PROPOSED LAKE CHAD BASIN TOURIST RESORT, YOBE STATE

USE OF ECO-FRIENDLY ARCHITECTURE TO ENHANCE TOURIST ATTRACTION

A THESIS SUBMITTED TO POSTGRADUATE SCHOOL,
AHMADU BELLO UNIVERSITY, ZARIA

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE OF MASTER OF SCIENCE IN ARCHITECTURE

DECLARATION

I,Jamila Usman Hussain declare that the work in the dissertation entitled 'Lake Chad Basin Tourist Resort:,Use of eco-friendly architecture to enhance tourist attraction' has been performed by me in the department of Architecture under the supervision of Arc.Maimuna Saleh Bala and Arc.Ahmed Sani.The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another degree or diploma at any university.

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Name of student	Signature	Date

CERTIFICATION

This thesis entitled "LAKE CHAD BASIN TOURIST RESORT:Use of eco-friendly architecture to enhance tourists attraction" by Usman Jamila Hussain meets the regulations governing the award of the degree of Master of Science of Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

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ACKNOWLEDGEMENT

I thank Allah (S.W.T) for making my stay in Ahmadu Bello University, Zaria a fruitful and successful one. Alhamdullulah. I wish to say a big thank you to my loving parents Alhaji Usman Hussain and Hajiya Hadiza Usman Hussain for the support, guidance and love they have showered on me. You are the building blocks of my life. I wish to appreciate the efforts of my adorable husband Musa Ajiya for the patience, under standing and moral support.

The entire Usman Hussain family, i am proud of you and you are the source of my inspiration.

Sincere gratitude goes to my lecturers like Arc. Maimuna Saleh Bala, Arc. S.S. Tulpule, Arc. M.H. Mukhtar, Dr. M.D. Ahmed, Arc. Ahmed Sani and Dr. M.L. Sagada for the constructive criticisms.

Regards to my friends like Faiza Mustapha, Sinina Salihu Isa, Kauthar Yahya, Hajara Mahmud, Zainab Sada, Maryam Kowa, Hameeda Kazaure, Karbal Kaltho and Segun Jaga.

ABSTRACT

Human activities have resulted in environmental deterioration and depletion of the natural resources which the earth is endowed with,Construction activities play significant roles in this aspect by destroying natural reserves and causing pollution to the environment.

The Architect and other professionals in the building industry should ensure that the interaction between man and the environment is friendly .There is a need to maintain the balance of the eco-system to prevent the extinction of some plants and animal species,eradicate pollution,and provide natural and serene outdoor spaces which are gradually becoming obsolete. The environment is the earth's treasure.

This aim of this research is to explore the basic strategies of eco-friendly architecture that can be adopted in the design of a tourist resort at the Lake Chad basin to ensure minimal destruction of the environment.A study of the basic strategies that are applicable to tourist resort was carried out.

RESEARCH METHODOLOGY

Data was collected and analysed by the use of case studies, tables, photographs and visual survey.

RESEARCH FINDINGS

The study revealed that most tourist resorts do not apply the basic principles of eco-friendly architecture in design. Only few resorts have taken positive steps in exploring eco-friendly architecture in their design.

The new trend in tourism has now shifted towards nature appreciation, conservation and the promotion of native heritage of the locality.There is therefore the need to apply eco-friendly design strategies in resort design to ensure enrichment and enhancement of the environment.

This resort design will serve as a channel through which eco-friendly desgn strategies will be studied and to provide guidelines for any future dcvelopment.This will minimise the encroachment of our natural ecosystem.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUUND OF THE STUDY

Tourism is a big industry that can earn foreign exchange ,provide employment and serve as a catalyst for the socio-economic development of any country that develops its tourism potentials. Kenya, Morocco and Egypt have immensely benefitted from tourism in Africa.

In recent years, in view of global trends, many African nations have taken positive steps to develop their tourism assets for its invaluable benefits. Nigerian government has decided to take positive steps to develop the tourism potentials in order to diverse the economy which is dependent on petroleum.

Nigeria is blessed with natural reserves and beautiful sceneries that serves as hot tourist destinations if properly developed. Lake Chad Basin is one of such tourist attractive spots. It is located in the Sudano-Sahelian zone of North-Eastern Nigeria. This place is ideal for the development of a tourist resort.

A tourist resort is a place of relaxation attracting visitors for holiday or vacation. It provides the visitor's wants like food, drinks, lodging, sports, entertainment and shopping.(Wikepedia 2007)

The Need For Eco-Friendly Architecture

Construction industry is seen as a major consumer of energy resources and the destruction of natural habitats. There has been a conscious movement in the construction industry to address this issue in order to utilise natural resources judiciously.

Eco-friendly architecture optimizes the performance of a building, and preserve and protect important resources like water, land, and energy. An eco-friendly building has minimal impact on the environment while enhancing user comfort and efficiency. This is accomplished through an integrated approach to architecture, blending design issues, using energy-efficient materials, construction techniques, effective building systems and taking advantage of renewable energy supplies. Eco-friendly architecture is a process that must be integrated into every phase of the construction project, from the beginning to end. To achieve true eco-friendly architecture, eco-friendly ideas need to be supported by everyone involved in the process from design to construction.

Building design is one of the simplest ways to create an eco-friendly building. Good architectural design reduces the need to cool or light up buildings. The use of solar-passive methods such as natural cross ventilation or skillful natural day-lighting can significantly bring down the costs as well as the energy needs of a building. Appropriate use of material is also very important in an eco-friendly building. Evaluating material in terms of energy required to obtain, treat, manufacture and to transport it to a job site is necessary. . It's also important to minimise the use of non-renewable, energy-intensive building materials like glass, steel, brick, vinyl or

aluminum.Architect K Jaisim, who uses hollow clay blocks in most of his creations, also embraces eco-friendly architecture. Alternate eco-friendly energy options like solar energy should be suitably used in an environment-friendly development. . Rainwater harvesting which basically involves the collection of water from surfaces on which rain falls is also an eco-friendly technique.

PROBLEM DEFINITION

Lake Chad Basin National Park is one of the eight national parks in Nigeria. It has a rich diversity of fauna and flora with a lot of beautiful sceneries and interesting natural features that have lots of potentials for tourism. Buiding projects have negative impacts on the environment which can lead to environmental destruction and extinction of some plants and animals species.This can be assessed through Environmental Impact Assessment (E.I.A).There is need for an eco-friendly resort design that is in tune with the climate and enhance the existing fauna and flora.

This thesis will reveal the importance of eco-friendly architecture in the preservation of such natural sites. The basic strategies that can be adopted to achieve minimal destruction of the environment will be defined for architects and environmentalists in general.

1.3 AIM AND OBJECTIVES

The main aim of this research is to study eco-friendly design strategies that can be adopted in the design of tourist resort and propose a tourist resort for the Lake Chad Basin National Park .

The aim is going to be achieved through the following objectives:

Study the basic principles of eco-friendly architecture.

Study the relationship between eco-friendly architecture and tourist resort design.

Analyse eco-friendly strategies that can be applied in tourist resorts.

Study design consideration for buildings as it relates to birds migratory area

Propose a resort design for Lake Chad Basin National Park using eco-friendly architecture.

1.4 SCOPE AND LIMITATION

Studies on tourist resorts will be reviewed in an attempt to check the degree of response of such resorts to the natural environment, study how eco-friendly architecture can contribute in environmental conservation to preserve natural habitats and enhance tourist experience.

1.5 SIGNIFICANCE OF THE STUDY

The outcome of this study will highlight the importance of eco-friendly architecture to architects and organizations, government parastatals at state and federal government levels in the development of tourist facilities to ensure minimum destruction of the environment.

1.6 MOTIVATION AND JUSTIFICATION

Lake Chad Basin National Park features scenic views and environment very conducive for the development of beautiful resorts .It has unique characteristics and immense potentials for tourism development. Use of eco-friendly architecture in its development will enhance sustainable use and development of such areas, and

provide a clear guideline for environmentally- conscious resort development to improve the quality of tourist's experience, preserve the natural environment and to improve the economic live hood of the local community.

2.0 CHAPTER TWO:LITERATURE REVIEW

MAN AND THE ENVIRONMENT

2.1 *EFFECT OF MAN ON THE ENVIRONMENT*

During development human activities affected the world in the following ways:

Deforestation

Pollution of land,sea and air.

Increase in land use or changes to the land as a result of human activities.

2.1.1 Deforestation

Trees absorb carbondioxide by the process of photosynthesis and release oxygen into the environment



Plate 2.1. Deforestation

Source Encarta *2008*

Human activities result in the destruction of forests which causes several problems as follows

Less CO_2 is absorbed from the atmosphere.

More CO_2 is released into the environment from the burning and decay of trees.

The increased level of CO_2 in the atmosphere enhances Greenhouse Effect and the destruction of trees leads to the destruction of habitats and the expansion of deserts.

2.1.2 Pollution

There are 3 types of pollution

(i) Air pollution

(ii)Water pollution

(iii)Land pollution

(i) Air pollution: This normally occurs when gases are released into the air from the burning of fossil fuels such as coal. Sulphurdioxide, nitrogen oxides and carbondioxide are released into the atmosphere which causes acid rain and green house effect. This causes damage to the environment, human health and the quality of life.



Plate 2.2 Air Pollution

Source:Encarta 2008

(ii) Water pollution: Water is usually polluted with sewage, fertilizer and toxic chemicals. Water pollution results in contamination of streams, lakes, and underground water. It makes streams, lakes and other water bodies unpleasant for usage.



Plate 2.3 Water Pollution

Source:Encarta 2008

Some of the pollutants include petroleum products, pesticides and herbicides, heavy metals, e.t.c

(c)Land pollution: Land is usually polluted in 2 main ways:

Using toxic chemicals, fertilizer and herbicides.

Building, quarrying and dumping waste.



Plate 2.4: Land Pollution

Source:Encarta 2008

Chemicals causes poisoning of plants and animals and eutrophication. Building and construction activities, quarrying and waste dumping results in the destruction of habitats and extinction of plants and animal species.

2.1.3 Conservation

Conservation is the sustainable use and protection of natural resources including plants and animals, mineral deposits, soils, and fossil fuels(Encarta 2009)

Natural resources are grouped into 2 categories:

(i) Renewable Resources: These are resources that can be replaced overtime e.g. natural vegetation or inexhaustible e.g solar energy.

(ii) Non-Renewable Resources: These are resources that are limited in supply and cannot be replaced or can only be replaced over extremely long periods of time e.g. fossil fuels, mineral deposits, e.tc

KASU

Natural resources are conserved for their biological, economic and recreational values as well as their beauty and importance to local cultures. Conservation conflicts arise when natural resource shortages occur as a result of increasing demands from growing population.

2.1.4 Methods Of Conservation

A variety of conservation methods are used to ensure adequate supply of resources for future generations. The methods used are:

(i) Reducing consumption e.g reducing high demand of tropical hardwoods in United States,

(ii) Protecting natural resources from contamination or pollution by limiting use of pesticides and other toxic chemicals, regulating drilling and transportation of petroleum products.

(iii) Protecting and preserving resources

(iv) Reusing and recycling resources where possible.

2.1.5 Types Of Conservation

(i) Biodiversity Conservation

(ii) Forest Conservation

(iii)Soil Conservation

(iv)Water Conservation

(v)Energy Conservatio

2. 2 ECO-FRIENDLY ARCHITECTURE

2..2..1 The Concept Of Eco-Friendly Architecture

Eco-friendly architecture refers to a building design that optimizes the performance of a building ,preserve and protect important resources like water,land and energy through an integrated approach to architecture, blending design issues, energy efficient materials, construction techniques, effective building systems and taking advantage of renewable energy sources.(Bangalore 2008).

Eco-friendly design is a design that makes use of resources that come from the earth and retuned to the earth without causing harm in a cycle that echoes the natural systems of living things.(Wilhide 2006)

The main objective of eco-friendly architecture is efficiency both in terms of energy and the use of resources.Efficiency can be achieved when all the elements of the design and construction are properiy integrated.Buildings have often been designed with little regard to the for the site or existing climatic conditions with the result of using costly technological input for heating or air conditioning.

The origin of eco-friendly architecture can be traced back to the passive design strategies employed in traditional building forms.In hot and dry areas,houses are typically long and thin to dissipate heat with internal courtyards that set up patterns of cross-ventilation.In cold climates,vernacular houses have compact plans with rooms tightly arranged around central heat-producing core.

Contemporary eco-friendly design looks into using technology to maximize efficiency and reduce wastage.Examples of the include photovoltaic systems.

