CHRISTIAN WORSHIP CENTRE

FEDERAL UNIVERSITY OF TECHNOLOGY

MINNA - NIGER STATE

AN INSIGHT INTO ACOUSTIC PROBLEMS IN CHURCH DESIGN)

BY

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CERTIFICATION

This thesis entitled CHRISTIAN WORSHIP CENTRE FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA PERMANENT SITE, meets the regulations governing the award of the Degree of Masters of Technology (M.TECH) in Architecture of Federal university of Technology, Minna and is approved for its contribution to knowledge and literary presentation.

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DECLARATION

I, OLUROTIMI JOHNSON AGUNSOYE of the department of Architecture, school of Environmental Technology Minna, do hereby declare that this project is an authentic design and research work carried out by me under the supervision of Arc. R. E. OLAGUNJU. That this work has not been presented either wholly or partially for the award of any higher degree elsewhere and all information are duly acknowledge by means of references.

DEDICATION

To God, Who Was There in the Beginning Who Will Be There in the End, and Who Makes Ways for Me and of Course, to My Wonderful Parents Mr & Mrs J. I. Agunsoye, God Bless You (Amen).

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ABSTRACT

Eccelesiatical studies shows that varied form have been used in chapel and Churches design in Nigeria and world - wide since the beginning of Christianity. Liturgical sequences have differed among demoninations. These leading to varied form of design of churches mostly without consideration of the acoutical implication of such design and possible sound insulation materials to be use during such design, planning and construction of such place like a worship centre which might be noise phone. A building is a climatic moderator. The structure of a building must protect the occupants from the ingress of atmospheric pollutants, and inclement weather conditions. It must permit tolerable thermal solar, day lighting and noise levels inside the building in addition, it must possess aesthetic and the necessary structural qualities.

My immediate concern is the acoustic path way's between the inner and outer environment of a worship centre, but it must be remembered that the selection of a building structure is agesant process involving the optimisation of several of factors.

Architectural tend during the last decade and the millianium has been toward lightweight building within large glazing area. Recent research carried out by the building Research Establishment shows the maximum glass areas recommended in order to keep the internal temperature below 24 °c in Buildings of light and heavy wight construction.

This work shows that building situated in noisy areas should have less glazing than those in quiet surrounding where solar heat gain is the guiding criterim. Clearly the design of a worship centre like the proposed Christian centre of the Federal University of Technology

Minna, would consider the selection of the building envelope so that environment as used as structural and aesthetic qualities acoustical qualities, their installation are not over looked finally in any building the weakest sound barriers are the glazing areas and doorways. Secondly sound transmission pathways also exist depending on the type of building and the quality of the construction.

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CHAPTER ONE

1.0 INTRODUCTION

In the design of a worship centre which is phone to noise or sound, basic concepts in acoustic which include masking diffraction, transmission, adsorption, echo, reverberation and insolation of sound must be noted. Audible sounds range from the threshold of audibility to the threshold of pan. Sound is measured on the decibel or phon scale. External control of sound is controlled by radiation at sources and use by absorbeat, screen and surface, insulation and building design. Auditorium or church acoustic is influence of reverberation; loudness of the original sound as well as the size and shape of the room. Acoustic standard vary for different type of building and shape. Example residential building differes from that of religions or worship and also their space requirements.

1.1 MOTIVATION

This project entilled "The Christian Worship Centre, federal University of Technology Minna, parmanent site is conceived primally for the following reason(s).

a. The promotion of unity among Christians students and staff of the University in respective of the Christian denominations.

b. The need for the Christians of the University to have a common ideal place, spacious, planned acoustical sound, in line with the principle of Architectural standard.

c. Promotion the concept of togetherness among Christian youth in the Unviersity, and its environ i.e the concept of God the Father, and Jesus Christ the Sun and the finisher of our faith.

1.2 AIMS AND OBJECTIVE

AIMS

The design intentions include the following:

1. A creation of an ideal place for Christian student and staff of the University to worship.
2. A monumental centre for Christian in and around Niger State to worship.
3. A centre, that would promote unity among Christian in the University irrespective of their various Christian denomination
4. A centre of Christian research and promotion of Christian teaching.
5. A centre spacious to accomodate 70% of Christian in the University.

DESIGN OBJECTIVE

This shall include the following:

1. Provision of good landscape
2. Provision of good acoustic meterial that are not phone to sound noise and their installation and construction meeting required performance standard.
3. Solving or reducing the persistance acoustic problem(s) that is associated with Church or Worship centre in Nigerian Church through planning construction, and Architectural consideration and technology.
4. Provide a church that is less phone to noise both internal and external
5. Creating a centre that is functional, aesthically, constructional balance for worship.

1.3 RESEARCH METHOLOGY

The research method adopted for this project shall include

1. Use of direct personal interview or oral interview with members of the staff and student of

the University.

2. Use of literature review from old and current publications, journals, magazines, study of maps, and other possible unpublished Architectural works.

3. Personal participation in some Church/Worship at some churches picked for case studies.

4. Visitation of the site ie. Federal University of Technology Minna, parmanent where the proposed whorship centre is to be built.

5. Case studies of other existing Universities worship centre and other related churches of similar value.

1.4 SCOPE AND LIMITATION

This project shall be directed toward solving or reducing problem of acoustic in church design, the method use, construction method, the planning of the building to control noise or sound using mechanical, natural mean etc.

The project is limited to the Architectural planning and the acoustic problems, and the way or means of reducing some of the problems.

1.5 IMPORTANCE OF STUDY

Acoustic is the science and technology of sound. And is related to noise its causes, effect, ecttoes, absorption insulation, acoustic aid etc., and if not proper study and planned in the construction of a place of worship like the proposed worship centre for Federal University of Technology Minna, would lead to the persistence acoustic problem in churches, thrathre etc.

Sound must be study control (if it has phrenological and physiological effect) in order to have an audible sound within and out the worship centre.

1.6 DEFINATION OF TERMS

This is the science of sound. It covers two areas:

- Acoustic. Thoses of room acoustic and control of noise.
- Absorption Co-officient. This is an indication of the sound that is not reflected and is thus an indication of both the sound absorbed and transmitted.
- Absorption (A). This is the product of the absorption co-efficient and the area of a given surface.
- Echoes : This is a distrinct repetition of the direct sound.
- Reverberation: This is the persistence of sound in an enclosed space as a result of repeated reflection or scattering after the sound source has stopped.
- Reverberation Time: It is the number of seconds required for the energy of the reflected sound in a room to diminish to one - millionth of the original energy it had it can also be defined as the number of seconds required for the sound pressane level to diminish to be decibels below its initial value.
- Sound Insulation: This is the reduction of sound transmission of air borne sound through walls, floor and partitions.
- Sound Reduction Index/Transmission Loss: This is the reductions effect of an element and is expressed in decibels.
- Sound: This is the sensation caused by a vibrating medium acting on the air.
- The Sound Level Scale: This is the logarithm of the ratio of measured sound intensity to the university at the threshold of audibility. This scale is also known as the deceibel (dB) scale.
- Noise; This is the unwanted sound.

- Back Ground Noise: This is the normal prevailing ambient noise from manys ources including street traffic and outdoor noise in general.
- Sound Pressure Level: This is defined by the equation No of dB sound pressure level-

$$20 \log \frac{\text{sound pressure level in pascal}}{2\times10^{5}\ \text{Pascal}}$$

N.B. It should be noted that although both sound paler level and sound pressure level are expressed in decided there is no relationship between these unit whatsoever

- Sound Power Level: This expressed in the standard unit of power namely maff (m). Defined as "The decobel (dB) notation is obtained from this by the equation Number of dB power level = 10 log

$$10 \log = \frac{\text{Power level in watt}}{10^{-12}\ \text{watt}}$$

- Acoustic Impedance Factor: This is use to determine actual resistance to sound transmission. It is the project of density of material and the velocity of sound within it; its dimension are Kg/m^2s.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 GENERAL REVIEW OF CHRISTIAN DENOMINATIONS

Every epoch is usually characterized by an architecture which to some extent portrays the manner of life of the age. This as an impoint of their civilization, lives through time, reminding the latter generations of the forme.

In recent times, penticostal churches have become more popular because of their sharp deviations from many orthodox Christian beliefs, practices and methods. Their architecture has also been a division from the orthodox and is seen by many as styleless which cannot be true as the efficiency of a building is measured on plenty scales ranging from functional to a psychological one with many schools of through laying emphasis on the latter as they see worship of deity as purelyesotric.

2.1.1 ROMAN CATHOLIC CHURCH

The term Roman Catholic denotes the Christian community which has continously accepted by the authority of the Bishop of Rome. Their main service include

i. Mass

ii. The Easter Litargy

iii. Baptism

iv. Marriage

v. Burial of the dead and devotions

Other liturgical activities include blessing, dedication consecration, confirmation and ordination.

2.1.2 CHURCH OF ENGLAND

They are Caracterized by the directional cast west orientation in which main action or activities are remote from the congregations. Loss of sense in engagement with the clergy in a common action and tended to become spectators rather than a corporate response to the liturgy.

2.1.3 THE PRESBYTERIAN CHURCH, SCOTLAND

The reformers extablished the doctrine of the priesthood of all belivers" in which it was not necessary for any human to come between God and a worshipper and the only mediator accepted was Jesus Christ himself.

2.1.4 THE METHODIST CHURCH

The Methodist church grew out of the church of England and a district feature of this movement ulnas the introduction of key preachers. The strong emphasis on evangelical preaching is rooted in the Methodist tradition.

The strong emphasis on

2.1.5 CHRISTIANITY PRIOR TO AD 30

One very interesting thing historian note about the rise of Christianity was the emoting of a faith primarily within the religious, social and cultural content of the Roman empire. The Jews at this time under the rulership of the Roman empire expected a Messiah who was to establish a theocratic government - government by priest or men who claim to know and serve the will of God.

JESUS CHRIST the founder of Christian faith ended his ministry during the Jewish feast of the unleavened bread when the Jewish authorities. Handed him over Roman

of the congression, street traffic and other outdoor noise in general; it may also include noise from adjoining rooms, noise from mechanical equipment etc.

Such background noise may reduce speech intelligibility and cause serious destruction in listening to music when such is present, the loudness of the original sound must be increase to over come the effects of interference. The sources both internal and external should be studied and proper remedial measures taken.

(C) LOUDNESS OF ORIGINAL SOUND

Intelligibility of speech increases with loudness. In large room like the church it is often necessary to use public address system (Acoustic Aid) for amplification. In this distortion of speech by the equipment should be avoided

SIZE AND SIZE OF ROOM

The size of a room will effect the reverberation time when the room is so large that the reverberation time is above acceptable limits sound absorbent materials. Large cured surface tend to focus sound and create an even distribution of sound. Thus high cured ceiling or cured near the walls in a long room should be avoided. In general a room of rectangular shape is preferable.

