THE UNIVERSITY PLACE FOR ASSEMBLIES.
(AHMADU BELLO UNIVERSITY ZARIA).

A Thesis

Presented to the Department of Architecture, Faculty of Environmental Design, Ahmadu Bello University, Zaria in partial fulfillment of the requirements for the degree of Master of Science in Architecture, - M.Sc. (Arch.).

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VOLUME II.

SKETCHES AND WORKING DRAWINGS.

- A B S T R A C T -

THESIS TOPIC:

The University place for assemblies, (Ahmadu Bello University, Zaria.)

GOALS & OBJECTIVES:

(i) Establishment of a permanent nucleus on the main campus for some of the many social, recreational, educational and cultural activities of the University Community, and possibly the Zaria-Kaduna catchement-area.

(ii) Provision of a new way of life for the University inhabitants to enable them enjoy creatively, the coming opportunities for leisure and for individual self realisation, with the assumption that extra - academic University life is desirable and exciting - an assumption shared by an appreciable proportion of the human race.

(iii) To promote further, person to person contact and communication on a grand scale outside the lecture rooms with the

belief that intelect can further be stimulated through social interaction and appreciation.

THESIS SCOPE: The place for assemblies is proposed as a unique venue for large formal and informal assemblies within the University campus. Its primary constituents are

(i) an auditorium bowl, capacity 1,800 seats with a flexible drum revolve open stage.

(ii) an amphitheatre, capacity 2,500 seats, while the Secondary constituents include,

(1) Restaurant/Coffee bar and kitchen.

(2) Exhibition Foyers and Spacious Lobbies.

(iii) Back stage facilities - dressing rooms with showers and toilets attached, cast assembly rooms, practise studio, a green room, admin. offices, scenery docks, scenery shop and stores, a large workshop, costume shop, male and female wardrobes.

(iv) Technical - projection room, light control room, sound control room, mechanical and electrical plant rooms.

(v) Outdoor utilities - open air kiosks/snack bars to serve amphitheatre, ornamental gardens, landscaped courts with reflective pools.

SPONSORS AND MANAGEMENT:

It is assumed that

(i) the project will be financed by the University through money appropriated by the University Council or possibly by a grant from the Federal Government.

(ii) The facility will be managed by the University Administration for the benefit of the University Community (students and staff) and the entire public.

USERS:

The facility will be used by the University Community and other external bodies, as may be decided by the management.

COMMUNITY ROLE OF THE FACILITY:

A University place for assembly will definitly play a role in the development of the academic community. This role is one of influence and importance, the presence of a well designed structure can become a symbol of local pride and progress. Events and attractions in the assembly complex can make the University a better place to live in. Besides, as an audience support facility. The University place for assemblies can relate to local goals and objectives in many ways and with proper management can serve as a focal point for many developments, as well as a revenue generating organ.

D E D I C A T I O N

This Thesis is with gratitude to God, dedicated as a small token of appreciation, to:
Daddy, Mummy, Yomi, Omobolade, Iyabo, Renike and Segun, who provided the unqualified financial resource and unlimited moral support that carried me this far and who up-to-date, constitute my most cherished asset.

A C K N O W L E D G E M E N T.

At the completion of a study programme, one is obviously indebted to quite a number of people for one reason or the other.

I haven't been any exception in this respect.

My indebtedness extends to:

(1) all those with whom I exchanged ideas on this thesis, especially:

- Prof. E.A. Adeyemi; whose personal alchemy and words of encouragement gave me the confidence to carry on, even in the face of defeat.
- Dr. F.W. Schwerdtfeger; cordinator, life project.
- Dr. (Mrs). M.G. Hajnosz, my understanding supervisor.
- Dr. A. Ikomi)) Thesis Cordinators
- Arc. Shim Adesina)
- The Entire staff of the Ahmadu Bello University, Department of Arch. for accomodating me through out the five trying years of study. I pray I do not disappoint you.

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- Wande Shonekan.
- Papa Roger Assadugu Rufus.
- Samuel N. Kama.
- Oliver Tonye Braide
- Kola Olusola
- Adekunle Thomas
- Olubumi Isimi

The lengthy period we spent together under the academic tension, watching the day break and the night fall, will be remembered for a long while.

(3) my junior colleagues who in one way or another assisted to make the completion of my thesis all but impossible, specifically;

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B.Sc. II Class:

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B.Sc. I Class:

- Omolara Oyesiku.

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(5) Mr. Stan Kawka; Head, University Project Office, and Mr. K Chanana of the University Project Office.

(6) The entire staff A.B.U. Development Office.

(7) The management of University of Ife, and University of Lagos Theatres/Auditoria, Mr. S.O. Williams; National Theatre, Lagos.

(8) Prof. & Mrs. I.S. Audu, Vice-Chancellor, A.B.U. Zaria, 1967-1975 who personally housed me during my formative years in this University.

(9) all those others too numerous to be listed here, but to whom I am no less indebted.

Lastly, while I admit that it's a matter of professional habit, for a scholar to record his sources of information, I also appreciate that instances do occur, when one is best served by ideas of others which he is least conscious of having absorbed.
Thus, if anywhere in this dissertation, I have failed to acknowledge any borrowing, this must be my excuse.

P R E A M B L E.

If Universities as we know them today, are to live up to expectation as citadels of learning, provision must be made for such extra-academic facilities that additionally stimulate intelect and promote person to person interaction, - Theatres, Sports, Culture etc.

The proposed University place for assemblies is aimed at providing a unique venue on the main campus for cultural worships, conventions, musical concerts, modern drama, exhibitions, matriculation, convocation and other large University gatherings-formal and informal. Basically it is intended as a place that meets the assembly needs of the University. Its components have been outlined in some of the preceeding pages, c.f. Abstract.

This Thesis addresses itself to studies of the design problems of a packed house and assembly processes and attempts to give a physical interpretation in terms of a design proposal for Ahmadu Bello University, Zaria.

No attempt is herein, intended to suggest specific solutions to the architectural problems of designing a University Assembly facility- Theatres or Amphitheatres. Detail and quantification can only be developed in response to the individual requirements of a particular University. Besides, as a facility which by its very nature is expected to permit the widest possible variety of expression and use, it would be ridiculous to expect to find a single ideal answer to the problem of providing a conducive architectural environment, and it would be rather dogmatic to attempt to lay down the law as to what constitutes an ideal University Assembly facility.

It is the author's hope that the general subjects discussed herein, will serve to give such facility planners a good insight to some of the considerations that must be resolved.

A.G. BIXIEE IMANA.

AHMADU BELLO UNIVERSITY
ZARIA.

MAY 1980.

P A R T I.

THE AHMADU BELLO UNIVERSITY ZARIA.

I.1 - Historical Background.

I.2 - Location.

I.3 - Climate.

I.4 - Population analysis and land use.

I.5 - Existing assembly facilities.

EPIGRAPH:

"There shall be in Northern Nigeria, a University to be known as Ahmadu Bello University...."

- Those words of A.B.U. law of Northern Nigeria legislature of October 4th, 1962, concieved the nucleus of the present citadel of learning in Zaria, which today has grown into the largest University Complex in Africa (Sub Sahara).

I.1 HISTORICAL BACKGROUND.

Founded in 1962 and named after the late Alhaji Sir, Ahmadu Bello (1910-1966), Sardauna of Sokoto and former premier of Northern Nigeria. The Ahmadu Bello University Zaria, inherited its present site and a few buildings from the Nigerian College of Arts, Science and Technology which had been founded in 1952.

At the time when the pioneer students of the University numbering 400 registered in 1962, it was expected that there would be about 1,200 undergraduates by 1968, and that the whole student population would eventually reach 4,000 to 5,000 by the end of the following decade, i.e. the seventies.

By 1979, the student population had escalated to almost 14,000 with more than 8,000 students concentrated within the main campus alone. The most up - to - date statistical data in print, reveals that by 1979, there were 2,329 senior staff and 9,670 intermediate and junior staff working in different arms of the University. From these figures it is glaringly obvious that the University has experienced a rapid paced growth since its inception, possibly because of its special faculties coupled with its location in the Northern part of Nigeria wherein it stands as the premier University.

I.2: LOCATION.

Zaria town is situated at a latitude of $10^{o}10'$ North and Longitude $7^{o}30'$ East, being almost centrally located in the Northern part of Nigeria. It is well connected to other parts of the country by air and rail services and a net work of good roads.

Relative to other cities in the North of Nigeria, Zaria is 78km from Kaduna, 176km from Kano, 240km from Jos and 387km from Sokoto.

The University main campus is situated in Samaru, which is 15km from the old Zaria City, see fig. I.2:2.

Some other arms of the University - The Institute of Agricultural Research and the new Teaching Hospital are situated in adjacent areas along the Zaria - Sokoto highway.

Topography.

The main campus lies on an elevated plain at an altitude of 670m above mean sea level. This gradually slope's down towards Kubani river at which end the sloping plain is cut by numerous valleys and streams which are generally widely spaced with ungullied banks and marshy alluviated beds. See fig. I.2:3.

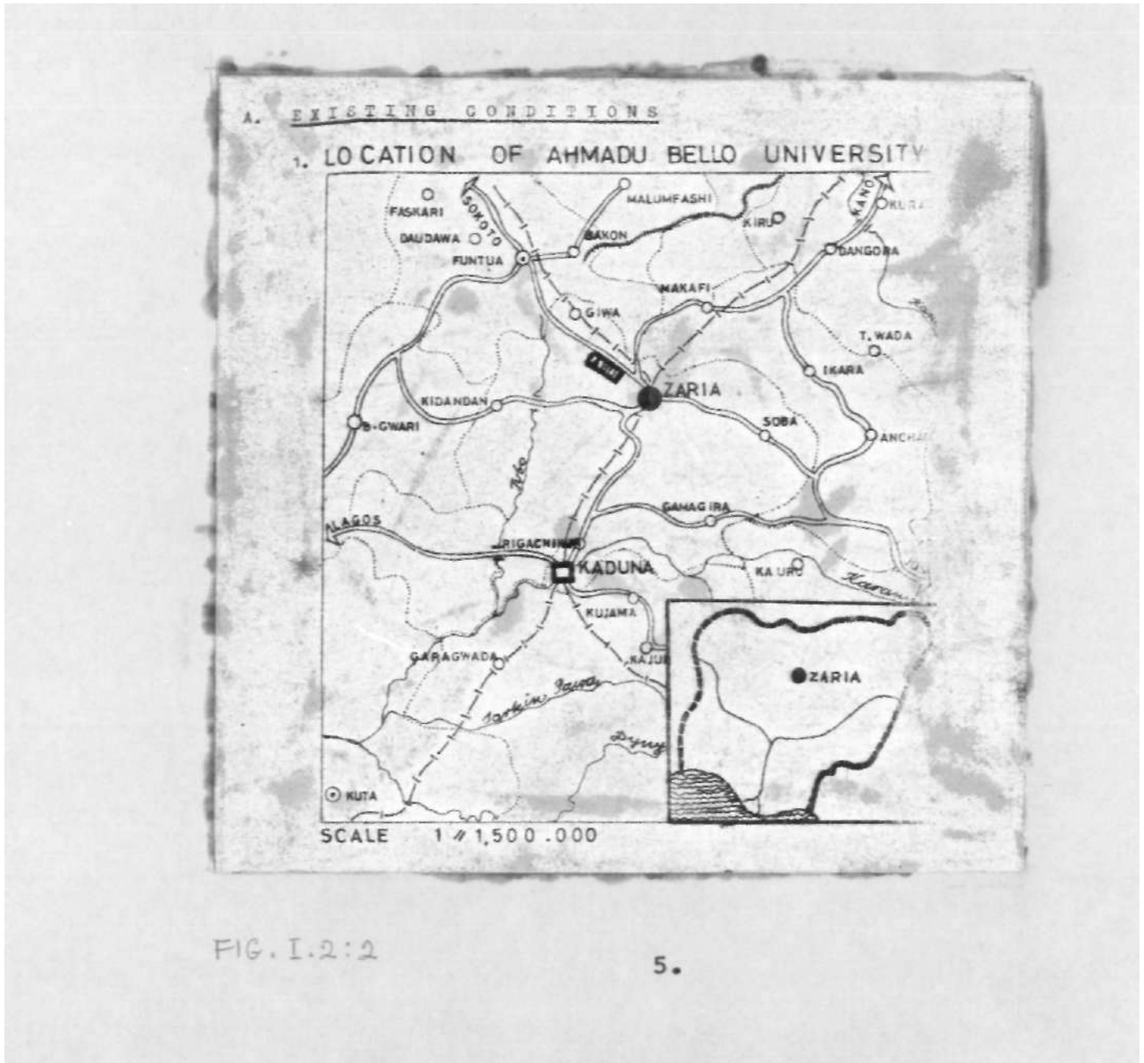

A. EXISTING CONDITIONS
1. LOCATION OF AHMADU BELLO UNIVERSITY
FASKARI
DAUDAWA
FUNTUA
SOKOTO
MALUMFASHI
BAKON
KIRI
KANO
DANGORA
WAKAFI
GIWA
T. WADA
IKARIA
ZARIA
KIDANDAN
B-GWARI
SOBA
ANCHI
GAMAGIRA
LAGOS
KADUNA
KA URU
KUJAMA
GARAGWADA
KUTA
ZARIA
SCALE 1 : 1,500 .000

FIG. I.2:2

a. Topography



FIG I.2:3

Geology.