The central challenge of eco-friendly design is setting-out priorities that will do the most good.This entails an assessment of environmental risk associated with any development.The following are the ranking of environmental risks:

(i)High-risk problems:This includes the destruction or alteration of habitats,extinction of species and loss of bio-diversity.

(ii)Medium-risk problems:These includes the use of herbicides and pesticides,acid rain pollution and surface water with toxins e.t.c.

(iii)Relatively low risk-problems:These includes oil spills,groundwater pollution and thermal pollution.

2.3 THE STRATEGIES OF ECO-FRIENDLY DESIGN

Eco-friendly design strategies that will be adopted are:

i. Use of thermal mass
ii. Natural ventilation
iii. Orientation
iv .Evaporative Cooling
v Shading
vi. Building materials.
vii Ecofriendly land scaping
viii Rainwaater harvesting
ix Use of photo-voltaic panels

2.3.1 THERMAL MASS

Thermal mass deals with the heat absorbance of materials. Thermal mass is the property of materials that determines its heat absorbing capacity. High density material like concrete, bricks and stones have high thermal mass because a lot of heat energy is needed to bring about a raise in temperature in such material. Such material heat up slowly and retain heat for long period. Appropriate use of thermal mass can make a big difference to comfort and cooling bills [Reardon et al 2008].

A number of factors determine the rate of heat transfer through building materials and effectiveness of the thermal mass. Optimization of thermal mass level depends on the properties of the material, building orientation, thermal insulation, ventilation, climatic conditions, use of auxiliary cooling systems and occupancy patterns. Effective heat storage of walling material depends on the thermal capacity and conductivity of the material [Reardon et al 2008].

At night, outdoor temperatures are lower than indoor temperatures. The structural mass of the building can be cooled by natural ventilation. This technique is known as ''night ventilation'' and it helps in decreasing the carrying road of air conditioned builds by about 60% or decreasing the over heating hours of buildings that are not equipped with air conditioners to about 75% [geros et al 2001]. The building is cooled at night, giving room for heat absorption the next day.

Buildings consume a lot of energy with the emission of harmful pollutants into the environment.The heat storage capacity of a building can be measured by adding

phase change materials in plaster. This contribute in decreasing the average indoor temperature.

Proper thermal mass design moderates material temperature by averaging day/night [diurnal extremes]. However improper thermal mass design can lead to huge energy and comfort liability. Heat will be radiated at all night during summer.There is a need for a sound passive design technique for an efficiency in the use thermal mass.

(i) Mechanism Of Heat Transfer Within Thermal Mass

Thermal mass works like a thermal battery. Heat is absorbed to delay heating the interior in summer. While in winter, it absorbs heat from the sun it release it into the interior at night; [reardon 2008]. Thermal mass stores and re-radiate heat.

(ii) Properties Of Thermal Mass

High density: The higher the density of a material, the higher the thermal mass.

Good thermal conductivity :There is a need for good thermal conductivity for a material to allow heat flow through the material. Brick has good thermal conductivity and therefore has good thermal mass. However, very high thermal conductivity does not allow for the required lag effect for diurnal moderation.

Low reflectivity: Dark and textured surfaces radiate and absorb more energy than the smooth reflective surfaces.



Plate 2.5 Use of bricks in the construction of buildings

Source wikepedia.com

2.3.2 NATURAL VENTILATION

Natural ventilation is the process of supplying and removing air through an indoor space by natural means. There are two types of natural ventilation occurring in buildings:

(i) wind driven ventilation

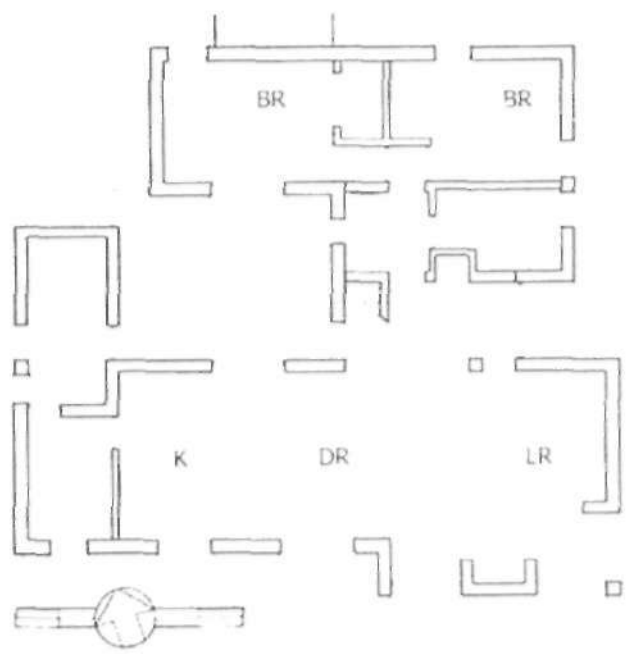


Plate 2.6 Wind driven ventilation

Source google.com

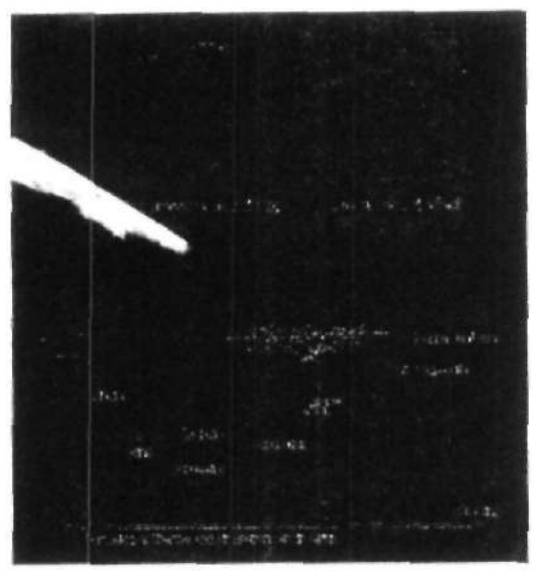


Plate 2.7 Stack ventilation

Source google.com

Cross ventilation is achieved with windows and openings opposite side of the building.It depends on the movement of air often driven by breeze.Cross ventilation is achieved using tall spaces within the building.These tall apaces are known as stacks.Openings at the top of the stacks enhance warm air escape while cool air enters the building from openings near the ground.

The positioning of windows on the prevailing wind direction enhances air movement.

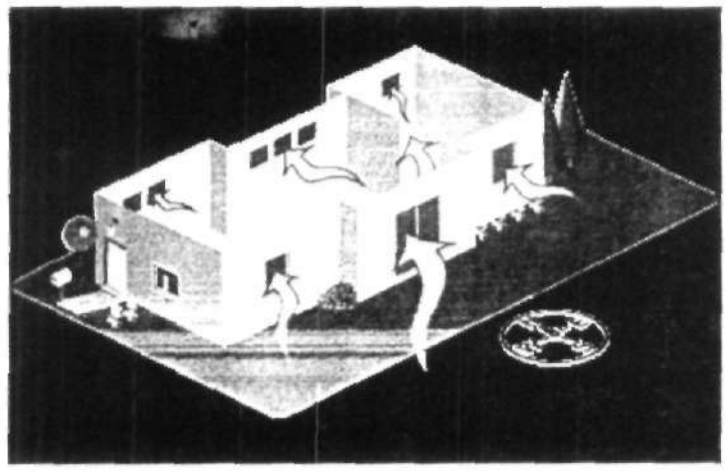


Plate 2.8 Cross- ventilation

Source google.com

The general principles to include in design to achieve maximum cross ventilation are:

i use of large doors and windows to promote cross-ventilation,

ii Open planning and wide free spaces between buildings,

iii Raising building on stilts.

iv Use of large overhangs to protect internal spaces from solar heat gain.

v Use of sliding screens to protect building from storms and insects at night,

vi Use of low thermal mass materials to minimize heat storage,

vii Use of double roofs with two layers and ventilated air spaces.

viii Use of high insulating materials in roof,

ix Use of maximum exterior wall with minimal number of interior rooms.

x. Use of vents at the highest point in the roof space,

xi. Use of small louvered windows close to the highest point of the building with flat roof.

Including those design features will facilitate adequate cross ventilation

2.3.3 SITING AND ORIENTATION

Siting and orientation of building is used to take advantage of passive solar loss and gain.This is achieved by determining the sun strength, angle and path across the site. The longer axis of the building should be along the North– South axis. Over hanging eaves will prevent interior over heating in summer.

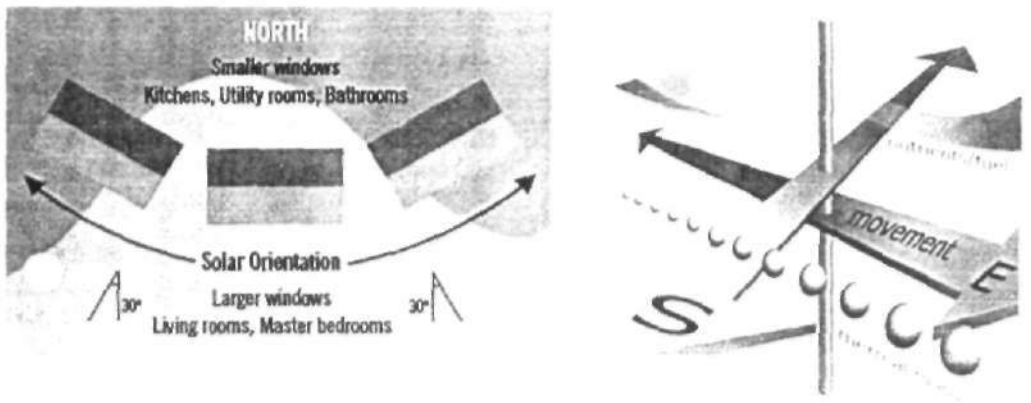


Plate 2.9 Passive solar orientation of buildings.

Source google.com

Buildings are oriented to take advantage of sun and cooling breezes.This ensures achieving greater comfort at lower cost.

In general, ideal orientation means:

Getting the right amount of sun during winter and not too much sun during summer.

Protection from strong/cold winds but taking advantage of breezes for cooling when it is too warm.

(i) **Positioning For Sun**

Buildings in cold climates are positioned to take advantage of the sun for warmth and natural light,The main main living areas should face north. The main glazing in the

house, such as windows, skylights and glass doors, should also face north. Anywhere between 20°W - 30°E of true north is fine.

Less glazing should face the west because of the potential for glare and overheating from late afternoon sun. East-facing glazing captures morning sun and can be sized according to your preference for light, heat control and ventilation in summer. South-facing windows receive minimal sun and should be relatively small to avoid heat loss but allow for light and ventilation.

The exact amounts and proportions of glazing will vary depending on other considerations such as climate, insulation and energy efficiency of the glazing.

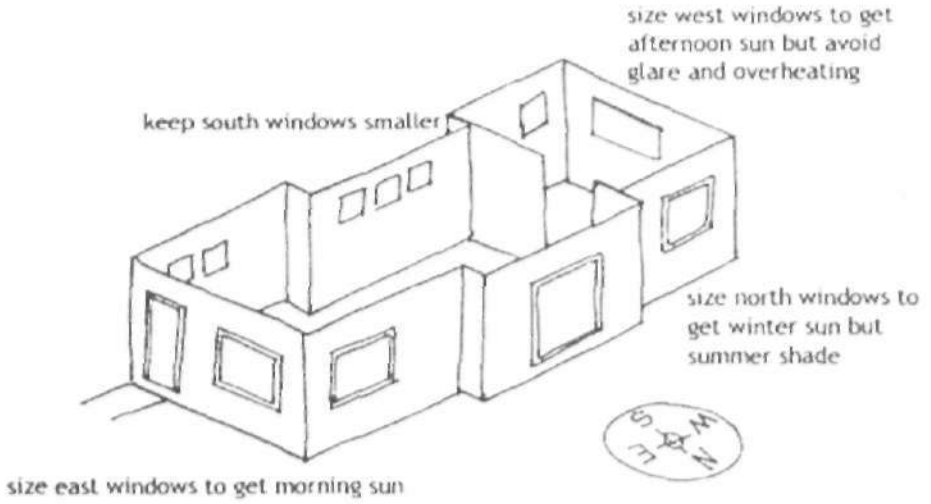


Fig 2.1 Passive solar orientation of buildings.

Source google.com

(ii)Positioning To Let In breezes And keep Out Wind

Ideally, a building should oriented to avoid the strongest and coldest winds but still allow in mild breezes to for cooling in summer.

Vegetation can be used to filter harsh winds.Landscape and building structure can be used to deflect cooling breezes into the interior but exclude harsh winds. Other features include well designed windows.