RECOMMENDED ACOUSTIC STANDARDS FOR VARIOUS

Building (Including Church)

Acoustic standard are available for various types of buildings. These standards establish how noise sensitive different buildings and spaces are. Thus educational building are less noise Aolerant than industrial building religious or worship centre. The standard for outdoor seduction are usually higher than those for indoors.

There is sometimes a need to copy corrections to the standards. The standard are set for daytime conditions and reduction for the evening and night time period is therefore needed. These are as follow

daytime	no correction
Evening	- 5 dBA
Night	- 10 - 15 dBA

Outdoor standards may provide a guide to the indoor standard after making corrections for the insulation of facades with windows.

Window Open	-	10 dBA
Single Window Shut	-	15 dBA
Double Window Shut	-	20 Dba

Recommended Indoor and outdoor acoustic standard are shown in table 8.2

(a) INDOOR ACOUSTIC STANDARDS

TYPE	FUNCTION	ACCEPTABLE NOISE LEVEL (dBA)
RESIDENTIAL	Bedroom, private house	25
	flat Room,	30
	Living Room	40
	Hostel	35
COMMERCIAL	Private Office	35 - 45
	Bank	40 - 50
	Conference room	40 - 45
	General office, shop store	40 - 55
	Restaurant	40 - 60
	Cafeteria	50 - 60
INDUSTRIAL	Pension room, class	30 - 40
	Room	
	Heavy worship	20 - 35
	Laboratory	35 -45
EDUCATIONAL	Lecture room, Class room	30 - 40
	Private study	20 - 35
	Library	35 - 45
HEALTH	Hospital, Publica Ward	25 - 35
	Hospital, private ward	20 - 25
	Operating thretre	25 - 30
AUDITORIA	Concert Hall	25 - 35
	Church	35 - 40
	Court room	40 - 45
	Conference	
	Room	20 - 25
	Recording Studio	20 - 30
	Radio Studio	30 - 40
	Threatre for drum	

(b) OUTDOOR ACOUSTIC STANDARDS

TYPES OF AREA	ACCEPTABLE NOISE LEVEL dBA
Rural residential	35 - 45
Sub-urban residential	40 - 50
Urban residential	45 - 55
Urban residential Urban residential with work - shop, business or main road	50 - 60
City centre business trade admistration	55 - 65
Heavy industry	60 - 70

Recommended indoor and outdoor Acoustic standards.

ACOUSTIC IMPEDANCE OF MATERIALS

MATERIALS	ACOUSTIC IMPEDANCE Kg/M^2s	MATERIALS	ACOUSTIC IMPEDANCE Kg/M^2s
CAST IRON	27.4×10^6	Lead	14.4×10^6
Concrete	$9.84.10^6$	Pine	1.34×10^6
Copper	31.6×10^6	Sleet	41×10^6
Cork	0.116×10^6	Water	1.41×10^6
Glass	14.1×10^6		

To control vibration sandwich system of high and low acoustic impedance materials should be used even if the interrupting materials are higly elastic, the energy of the oscillating

source cannot be readily transmitted example, system of vibration. Control combing steel work cork are particularly successful.

REDUCTION IN SOUND PRESSURE

When the observer is some distance away from the sound of a sound example is a preacher/pastor to the last roll seat of the church, the sound pressure level here will reach their (congressional members), ears are affected by four (4) distinct agencies. They are

a. Distance

b. Air absorption

c. Ground absorption

d. Wind

e. Distance. The basic reason wyy sounds reduce with distance is the inverse square law which also affect the intensity of light, magnetic and electric fields etc. In the sound this is complicated by the decibel notation, with sound of all frequencies the frequencies the reduction in intensity of sound in term of number of decibels, taking a distance of one (1) metre from the source of noise as standard is given by the formula.

$\Delta dB = 20 \log d$

d = distance in metre from the source, thus at a distance 10 metre from the sources, the intensity of any given frequency sound is 20 decibels less than it is at a distance 1 metre from the source while a distance 100 metre from the source, the sound pressure intensity has reduced by 40 decibels.

AIR ABSORPTION

Reduction of sound due to the ability of air molecedes to reduces the sound pressure

level by converting some of the sound energy into thermal energy varies according to the frequency of the sound. The reduction in decibels is

o.1f log d

d = distance between source and the abserver in metre

f = in a factor that depends upon the frequency of sound. This factor equals 1 for sound at a frequency of 500 Hz, 1.5 at 100 Hz, 3 at 2000 Hz and 7.5 at 400 Hz..

GROUND ABSORPTION

Ground absorption is negligible with hand surface such as concert, hard metuiled load, and the like. It becomes appreciable when surface with a high absorptivity such as ground covered with grass are considered.

The absorption effect can be expressed by the equation number of decibels = 4 a log d where a is the absorptivity of the ground surface as expressed as a dimension less fraction, while d is the distance between source and the observer which in this case are the preacher and his congression.

WIND

Wind can have the effect of increasing or decreasing sound pressure levels, depending whether the wind travel towards or away from the observer. The design of the worship place (church) will be in the windward direction.

IMPACT SOUND TRANSMISSION

If a structure is homogeneous, impact sounds are hardly diluted at all and travel a very long way without reduction. For example in an all concrete building if a tenant on any floor should decide to knock on the floor or wall with a hammer, the sound would be heard all over

the building. Metal pipes such as water and heating lines transmit impact vibration particularly well muti-storey building without so called floating floor are extremely noisy as the slightest sound made by people in an upstair flat is transmitted undiluted to the flat below.

3.3.0 NOISE AND IT'S PROPERTIES

NOISE: This is unwanted sound while the power pitch and timing of sound can be precisely described, their noisiness is a subjective quantity. Thus the analysis and control of noise is marked by technical elegance social confusion. Most work has been done on interior acoustics, yet the less easily controled but increasing pressing problem of outdoor nosie is now receiving more attention.

Environment with too little sound can be disturbing but are rare. Sound sources problem then is the to find ways of reducing the sound level or its information content. The introduction or enhancement of desirable sound is usally neglected. The loudness or energy level of a sound is measured in decibels (abbreviated dB) x decibel is a measure of the differences between the energy level of the pressure wave of which a sound. To be exact, the devibel number is equal to ten times. The sound in question and reference sound that reference sound is the one that is just barely audible to a good human ear and so that decibel scale begin at o at the threshold of hearing and rans up to about 135 at the threshold of pain so a noise that is 20 decibels launder than another one has too times to energy of the letter and may seem about four (4) tunes as laud. This togarithnic scale is made necessary by the among ability of the human ear to discriminate sounds that may vary in pressure by a vatis of as much as 10^{14}.

Some common sources and perception scale roughly as follows:

Decibels	Decibel scale
0	threshold of hearing
10	Rustle of leaves
20	Insider a quiet country house a soft misper
30	Inside a quiet city apartment
40	a quiet office
50	Anoisy office ambient noise of a normal kitchen ,interference with sustained conversations
60	Level of ordinary conservation, noise becomes intrusive
70	80 km/hr (50 mph) auto at 15m (soft): deficient to take on the telephone
80	Busy city street, noise is clearly annoyin
90	Noisy Kitchen some possibility of heaving damage if there is long expasure.
100	Power mover, freight train close by, damage of hearing
120	Amplified vacle music (church for example)
130	jet airphone at 30m (100ft)
135	Threshold of pain

Sound perception

The indivudual perception of this scale is variable until we reach, the level of oragnic damage. Extremely laund sounds, or prolonged exposure at high level, can cause deteriorition of the auditing nerve and a loss of sensitivity of sound in 2000 - 3000 cycle range. This damage begin for most at continued exposures above 100 dB but rarely occurs below 85 to

go dB below this differen ears have varying acuities for different frequencies, and more important culture personality and the task at hand will make the same noises agreeable or maddening.

THE EFFECT OF NOISE ON PEOPLE

Noise has

a. Physiological

b. Psychological

c. Behavioural effect on people

d. Physiological effect

Exposure to excessive noise can cause permanent hearing loss. The cause in the over - stimulation of the delicate recapture cells within the inner ear. Although this can occur during short term exposure to very high noise level it is more common when people are exposed to intense noise for a long period. The standard accepted criterion to avoid permanent hearing damage is that exposure times is halved noise level can be increased by 3 dB without increasing the danger.

This means that the following maybe regarded as reasonable limits

8 hours at an average noise level of 90 dBa

4 hours at an average noise level of 93 dBA

2 hours at an average noise level of 96 dBA

1 hours at an average noise level of 99 dBA etc.

Pure tones are physiologically more harmful than brand band spectra for pure lones the above limits should be reduced by 10 dBA. In addition, sharp and unexpected noises can

here harmful physiological effect.

PSYCHOLOGICAL OF NOISE

The psychological effects of noise are far less easy to define because they vary considerably from person to parson. Some people vary consider the dipping of a lop as unacceptable, while others are anaffeated by even high noise level. To establish a centrum that cater for the psychological response of the majority of the population BS 4142 has laid down a standard for acceptable noise level in industrial environments.

It is suggested that one should First measure the noise level outside homes in Dba. The following addition and are, then made.

a. If it has a definite tonal characteristic (hiss, screech, whine) + 5 Abe

b. If there are definite irrequalarities in the sound (intermitted etc.)

c. If the noise is non continous estimate the fractory of the noise operate 50% Dba, 25% = 6 Dba 12.3% = - Dba

TOLERABLE NOISE LEVEL

The basis criterion of noise that has been established as being tolerable as 15 Dba, to which the following correction are made:

a. Rural residential area 5 dBA

b. Suburban residential area 0

c. Urban residential + 5 dBA

d. Urban Semi - residential + 10 dBA

e. Urban light industral area + 15 Dba

f. Heavy industrial area + 15 Dba

Time of day correction are in addition

g. Week days between 8 am - 6 pm + 5 dBA

h. Other daytime period 0

i. Night time -5 Dba

N.B. A satisfactory noise level would be one where the corrected noise level in dBA is less than the limit of tolerable noise.

INSULATION AGAINST NOISE if we compare sound insolation to thermal insolation, considerable differences comes to mind. For example, heat flows in basically the activation of internal molecular structures, as elections jump from lower quantum level to higher ones and vice versa. Radiant heat deals with election argentic radiation with wavelengths of around a micrometre, which can pass through a caccum.

Sound waves are totally different while the speed of light and thermal radiation is absorlately content at 299792.4 km/s, the speed of sound various according to the medium by which it is transmitted. It is also of much smaller magnetite armoring to a metre 3km/even when passing through steal bars,a nd only 343 m/s when passing through a vacuum and obeys few of the mathematrical rules that govern heat transfer. For example, pirous material such as mineral wood are excellent in preventing the passerge of leaf while solid substances such as concrete are poor thermal insulator. The opposite aples to the transmission of airborne noises. It is the solid construction that keeps out airborn noises. It is the solid correction that keeps out noise while the minral wood has virtually no effect in this respect.

From the pint of view of the insulation industry, the problems of noise insolation fall three categories.