The campus area is largely underlain by indifferentiated pre-cambarian base-ment complex formations and comprise of both igneous and metamorphic rocks. The igneous rocks are mainly Biotite Gneisses and older Graintes while the metamorphic sediments include quartzites and schists found mainly in stream valleys. Alluvial deposits of laterite overlie most of the area.

I. : CLIMATE.

Due to its situation on an elevated plateau, Zaria is exposed to a tropical savanna climate with distinct wet and dry seasons.

During the dry season, the dust laden harmattan winds blow from North-East directly from the Sahara regions.

Between the months of May and October the prevailing rain bearing winds blow from the South West Regions.

The daily mean max. temperature could be as high as 38°C in April and as low as 10°C in December through January.

The mean annual rainfall in Zaria is 1100mm. Relative humidity is very low during the dry season and changes greatly in August when the monthly mean humidity goes up to over 85%.

I.4: POPULATION ANALYSIS ANL LAND USE.

It has already been mentioned in an earlier section in this part that the University opened with 400 registered students.

Statistical data reveals that during the first ten years the number of students increased to 4,500, and it took only five years for this number to triple, see fig. I.4:1.

The total number of University senior staff was about 2,329 in 1979, giving a staff-student ratio of about 1:4, and a teaching staff-student ratio of approximately 1:7.

The number of intermediate and junior staff as at 1979 was 9,670.

A good proportion of the University staff-senior, and intermediate) and students are housed on the main campus while the remaining live in the nearby village of Samaru, and a few in Zaria town.

The main campus has developed gradually over the years without proper zoning or any rational community structure, though, several fragmentary plans have tried to control recent developments without success as none made any overall concepttion for the campus present and future functional requirements.

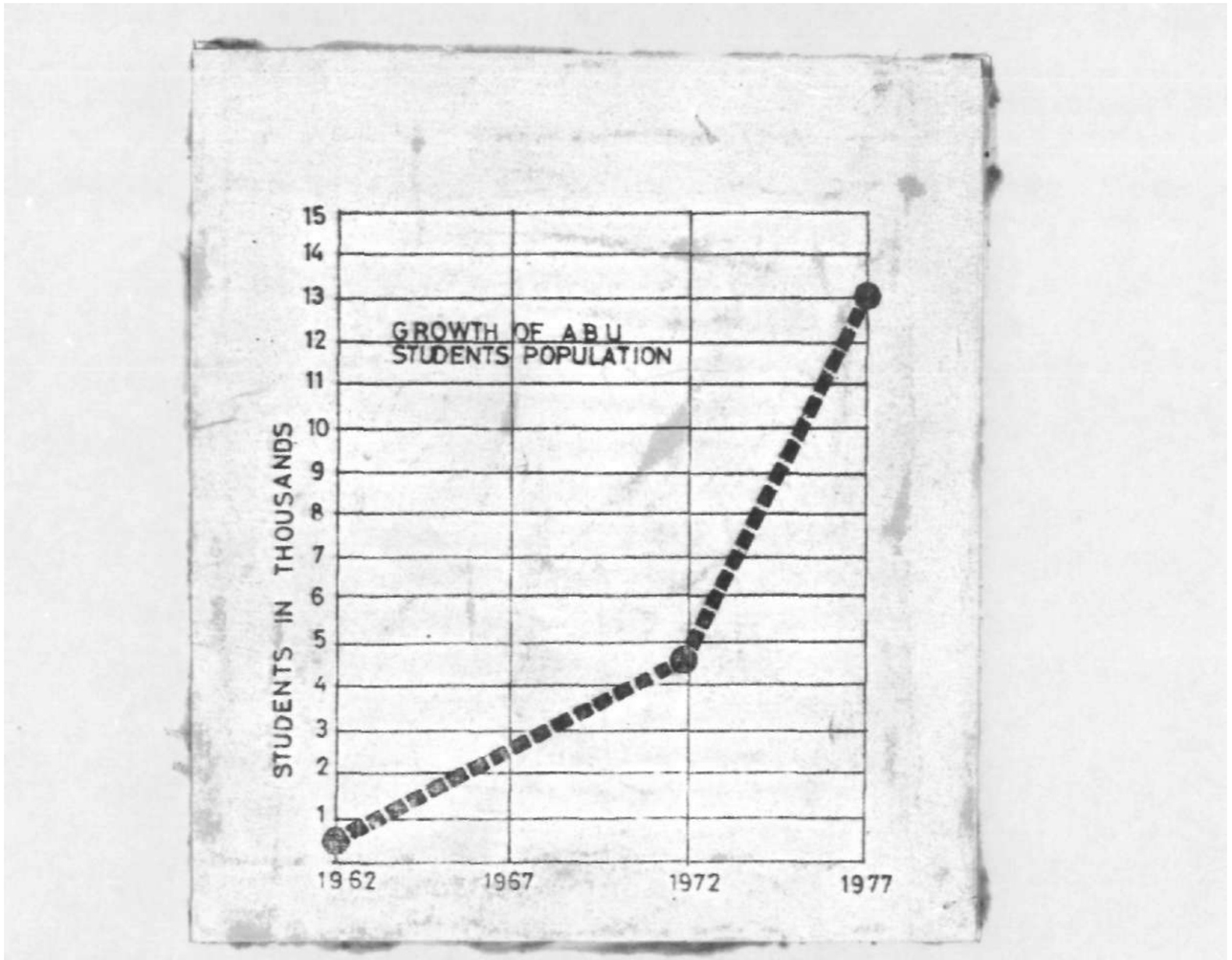

GROWTH OF ABU
STUDENTS POPULATION
STUDENTS IN THOUSANDS
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
1962
1967
1972
1977

FIG. 1-4:1

As it is today, the main campus area is divided into three distinctive parts - Central area, Institute of Agriculture and the new Teaching Hospital. These areas are connected together by inter-state highways, though the newly constructed internal campus roads have improved the connections significantly. see fig. I.4:2.

Residential communities are spread out-all over the campus area, in some parts they are merged with academic buildings, while in some others they are merged with students hostels.

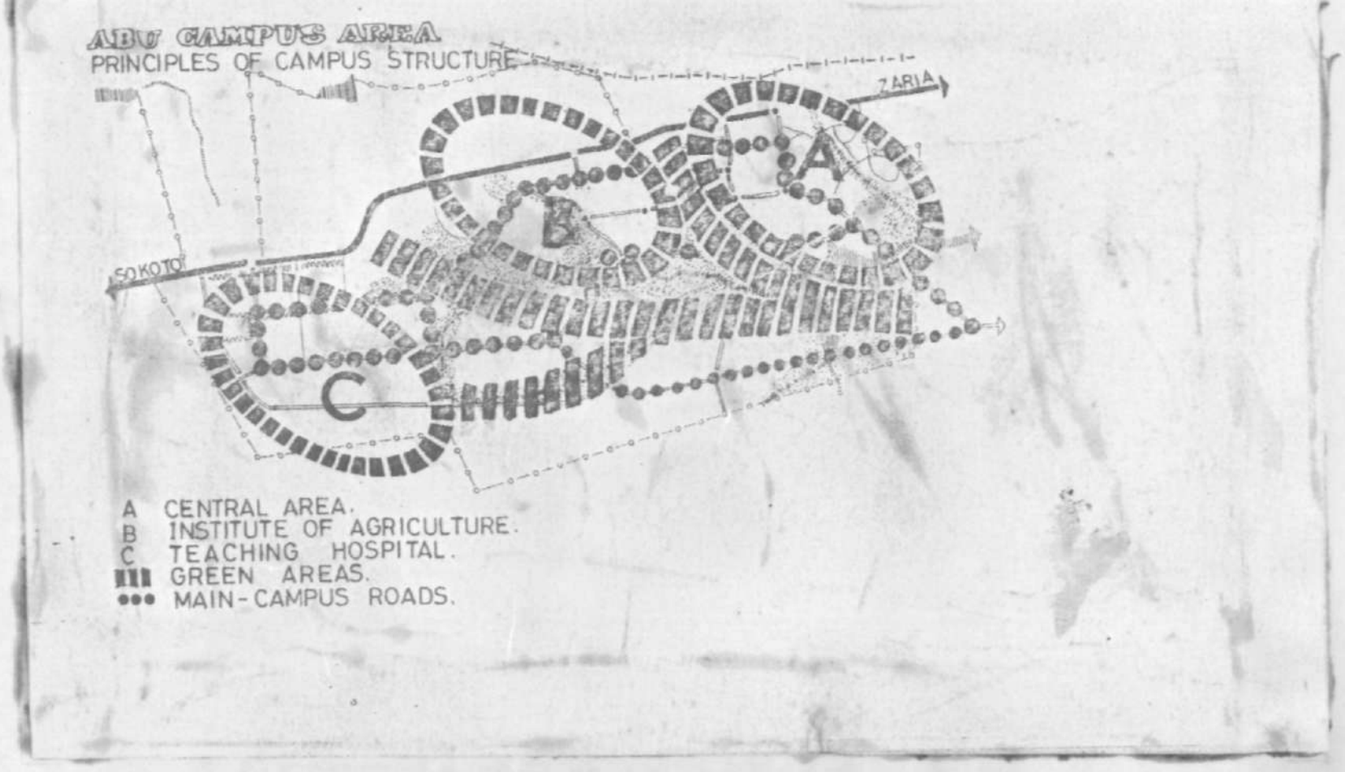
There is no community centre on the campus, though a few community buildings are scattered all over the academic area as inherited from the old College of Arts, Science and Technology.

Other community facilities such as Banks, Supermarkets, Cinemas, Workshops etc are located outside the campus either in Samaru Village or in Zaria City. As these are owned and managed by private enterprenuers they do not exactly meet the needs of the University Community.

However in the absence of standard community facilities of its own, the University has had to make do with the ones in Samaru and Zaria City over the years.

The following community buildings are scattered all over the campus area:

- Primary staff school
- Islamic mosque and Protestant chapel
- Post office
- Health centre
- Petrol station
- Meat shop
- Kiosks
- A senior staff club


ABU CAMPUS AREA
PRINCIPLES OF CAMPUS STRUCTURE
ZARIA
SOKOTO
A
B
C
A CENTRAL AREA.
B INSTITUTE OF AGRICULTURE.
C TEACHING HOSPITAL.
GREEN AREAS.
MAIN-CAMPUS ROADS.

FIGURE, I.4:2.

I.5: EXISTING ASSEMBLY FACILITIES.

The University main campus houses an assembly hall (capacity - 650 seats) and convocation square inherited from the old College of Arts, Science and Technology, a few lecture theatres with capacities ranging from 350 seats to 700 seats, and a studio theatre exclusively for the Drama Department. These structures accomodate the different University assemblies depending on the programme requirement of the assembly in question. For example the assembly hall which was designed as a flat floor multipurpose hall is used for screening films public lectures, banquets, variety entertainments, and occasionally drama presentations. The lack of ambience and poor acoustic situation in the hall make it ill-suited to most of these activities. Besides, the relatively small size makes it inadequate for the University assembly needs though in the absence of a more grandiose one it serves a purpose.

The lecture theatres are used mainly for screening films apart from educational purposes. The small size of their stage and lack of changing facilities make them inadequate for drama presentations or musical concerts. Furthermore with their restricted seating capacities they do not exactly satisfy the assembly needs of

the University.

The convocation square which is an open square with a few 'rakes" on three sides and a raised podium on the fourth accomodates the University matriculation and convocation ceremonies, public lectures and conventions, and other informal gatherings. It is also the scene of traditional dances and cultural displays which the University sponsors eg. Queen Amina day, A.B.U. day, etc. The flat floor profile of the square results in very poor sight lines (except from the front rows of seats) when there is any gathering or assembly in addition its proximity to the assembly hall makes it inconvenient for the two facilities to be used simultaneously, more so as the assembly hall is not insulated against extraneous noises.

The lack of toilet and dressing facilities and the remoteness of those in the assembly hall stage render the convocation square unsuitable for drama presentations though with a certain degree of improvisation at the expense of the audience such presentations are very possible.

Diagnosis of Extra-academic activities:

Post mortem of the extra curricula activities on the main campus revealed the following:

- a lack of grand scale social and cultural activities expected in a community such as this, due to inadequate facilities and a proper venue.
- poor style of entertainment and narrow spectrum of extra - academic activities which have mortified social life in the University.
- damage to University property during any entertainment or social gathering due to scramble for the few seats available in the assembly places.
- exclusion of staff members and responsible public from such social functions due to rough atmosphere generated.
- morbid seggregation, which has nutured hostility in many instances.