The following points should be considered when designing to take advantage of breezes and avoid wind:

Prevailing wind direction (vegetation patterns can sometimes indicate this, coastal breezes are usually from an onshore direction)

Wind changes with season - in terms of direction and strength

Wind strength or direction changes at different times of day - for example, in hilly areas cool breezes often flow down valleys in late evening and early morning

Winds are stronger near coastal areas and ridge tops

2.3.4 EVAPORATIVE COOLING

According to the Harkners and Mehta [1978], evaporative cooling lowers indoor air quality by evaporating water. Evaporative cooling in dry climates is achieved by evaporating water directly in the building enclosure. Indoor air quality,indoor

comfort and temperature reduction can be achieved through convective cooling.Convective cooling may be natural,,mechanical or hybrid.Careful positioning of openings in naturally ventilated buildings is a crucial parameter that determines the the cooling effect of convective cooling.The most important element of passive cooling is air movement in the

building enclosure.

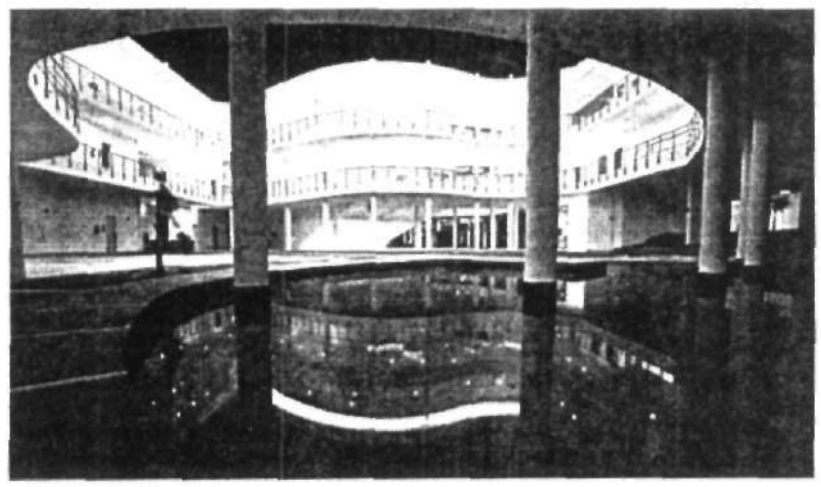


Plate 2.10 Evapourative cooling

Source google .com

Evaporating water absorb large amount of heat from the surrounding [about 1055kg of evaporated water]. Sweating is a common example of cooling effect of evaporation. In arid, hot climate body temperature is controlled by a rapid evaporation of perspiration from the surface of the skin. In hot climate with high atmospheric pressures, the cooling effect is less because of the high moistture content of the surrounding [Herkners and Mehta 1978].

The process of evaporation happens all the time.Whenever dry air passes over water, some of the water will be absorbed by the air. That's why evaporative cooling naturally occurs near waterfalls, at rivers, lakes and oceans. The hotter and drier the air, the more water that can be absorbed. This happens because the temperature and the vapor pressure of the water and the air attempt to equalize. Liquid water molecules become gas in the dry air, a process that uses energy to change the physical state. Heat moves from the higher temperature of the air to the lower temperature of the water. As a result, the air is cooler. Eventually the air becomes saturated, unable to hold more water, and evaporation ceases.

Evaporative cooling method can be used to enhance the cooling rate in convective cooling systems. Evaporative cooling strategies are well suited in regions with high requirement for cooling. The warm night air can impede natural convection and heat dissipation from a building.

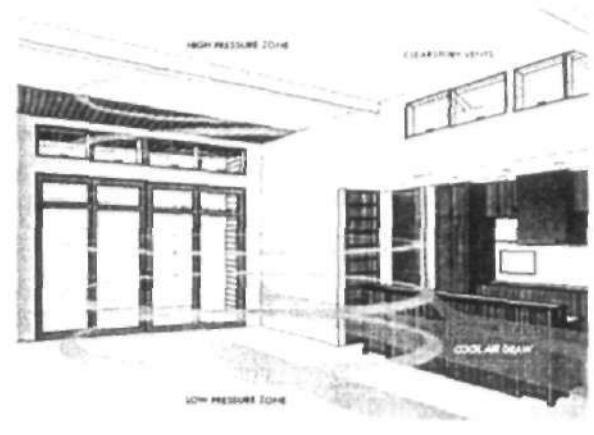


Plate 2.10 Evapourative cooling in building enclosure

Source google .com

The introduction of a thin layer over the water increase the overall cooling rate of the room by 50-100% due to resulting evaporation [Harkness and Mehta 1978].

There are several methods of achieving evapourative cooling in buildings.One of this methods is the use of evapourative coolers.

Evapourative Coolers

An evaporative cooler produces effective cooling by combining a natural process - water evaporation - with a simple, reliable air-moving system. Fresh outside air is pulled through moist pads where it is cooled by evaporation and circulated through a house or building by a large blower. As this happens, the temperature of the outside air can be lowered as much as 30 degrees.Evaporative coolers add moisture to the air and blow it around, they are sometimes knowns as "swamp coolers." Evaporative coolers can work wonderfully well, provided the outside air they are drawing in is dry and desert-like. As the humidity increases, however, the ability for them to cool the air effectively decreases.

2.3.5 SHADING

Shading of the building and outdoor spaces reduces temperature raise and improves comfort and save energy. Shading can block up to 90% of heat [Olgyay and Olgyay 1951].

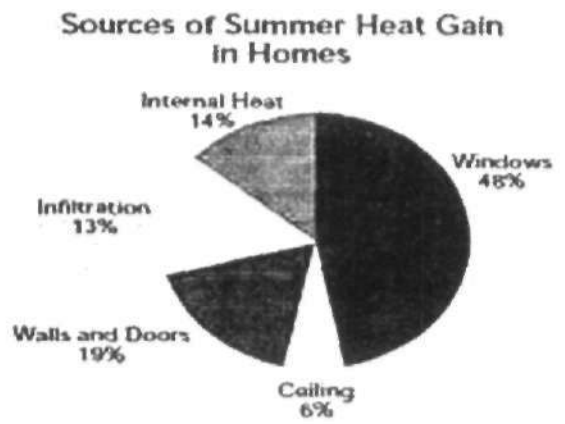


Fig 2.2 Sources of summer heat gain in homes.

Source google.com

Heat gain in a building can be reduced with shading of wndows,walls and roof surfaces.

Shading requirement vary according to climate and house orientation.

(i) General rules for shading

Olgyay and Olgyay [1951] gave these guide lines for shading :

- Using plants to shade building particularly windows reduce unwanted glare and heat gain. Deciduous varies and tree to the north and deciduous or ever green tree to the east and west. North facing opening receives higher angle sun and therefore require narrow overhead shading devices.

  Deep verandas, balconies and pergolas can be used to shade east and west elevation, but may still admit very low angle summer sum. .

Shading should be designed to take into account the sun's path in summer and winter . The sun travels higher in the sky in summer, so shading can be designed to keep summer sun out but let winter sun in.

(ii) **Fixed shading options**

Fixed shading options include:

Eaves

Pergolas

Fixed louvers

(iii)Covered balconies (note: a balcony on the north side of your home could block winter sun).

Eave design

Eaves should be designed to let as much sun as possible into the building in winter (when the sun is low in the sky) but keep the sun out in summer (when it's higher in the sky). The exact design of the eaves will depend on the amount of glazing , which way it faces and the amount of direct sunlight that is admitted into the interiors of buildings.

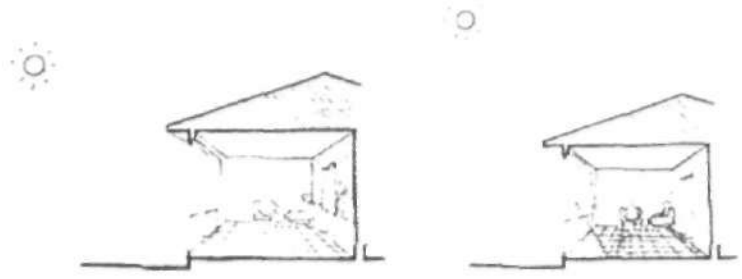


Fig 2.23a Eave design

Source google.com

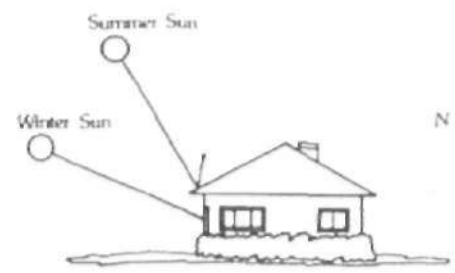


Fig 2.3b Eave design

(ii) **Planting for shade**

Planting provides flexible shade options:

Deciduous vines and trees let winter sun through, and provide summer shade.

Ground-cover plants keep surface and ground temperatures lower in summer, as well as reducing glare. There is a need to use plants instead of hard paving in outdoor living areas exposed to direct summer sun.

A shaded courtyard next to the main living area helps to cool air well.

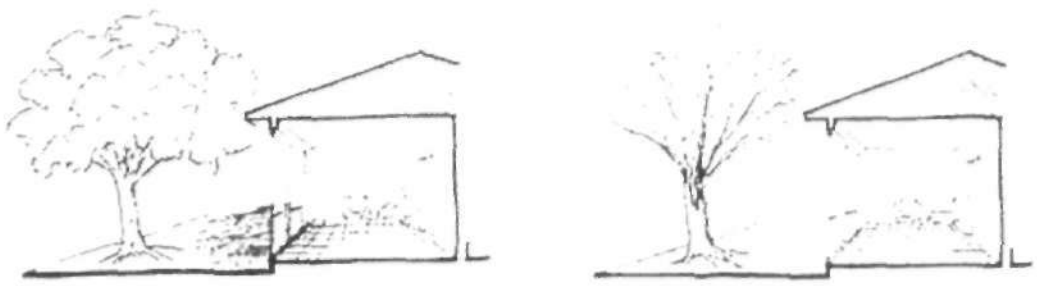


Fig 2.4 :Use of trees for shading

(iii) Adjustable shading options

Adjustable shading provides flexibility. It is more useful when there is a need to deal with low-angle morning or evening sun.

Adjustable shading options include:

Manually-adjustable louvres

Shutters

Curtains

Sliding screens

Retractable awnings and sails

Removable shades that can be taken down at the end of summer.

Adjustable shading may be combined with fixed eaves or pergolas to provide deep shade in summer, but allow winter sun into these areas.

2.3.6 **BUILDING MATERIALS**

Timber

Timber is a renewable building material.It has low embodied energy and a good reneweable resource.Timber frame structures are light-weight,easy to insulate and readily converted,altered andre modelled.

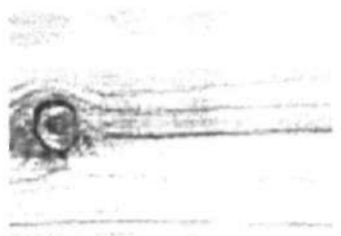


Plate 2.11 Timber

Timber has low thermal mass and do not store heat well but can heat up quickly.This is one of the disadvantages of timber buildings but can be a solution to modern working families.Good energy efficiency can be achieved when the basic structure is light-weight timber frame,external walls are well insulated timber and internal walls are made of high thermal mass materials like concrete.blocks or bbricks.

Adobe and Rammed Earth

One of the most eco-friendly materials of all times is earth.About 1/3 of world's population live in house constructed from earth.(Wilhide)

Adobe walls work moderately in regions with moderate and warm climates.The thick noiseless walls absorb heat during the daytime and slowly release the heat into the interiors at night.

The raw material from this form of construction is earth with the addition of sand,straw and other binders to form bricks which can be curved into organic shapes.This building material is seated on elevated foundation of concrete work or stone.Exterior stucco and rendering provides moisture resistance.

Strawbale

Strawbale is the dried stalk left after grain crops have been harvested.It is a sound eco-friendly building material.Compacred strawbale works exactly overscaled building block.Stacked flat in staggard rows and pinned together with steel rods to form load bearing walls.

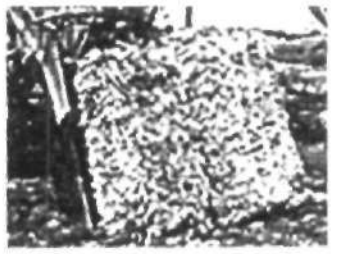


Plate 2.12 Strawbale

Source google .com

Strawbale walls are suppoted on elevated concrete foundations for strength snd to avoid moisture penetration.The walls are up to 60cm thick and have excellent qualities of sound and heat insulation.

2.3.7 RAINWATER HARVESTING

Rainwater harvesting involves catching storm water that runs-off the roof.The collected water is not portable but can be used to irrigate gardens and for other activities that do not involve direct consumption.