1. The reduction of noise within the area where it is produced. This means the one seeks to absorb sound energy, rather than to allow it to be reflected and to reverberate within the working area.
2. The reduction of impact noise:- one seeks to reduce its transmission through solid materials by the introduction of noise - breaks, which convert the energy contained in the sound into thermal energy.
3. The elimination of airborne noise such as noise originating from traffic, a nearby airport etc. The solution may in some case be similar to those employed for thermal insulation purposes, but in most cases they are radically different

THE NATURE OF SOUND

Sound in caused by fluations in air pressure. These fluation start from the source of the sound, which may be a plucked string, a not too well - balanced motor or simply a crying baby, where the source of the fluation are intensity vocal cords.

Whatever the intensity of the sound its speed of transmission depends upon the modulus of elasticity and the density of the medium through which it passes. The velocity of sound is quoted as.

$V = K (E/D)^{1/2}$

Where V is the velocity of sound in m/s

E is the modulus of elasticity of the medium in pascals

D is the density of the medium in kg/m^3

K is a constant equal to 0.843 (dl)

for air at 1 bar pressure the velocity of sound is expressed by the formula velocity = (331.4+0.60t) m/s.

Where t is the temperature in C°

At 20°c the velocity of sound in air at 1 bar pressure is therefore 343.4m/s. In other needing the approximate sound velocities are:

Aluminum	-	4880 m/s
Lead	-	1220 m/s
Steel	-	5020 m/s
Timber	-	3350 m/s
Water	-	1370 m/s.

ELECTROACOUSTIC AIDS

Why do we need electroacoustic aid, especially for places of worship like the church?

1. Basically they are required in large halls like the three auditorium, cinema Hall etc.
2. They are required by quiet speakers
3. For sound distribution

Components of Electroacoustic Aids

The electroacoustic aid system is composed of :

1. Micro phone
2. Electrical Amplifiers
3. Lound speakers

CHAPTER FOUR

4.0 CASE STUDIES

OBJECTIVES OF CASE STUDIES

In the choices of cases studied, effort was made to genuinely look at some churches in the country and those that exist in other countries. The objectives of carrying out these studies is to.

A. Establish a base for development on the already existing case studies.

B. Define a basis for comparison

C. Identify areas of deficiency on the cases studied and make corrections

D. Paper professional suggestions based on the effect and causes of problems identified.

E. Identify problem areas existing on the cases studies and make amends

The summary of the various finding is employed in this project to make up for the disadvantages or problems associated in such case studies.

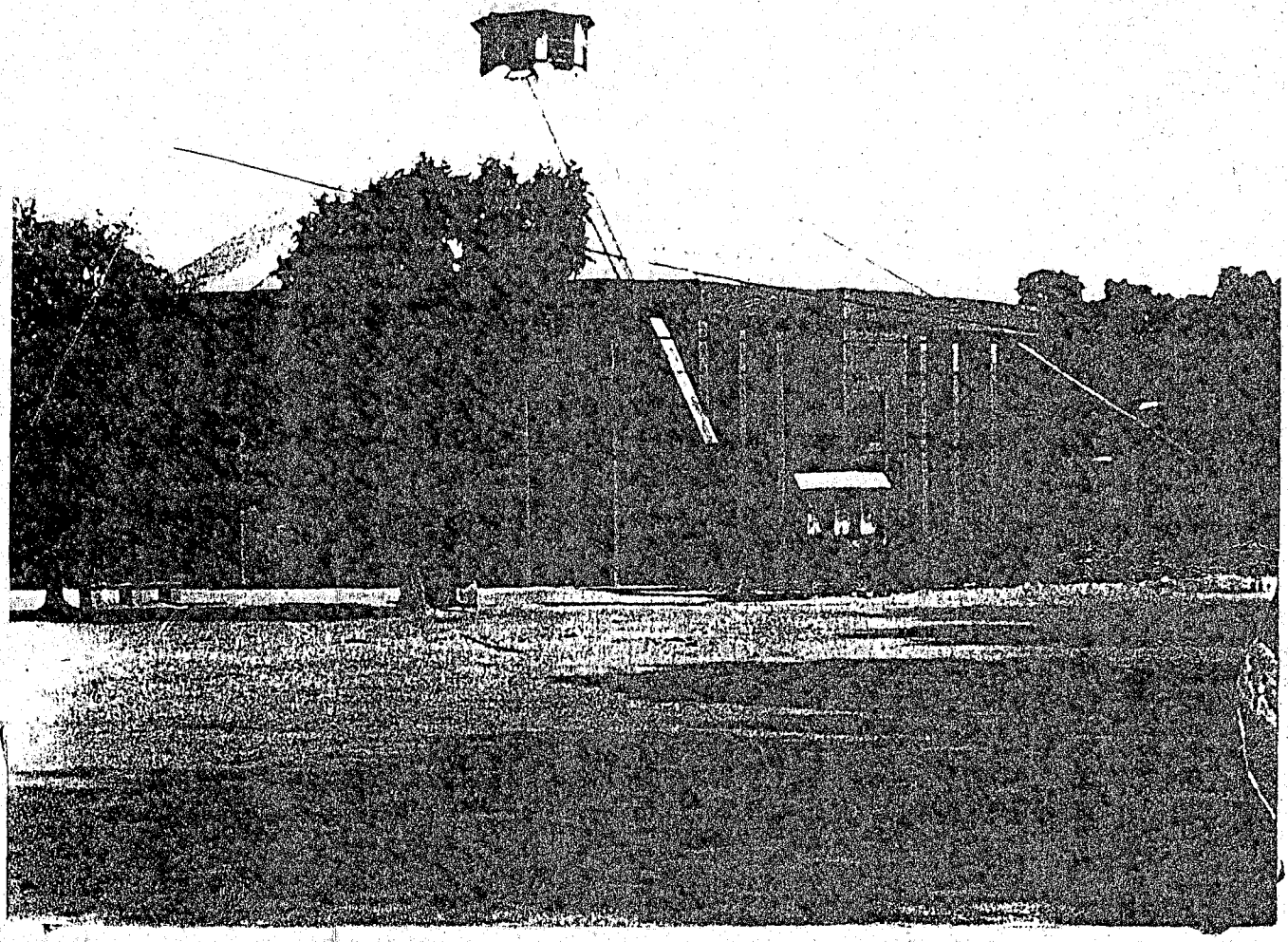
SELECTION CRITERIA

The case studies, hereby, documented, represent a little fraction of church building and probably much more less, than a fraction of all church facilities available in Nigeria to day.

Those facilities and activities can be both an indoor or outdoor spaces.

4.1.0 THE AHMADU BELLO UNIVERSITY WORSHIP CENTRE

SAMARU-ZARIA (OUR LADY OF QUEEN PARISH AND CHAPEL OF REDEMPTION)



APPROACH ELEVATION OF
OUR LADY OF QUEEN PARISH

PLATE 1

4.2.1 INTRODUCTION

The Ahamadu Bello University Christian worship centre, Samaru - Zaria, was built in the late eighties shortly after the infemous religious crises on 1987 which resulted to the bunt down of the famal church. The present centre comprises of the catholic church (our Lady of Queen Prish) and that of the protectants (the chapel of Redemption). The centre was borne out of the need to establish a christain worship centre for both the staff and student of the university.

4.1.2 DESIGN AND PLANNING

The Ahmadu Bello University Samaris Zaria, Christian worship centre is located between the Female Hosted Suleiman Hall, the demonstration secondary school and the male hostel, Suleiman Hall. The design for the catholic church is typical of Roman Catholic church desing with long and pointed conical rooting. And the use Arch windows, entrance and outlet. That of the chapel of Redemption (for the protestant) is also typical of the modern day church design.

4.1.3 MATERIAL AND FINISHES

Material and finishes use for construction are the typical block work of 450mm x 250mm, current finishes concrete reinforce and terrazzo finishes for the flooring. The material is the long span aluminum roof sheet green colour which aesthetical to the beauty of the two worship centre.

4.1.4 OBSERVATION

MERITS

1. It's aesthetically pleasing.

2. Construction sound.

3. It's properly ventilated.

4. Acoustically sound due to the favor usage of pillars.

DEMERITS

1. Wrongly located between the male and female Hostel i.e noise phone areas.

2. Poorly landscaped .

3. Inadequate and no defined car parking spaces.

CASE STUDY 2

ST, MICHAEL CATHOLIC CATHEDRAL CHURCH MINNA - NIGER STATE.

4.2.1 INTRODUCTION

This is the headquaters church of the catholic faithful in Minna - Niger state, it's located along the Bosso road Minna - NIGER STATE.

4.2.2 DESIGN AND PLANNING

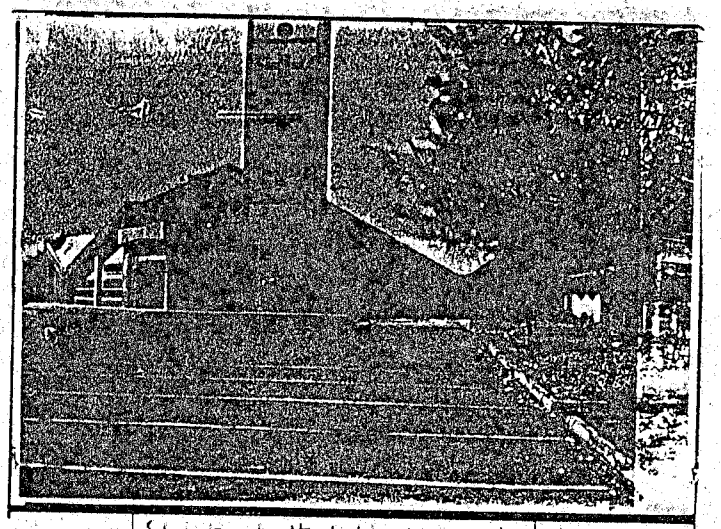
The church is located at a good area of the town and has enough land for future expansion. It is aesthically beautiful and properly orientated to south west direction for proper ventilation of the church.

4.2.3 MATERIAL AND FINISHES

The material and finishes use in that of the store work, which gives it an added beauty. The approach facades is Aesthically sound. The stonework makes the church more durable than conventional block work type.

