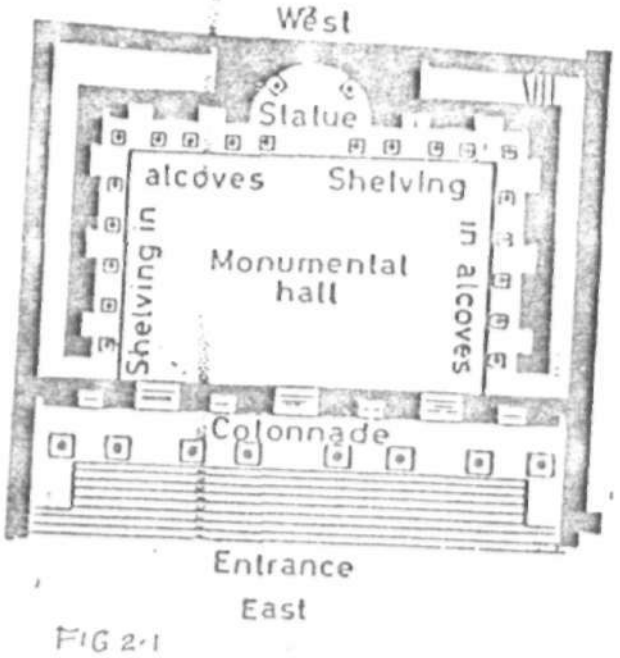
2.2.1 The Classical Plan

This originated in ancient Rome and was used throughout antiquity and the renaissance.

It consisted of a single monumental hall for the three elements of the library (readers, books and staff) decorated with sculpture and moral paintings, with book cupboards or shelves placed against the walls (later) galleries. At first these libraries were generally connected with temples, later they were attached to or formed integral parts of Cathedrals and Princely dwellings. The classical plan was designed for few books and few readers. It ultimately failed because of this limitation and the noisiness of a large open hall. The prototype was the Roman library at Ephesus (A.D. 107), (Fig. 2.1).

The Medieval Plan

This was usually a small library for monastries Cathedrals and small colleges. It consisted of a room with book shelves projecting from the walls like Church Pews and Central aisle. It developed through several stages into a series of alcoves created by book shelves with tables and chairs in each alcove. The medieval plan has proved ideally suited for small libraries or even special collections or rooms within large libraries. The prototype here was the library of Queen's College, Cambridge (1440) (Fig. 2.2).



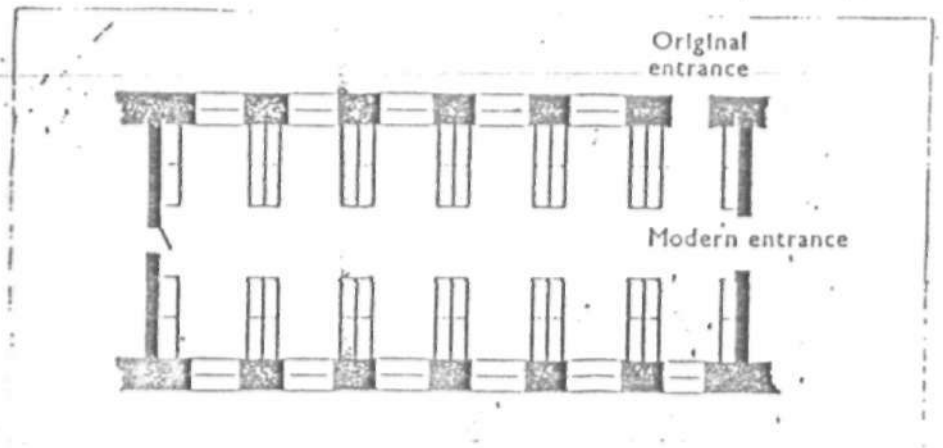
F 2·1

FIG 2·1

ROMAN LIBRARY AT EPHESUS

LIBRARY BUILDINGS OF BRITAIN AND EUROPE.

11



F2·2

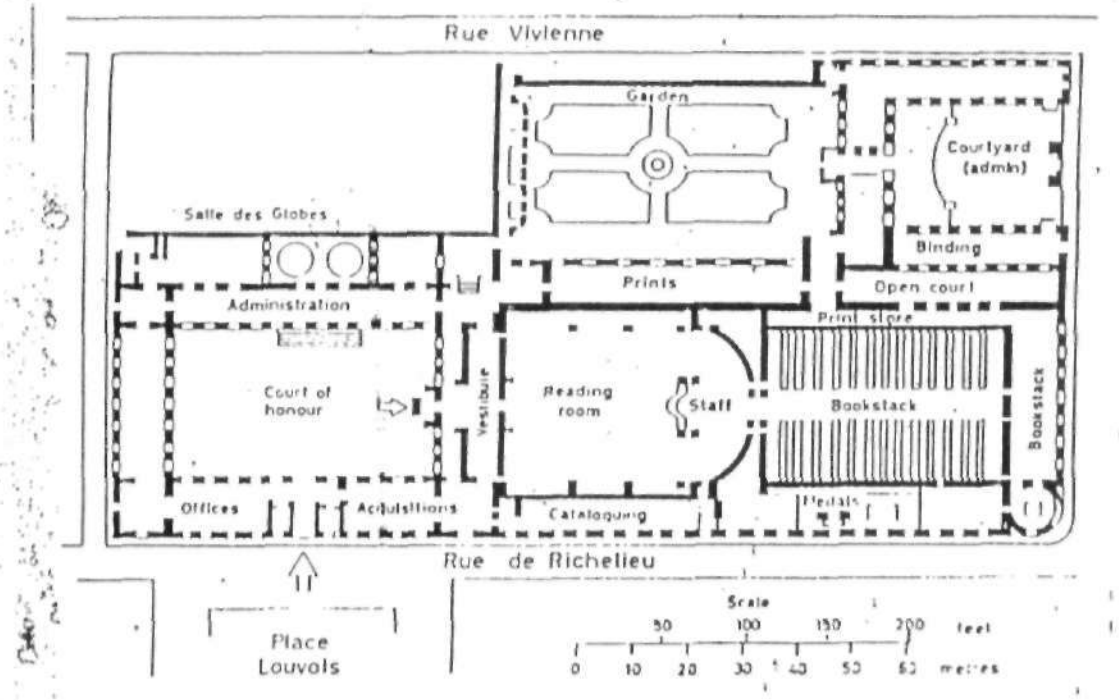
FIG. 2·2 TYPICAL MEDIEVAL LIBRARY PLAN AT QUEEN'S COLLEGE, CAMBRIDGE.

SOURCE: LIBRARY BUILDINGS OF BRITAIN AND EUROPE.

2.2.2 Plans for Closed Bookstacks

The real impetus to planning modern library buildings stemmed from designs to solve the problem of supplying many books to many readers. In the early 19th century, books began to be produced in much larger quantities and towards the end of the century also, the development of education brought greatly increased numbers of readers, so that it became necessary to separate the elements of the library, in particular books and readers. The books were kept in closed bookstacks, while the readers were accommodated in a large reading room. The prototype of this was the bibliotheque Sainte-Genevieve at the University of Paris. This had the bookstacks above and the reading room below.

Another arrangement of closed-stack libraries consisted of a circular reading room with the catalogues and library staff in the centre. The open access collecting of reference books is kept in the inner walls and in a gallery, the whole being surrounded by closed bookstacks on several floors. The prototype was the British Museum Library, London (1857). The excessive traffic through the reading room made this a disadvantage. Another closed - stack plan was in form of a rectangular building, in which the reference staff were placed between the readers, in front and the closed bookstacks behind. The prototype was the Bibliotheque Nationale Paris (1854). See Fig. 2.3



F2.3

FIG. 2.3 LABROUSTE'S PLAN OF THE BIBLIOTHEQUE NATIONALE, PARIS
SOURCE: LIBRARY BUILDINGS OF BRITAIN AND EUROPE.

2.2.3 Open Access Plan (Modern Plan)

The practice of keeping books in closed stacks must have stemmed from the notion that the library was primarily a repository. Faced with the growing demands for books in the 19th century, it is no surprise, the librarians' first impulse was to protect the collections from the reader. In the middle ages, books used to be chained to iron-bars on library desks to prevent their being removed. In Church Libraries, monks wrote"books curses" into them to deter thieves. The same air of possessiveness was reflected in the various plan types that excluded the readers from the stacks.

By 1920s, however, the whole philosophy of librarianship had began to shift. Service to users became far more important than it had been. Books were in any case cheaper and more readily available. On the Campuses, libraries came to be viewed less as passive repositories of knowledge and more as an integral part of the teaching machinery.

The open access building plans are the result of efforts in modern times to bring books and readers together.

2.2.4 Comments/Conclusions

Looking at the historical conceptions of libraries from early civilisation to date, will convince any researcher of the metamorphosis the design concepts have under-

gone in both planning and constructional techniques. It will be interesting to observe the following about the evolutional trends.

(a) From the three basic components i.e the users, staff and materials; the early libraries (classical libraries) accommodated all in one room or hall with materials arranged on a raised platform along the wall or alcoves. This was maintained during the medieval period and the only improvement was on the bookstacks, which was made in such a way as to enable the readers sit and scrutinize the materials.

This concepts ultimately failed because it could not accommodate the increasing number of readers, books and the difficulties of allowing large numbers of readers into the open hall for either lending, reading of for information.

(b) In the early part of the 19th century, the closed bookstack replaced the former one. This also was later abandoned since it did not allow scanning through collections.

(c) Library design in the later part of the 19th century was the evolution of the open access plan to stacks and subject division within the library. This developed into the separation of the administration and the lending area from the quiet reading spaces. There was quite a number

of merits in this consept.

(i) The reader has a greater freedom and can scan through collections with little waste of time.

(ii) Offers greater accessibility to books, reader areas.

(iii) Has the ability of self service, which eventually saves personnel, thus making the library more efficient.

2.3.0 The Development of the Modern Library

The libraries of the 17th century were profoundly influenced by religious, political and economic trends. Great library collections rose and fell with the fortunes of war and politics. Although University libraries flourished in Europe at this time, especially in the Scandinavia, Central and Eastern Europe, Italy, Spain and Portugal. The University library as an effective tool of research did not exist before the late 18th century.

The 19th century German University libraries became prototypes for most of the world. The libraries of Berlin, Leipzig, Heidelberg, Breslan and Tubeigen had adopted precise definitions of acquisition and cataloguing policy.

Two of the new American institutions founded on the German models, the John Hopkins University (1876) and University of Chicago (1890) put major emphasis on Departmental libraries to promote the seminar type of University institution.

Old Universities such as Hovard, Yale, Michigan and Columbia recognised their existing centralised collections to serve the new type of research scholar while many other college libraries of the 18th and the 19th century remained antiguarian.

2.4.0 The Library

The description of a library has no specificity, thus many descriptive definitions have been given by many different people. This section attempts to look at some of them.

(a) Libraries have been described as "repositories (place where valuables are deposited for safe keeping) of human knowledge to cover it, to make it available to present and future generations for further growth" Sharma (1978).

(b) The library is a tool foe intellectual freedom and economic development, and a gateway to political, economic and social happiness and survival.

(c) A library is a planned collection of volume of books to enable or guaranttee ease of obtaining a target readership.

(d) The library can be perceived as an institution to which an individual can turn for a permanent and comprehensive store of information pieces.

(e) The library is a building where books and information materials are preserved for references. In an ideal

library, the collections should not be less than 1,000 volumes.

2.4.1 Comment

If the ideal nature or pattern of the library as advocated by the last definition is to be adhere to, one will subscribe to the fact that a particular setting cannot be described as a library until it has a collection of at least 1,000 volumes. All the definitions of the library above, though varied, tend towards a focal point - intellectual development.

2.5.0 Classification of Libraries

Many categories of libraries exist, ranging from the specialist to the general.

A department of Architecture in a University, for instance, will only have holdings peculiar to architecture. A Professional library, say an Engineering library, will have holdings in all fields of Engineering, while a public library will attempt to have holdings for all the fields, so also is the University library complex meant to serve the institution.

The classification of libraries is done according to the services they offer.

a) 2.5.1 Academic Libraries

These are meant to serve the academic community. The collection covers all areas of knowledge in the given academic community. These type of libraries are:

- School and College libraries
- University libraries.

These libraries are in many cases, used as research libraries.

b) 2.5.2 Public Libraries

These are very large libraries serving the need of a wide patron community. They acquire materials or documents to meet the needs of both old and young, literates and illiterates; school children and educated adults. They are being financed by the public eg. from the government treasury and organisations. They also store and pass vital information pieces to the public; literacy campaigns. Example of such libraries are: National Libraries, State Libraries, Division or Branch Libraries.

c) 2.5.3 Special Libraries

These are libraries of special institutions or organisations, serving specific or well-defined purpose. They are usually small and their collections are also limited, tailored towards satisfying the needs of a special group of readership. These libraries include the following: Research Libraries, Medical or Hospital Libraries, Prison Libraries; Military libraries.

d) 2.5.4 Departmental Libraries

These are small libraries serving the needs of both students and staff of a given department within an institution. Their collections are limited to the subjects of study within the department. These type of libraries could generally be classified under academic libraries.

CHAPTER THREE

CASE STUDIES

3.1 Introduction

This chapter is devoted to the case studies of existing libraries. In all, four case studies have been carried out. Two locally and two internationally. The local case studies have been in such a way that a more recent one based on system of modules and an old building not based of this system. This is done to examine the implication of modules on the library in terms of flexibility and expansion.

The foreign case studies are to serve for comparative purposes, between local and international standards so as to have a broader knowledge of library architecture in general. Appraisals of these libraries have been done with a view to incorporating relevant and interesting elements.

3.2.0 Case Study 1: Kashim Ibrahim Library, Ahmadu Bello University (ABU), Zaria. (Plate 3.1).

3.2.1 Brief

ARCHITECTS: Egbor and Associates.

TYPE OF LIBRARY: To house the Sciences, arts and social sciences collections.

LOCATION: A.B.U. Main Campus (Fig. 3.1)

DATE OF OCCUPANCY: 1978

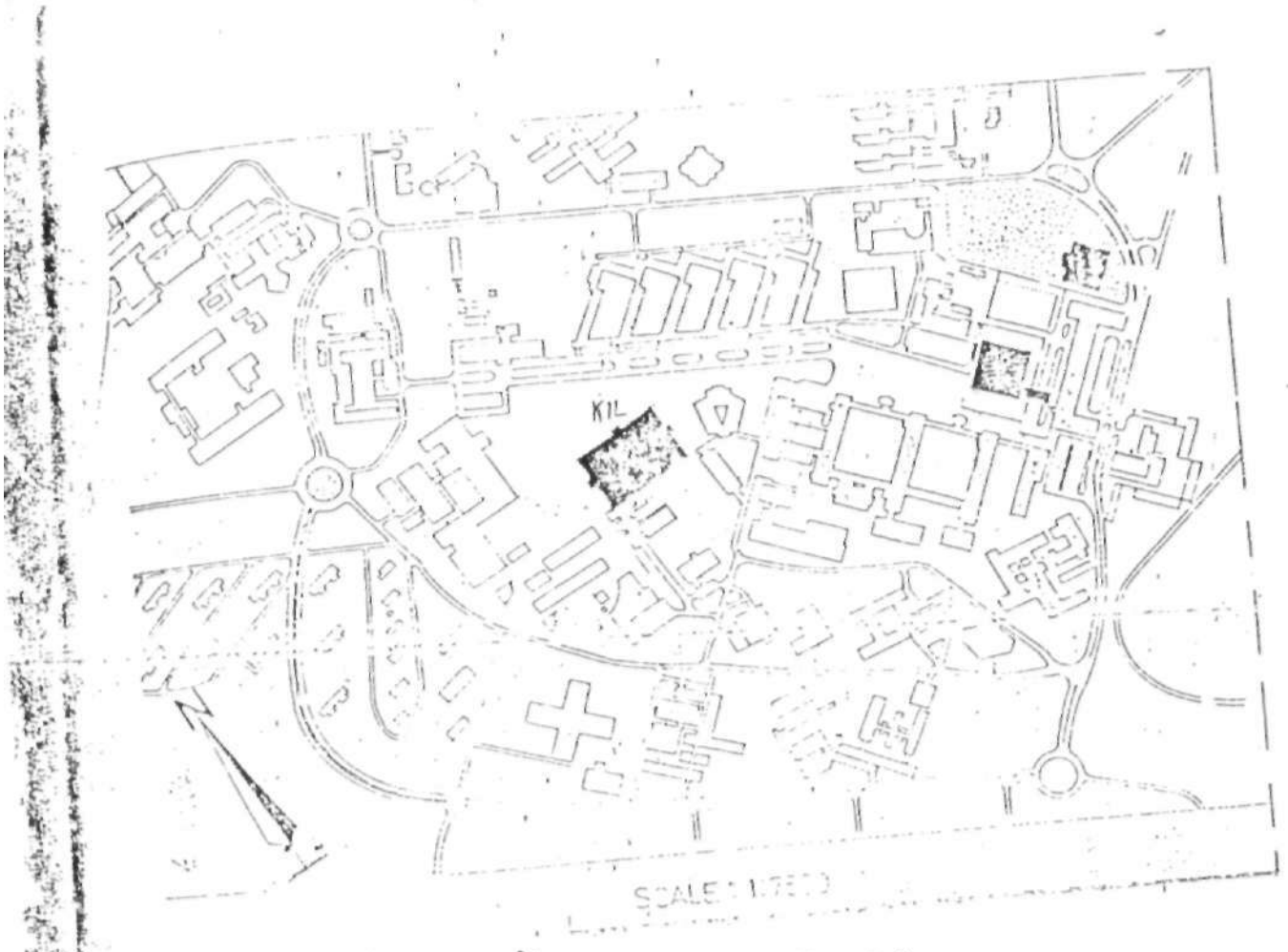
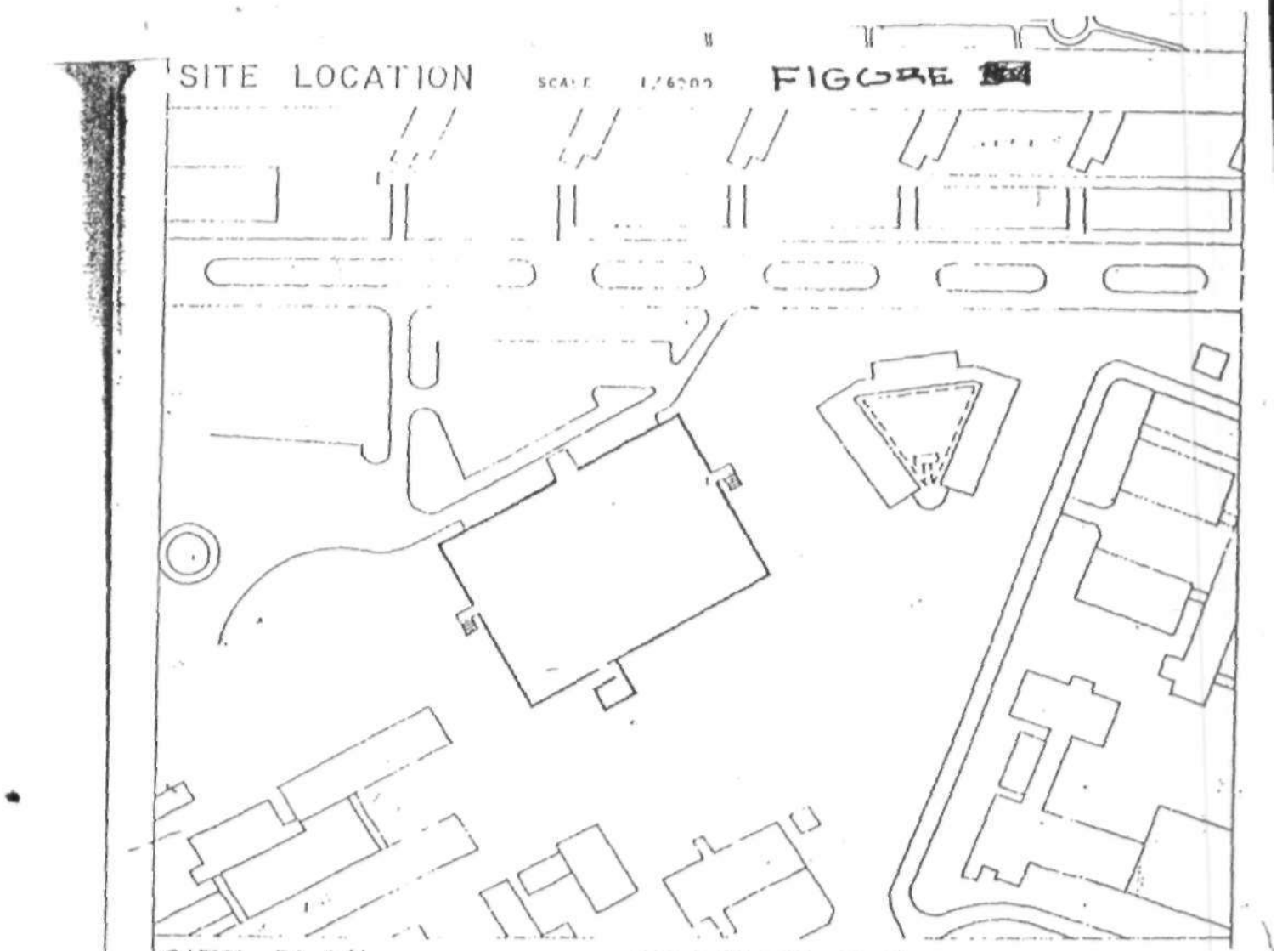


Fig 3.1

Ahmadu Bello University, Central area


SITE LOCATION
SCALE 1/6000
FIGURE 3.1
SITE PLAN
SCALE 1/2000
FIGURE 3.2
ABU MASTER PLAN – ZARIA – NIGERIA
N8011 – July 1980

3.2.2 Site Considerations

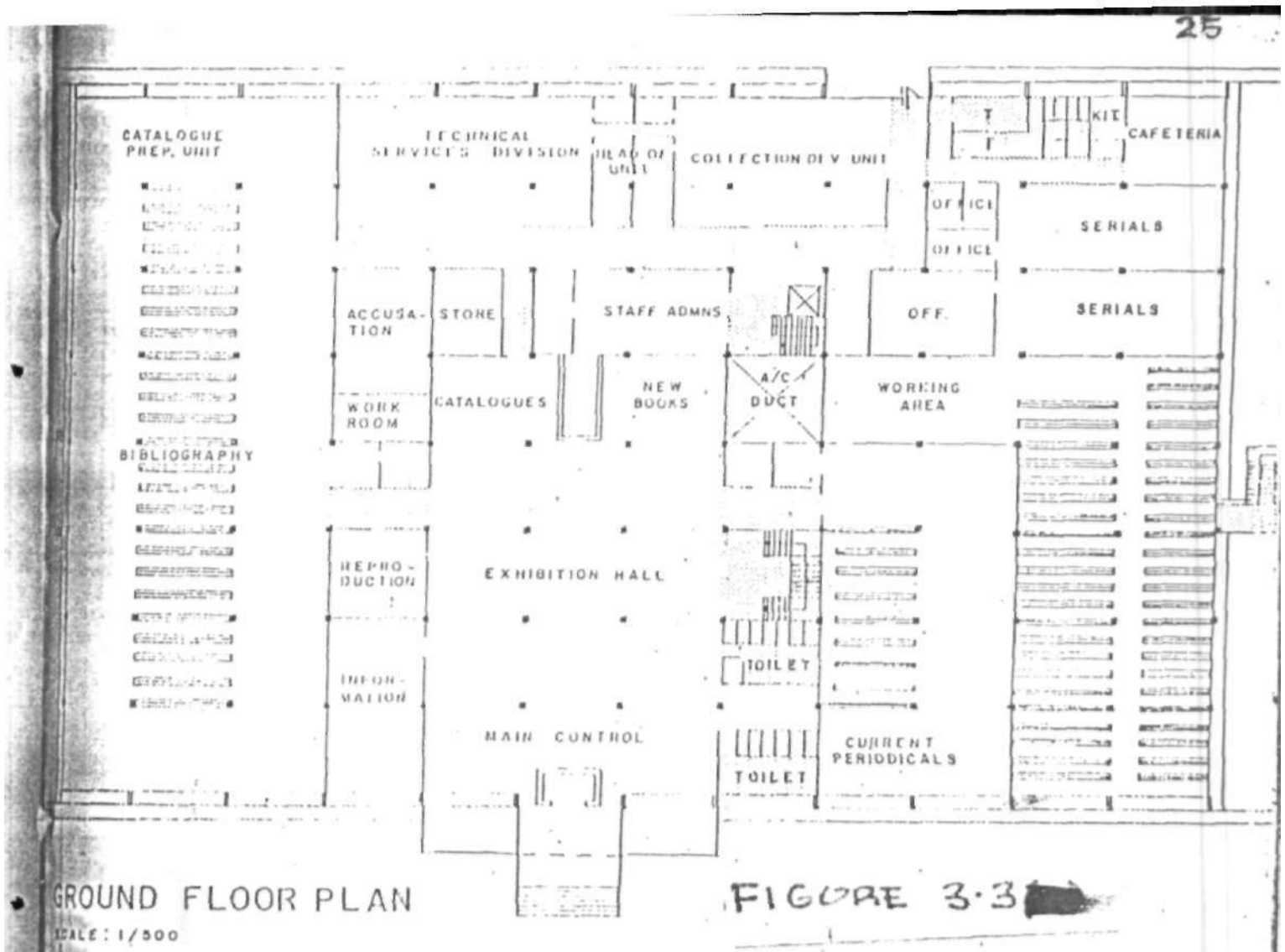
The site is bounded to the east by the Biochemistry Department to the South and West by the Computer Centre and Faculty of Environmental Design respectively. To the approach is a wide parking space and dual carriage way separating the library with the male student hostels. Thus by location, the library is central and easily accessible from most part of the Campus. Fig. 3.2

3.2.3 The Library

The library has about 170,000 volumes of books, 2,000 microfilm items and 34,500 bound volumes of periodicals. The number of journals currently received is about 2,880 titles. The library was designed for a capacity of about 500,000 volumes and 2,000 seats spread over each floor or section.

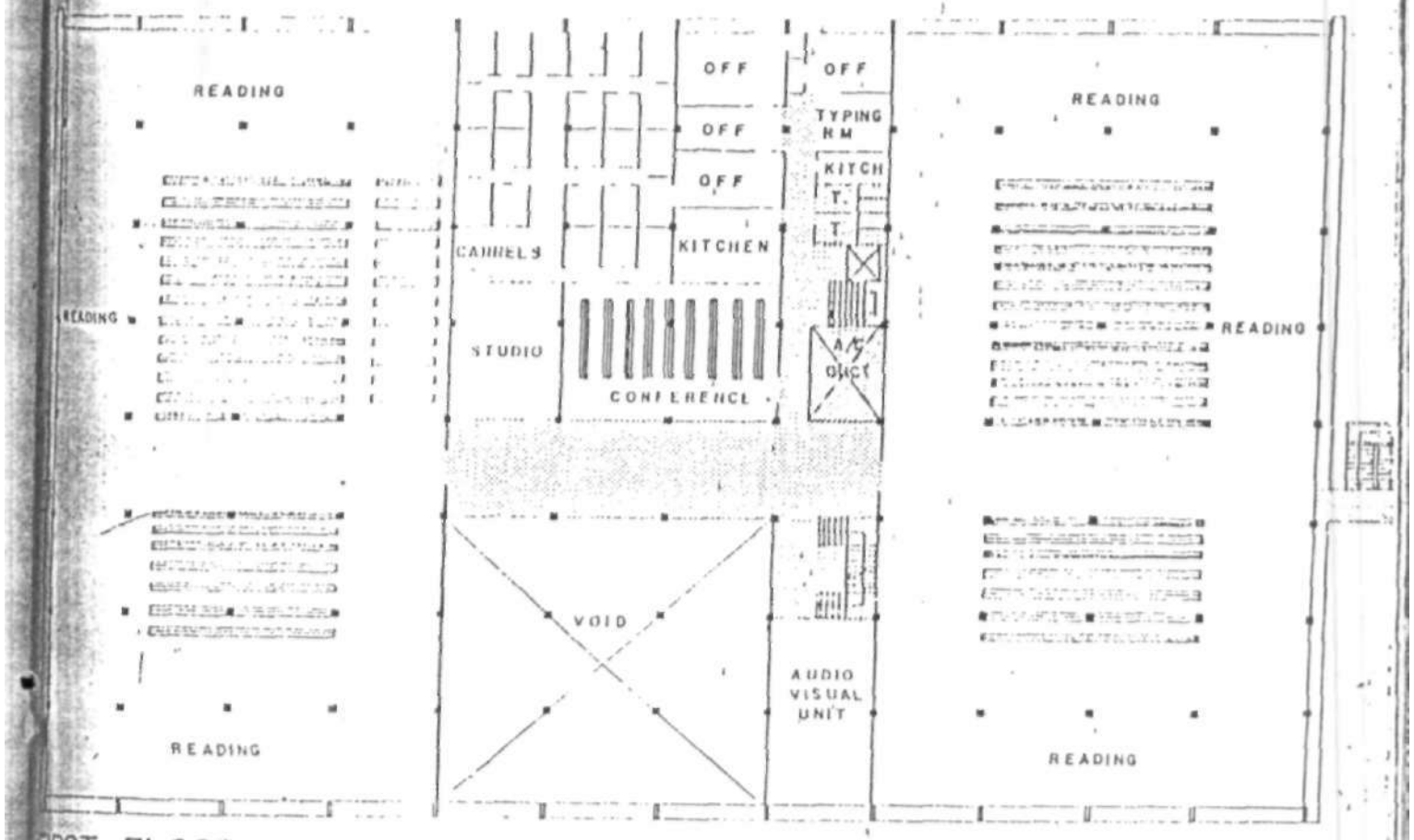
The library manages about nine other branches in addition to departmental libraries. It has a total 222 members of staff of which 33 are professional librarians. It has about four divisions with twenty different units.