The rain water is collected from the catchment area, filtered,and then stored in an underground storage tank of considerable size.The storage tank is ideally located underground and a pump is used to deliver the rainwater supply.

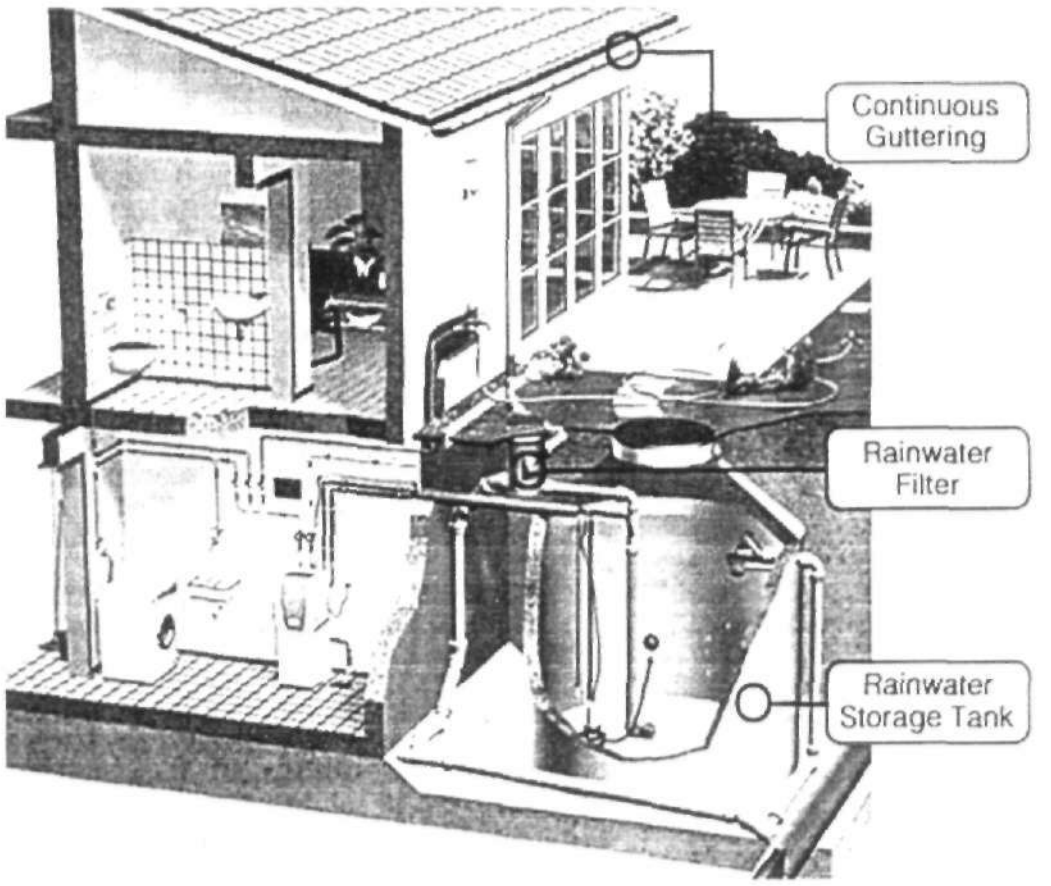


Plate 2.13:Rainwater harvesting

Source google.com

198623

IM LIBRARY

2.3.8 ECO-FRIENDLY LANDSCAPING

Eco-friendly landscaping is deeply rooted in the locality itself.It involves planting and designing the landscape with regard to the local conditions i.e the soil type,amount of rainfall,temperature range and prevailing winds. The fundermental strategy is to work with the site to promote native species,conserve water and employ organic methods of control.

Xeriscaping is an aspect of eco-friendly landscaping which involves working with local climatic conditions.It is practiced in very arid climatic conditions The main focus here is water efficiency which is achieved by enhancing water retention,grouping plants with similar water needs,and selecting drought-tolerant species of trees.

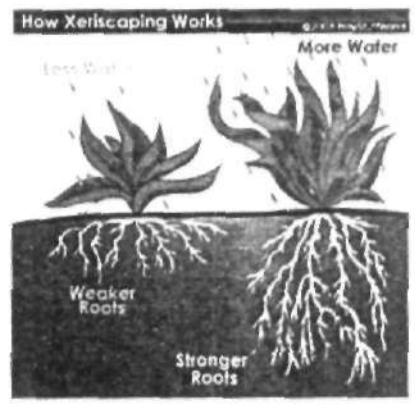


Fig 2.5 :How xeriscaping works

In this form of landscaping,birds,butterflies and other forms of wildlife are attracted by planting trees and shrubs that attract them.Small water bodies like ponds also attract birds and other forms of wildlife.

2.4 ECO-FRIENDLY BUILDINGS

Eco-friendly buildings designed and constructed using energy-efficient, environmentally-friendly engineering methods and materials. The Leadership in energy and environmental design (LEED) program offers five categories in which a building can achieve credits as beign eco-friendly. The number of credits earned and approved for a building corresponds to varying levels of LEED certification.

THE FIVE CERTIFICATION CATEGORIES ARE AS FOLLOWS

1. Sustainable Sites: To reuse existing buildings and/or sites; protect natural and agricultural areas; reduce need for automobile use; protect and/or restore sites by reducing the impact on the environment through site selection.

2. Water Efficiency: To reduce the quantity of water needed for the building and reduce municipal water supply and treatment burdens.

3. Energy and Atmosphere: To establish energy efficiency and system performance; optimize energy efficiency; encourage renewable and alternative energy sources; and support ozone protection protocols.

4. Materials and Resources: To reduce the amount of materials needed; use materials with less environmental impact; and reduce and manage waste (both during construction and during building operation).

5. Indoor Environmental Quality: To establish minimum indoor air quality performance to prevent the development of indoor air quality problems in buildings, and to maintain the health and well being of the occupants.

2.5 THE BENEFITS OF ECO- FRIENDLY DESIGN

The benefits of eco-friendly design en can be simplified into the following classifications:

Environmental benefits:

Enhance and protect ecosystems and biodiversity

Improve air and water quality

Reduce solid waste

Conserve natural resources

Economic benefits:

Reduce operating costs

Enhance asset value and profits

Improve employee productivity and satisfaction

Optimize life-cycle economic performance

Health and community benefits:

Improve air, thermal and acoustic environments

Enhance occupant comfort and health

Minimize strain on local infrastructure

Contribute to overall quality of life

2.6 RESORT DESIGN

A resort is a place used for relaxation or recreation, attracting visitors for holidays or vacations. Such a self-contained resort attempts to provide most of a vacationer's wants while remaining on the premises, such as food, drink, lodging, sports, entertainment, and shopping. A resort can also be defined as a place essentially developed for the sojourn of tourists, providing facilities for their accommodation, leisure and other needs (Baud-Bovy and Lawson, 1977). It can be a place for recreation and leisure aimed at refreshment of the mind. It also can be defined as a place essentially designed or developed to cater for the sojourn of tourist, providing multiple facilities for their accommodation, leisure, and other needs. (Buoy and Lawson, 1977). Resorts may be places in the snow for skiing or places in the sun.



Plate 2.14 A Resort

Source :Wikipedia 2009

2.7 TYPES AND CLASSIFICATIONS OF RESORTS

Resorts range over many types, catering for different tourists requirements, they are as follows:-

Island resorts, Hotel resorts, Health resorts, Golf resorts, Luxury resorts, Ecotourism resorts, Mega resorts, Beach resorts, Spa resorts, Ski resorts, Diving resorts, Historical resorts, Lake resorts, Mountain resorts e.t.c

Resorts are categorized under vacation types:

i. Beach resorts and Island resorts

These are resorts by the sea or oceans. These are located in countries that have shorelines by the sea, or ocean. These places attract many tourists all year around.

Visitors to island resorts are primarily beach and nature lovers, who seek a resort that is well integrated into the surrounding landscape. Island resorts typically developed in environmentally sensitive areas, with casita-type building construction, and the success of the design is particularly dependent on the relationship of the resort building with the topographical, ecological, and climatic factors of the site.

The basic tourist facilities found in these resorts include extensive use of water resource in recreational or sports activities such as water skiing, swimming, sunbathing and others. (McGraw-Hill, 1999.)

ii. Ski resorts

Ski resorts are incorporating other seasonal activities in order to balance costs and increase revenues. The transformation from winter to all season operation has called for the construction of extra facilities, such as village shops, a playhouse and a variety of restaurants combined with suitable off-season sports such as hiking, golf, tennis, mountain bike trails, and hot-air ballooning. (McGraw-Hill,1999)

Iii Ecotourism resort

The concern with personal physical fitness and healthful outdoor activities is closely connected with an interest in wildlife and environment conservation issues. The "soft" activities of fishing, hiking, biking, and backpacking in nature parks have become enormously popular.

The new concepts of Ecotourism and eco-resort have arisen from this interest. There are two associated objectives:

To provide a natural wildlife experience.

To ensure minimum environmental damage. (McGraw-Hill,1999).

iv. Health and spa resort

Health resorts are commercial establishments providing facilities devoted to health and body fitness. These facilities cater for health needs that is, to enjoy recreation and relaxation. Health resorts are also places where people visit for recreation, healings, and cures, which present natural attractive features such as mountains, waterfalls, and lakes. Health resorts can also be defined as health oriented recreational facilities where

counseling, psychoanalysis, therapy, and recreation are combined with nature, water, landscaping, and architectural planning to refresh and rehabilitate the mind and the emotions as this will also have an interpretation on the physical well being of the person. In such a place various methods are used for the treatment of many diseases some of which are hydrotherapy and aromatherapy. Hydrotherapy is the use of water for treatment of diseases and for relaxation. Hydrotherapy can be used to ease pains due to sprains and muscle-related injuries and speed up the repair process after a strenuous workout. Aromatherapy is the use of fragrance and hydrotherapy for relieve from certain ailments. It has been proven that the scent of particular plants in a garden can have therapeutic qualities. Other treatments include physiotherapy, reflexology, psychoanalysis, water exercise and massage. (McGraw-Hill,1999)

1977).

2.8 RELEVANCE OF ECO-FRIENDLY DESIGN TO TOURIST RESORTS

A tourist resort provide a place used for relaxation or recreation, attracting visitors for holidays or vacations. However the facilities built for tourists have to be designed to cope with the climatic stress of the

tropics, provide a lifestyle compatible with tourists' requirements, and do it in the most economical way.Tourists always like to get closer to the nature and culture of the region whilst at thesame time being conscious of the need to preserve the environment. Their expectations and aspirations

are achieved from their perceptions with the environment and the ability of modifying them to a large extent. This fact could and should be utilised in the resort plan and design to work with the environment rather than against it.

2.9.1 Application of eco-friendly design strategies in tourist resort design

i . **Use of thermal mass**

A tourist should be constructed with materials with high thermal mass to provide the required time –lag effect that is needed to maintain thermal comfort in the building interiors.

ii . **Natural ventilation**

Air movement is considered the only effective way of ameliorating thermal conditions in warm climates. Hence, both the internal plan and envelope characteristics should provide for numerous effective air paths through the interior. The rate and volume of cross-ventilation airflows through building interiors is very important.

iii .**Orientation**

In order to ensure free movement of air through the site, resort buildings should be located a fair distance

from each other; this also avoids obstructing land–sea breezes.. Generally, the long axis should be aligned in an east–west direction.

iv . **Evapourative cooling**

Tourism is aimed at nature appreciation and enhancement.This can be maximized with the desired thermal confort.Evapourative cooling enhances cooling in hot climates during the day creating a cooling effect of as much as 5 K. at night. Water also moderates extreme temperature variations raising winter minimums and lowering summer heat peaks.

v .**Shading**

In the design of tourist resorts,there is need to provide adequate shading so as to provide the required thermal comfort .

vi . **Building materials**

Building materials used in the construction should include the use of natural building materials, such materials can be renewable materials; materials that can be replaced naturally when tampered with, .

Vii . **Ecofriendly land scaping**

In the design of tourist resort,the is a need to use trees that are native to the area.The use of trees and other natural vegetation cover of the land tends to stabilise temperatures and decrease extremes (similarly to water) while artificial surfaces tend to exaggerate them. Plants are a natural absorbent of heat, light and sound.

Viii **Rainwaater harvesting**

Water conservation can enhance resort reputation among its guests concerned about water consumption levels and protecting local resources.Resorts can produce significant quantities. By harvesting as much water as possible.