4.2.4 OBSERVATION

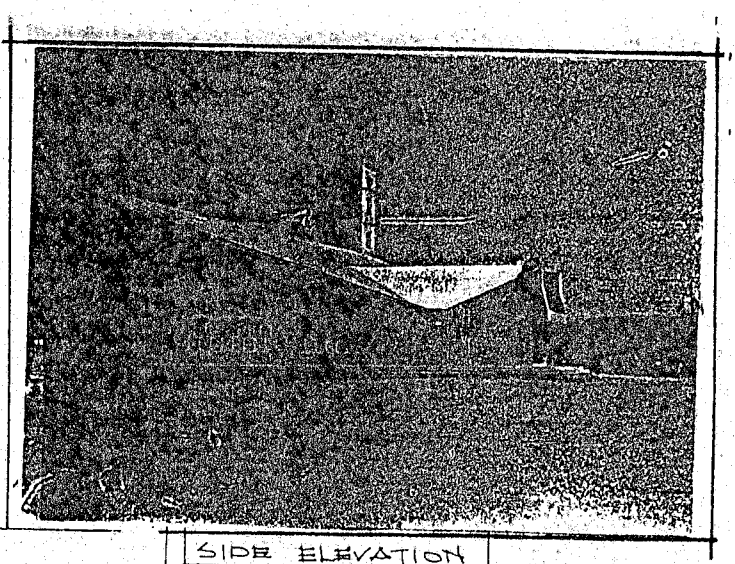
MERITS



APPROACH ELEVATION

PLATE 1

PLATE 2



SIDE ELEVATION

1. Aesthetical pleasant
2. Properly ventilated
3. Proper/good drainage (roof)
4. Gives room for future expansion.

DEMERITS

1. Prone to acoustic problem i.e use of colums
2. Too small for it's function
3. Poor landscaping
4. Lack of enough parking space
5. Lack of proper use of acoustic aids.

4.3 CASE STUDY 3

4.3.1 THE ECUMENICAL, CENTRE ABUJA (F.C.T.)

INTRODUCTION

The Ecumenical Christian centre Abuja presenting under construction was established by the Christian Association of Nigeria (CAN) under the auspices of the Federal Government, Babangida regime. It was bone out of the need to establish a general worship Christian centre in the Federal Capital and thus the name Ecumenical.

4.3.2 DESIGN AND PLANNING

It is evident that Ecumenical centre Abuja is poorly planned in design and general organization. The architecture is purely gothic which cannot be say give an impression of cathedral assemblage. It lack the symbolic touch or impression it's might to achieve. It is adequately located in the less noisy area of the territory.

4.3.3 MATERIAL AND FINISHES

Material use are five resistant and durable which makes it easy to maintain.

4.3.4 OBSERVATION

MERITS

1. Located in a less noisy area of the territory,
2. Enough land for future Expansion.
3. An Architectural monument.

DEMERITS

1. Acoustical prone to sound due to the roof method employed
2. lacks enough parking spaces for it's capacity
3. At present lack any landscaping.

4.0 CASE STUDY 4

THE BASILICA OF THE ANNUNCIATION NAZARETH (ISRAEL)

4.4.1 INTRODUCTION

A general view of Nazareth is dominated by the Basilica of the Amunciation. The city is located in a volley in Southern Galilee. Today the population of Nazareth is mixed between Christians, Moslems and Jews. The Christians belong to various denominations: orthodox, Roman Catholic, Greek Catholic, Maronite, copt, Armenian. Baptist and other protestant sects. The are many churches, monasteries, convents; hostels, hospitals and schools maintained by the various denomination.

4.4.2 DESIGN AND PLANNING

The present Basilica was designed by the Italian architect, Prof Giovanni Muzio was

complected in 1969. The church was constricted with modern and ancient Greek architecture.

4.4.3 MATERIAL AND FINISHES

materials and the finishes use are the of stonework of the ancient Greek form and the modern brickwork. They are of high resistance and are durable in nature.

4.4.4 OBSERVATION

MERITS

1. Good ventilation
2. Large entrance for congressional members.
3. Aesthetical pleasant

DEMERITS

1. Lacks enough or defined parking space
2. Poor Landscaping of the environment
3. Phone to acoustic problems like echos, reverberation

4.5 GENERAL DEDUCTION FROM CASE STUDIES

From the above case studies and others study in the cause of these project. The following deduction can be made namely:

a. The churches study lack adequate parking spaces

b. There is the problem of landscaper in most of not all the ease study.

c. The use of columns in church design has cause view (congregation member) problem and acoustic problem.

d. The churches study and worship centre lucks good acoustic aids to help in the audibility of sound.

e. The churches study, and most Nigerian churches does not use or put much consideration in acoustic material such as Acoustic tiles, floor or ceiling (suspended) or carpet materials in the design of the church.

TABLE 15: AVERAGE DAILY MINIMUM TEMPERATURE IN SOME LOCATIONS IN NIGER STATE, 1996

(DEGREE CENTIGRADE)

LOCATION	JAN	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
BIRNIN KEBBI	17.5	20.1	22.0	21.5	20.1	17.7	20.7	-	-	-	-	-
BIDA	20.5	20.7	26.2	25.5	23.5	22.0	22.6	22.8	22.9	22.6	21.1	19.2
NCRI (BADEGGI	15.0	21.2	23.8	25.0	23.1	24.0	22.7	20.4	21.4	23.1	27.3	25.7
MINNA	19.2	24.5	24.9	25.0	22.8	21.5	21.3	28.6	29.8	31.1	25.0	25.4

Source: Niger State Agric. Development Project, Minna.

TABLE 16: AVERAGE DAILY MAXIMUM TEMPERATURE IN SOME LOCATIONS IN NIGER STATE, 1996

(DEGREE CENTIGRADE)

LOCATION	JAN	FEB.	MARCH	APRIL	MAY	JUNE.	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
BIRNIN KEBBI	-	-	-	-	-	-	-	-	-	-	-	-
BIDA	-	-	-	-	-	-	-	-	-	-	-	-
NCRI (BADEGGI	35.0	37.3	38.4	39.0	34.0	33.0	31.2	22	21.4	22.0	21.1	16.9
MINNA	36.9	37.7	38.3	38.0	34.1	30.5	29.2	20.8	20.3	20.6	17.4	17.2

Source: Niger State Agric. Development Project, Minna.

escarpment. The main town water storage is also on this hill, below is the valley of this hills nus the rail-lie to Kaduna. To effectively take care of the negative impact these weather conditions may have on the buildings. Adequate provision were made for gutters around the courtyards, roof qutter to immediately collect the rain water and drain them completely from buildings surroundings to the nearby drainage of the main road adjoining the school site.

Also to protect the building roofs from the strong effect of the wind, trees, are planted rantomly on the site and the parapet wall are such that they extend above the roof at the lower end and the roof wall at the upper part of the roof also extend above the roof at the lower end the roof wall at the upper part of the roof also extend above it to avoid direct contout of the wind of the roof.

5.2.3 VEGETATION

Niger state is gradually becoming a semi-woodland- tree forest vegetation. This is a belt with derived dry sahel savannah grass/scrub land in highly "degraded stage". Chanchaga local government area of Niger state where Minna indeed the sit are located belong more to the woodland eco-zone. This is due to the intensive fallow type agricultural practice it is however, dominated by started shrubs interspersed with "moderate -height trees with perennial foliage. As described in a letter setion most of the trees species in the chanchaga area are generally of eveqlyptus extraction with fairly useful - by products with increase human pressure and land use "abuse" which is characteristics of the Nigeria country side, the site may lose its remaining trees species to development only deliberate efforts to programme them with land utilization can preserve what is left.

5.3 SOCIO - CULTURAL LIFE

Minna is basically a Gwari Town and got it name from a ritual performed yearly by the Gwari founders of the town to observe the beginning of the name of ear. The word itself is Gwari mean to spread five" it came into existence because the Gwaris used to put out every bit of fire in the area even in all the citchen in the town on the last day of every year.

About three days to the last day of every year, the chief of the town together with his priest and some member of the traditional council would travel to lafiyagi a village on the boundary between Bida emirate and Paiko district about 60 km away to bring real fire to Minna. On the morning of the New year everybody would then have his fire out of the publich fire to go and light it again in their respective houses to mark the start of the new year. This ceremony eventually become synonymous with the town and consequently gave it the present Minna. The origianl name of the settlement on the hill top was Paidi, and srrounding village like Debo, Fedi, Jenping Tafi, Panyi, Pasui and Shaknus work all under his domain. Eery year their inhabitants would all come to get their New life from running house in Paida. The early selfless and founders of the town leved on the top of the range of hills which live the Eastern and Norther sides of the present Minna.

5.4 ECONOMY AND COMMERCE

From the analysis so far, Niger state may be aptly described as a vastland of hitherto under utilised and unutilised resources potentials. Agriculture forms the backbone of the state's economy but this is mainly in the hands of traditional, samll-scale producers. Less that 25% of the states arable land is presently under cultivation, partly as a result of the sparistiy of the rural population in many areas, and partly as a result of the technological limitation of

the traditional methods of production.

The bulk of the state's proven mineral resources are also waiting to be exploited. Quarrying of rock materials for the consturction industry is presently the nearest actively to Minna in the state. Industrially, the state can boast of only a handful of small - to - medium - scale manfacturing outfits. The state's industrial base is therefore very week. Indeed, Niger states of the Federation, accounting for only about 0.8 percent of the natural industrial labour force and an insignificant proportion of the total national value of manufacturing.

The modern sector of the economy is therefore dominated by tertiary services cinching the public service) and an informal sector comprising traders, transporter, artisans, and small - scale processors. The bulk of those enterprises, as elsewhere in the country, are located in the urban -centre and the larger rural sottlements.

5.5 DEMOGRAPHIC DATA

The gralest resources of Niger State are its people who apply their skills, labour and training to transform compoents of the natural environment into goods and services. The structure and distribution of this population is presented in this section.

According to the 1991 national head count, Niger State had a total population of 2, 482, 367 people of this total 1,2,90, 720, (or 52%) were males while 1,121, 647 (or 48%) where females.

Judging from the shear absolute numbers, however, the average density of population in the same maybe put at about 33 per square kilometre, which must be among the lowest in the country, I deed, falling even below this low average density would be the densities mariga and shiroro.

What these statistics suggest is the presence in Niger State of large expenses of land resources waiting to be developed either through carefully guided policy of induced population redistribution or technological improvement for more efficient resources utilisation; or a combinations of all those.

5.6 TRANSPORTATION AND TRAFFIC

Niger state is not just centrally located on the map of Nigeria. The state is also served with an efficient transport and communication Network which enhances accessibility both within the state as may as between it and the outside world.

Access to the Federal University Technology permanent site in along the Minna - Bida major road. And the access to the main campus according to the master plan is a dual carriage way of 40m right of way linking the Minna - Bida highway. This is classified as first or der road. This leads to the central area defined by another, road, endorsing the central core. This central core houses the academic area, the central administration and other public facilities. This ring road also double as the second access road and inks the same minna - Bida highway about 1.75km further to the south.