As one enters the library on the ground floor, is the control and exhibition space. Directly opposite the entrance and at the far end is the circulation desk/loans, catalogues administrations and technical services. On the right and left from the entrance are the serials and reference sections respectively. The first floor houses Arts and Social Sciences collections, Audio-Visual, Administrative Offices



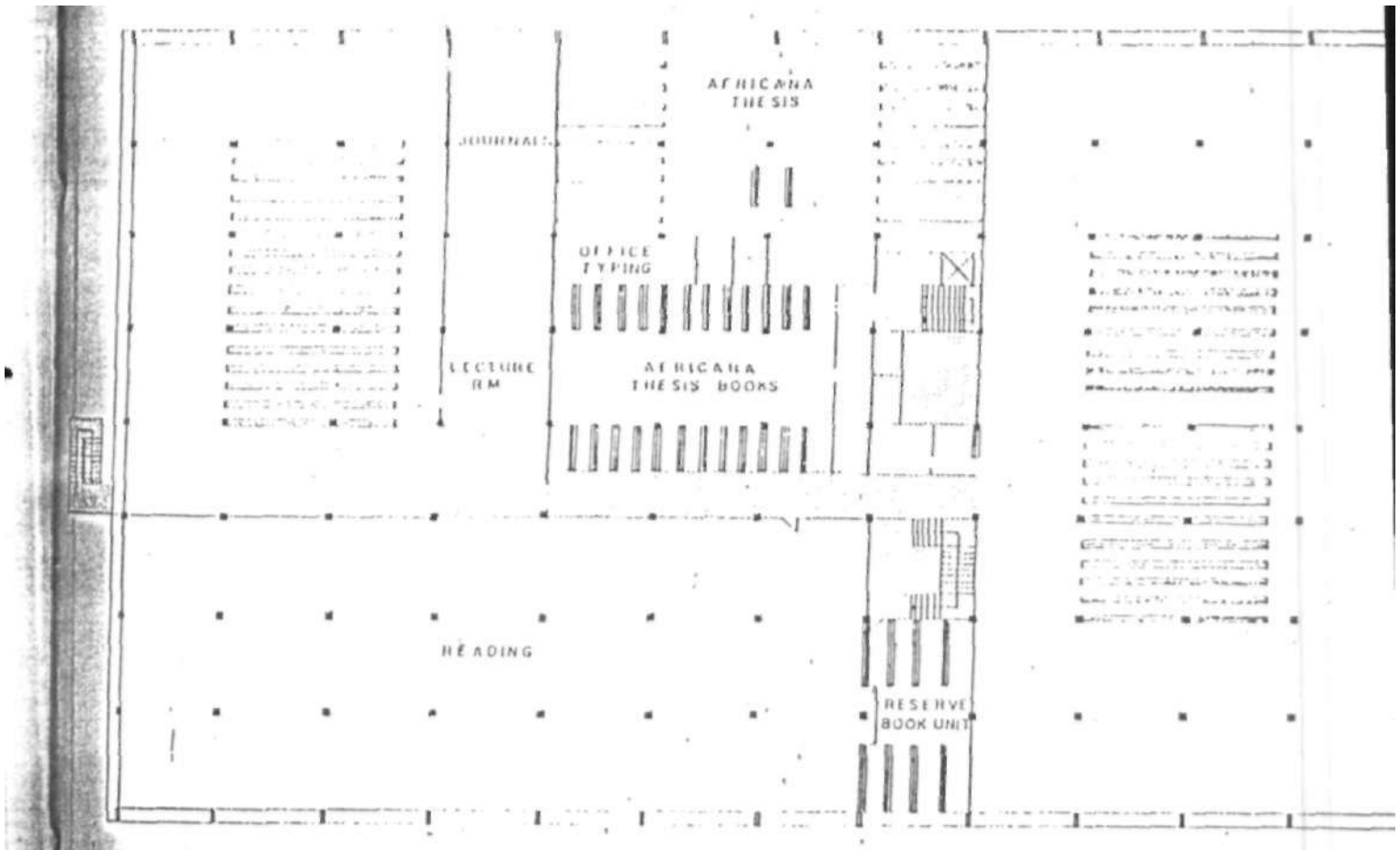
GROUND FLOOR PLAN FIGURE 3.3

SCALE : 1/500



FIRST FLOOR PLAN FIGURE 3.3

ALE : 1/500



SECOND FLOOR PLAN SCALE: 1/500 FIGURE 3·3

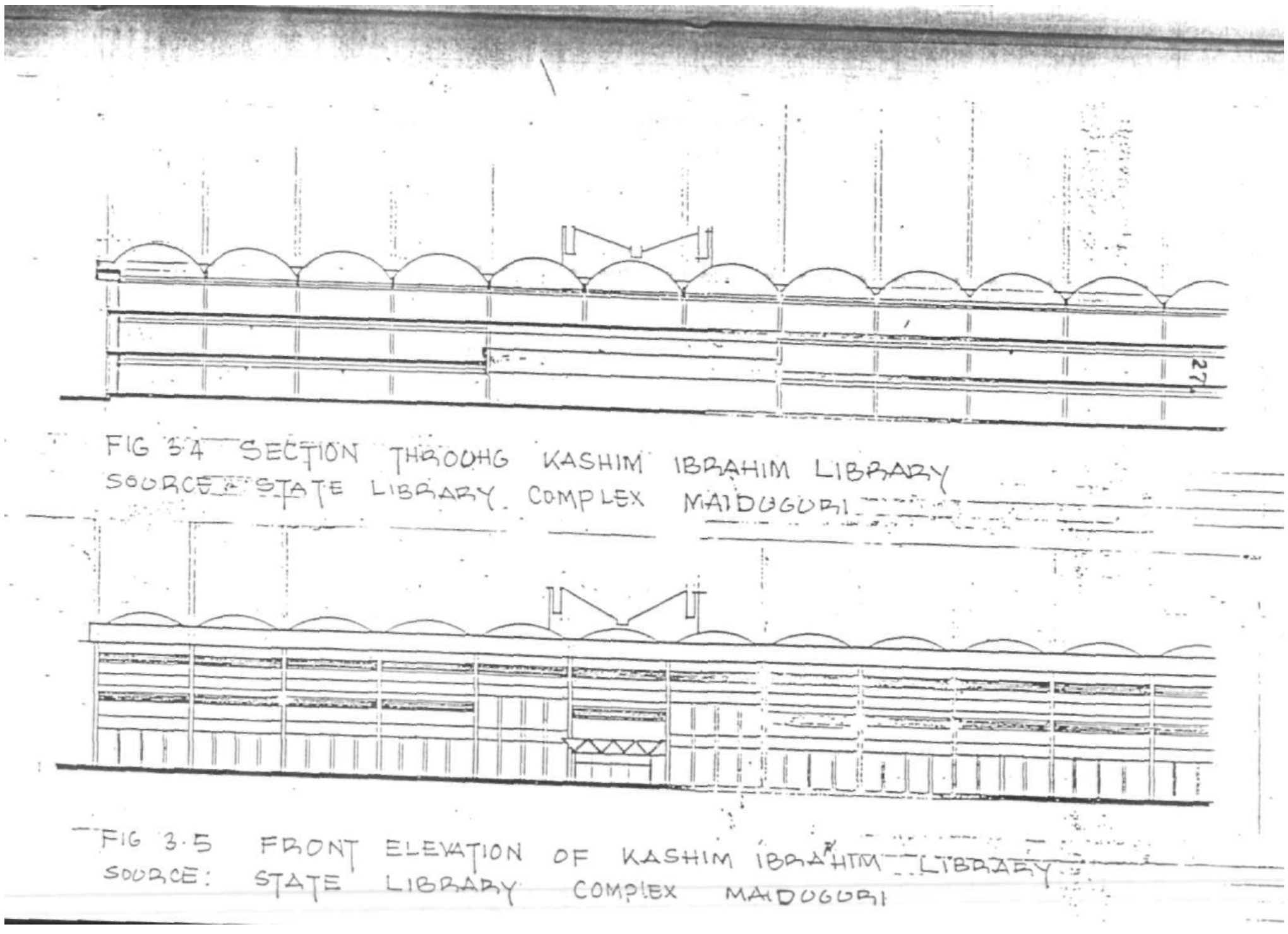


FIG 3.4 SECTION THROUHG KASHIM IBRAHIM LIBRARY
SOURCE: STATE LIBRARY COMPLEX MAIDUGURI

FIG 3.5 FRONT ELEVATION OF KASHIM IBRAHIM LIBRARY
SOURCE: STATE LIBRARY COMPLEX MAIDUGURI

EXISTING CONDITIONS — NEW KASHIM IBRAHIM LIBRARY

BUILDING SURVEY -

Present Use	:	Library
No. of Stories	:	Three
Structure	:	Reinforced concrete frame with concrete floor and roofs. Sand/cement blockwork to exterior walls and partitions. Ground floor slab raised above grade.
Finishes	:	Painted sand/cement render to vertical and horizontal concrete louvres walls; tyrolean to the main columns of the projecting lobby entrance and canopy. "Painllette" tiles to internal walls, to the top of the concrete beam. Aluminium horizontal projecting window with aluminium door frame to the main entrance and internal way into the reading area. Flush wood doors with wood frames to key offices. Three walls of the lobby is finished in timber and plywood. All floor finishes are grano.
Colours	:	Exterior: "Sandtex" tyrolean to main columns. Off-white to beams and grey to the walls and secondary columns. Dark green to concrete gutter fascia. Interior: Off-white to render for walls and ceilings. Natural finish to timber and plywood on walls. Light yellow to offices and main rooms.
Sun-protection	:	Vertical concrete and aluminium louvres, horizontal aluminium louvres and concrete claustra.
Mech. Equipment	:	Central air conditioning throughout the building; Additionally standing fans in the offices.
Ventilation	:	As above.
Roof Drainage	:	Roof slab falls to drains outlets with cast iron down pipes to the ground level drains.
Toilets	:	Men : 6 W.C., 4 wash basins, 4 urinals per floor. Women : 6 W.C., 4 wash basins per floor.
Conditions	:	Newly built.

and Carrels, with seating and staff to the left and right.

The second floor contains the Science and Technology and Librarianships collections to the right, while the reserve and documents sections are to the left. Directly opposite the stair landing leads to the Africana (Fig.3.3) and theses section. On the roof is the plant room. It has a total floor area of 13,455 square metres. (Table 3.1 and 3.2)

3.2.4 Architecture

The design consists of a Mezzanine floor at the Reception running through the first floor. The structure is reinforced concrere frame with concrete floor roofs, sand/ cement block work to the exterior walls and partitions. Ground floor slab is raised above grade. Vertical concrete louvres, horizontal and vertical aluminium louvres and concrete claustra are used for sun protection. (Fig. 3.4 and 3.5) and plate (3.1).

Lighting and ventilation are purely mechanical.

3.2.5 Merits

(i) Proper functional co-ordination of units

(ii) Good Structural grid system

(iii) Good traffic flow for both materials traffic and users.

(iv) Aesthetically appealing elevations.

(v) Use of square columns inside and rectangular out is good.

3.2.6 Demerits

(i) Use of uniform module of 6.7m did not consider the changing needs of other accommodations,

(ii) Deep planning, makes it impossible for use of natural lighting and ventilation. When power fails, most parts of the library are left in darkness.

(iii) Mechanical plant on the roof top causes vibration to the structure when in use.

(iv) No provision for out door reading.

(v) Toilets are badly positioned and constitute menance to the entrance with its odour when there is no water.

3.3 Case Study; University of Ibadan Library (Plate 3.2)

3.3.1 Brief

ARCHITECTS: Design Group Nigerian Chartered Architects

TYPE OF LIBRARY: To house Sciences, Arts and Social Sciences collections.

LOCATION: Central

DATE OF OCCUPANCY: 1954, and 1969.

3.3.2 Site Conditions

The library is bounded on the South and West by the Sports Complex, on the North-west by the Institute of Education and on the East by the Faculty of Arts. The Benue road bounds it on the North. (Fig. 3.6)

3.3.3 The Library

Ibadan Unive rsity Library was completed in two stages. The old building was opened in 1954, (Plate 3.1) while the new building known as the research library was opened in February, 1969.

The undergraduate library consists of six floors including the ground floor and the basement. A general reading room is attached to the building at the east end. Internal flexibility is achieved through grouping of fixed elements such as staircases, the lift and levatories in the centre; thus almost dividing the building into two halves (Fig. 3.6).

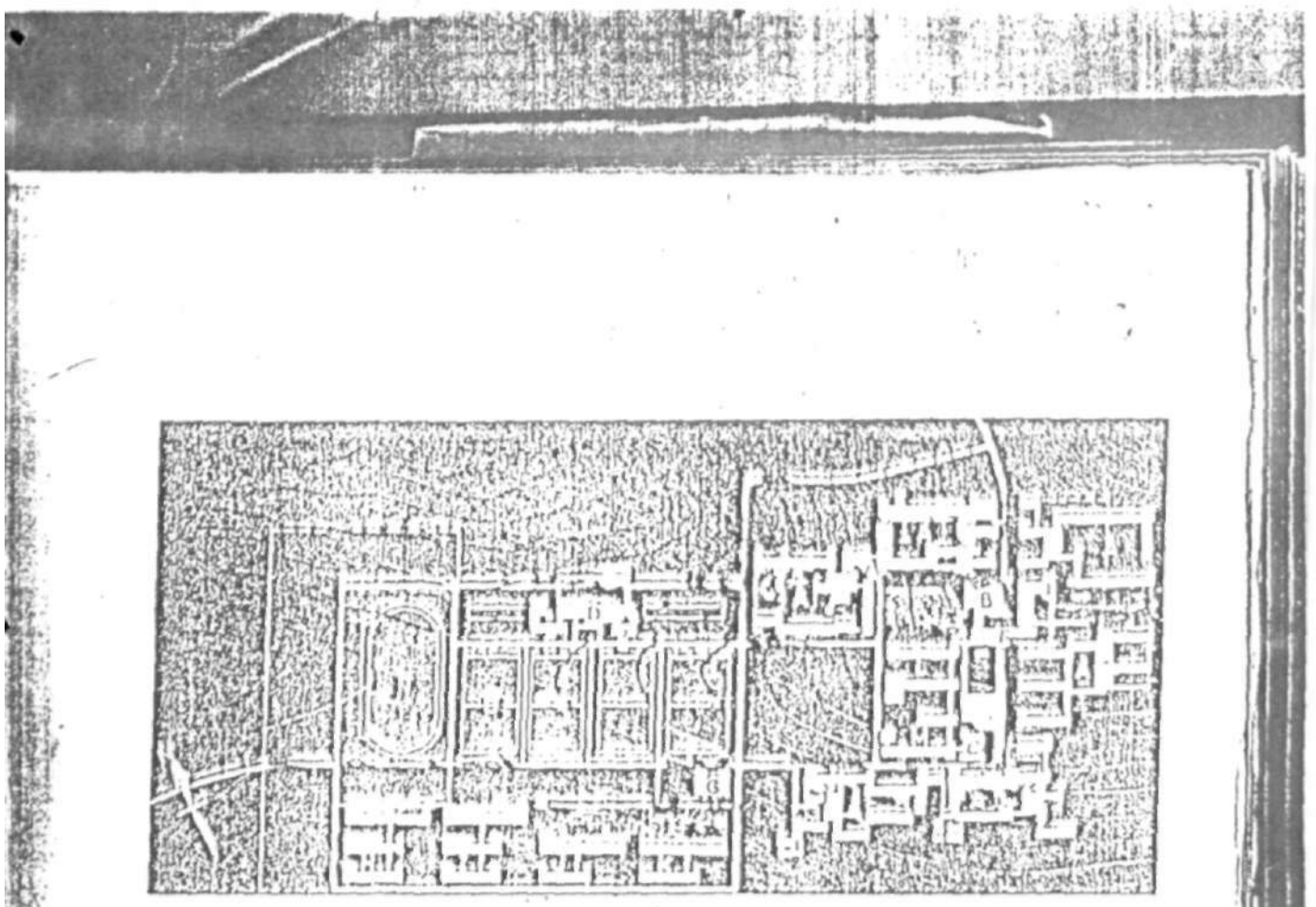


FIG 3.6 SITE PLAN OF UNIVERSITY OF IBADAN SHOWING THE LIBRARY LOCATION LETTERED "D"
SOURCE: TROPICAL ARCHITECTURE IN THE DRY AND HUMID ZONES

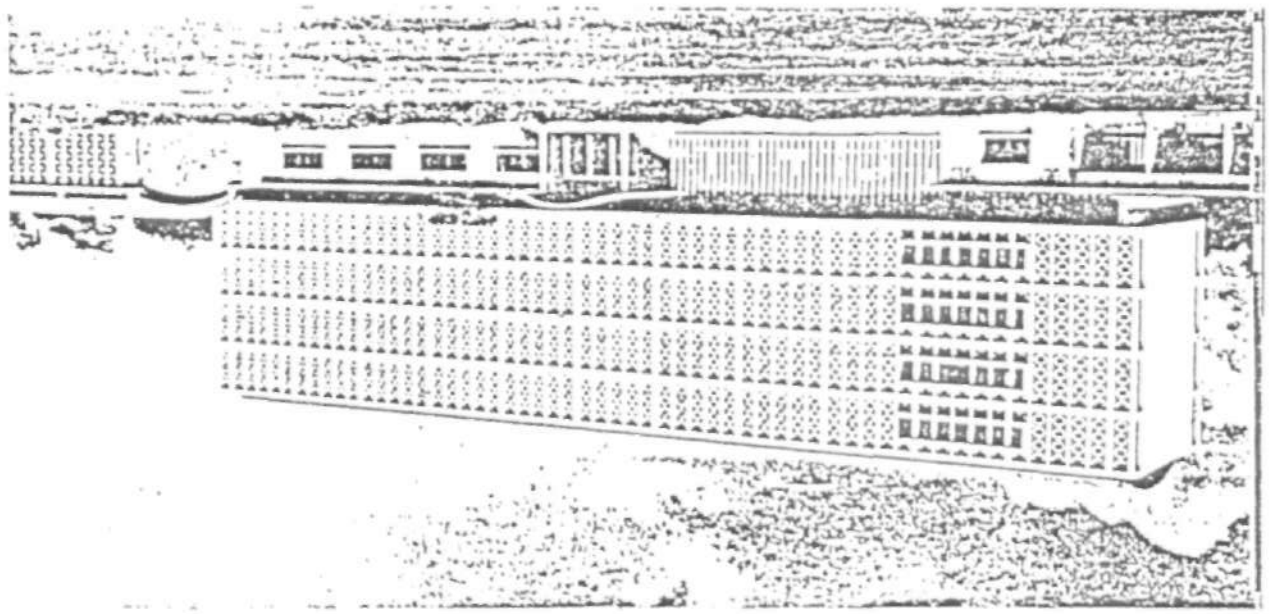


PLATE 32 VIEW OF UNCERTAIN DATE — LIBRARY UNIVERSITY OF BADAJOZ

SOURCE: TROPICAL ARCHITECTURE IN THE HOT DRY AND HUMID ZONES.

case study 2 Ibad

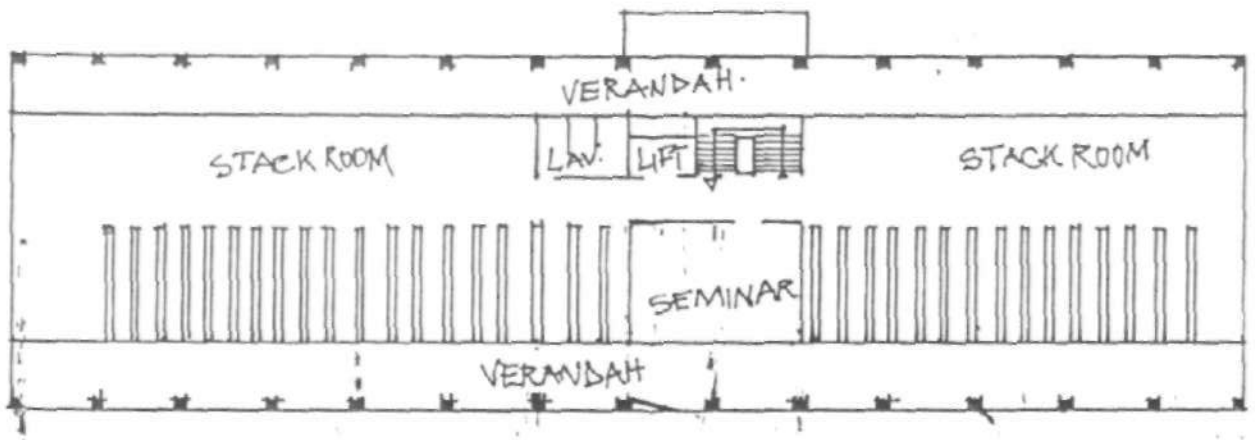
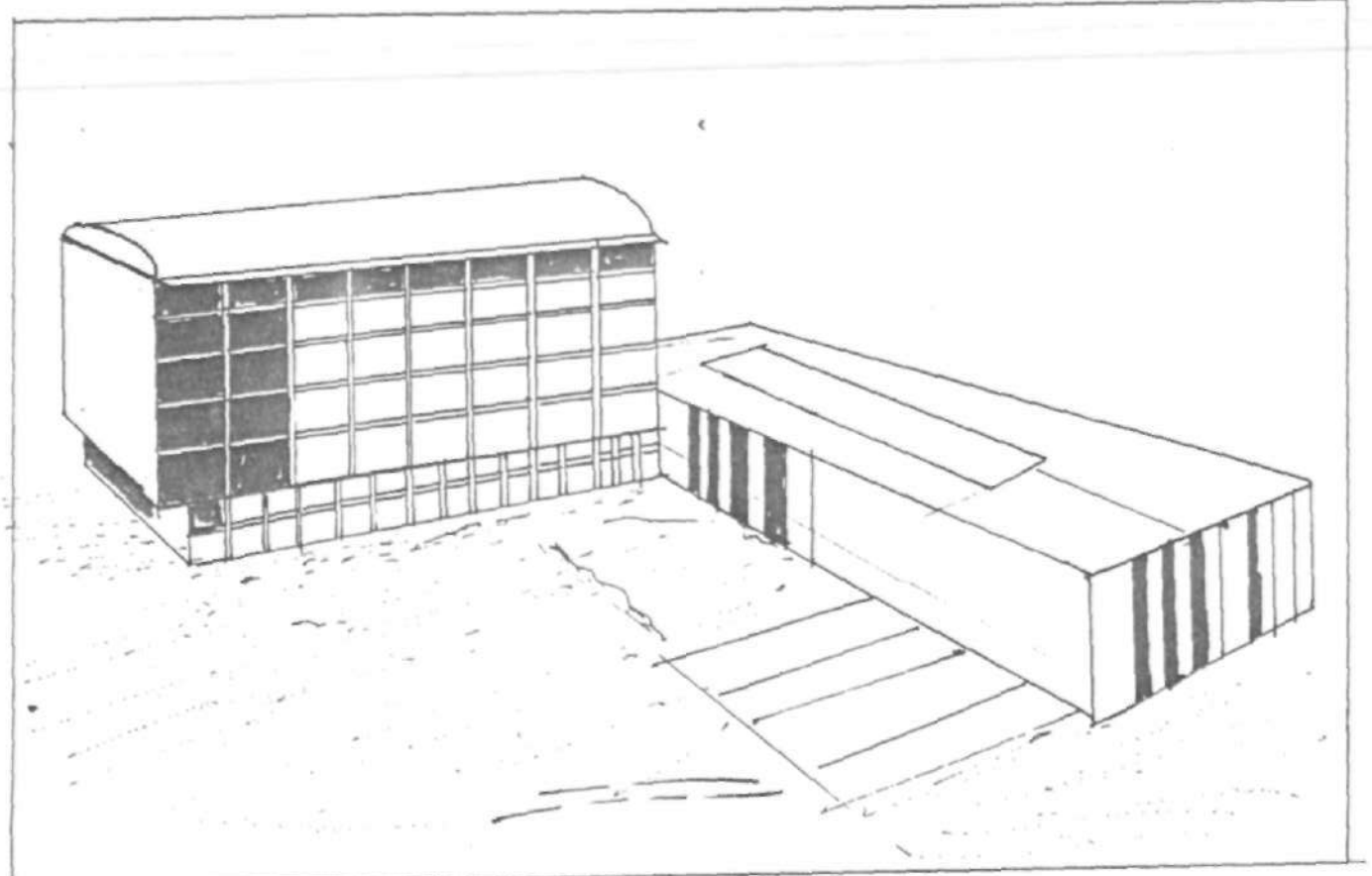


FIG 3.7

A TYPICAL FLOOR PLAN OF UNDERGRADUATE LIBRARY OF UNIVERSITY OF IBADAN.



F19.8

ABOVE SHOWS THE OLD BUILDING (SIXSTOREYS) LINKED BY THE ~~OLD~~ NEW BUILDING (TWO STOREYS) AT RIGHT ANGLES.

V 36

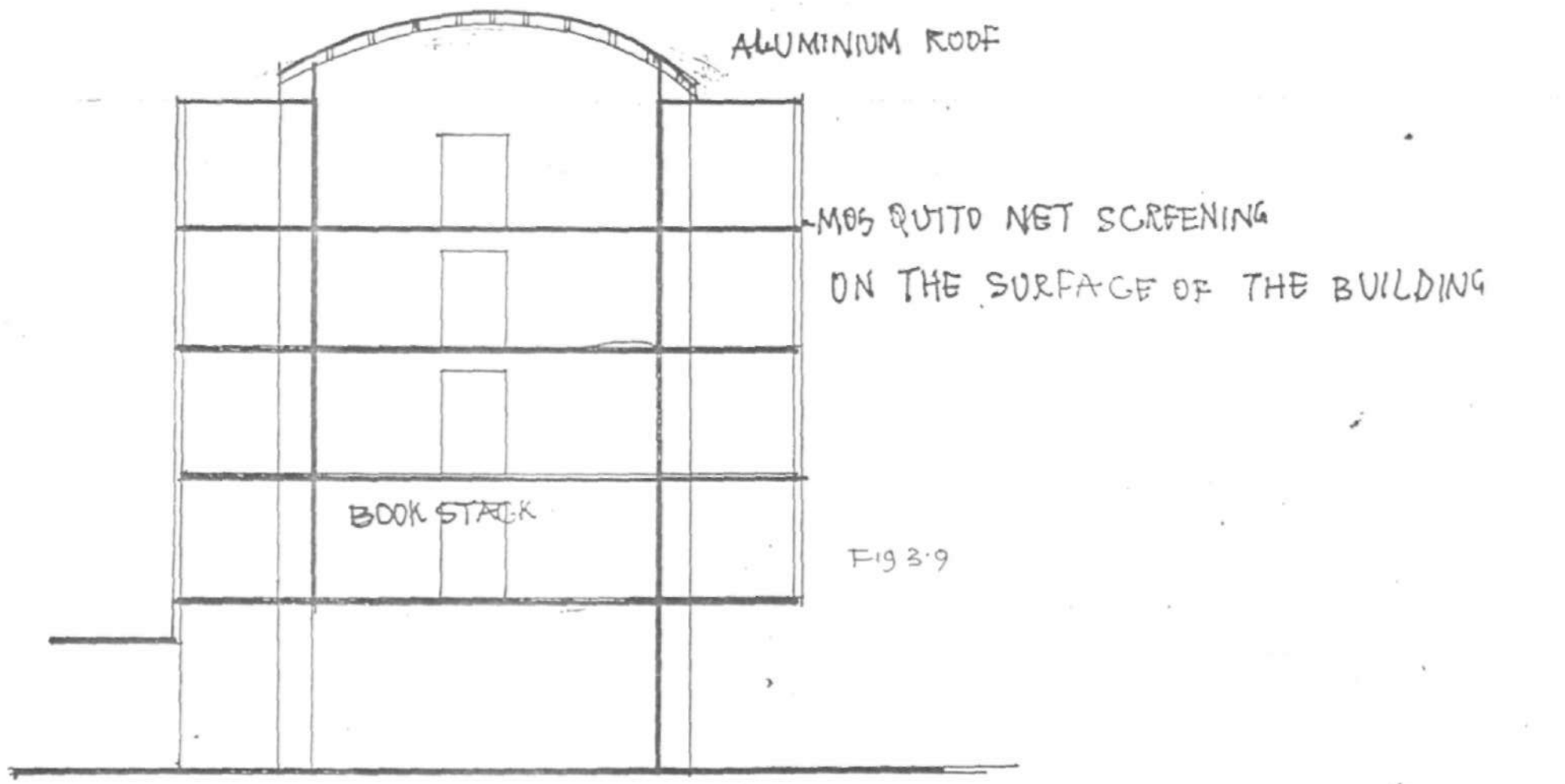


Fig 3·9

SECTION THROUGH THE LIBRARY

The rest of the floors are virtually free from structural obstructions. The layout is simple and easy to follow.

The ground floor houses the general reference collections, the first, second and part of the third floors are devoted to stack (Fig. 3.7) and reading areas. The Librarian's Office is accommodated on the third floor of the building. The fourth floor houses the manuscripts and maps department and Arabic and Librarian collections

The new building is joined at the right angles to the old one at the West end (Fig. 3.8). Unlike the old building, the new building (research library) has only two storeys, but maintains the imposing structure of the old building (plate) and (Fig. 3.8). The research library has added another floor area of 5,213 square metres to 4,284 square metres of the old building, thus bringing the total capacity of the University library to half a million volumes and 1,250 readers.

3.3.4 Architecture

The old building was certain definite objectives. It was to provide without air conditioning the most suitable conditions possible in Ibadan climate for books and users. To this end, verandahs run the full length on both sides to keep the sun off the main structure and the whole building is completely screened with mosquito netting.

Cross ventilation is achieved by keeping the building narrow and through the liberal provision of wooden doors along both sides.

The long horizontal plotting of the new library building contrasts, favourably with the vertical lines of the old one (see plate). The outer walls of the new building are covered with a ferm of quartz known as Nigerian Marble from Lokoja, thus keeping the need for maintenance low. The inside wall panelling is of sterculin, a timber from Sapele. Sky light is admitted into the reading room through the marbon coloured ceilings prepared from a dirt resistant ground glass compound known as fantax.