I. Use of photo-voltaic panels

In resort design,there is a need to provide home comforts and conveniences, such as air-conditioning, to resort guests t. This consumes lot of energy and results in generating harmful gases that pollute the environment . Passive design with efficient use of

renewable energy like the solar panels can decrease dependency on unnecessary energy input.

2.9 BIRD FRIENDLY ARCHITECTURE

2.9.1 The Concept Of Bird Friendly Architecture

In the "Designing the Next Industrial Revolution" building should be judged not just by its energy performance, but also by the number of birds that could be heard singing outside the building. McDonough uses this Rachel Carson reference to suggest that birds can be seen as an indicator of ecosystem health. Our buildings should be considered part of the environment, and they should be designed accordingly. A silent building in an area previously inhabited by birds has the same toxic effect as DDT. (McDonough 2000)

No matter how "green" a building is in using recyclable building materials, addressing energy conservation, hydrology, and erosion, it is not "green" to me if it kills birds, unintended victims that are the result of strikes against clear panes with habitat visible on the other side, or against reflective panes offering an illusion of the facing habitat and sky." -- Daniel Klem Jr

Tim Spence is the first architect to design bird friendly buildings.Awareness is the most important way to get more buildings to be bird friendly".Many construction managers and clients do not always consider how birds are affected by buildings.Green building is more known for energy efficiency than saving fowl. A green designers is supposed to incorporate guidelines for birds in addition to energy efficiency. Correct sizing of windows will decrease the amount of thermal gain during summer and reduce thermal

loss during winter. Size matters too, smaller windows reduce the chance of impact. Fritted and colored glass can also cut down on impacts while improve performance. Overhangs and solar shading are also techniques to enhance climatic and ecological connectivity.

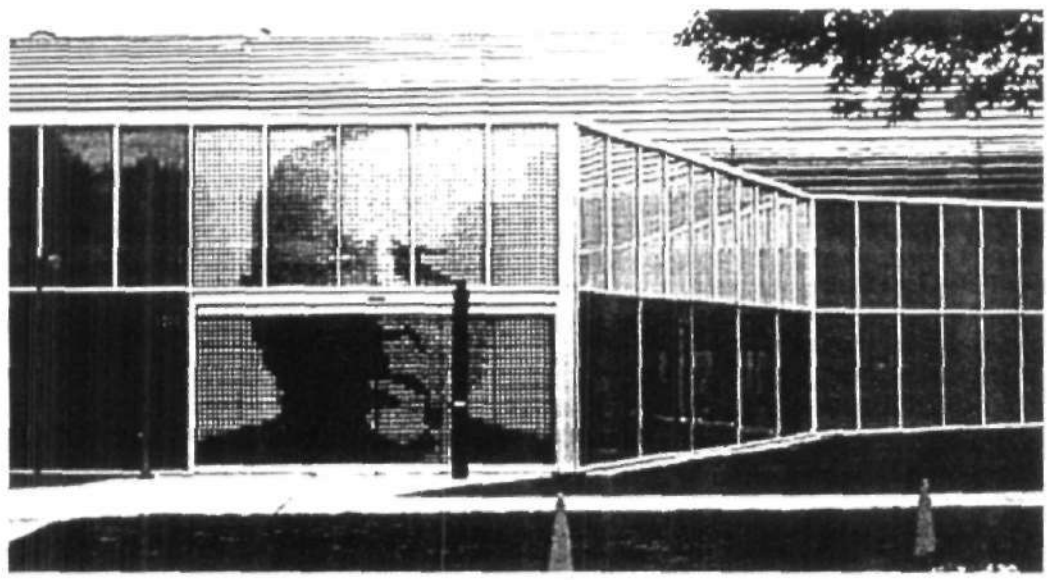


Photo By Philippe Ruault

Plate 2.15: Colured glass

Source google.com

2.9.2 BIRDS AND BUILDINGS

Site strategy/ landscape

Birds do not understand that reflections are false They do not understand that glass is a solid barrier.Birds are therefore attracted to light and try to fly into lit spaces.

Composition

In terms of the building composition,there is a need to create visible details that birds will recognize. Including visible structural details such as columns, balconies and lintels in building façade will give a good composition. There is a need to aviod flat reflective openings larger than two inches wide or four inches tall.

Exterior

Designing façades with elements that are visually interesting and create a physical barrier that birds easily see e.g. vines or sun shades.

Materials

Birds are attracted to buildings with reflective glasses. which results in collusion with the building fabric.In designing bird safe buildings there is a need to use fritted glass and , window film, decals, decorative paint and grills to minimize clear window area

2..9.3 DESIGN CONSIDERATIONS FOR BUILDINGS AS IT RELATES TO BUILDINGS

(i) Research has shown that the design of building angled at 40 degrees is the safest for birds.

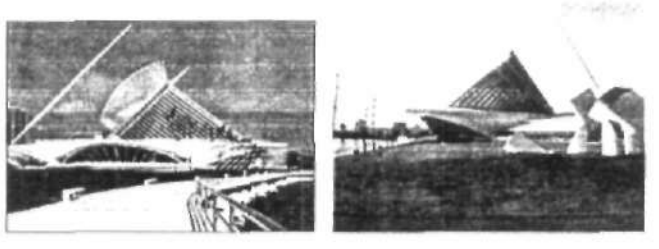


Plate 2.16 Buildings angled at 40 degrees

Source www.mam.org

The Milwaukee Art Museum recently expanded with a glass building on the Lake Michigan shore. The museum building features angles in every section. The design choices make it very bird-safe.

(ii) The use of non-reflective glass.



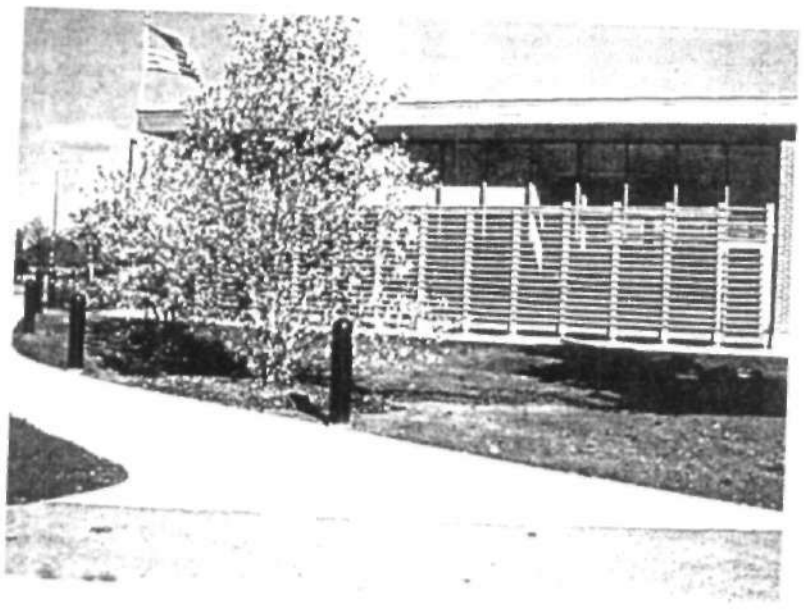
Plate 2.17 Soldier Field

Source www.mam.org

The windows do not reflect the sky. The design has been confirmed to be bird-safe.



Passive design controls like sun shutters are used for bird friendly buildings.



CHAPTER THREE

METHOD OF STUDY

The method of study for this thesis is based on qualitative research method.

3.1 Case studies:

The adopted case studies carried out on this research were based on purposive sampling of selected resorts located the apply eco-friendly design strategies in their design.

The method of study can be viewed in two aspects

1. As a case study unit of analysis:

The eco-friendly resorts were studied and analyzed individually by the use of field forms which had a table containing design elements broken down under the applicable strategies of eco-friendly . This study is to analyze each resort studied and how each resort has applied the strategies of eco-friendly architecture.

2. As a case study research assessment method.

Based on the selected eco-friendly , an assessment table on applicable strategies of eco-friendly architecture was used to conduct a comparative analysis of all theeco-friendly resorts studied in order to find out the extent to which eco-friendly strategies have been applied in resort design.

3.2 Data collection

The collection of data was done through various ways which include:

3.3 Visual survey

A visual survey was done by looking and identifying what has been achieved by the already existing eco-friendly resorts with reference to the applicable strategies of eco-friendly architecture, this was done by the use of photographs.

3.4 Field forms

Field forms consisting of variables of eco-friendly architecture principles were used to document on each eco-friendly resort selected for this research.

3.5 Interview schedule

The selected resort operators / managers were interviewed to get more information on each of the existing eco-friendly resort resort.

3.6 Data analysis and presentation

Data collected on each case study was analyzed and represented in different forms which include:

3.6.1 Photographs

Pictures of the existing eco-friendly resorts were studied were taken and documented showing the resort facilities and how eco-friendly green design elements were applied, (if applied).

3.6.2 **Tables**

Data collected on this research were documented and presented on the eco-friendly architecture case study assessment tables. Refer to tables under case studies (chapter five).

3.6.3 **Figures**

Data collected on the case studies were also documented in form of drawings, such as the resort site plans e.t.c. Refer to figures under case studies (chapter five).

3.6.4 **Descriptive Analysis**

The selected resorts showed the extent to which each resort applied eco-friendly design strategies r the case study analysis was done; this can be viewed under the case study summary and conclusion sheets. Refer to Case studies (chapter five).

CHAPTER FOUR

4.0 CASE STUDIES

4.1 CASE STUDY SELECTION CRITERIA

Case studies were selected based on eco-friendly design issues and the way eco-friendly design strategies are adopted in the design.

Each of the case studies has been analysed based on 2 aspects:

1.An overview of the resort.

2.An evaluation of the eco-friendly design strategies that were adopted in the design.

4.1.1 Case Study 1-Are Tamanu Beach Resort, Cook Island.

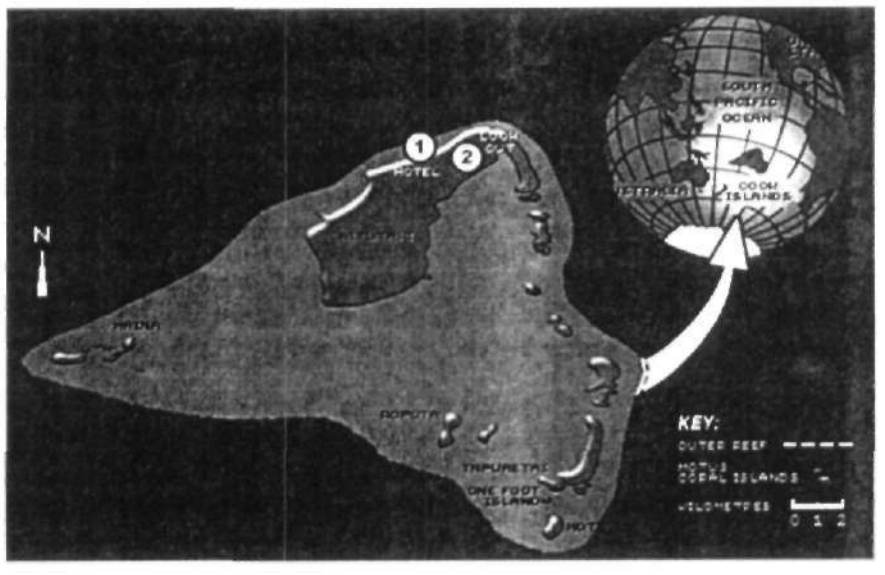


Plate 4.0 Are-Tamanu resort site plan

Source google 2009

Are Tamanu is a luxurious and stunning beach island resort built in the woody land of Are Tamanu village,meaning land of the wood. The resort is surrounded by an expense of sandy white beach within the wooded land of Amuri Village, Aitutaki,Cook Islands.The private white beach provide opportunities for endless tourism.It was completed in 2001 at average cost of US$1.2 million (approx).

Architect:Designed by Des Eggelton of Frame Group,Cook Islands.

Consultant: Michael Henry

Builder: Maru Ben

Tamanu Beach Resort is a front property located on the western sunset side of activities.

GENERAL DESCRIPTION

Aitutaki is heaven on earth- situated 225km to the North of Rarotonga, the capital of the Cook Islands. Aitutaki is located within the Southern Group of the Cook Islands in the South Pacific Ocean. It is set within a breathtaking lagoon with crystal clear turquoise waters and sparkling white beaches.No trip to the Cook Islands is complete without a visit to beautiful Aitutaki.

Positioned on the sunset side of the island, the Tamanu Beach resort sits on its own private white sand beach, offering stunning beachfront accommodation.The Maunga Pu lookout is the highest point on Aitutaki. The lookout provides spectacular views of the island.

PRINCIPAL ATTRACTIONS

The lagoon and reefs of Aitutaki, the island's nature and water sports.