A juxtaposition of these diagnoses calls for an assembly complex as a nucleus within the University Centre with enough facilities to accomodate the visual arts and host the performing arts, with the hope that this will make the University a more interesting place to live in, academics apart! - This is the GOAL of my thesis.



FIG, I·5:1.
THE EXISTING ASSEMBLY HALL,
IN THE FORE GROUND IS THE
CONVOCATION SQUARE IN PART.



FIG. I, 5:2.

THE RAISED PODIUM OF THE CONVOCATION SQUARE. IN THE BACKGROUND ARE THE UNIVERSITY TOWER AND THE UNIVERSITY GARDEN.

P A R T II.

THEATRES AND AMPHITHEATRES.

II.1; Origin and Development.

II.2; Elements of the Theatre.

II.3; The Theatre as a place for Assemblies.

II.4; The Assembly process.

II.5; Economics.

II.1, ORIGIN AND DEVELOPMENT OF THEATRES AND AMPHITHEATRES.

The theatre has been described as "a building especially adapted to dramatic, operatic, or spectacular representations", in other words a playhouse. The form, shape, size and seating capacities of such structures vary as much as their programme requirements, the general consensus being that no single size of theatre will meet the needs of all performances.

Consequently, developments in recent years have given birth to complexes such as Lincoln Centre for Performing Arts, N. York, John F. Kennedy Centre in Washington etc. which house separate but adjacent facilities of varying seating capacities to provide accomodation for different programme requirements.

To say that entertainment, in one form or another is not almost as old as humanity itself is an understatement, and a "big" one at that logically, it follows that public assembly facilities might not be less older.

Probably one of the best known of the very early facilities was Rome's Circus Maximus, an enormous structure about 625 yds. long, with seats for over 150,000 persons. It was completed in 329 B.C., and served primarily as a course for chariot races. A later development was another type of Roman arena - the amphitheatre.
This was smaller than the circus and bowlshaped, so it gave spectators a closer view of the actions therein.
One of the largest was the Flavian Amphitheatre, which is now known as the Colosseum, it is located in the Southeast corner of the Forum between palatine hill and Esquiline hill.
This particular amphitheatre was begun in A.D. 72 by Vespian and finished in A.D. 80 by Titus of the Flavian family. Its seating capacity is estimated at 50,000 to 80,000 persons. In the mean, on a higher cultural level the outdoor theatre which was devoted to drama was developing gradually in the Grecian World. On yet another level, the accomodation of large crowds for political and religious purposes was becoming evident.

The gradual appearance of covered structures to protect the public from inclement weather followed as a logical evolution of need, and construction capabilities.

Such early meeting houses served not only for assemblies but as a refuge in times of danger or emergency, and in this single building much of the community life was focused.

Those meeting houses were therefore the forerunners of the town hall opera house, theatre or whatever name it may be given today.

With need and community pride as incentives, the nineteenth century saw the construction of a large number of "town halls" in most communities all over the world. These were in many cases constructed with a low stage, a flat floor, and adjustable seating, with the result that the auditoriums served as theatre, lecture hall, concert hall, voting place on election day, and in some communities an arena for athletic events.

Today, developments in drama and similar performing arts have lead to the design and construction of highly specialised theatre buildings which do not need to satisfy the programme requirements of other assemblies. An obvious fact is that the economic advantages of multi-use theatre buildings cannot be over shadowed by developments in the performing arts, it is more or less a function of the needs of the community concerned.

II.2, ELEMENTS OF THE THEATRE.

The theatre provides for three basic activities viz,

- talking + hearing
- showing + seeing
- relaxation.

These three activities demarcate the theartre into three corresponding distinct zones or areas namely:

- the Auditorium proper, for hearing and seeing
- the performance area, for talking and showing
- the relaxation or catering area.

Thus in a building these three basic areas must be provided if the building is to function as a theatre. Two other areas may be desireable depending on the intended size of the theatre and its scope of presentation these are the administration area, and the production area. The extent of the office accomodation is determined by the administrative structure of the company which is to occupy the building. The needs will vary widely according to the kind of operation anticipated; while production

spaces are only needed where productions actually originate.

The functional diagrams illustrate the components of each major area or zone and the functional relationships between these components. In some cases the functional diagrams go further to show the relationship between these components and the auditorium proper.