The whole new building has been air conditioned.

3.3.5 Merits

(i) The old building is a total demonstration of design with climate in Ibadan type of climate.

(ii) The admittance of sky light into reading room is good.

3.3.6 Demerits

(i) Although the modular system is used, a complete flexibility is not visible as a result of the narrowness of building and regular repetition of bay sizes which may not be suitable for all areas of the library.

(ii) Provision of screened verandahs on both sides of the old building is likely to make the interior look gloomy.

3.4 Case Study - 3 Edinburgh University Library (Plate 3.3)

3.4.1 Brief

ARCHITECTS: Sir Basil Spence, Glover and Ferguson

TYPE OF LIBRARY: To house the Sciences and the Arts and Social Sciences collections.

LOCATION: Urban site city square.

DATE OF OCCUPANCY: 1967

3.4.2 Site Conditions

The library is bounded on the North by the George square, on the east by the Buccleuch Palace and on the South by the Meadow Lane. (Fig. 3.10)

3.4.2 The Library

The library as the largest building of its kind in Britain with accommodation for 2,000,000 books on open acce access and places for 2,500 readers. The library is on eight floors. One below the ground floor level and six above the building is fully air conditioned and 75 percent of its total floor area is adaptable in use i.e free from structural walss, columns and floor openings.

The ground floor consists of five main functional areas, control point, services deck and catalogue, library technical departments, main reference room, current periodicals room and rare books departments which includes a luxurious rare book exhibition room.

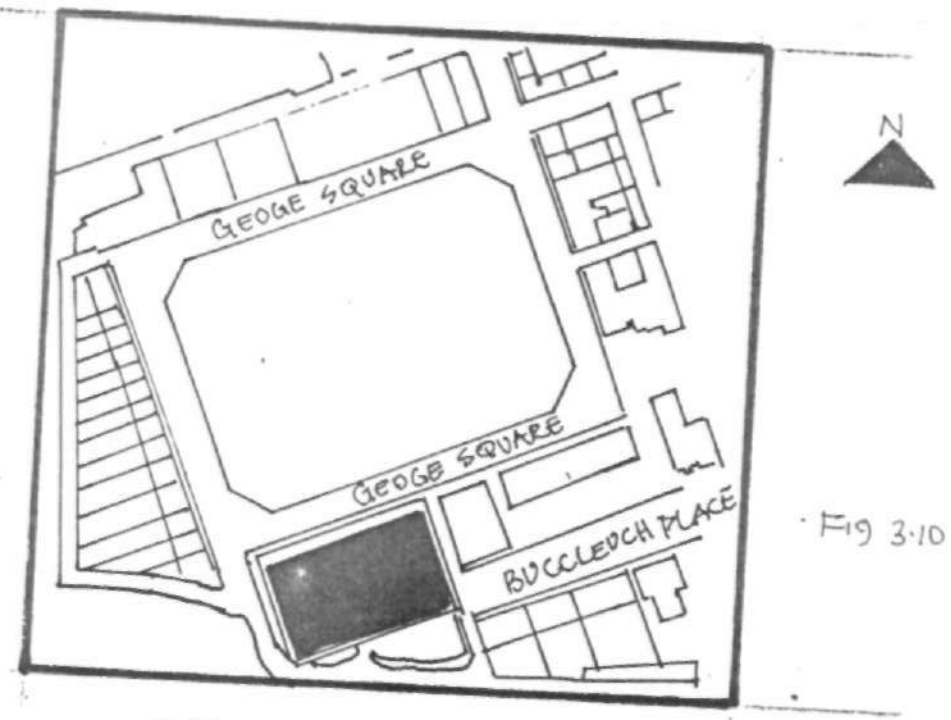


Fig 3.10

SITE PLAN (1:3750)
UNIVERSITY OF ENDINBURGH

inna library com

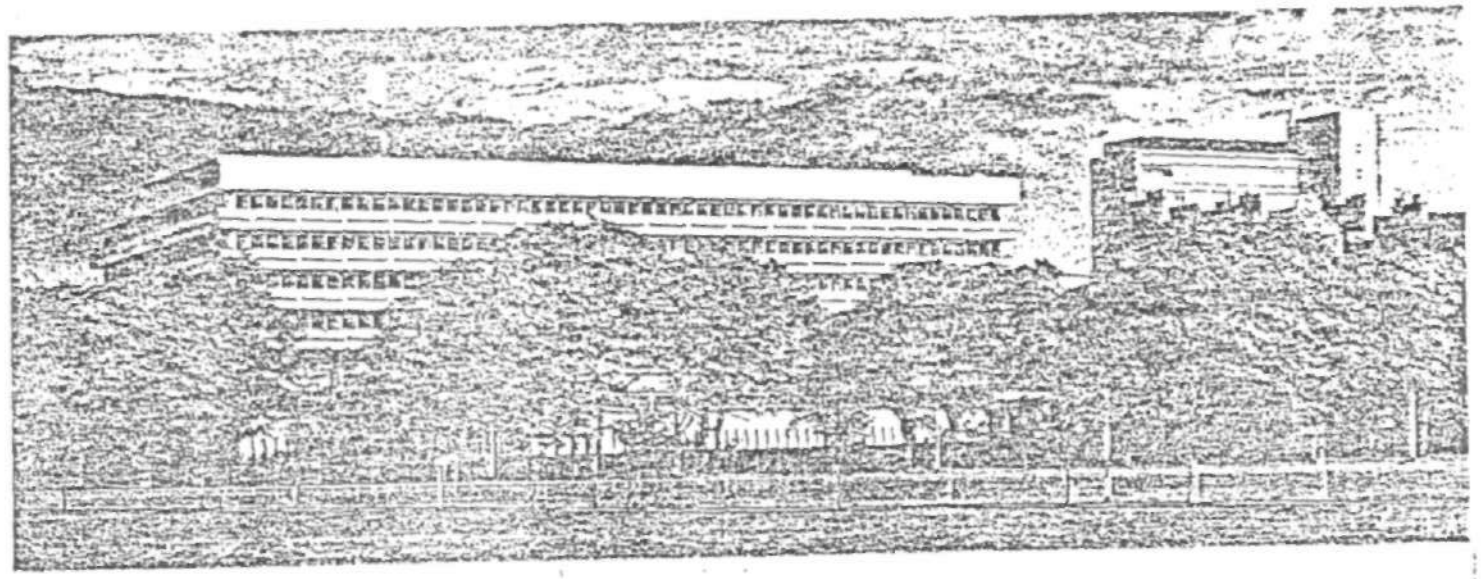
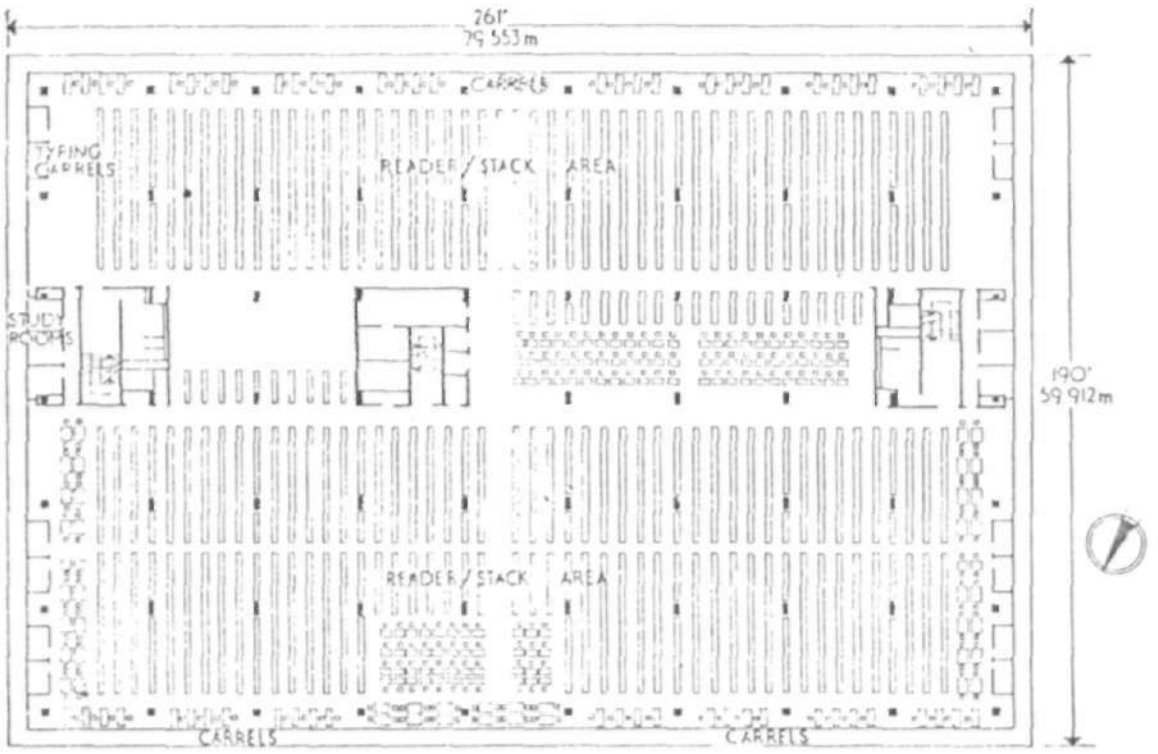


PLATE 3·3

Edinburgh University Library (architects: Spence Glover and Ferguson; photo: A. L. Hunter)

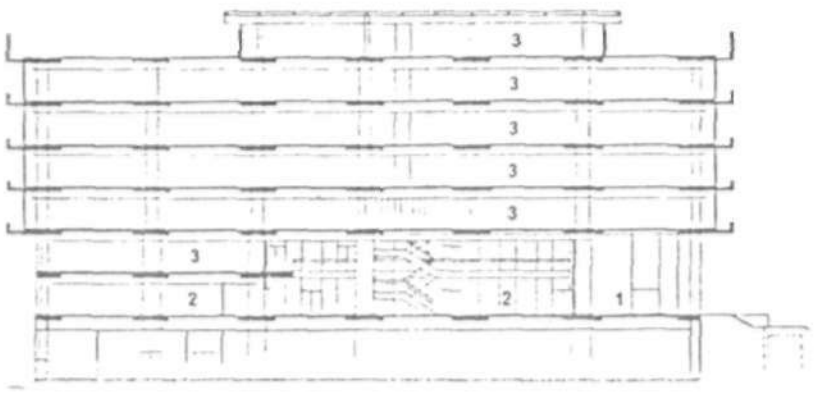
A PHOTOGRAPH OF EDINBURGH UNIVERSITY LIBRARY





Edinburgh: top, typical stack floor plan (1:576); centre, plan showing circulation desk, catalogue and administrative areas; bottom, section to same scale

Fig 3·11



1 Entrance
2 Circulation desk, catalogue, administration

The technical services department comprising ordering, accessioning and cataloguing is arranged as an open area easily adaptable to changing needs of library administration. The catalogue and reference room are immediately available to the cataloguing staff.

A staff lift and a staircase from the trolley park in the technical services provides direct access to the reception and shipping area on the lower ground floor and to the upper floors, thus minimising circulation necessary for movement of books within the library. (Fig. 3.11).

The lower ground floor contains and undergraduate reading room, senior administrative offices and staff common room. Above the first floor, the arrangement of the main library elements is repetative and easy to follow. Each of these floors has minimum areas free from structural restrictions. The lifts on the centre of each floor and placed so that on a arrical, a reader can easily find his way or bearing. The services core, staircases, study rooms and special function rooms like microtext room occupy the central bays.

Stack ranges are placed along the length of each floor on either side of the service core. Reader places are on the periphery of each floor, adjacent is the windows, thus taking advantage of natural light; in groups within

outer stack, or in the centre section of each floor. In this way readers have access to the shelves and can sit close to their subject area. Typing and study rooms are provided on each floor for academic staff or research students. These are individual rooms with a reasonable standard of sound insulation and electric points to permit use of reading aids, taperecorders and typewriters. The perimeter carrels comprise a 162cm x 610m desk with a back shelves and locker. Each carrel is adjacent to an electric point, making possible use of microform reading and audio equipment with head phones.

3.4.4 Architecture

The library has full height glazing on all sides (Plate) and each floor projects beyond the surface of the window to form a continuous balcony (Fig.3.12). The structure is faced with precast units with a portland stone finishing.

3.4.5 Merits

(i) Stack rooms have minimum structural restrictions.

(ii) Seating arrangement for readers provided close to stack and windows.

(iii) Provision of individual study rooms which permits the used of microform and audio equipment.

(iv) Good traffic pattern.

(v) Provision of rare books exhibition.

3.4.6 Demerits

(i) The use of rectangular columns in the module may not be a good idea if the stack arrangements are for instenced charged in the other direction.

(ii) The columns could also get in the way the user or services

(iii) Senior administrative officers are rather far from work areas thus making it difficult for supervision.

3.5 Case Study 4: University York Library (Plate 3.4)

3.5.1 Brief

ARCHITECTS: Robert Mathew, Johnson Marshal and Partners.

DATE OF OCCUPANCY: Summer 1966.

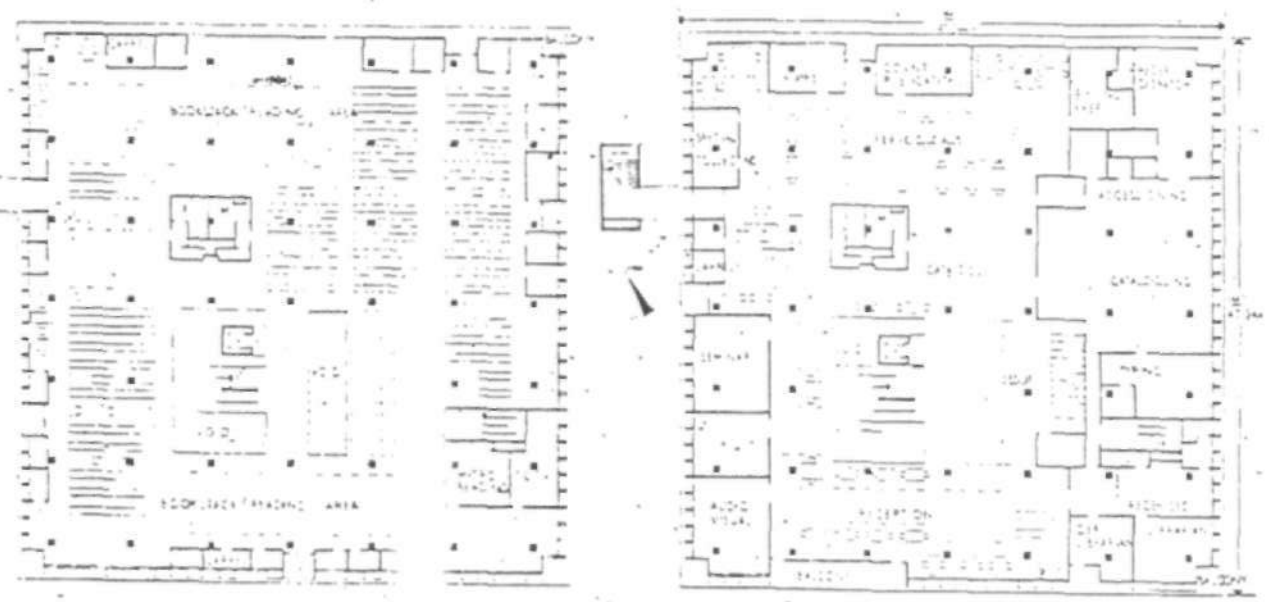
3.5.2 The Library

York was the second in the series of seven new British Universities and its library was completed in the summer of 1966. It is linked to the remainder of the University through a system of covered walkways and Bridges which connects the cluster of buildings forming colleges and teaching groups (Plate). The entrance level of the library has a bookshop, a small coffee shop and various services and cloak room facilities. Space for books and readers does not start until the first floor where the circulation desk faces the stairs from the entrance level or floor. The stairs and the lift rise in a open well in the middle of the building. The library was designed for a University population of 3,300 and had a book capacity of 250,000 volumes. There were 680, places for readers and space for 45 members of the library staff.

3.5.3 Architecture

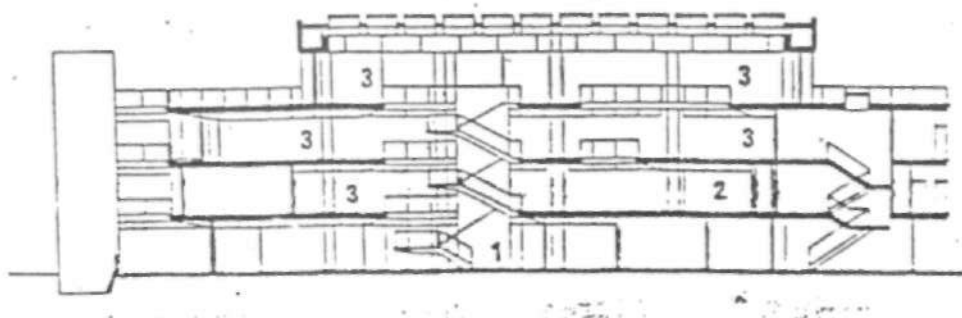
The library is on a slope above the road and looks out on colleges grouped around a lake. The three floors of the library proper have a their focus a large top-lit void which has within it an open stair and lift shaft.

University of York: relative areas of departments. Compare with plan below, which is to scale of 1:256



UNIVERSITY OF YORK LIBRARY: FLOOR PLANS

Fig 3.12

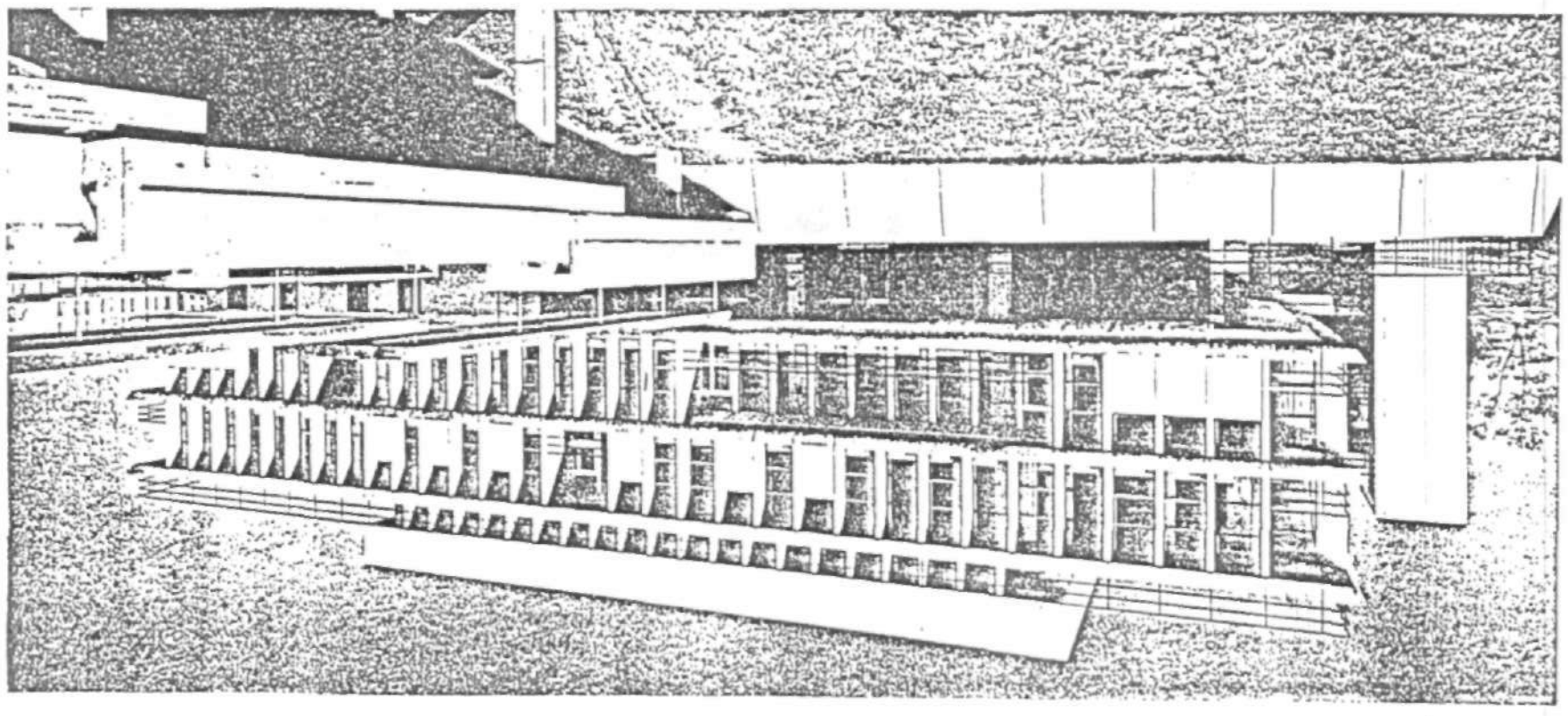


32

SECTION: UNIVERSITY OF YORK LIBRARY

Fig 3.13

PLATE 3.4 VIEW OF J.B. MAGELL LIBRARY



SOURCE: LIBRARIES AND EQUIPMENT.

There is a terrace on the roof (see Fig. 3.13).

3.5.4 Merits

(i) Provision of informal reading on the roof top is commendable.

(ii) Separation of library staff from the reader/stack area is a good attempt in achieving effective flexibility.

(iii) Use of squere columns for modular design is wise.

3.5.5 Demerits

(i) Provision of services on the entrance level.

3.6.0 Conclusions and Deductions

3.6.1 Conclusion

From the studies carried out certain systems were repeated in almost all e.g the modular system, achieving goals in varying degrees from one library to another. It is the desirable to identify the useful ones which will help in reaching the goals of this thesis. They could be seen from the deductions below.

3.6.2 Deductions

(i) That in the design of an academic library, a module size should be adopted. This size should be got from the analysis of space requirements of stack, reader, staff and services. Maximum flexibility is achieved in this manner.

(ii) The fixed elements like staircases, lifts, toilets are grouped together and quiet of some are centralised.

(iii) That the reader area should be kept as close to the window as possible to catch the natural lighting.

(iv) The library plan should be adopted in such a way that separation of the library staff from main library area (librarians/readers) is done. This will help in adopting a suitable module size for each function based on the results of (i) above.

CHAPTER FOUR

4.0 RESEARCH REPORT

4.1 Introduction

This chapter hopes to research into the Module sizes as system of design in relation to or from the analysis of the various space requirements of the library activities which will in turn affect or dictate the choice of suitable module sizes for the various sections or activities in the library. This study will principally be categorised under two broad headings. They are:

(A) analysis of module sizes in relation to book stack,

(B) analysis of module sizes in relation to other accommodations e.g. readers and other library activities.

The synthesis from the analysis will be used to evolve or adopt suitable module sizes for the different activities of the proposed library. To further complement the desired goal of this thesis, a system of division or separation of the various library activities which will enable the application of the research result will be used. This will be seen in the conclusion to be drawn from these analyses and later in the proposed design.

A STUDY OF MODULAR SYSYEM

4.2 Modular System

Under the modular system, as the term is used here, a building is supported by columns placed at regular intervals. Nothing within the building is weight bearing except the columns, which follows in theory that nothing within the building is fixed and immovable except the columns, though infact it is generally impractible if not impossible to shift the location of stairways, elevators, heating facilities, ducts and plumbing.

A rectangle - usually, but not always, a square- defined by four adjacent columns, is known as a bay. The modular building, then is made up of identical bays, anyone of which may be furnished as part of the reading area, filled with ranges of shelving, or divided by partitions into offices, or combinations of two or even three of these may be used.

4.3 Modular System in Library Design

There has been a revolution during recent years in favour of the use of modular systems in library design by the efforts of Angus Swed McDonald, Ralph Ellsworth, other forward looking librarians, architects and builders.

It is not possible to have a library building designed to consist largely of space that can be used for almost any purpose without extensive or expensive alterations

which so often arise as space requirements change. The modular system or some adaptation of it is now standard practice in libraries as well as in other buildings.

Like most innovations, however, the modular system is not a panacea; it has its faults and pitfalls.

a) (i) The fundamental objection is that no one column spacing or bay size is ideal for all purposes; the module that is almost perfectly adapted to one function will not be equally suitable to another.

(ii) Modular buildings have sometimes encountered serious acoustical problems because the moveable partitions and book cases on which they depend to divide up each floor have not been adequate barriers to sound.

(iii) The columns themselves are inflexible and may get in the way of readers, stack ranges, aisles tables and other features.

(iv) Complications often arise in determining the distance between floors; an appropriate floor to ceiling height suited to book stacks may be unsuited for readers.

b) Merits of Modular System

In spite of these difficulties, the modular system has undoubtedly arrived in library planning and is here to stay and should be used in most new library construction if it is used with care. Its advantages can be summarised as follows.

i) It simplifies the task of estimating costs and makes the result more accurate.

ii) It saves time on the site because materials are acquired in suitable size, and it largely eliminates cutting, patching, and wasting materials.

iii) It simplifies supervision as much of the work is routine.

iv) It should improve the finished product because more of the work is done under factory controls instead of field conditions.

v) It provides more flexible space adapted for any likely purpose.

4.3.1 A - The Module Size and Bookstacks (Analysis)

The decision in regard to bay sizes for book stacks might seem to be easier and simpler to make than for reading areas, because in general, one part of the book stack differs from another less than one reading area for another; taken as whole, however, it is the most complicated of the module size problems, because of the

possibility and often the desirability of different depths of shelving and widths of aisle in different part of the stack. However, in deciding the most suitable module size to be adopted for the book stacks the following factors should be kept in mind and properly analysed.

i) The size and the shape of the supporting columns
ii) Arrangements for housing ventilating, mechanical, and wiring services.
iii) The length of the stack section
iv) The length of the stack ranges before cross aisles are used.
v) The depth of the shelves and ranges.
vi) The width of the stack aisles between ranges.
vii) The width of the main cross aisles.
viii) The direction in which the stacks run, now or later.
ix) The clear ceiling heights
x) The type of lighting

These are interrelated. Decision on each of the ten may affect one or more of the others. This will further be discussed in detail with illustrations.

(i) Column Sizes:

The size of the columns in a library building depends on:

(a) technical requirements based on the loads to be carried;

(b) The type of construction;

(c) Whether they enclose heating and ventilation services, and

(d) their shape.

a) Load-Bearing Requirments:

The heavier the load to be carried by the columns, other things being equal, the larger the column must be. The load to carried include, the dead load, ie the floors and the live loads persons, equipments etc. The load bearing capacity depends on size of the bay. The smaller it is, the more its load bearing capacity.

b) The Type of Column Construction:

Columns are generally of reinforced concrete or of steel covered with concrete for fire protection. Building codes generally forbid the use of steel alone, unless protected by concrete, because fire in the building might cause the steel to buckle. It may be impossible to hold a reinforced concrete column to the desired size of 42mm (14in) in diameter if a large bay size is selected or if there is a multistory stack. There are then four variables: the size of the columns, the construction of the columns, the size of the bay, and the total load to be carried. One or more may have to be changed to suit the situation. A reinforced concrete column takes more space than a steel column protected by concrete, but costs

less. The larger the bay, the stronger and larger the columns must be and the more floors in the building, the heavier the load to be supported by the columns which inturn means heavier or larger columns.

c) Location of Services:

Another factor closely related to column sizes deals with whether or not they are to include heating and ventilating ducts. If services are to be housed in them, variations in sizes of columns are from the Fig. 4.10. From the figure, the most ideal column size is a square. This will allow the necessary flexibility required when the direction of the shelving is changed and will not get in the way of users and stack ranges.

d) The Shape of the Column:

Columns should not be wider than the stack ranges, as they get into the way of users. See Fig 4.10 for the illustration. The best of the columns is the square.

The Length of the Stack Section

The length of what has come to be known as the standard stack section is 900mm (3ft) on centres. If the diameter of the columns are 42mm (14in) two of them, plus the recommended margin for the upright next to the column will take as much space as 900mm section and with a clear distance between columns being a multiple of 900mm, there will be practically no waste space. The ranges will

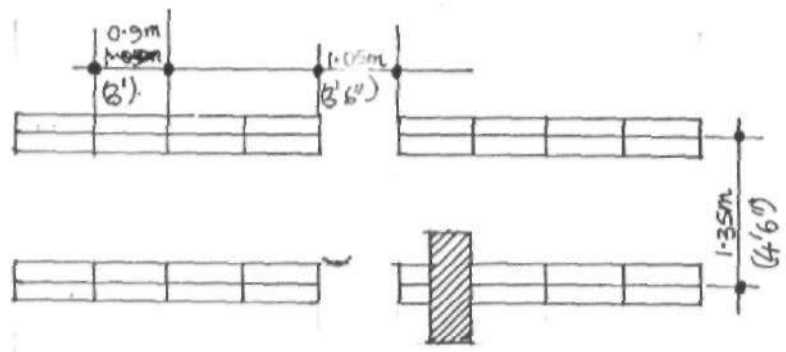


FIG 4:1(a)

Column wider than the range. Columns in a book stack should always be in line with the ranges and not so large as to project into a stack or a cross aisle as above.