FACILITIES

An endless white sand Aitutaki beach offers plenty of opportunities to explore the lagoon on complimentary kayak or venture out to coral reefs

Accomodation

Tamanu Beach offers a variety of lagoon view, tropical garden and absolute beachfront view bungalows on the lapping shores of Aitutaki lagoon. There are 22 bungalows.

All suites feature:

A separate bathroom IID telephone

Television

Iron and ironing board

Tea and coffee facilities and room service is available on request

Super king sized bed

Bar-fridge

Air conditioning

Ceiling fans

Hairdryer Safe



Plate 4.1 One bedroodroom beachfront view

Source google 2009

One bedroom bungalow or a honeymoon suite right on the beachfront of Aitutaki's crytal-clear lagoon. The surrounding view is covered by soft white sand.



Plate 4.2 One bedroodroom beachfront view

Source google 2009

1986

KASTUM

The one bedroom lagoon view bungalows are well appointed with traditional pacific Island décor.

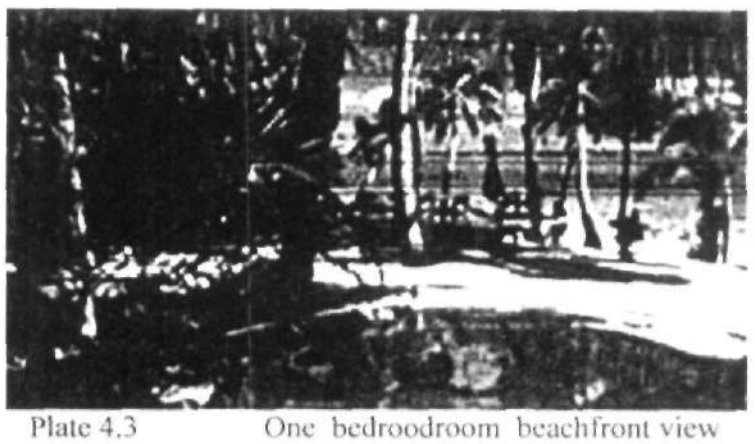


Plate 4.3 One bedroodroom beachfront view

Source google 2009

The beachfront Studios have wide furnished verandah to watch the amazing Aitutaki sunsets.



Plate 4.4 Studio lagoon view

Source google 2009

These Polynesian architectural style studios all enjoy beautiful lagoon views. An amazing accommodation option.

Studio rooms- garden-view



Plate 4.5 Studio bedroodroom garden view

Source google 2009

Garden Studios are set amongst Tamanu lush tropical gardens and are perfect for a self-catered Cook Islands holiday.

All bungalows are well placed to provide for maximum privacy and comfort during your stay and you can enjoy the tropical surroundings from your furnished verandah

Outdoor recreational facilities

The resort offers facilities for swimming with sun loungers and excellent beach front dining and bar. Free kayaks and snorkelling equipment is available at the resort. The resort offers various facilities for outdoor recreation.This includes fresh water horizon pool which is located on the beachfront surrounded by outdoor deck for relaxing in the sun and enjoy daily tropical breakfasts, and poolside cocktails



Plate 4.6 Outdoor recreational facilities

Source google 2009

Restaurant

Tamanu Restaurant is nestled on the beachfront on Aitutaki's blue lagoon. The restaurant is built in the traditional 'Are' style, with local Tamanu timber (mahogany) offering an authentic Pacific Island dining experience. It has a seating capacity for 80 and offers a variety of dishes inspired by Pacific Island cuisine with a range of western favourites

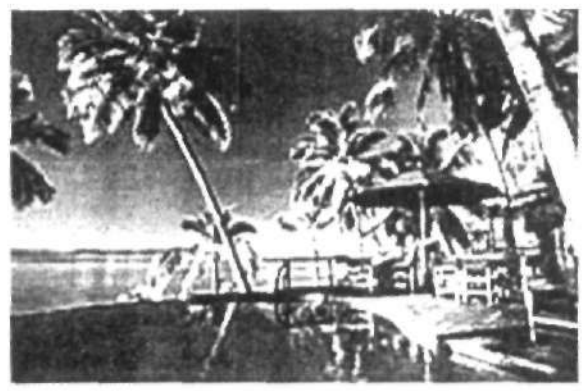


Plate 4.7 Outdoor restaurant

Source google 2009

Weddings, conferences & events

Tamanu Beach Resort, Aitutaki, provides the perfect backdrop for memorable meetings and successful conferences, along with **entertainment** and **activities** guests.

Te Vaka Terrace seats up to 60 people theatre style or 40 people in a banquet table setting. This room has white walls for projected images along with all the audio-visual equipment for a successful presentation. Business facilities include wireless broadband, phones, photocopier and fax machine. Full use of the resort bar and excellent catering facilities are available. Tamanu also has a private facility available for board room meetings seating up to 12 people.Other facilities on site include cafe-bar, offices and laundry.

There is usually an Island Fire performance of Cook Islands song, dance, fire dancing and more from our talented and dynamic cultural group.



Plate 4.8 Are - tamanu beach cultural fire & dance show

Source google 2009

Dressed in traditional costume, these fascinating traditional dancers take a mesmerizing journey through the South Pacific. Tamanu's performers display authentic dance with beautiful costumes and lovely songs.The warrior men dance with fire to the upbeat rhythm of Pacifica drums, as the Cook Island women move gracefully singing in sweet harmony.

APPRAISAL

This is an examplary approach to architectural design that creates harmony between the building and the natural environment. The resorts is sited in locations of a suburban character,

and resort development has brought about an improvement rather than destruction of the original sites. In keeping in tune with nature, Are Tamanu's luxurious self-catering individual ares feature tamanu floors and Cook Island style thatched roofs. Tamanu is also used for the carvings in each and is a feature of the popular poolside bar.

In site planning and landscaping , the site modifications amountedto 13 coconut trees being removed, several ornamental trees and bushes being planted, three large volcanic rocks being brought to the site, an in-ground swimming pool and a fish pond being built, and a few walkways being paved.

The bungalows are an example of a very smart and efficient use of design, which makes excellent use of natural building materials such as engineered timber products (exterior graded Fijian plywood,New Zealand pine poles, bearers and joists, timberdecking and flooring), palm-leaf thatch and rattan matting as well as ceramic floor tiles.

The thatch gives the units a traditional appearance and reduces the noise from the rain. Materials require minimal maintenance. The bungalow layout is also exemplary as an

efficient and functional space design thatched roof pitched at 35 degrees shades the single skinwalls made of plywood. Available lengths of structural elements determined the angle but it still works well by allowing for ample overhangs shading external walls. The combination of single-skin plywoodwalls and high cathedral ceilings underthatched roofs makes efficient heat dissipation possible and accounts for very good thermal conditions at minimal cost.

MERITS

Site planning provides reasonably good for the given conditions views and ventilation without compromising visual or acoustic privacy

Application of building materials is smart and efficient, and energy and water are used in the best possible way.

The guest units are easy to maintain and their functional layout is highly efficient.

DEMERITS

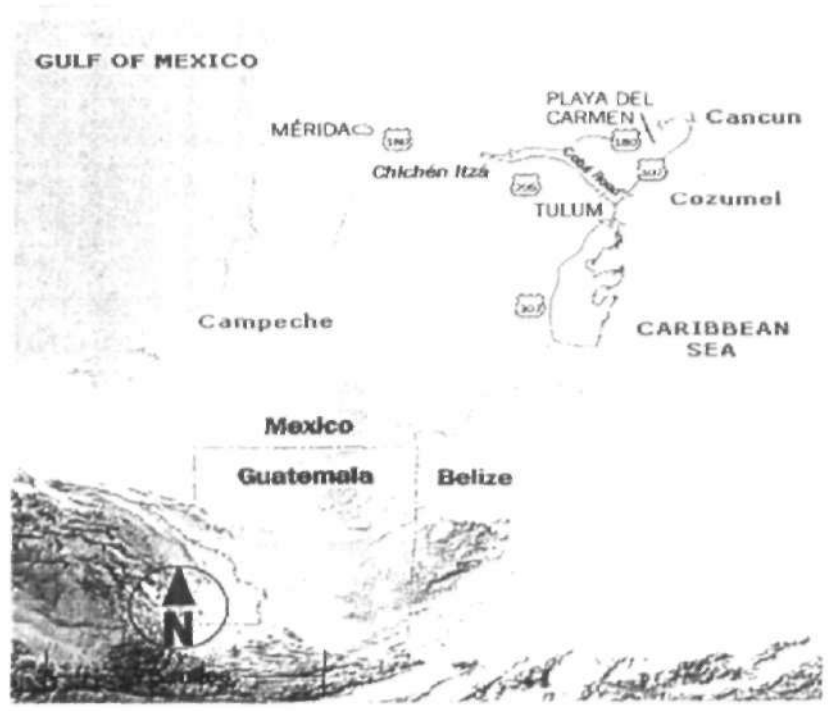
The guest units rely on air-conditioning for most of the time, however, and natural ventilation is not critical to their performance.

Despite being open on their short ocean sides, this narrowness combined with constricting vegetation severely hampers penetration of breezes and air movement through the sites.

Site Planning	Construction	Passive Cooling	Alternative energy generation	Rainwater harvesting
• Maximum retention of trees on 13 coconut trees were removed	• Engineered timber products were used.Timber is a natural building material.	• Use of an in-ground swimming pool and fish pond for passive cooling.	• Use diesel powered generator	2rainwater collection tanks capable of storing 108000 litres of water.
• Three large volcanic rocks were brought into the site.	• Use of palm –leaf thatch roof and rattan matting which are natural building materials • Use of ceramic floor tiles.	• Thatch roof at 35 degrees shade the single skin walls made of plywood.	• Solar powered landscape lightning	

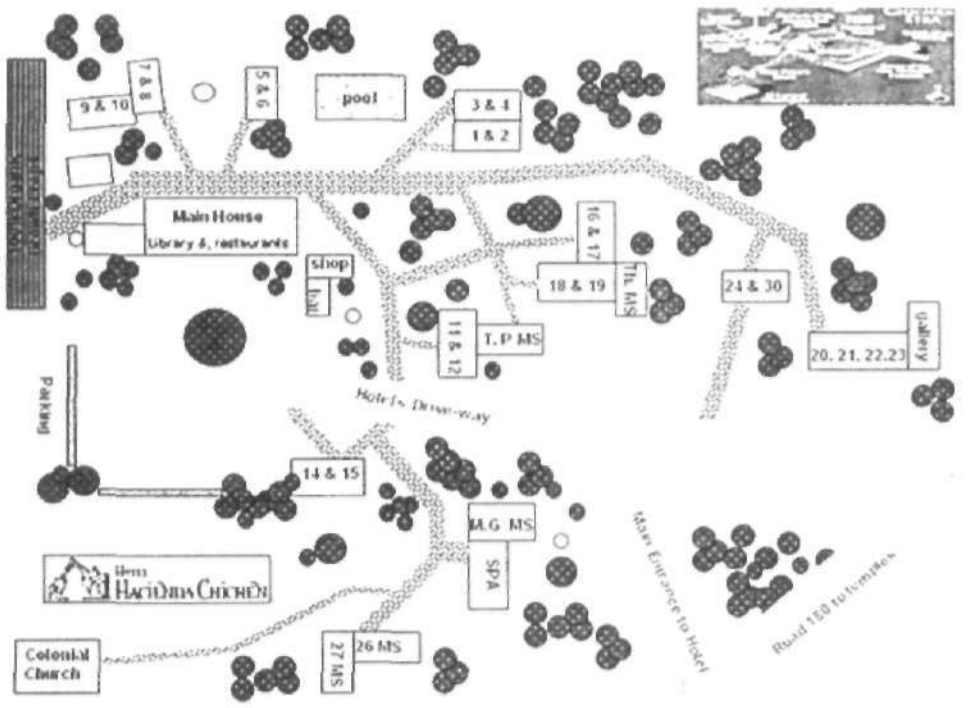
Table 4.1 Summary of findings in relation to eco-friendly architecture

CASE STUDY 2: HACIENDA CHICKENRESORT,YUCATAN MEXICO



Pate 4.9 (a)Hacienda Chiecken resort site plan

Source google 2009



Pate 4.9(b) Hacienda Chiecken resort site plan

Source google 2009

Architect: Barbachano-Gordon

Consultant: Bruce Gordon and Tim Harper

Builder: Local craftspeople .