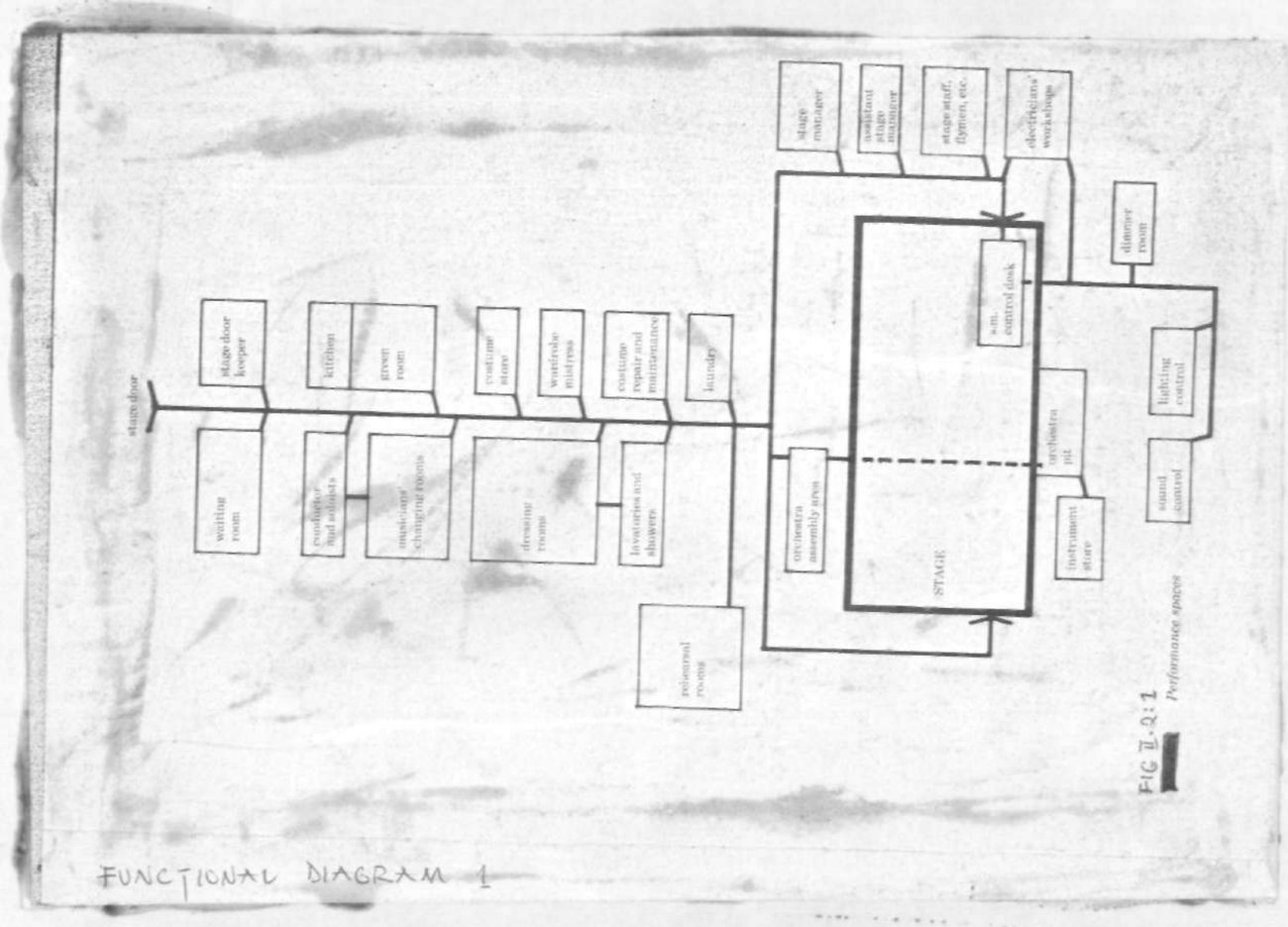


FIG II.2:1 *Performance spaces*

FUNCTIONAL DIAGRAM 1

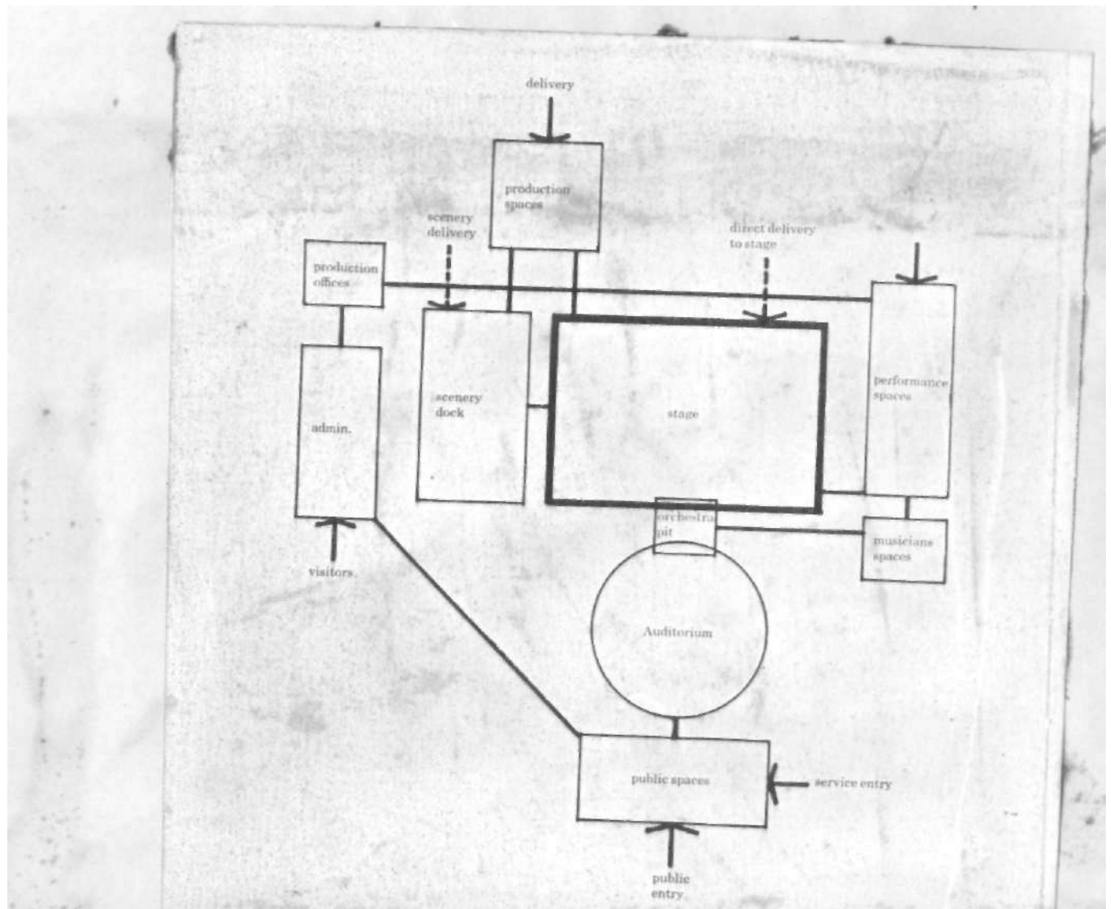


FIG. II·2:2 *Relationship of functions*

FUNCTIONAL DIAGRAM 2

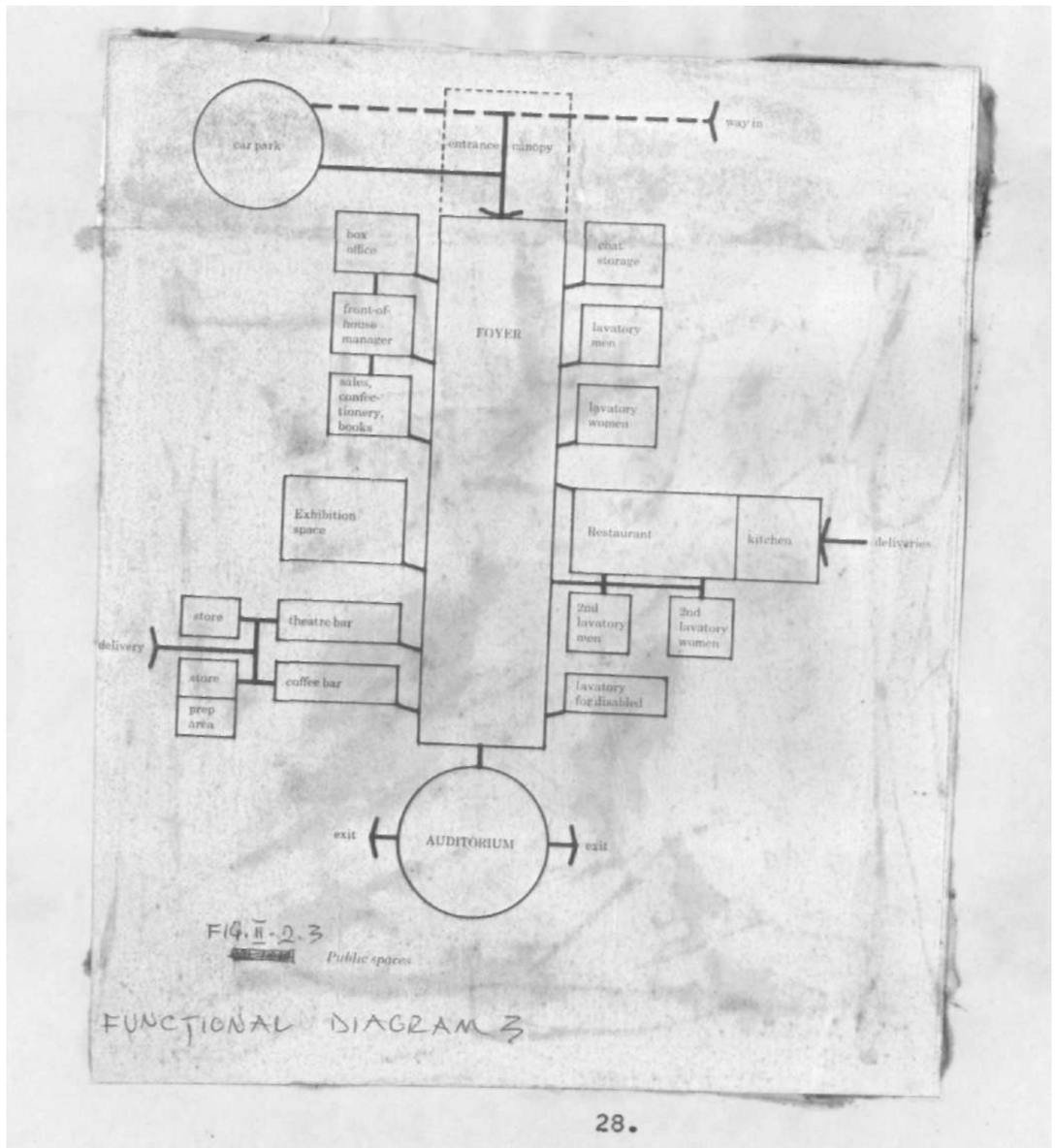


FIG. II-2.3

Public spaces

FUNCTIONAL DIAGRAM 3

II.:1, RELATIONSHIPS BETWEEN AUDITORIUM AND STAGE.

In the live theatre there has been a strong reaction against separation of the play from the audience, which is the characteristic of the typical proscenium theatre.
This has encouraged a search for new actor to audience relationship which could be viewed as a revival of past forms. The aim has been to bring auditorium and acting area into the same space envelope and to get as close as possible a relation between the action of the play and the audience watching it, to enhance intimacy.
The focus of the audience's attention is on the centre of the drama, and members of that audience naturally tend to group themselves round this focus. How far round they should encircle the focal point has always been a controversial issue.

An open stage is defined as an arrangement in which performance and audience are contained within the same space envelope as distinct from the proscenium stage where the whole or substantial part of the acting is

in a space separated from the audience by a wall with an opening - the proscenium, through which the performance is seen.

The various forms of auditorium to stage relationship are classified by the degree of stage encirclement by the audience. The classifications are as follows:

(i) Zero encirclement (0^{o});

- This is usually called an end stage; it is an open stage in as much as the acting area and the audience are in the same space envelope. In this stage form the physical limitation of the structure limit the use of scenery.

The end stage condition comes about as a result of the restrictions imposed by an existing shell or a consciously chosen structure.

(ii) 90° encirclement;

- This arrangement allows most of the action to be seen against stage walls, it has many possible variations and allows for extensive use of scenery: but is limited by the extreme sight lines.

(iii) 180° encirclement:

- The early Roman theatres were of this type, more recent versions of this arrangement are called "thrust" stages, though the terms "peninsular" or "three sided" stage are used occasionally.

(iv) 210°-220° encirclement:

- Classical Greek and Hellenistic theatres were of this arrangement where the principal acting area is at the focus of the seating.

(v) 360° encirclement:

- In this arrangement the acting area is surrounded on all sides by the audience, it is also called theatre-in-the-round, island stage, arena or central stage.

  Entrances to the acting area are through the audience or from under the stage.

  In this arrangement the acting area does not require any scenic background and so the problem of horizontal sight lines do not occur.

  A variation of this arrangement yields the transverse stage form in which arrangement most of the audience sit on the two opposite sides and face one another across the stage.

II.3; THE THEATRE AS A PLACE FOR ASSEMBLIES:

- Criteria for multiple - use,

Every age has used its buildings for performance in ways other than those for which they were specifically designed, and the reasons for this have been deeply rooted in economics:

- expenditure to get a building designed and constructed,
- use factor,
- maintenance cost when the building starts to operate.

The performing arts can be looked at as being synomimous with living organisms and like living organisms, they have in every age, had to adapt themselves in order to survive the panoramic social environment and the ever changing financial structure of society.

History shows that theatre architecture too, has undergone change to suit the varying needs of art and society.

The possibility of bringing large groups of people together under one roof makes live performance unique and impresses on such groups of people

a sense of occasion. If the design of new buildings is to help maximise impact of the performing arts in society, it must contribute and positively too, to the movement toward a truely functional community theatre. This calls for a building that can fulfil a social need rather than create one. On practical basis this means good acoustics; good sight lines; comfortable seating for all users; pleasantly lighted and well ventilated public spaces for the audience; a well planned functioning stage and back-stage spaces with adequate performance conditions. These requirements are based on the fact that a comfortable audience is a more receptive audience, and the more receptive an audience, the better its appreciation of whatever presentation is being offered.

When designing a multi-use place for assemblies the designer must first resolve to describe as completely as possible and in advance of design, a programme that strikes a responsible balance between the community's capacity and needs in regards to initial cost, use factor, and available talent.

A community theatre building must be soundly built and as economical to maintain and operate as porsible.

Experience has shown that a well designed and efficiently operated multi-use building demonstrably offsets other more serious disadvantages where the community is concerned simply because of increased use factor and consequent ability to yield revenue.

It is to be borne in mind that a poor attempt at design of a multi-use building results in a structure that performs no one function adequately and is of little use to anyone. It-goes further to discredit the whole concept of muti-use community theatre design.

Thus one could say on the whole, that multi-use community buildings such as theatres. Auditoriums, Arenas etc should reflect a realistic response to the needs of the community concerned. In which case such theatres or Auditoriums apart from serving the performances for which they were specifically designed (if any,) should also meet other programme requirements of community assemblies. More so if there isn't an alternative venue for such assemblies.

II.4; ASSEMBLY PROCESSES.

An examination of assemblies on the basis of their constituent forms reveals that there are basically two process forms - "action" or "non-action".

Action calls for "reaction and similarly non-action is synonimous with "non-reaction".

Assemblies principally involve action and reation processes, while non-reaction may be considered as a catalyst to the main process.

Two main stimulus-reaction processes can be identified in an assembly, They are the nitegral process of "Talking and hearing" and the collateral process of "showing and seeing".

Every verbal composition has a tint of the personality concerned to such an extent that no two people ever communicate verbally any one action with the same meanings. It logically follows that for any accurate communication, verbal processes must be substantiated with visual ones.

Assemblies centre around the impartation of ideas knowledge, information

etc. onto a congregation, ccnsequently for effectiveness of purpose the principal action of "Talking and hearing" must be substantiated with "showing and seeing".

The glaring conclusion that can be made is that in designing a place for assemblies, the architecture of the place should give physical interpretations to these two stimulus - response processes which have been briefly described above.

II.5; ECONOMICS.

Threatres are not physical necessities, like housing, hospitals, or schools and as such when they are built it is by an act of faith. Faith that they will contribute to the quality of living in the community concerned, as they offer various degrees of participation in a creative process, from the appreciation of a professional performance to participation in an amateur one.

On one platform they provide a leisure activity which compete favourably with other forms of entertainment, while on another it is the opportunity they give people to excercise various creative talents which has raised them to their level on the social ladder.

In the past, social and economic factors made it possible for the theatre through its programmes, to pay for itself out of charges for admission.

Today, in an era when television has taken over as the mass form of entertainment, it takes theatres a much longer period to pay for themselves. This has to a large extent underminned the interest of private

enterpreneurs in such granciose projects as theatres. Theatres are likely to be initiated by enthusiasts whose ideas and methods differ widely. History would suggest, that the majority of outstanding theatres providing the milestone of theatrical development were designed to house the productions of a man who knew exactly what he wished to do with his theatre. These men had one theatrical aim in view and their buildings were appropriate to their respective production style.

Today, in a quest for flexibility the story is different as the requirement is for a building capable of providing for the variety of uses that a number of annonymous producers may wish to make of it and which will not be out-dated from the ideas of one inspired individual.

The prospects for investment of capital for private gain in the building of new theatres might not be very attractive as almost any other investment would produce a better return.

Relative to a University community one can say that there is considerable

dividend on investment in a theatre complex. It has already been pointed out in a preceeding portion of this writing, that such facilities add to the quality of life, in addition it may fairly be said they make the area they serve more attractive to other undertakings and obviously do much to attract tourist trade.

II.5:1, SOURCES OF INCOME:

At the completion and opening of the theatre building the continuous sources of revenue can be classified as follows:

(i) Sources direct from the activities of the complex:

- box office reciepts
- sale of snacks and profits from bar/restaurant
- film and television rights.
- hiring out of costumes to outside groups.
- sale of programmes and the subsequent advertising in them by outside enterprenuers.

(ii) Indirect sources connected with the theatre complex:

- for example if the theatre is part of a larger building complex which may include shops and offices, the revenue from these may be collected by the theatre.

(iii) Revenue from sources outside the theatre:

- This may include grants from local authorities eg. local government councils, charities, Arts Councils etc.

P A R T III.

DESIGN CONSIDERATIONS

III.1; Acoustics, Communication, Speech.

III.2: Vision and Seating Geometry.

III.3; Lighting Design.

III.4; Ventilation services.

III.5; Circulation.

III.1 ACOUSTICS, COMMUNICATION, SPEECH.

One phenomenon common to Acoustics, communication and speech is sound. Sound has been described as a sensation produced in the ear as a result of fluctuations in air pressure. These fluctuations result in a wave motion which is established by a process of rarefaction and compression of air molecules away and from the source of sound.

The wave motion can be described by the equation $v = w \times f$

where

v = velocity

w = wavelength

and f = frequency.

Audibility range of sound is from 30 cycles/sec (C/S) to 20,000 C/S, with corresponding wavelengths of 11,278 to 12.7mm.

In a quiet surrounding the intelligibility of speech is high which means sound signals can be well percieved. Intelligibility however, decreases with increase in noise level within the surrounding until, such a level that the speech is

masked by noise. Masking could be difficult to predict, though a general observation has been made i.e., sounds of similar frequencies are more apt to masking which implies that two similar frequency noises will mask a high frequency noise more than the latter will the former.

Sound wave incident on a surface may be reflected, absorbed or diffracted. When sound is reflected from a surface the angle of reflection is always equal to the angle of incidence, this situation is typical of hard surfaces.
Soft porous materials cause a decrease in energy of sound waves on incidence, part of the wave is then absorbed and converted to heat energy within the material.
Some objects can effectively bar the way to a sound wave, though this depends very much on the dimensions of such objects and the wavelength of the sound, sounds of higher wavelengths than the largest dimensions of an object get diffracted round such objects.

In an enclosed space whenever sound waves are incident on the boundary surfaces, part of the energy is absorbed and the remainder is reflected.

The reflected sound wave undergoes the same process of absorption and reflection, the process continues until the sound gradually fades into silence provided no fresh sound signal was introduced during the whole process.

The time it takes for the sound to "die away" depends on two factors -

(a) how much absorption occurs.

(b) frequency of absorption.

Since absorption depends on the material in question, factor (a) must be discovered from the product of the area of material and its absorption efficiency. Factor (b) will depend on the size or volume of the enclosed space. Since sound waves travel at a given speed or velocity, a large volume implies that the waves will come in contact with the surfaces of the enclosure less often and consequently the higher will be the decay time technically known as reverberation time (RT).

The reverberation time (RT) is given by the equation

$$RT = \frac{0.16V}{A}$$

where V = volume of enclosure (m^3)

A = total absorption (= sum of areas times respective absorption coefficients)

If a sound of given energy is introduced into an enclosed space, the loudness is greater than it will be in open air. This is due to the continuous process of non-perfect absorption and reflection of the sound wave. One can therefore, infer that reflection contributes the additional value known as "reverberant sound" which reinforces the "direct sound".

In a space, sound dies away inversely with distance due to absorption by the medium. Hence sound from a source at one point does not travel indefinitely, after a particular distance from the source it becomes inaudible.

III:1.2 SPEECH AND ROOM ACOUSTICS.