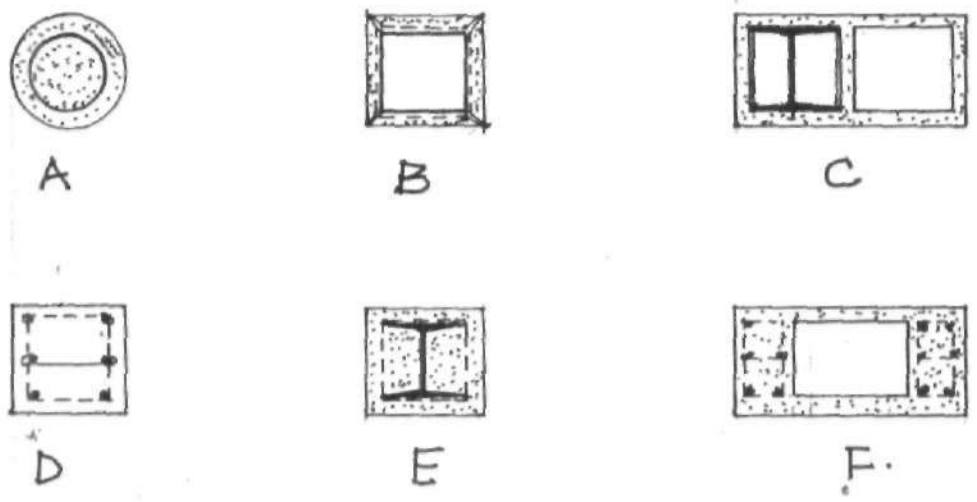


Fig 4·1(b)

TYPES OF COLUMN CONSTRUCTION:

A — Lally Column

B — Hollow steel column protected by concrete with services in centres.

C — Divided column with left-hand section of reinforced concrete or steel protected by concrete, and right hand section enclosing a duct for services protected by reinforced concrete.

D — Reinforced concrete column

E — Steel column protected by concrete

F — Column similar to D with duct in centre with structural reinforced concrete column on each side.

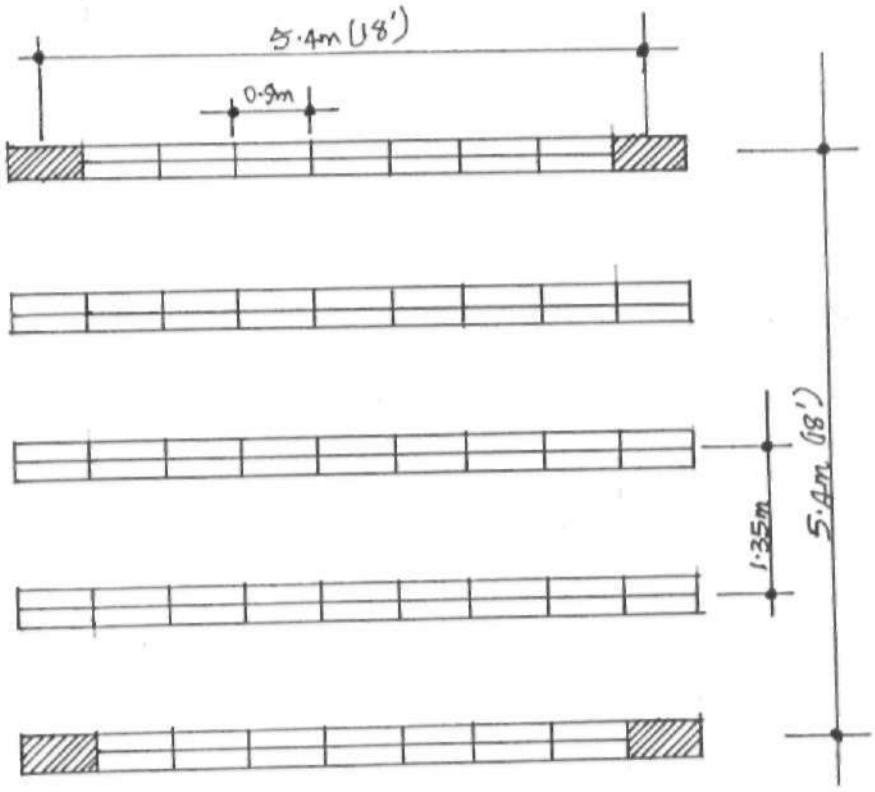


Fig. 4·2

The effect of rectangular columns on bay sizes: The capacity is reduced by two instead of one section in each bay. The ranges all come out even. The distance between centres in both directions should be a multiple of 0·9m (3ft), not a multiple of 0·9m plus 0·45m.

come out even with those where there are no columns.

The Length of the Ranges

There are several problems in connection with the range lengths. The first, obviously, an important one, is a question as to what length of ranges can be permitted without undue inconvenience to the reader and staff. It is sufficient here to say that (a) range length should vary with circumstances.

(b) ranges longer than those that are considered are possible, particularly in large installations where the use is light.

(c) long ranges may increase total stack capacity up to 10 percent or more, and

(d) other things being equal, the longer the range or the heavier the use, the wider the stack aisle should be. See Fig. 4.3 (a & b) for comparison. A second problem deals with the column sizes has been discussed under (1) above, where it stated that if the column size in the direction of the range is 42mm (14in) and the range before a cross aisle is reached, includes two columns, it will not interfere with the cross aisle.

The third problem is that if the module size is based on the distance between columns and hence is a multiple of 900mm (3ft), the width of cross aisles will also normally be a multiple of 900, 1800 or 2700mm

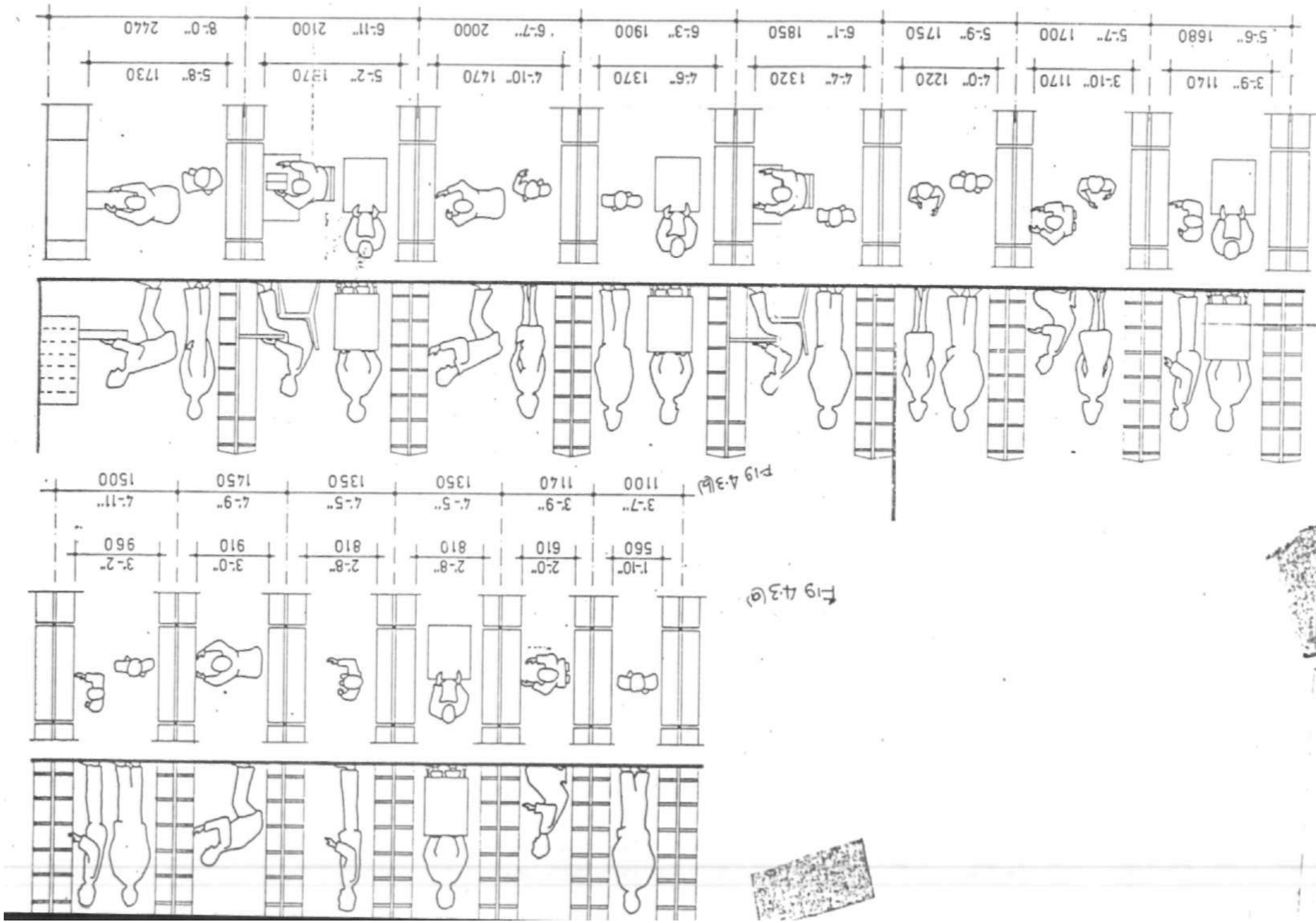


Fig 4.3(b)

Fig 4.3(a)

(3, 6 or 9ft). But as noted in "3" above, the range length should normally be a multiple of section length adopted.

The Depth of the Shelving and Width of the Stack Aisles

One may fail to see why the bay sizes affected by the shelf depth or, the stack aisle width. But they are. This is because if space is to be used to advantage, the distance between columns should be an exact multiple of the distance from the centre of one range to the centre of the next, and this distance should be determined by two things: the optimum depth from front to back of each range and optimum width of the aisles - fig 4.4 shows the result, when this rule is not followed.

The Width of the Main and Subsidiary Cross Aisles

Here the problem arises in a modular stack that can be avoided in a multi tier stack. In a multitier stack it is possible to arrange for aisles of any width desired, so long as those above and below, use the same layout. They can be found from as narrow as 750mm (2ft, 6in) or even less for subsidiary or side cross aisle up to 1,800 (6ft) or even 19500mm (7ft) for the main central aisle. But in a modular stack, if the plan is based on 900mm (3ft) stack sections and a multiple of 900mm (3ft) between columns, these aisles apparently must be 900, 1800 and 2700mm (3, 6 or 9ft) wide. Obviously 900mm is not enough

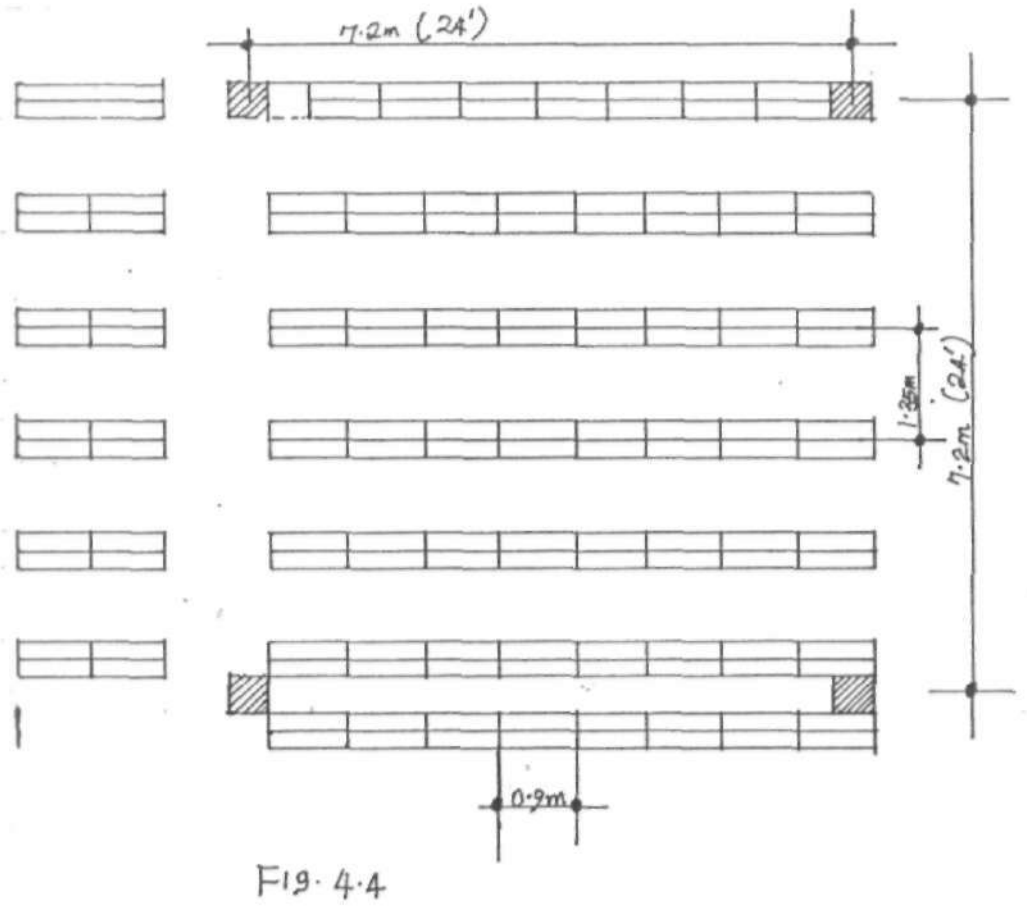


Fig. 4.4

Column and range spacing fail to gear together. A 7·2m (24ft) square bay with ranges 1·35m (4½ft) on centres shows the disastrous results of improper spacing. Ranges with 7·2m bay should be 1·2m (4ft) on centres, but there is still trouble in the direction of the ranges, Unless the columns are a long rectangle and occupy the space of full section.

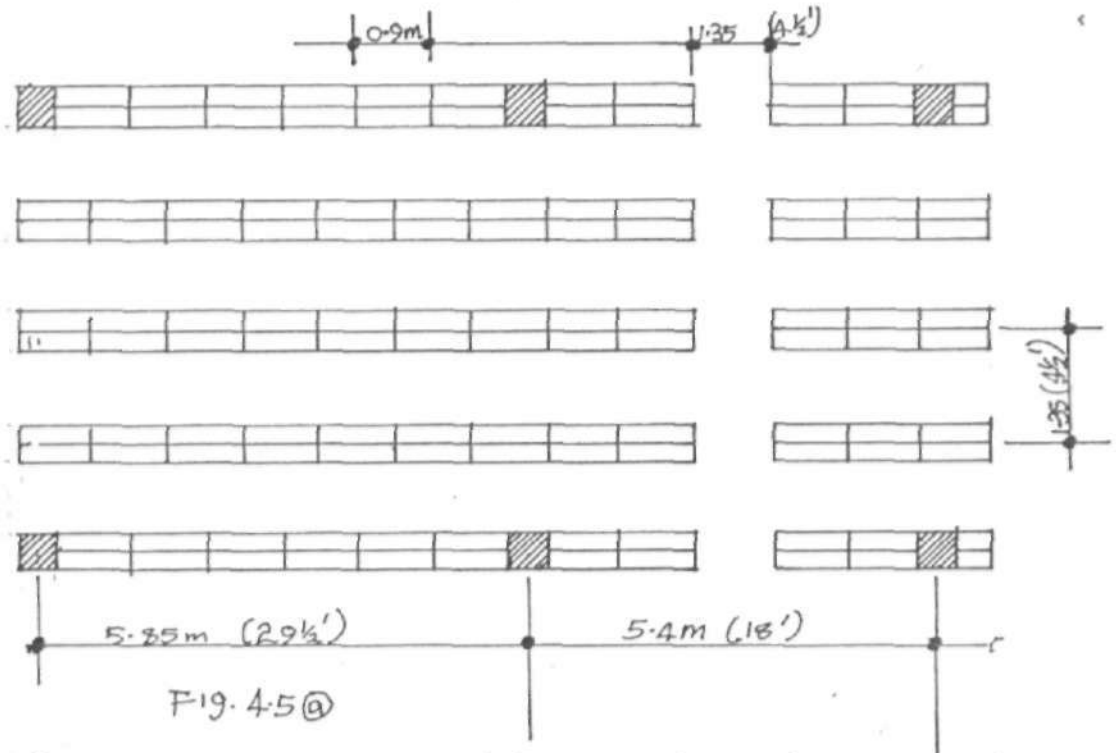


Fig. 4.5@

Cross-aisle width controlled by increasing or decreasing column spacing. This figures shows that if the the distance between column centres is changed or staggered in the direction of the ranges bays sizes will not be square.

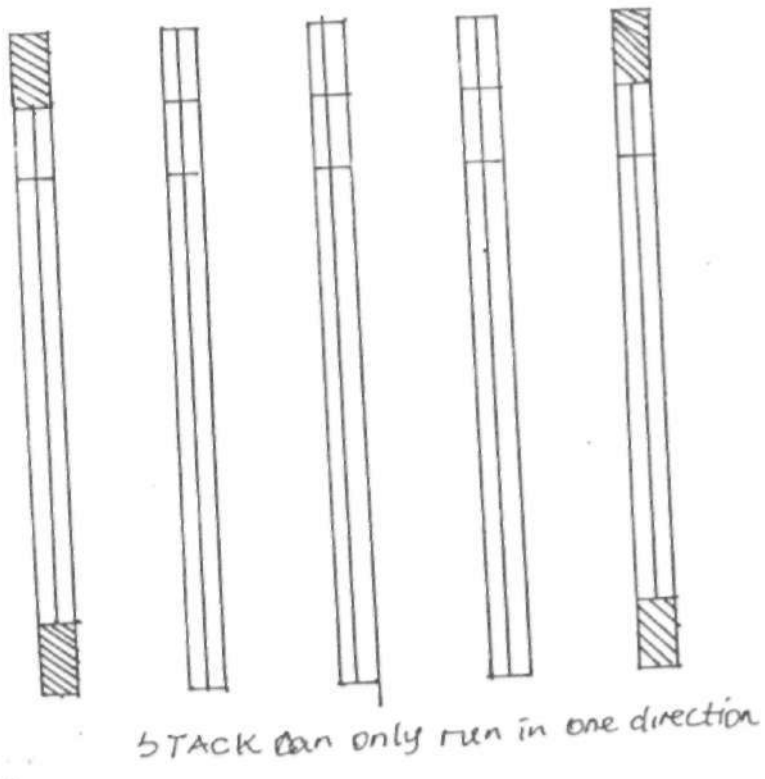
for main aisle but it is wide enough for subsidiary aisle. A width of 1350 (4ft, 6in) is adequate for the main aisle but this will not out if the distance between columns is a multiple of 900mm (3ft). This can be resolved by making the distance between columns in the direction of ranges multiples of 900mm plus 450mm in every other bay, and place the cross aisles in those bays as shown in fig 4.5(·) but make no change in column spacing in the other direction.

The Direction in which the stack runs

If the column spacing is so designed that the stacks must always run in one direction, a certain amount of flexibility is lost. The best column spacing is one which will allow the stack runs in any direction.

Ceiling Heights and Lighting

The clear height of a stack level between the finished floor and the finished ceiling is a bay size problem only indirectly, but it may be a matter of importance in connection with the cubic frotage in the building. The lowest ceiling that with permit seven shelves 36cm (12in) apart on centres is just 2250mm (7ft 6in). Anything above this, is useless. The extra height however, makes the space available for multip;e seating accommodation.



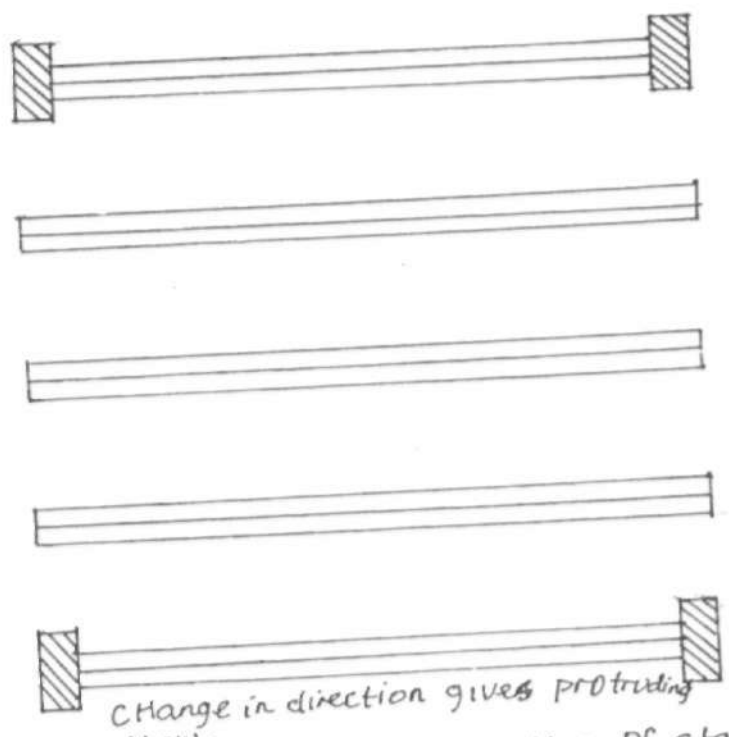


Fig 4.6 Direction of stack runs.

The effect of lighting in determination of bay size of stack relates to ceiling height, also to the number of fixtures to a bay and their spacing. The bigger the bay size, the more lighting is needed for it and vice versa.

Module Sizes and Book Capacity

For the total comprehension of this study, a further breakdown of the bookstacks area according to function was done to enable the researcher give a root to recommendations that will later follow in this work. Below shows an attempt to calculate the number of books houseable in either closed or open stack rooms. This will later mature into the desired modules for the various capacities.

Popular Open Access Rooms

Books per single-sided 900mm (3/4 full, 5 shelves high) is 120 to 130.

Current periodicals on open display each	$90mm^2$
Depth of single sided tier	200mm
Height of wall shelving (adults)	2m
Height from floor of bottom shelf	300mm
Distance between free standing book cases	2m to 3m
Overall capacity in rooms with 3m ceiling	65 books/m^2
	6.5 books/m^3.

Open stack: metric sizes

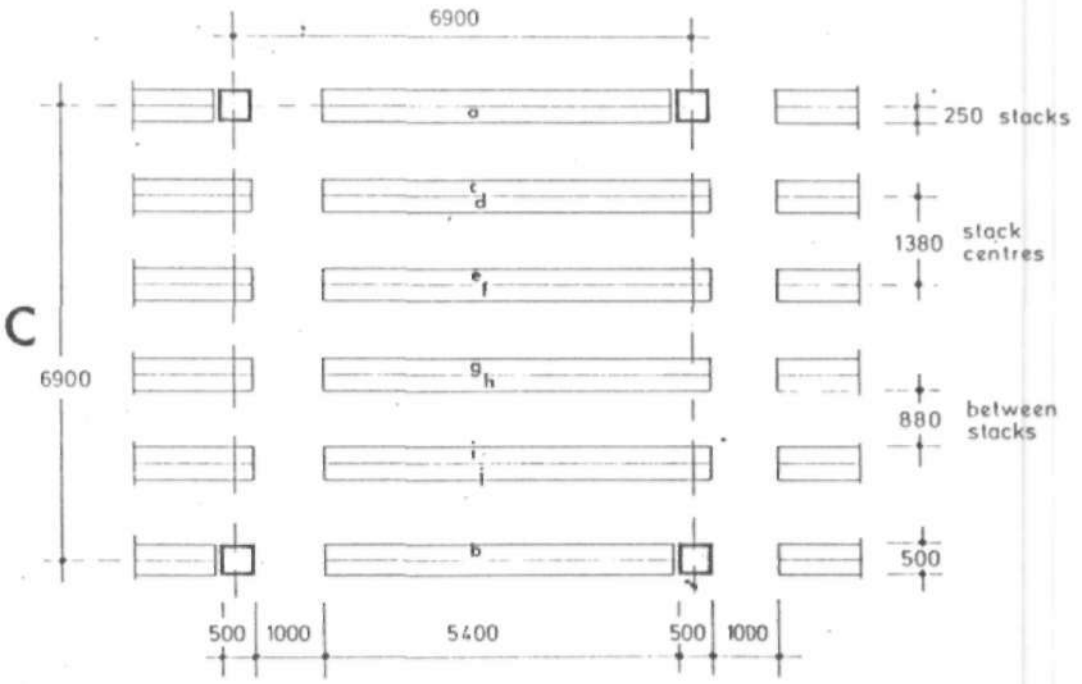


Fig 4·7

C Metric sizes based on a grid of 6·9 m (22 ft 6 in)

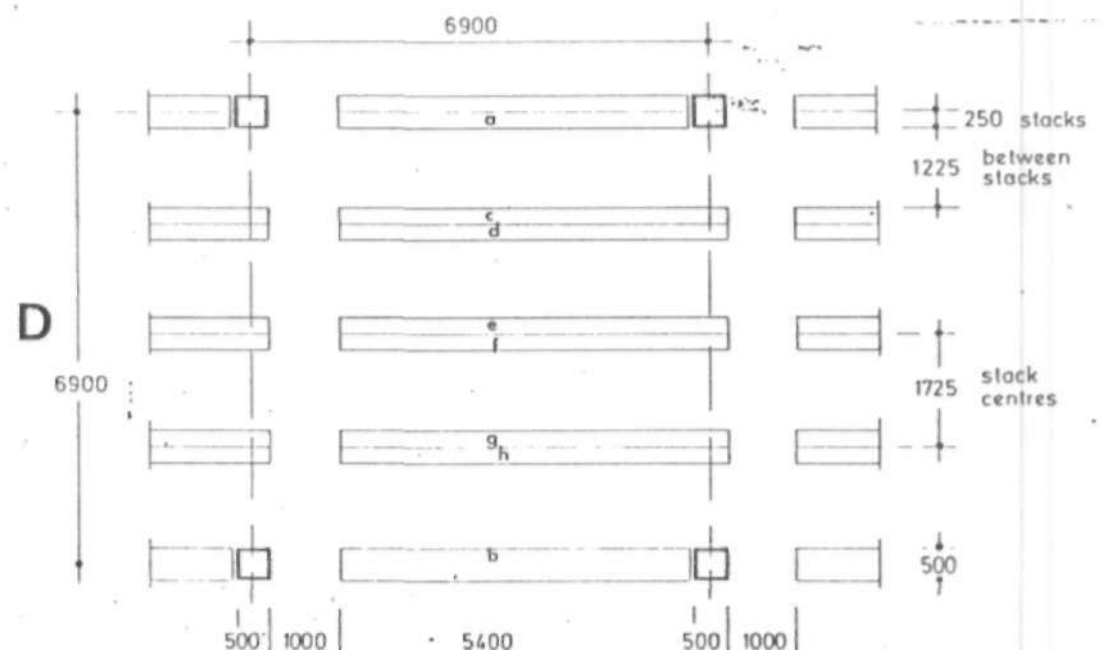
2 stacks (a and b) each 5·4 m long = 10·8 m
8 stacks (c to j) each 5·9 m long = 47·2 m
= 58 m

58 m 7 shelves high = 406 linear m
406 linear m at 20 books per m = 8120 books
= 169 books/m²

D Metric sizes based on a grid of 6·9 m (22 ft 6 in)

2 stacks (a and b) each 5·4 m long = 10·8 m
6 stacks (c to h) each 5·9 m long = 35·4 m
= 46 m

46 m 7 shelves high = 322 linear m
322 linear m at 20 books per m = 6440 books
= 134 books/m²



Stack Areas

Open stack 2.3m high with 3m ceiling	140 books/m^2
3/4 full), books of all sizes in optimum	14 books/m^3
grid and gangway conditions	
Books under 300mm tall in these conditions	180 books/m^2
	18 books/m^3
Books per single sided 900mm (3/4 full, 6 shelves	140 to 150
Bound volumes of periodicals per single sided 900mm	
(3/4 full, 5 shelves high)	75
Reports in laterial filing cabinet single sided 900mm	
wide, 1800mm high	750 - 1450

Closed Stacks

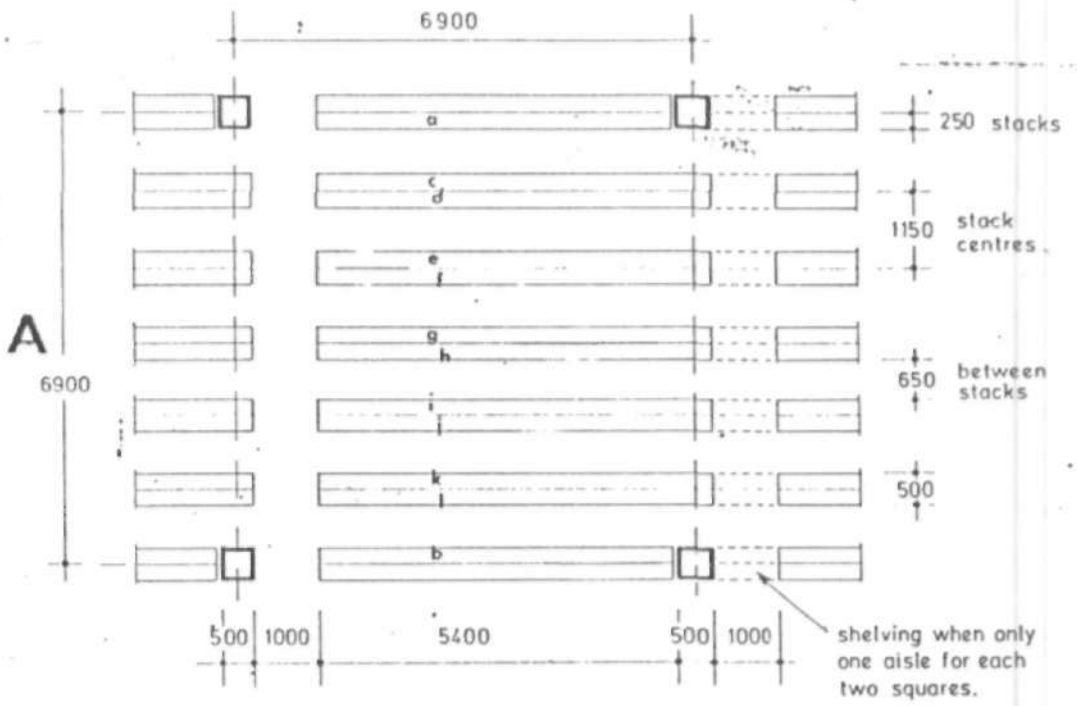
Closed stack 2.3m high, shelved closed to ceiling	
(3/4 full) 2.5m	180 books/m^2
Ceiling of all sizes in optimum grid and gangway	
conditions	22.5 books/m^3
Books under 300mm talls in these conditions	220 books/m^2
	28 books/m^3
Compact book storage	330 to 440 books/m^2
	40 to 55 books/m^3

Miscellaneous

To allow storage space for expansion for each year (assuming less withdrawals.