GENERAL DESCRIPTION



Pate 4.9 Hacienda Chiecken resort

Source google 2009

Hacienda Chicken resort is the most unique boutique green hotel found in Yucatan, Mexico. It is a colonial hacienda and Mayan Eco-Spa Jungle Resort."Hacienda Chichen and Yaxkin Spa do not just reflect their surroundings they help define them. Their transcendent innovating vision leaves an insight that only soulful places can provide." Feldman S.



Pate 4.10 Hacienda Chiecken resort

Source google 2009

Hacienda Chichen offers visitors a vast range of Holistic Spa Mayan experiences and eco-cultural activities, from mystical Mayan ceremonies to Chichen Itza guided tours. Hacienda Chichen offers guests genuine opportunities to explore and be captivated with Yucatan's flora and fauna, as with the amazing Maya Culture. Embracing the soul of all visiting travelers, this beautiful and serene boutique hacienda hotel has become a Sanctuary of Life, transcending beyond its Colonial hotel charm to an enchanting soulful place that provides guests with a deep sense of cultural insight, environmental awareness, an intimate contact with mother Nature, the Mayan people, their mystical ceremonies, cuisine, and holistic herbal healings.

PRINCIPAL ATTRACTIONS

Chichen Itza and other archaeologicalsites,cenotes(sinkholes),Sian Ka'anWorld Biosphere Reserve, nature and culture tours.

FACILITIES

Accomodation



Pate 4.11 Resort accommodation

Source google 2009

12 cottages with 24 guestrooms. Guestrooms were recently remodeled with green awareness sense, furnished with reclaim colonial antique decor, in an eco-design cottage style and charm. Each rooms includes many eco-friendly features, Colonial tiles, hand-woven bedspreads, colorful pillows, scented candles, fresh flowers and bird photograph collection.



Spacious private garden terrace

Air conditioners and ceiling

Servi-bar and dehumidifier unit

Private bathroom,amenities & hair dress

Bird-watching



Plate 4.12 Birds species at hacienda chicken resort

Source google 2009

At the Hacienda Chichen's Bird Refuge and Maya Jungle Reserve in Chichen Itza, Yucatan, Mexico, guests and visitors alike marvel at the beauty of Mother Nature's wildlife, and Maya flora (plants) and Maya fauna (animals).Hacienda Chichen is

Yucatan's ideal bird-watching; This Yucatan's birding destination allows visitors to truly enjoy bird-watching (birding) and experience great eco-friendly fun activities . There are about 157 wild birds found.

Flora

Hacienda Chichen's has lush tropical gardens and have varieties of beautiful flora with nice scents that are native to Mexico and South-America . The trees grace variety of open terraces, foot paths and gardens. Flowers have various tones from white, yellow, rose, and magenta.

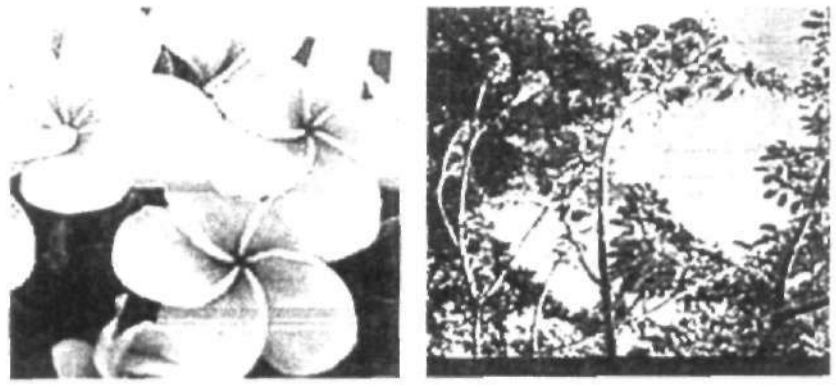


Plate 4.13 Native flora

Source google 2009

Spa

Yaxkin Spa is one of Mexico's best Eco-Spa Retreat and Mayan Holistic Spa Wellness Center; this green Spa retreat donates 10% of its profits to the environmental protection and animal welfare efforts .Ancient Maya were intimately connected with the natural balance of Mother Nature, respecting and caring for the environment, and at Yaxkin Spa, we are committed to restore this tradition in today's Maya rural society.

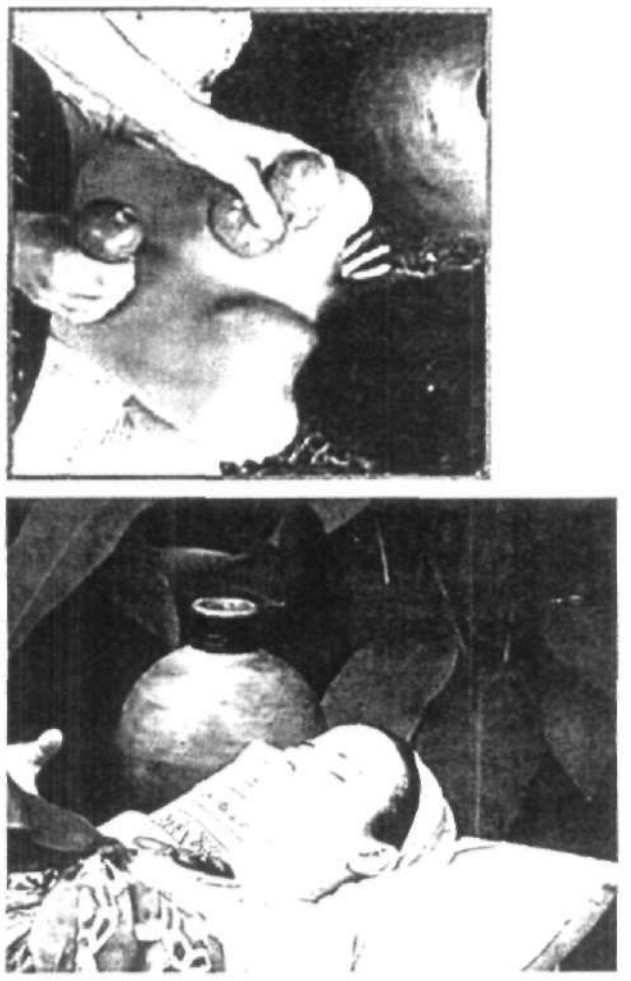


Plate 4.14 Spa

Source google 2009

Private parties, wedding gala catering service & other celebrations

Hacienda Chichen is known for its elegant gourmet gala parties, romantic wedding services, private reunions and incentive luncheon fiestas. This Green Wedding Destination and unique boutique hotel offers intimate private reserved areas in our restaurants and a

variety of beautiful open terraces and garden settings.



Plate 4.15a Outdoor eating

Source google 2009

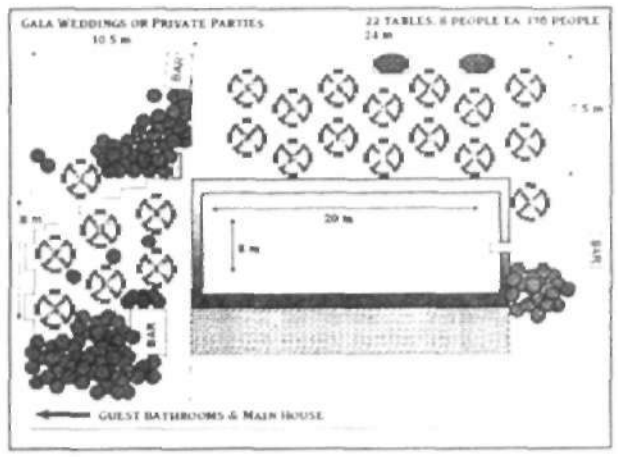


Plate 4.15b Outdoor eating floor plan

Source google 2009

Museum

Hacienda Chichen Resort inaugurated Dr. Merle Greene's Maya Rubbings Museum and Gallery in 2005, exhibiting her elegant private collection of Mayan Rubbings. The museum is open to the Hacienda Chichen guests and visitors of this unique green boutique hotel.

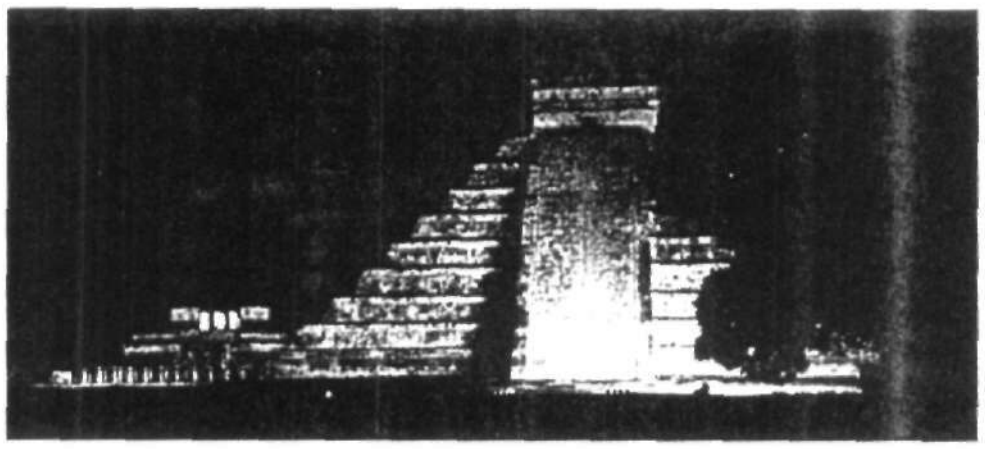


Plate 4.16 Museum

Source google 2009

APPRAISAL

The resort was created on the site of the Carnegie archaeological expedition. The design has utilised many of the original Hacienda buildings. It is a classic example of the recycling of the entire site, whilst maintaining its original purpose of providing an overnight shelter for visitors to the ancient Mayan city.

The resort is located in a hotel zone. It occupies the site of a 500-year-old cattle ranch redeveloped and extensively modified in the 1920s for the purpose of housing the 'permanent' archaeological expedition. All the bungalows offered by the resort were built more than 80 years ago, but have been retrofitted and adapted to serve its modern purpose. In addition, some trees were removed,walkways were paved and an in-ground pool was built. A project currently under way aims at reforestation of the entire site. Nurseries of native trees such as zapote and caoba (native mahogany)have been established and seedlings are progressively moved to recultivated parts of the property. The resort is intend to be converted into a wildlife reserve supporting eco-tourism with a bird-watching trail.

In line with the local building tradition, the resort was built chiefly with heavy materials such as limestone (mostly recovered ages ago from the Mayan ruins),plaster and floor tiles. Concrete blocks and concrete in-situ have also been used as well as timber.The materials not only require minimal maintenance but are resistant to strong winds occurring in the hurricane season.. The building materials have significant heat storage in massive elements (structural wallsand floors) of the resort. Conditions inside were warmer than those outside for the corresponding period and the range of indoor temperatures was fairly small. It can be predicted, with some level of certainty, that in warmer weather the indoors will offer an environment quite a lot cooler than the outside.

MERITS

The building materials require minimal maintenance and are resistant to strong winds occurring in the hurricane season.

Only 0.5% of the land has beed developed the rest has been conservsed.,

The use of flat roofs which give more insulation to the building

DEMERITS

Lack of sufficient natural ventilation seems problematic but has been resolved by the use low powered exhaust fans inslalled close to the highest points of the building.

- **Summary of findings as it relates to eco-friendly architecture**

Site Planning	Construction	Passive Cooling	Alternative energy generation	Rainwater harvesting
• Minimal disruption and reforestation of the entire site. • Use of palm trees close to the buildings to act as shading devices. • Growing of nurseries of native trees such as zapote and caoba (native mahogany).	• Use of heavy building materials such as limestone and concrete which have high thermal insulation. • Use of renewable building materials such as timber. • Use of flat roofs for additional insulation. • Buildings are rectangular in shape	• An in-ground pool has been built to enhance passive cooling • Buildings are well spaced out to ensure adequate passive cooling.	• Use a generatetor half buried under the ground.	• Mixes rainwater collected with two artesian wells.
•	•	•	• Wind vane and 11kw propane backup generator.	