Speech consists of various combinations of vowels and consonants. Consonants are high frequency sound components which sound give speech definition. Requirements of a building designed for speech or music are:

(i) absolute minimum of ambient or background noise

(ii) reverberation though necessary to define the liveliness of a building should not exceed a given limit (1.0. Sec. for speech) otherwise, intelligibility suffers as the sound of each syllable is obscured by the still present reverberation of previous syllables.

The requirements of a large room for speech are as follows:

(i) The direct sound should be uniformly strong everywhere in the room This sound however, weakens with distance from the source, consequently, the average distance between the listeners and the source should not be too large.

(ii) the direct sound should not be obstructed

- This implies there shouldn't be columns or other obstructions in the

path of the direct sound, similarly, one listener should not obstruct another in the path of direct sound. This calls for raking of the floor of the room, or where this is not convenient, staggered arrangement of seats.

(iii) If rooms are planned only for useful reflections all surfaces can be made reflective, echoes should be avoided. In this respect the only absorbing surfaces in the room to take care of reverberation will be the seats and the listeners.

Attempts should be made about the seats such that when they are not occupied and when they are fully occupied their absorption values remain the same.

(iv) Owing to the directional characteristics of sound, no listener should fall outside an angle of 140^{o} subtended at the source. This forms the actors arc of command.

(v) The early reflected sound from side walls contribute a sense of envelopement which is characteristic of halls with the best acoustics. It is important that this sound arrives not later than 0.3 secs after

the direct sound. The angle of arrival relative to the direct sound should be as large as possible, which suggests that fan-shaped hall are not very functional in this respect, whilst a reverse splay shape is particularly good.

(vi) The volume of the room should be determined to give the optimum reverberation time. The recommended volume is $2.83m^3$ per seat.

(vii) Reverberation time in a room or hall for multiple activities should have a value of 1.0 second (for speech) but variable up to 1.6 seconds (for concerts). The variation can be achieved through the use of variable absorbents, acoustic clouds, or assisted resonance.

III.1:3 ACOUSTICAL DEFECTS.

(1) Echoes:

Reflections off large plane surfaces risk being heard as discrete delayed repititions of the direct sound. This delayed repitions are called echoes.

Back walls are the surfaces most likely to cause very audible echo. This defect can be eliminated by making the back walls sound diffusing or by careful re-orientation of their surfaces.

(2) Flutter Echoes:

If a sound is made between two parallel surfaces, the regular reflecticns between them are heard as a metallic ring. This defect is known as flutter echo.

Flutter echoes can be eliminated by applying absorbents to the surfaces concerned, or by avoiding a situation where a speaker speaker is positioned between two parallel surfaces. It is highly recommended that no two surfaces or planes in a

theatre or auditorium should be parallel.

III.1:4 ELECTRO-ACOUSTIC AIDS.

Sound does not travel indefinitely over long distances, it gradually dies away with increase in distance from the source, due to attenuation in media. To propagate sound uniformly to all parts of a hall or room electro-acoustic aids can be employed.

Two basic types are sound only systems, (common to theatres and halls for speeches) sound with picture system common to conference centres

(1) Sound-only-systems

- microphone-loudspeaker system
- wireless sets
- intercommunication sets such as telephones.

(2) Sound-with-picture systems

- television
- motion picture
- close circuit television

Microphone loudspeaker system is the system most frequently used in places of assembly. The system usually consists of a ring of microphones arranged sound the stage or the speakers stand, these microphones pick up sound signals and relay them to an amplification system which amplifies the sound, and feeds it back into the room space through loudspeakers placed in suitable positions in the room. The loudspeakers form "secondary sound sources" which reinforce the direct sound and thereby enhance good room acoustics.

One theory of room acoustics attempts to establish that sound moves in phases. If we adopt this theory, and imagine that two sounds originate from two or more sources and are heard by an auditor equidistant from the sources, it is quite possible that the sounds will be out of phase when percieved by the auditor, which means he will be able to identify the two sounds. The directional senses of man are very strong in the horizontal plane and rather weak in the vertical plane. This suggests that distribution of speakers in this plane should be carefully studied, before a decision is taken. It is however, adviseable that loudspeakers be positioned over the source and on the centre line of the house unless a multidirectional system is intended.

EFFECTS OF PLAN SHAPES ON ACOUSTIC.

The plan shape adopted for a place of assembly depends on priorities relative to acoustical and functional requirements.
Certain basic types, however, appear to have evolved over the years. Their acoustical advantage/disadvantage are outlined below:

(a) Rectangular Shape.

- This has a high degree of uniformity and a good balance of early and late reflections. It is however, liable to flutter echoes and will only be good for opera presentations.

(b) Fan Shape.

- Will accomodate the maximum number of people in a given angle for a specified maximum source receiver distance.
It is good for economy and provides an intimate setting with a high degree of flexibility for a wide range of productions.
Its limitation is the inherent character of the side wall not affording early lateral reflections. Such hall develop non-uniform acoustics,

with poor conditions in the centre of seating.

(c) Horse Shoe Shape.

- This type is adaptable to contemporary drama forms, or small cast.. The shape affords the audience partial encirclement of the stage and as such speaker audience distance is minimal. Its concave surfaces tend to cause focusing of sound in some areas.

(d) Circular Shape.

- In this type there is a complete absence of lateral reflections, the shape enhances high intimacy between actor and audience.

III.2; VISION AND SEATING GEOMETRY.

Every performed art is a performer-audience shared experience which depends entirely upon the sensations of seeing and hearing. Physiologically the receptors of both systems (seeing and hearing) are responsive to separate net-work of nerves that connect to the brain. Consideration of these is beyond the concern of this dissertation, what is of importance are the quantitative parameters within the restricted environment of a theatre essential for maximum excitation of the sensors for each system. Both systems in the normal human being have sensors in pairs (right and left) thereby providing binocular vision and stereophonic sensation of sound. When physically considered these two systems constitute the separate studies of optics and acoustics which share common properties of reflection, refraction, diffraction and absorption, a precise understanding of which, within the operative ambient environment of performer and audience provided by a building or other structure, is the basis of theatre design.

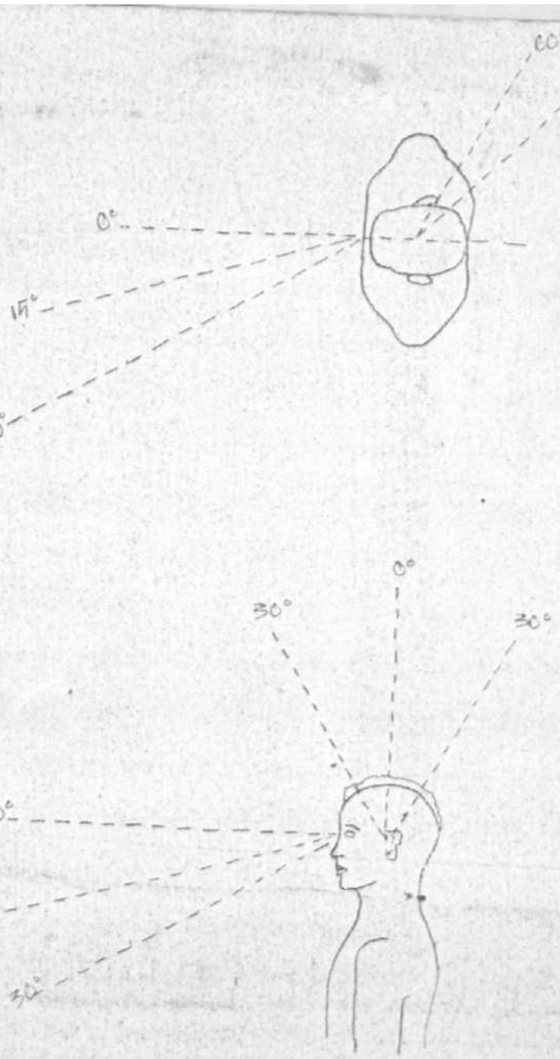


FIG: III.2A¹

SIGHT LINES & HEAD MOVEMENT OF HUMAN FIGURE IN PLAN.

0° —— STANDARD SIGHT LINE
15° —— NORMAL SIGHT LINE
30° —— MAX. EYE ROTATION
45° —— EASY HEAD MOVEMENT
60° —— MAX HEAD ROTATION

FIG: III 2A²

SIGHT LINES & HEAD MOVEMENT OF HUMAN FIGURE IN ELEVATION.

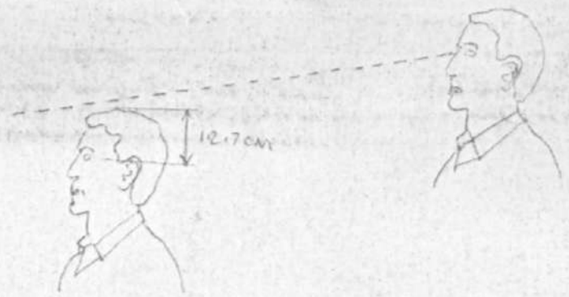


FIG: III·2B¹

THE VERTICAL SIGHT LINE: EVERY ROW VISION

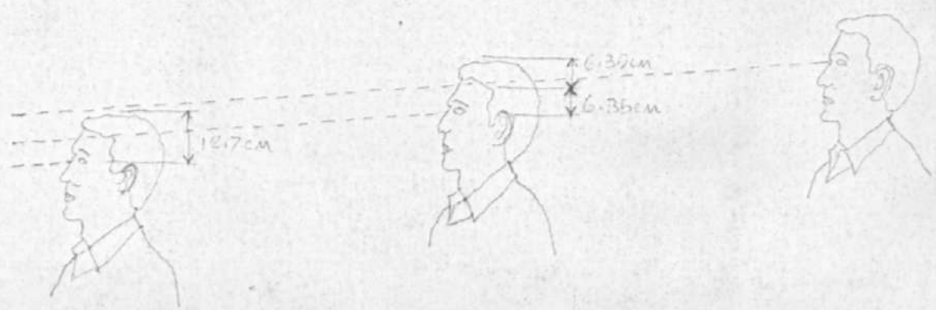


FIG: III·2B²

THE VERTICAL SIGHT LINE:

EVERY OTHER ROW VISION

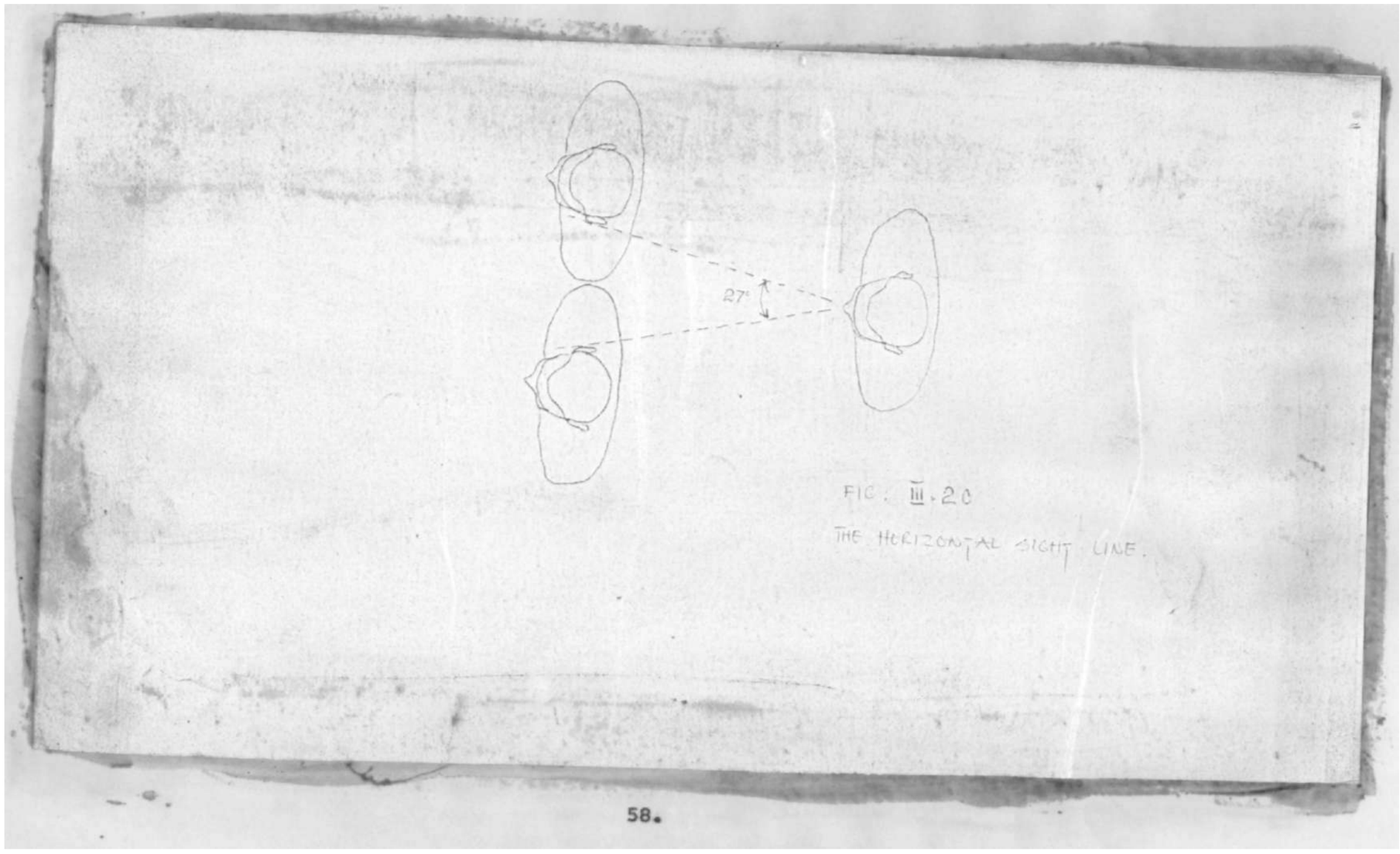


FIG. III.20

THE HORIZONTAL SIGHT LINE.