Books - (additions ÷ 120) x $\frac{9}{10}$ = m^2 required.

Closed stack:
metric sizes



F19 4·8

A Metric sizes based on a grid of 6·9 m (22 ft 6 in)

One 1 m cross-aisle per grid square

2 single sided stacks (a and b) each 5·4 m long = 10·8 m
10 single-sided stacks (c to l) each 5·9 m long = 59 m
} = 69·8 m

69·8 m 7 shelves high = 488·6 linear m
488·6 linear m at 20 books per m = 9772 books
= 204 books/m².

One 1 m cross-aisle every other grid square

Extra shelving = 12 × 1 m = 12 m
12 m 7 shelves high = 84 linear m
84 linear m at 20 books per m = 1 680 books every other square
= 840 books per square
9772 + 840 = 10 612 books
= 221 books/m².

B Metric sizes based on a grid of 6·9 m (22 ft 6 in)

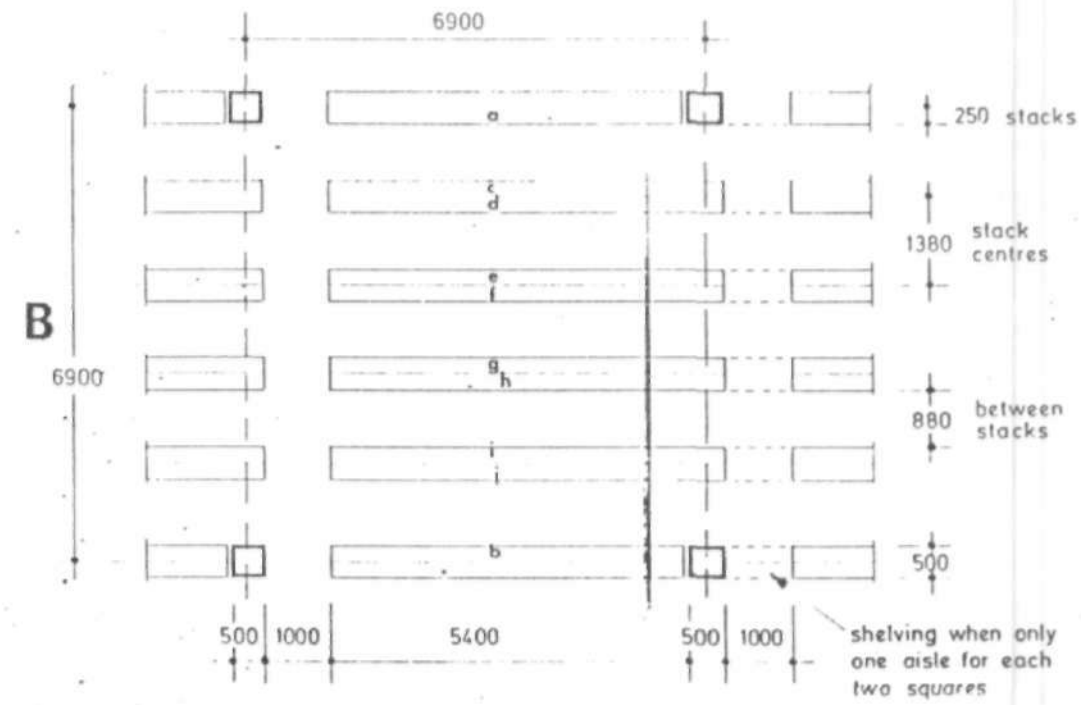
One 1 m cross-aisle per grid square

2 single sided stacks (a and b) each 5·4 m long = 10·8 m
8 single-sided stacks (c to j) each 5·9 m long = 47·2 m
} = 58 m

58 m 7 shelves high = 406 linear m
406 linear m at 20 books per m = 8 120 books
= 169 books/m².

One 1 m cross-aisle every other grid square

Extra shelving 10 × 1 m = 10 m
10 m 7 shelves high = 70 linear m
70 linear m at 20 books per m = 1 400 books every other square
= 700 books per square
8 120 + 700 = 8 820 books
= 184 books/m².



Periodicals (additions ÷ 75) x $\frac{9}{10}$ = m^2 required

Work space per head of staff $11m^2$

Cataloguing staff $13.5m^2$

Capacity of catalogue drawer 1000 cards (300 titles)

Percentage of students who will require seat in an academic library - 30 percent.

The table below summarises the modular sizes and the books to be accommodated.

Grid size (m)	Stack Centres (m)	No of sided Stacks	Books per grid square (one aisle per square)	Books per m^2 (one aisle per square)
5.6	1.4	3	5012	160
6	1.5	3	5480	152
7.25	1.45	4	8610	164
7	1.55	4	9310	155
7.8	1.56	4	9300	154
	1.3	5	11290	186
8.4	1.68	4	10220	145
	1.4	5	12292	174

Table 4.1

Notes: The above figures apply to books that can be shelved 20 books per m and 7 shelves high.

4.3.1 Conclusions and Recommendations

From the analysis of the above factors in determining a suitable module size for the bookstack area, the following conclusions and recommendations can be made.

i) Other things being equal, the larger the bay, the better. If it does not increase construction costs unduly or necessitate columns more than 42cm (14in), or 54cm by 96cm (18 x 32in) if they are to include the ducts and if the direction of the ranges is not to be changed.

ii) Square bays tend to be more economical and give more flexibility.

iii) Except for the top floors or in some cases where the use of the prestressed concrete is desirable, it is probable that 710 x 710mm (27 x 27ft) will be the offer limit for square bays, unless columns are to be more than 42 x 54cm (14 x 18in). If rectangular, or 54 x 97cm (18 x 32in) if much longer, in one direction.

iv) If the smaller column is selected, the distance between columns should be a multiple of 900mm (3ft) plus 10.2cm (4in) for the 5.1cm (2in) extra space on either side of the column for the last upright. Since the column takes 54cm (18in), this will give bay sizes of 7650mm (25ft, 6in), 6900mm (22ft, 6in), 5850mm (19ft, 6in), 4950mm (16ft, 6in) as possibilities. A bay size of 7650mm (25ft, 6in) will permit six ranges 1275mm (4ft,

3in) on centres to a bay. This arrangement is suitable for large collections not heavily used with the length of the ranges running up to 9000mm (30ft) or even 10800mm (36ft). A bay size of 6900mm (22ft, 6in) would be better for a heavily used open access undergraduate stack collection, with ranges - 1350mm (4ft, 6in) on centres and range lengths from 4500mm (15ft) to 9000mm (30ft), varying according to the amount of use in relation to the amount of use in relation to the size of the collection.

If 5850mm (19ft, 6in) is chosen, it will provide a stack for very limited access, with 5 ranges 1230mm (3ft, 11in) on centres and ranges preferably 400mm (16in) from the back and certainly no more than 540mm (18in), or for four ranges 1600 (4ft, 10in) on centres for undergraduate collections with extremely heavy use. Ranges up to 600m (20in) from front to back would be permissible in the latter circumstances but would rarely be warranted.

For closed access and research library 4950mm (16ft, 6in) is possible, but they will become too numerous and unnecessary. It will provide for four ranges 3810mm (4ft, 1½in) on centres.

4.4 Module Size and Other Accommodations

Space for purposes other than concentrated book storage can be those that require area without column obstruction. Some of these areas are large in some functions and thus affecting bay size selection. These include:

i) Large reading areas for any use, such as for reference collections, current periodicals, reserve books, public documents, divisional reading, maps, large special-subject rooms and night-study areas.

ii) Public areas around service desks and card catalogue room.

iii) The processing room or rooms.

iv) Classrooms and audiforiums, audiovisual rooms and library school areas.

v) Non-assignable space for lobbies, mechanical areas and stair wells.

The following methods could be adopted in providing large areas for the functions above:

(a) By placing the room on the top floor where no function will be on top and with no weight but the roof.

(b) Make the room high enough so that heavier beams can be used in the ceiling.

(c) Make the column spacing narrower in one direction and so make possible a wider spacing in the other.

v) If the rectangular 420 to 540 x 960mm (14 to 18 x 32in) column is selected, any column spacing divisible by three will be feasible, and 8100 x 8100mm (27 x 27ft), 7200 x 7200 (24 x 24ft); 6300 x 6300 (21 x 21ft) and 5400 x 5400 (18 x 18ft) should be considered.

An ideal for an undergraduate collection is 8100 x 8100 (27 x 27ft) which will give six ranges to a bay - 1350 (4ft, 6in).

(d) Cantilever the areas close to the outside walls.

For the small areas such as:

(a) Walled in areas for offices, and enclosed carrels.

(b) reading alcoves combining shelving and reading accommodations.

(c) Individual seating, both for staff and readers.

The following points could resolve the problem:

i) With any of the bay sizes recommended 22½ft, 25½ft or 27ft (6.gm, 7.65 and 8.1m), the chief librarian's office can be filled in easily without column troubles. Two small offices can be placed in any of these sizes.

ii) An 18ft (5.4m) bay will take care of one large office, two small ones, three good sized closed carrels or four open ones.

iii) A 6.gm bay will provide outside wall space for fine small offices or large studies, three adequate study rooms, five open carrels.

iv) A 7.65 (25½ft) bay will provide for two offices, 3 minimum ones, three or four small studies, five closed carrels and size open ones. See fig. 4.7

SQUARE MODULES WITH THE COLUMN SPACING A MULTIPLE OF 3FT (0.9m) PLUS 1½FT. (0.45m) FOR COLUMN ITSELF.

Bay Size	Sections Between Columns Standard 3ft	Ranges to a Bay.	Range Spacing on Centres	
			Metre	Feet
5.85 x 5.85m	6	5	1.18	3'10 4/5"
(19'6" x 19'6")	6	4	1.47	4'10½"
	6	3	1.95	6'6"
6.9 x 6.9m	7	6	1.17	3'9"
(22'6" x 22'6")	7	5	1.38	4'6"
	7	4	1.73	5'7½"
7.65 x 7.65m	8	7	1.13	3'7 5/8"
(25'6" x 25'6")	8	6	1.29	4'3"
	8	5	1.86	5'1¼"
	8	4	1.94	6'4½"
8.55m x 8.55m	9	8	1.12	3'6¾"
(28'6" x 28'6")	9	7	1.22	4'0 6/8"
	9	6	1.47	4'9"
	9	5	1.75	5'8 2/5"

Columns should not be wider than the depth of range: 0.42 x 0.42m up to 0.42 x 0.54m is suggested. Table 4.2A

Bay Size	Sections Between Columns Standard 3ft	Ranges to a bay	Range Spacing on Centres	
			Metre	Feet
5.4 x 5.4m	5	5	1.12	3'7 1/5"
(18' x 18')	5	4	1.38	4'6"
	5	3	1.8	6'
6.3 x 6.3m	6	6	1.08	3'6"
(21' x 21')	6	5	1.27	4'2 2/5"
	6	4	1.59	5'3"
7.2 x 7.2m	7	7	1.05	3'5 1/7"
(24' x 24')	7	6	1.2	4'
	7	5	1.48	4'9 3/5"
	7	4	1.8	6'
8.1 x 8.1m	8	8	1.04	3'4½"
(27' x 27')	8	7	1.20	3'10 2/7"
	8	6	1.38	4'6"
	8	5	1.64	5'4 4/5"
	8	4	2.07	6'9"

Columns should not exceed or be wider than the depth of their range. 0.32 x 0.96m is suggested.

table 4.2B

Note:

These are recommendations and may not be considered rigidly.

RECOMMENDED CROSS AISLE WIDTHS

	Main aisle		Subsidiary Cross aisle.	
	Min. (m)	Max. (m)	Min. (m)	Max. (m)
Closed access storage	0.9	1.35	0.75	1.05
Limited-access stack	0.9	1.35	0.9	1.05
Heavily used open access stack	1.2	1.5	0.9	1.2
Heavily used open access stack for large collection and ranges 9m or more long	1.35	1.8	1.29	1.35

The length and the width of bookstacks have been considered here.

Table 4.4

LONG RECTANGULAR MODULES, 6.9m (22½ft) IN ONE DIRECTION

Bay Size (m)	Ranges of a Bay	Range Spacing on Centres (m)
6.9 x 5.4(22'6" x 18')	4	1.30 (4'6")
6.9 x 6.0(22'6" x 20')	5	1.2 (4')
6.9 x 6.3(22'6" x 20'10")	5	1.26 (4'2")
6.9 x 6.54(22'6" x 21'6")	5	1.32 (4'4")
6.9 x 7.2(22'6" x 24')	6	1.2 (4')
6.9 x 7.5(22'6" x 25')	6	1.26 (4'2")
6.9 x 7.8(22'6" x 26')	6	1.32 (4'4")
6.9 x 8.1(22'6" x 27')	6	1.36 (4'6")

A bay of this size will give seven sections 0.9m (3ft) long between 0.42m (14in) in the direction of the column range. The column sizes suggested table 4.2A are suitable here.

MODULES FOR SMALL STUDY AND CONFERENCE ROOMS.

Bay Size	Small Faculty Study*	Small Conference room.
5.4 (18') (19½ft)	3	2
5.85m (19½')	3	2
6.3m (21')	3	2
6.9m (22½')	3	2
7.3m (24')	4	3
7.65m (25½')	4	3
8.1m (27')	4	3

table 4.3

Note: These are recommendation and can change with circumstance.

Recommended Stack-aisle Widths and Stack-range Lengths.

Typical use of Stack	Aisle Width		Range Lengths	
	Min(m)	Max(m)	Min(m)	Max(m)
Closed-access storage stack	0.72	0.9	0.9	1.[illegible]
Limited access, little-used stack for over 1,000,000 volumes	0.78	0.63	9	12.6
Heavily and open access stack for over 1,000,000 volumes	0.63	1.08	7.2	10.8
Heavily used open access stack with less than 1,000,000 volumes	0.99	1.2	4.5	9
Newspaper stack with 0.54m deep shelves	1.08	1.35	4.5	9
Reference and Current periodical room stacks	1.08	2.16	3.6	[illegible]
Current periodical display stacks	1.26	2.16	3.6	6.3

These are recommendations and may not be definite

Table 4.3

CHAPTER FIVE

5.0 THE SITE STUDY

5.1 Introduction

This chapter hopes to examine the project town and other physical factors that will inturn dictate the architectural character of the proposed design. A little digression will be made to discuss the state from its creation and other related issues before discussiong the site.

5.2 Niger State

Niger State was created from the defunct North Western State in 1976. It derived its name from the river Niger which flows through it. The State is bounded in North by Sokoto and Kaduna States on the East by Kaduna and Federal Capital Territory; on the South and West by Kwara State. See Fig. 5.1 (a - c).

5.3.0 Minna Town

Minna town, the capital of Niger State of Nigeria lies at latitude 9° $37^{'}$ North and longitude $6^{\circ}33^{'}$ East on a gealogical base of undifferenciated basement complex of many gneiss and magnetite. General height of the town above see level is 848ft (282.7m). To the North East of the town, a more or less continuous steep outgrowth of granite occurs limiting development in that direction. The proposed University site is to the Southern part along

locati



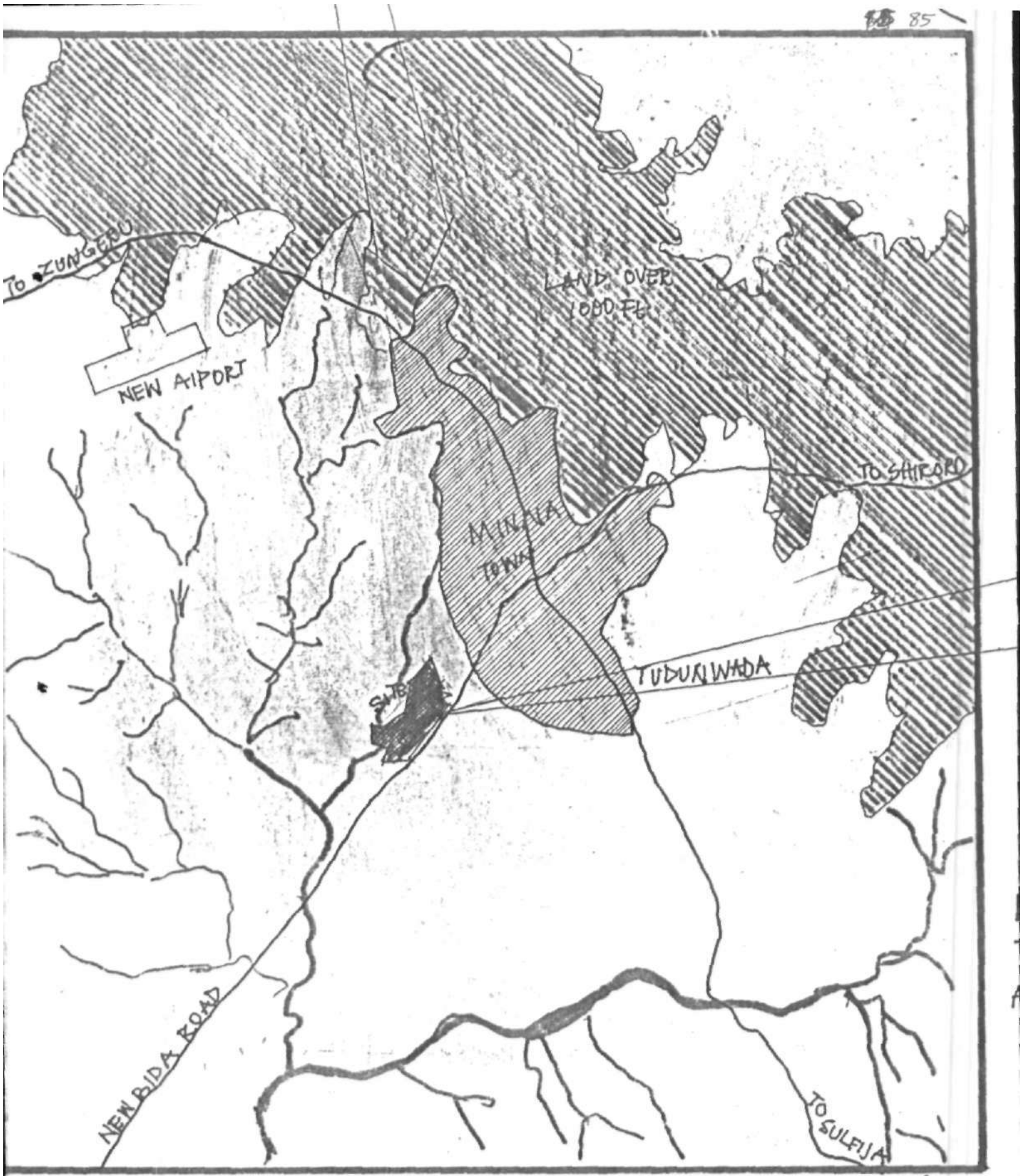
FIG 5.1(a)

MAP OF NIGERIA SHOWING
NIGER STATE AND LOCATION
OF MINNA TOWN



Fig 5.1(G)

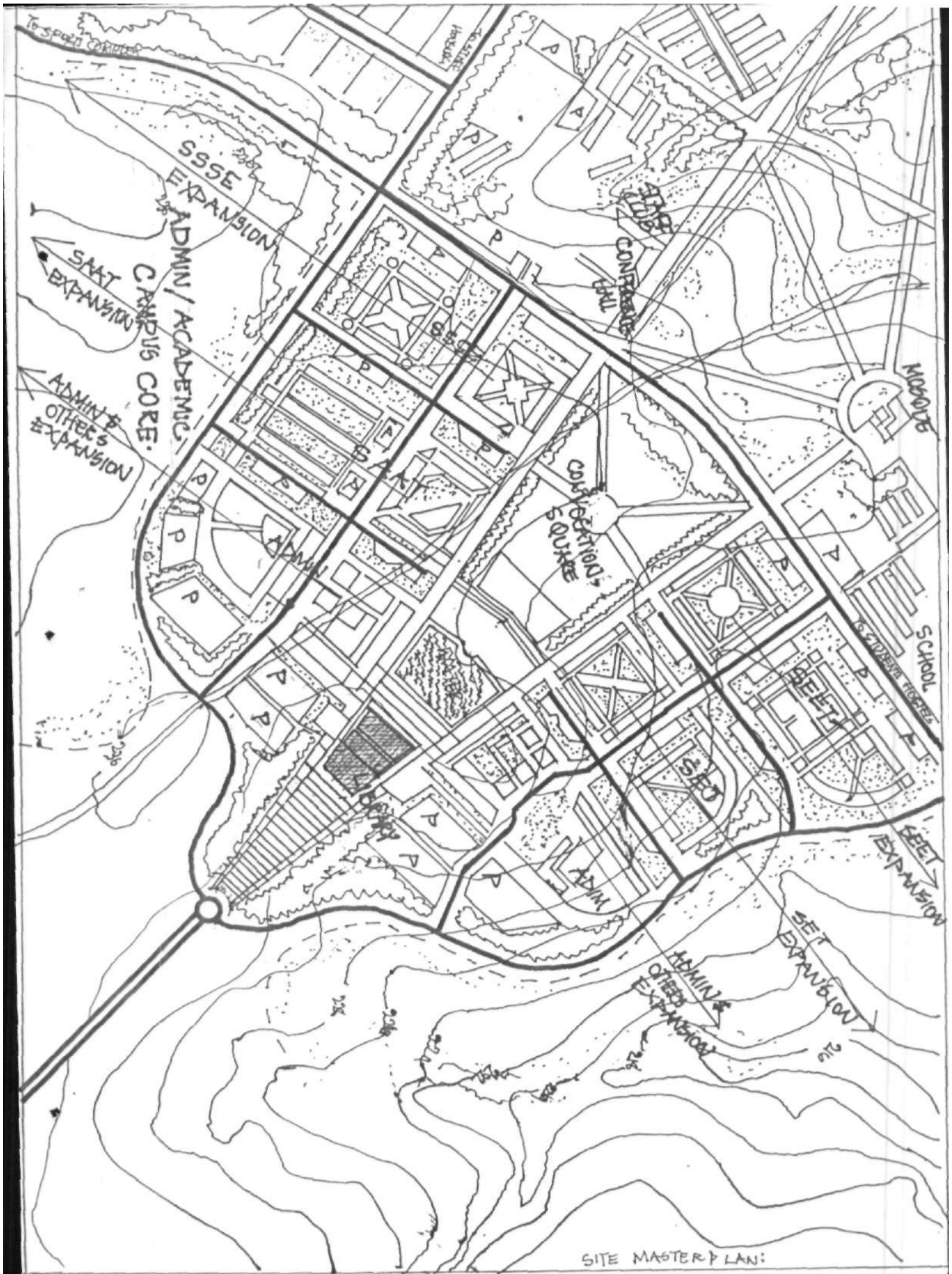
MAP OF NIGER STATE SHOWING MINNA AREA



town and topography

Fig 5.1(6)

follot



SITE MASTER PLAN:

FIG: 2

Minna-Bida road.

5.3.1 The Project Site

The new University site, as earlier mentioned above is located on the Southern part of the town along the new Minna-Bida road.

The proposed library is located within the academic core as can be seen in (Fig. 5.2) on the master plan of the University.

5.3.2 Site Characteristics

(i) Rainfall

Minna, the project site has an average annual rainfall of 133.3mm, with the highest rainfall between August and September and least rainfall in November. The rainy season disappears with the coming of the hostile North east trade wind - the harmattan.

(ii) Temperature

Minna has a mean annual temperature of 27.5°C with mean monthly temperature highest in April (31.1°C) and lowest in August (25.2°C) when rainfall and relative humidity are at there peaks. See Fig. 5.3

(iii) Humidity

From the diagram of the humidity group shown in Fig. - it can be seen that most of the year falls within low humidity. Fig. 5.4

Rainfall

Rainfall records of four years were studied and the behaviour plotted below.

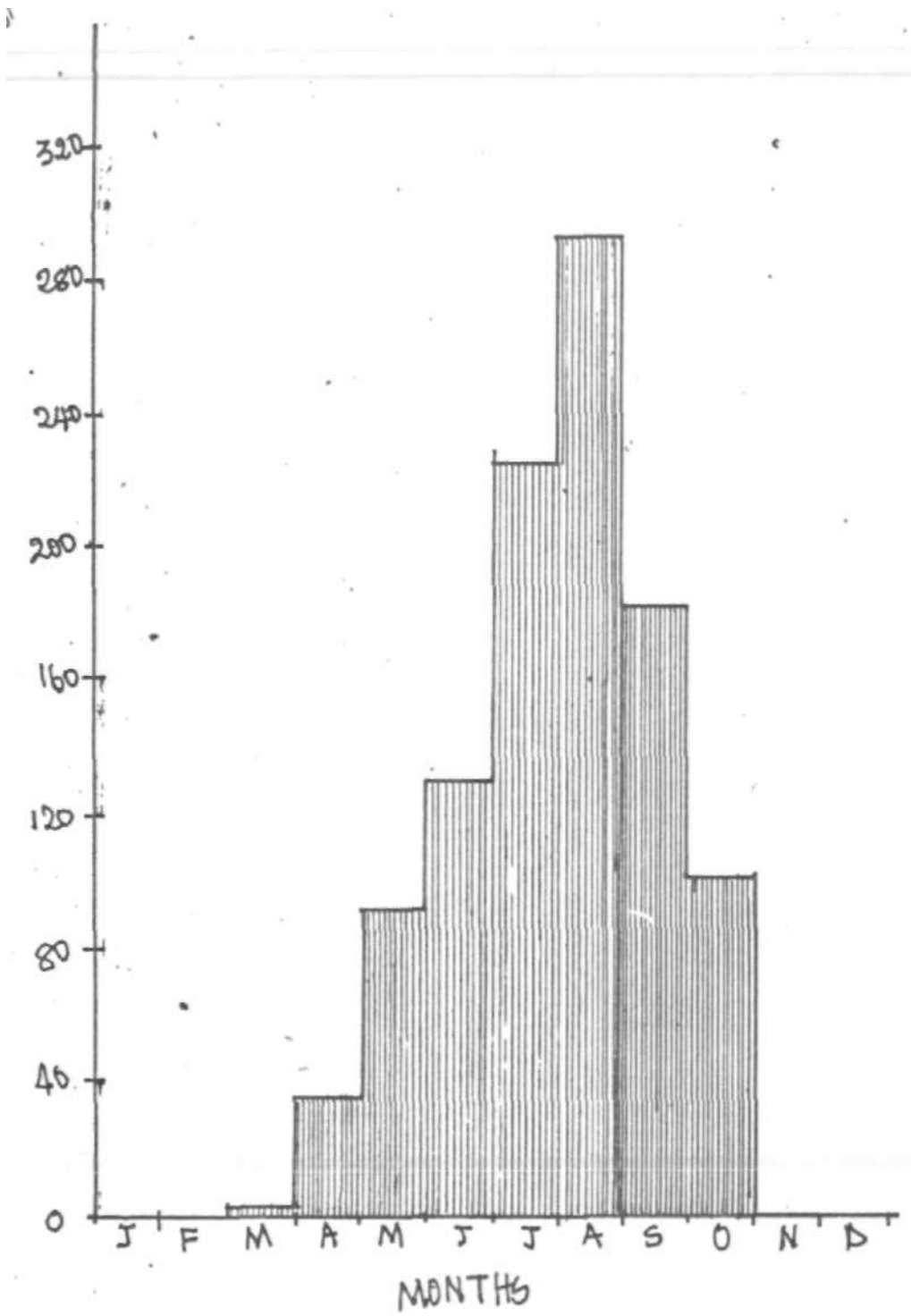
Year	MONTH											
	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1980	0.0	0.0	0.0	7.8	239.1	130.8	206.9	259.8	177.8	141.7	0.0	0.0
1981	0.0	0.0	0.0	22.8	57.6	168.1	239.2	276.1	183.0	92.3	0.0	0.0
1982	0.0	0.0	13.0	99.8	45.3	138.1	288.9	353.2	160.0	104.6	0.0	0.0
1983	0.0	0.0	0.0	12.2	36.3	85.3	166.7	288.8	206.8	71.0	0.0	0.0
Average	0.0	0.0	3.3	35.65	94.7	130.1	225.4	294.3	181.9	102.4	0.0	0.0

Temperature

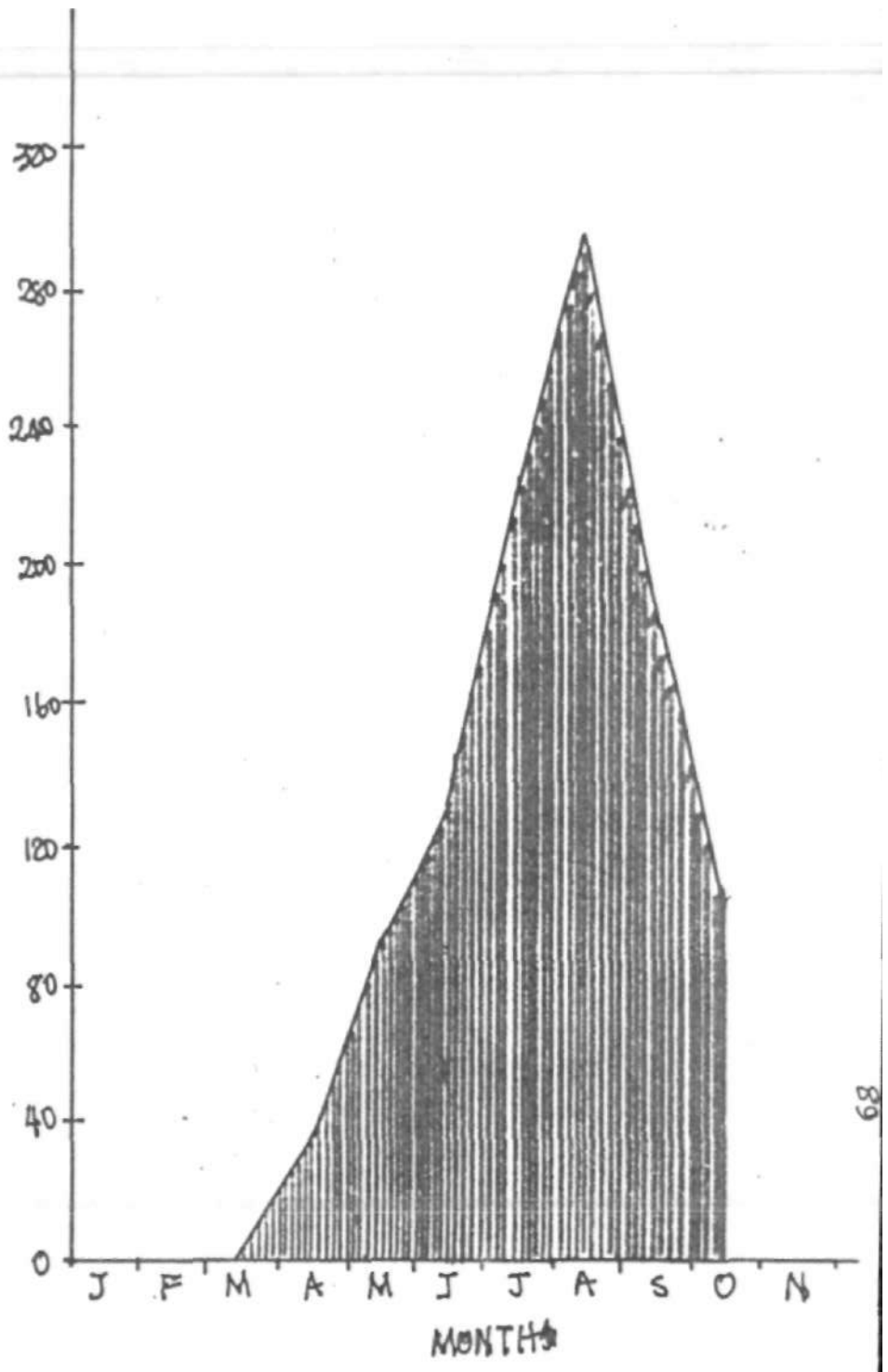
Temperature for the same number of year were studied and results plotted below.