Circulation planned for the campus has one major aim i.e to provide efficient access to various activity dreas and buildings without creating any confusion or traffic problem. Vehicular and pedestrian movement have been segragated, get inter-related. This resolves conflict of movements of people and vehicles. Traffic requirements at ceremonial occasions like convocations and sports activities as well as movements of visitors, staff and students have been considered in working out the network and parking lots

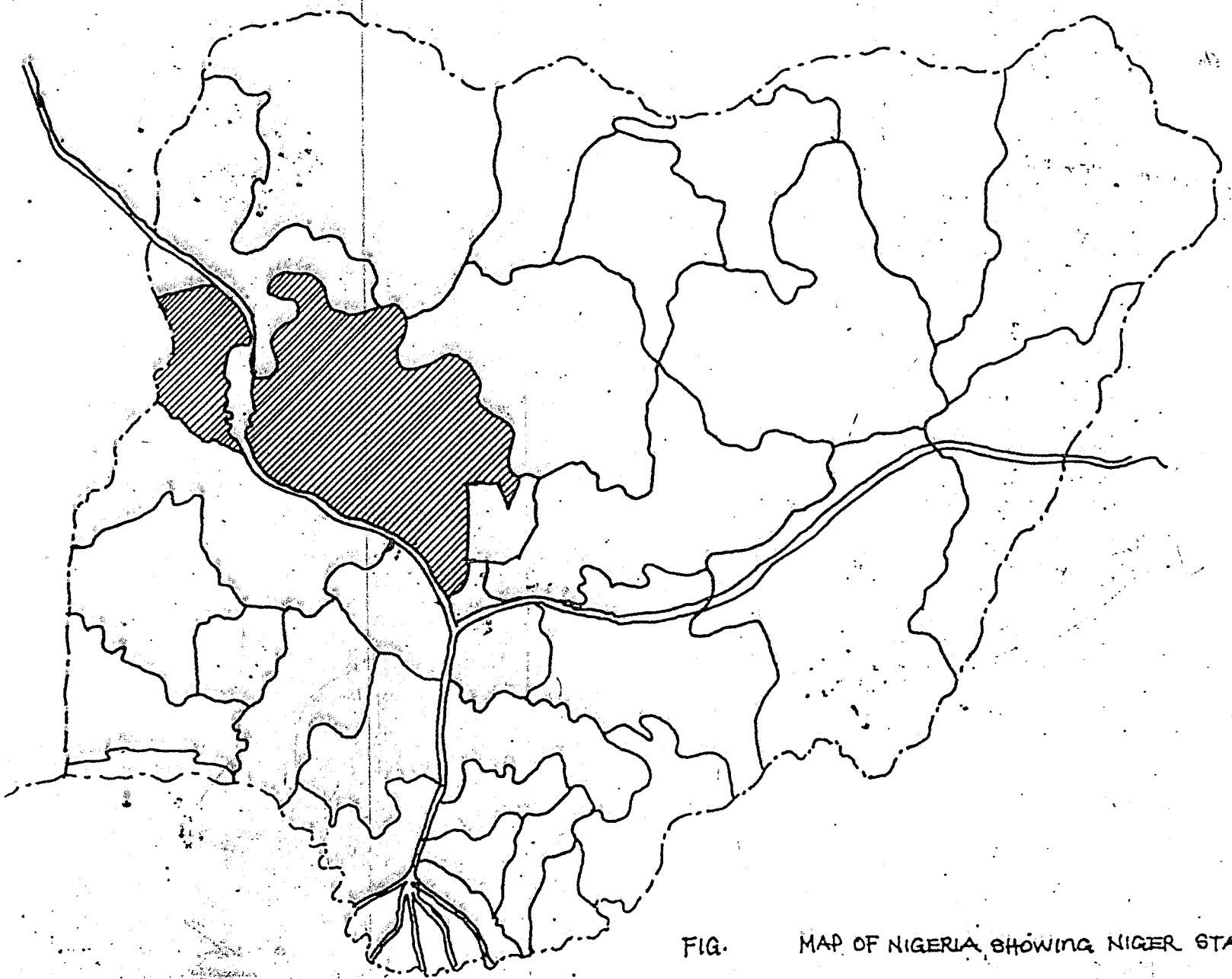


FIG. MAP OF NIGERIA SHOWING NIGER STATE.

5.7 EXISTING LAND USE AND FUTURE TRENDS

Sharp sand and gravel - These materials are locally available near the site and in good quantity and quality along the major course. They can used for civil Engineering works

1. STONE:

The adjacent area is to the permanent site has a lot of cropping stones especially granites and geniuses. The granites are potential targets that can be quarried as aggregates for major construction works on the site. However, the biotite horn blonde granite variety has a particular as an aggregate particularly for road construction because of structural weakness association with the foliation and the aligned biotite.

2. BASE COVER AND FILL MATERIAL

The entire surrounding area as repeated (according to master plan) has a very high CBR value greater than 60%. The bedrock is close to the ground surface and exposed in many places, thus making for greater foundation stability.

3. BUSH STICK FOR SHUTTERING

The most important plant species in the area are eucalyptus family. There are shrub and trees, wood (they are interspersed). These treas are a good sources of bush stice for suffering.

5.8 DEDUCTIONS

Geologically, the state is covered by thus main formation. Sedimentary rocks and base complex rocks. It has the hottest months in the year are march and April that is just before the onset of the first rain. The main daily maximum temperature remain high throughout the year at about 32°c for most of the year.

Soil and vegetation of the state bear a close relationship of its geology, since soil are derived from geology parent material.

CHAPTER SIX

6.0 SITE ANALYSIS

6.1 CRITERIA FOR SITE SELECTION

The selection of the site was based on the avability of site car marked, for the same purpose by the University Master plan nevertheless the following factors are projor consideration

1. The character and stability of the site environment
2. Accessibility of the site for the membership and visitors.
3. Relationship to the main campus dual carriage ways
4. Provision of ample parking species
5. Soil characteristics
6. General contour of the site
7. Climatic factors
8. Availability of utilities
9. Possibility of water source

6.2 SITE LOCATION

The proposed site for the a Christian worship centre, for the federal University of Technology minna permanent site is on the North-East part of the permanent site. It is on the major wod leading to the school farm and qrusing land. The site is located on the less noisy area of the campus.

6.3 SITE CHARACTERISTIC

The proposed site for the "christain worship centre for the Federal University of Minna, permanent site" is relatively flat although in qantle slope founds the North-East (the mash area). Generally speaking, soil type on the site is very important in that it help in determining the foundation types to be used i.e pad, raft, pile, strip foundation. As required the site, the soil type is fuirly sand and fairly clayed in nature.

6.4 ACCESS AND CIRCULATION

The main access to the campus according to the master plan is a dual carriage using of 40m right of may linking the Minna-Bida highway. This is classified as first order road. This leads to the central area defined by another road endorsing the central core. The road before the centre road on the North-East leading to the school farm in where the proposed site is located. The right of using of this road is 30m and it is the road that cust the site of the secondary school on the North side. The creating of a suitable circulation flow in the proposed site suit the master plan pedestrians movement pattern is planned for the campus which will enable students and staff to work freely to walk to the academic core without crosing the road vin the central parking.

6.5 UTILITIES ON SITE

These include the following

a. Stone - cropping stones especially grainiest and geniuses

b. Base cover and fill meteral

The entire surrounding area as reported has a very high value qreater than 60%. The bedrock is close to the gound surface and exposed in many place, thus making for grater

foundation stability

c. Bush stick for shuttering

The most important plant species in the area are eucalyptus family. There are strub in tree mood.

6.6 SCENERY/MAN MADE FEATURES

One of the man-made features on the propose side is the loop road according to the master plain. Another features which is scenery to the site is the nature mash area which create the growth of business and green vegetation in the site.

6.7 ENVIRONMENTAL PROBLEMS

The major environmental problem on the site is the elimatic factor effecting the site. That is the effect of the South-West trade wind and North Estate trade wind, which are properly analysed in the site analysis diagram below.

6.8 SITE ANALYSIS DIAGRAM

The proposed "Christian worship centre" for the federal University of Technology Minna is to be located at the less noisy part of school to guide against noise that could be generated from the centre which is prone to sound (noise).

CHAPTER SEVEN

7.0 THE DESIGN CONCEPT

The proposed worship centre" conceptually generated or form from the greek cross of crusfication (a symbol of Jesus Christ the Son of God, crusfication, dead and rise) and the salvation of mankind from sun.

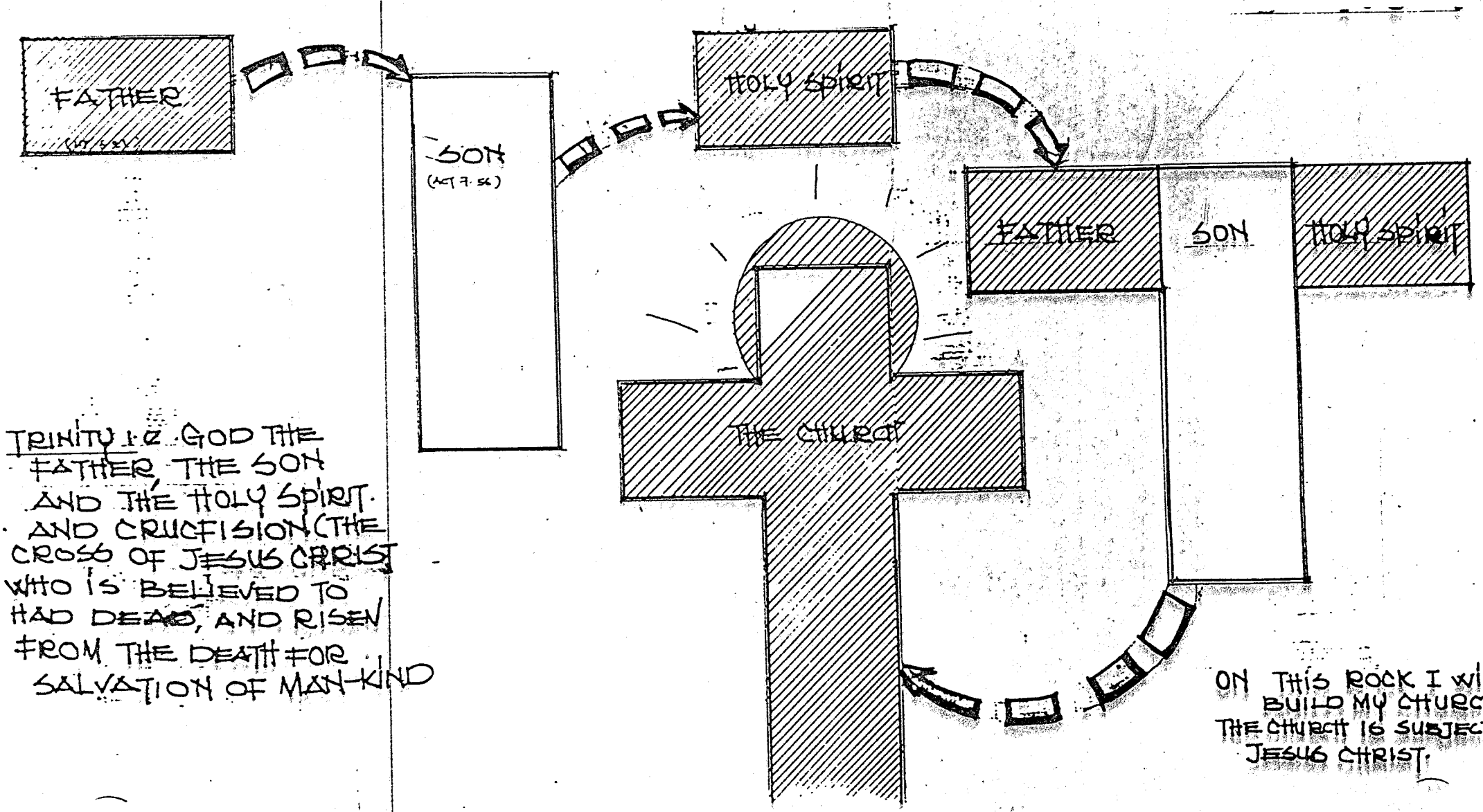
The choice of the concept for this design depit the important of the cross to the Christiandom inves picture of their faith. The cross represent a symbol of salvation of Christ suffering on the cross of calvery for the sins, of mankind in other that mankind might be saved.