III.2:1; Sight Lines:-

A sight line is defined as the path of vision from the position of a spectator in an auditorium (usually seated) to the performer or performance space.

(a) A good sight line is one in which there are no obstructions to vision and angular displacements (vertical and horizontal) of the eyes, and head falls within the criteria for comfort. See fig. III. 2A.

(b) A vertical sight line is defined as the angular path of vision in the vertical plane over or under impediments, if any, between a sight point and the performance area. This is usually concerned with heads of intervening spectators as illustrated in figs III.2B. or building restrictions such as balcony rail, underbalcony structure etc.

(c) A horizontal sight line is defined as the angle of vision in the horizontal plane between or around intervening obstructions,

(if any) between a sight point and the performance area. These are usually the heads of spectators in the row or rows immediately in front. See fig III.2c.

Visual Limits:

There is a limit to the distance at which a performer can project his performance and hold the attention of his audience. This limit is a function of the performer's skill, the eyesight and acuteness of hearing of the audience.

In a theatrical entertainment which has as its chief visual component, human actors, eg. live shows, the extent to which performers must be seen to satisfy audience varies;

(i) in drama presentations, details of make up, facial expression and small gesture are important. This holds true for intimate revue and cabaret as well.

The accepted maximum distance from the farthest seat to the geometrical centre of an open stage or to the setting line of a proscenium stage is 20m.

(ii) in musical concer , only broad gesture by single individuals is important. Th also applies to comedy presentations and dance. Hence, th accepted maximum distance as explained above can be increased 30m.

(iii) in pageant prese ation, gesture by individuals is unimportant, and movemen of performer from place to place is of little significance.

Depth of the house:

Many formulas have been used to determine the relationship between depth of the house, width of the house and width of the stage. Such formulas were empirically derived on the basis of existing theatres with little consideration as to how functional such theatres really are, consequently these formulas are not universally applied. Practically there are only two significant considerations in planning the depth of the house. These are

(i) Visual acuity

- details of actors make up, and facial expression are not plainly recognizable at distances of more than 20m from the stage.

(ii) Capacity

-, this is a function of optimum seeing requirements thus, it can be seen that sight lines determine proscenium splay (i.e. width of stage opening) and house width, while visibility limits determine capacity and consequently, house depth.

III.2:2. Seating Geometry:

The fact of theatre seating derives from the obvious: the human body is more comfortable, the mind is more receptive, and sensitivity to optical and aural stimuli is improved for extended periods of time if the body remains relaxed and quiescent in a position halfway between erect and prone.

Studies in Educational psychology conclusively show that when a person is seated, concentration is maximized as physical discomfort due to muscular and nervous fatigue are minimized.

Modern Auditorium seating geometry in plan is virtually infinite in variation and combinations. The four basic seating geometries in plan are:

(i) Rectilinear

(ii) Curvilinear

(iii) Single herring bone

(iv) Double herring bone

These are applied at will by Architects and Designers to all forms of theatre/auditorium. See fig III. 2D.

Legal requirements are well documented relative to seating, the basic consideration is safety of users. In the event of panic or emergency, the theatre space should be evacuated within the stipulated interval of time.

The legal requirements govern such factors as seat sizes, spacing and arrangement and distances from circulation aisles.

The functional requirements are that seats must accomodate people, comfortably and conveniently for the purpose of seeing and hearing.

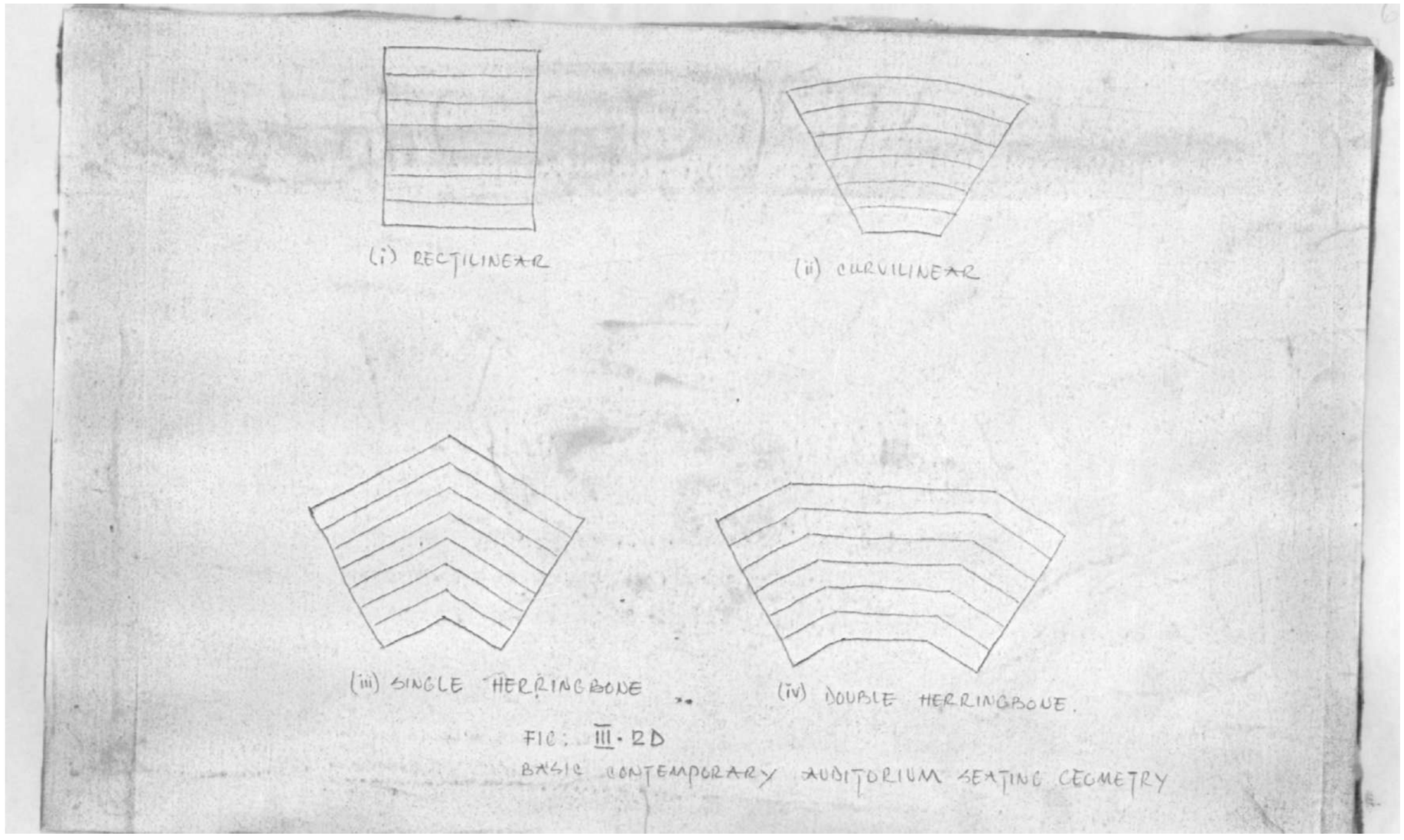


FIG: III·2D

BASIC CONTEMPORARY AUDITORIUM SEATING GEOMETRY

III.3, LIGHTING.

The need for adequate lighting in any space, can never be over emphasized.

General principles and methods of lighting places of assembly-Theatres, Assembly Hall, Conference centres etc. are outlined in the following text.

Principles of lighting:

The underlying principles for good lighting fall into two categories.

(1) Practical lighting for vision.

(2) Lighting for aesthetics.

III.3:1 PRACTICAL LIGHTING FOR VISION.

This involves lighting as a basic requirement for visual perception of different activities.

In considering the Theatre/Auditorium, several activities have to be identified, these categorise lighting into the following types:

- general uniform intensity lighting
- stage lighting.
- Lighting for close range activities such as reading.
- Aisle lighting.
- sign lighting.

One inference that can be drawn is that, lighting is either general or localised. General lighting more often than not, is necessary if only for personal orientation.

Type of lighting employed is necessitated by the degree and nature of details sought from the object to be viewed, this is synonymous with the type of activity to be performed on the object. On this basis, work can be categorised as follows:

(i) Teloramic work

- any work involving perception of objects at distances of two metres and beyond.

(ii) Mesoramic work

- any work involving perception of objects within the range of 30cm to 2m.

(iii) Ancoramic work

- any work involving perception of objects at a distance less than 2cm.

One might therefore deduce that, whatever type of lighting is required is a matter of details and distances sought.

The principles of lighting relative to a Theatre centre around:

(a) Ease of performance

- which is a measure of details sought for perception

(b) comfort

(c) safety

(d) economy.

III.3:2, LIGHTING FOR DECORATION.

Decorative lighting is that which is primarily intended to reveal or heighten values of spaces, forms or shapes. General practical lighting may also be decorative anyway.

In decorative lighting, the quality of light is important, quality, in terms of colour composition and intensity. Objects could loose their character, colour and so on under different lights. Experiences under mercury or sodium lights are good examples.

Different operations can be graded in respect of the colour factors on the basis that the visual tasks associated with them involve:

(i) very good colour sensitivity and appreciation of subtle differences of hue

(ii) ordinary colour sensitivity and appreciation of fair colour contrasts

(iii) indefferent colour sensitivity

Generally no activity in the Theatre will require such qualities as

in (i), qualities under (ii) are necessary as they influence activities such as film shows, and exhibitions.

It can therefore be said that the design of a Theatre/Auditorium relative to lighting and appreciation of colour should be done in such a way that the intended colours, textures are not lost, but add to the dramatic experiences of the spaces.

III.3:3, VISUAL ACUITY AND CONTRAST.

It is possible to express in numerical terms the amount of illumination which is necessary on a visual task in order to permit detail of a given apparent size to be seen with a given certainty. The numerical measure of the finest critical detail which can be seen is usually expressed in terms of what is known as "visual acuity". Visual acuity is defined as the ratio of the size of the detail to the distance from the eye. Hence, it is a measure of the angle subtended by the detail at the eye.

It has been established that there is a clear numerical relationship between the magnitude of this angular subtense of detail, and the illumination on the detail. The higher the level of illumination, the smaller the detail which can be seen with certainty.

It has also been established that the amount of light falling upon a visual task also governs the least differences in brightness between adjacent areas in the task which can be detected by the eye. Thus, the eye can see finer shades of brightness difference, or contrast, the

greater the amount of illumination falling on the task.

The sense of colour is also enhanced by the lighting level, smaller differences of lightness or colourfulness of the same huc and smaller differences of huc also, can be seen the higher the level of illumination. It becomes obvious that seeing is aided by higher levels of lighting in a threefold manner, viz;

(a) finer detail can be seen

(b) smaller differences of brightness or contrast can be recognised

(c) colour can be distinguished with greater certainty. It therefore follows, that it is possible to analyse any given visual task in terms of,

(i) critical detail

(ii) critical brightness contrast

(iii) critical colour difference

and with the aid of the relationships between these factors and illumination level, the amount of light can be predicted which is necessary to ensure adequate vision for any visual task in the Theatre, stage or public areas.

III.3:4, GLARE AND DISCOMFORT.

The human eye cannot tolerate excess of light. While inadequate light leads to "eye strain", discomfort and distress, too much light leads to glare and dazzle and consequently discomfort of a different kind.

The lighting designer is therefore campelled to steer a middle course between lighting which is inadequate for its purpose, and lighting which taxes the adaptation machanism beyond its confortable limits.

Generally there are two aspects of glare which a designer has to be careful about, in interior lighting design:

- (1) glare which arises due to harsh contrast between juxtaposed areas,

  and

  (2) glare which arises because areas are of such an excessive brightness that the visual mechanism becomes saturated.

It is very necessary to avoid glare occuring in a Theatre/Auditorium because of the discomfort it causes although it is very unlikely that glare in a building causes direct disability.

III. 5, THEATRE/AUDITORIUM LIGHTING.

The theatre is primarily a performing arts centre. Performing arts centres require not only general lighting, but general practical lighting in addition, tc aid in the conveyance of ideas through the actions on the stage.

Once the general level of illumination has been established as outlined by the foregoing principles, attention can be focused on the provision of lighting to achieve dramatic or decorative effects. Such lights have defined areas of coverage, and designs should carefully avoid their spilling over.