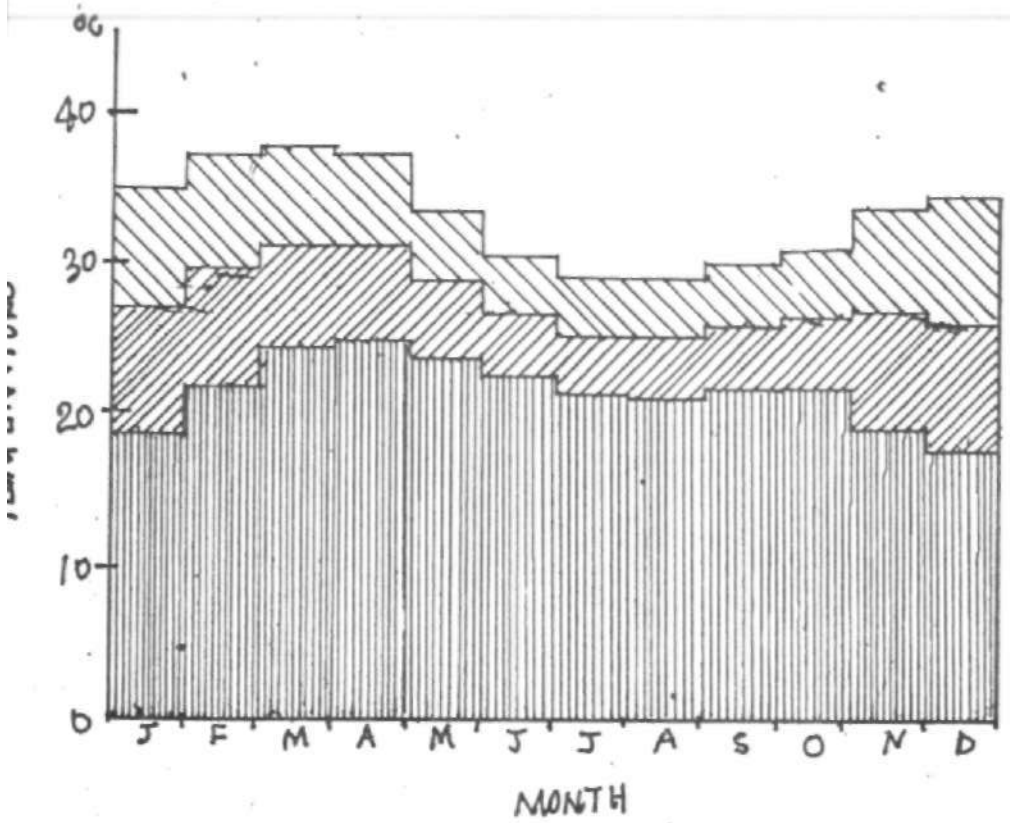
Year	MONTH											
	JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1980	20.9	23.6	25.0	25.6	24.0	22,5	22.0	21.8	21.9	21.5	19.9	15.9
1981	18.3	21.3	24.3	24.3	23.1	22.3	21.6	19.7	22.6	21.8	19.6	16.2
1982	16.3	20.4	23.5	23.7	23.1	22.2	19.8	21.9	22.6	22.6	19.0	18.8
1983	19.1	22.8	24.9	25.7	24.6	22.9	22.3	21.8	21.0	21.6	19.2	20.2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mean	31.1	37.0	37.5	37.4	33.3	31.[illegible]	30.[illegible]	31.[illegible]	31.3	31.3	34.2	34.7
Mean Min	18.7	22.0	24.4	24.8	23.7	22.[illegible]	22.[illegible]	21.8	21.8	21.9	19.4	17.8
Average	26.9	29.5	31.0	31.1	28.7	26.5	25.3	25.2	26.0	26.6	26.8	26.3

Mean Annual Temp. 27.5

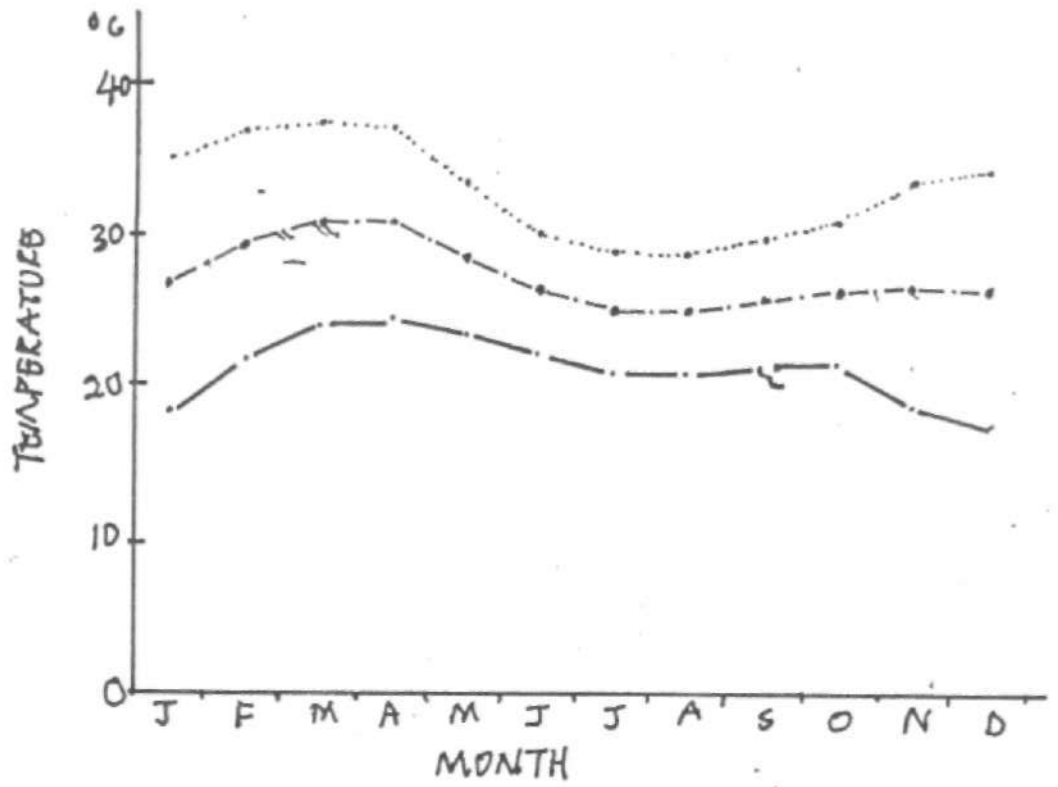


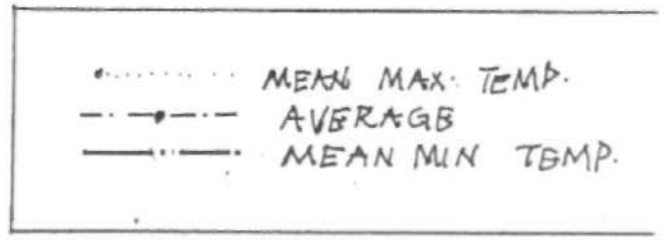
MEAN MONTHLY RAINFALL





MEAN MONTHLY TEMPERATURE.





Relative Humidity(%)

	J	F	M	A	M	J	J	A	S	O	N	
Mean Monthly Max. a.m.	29	32	46	62	73	83	83	89	88	77	44	
Mean Monthly Minimum p.m.	27	28	40	50	65	73	77	85	80	75	40	
Average	28	30	43	56	69	78	79	87	84	76	42	42
Humidity group	1	2	2	3	3	4	4	4	4	4	2	2

Humidity group 1	If average R.H below 30%
2	30 - 50%
3	50 - 70%
4	above 70%

With the months of June, July, August, September and October with relative humidity above 70%. The remaining part fall below the 50%.

(iv) Climate (Macro)

Minna town has the predominant tropical climate of hot and dry charater. The climate of Minna is marked by two distinct seasons - the rainy season which lasts from April to October and the dry season from November to March. The seasons are engendered by the tropical maritime air-mass and the tropical continental air-mass which blow in from the South West and North East respectively

(v) Site Micro-Climate

The Micro-Climate as it influences the project site is principally caused by the topography of the area, which is characterised by the undulating land and the hilly Western part of the site. Rivers Nakwo and Gwakodna dictates to some extent the Micro Climate of the site. These rivers however are seasonal and have seasonal effects.

(vi) Geology

Minna town has predominantly gneiss and magnetite and other undifferenciated rocks. On the North-Eastern part of the town. The soil and subsoil comprise the laterite type. This also extends to the project site along Bida road.

(vii) Winds

The major winds that influence the tropical climate are also experienced in Minna. However, the local winds which most of the time do not have any definite direction are also experienced. The major South West trade winds are moisture laden and brings rain for the town and the North East trade winds are hot and dry and are responsible for the harmattan experienced in the town. On the average, the speed of winds is 8m/s which is relatively low.

(viii) Vegetation

Vegetation of the site is of the Savannah. This is marked by the large extent of grass land dotted by tropical trees and shrubs. In this area, they include the locust bean, trees, elephant grass. etc. Fig. 5.5

(ix) Sunshine

Minna town has high number of sunshine hours per month. Insolation is usually very high during the months of February to April and characterised by clear cloudless sky. It is minimum during the months of May to October due to cloud cover.

(x) Noise

The site of this project is at the out skirts of Minna town and it is therefore not threatened by any form of noise or disturbance from the town itself. However, some noise could be generated within the site by vehicles.

(xi) Circulation

The site is linked by a double road tapped directly from the main Minna-Bida road some distance away from the toll gate. The road network on the site and access to the library is shown in the master of the site.

(xii) Structures

At present the site has no any physical structure. This is because the site has not been developed. The master plan of the site however shows the proposed developments to take place apart from the library.

5.4.0 Analysis of Site Characteristics and Recommendations

(i) Rainfall and Wind

As a result of the mixed climatic character of this region, Minna town experiences heavy rainfall accompanied by strong windstorms in certain occassions. Hence there is a need for well designed storm drainage systems on the project site. Such design will considers the quick removal of water from roofs by creating high pitched roofs and properly designed gutters. Heavy plantiny could reduce wind storm speed to some degree.

(ii) Temperature

The temperature of Minna town is generally high and on the project site, it will be expected to be high as a result of the high solar radiation. The high temperature causes thermal discomfort both within and outside the building.

Heavy planting, landscaping could ease the problem to some degree.

A careful choise of building materials which are heat retardants and insulators can also alleviate the problem.

(iii) Humidity

The relative humidity values for Minna is averagely low for most of the year. The exceptions are from the month of June to October where the values exceed 70%.

Therefore discomfort caused by high humidity is relatively low for most of the year. However to enhance living condition, maximum openings for free flow of air could be allowed. This induces air speed within the interior. The high speed of air promotes evaporation and consequent cooling.

(iv) Vegetation

Vegetation of the site is that of trees and grass. As earlier mentioned, development on the site has not started, therefore this chance will be used to propose that the trees on the site should be maintained at the beginning of the development. This will go along way in minimising problems like high temperature, humidity and wind speed.

(v) Geology

It is not known whether scientific soil test has been carried out, but data available reveals that the soil and subsoil is that of laterite. The use of strip foundations for the buildings is adviseable.

(vi) Noise

The site is far off the main road, which means noise from the busy high way is not a problem. The other sources of noise could be from the road net work near the site. This could be treated by planting and provision of parking spaces far from the building. The

already marked out area for parking is enough solution.

(vii) Circulation

The vehicular circulation network has already been done. It is therefore not the scope of this study to redesign the road net works. However the provisions given will be adhered to effectively. The pedestrain circulations have also been considered. It is hoped that these will function effectively to the requirements of site.

(viii) Sunshine

Sunshine is synonimous with clear sky. In Minna, solar radiation reflected from the sky or clouds causes glave. When incident on the ground surface, the solar rays are absorbed or reflected back to the air. This reflected rays cause discomfort, excessive expansion of building materials and changes the configuration and appearances of external finishes.

This could be reduced by good landscaping, heavy planting of trees and articulate use of solar energy reflective materials like flashings on roofs and exposed concrete.

5.5 Site Selection Criteria

The selection of this project site is not the decision of the researcher. It is the mapped out site for the project in the master plan of the site. Although the criteria for selecting the site are not known to the researcher, it is considered wise to further buttress the selection by the following points.

(i) The site is centrally located within the academic core in which it is serving, thereby serving as a focus for the core.

(ii) The site is easily accessible from within and outside the campus.

(iii) The site appears to be relatively high thereby making the building visible from all sides and on entering the campus.

5.6 Conclusions from Analysis

Any good architectural design must be itself provide its design solutions that would attempt to resolve or control the problems highlighted above. In this regard an attempt has been made at analysing the site situations, comfort level requirements and available resources so as to come up with workable and comfortable design proposals.

CHAPTER SIX

THE DESIGN SCHEME

6.1 Design Brief

Before proper schedule of accommodation is drawn, some determination of space analysis will be done based on the results obtained from the research work in Chapter four. The results obtained there will be used to arrive at proper modular sizes to be adopted in this design. Also the schedule will be based on the requirement of the University and the requirements set by the NUC (National Universities Commission).

Below shows the requirements of the National Universities Commission (NUC), which are not different from the University's requirement.

No. of Book	No. of Readers	Area of Readers	Area of Books
500,000	1,500	2,951	3,450

Table 6.1

Note: NUC recommendations are at 10,000 capacity.

The library will serve 30% of the projected students population of 5010 students by 1999. The table below shows the present population and the enrolnment projection by different schools.

SUMMARY OF ACTUAL STUDENTS ENROLNMENT 1984 - 1990

SCHOOL	83/84	84/85	85/86	86/87	87/88	88/89	89/90
Agric. & Agric. Tech. SAAT	-	-	56	70	99	108	136
Eng. & Eng. Techn. SEET	-	-	122	222	326	313	420
Env. Technology SET.	-	-	86	106	131	100	131
Science & Science Educ. SSSE	102	158	162	188	250	263	657
TOTAL	102	158	426	592	806	794	1,352
Annual Growth Rate(%)		55	167	39	36	-15	70

ENROLNMENT PROJECTION BY SCHOOLS 1990-1999 (SUMMARY)

SCHOOL	89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99
SAAT	95	237	380	511	634	750	900	1050	1080	1080
SEET	345	445	542	630	702	750	900	1050	1080	108
SET	94	266	434	598	788	913	1100	1290	1320	1320
SSSE	398	572	701	757	903	1050	1260	1470	1500	1530
TOTAL	933	1520	2057	2496	3027	3463	4170	4860	4980	5010
Growth Rate (%)	-	63	35	21	21	15	20	17	3	0.6

Table 6.2

NOTES:

SOURCE: ACADEMIC OFFICE FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA.

DATE: JUNE, 1991.

From the table 30% of the projected students population = 30% of 5010 = 1,503 readers.

Provision of space will be made based on the NUC standards shown from table 6.1.

Taking the NUC stanadards of 1,500 readers for 2951m^2, and 500,000 volumes for 3450m^2,

80% of the books are on open access,

80% of 3450 = 2760m^2.

Assignable space for books tacks is based on 7m^2 at 1,000 volumes.

For volumes on open access = $\frac{2760m^2}{7m^2} \times 1{,}000$

= 394000 volumes.

20% for limited access

Area for limited access = 20% of 3450 = 690m^2

Assignable space for books on limited access is based on 5m^2 per 1,000 volumes.

Volumes on limited access = $\frac{690m^2}{5m^2} \times 1{,}000$

= 106000 volumes.

∴ Total volume of books in the library = 500,000 volumes

The determination of other areas are based on the brief in the next page.

The following assumptions have been made in preparing this brief.

a) The standards will be those enunciated in National Universities Commission (NUC) standard guide and internationally accepted stands not spelt out by NUC.

b) The stack and services of the library will be provided on a subject divisional basis.

c) The faculties in the University includes:
   (i) Schools of Environmental Technology,
   (ii) Engineering (Only Chemical, Electrical and Mechanical,
   (iii) Agriculture
   (iv) Science and Science Education.

d) That the Faculties will grow in future as soon as it is moved to its permanent site.

e) The number of teaching staff to students is 1.12.

f) The seating provision will be required for 30% of the user population.

g) There will be one professional librarian to 200 students.

h) There will be three (3) assistant library staff to every one professional staff.

i) Bindery staff will be additional two (2) senior staff and twelve (12) junior.

j) Audio-visual will be additional two (2) senior and eight (8) junior staff.

k) Seating provision will be required for both junior and senior.

l) Library staff (75% junior, 25% senior).

m) The ultimate book capacity is 500,000 volumes.

n) The total assignable space is derived from application of the following space standards

(i) 1.2m^2 for each full time equivalent undergraduate students.

(ii) Ratio of 1:12 of the teaching staff of students

(iii) 2.5m^2 for each junior library staff.

(iv) 5m^2 for each graduate research students.

(v) 10m^2 for each professional library staff.

(vi) Allowance for an office space of 35m^2 for the Librarian and 25m^2 for Deputy librarian.

(vii) Assignable space for the bookstacks is based on the provision of 7m^2 for 1,000 volumes of books and periodicals on open access and 5m^2 for 1,000 volumes of items on closed access.

(viii) Space for the bindery/printing will be calculated at the professional library staff space standards of 10m^2 for each staff.

6.2 Schedule of Accommodation

Space	Area (m^2)
GROUND FLOOR	
Entrance Porch	
Vestible	100
Control Area	18
Exhibition	140
Public Catalogue	108
General reading without shelves	340
Public Toilets	72
Circulation Department	
Loans/Circulation desk	32
Circulation work room	100
Circulation Librarian	20
Clerks	15
Inter library loans/service office	16
Clerks	15
Reference Department	
General reference and bibliography	234
Reference librarian	35
6 Number of subject specialist/Librarian	156
Toilets	24
Journals and Current Periodicals	216
Photocopying room	81

Technical Services Department

Staff Entrance	18
Work room	72
Reprographic Facilities	90
First Aid	30
Staff Common Room	90
Bindery Work room	140
Office for the bindery chief	18
Serials preparation	120
Goods entrance	18
Trolley park	12
Collection development work room	124
Collection or accessioning development librarian	18
Cataloguing Unit	80
Chief Cataloguer	15
Service stair case and lobby	40
Books preservation	72
Head-Technical services	24

FIRST FLOOR

Library Administration Department

University Librarian	36
Secretary	18
Deputy Librarian	30
Secretary	15
Conference room	72
General Office	36

Store	24	
Staff Toilet	24	
Service Stair case	24	
Accounts Office	36	
Store	30	
Main Stairs and lobby	36	
3 numbers of Seminar rooms	180	
2 numbers of Group Study rooms	72	
Open access collection/reading I	2540	(350 stands)
2 typing carrels	36	
Toilets	24	
Audio-visual	172	
Open access collection/reading II	2540	(350 stands)

SECOND FLOOR

Reserved books	200	
Computer Terminals	100	
Open access collection/reading III	2540	(350 stands)
2 numbers of group study rooms	72	
Open access collection/reading IV		
Special collections	216	
Research development unit	54	
Toilets	24	
Store	24	
Special collection librarian	18	
Non-book Material room store	30	

6.3.0 The Design Report

6.3.1 Introduction

This chapter describes the procedures adopted in the design up to the final realisation of the design itself. It explains the systematic approach used in analysing and planning the library.

6.3.2 Broad Zoning of Activities

To be able to evolve a concept for the proposed design, major activities which will take place in the proposed library have been identified and zoned accordingly. Such zoning has been affected by noise, privacy, security and similarity of functions.

(a) Readers and Books

This is the main concern of the library building. It encompases all forms of learning, teaching, audio-visuals areas etc. The associated functions include, group study rooms, seminar rooms, typing carrels, exhibition areas, visual display rooms, open access reading and closed access reading areas.

(b) Technical Services

This area is concerned with the handling of the library material right from the time they are brought in up to the time they are ready for use.

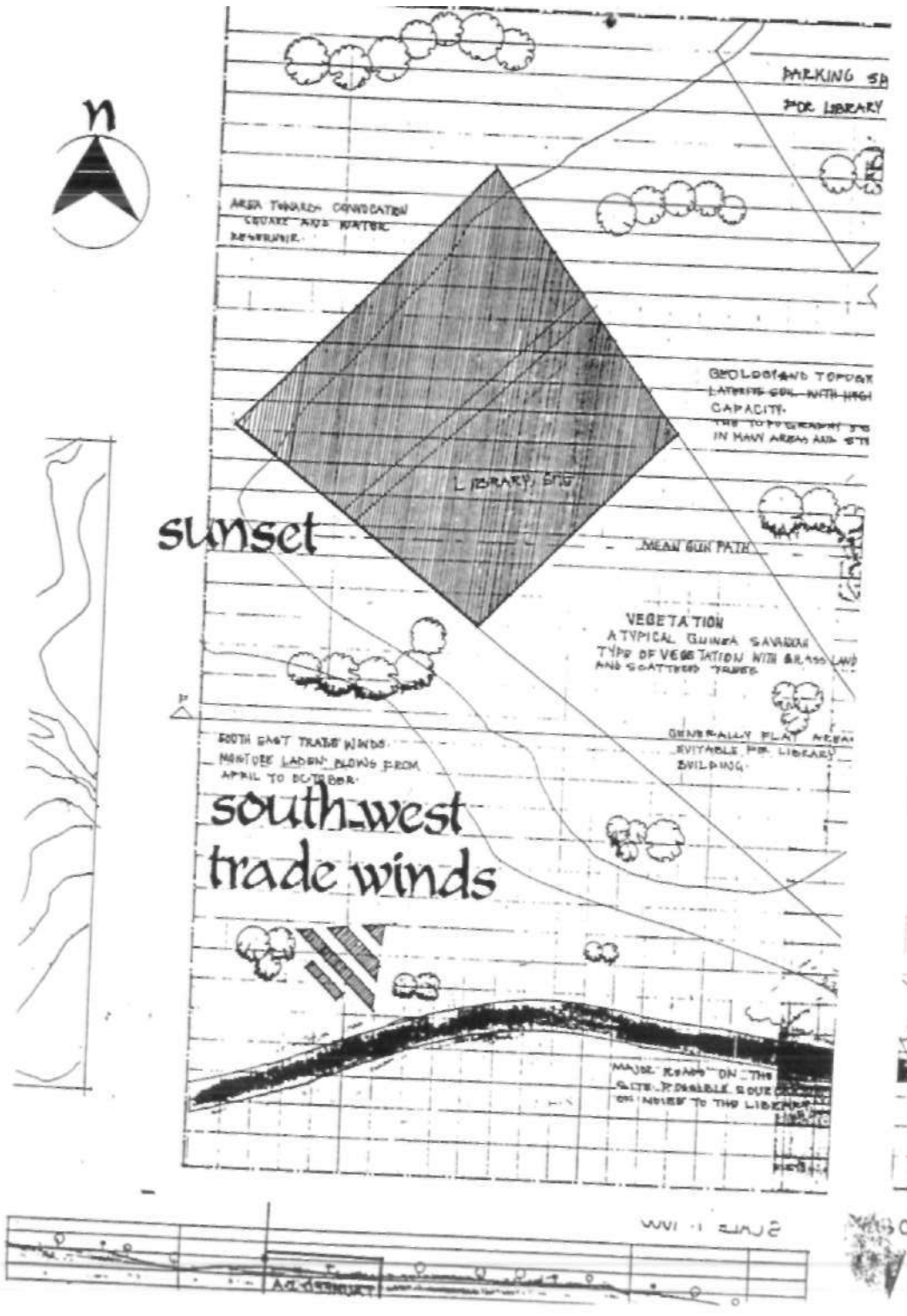

N
PARKING SPACE FOR LIBRARY
AREA THROUGH CONVOCATION SQUARE AND WATER RESERVOIR
GEOLOGICAL TOPOGRAPHY LATERITE SOIL WITH HIGH CAPACITY.
LIBRARY BLDG
MEAN SUN PATH
VEGETATION
A TYPICAL GUINEA SAVANNA TYPE OF VEGETATION WITH GRASS LAND AND SCATTERED TREES
GENERALLY FLAT AREA SUITABLE FOR LIBRARY BUILDING
SOUTH EAST TRADE WINDS
MONTHS LADEN WINDS FROM APRIL TO OCTOBER.
south-west trade winds
MAIN ROADS ON THE SITE IS ENABLE TO GIVE ACCESS ON NOISE TO THE LIBRARY
north-east trade winds
PARKING SPACE FOR LIBRARY
HIGH SPEED ROADS; DRY AND DUSTY HARMATTAN
SUNRISE
ROAD LEADING TO OTHER ADMIN AREA AND STUDENT HOSTELS, SPORTS STAFF
ENTRANCE ROAD FROM THE MAIN ROAD
SCALE 1: 1000

Fig 6.1

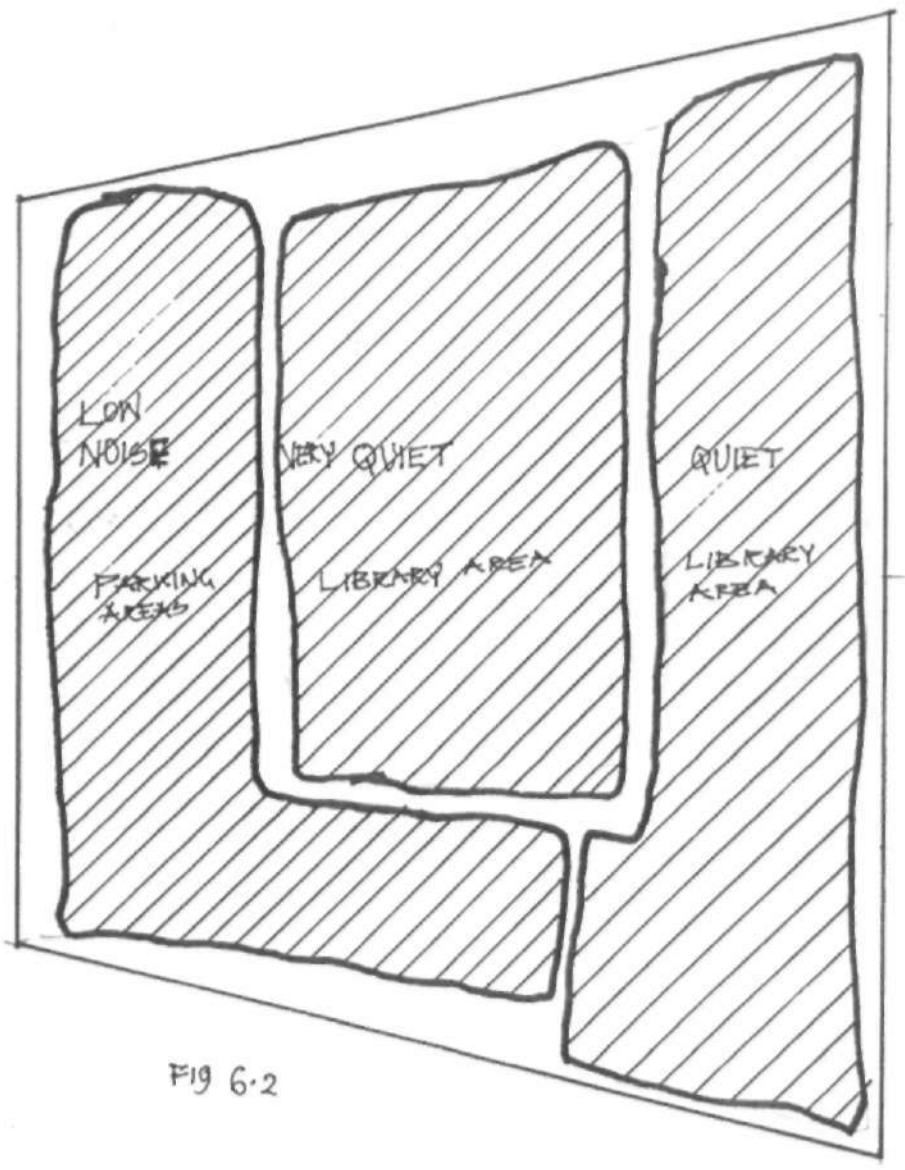


FIG 6.2

SITE ZONING

ZONING OF ACTIVITIES IS BASED ON NOISE AND ACCESSIBILITY TO THE BUILDING.
READ ON THE NEXT PAGE HOW THIS DEVELOPED INTO SITE STRUCTURE CONCEPT / SITE DEVELOPMENT CONCEPT.