7.1 DESIGN BRIEF

MAIN CHURCH AUDITORIUM

This is to accommodate a congressional member of about 4,000 member. It comprises of a ground floor and an upper flow which is in a form of a gallery. It shall comprised of the following also:-

- chapel office
- instrument rook
- general store.
- changing rooms (male and female)
- meeting/conter
- alter
- convinces



TRINITY i.e. GOD THE FATHER, THE SON AND THE HOLY SPIRIT. AND CRUCFISION (THE CROSS OF JESUS CHRIST WHO IS BELIEVED TO HAD DEAD, AND RISEN FROM THE DEATH FOR SALVATION OF MAN-KIND

ON THIS ROCK I WIL BUILD MY CHURCH THE CHURCH IS SUBJECT JESUS CHRIST.

- assistance pastor/chapel
- main church hall/auditorium

B SUPPORTIVE HALL

There are tuco(2) of these type with each on the side of the main church auditorium. The supportive halls would act as a sub-unit of the main church in areas of children services, banquets, marriage seminars or conferences etc.

The supportive Halls shall include the following:-

- main hall/auditorium
- alter
- general stone
- champing room (female & male)
- office (pastor)
- sectary to pastor

C BOOK-SHOP

This unit will be solely for buying and selling of Chritain journals, magazins, books and research finding. The Boorkshop shall entail the following unit .

- entrance hall
- store
- postal agency office
- photo copy room
- reception hall
- exhibition room

D LIBRARY

This unit shall comprise of the following unit

- Entrance Hall
- Liberian P
- store
- Reference unit general office
- Chief Liberian office
- Blinding unit
- Convinces
- Media room

E REST HOUSE (GUEST INN)

These shall serve as accommodation for quest or visitor to the church who for one or reason might have to stay for a day or more. 17 shall include the following components:

- Reception Hall
- Single Suite room
- Conviencies
- Restaurant
- bar
- pining area
- kitchen
- sitting room
- car port

F CHAPLAIN HOUSE

This unit is to serve as the rest house for the school chaplian and his assistance. It shall include the following exponents namely:-

- Foyer
- General louge
- Dinning Area
- Bed room
- Kitchen
- store
- garage

all these are on the ground floor the upper floor on the first floor shall include the following:

- master bedroom
- family louge
- bedroom
- conviencies

CAFETERIA

This shall be provided to serve the students and staff, guest or visitor to the worship centre mostly during speical meeting. It component shall include:

- kitchen
- cold store
- dry store
- enting/dinning area

- serving
- pantary

OPEN AMPTI-THEATRE

This is to serve as a supportive structure to the church and the supportive Had it shall comprise of the following

- Back stage
- changing room
- conviences
- office

7.2 FUNCTION ANALYSIS

The arrangement of functions for the project was based on the measure of relationship of each function to another. The analysis of the various functions can be seen diagrammatically as illustrated in the functional diagram below:

7.3 SPACE ACCOMMODATION

The various paces allocated to each function weathers this project is broken down as shown on the space schedule of accommodation. Each space taken into consideration the relationship to man to furniture, equipment and circulation space. Others are special fixtures and design, like store, cold room.

7.4 DESIGN CONSTRUCTION

The construction of the building can be considered as the product of a temporary factory, the building contractor will make the product. To enable this to take place the builder requires, men, materials, and plants ie. the act of construction management skill or knowlege

to achieve a balanced result (obtaining maximum efficiency on the site)

7.5 DESIGN MATERIAL

The basic materials required for this project would be the usual traditional materials such as concrate, block work, mortar, tumbar, steel. The properties of such are classified generally as physical, chemical and mechanical. The cowice of this common materials is a result of their proven properties, availability and workability, this would reduce the whole construction process to a simple and less tedious operation, enhancing the economic viability of the project.

CHAPTER EIGHT

8.0 DESIGN SERVICES (PLUMBING, ELECTRICAL MECHANICAL)

Such services like plumbing and eledtrical would be sourced from the University main electricity system or plumbling system. it will comprise the following:

a. Sever pipes

b. Electrical supply cable

c. Water mains

d. Telephone cables

In planning, adequate co-ordination between the various municipal bodies in charge must be maintained saucers due to their lower flexibility hence they must be given priority.

Services grouped together, like electrical cable water and telephone line should be laud is trenches to the building sites according to which is lowest and then the next.

8.1 FIRE AND SECURITY

Fir protection could be defired as a means of detecting and extinguishing fires and the elimination of its causes.

It is supply aimed at subsquaring life and protarting of building occupants by controlling fire spread, its reduction and provision of adequate means of escapes for the occupants.

The most important aspact of fire protection is the means of escape and design, of which adequate provision within such structures. From a point one should bot travel a distance of more than 20-24m to escape, andthe exist should be able to release 30 - 35 people

at a time. The design of the worship centre would cater for tfire detectors. That is, there should be good and appropriate locations for these detectors. These detectors include heat, smoke, or flome and fire detectors, fire control panel, power supply and accessities.

The nature and type of materials used for such building must be highly resistant to fire, therefore materials specified must conform with such standard. Example of some materials include heat tempered glass, burnt brices, bestos, concrete. Another important aspect of fir protection in such building is the case of life extinction mechanism. These structure, must possess fire fighting equipment's which must be easily accessible and conveniently located. Other such as house reals are located 40m apart wile the fire extinguisher is to cover an effective area of $36m^2$.

8.3 EXTINQUISHING FIRE

There are so many methods of extinquishing fire, like the addition of dilutant to the combustion/flame zone, coolant using mater and carbuidioxide using insolation concept (foam process) and the chemical/physical inhibitor process. For this project the chemical/physical inhibitor process is recommended it works by braking down the chain reaction essential to combaustion process.

This is set-up using the Halon modalar system. This relies on individuals cylinder located within the area and potected. Usually they would be lived at a highly sansitive detector system such as an 10misction smoke detector. The major advantage of this ystem is that its installation is simple movable, economical to maintain and mounted easily in used space like ceiling. The Bs approves a low toxil level factor for Helon of 1301 (Btm) or Helon 1211 Bcf) and Carboudioxide usable in public places.

8.4 AESTHETIC APPRAISAL AND CONCLUSION

Aesthetic on be looked upon as an expression of satisfaction. The satisfaction has its roof in the satisfaction created by the design which is this case is the "Christian worship centre" federal university of Technology Minna, permanent site.

It is a centre that would accord the Christian faith of the University and it's surrounding environments, a sease of belonging togetherness, rather than the prosoat situation of separation or organization. The site arranged in form of the concept of the crucifixion of the cross Ca symbolic for the salvation of man's freedom for sin, through the dead and risen of Jesus Christ on the Cross of Calvary).

The building like the church auditorium are will treated against acoustic problem, and are well land scope to the noise or sound from the various building interfering into another building. The flexibility of the seating is a possibility, for opened of for evaluation and, out as ground insulator.

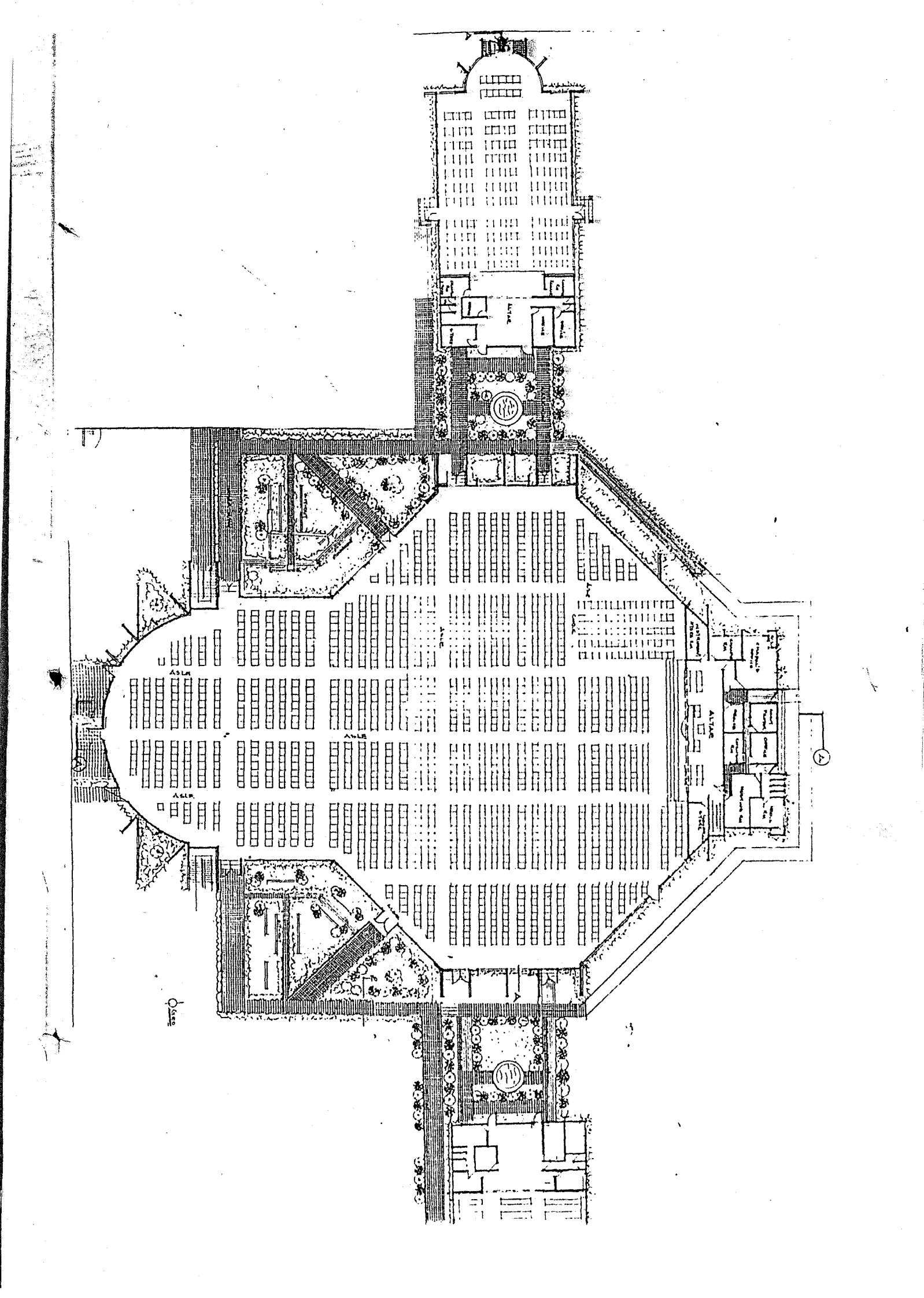
CONCLUSION

All along, the church ha had to struggle with beliefs and value and their expression in the physical world and the struggor between idealised aspirations and their fulfilment in everyday life. The church need to outgrow the past believer or doctrine of denomination services or believe the Christian here never been in agreement as the nature of the church but have a common believes the cut across all the different denomination. i.e Jesus Christ is the head of the church, and He died for the solvation of man-kind and He is the father, son and Holy Spirit and no one goes to the heaven except through Him.