All lights in the Theatre except those in work spaces below or above the stage are controlled from a central control room which is best situated behind the audience facing on the house and placed in such a way that there is an unobstructed view of the acting areas from this room.

The room houses the lighting console with ad quate allowances for an

operator or operators. Design standards recommend an area of 3.0m (width) by 2.4m (depth) for the control room which should meet the following requirements as well:

(1)-localised lighting for operation of the lighting console

(2)-position of room should be near the sound control room but insulated from it

(3)-should be separate from the projection booth but close to it.

(4)-silent, dust-free, thermostatically controlled ventilation is always necessary.

In addition to the fore mentioned types of lighting emergency lighting is also very necessary in theatres. This calls for the provision of a battery room in addition to the mains supply unit. The light fixtures all over the complex should be switchable automatically to the direct current supply.

It is noteworthy that stage lighting is a specialised aspect of Engineering.

LEVELS OF ILLUMINATION FOR DIFFERENT SPACES:

SPACE	ILLUMINATION LEVEL (Lux)
1. Offices	400
2. Conference suites	600
3. Auditoriums and Foyers	100
4. Exhibition Halls	
- general	200
- objects	600
5. Lounges	100
6. Dining Rooms	100

III.4, VENTILATION SERVICES.

In some buildings, windows or means for natural ventilation cannot be provided in order to avoid environmental pollution, such buildings include Theatres and Auditoriums.

Ventilation is very essential in any space for human habitation, since natural ventilation is not exactly convinient in Theatres, Mechanical means are adopted which involve mechanical movement of air about a space:

Mechanical ventilation involves, the following process:

(i) propelling or moving air

(ii) filtering

(iii) washing

(iv) humidification and dehumidification

(v) cooling

(vi) heating and re-heating

The one system that handles all these processes is called an air handling plant", air conditioning is the installation only when humidification is involved.

Certain criteria dictate ventilation:

(i) Air movement

- a feeling of air moving around ones body ensures comfort. A speed of 0.1-0.33m/s is considered reasonable in Theatres and offices.

(ii) Smoking + body odour

(iii) Fumes, and smell

(iv) Bacteria

- in spaces where an appreciable number of people gather, airborne bacteria is transmitted easily. Adequate ventilation reduces the possibility of transmission.

(v) Relative humidity,

- if this is between 30% - 70% it is considered acceptable depending on the temperature. Very high or low value of humidity induce discomfort.

(vi) Excess heat.

One noteworthy fact is that, the body gives out heat continuously, thus when a number of people are gathered in a space there is bound to be heat build ups which will cause discomfort if not reduced to a minimum through proper ventilation. The extent to which the body gives out heat depends very much on the measurable external conditions namely:

(i) relative humidity

(ii) air velocity

(iii) dry bulb temperature

(iv) mean radiant temperature

Conditions (i) and (ii) are physical variables under direct control of an air-conditioning plant, (iii) is a consequence of the method of air distribution adopted, while (iv) cannot be manipulated by air-conditioning.

Recommended minimum rates of fresh-air supply to buildings for human habitation:

TYPE OF BUILDING	RECOMMENDED MINIMUM RATES OF FRESH-AIR SUPPLY TO BUILDING.
1. Assembly halls	$28m^3$ per hour per person
2. Canteens	$28m^3$ per hour per person
3. Kitchens	$56m^3$ per hour per person
4. Places of entertainment	$28m^3$ per hour per person
5. Restaurants	$28m^3$ per hour per person
6. Factories & Workshops	
Work rooms	$22.6m^3$ per hour per person
Lavatories	2 air changes per hour
7. Corridors & W.Cs	2 air changes per hour
8. Cloak rooms	3 air changes per hour

III.4:1, VENTILATION DESIGN CRITERIA.

Theatres/Auditoriums require an air supply of $28m^3$ per person per hour.

If the air is cool and clean, it may consist of 75% of fresh air and 25% of re-circulated air.

If the air is fully conditioned with a humidity of not more than 55%, the supply may be half fresh and half re-circulated air.

78% of the air should be extracted mechanically with a proportion being taken out through the stage.

The air installation in a Theatre/Auditorium may be of the three types:

(i) an exhaust system.

- this involves removing the used air to allow fresh air find its way in, through grilles and openings.

(ii) a plenum system,

- this supplies fresh air into the Auditorium space and forces out used air through grilles and other outlets.

(iii) the balance system,

- this involves simultaneous supply and removal of air, it is the most efficient and most expensive of the three systems outlined.

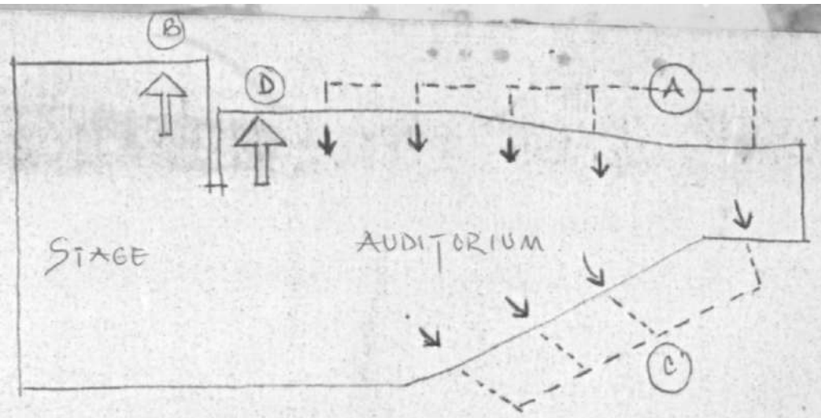
Two methods of air - conditioning possible in a Theatre/Auditorium are:

(a) a system where input is at a low level and extraction is placed at a high level.
A system which reinforces natural circulation.

(b) The reverse system, where input is at a high level and extraction is at a lower level.

Because the air in the Theatre/Auditorium is warmer than the incoming air, the latter will be felt as drought.

On the strength of this method (b) proves to be the more appropriate of the above mentioned methods of air-conditioning.



DOWNWARD SYSTEM WITH INDEPENDENT STAGE AND AUDITORIUM EXTRACT FANS AND INLET FAN.

(A) = inlet- fan
(B) = stage extract- fan
(C) Auditorium extract- fan
(D) Auditorium emergency extract- fan.

* Usual starting order = B, A, C.

III.5: CIRCULATION.

There are no strict laws governing circulation patterns in a theatre or amphitheatre. What is important is that circulation be worked out in such a way that a new patron can pick his way to places of interest within the complex without loosing his bearings or sense of direction. In addition to a well worked out circulation pattern, the use of well labelled signs enhances ease of circulation.

It is esoteric knowledge that amongst any audience there are bound to be some people who are visiting the building for the first time and some others who may not be quite familiar with it. Now or then, in the event of a panic or emergency the building must be evacuated in minimum time, and the ease with which this is done depends on the clearity of the circulation pattern and the adequacy of the escape routes.

It is highly essential that escape routes - panic exits, and fire outlets be designed in strict conformity with standards stipulated in the building Regulations of the area concerned.

These regulations are also well documented and are available on request.

P A R T IV.

THE DESIGN SOLUTION

IV.1: Site Analysis.

IV.2: The developed brief.

IV.3: Design concept and schedule of accomodation.

IV.4: Construction Planning and Materials.

IV.1: SITE ANALYSIS:

IV.1:1, Location Criteria:

To locate an assembly facility within a University campus is one factor, it is a different factor altogether to site it in a suitable area within the campus.

The siting of such a facility has to be based broadly on the following:

(i) accessibility to users
(ii) cost and size of site
(iii) design implications of site
(iv) service accesses
(v) micro-climate on site

Access, cost and design implications of site are concerns which are primary to the siting of University Assembly facility. This is because the facility as a revenue generating organ has to sell its services which are in no way essential.

Consequently, it is important that the facility be designed to advertise itself to compel buyers to seek its services and the experiences gained therein should be a living memory to those who have had the opportunity of a visit.

The proper siting of a facility such as this, goes a long way to determine its success or failure. It is advisable that a University assembly facility should, where possible be centrally located within the circle of possible users on a site which is easily accessible to them.

IV.1:2, The Site.

A site which falls within the University administration core was chosen for the project.

It lies between the University senate and administration building, the University new Bookshop, the assembly hall/convocation piazza.

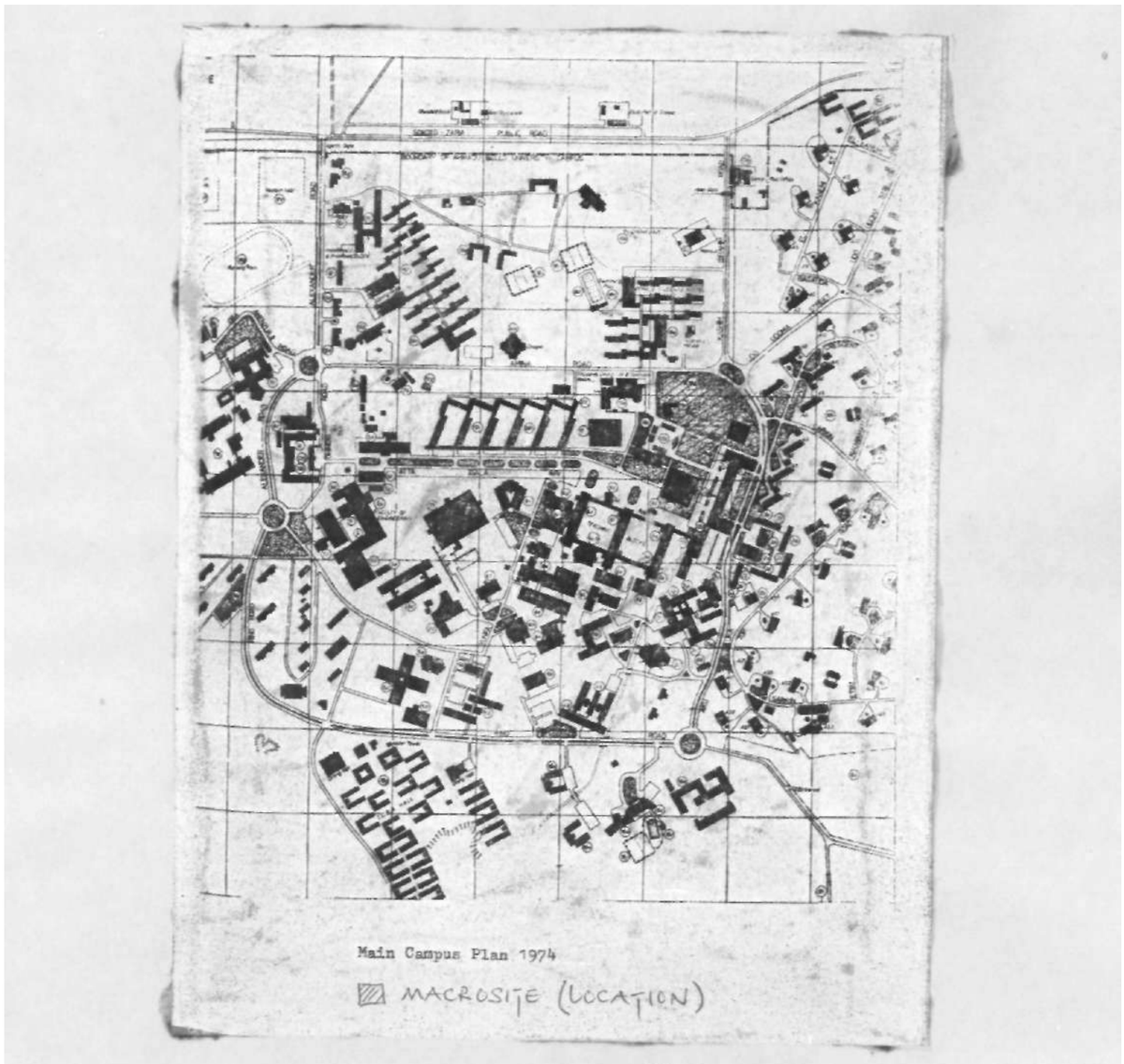
In accordance with location criteria (part IV.1:1), this particular site was chosen amongst others because it would facilitate the integration of the assembly complex into the central administration core of the Institution. This is in conformity with traditional standards of academic planning concepts.

The site, part of which houses the existing University convocation piazza is relatively flat and buildable.

Though the site does not fall within the geometric centre of the campus (as can be seen from the principles of campus structure diagram), direct connections (vehicular and pedestrian) exist on the ground level between the site and other areas of the University.

From outside, the site is easily accessible from the three University gates or entrances.

There is adequate parking facilities around the site, these are the parking areas which serve existing buildings in the immediate vicinity of the site, eg. senate and administration building, University Bookshop etc.



Main Campus Plan 1974

MACROSITE (LOCATION)

IV.2; THE DEVELOPED BRIEF.