(c) Recreation

This falls into the catagory of activities aimed at alleviating strain and fatigue in all works. It embrace outdoor [illegible] and viewing, relaxation areas chack bars and terraces for these activities.

Associated functions include collection development unit or acquisition, cataloguing, bindery, serials preparation and reprographic facilities, workshop and maintenance.

(d) Administration

The library administration is concerned with providing services to readers as well as supervision of the workers in the technical services. Associated functions include - lending of books, issuance of materials, on closed access to readers and assisting readers when needed, like the reference librarians and subject specialists.

6.3.3 Site Development Concept

This involves the zoning of the major functions identified above. Zoning of the functions on the site involves many functions.

In proposing a site development concept for this project, the factors which have been considered include effective circulation within the site, separation of noisy areas from less noisy areas. See fig. 6.1 (Site analysis).

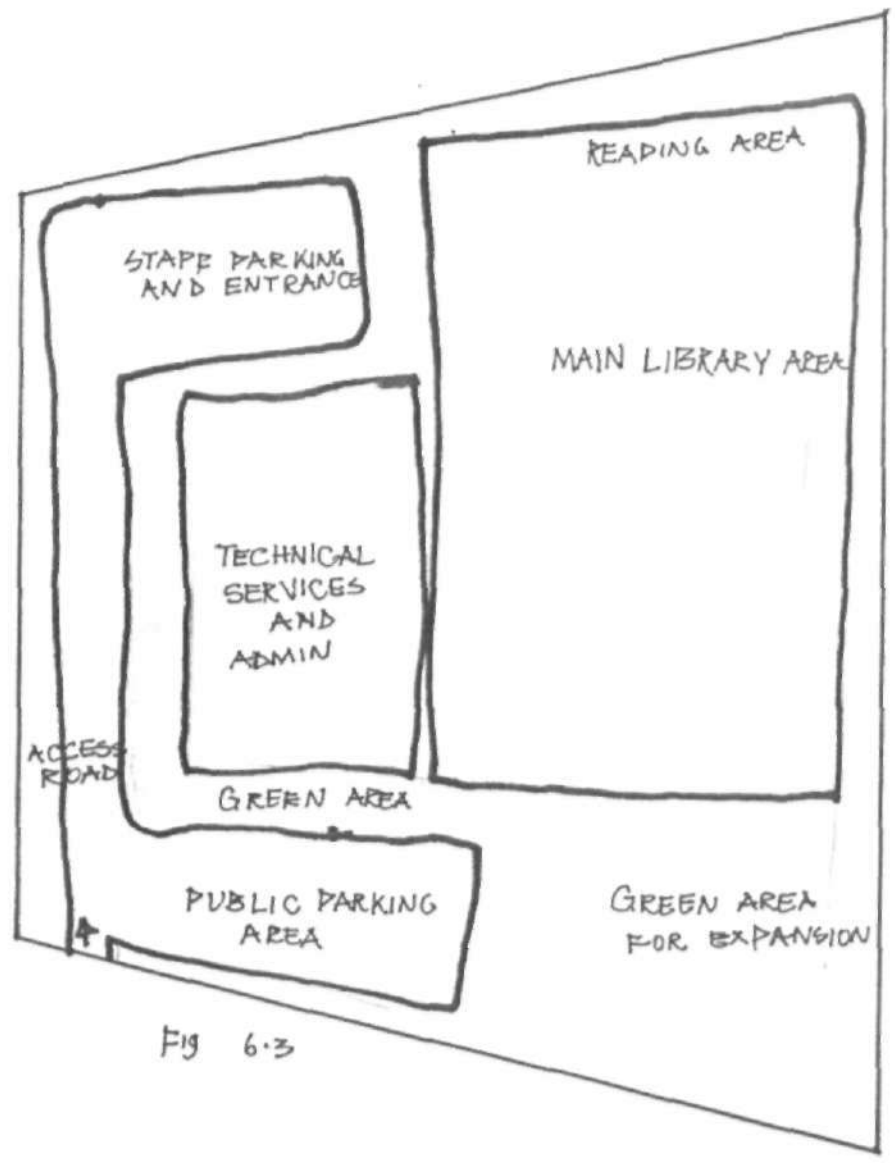


Fig 6.3

SITE DEVELOPMENT CONCEPT.

The development of the site concept finally adopted the solutions of the major problems analysed during the data collection which are those of the climate in the area. To enhance natural lighting and ventilation, courtyards are adopted. This will also limit other problems like humidity, thus cutting down the operational cost.

6.3.4 Design Concept of form

In congruous with the site analysis and site zoning, a concept of form and planning is created by the arrangement of respective functions in an articulate manner in harmony with the site.

Use of existing standard furniture forms to design an ultimate form is adopted, hence the rectangular form. The general idea behind the form adopted is to achieve the form of a reading table and a chair beside it. This can be seen - (fig. 6.2) that the rectangle at the centre represents the reading table and the two wings represent the chairs on the opposite sides of the chair. The advantages of this form can be enumerated as below.

(i) The rectangular form conforms with the philosophy of this study which is the modular system.

(ii) The spaces created by this form are easily adaptable to changing needs.

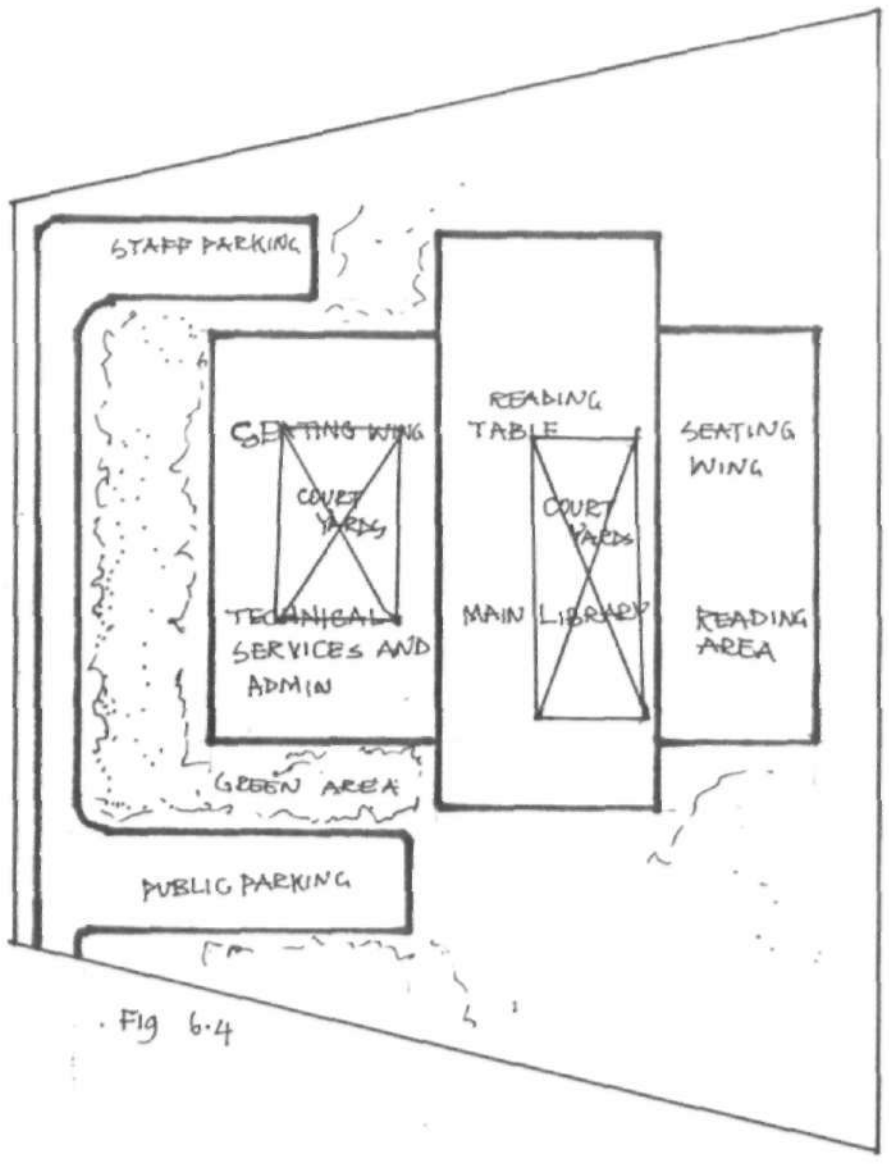


Fig 6.4

FORM CONCEPT.

THE IDEA BEHIND THE FORM CONCEPT IS TO ACHIEVE A FORM OF A READING TABLE AND CHAIRS BESIDE IT, ON PLAN. THIS CONFORMS WITH AND ADOPTS THE PHILOSOPHY THAT A LIBRARY IS A READING AREA. SEE THE NEXT PAGE FOR ITS MATURITY.

6.3.5 Concept of Planning

The general idea in planning is to achieve to a high extent that the building is as flexible as possible and to eliminate the problem of having a uniform grid which does not agree with certain functions in the library. The functions have been carefully studied and appropriate modular sizes have been recommended for them in chapter four which will be used in this design to achieve the goal of the design.

The functions which can remain in the same grid have been zoned according to such requirements. Fig. 6.3 shows the system of zoning and hence arriving at a final form as shown in fig 6.4. It can be clearly seen that the spaces needed by the technical services department and Administration areas are different from those of the stack and readers areas. This in turn follows that a system of modules which will suit each purpose will be used. This will be seen in the design proposal. The final outcome of this system is that two grid (bay) systems have been combined to evolve suitable and flexible working spaces without column interruption in useable spaces as found in many libraries.

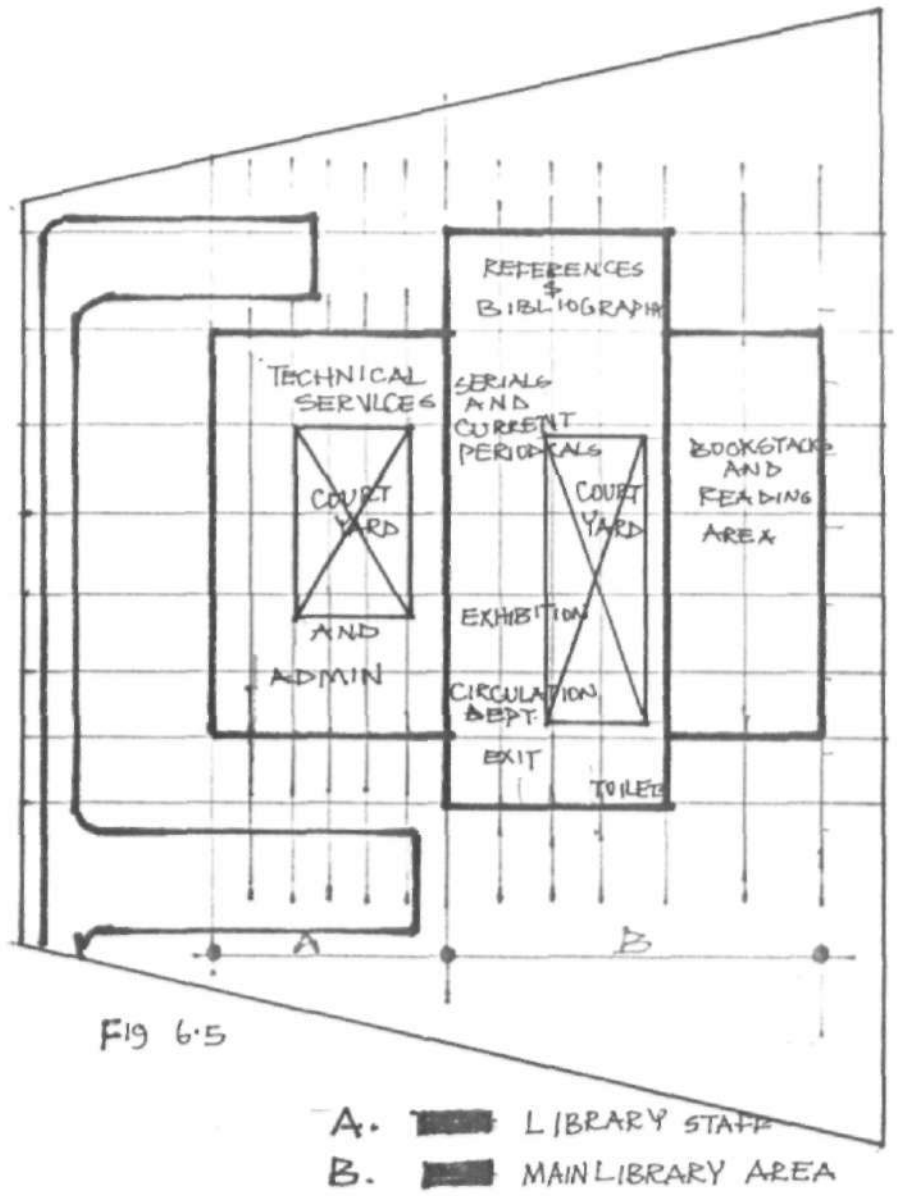


Fig 6.5

CONCEPT OF PLANNING.

- THE CHANGE IN THE SIZES OF GRID HAS ALREADY BEEN EXPLAINED IN THE TEXT.
- CLASSIFICATION OF FUNCTIONS IS THE KEY ROOT TO CHANGES IN MODULE SIZES

6.3.6 Detailed Plan Concept (Proposed)

Below is a table of various major functions and the module size adopted for each of them.

Floor	Function	Adopted Modular Size
Ground	Technical Services Dept.	5.4 x 7.2m
	Main Library (bookstacks, readers and Librarian) and exhibition	7.2 x 7.2m
First	Administration	5.4 x 7.2m
	Main library (bookstacks, readers and librarians)	7.2 x 7.2m
Second	Main Library area (books stacks, readers, librarians)	7.2 x 7.2m

Table 6.3

6.3.7 Modular Size and the Main Library Area (Solution Adopted)

The main library area consists of the exhibition hall, public catalogues, circulation department, reference and bibliographical department, serials and current periodicals department, open access and closed access stacks, readers areas, seminar rooms, non-book material store, audio-visuals, public toilets and stairs.

These require large areas and a bay size of 7.2m x 7.2m (square bay) is adopted for them. The square module is chosen because of its maximum flexibility especially in the bookstack areas, where stacks can be turned in

any direction as desired without extensive alteration. The reader areas are located at the periphery of the windows. The square module is also found to give the highest flexibility in reading areas. The 7.2m x 7.2m module is capable of holding many stacks and readers in it. It is also economical since the columns are wide apart and pose little or no structural problems if properly designed and constructed.

The table below also shows the proposed spacing of the stacks.

Proposed Module size	Sections between columns at 900mm standard	Ranges to a bay	Range spacing on Centres
7.2m x 7.2m	5	5	1.38m(4½')

Table 6.4

6.3.8 Modular Size and other Accommodations (Library Staff) (Solution adopted)

The other accommodations in the library that require suitable sized-bay include the technical services and Administration. These are mainly offices and work rooms which will require space without column interruption. The suitable and economical bay proposed is 5.4m x 7.2m. Double bay in the direction of 5.4m length gives a column free space enough for work rooms. A single bay is suitable for the University librarians office and general

office. The detailed arrangement can be seen in the proposed design.

6.4 General Design Parameters

In an attempt to propose successful design, certain laid down guides must be observed. Such guides include fire precaution measures, accessibility, comfort security, organization, flexibility, Extendibility. The above basic factors will be discussed in detail.

(a) Fire Precaution Measures

Although library buildings are rated among the lowest in terms of fire disaster, it is necessary to adopt the precautionary measures. The following are some of such measures that have been considered.

(i) Prevention of fire spread from one space to another by compartmentation; use of fire resisting door which are self-closing and minimising openings at property boundaries.

(ii) Location of water hydrants in certain areas that donot house books, since the use of water may be more disastrous to books.

(iii) Use of fire resisting materials for walls, roofs and floors.

(iv) Provision of escape external staircases in an average working distance of 30m.

(v) Adequate spacing between stacks to control spread of fire within the building.

(vi) Proper roof separation to control the spread.

(vii) Use of warning alarm bells and fire lights for escape routes and entrances or exit.

(b) Security

In the early age of library evolution, the library collections were chained to the shelves to protect them being stolen. Today, libraries encourage public use of their treasure of knowledge by having open access collections. The printed pages, the film and the manuscript are taken for granted and all too often taken for "free".

Because of the difficulty in collecting reference materials, and the attitude of the reading public to these materials, the library must jealously guard its collections and consolidate their protective measures. To this effect certain measures must be adopted in the design stage to minimise if not eliminate the habit. These measures include:

(i) Windows should be designed with suitable theft proof materials to prevent readers from pilfering library materials through them to the outside.

(ii) Open and window should be designed with certain set backs.

(iii) The public entrance should have control area where books are checked before allowing the readers out.

(iv) Provision of modern automatic security devices.

(c) Accessibility

Movement of staff and readers should clear from the exterior into the building and from the entrance to all parts of the building, with an easy comprehensive plan needing minimum supplementary directions.

(d) Extendibility

Library buildings should be planned with eye for future growth allowance must be made for extensions either on the adjoining ground or upwards.

(e) Comfort

This is a major aim in design and is achieved by compromising all enviornmental forces. This can be achieved through ensuring adequate cross ventilation, damping excess heat in the interior. Maximum comfort means high efficiency of use. This is achieved in the proposal by adopting the following methods.

(i) Orientation of the building: By exposing the smaller surface area of the building east-west, direction, thereby minimising solar heat gain by the building.

(ii) Use of court yards: This promotes high cross-ventilation in all parts of the building.

(f) Flexibility

Flexibility is of primes importance in every University library building. A flexible building is one which permits inter-change of use without structural revision: the stack for instance, can be used to accommodate readers and the reading area to house stacks.

(g) Organisation

A principal quality or function of a library building is to permit the display of library materials in such a way that they are accessible and easily available. The layout should be simple and easy to follow.

(h) The library building should be economical to build and to maintain with minimum resources both in finance and staff.

(i) Compactness

Library buildings should be as compact as possible. A cube has been found to be the ideal shape for library building as far as compactness is concerned. Books, readers and staff have shorter distance to travel in a cube. However, in the proposed design a rectangle is adopted to eliminate deep planning.

C.5 Functional Requirements of the Library

(a) Approach to the Library

A direct walk way leading from the main road going into students' hostels and schools into the entrance of library is designed. This makes the reader without a car the most important person, followed by car owners who are made to park some metres away from the approach and take the same walk way into the building.

At the entrance provision for bags to be deposited is therefore before entering the main hall.

(b) Reception Hall

The reception hall here comprises the exhibition hall, control desk, public catalogue area, circulation desk area, browsing area. These functions have been located here because of relatedness in function and service to the readers. The control desk is located near the entrance to act as check points on the readers. The loans desk is located in such away that it is close to the entrance and easily visible by loaners. The staircases leading to upper floors is located such that a reader has to pass through the exhibition in the same process browsing through the exhibited materials. The staircaes is also located such that it directly visible at the entrance to the readers. To ensure effective supervision and grouping of activities, offices for the circulation librarian, inter-library services have been close to the loans desk.

(c) Catalogue Area

This is grouped together with the control area, browsing area and loan area. This has been located near the entrance and easily accessible by readers. Readers can go to the reference areas from here or go to the upper floors.

(d) General Reference and Bibliography

These have been grouped together. Enquiries will be Handled by reference librarian and subject specialist librarians whose offices are in the reference area. The location of this area from the entrance and main hall is direct. Since bibliographical materials will be required by staff in the technical service, the collection has been placed as close as possible.

(e) Serials and Current Periodicals

Current periodicals, newspapers are grouped together. if is desirable to have current periodicals and newspapers displayed near the bound volumes. These area has been located to have direct access to the serials preparation.

(f) General Reading without shelves

A general reading room where shelves are not provided is placed at the far right hand end of the entrance. An extension of the reading area is made into the well landscaped courtyards. The courtyard is accessible by stepping down into the open space, which is glazed and screened from

possible noise from the entrance. It is located such that it is at the lower level of 600mm below the exhibition space.

(g) Photocopy

This is provided at the right hand of the entrance hall to serve the entire library users.

(h) Toilets

These have been provided for both male and female on the ground and first floors. Because of the bad odour from the toilets, they have located such that their windows open to the outside directly and lobbies which will accommodate the wash hand basins separate them from the main hall.

(I) Technical Services Department

(i) Goods entrance

This has benn located at the side where access road leads directly to the staff parking. Goods are delidevered here and taken in to collection area.

(ii) Despatch and delivery

Unpacking and preliminary sorting is done here. All receipts are recorded and materials checked against order. This has been located close to the cataloguing department.

(iii) Cataloguing Unit

All new acquisitions from collection development unit are received here for cataloguing i.e materials are classified and entered into catalogues. Provision has been made for 5,000 volumes, six staff and chief cataloguer's office.

(iv) Bindering/Printing Unit

This division handles all book binding for the University. Because of noise from the heavy machines in this area, it is located away from the reading areas, and close to the delivery entrance where binding materials can easily be delivered.

(v) Book Preservation

This is an air tight room with one window and built in shelves where books are fumigated. It has been located away from the public areas and close to the delivery entrance for its service.

(vi) Serials Preparation

This is an enclosure where serial materials are prepared for binding. This has been located close to serials room and having direct access to serials store and current periodicals.

J. (i) Readers and Books

This is the main library area and is the most important part. The reading areas have been placed together with books on open access which carries 80% of the total allocated area for books and readers, 20% for limited

access.

(ii) Shelving Area

Provision has been made for an optimum shelving space for 500,000 volumes at $7m^2$ per 1,000 volumes on open access and $5m^2$ per 1,000 volumes on closed access.

(iii) Reading Area

Reading accommodation is required for 1,500 readers which consistitute 30% of the projected students population. This includes the study carrels and informal reading areas like the roof top and open courtyards.

(iv) Special Collections

This include Government documents, theses, archieves, restricted or confidential materials like patents standards, research papers and lecture series and collections of publications. This section has been located on second floor (last floor) and is under tight supervision.

(v) Reserved Books Area

Space will be required to house books that is high demand and lend them to readers on hourly basis. Reserved books must not be taken out; therefore a provision of reading space for 100 students is made on the second floor.

(vi) Postgraduate Section

Because of the nature of the postgraduate studies which may sometime not conform with undergraduate studies, special reading area for postgraduates only has been made

with a capacity of 150 students on the first floor.

(vii)Research Development Unit

This area has been kept away from reading areas and provided with sound proof carrels for school members and research scholars with enough space for 10 readers.

(viii) Lecture, Seminar and Tutorial Rooms

Each room is capable of accommodating 40 students and have spread on the floor where different uses can be done at a time. They have been located so that they are easily accessible from the staircase.

(ix) Roof top

This has been considered for outdoor expansion during certain months of the year. By the provision of a hand-rail set back, safety of users and books is preserved. They type of activity that will take place here include, soft musical presentations, art exhibitions, informal reading area for 40 readers. The roof top is well landscaped for attraction.

(x) Courtyard

The courtyard within the main library area has been well landscaped for the purpose of outdoor reading. The courtyard may serve the purpose of exhibition when expansion is required.

6.6 Fut re Expansion

The provision for future expansion has been two directions - in the vertical and horizontal direction.

In case of vertical expansion, the roof top can be properly roofed and converted into a more useful space if the need arises.

The site plan has been done such that there is room for expansion in the main library sides as indicated on the site plan.

6.7 Materials and Finishes

(i) Floors

Floor finishes comprise of concrete paving in the courtyards, terrazzo finishing along the main circulations including the exhibition area. Polyvinyl floor tiles are specified for interior of offices while the audio-visual and reading areas are finished with padded floor tiles for acoustic purposes, and granolithic finish for the workshop to withstand impact.

All exposed concrete surfaces are finished with asphalt tanking with a coating of alminium flashing.

Circulation routes round the rite is of concrete paving.

(ii) Walls and Columns

The main structural elements are columns which are in reinforced concrete finished with cement plaster and rendered in emulsion paint to desired colour. The non-

structural walls are concrete blocks for the external walls and certain internal areas which are also finished in the same way as the columns. All windows are aluminium horizontal sliding type for the offices and projected windows for the reading areas. All doors for offices are formica finished plywood flush doors. Other doors like the entrance doors are aluminium framed doubled action doors. Roller shutter doors are used for the storage areas.

(iii) Roof

The roofing material is the long span aluminium roofing sheet, double-pitched because of the wide width of the covering areas. For simplicity of roofing, divisions into parts were done. The roofing members are timber wood.

The roof top is exposed concrete for the activities on the roof top. The roofing of the roof top bar is done using long span aluminium on space frames.

6.8 Landscape

The importance of landscape in modern architecture cannot be over-emphasised.

Landscape elements are used not only around the site and building but they also extend to reading areas indoor and outdoor. The roof top is landscaped to serve as a

exesthet c elements of the design.

6.9 Site Layout

The layout of site is done in such away as to give room for future expansion which was mentioned earlier that can take place both vertically and horizontally.

Access to the building is done such that a direct walkway leads the user into the main entrance of the building. The car owners are also led to the same entrance on tthe same walkway after parking their cars infront of the building.

The orientation of the building is done such that the shorter length is exposed east-west. This reduces heat gain by the building.

6.10 Conclusion

The fact that libraries serve as store houses for knowledge and the challenge its effective planning poses to the architect has been the basis of this work. The work does not portray itself as a perfect solution to the defined problem, and therefore should be seen as a move towards tackling the problem.

It is therefore hoped that future researchers in this direction will seek to bring out unattended aspects and positively improve on them or entirely bring up alternative solutions which further consolidate in solving the problem.

It is the hope of the researcher that future researchers will see this piece of work useful in finding information.