Furthermore, the design of the "Christian Worship centre of the Federal University of

Technology Minna permanent site was conceired on the basis of achieving a functionally constructional Remedial and acoustical sound or less acoustical prone church as it's common found in most church or worship centre in Nigeria. The main problem encountered in this project were more of acoustic performances, noise control.

Finally, in concluding this these work, it must be it must be observed that writer has dealt throughly with the historical background of churches believes, design existing cases, costly across the various Christian denominations, site plan, aesthetic and functional arrangement. New trends have been taken into ensideration so that the design can withstand the test of time and adapt to further change of need be.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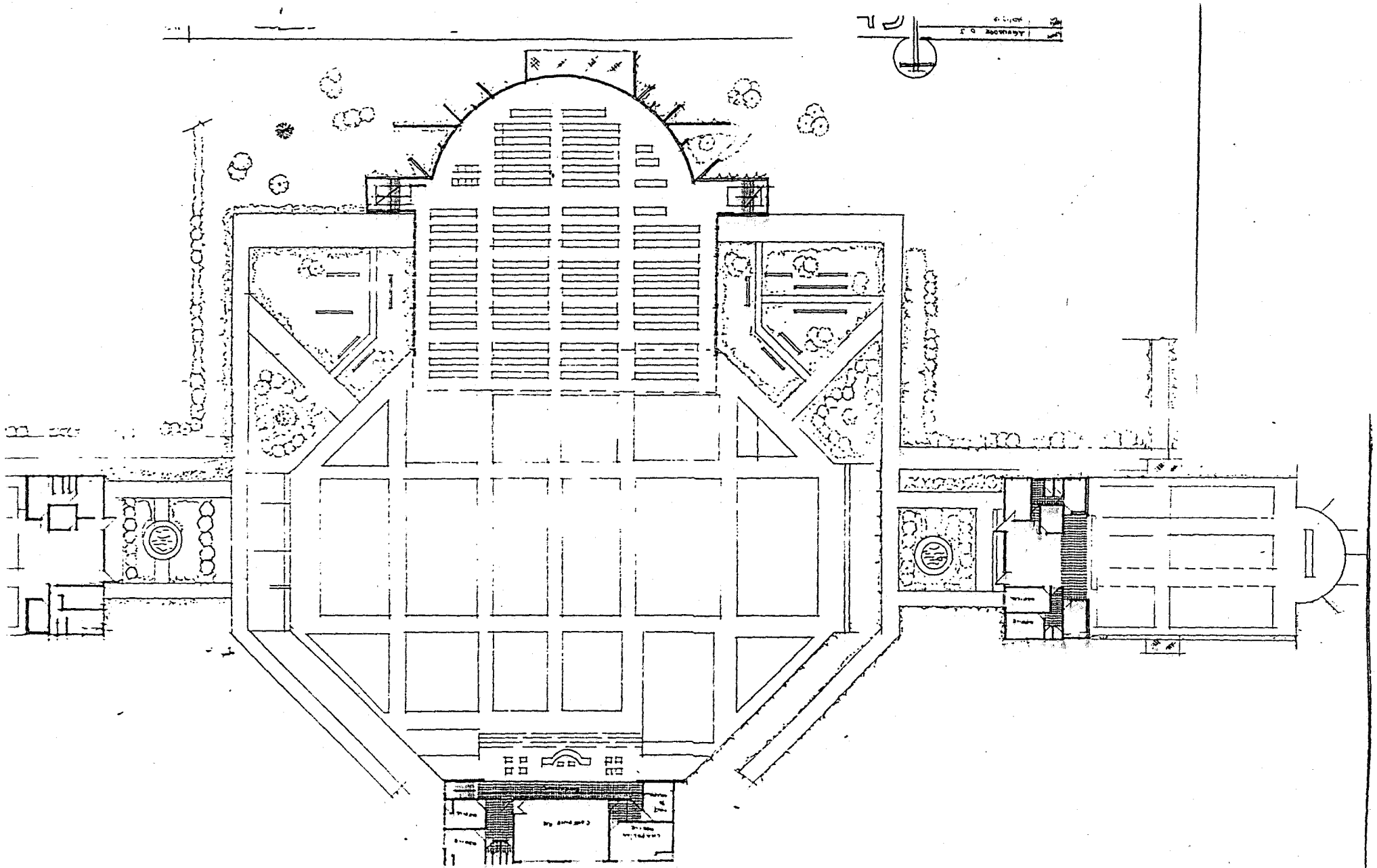
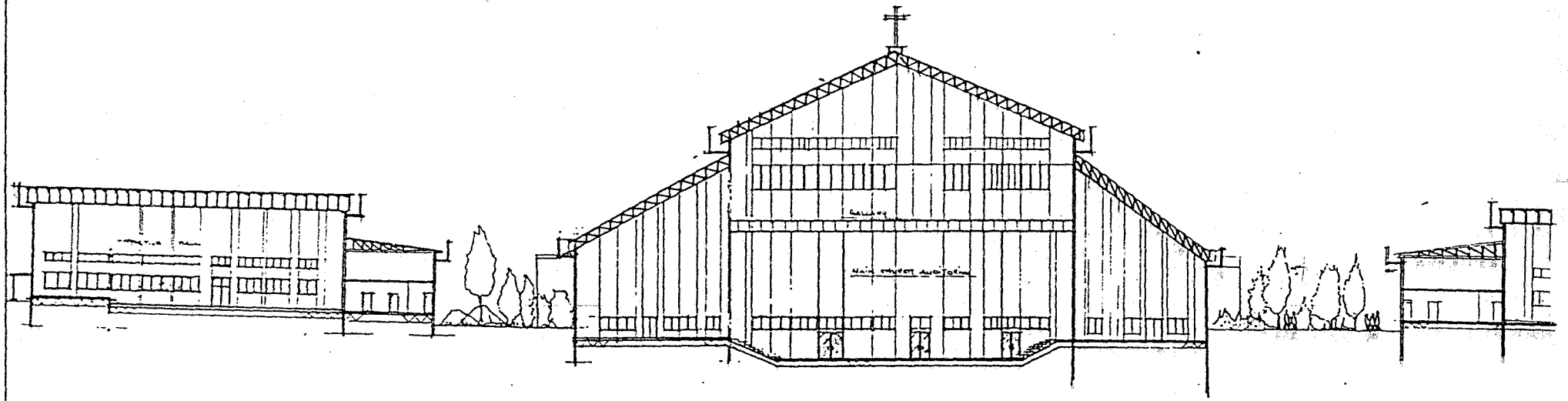
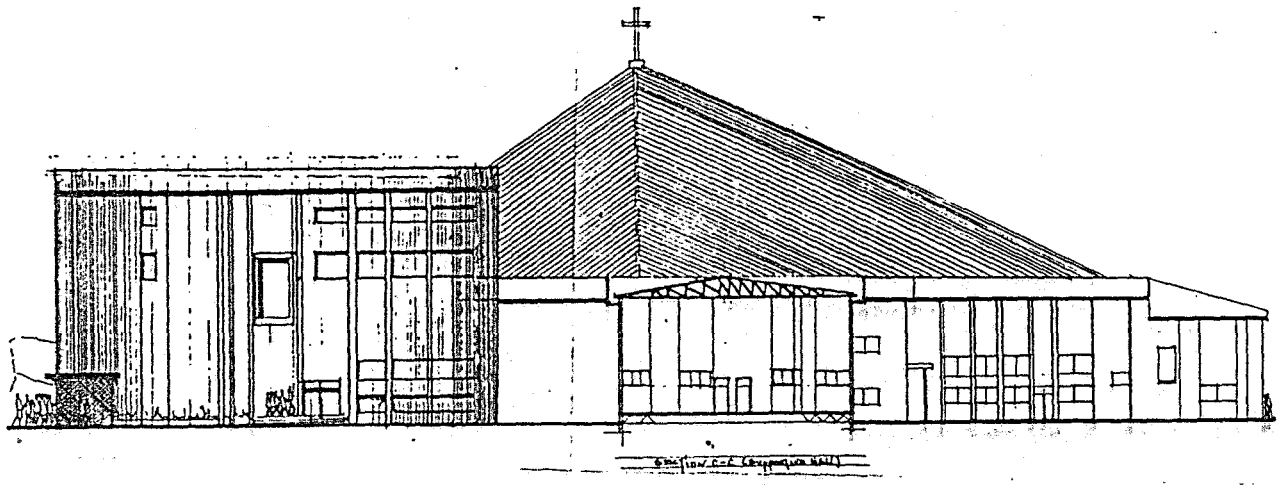
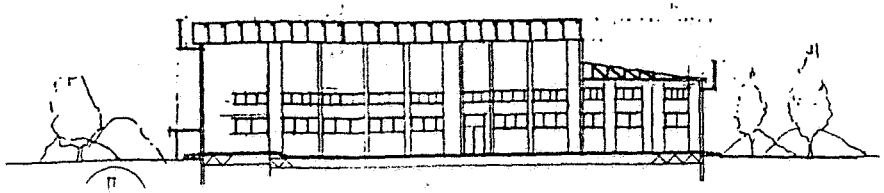
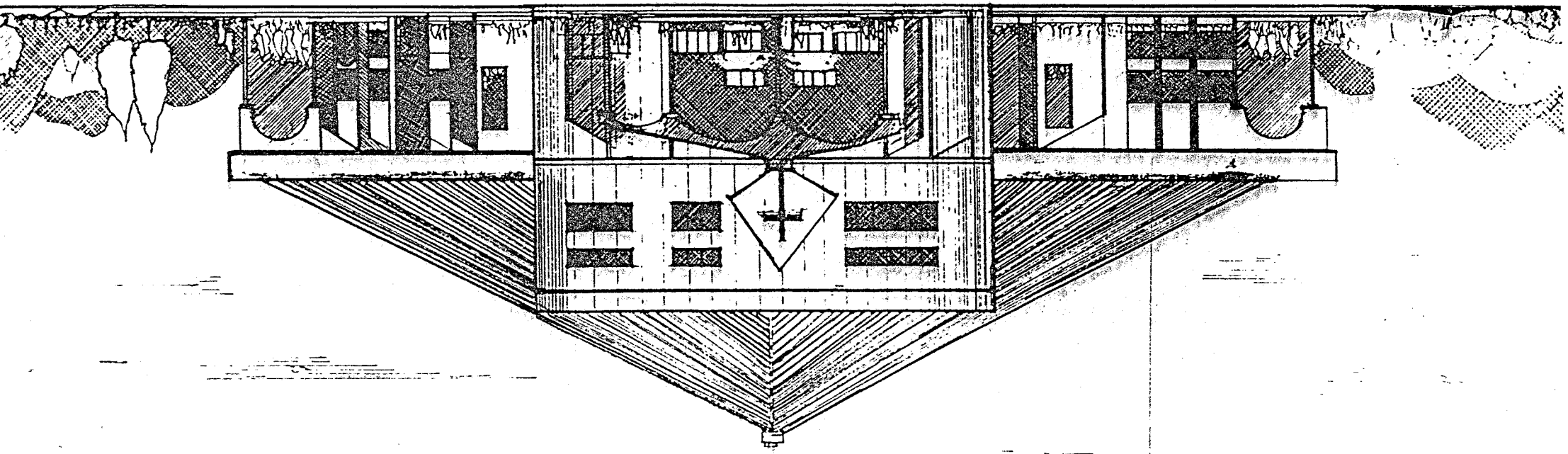