The developed brief called for a facility in the central administration core of the University, to complement the convocation square/ assembly hall and remedy the community deficiency in adequate facilities for performing arts and choral music, etc. In developing the brief, the University development office and the Drama School were consulted as stakeholders and potential users.

Analysis of results of consultation reflected a wide range of demands which were in conflict with one another and some in conflict with the basic provisions of a proper Theatre.

Researchers have established that every medium in the dramatic and musical arts cries for a specific scale for the performing area and the audience, for example with the spoken word in drama, sense of intimacy is essential both visually and aurally but, when music and singing from a musical comedy are added, the scale of an auditorium will increase appreciably.

The consultations with the University Development Office and the Drama School revealed that live performances (drama and musical concerts), cinema, public/political and religious conventions, exhibitions, lectures and the annual University Matriculation and Convocation are the main activities to be accomodated.

IV.2:1. The design problem.

The design problems in this particular case were:

(i)-to reconcile these multipurpose requirements within a building which should be flexible enough for desired adaptation.

(ii)-to resolve the conflicting acoustic requirements of music and speech.

(iii) - to develop a structure which inspite of its flexibility would relate properly to the University environment and its inhabitants.

IV.2:2; Design Proposals.

In satisfying the diverse needs of the University Community it was the designer's intention to create spaces and atmospheres for all kinds of cultural worships and activities.

The following proposals were therefore made:

(i) - the acoustic performance of the auditorium should provide a natural reverberation time suitable for speech, and an extended reverberation time suitable for music and choral works.

(ii) - the capacity of the auditorium be restricted to 1,800 seats in keeping within optimum visual and acoustic limits.

(iii) - a drum revolve stage be incorporated in the stage proper of the auditorium. This in addition to other sophisticated stage machinery will heighten the flexibility of presentations on stage.

(iv) - a moveable cyclorama be provided on stage, to allow stage depth increase or decrease as required.

(v) - The auditorium should be insulated against external noise owing to its proximity to the amphitheatre and piazzas and because the site lies under the flight path of aircrafts on test flights, from the civil aviation training crntre, Zaria.

(vI) - the capacity of the amphitheatre be restricted to 2,500 in proportion to the scale of the auditorium.

(vii) - other portions of the site not buildable or undeveloped, be developed and cultivated into piazzas (open courts) with onamental fountains and evergreen park areas in a complimentary manner that identifies different land uses, and forms the compositional backbone of the assembly complex.

These proposals it is hoped will give birth to a multi-purpose arena offering facilities for a wide spectrum of events including outdoor relaxation. The proposals are graphically illustrated in vol.II. of this thesis.

IV.3: DESIGN CONCEPT AND SCHEDULE OF ACCOMODATION.

The theatre which is located to close partially the vista from the main gate has been design to accomodate 1,800 patrons; approximately 22.5% of the overall student population on the main compus. While the Amphitheatre is designed to accomodate 2,500 patrons, 31% of the student population.

The auditorium design is based on a steeply banked semi-circular, Greco-Roman three sided seating arrangement surrounding an open thrust stage with a drum revolve.

The amphitheatre design is based on a mildly raked 90° encirclement seating arrangement with such facilities as snack bars, and toilets under the upper tiers which accomodates the projector room and other servant spaces.

Both the theatre and amphitheatre share common back stage facilities, and storage spaces for purely economic reasons.

The Theatre and Amphitheatre are located and planned to meet the practical and cultural needs of the University Community.

Performance in the Theatre is considered a social occasion and dramatic entertainment and as such spacious lobbies and foyers are arranged on all levels of the building to show off groups of people and their attires see vol II. of Thesis. This also stems from the fact that one of the characteristics of a visit to a place of live entertainment is a sense of occasion.

Landscaped courts with ornamental fountains and pools are prominently placed in the layout. These together with the open parks create a conducive microclimate and a cool restive atmosphere in the immediate vicinity of the complex.

Due to the proximity of existing parking facilities which are used by adjoining buildings and which are free in the evenings and nights when the amphitheatre and theatre will mostly be used, no extensive parking area has been provided in the vicinity of the complex, except a small one off the service route for important guests during special events and possibly theatre officials and stage crew. Otherwise, the whole site is vehicular traffic free. This gives patrons and guests apportunity to lounge in the parks and piazzas and appreciate the work of nature on their way to the theatre building wherein they'll definitely marvel at the creative ability of the designer. In addition, person to person contact is ensured by this arrangement both before and after a performance.

Schedule of Accomodation:

(1) Theatre:
    (a) Public areas,
        - Foyers and lobbies.....
        - Restaurant/Coffe bar.....
        - Toilets.....

    (b) Auditorium,
        -- Seating capacity.....
        - Number of tiers.....
        - Area of auditorium.....
        - Area of working stage.....
        - total stage area including property rooms and aucillary accomocation.....
        - volume of auditorium.....
        - stage height.....

(2) Amphitheatre:

        - Seating capacity.....
        - Number of tiers.....
        - Area of amphitheatre.....
        - Area of working stage.....
        - Area of sanitary conveniences.....
        - Overall Area of Technical Services Unit....

(3) Theatre Technical:

        - Projector room.....
        - Light Control Rocm.....
        - Sound Control Rocm.....
        - Air Handling Plant.....
        - Battery/Generator Room.....

IV.4; CONSTRUCTION PLANNING.

The programme of activities within a Theatre is on a complex scale, so much so that it is almost impossible to phase the construction without the Theatre providing only maginal services which is neither in the interest of the stakeholders nor the management.

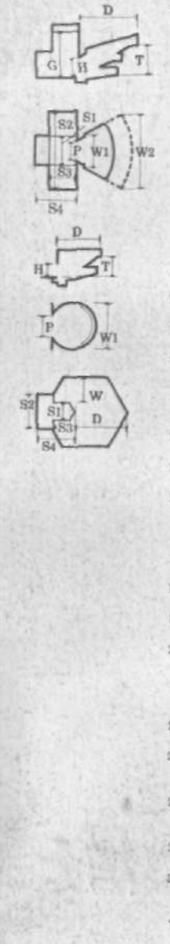
Hence, it is advisable that construction planning for the Theatre should anticipate a once - and- for all process.

Relative to the University place for assemblies, the theatre is designed as a unit to be constructed in one phase and similarly the amphitheatre is designed as one unit to be built in one phase.

However, the complex of Theatre and Amphitheatre does not necessarily have to be built in a single phase.

MATERIALS:

The structural materials used are reinforced concrete and steel, for floors, walls and roof, in accordance with Engineering requirements of Theatres and amplitheatres.



	Theatre	Normal use	Date built	Architect	Seating capacity	No. of tiers	Approx. theatre site area at ground level (m²)	Approx. theatre site area per seat (m²)
1	Wyndham's London	Drama	1899	W. G. R. Sprague	785	3	680	0·89
2	Apollo London	Drama	1901	Lewen Sharpe	827	4	777	0·94
3	Shaftesbury London	Drama & Musicals	1911	Bertie Crewe	1 300	3	873	0·67
4	Aldwych London	Drama	1905	W. G. R. Sprague	1 030	3	905	0·88
5	Piccadilly London	Drama & Musicals	1928	Bertie Crewe & E. A. Stone	1 144	3	921	0·80
6	Mermaid* London	Drama	1959	Elidir Davies	498	1	985	2·01
7	Palace London	Musicals (built for opera)	1891	T. E. Collcutt & G. H. Holloway	1 462	4	1 036	0·71
8	Old Vic London	Drama	1818	Rudolf Cabanel	878	3	1 137	1·29
9	Festival* Chichester	Drama	1962	Powell & Moya	1 360	1	1 171	0·86
10	Forum Billingham	Drama	1968	Elder Lester & Partners	637	3	1 304	2·04
11	Thorndike Leatherhead	Drama	1969	Roderick Ham	530	1	1 417	2·67
12	Belgrade Coventry	Drama	1957	Arthur Ling Coventry City Arch.	910	2	1 435	1·54
13	Shakespeare Memorial Stratford	Drama	1932	Scott, Chesterton & Shepherd	1 353	3	1 444	1·34
14	Playhouse Nottingham	Drama	1963	Peter Moro & Partners	756	2	1 537	2·03
15	Crucible* Sheffield	Drama & Studio	1971	Renton Howard Wood Associates	1 018	1	2 090	2·06
16	Royal Opera House Covent Garden London	Opera & Ballet	1858 1964	Sir Edward Barry (upper tiers reconstructed by Peter Moro)	2 110	6	2 638	1·25
17	Coliseum London	Opera	1904	Frank Matcham	2 340	4	3 075	1·31
18	Bayreuth Germany	Opera	1876	Otto Brueckwald (& Richard Wagner)	1 645	3	3 131	1·90
19	Civic Theatre Trier, Germany	Drama	1964	G. Graubner	622	1	3 140	5·03
20	Theatre Royal Drury Lane London	Musicals	1812 1922	Benjamin Wyatt (Auditorium reconstructed by Emblin Walker & Edward Jones)	2 283	4	3 196	1·40
21	New York State Theatre, U.S.A.	Musicals	1964	Philip Johnson	2 729	6	3 577	1·31
22	Civic Theatre Gelsenkirchen Germany	Drama & Opera	1959	Werner Ruhnau Ortwin Rave Max von Hausen	1 059	3	4 385	4·15
23	Helsinki City Th. Finland	Drama & Studio	1967	Timo Penttila	920 (200)	2	5 466	5·76
24	National Opera House, Paris	Opera & Musicals	1874	Charles Garnier	2 150	6	8 770	4·08
25	National Arts Centre Ottawa	Opera Drama & Studio	1969	Affleck, Desbarats, Dimakopoulos, Lebensold, Sise	2 300 (O) 900 (D)	4 2 1	14 420	4·65

*open stage

	Approximate allocation of space (per cent)				Auditorium dimensions metres (see key plans & sections in margin)			Proscenium dimensions		Stage dimensions		
	Auditorium	Working stage	Total stage area including scene dock, property rooms & all ancillary accommodation	Other space	Width (W1) (Width for a fan shaped auditorium the greater width (W2) is shown in brackets)	Horizontal distance from proscenium to back of auditorium (D)	Height above stage of horizontal seat (T)	Width (P)	Height above stage (H)	Width (S_1) (S_2)	Depth (S_3) (S_4)	Height to grid above floor (G)
1	37	23	32	31	10 700 (16 800)	18 300	11 900	8 200	7 900	19 200	8 800	14 900
2	38	23	38	24	13 700	20 400	15 200	9 100	8 800	21 300	8 500	18 300
3	55	22	27	18	20 700	23 200	12 200	10 100	9 100	21 300	9 700	15 600
4	34	23	32	34	16 500	22 200	11 000	9 100	7 900	20 100	12 200	17 100
5	39	24	36	25	17 400	23 800	13 400	9 400	8 500	20 700	12 200	16 500
6	30	14	16	54	14 900	24 100	5 200			14 900	8 300	
7	38	21	35	27	15 500 (19 300)	26 800	18 300	10 400	10 400	20 100	14 600	22 900
8	44	17	43	13	21 600	25 600	9 100	8 500	8 500	18 900	10 400	16 200
9	60	10	15	25	12 200	24 400	5 800			11 000	12 800	
10	28	20	32	20	20 700	20 700	7 900	13 400	7 000	21 300	11 900	17 100
11	23	15	44	33	12 200 (23 500)	17 400	4 600	9 700	4 900	18 900	10 100	14 000
12	25	13	36	39	14 600 (21 900)	19 800		11 000	5 500	18 300	8 800	12 500
13	36	18	59	25	18 300 (26 800)	35 900	10 100	9 100	7 000	17 700 36 600	14 000	19 800
14	24	22	40	36	21 900	20 400	9 100	9 700	6 500	29 000	15 200	18 300
15	32 10	7	28	30	14 600		4 900			5 500	28	
16	28	19	47	25	23 200	36 600	16 500	15 200	11 900	27 400	27 100	22 000
17	29	24	38	33	30 500	32 300	15 200	16 800	11 900	27 400	25 000	21 000
18	21	21	57	22	15 200 (32 600)	33 000	12 900	12 900	11 600	28 000	23 200	29 600
19	10	18	78	12	15 800 (30 500)	19 800	3 700	12 200 15 800	7 300 10 400	20 200	16 800	20 700
20	19	18	48	33	17 100 (23 200)	25 000	15 800	12 800	9 500	24 100	23 800	21 600
21	21	12	30	49	30 500	40 800	21 300	17 100	15 500	23 200	15 200	29 300
22	10	21	51	38	22 900	19 800	12 200	11 600 15 800	8 500	23 800	16 800 33 000	24 400
23	8 4	13 4	55	33	36 000	21 300	9 100	11 600	10 100	32 000 58 000	22 900	23 200
24	17	11	24	59	23 200	30 500	12 200	15 800	13 700	45 700	26 000	36 300
25	8 4	10 4 2	42	44	(O) 35 000 (D) 27 400 (37 200)	35 000 20 200	15 200 12 200	18 300 13 700	12 200 7 900	27 400 56 300 24 400 38 000	18 900 35 000 14 600 19 812	28 000 18 900

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