T.I. Alhaji

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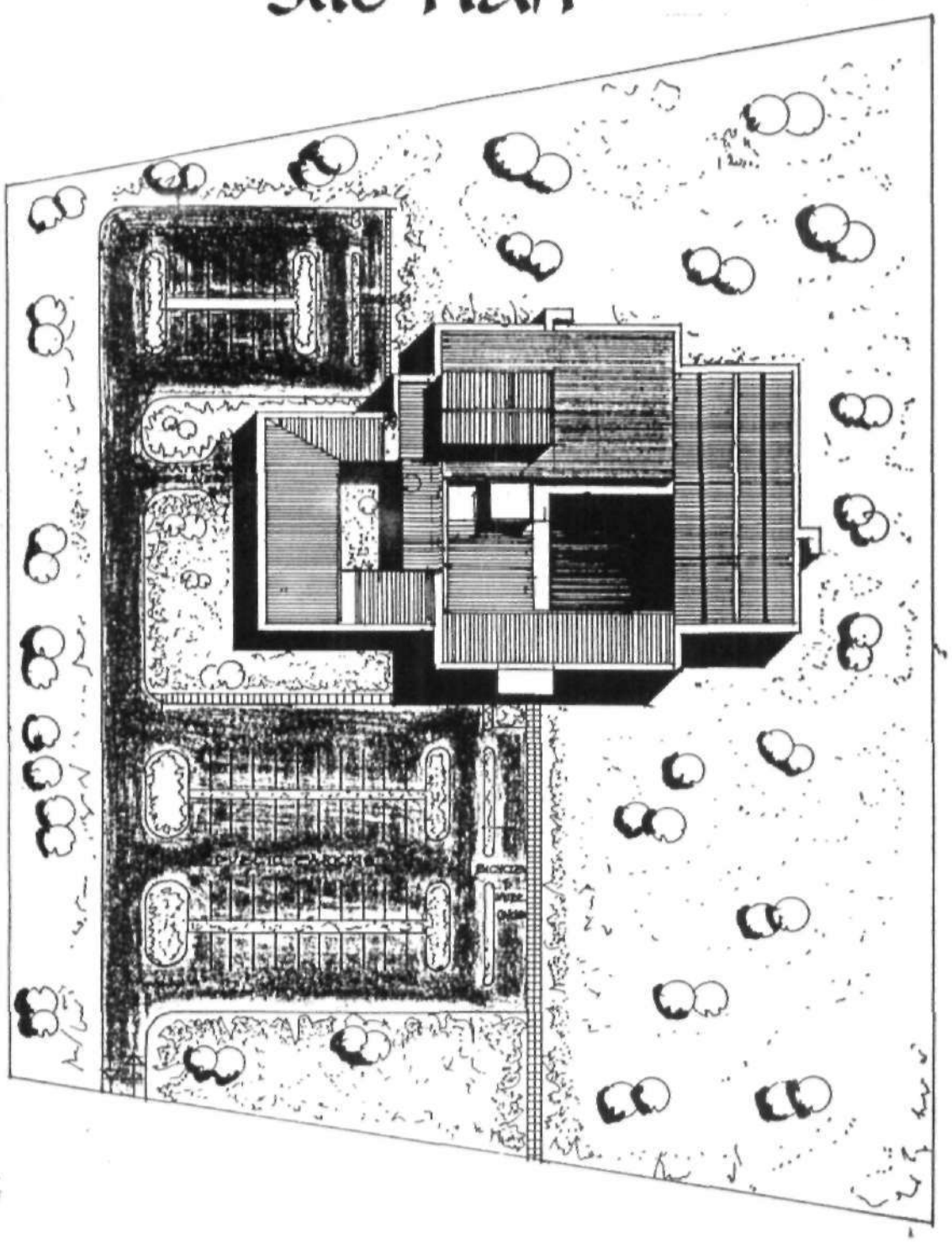
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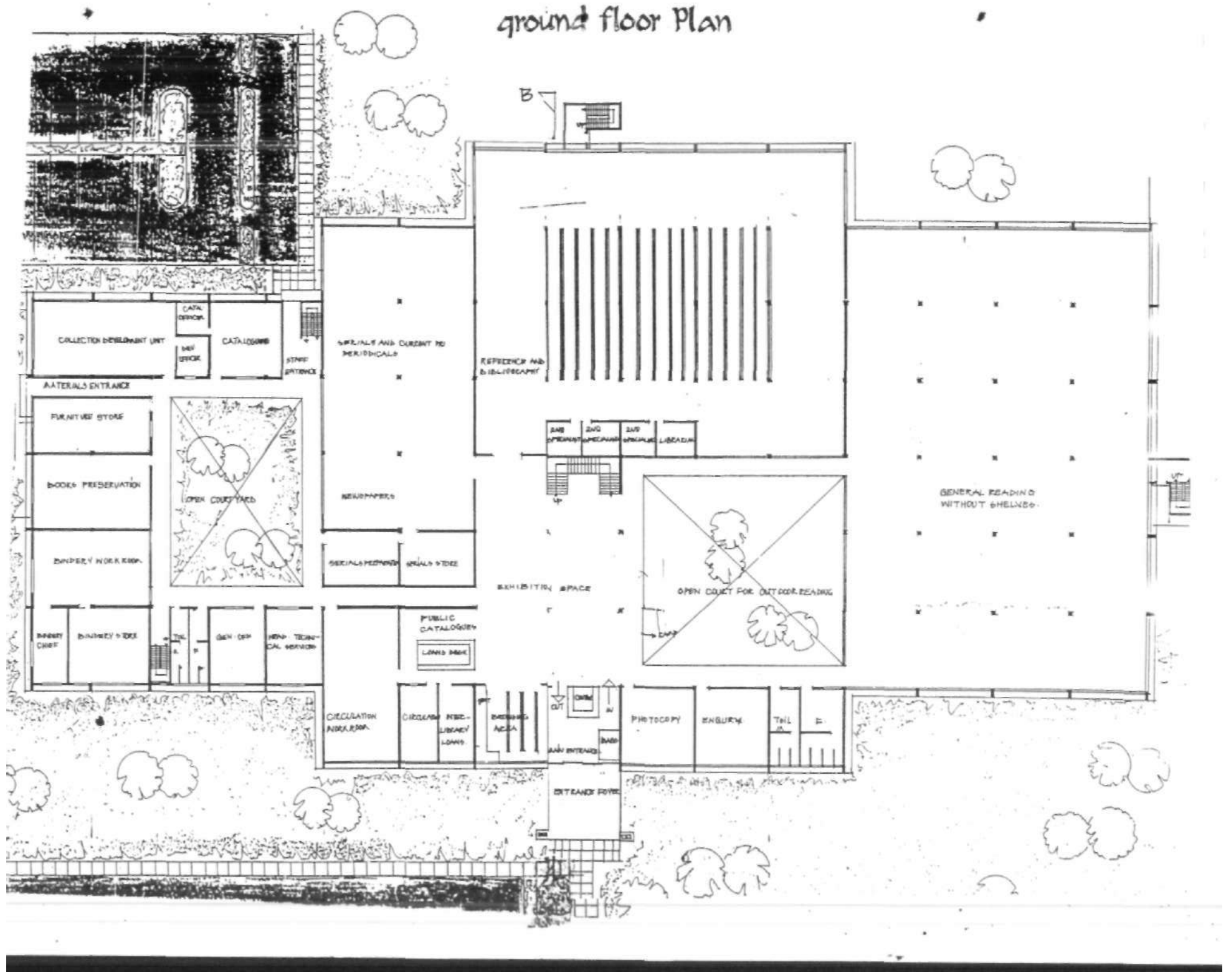
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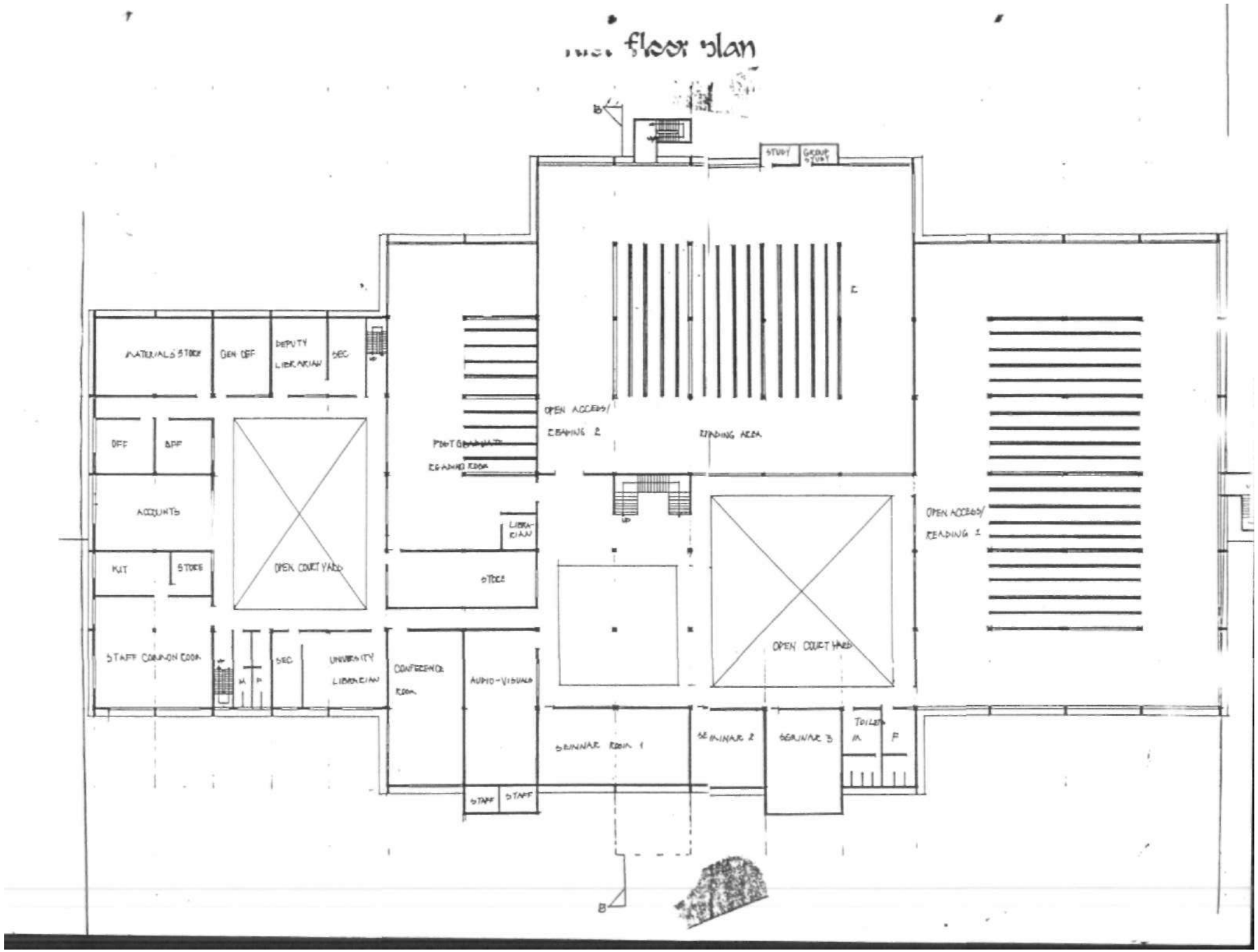
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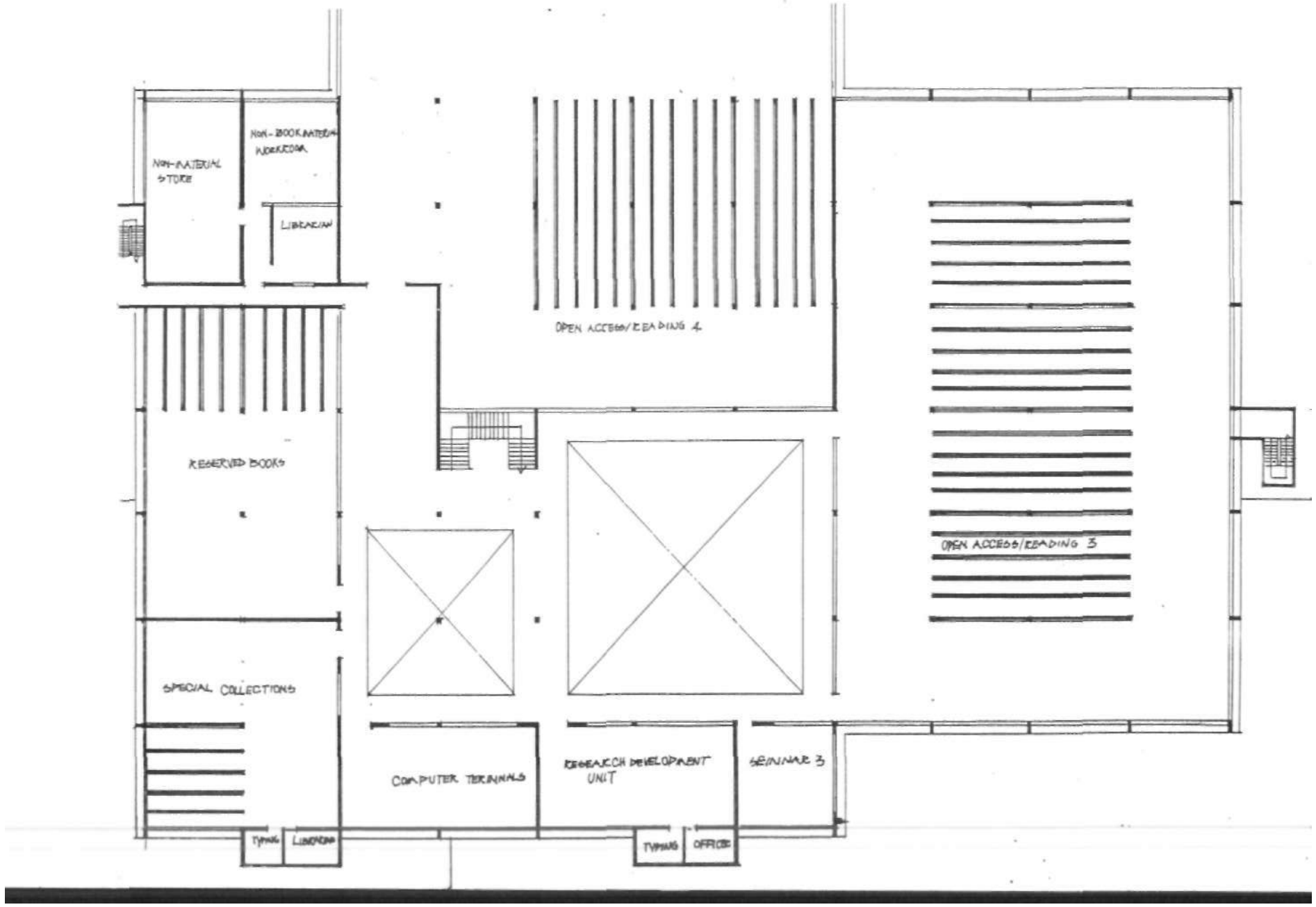


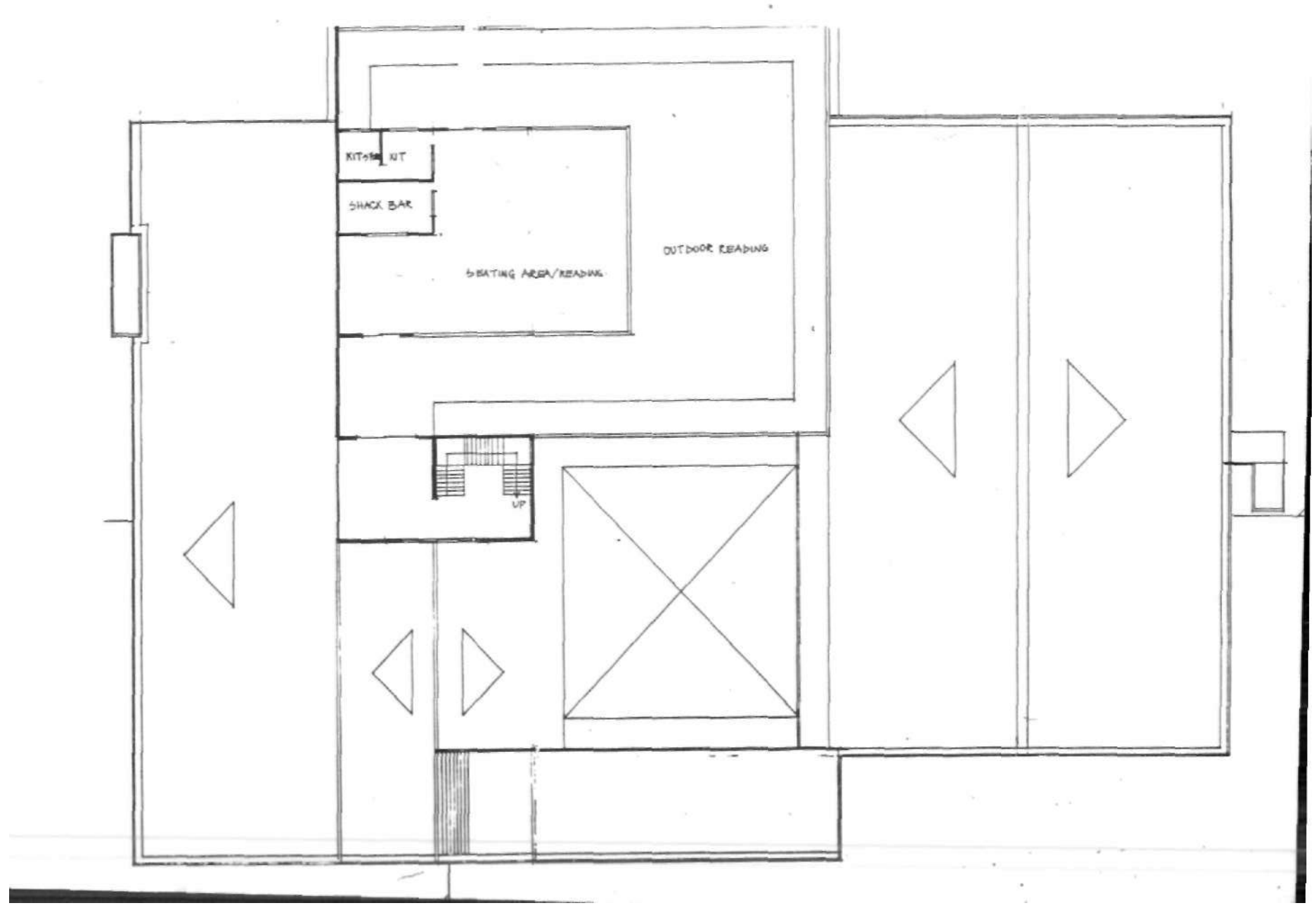
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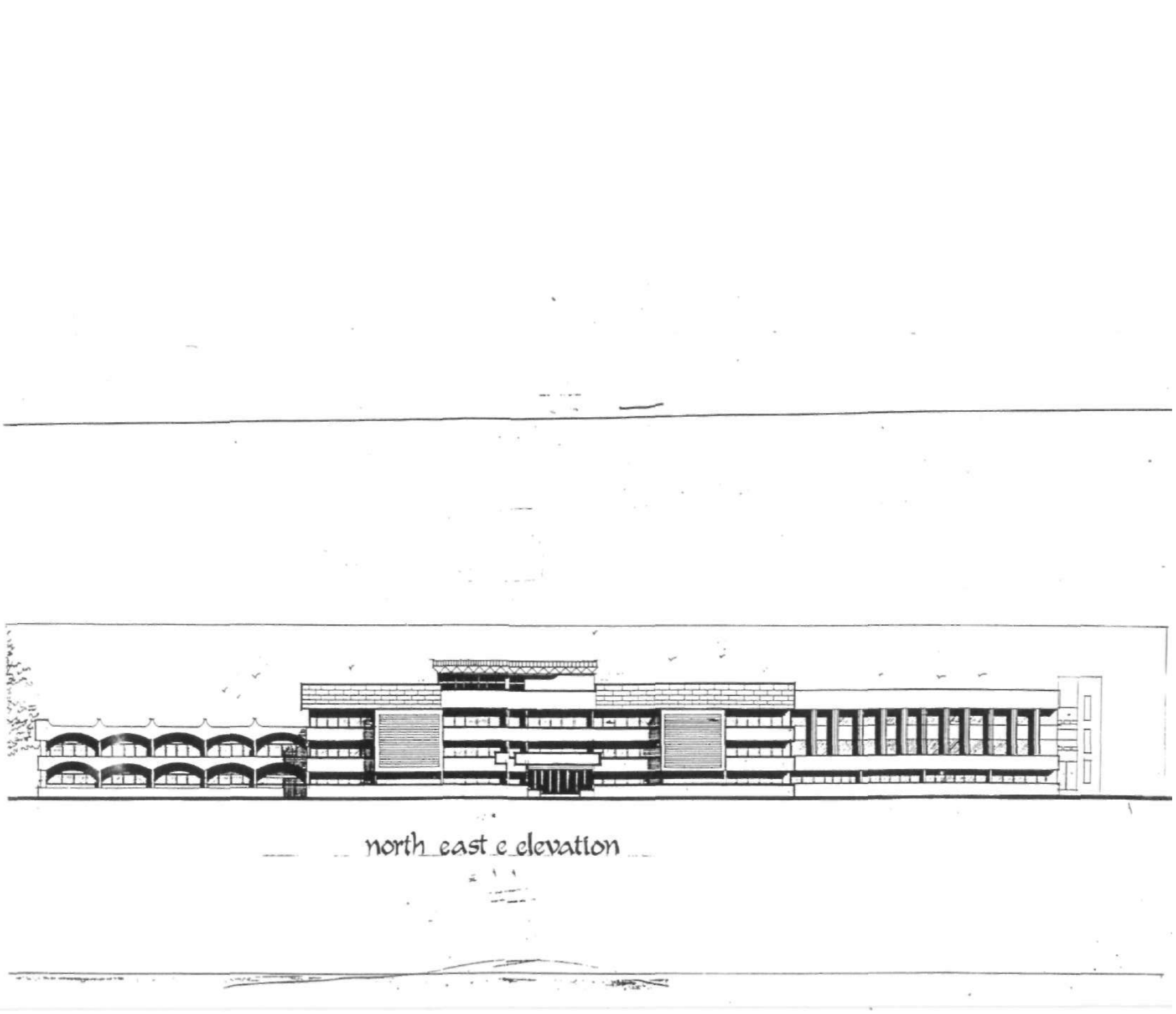


first floor plan

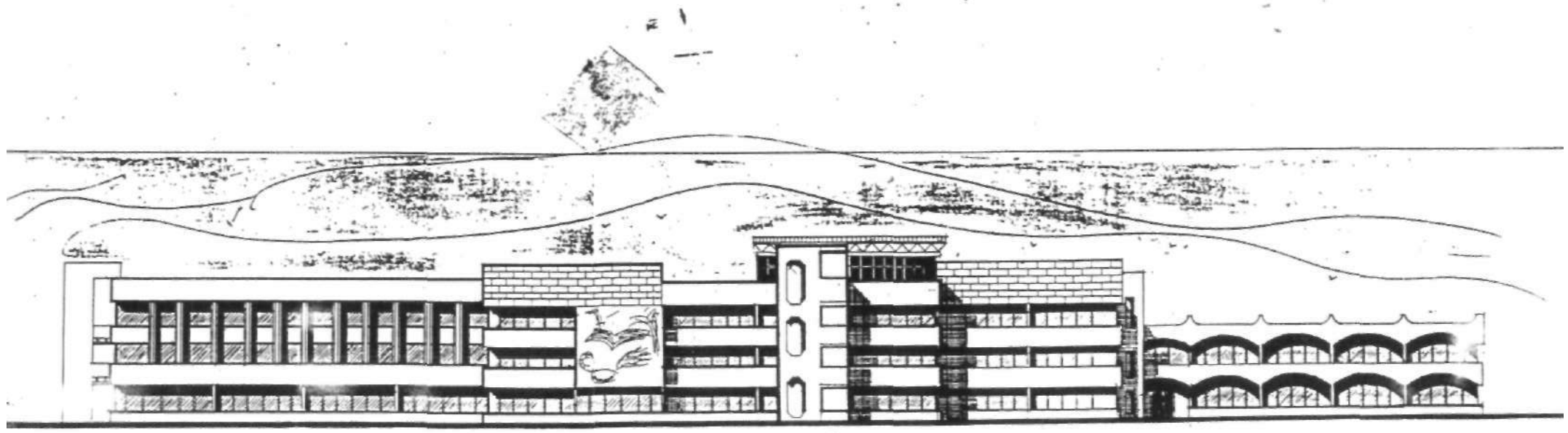



NON-MATERIAL STORE
NON-BOOK MATERIAL WORKROOM
LIBRARIAN
OPEN ACCESS/READING 4
RESERVED BOOKS
OPEN ACCESS/READING 3
SPECIAL COLLECTIONS
COMPUTER TERMINALS
RESEARCH DEVELOPMENT UNIT
SEMINAR 3
TYPING
LIBRARIAN
TYPING
OFFICE


KITCHEN
SHACK BAR
SEATING AREA/READING
OUTDOOR READING
UP

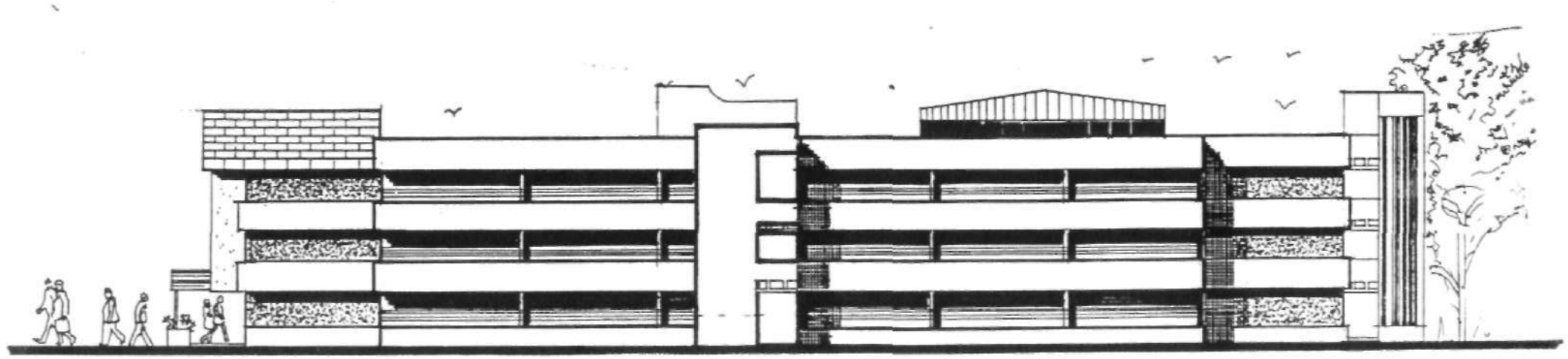


north east e elevation

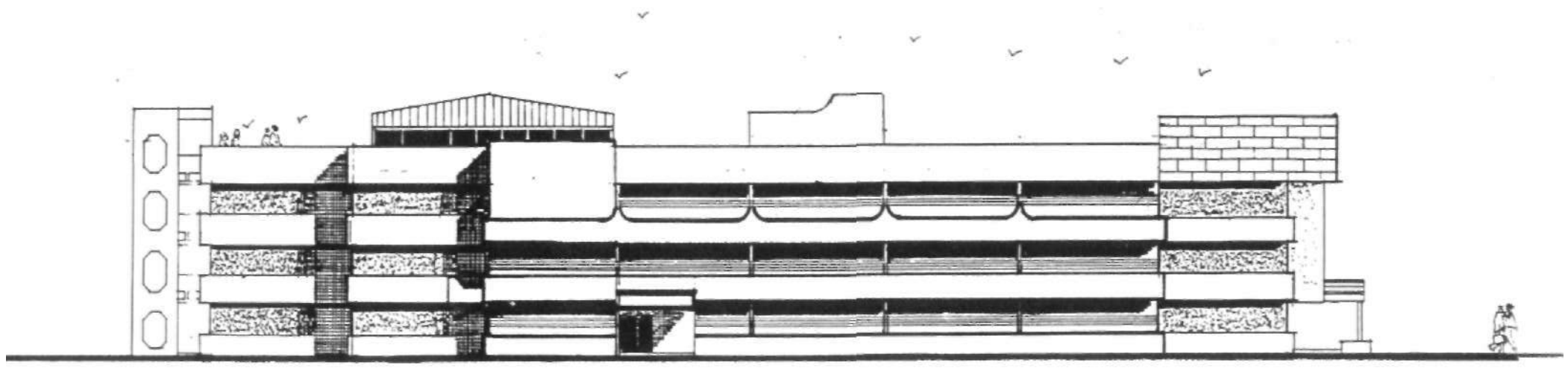


south west elevation

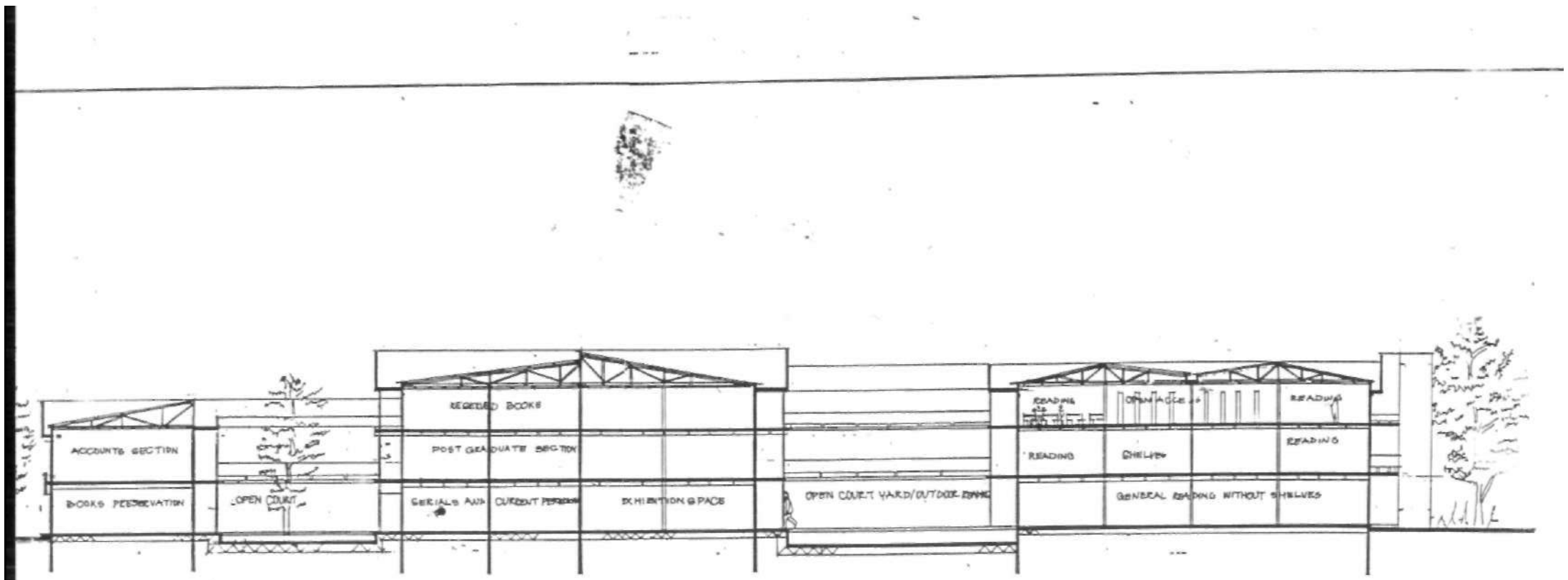
f.n.t minna library



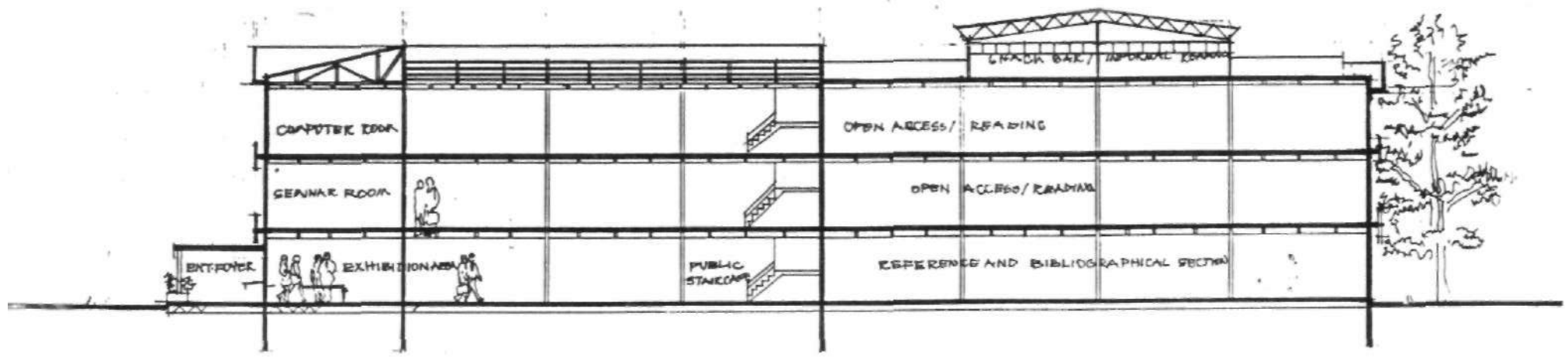
north west elevation



south east elevation


ACCOUNTS SECTION
BOOKS PRESERVATION
OPEN COURT
REGISTERED BOOKS
POST GRADUATE SECTION
SERIALS AND CURRENT PERIODICALS
EXHIBITION SPACE
OPEN COURT YARD/OUTDOOR SEATING
READING
SHELVES
READING
READING
GENERAL READING WITHOUT SHELVES

section a-a


COMPUTER ROOM
SEMINAR ROOM
EXT. FOYER
EXHIBITION AREA
PUBLIC STAIRCASE
OPEN ACCESS/ READING
OPEN ACCESS/ READING
REFERENCE AND BIBLIOGRAPHICAL SECTION

section b-b