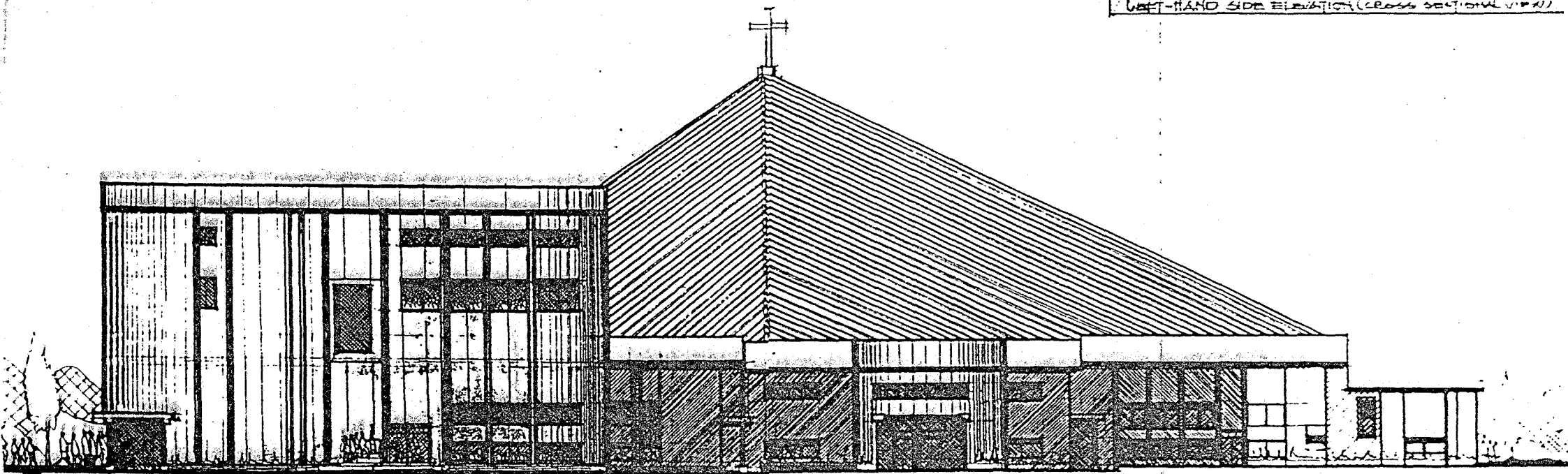
SECTION A – A (ACROSS THE SUPPORTIVE HALL AND THE CHURCH AUDITORIUM



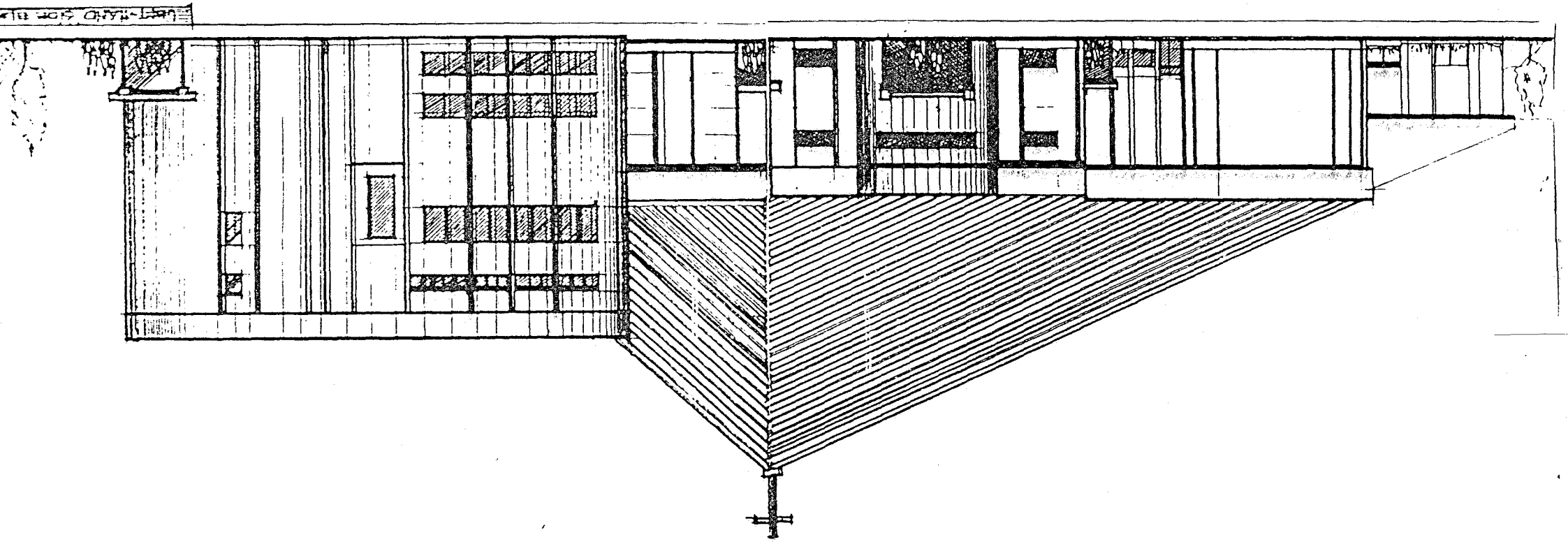


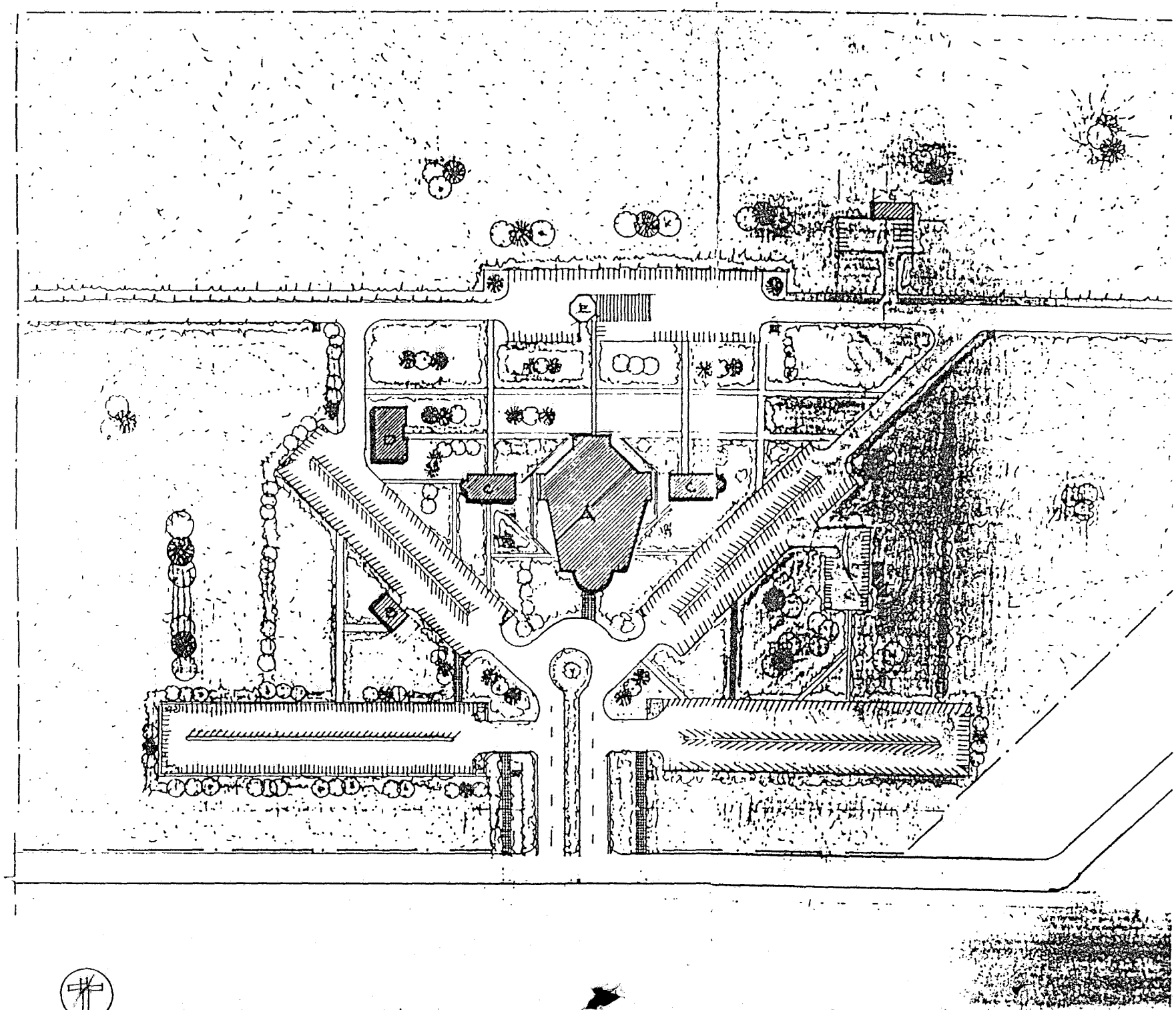


LEFT-HAND SIDE ELEVATION (CROSS SECTIONAL VIEW)



RIGHT-HAND SIDE ELEVATION (

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