CASE STUDY THREE :BALAMU INN RESORT,MEXICO

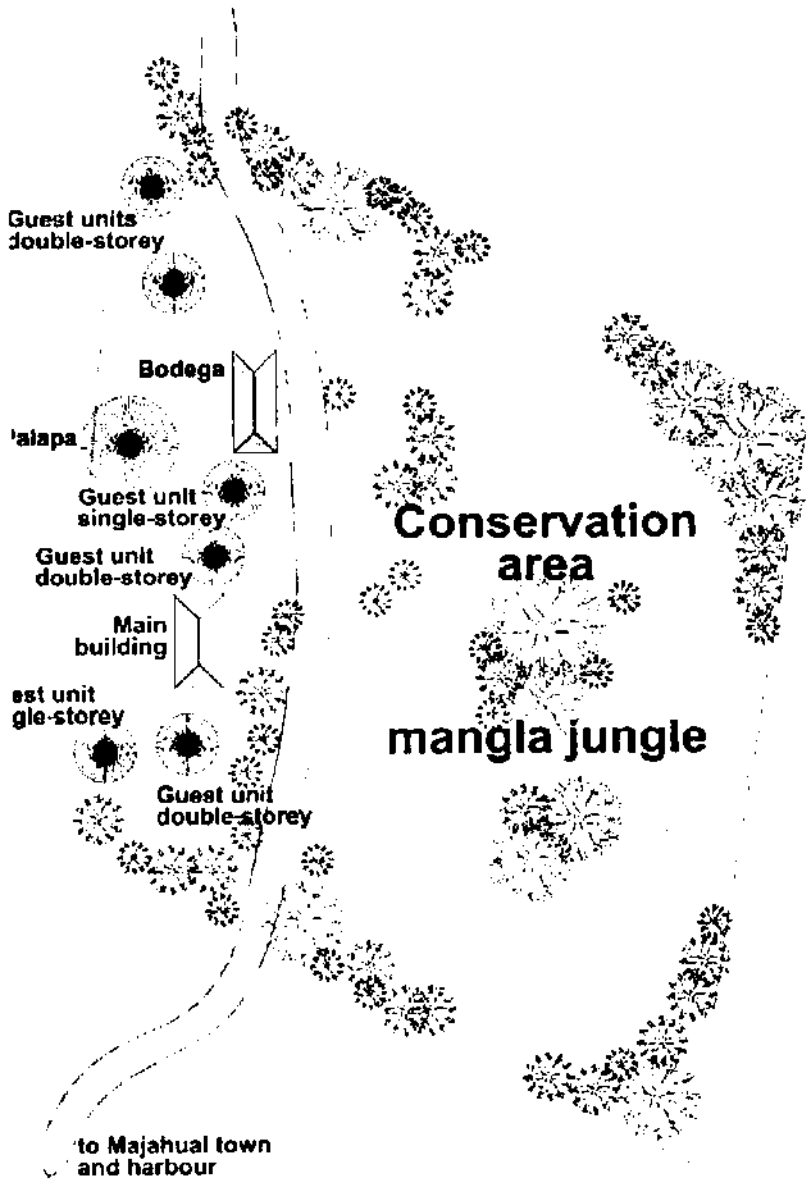


Plate 4.17 Site Plan

Source google 2009

Architect/designer: Alan Knight and Carol Tumber

Consultant: Dinah Drago

Builder: Alan Knight with local craftspeople.

GENERAL DESCRIPTION



Plate 4.18 The resort

Source google 2009

Balamuku Inn Resort is an eco-friendly constructed in 2006 at total cost of approximately $550. It has a total site area of 4 acres (1.6 ha).It is accessed. by road (from Cancun International airport, Chetumal airport or Mahahual harbor.It is one of the best Inns in the area with comfortable rooms, congenial hosts and a nice sandy tanning area with plenty of room to spread out. Here you can lounge, get some sun or gaze out on the Caribbean in peace and tranquility. This is a beautiful natural setting where it's common to see egrets, pelicans and birds of prey just off shore. The surroundings are intimate, well suited for tourists relaxation.

Rooms are spacious and comfortable, decorated with Guatemalan textiles and furnished with native hardwood furniture. Louvered glass windows can be opened to aid the sea breeze and all rooms have a ceiling fan. The thatched roofs above the second level rooms help keep things cool. Together with the ceiling fan the interiors stay quite pleasant even in summer.

PRINCIPAL ATTRACTIONS

Costa Maya reef, the lagoon and beach, Sian Ka'an World Biosphere Reserve,archaeological sites, nature and culture tours

FACILITIES

Accomodation



Plate 4.19a Exterior view of chalet

Source google 2009



Plate 4.19b Swimming pool

Source google 2009

the accommodation consist of guest units and a main house with the swimming.there are three bedrooms in the main house and one bedroom in guest units. the main house has two bedrooms on the lower level, just off the ocean/sun terrace. one has two twin beds and the other has a king size bed. each has a private bathroom and opens to a

shaded patio, then to the sun deck which has a couple chaise lounges.the upper level has a bird's eye. the kitchen, living room and the third bedroom are located near lagoo. all have an excellent sea view. access to each is from a shaded balcony/terrace which has chairs and a couple tables. it is another good place to watch the sunrise over the caribbean. the living room/ dining room is just off the kitchen. the dining room table has chairs for five with additional seating and tables in the living room. the fully equipped kitchen is directly behind the dinner table with a pass-through for easy serving. the living room has a built-in l shaped couch, and additional tables and chairs. large windows face the sea view. a little farther down the terrace is the master bedroom. it has a queen size bed, and an oversized bathroom with luxurious bathtub and double sinks. just outside is a table and chairs to enjoy the view in relative privacy.

Swimming pool

The swimming pool is on the garden side of the main house, and it has chaise lounges, tables and chairs. The setting is very private and tranquil, surrounded by tropical plants. Tropical trees and a shade arbor provide some shade .when it is sunny.

Dining

Balamku Inn only provides breakfast in the dining room.. Breakfast is include fresh fruits, yogurt, home-made breads, granola, eggs, and their specialty coffees.



Plate 4.20 Diningroom

Source google

Guest Units

The guest house has a large living room with a raised kitchenette/bar counter at one end, perfect for entertaining. A pool/garden porch if buffered from the pool by lush greenery and a short curved sidewalk leads out to the pool. Back inside, the guest house bedroom has a king size bed and private bathroom. Doors open to a private garden patio facing the greenery, right next to a natural *cenote* (freshwater pool).Rooms are spacious and comfortable, decorated with Guatemalan textiles and furnished with native hardwood furniture. Louvered glass windows can be opened to aid the sea breeze and all rooms have a ceiling fan. The thatched roofs above the second level rooms help keep things cool. Together with the ceiling fan the interiors stay quite pleasant even in summer.

Other facilities include:

Internet

Gift shop with art and clothing and books on the local birds and animals,

Kyaking,

Deep sea fishing,

Horseback riding

Birding

Hiking,

Trips to Mayan ruins

Scuba diving

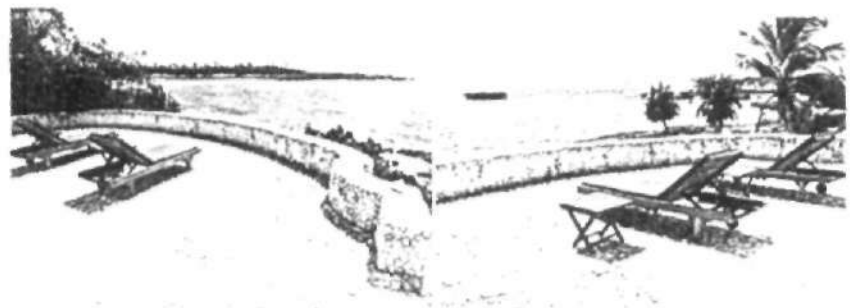


Plate 4.21a 1st lower level bedroom on the sun deck

Source google



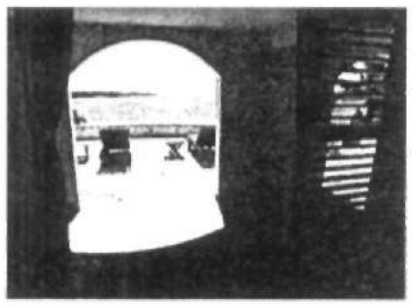


Plate 4.21b 2nd lower level bedroom

Source google





Plate 4.21b 2nd lower level bedroom

Source google



Plate 4.22 a upper level ocean view terrace, tables and chairs

Source google

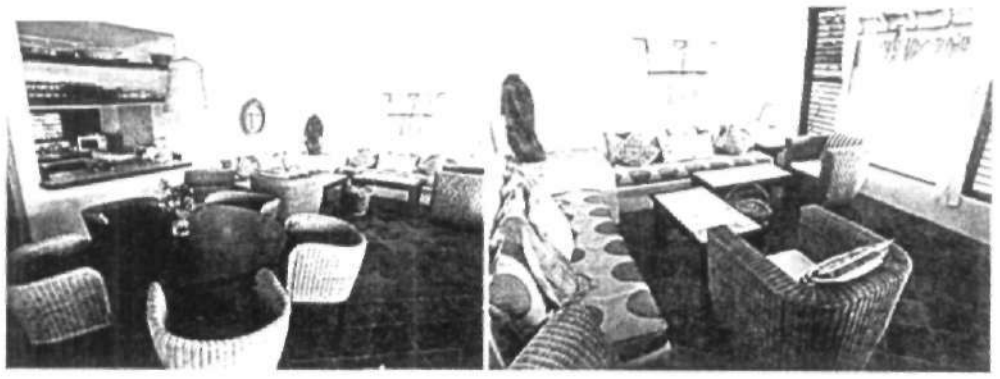


Plate 4.22 b upper level living room and kitchen, opens to the terrace

Source google

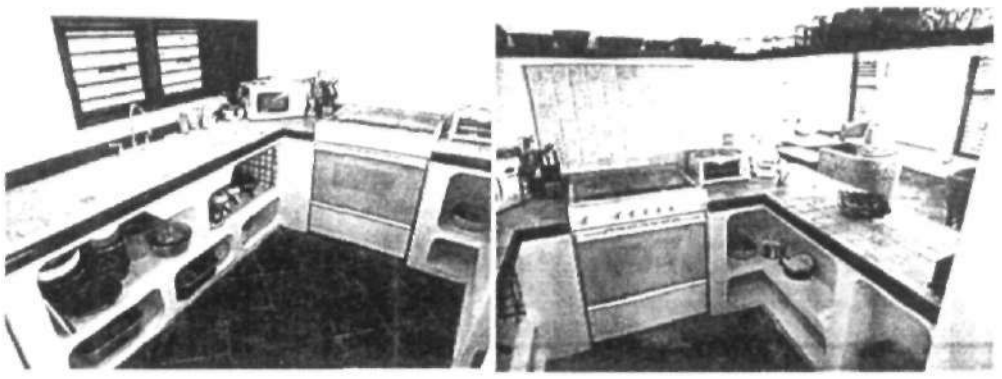


Plate 4.23 Kitchen

Source google



Plate 4.24 upper level ocean view bedroom, opens to the terrace

Source google



Plate 4.25 Ocean view entrance lounge area

Source google





Plate 4.26 guest house bedroom with private bathroom

Source google



Plate 4.27 guest house pool front patio and garden patio

Source google



Plate 4.28 Casa Aurora's seaward facing side, lagoon entry area and ocean view

Source google

APPRAISAL

Balamku is an eco-friendly resort that is committed to providing comfort and quality services using the resources of nature without abusing the environment .



Plate 4.29 Resort surroundings

Source google

The design of the resort is aimed at protecting the environment and reducing the impact of tourism by using eco-efficient energy and water systems, waste management practices and preserving the natural environment.Effort has been made to preserve the original vegetation on the site. Nearly a third of the site remains undeveloped and a reforestation project has been undertaken with the aim of creating a wildlife refuge. Re-vegetation has been done with indigenous flowering plants but otherwise the landscaping scale has been quite modest. An attempt has been made to stop continuing beach erosion. ownersbelieve that the resort could do better Emphasis has been laid on

minimizing negative impacts on land by having fewer buildings and lighter use of the land but with more vegetation.

The resort is built chiefly with heavy materials such as concrete blocks and concrete laid in-situ as well as ceramic floor tiles. Materials require minimal maintenance and are resistant to strong winds, thus increasing the structures' stability and safety in the hurricane season. Double-storey buildings also have tiled concrete floors between storeys. Local grass and timber are used for roofing allowing for sufficient heat dissipation into the night sky. Many resort activities take place outdoors in a traditional open-air structure called a palapa, which has no walls and only a lightweight grass roof supported by timber poles.

A study of the climatic performance of the bu ilding indicates quite significant heat storage in massive elements (structural walls and floors) of the resort.

MERITS

The resort has minimal negative impact on the environment one quarter of the land has been developed.

Enhancement of the existing flora by planting the indigenous flowering plants

Use of local building materials which are eco-friendly.

DEMERITS

Insufficient facilities.

Table 4.3 Summary of findings as it relates to eco-friendly architecture

Site Planning	Construction	Passive Cooling	Renewable energy sources	**Rainwater harvesting**
• Minimal disruption and reforestation of the entire site only ¼ of the land has been developed..	• Use of heavy concrete structures which have high thermal mass.	• Resort buildings are built relatively close to each other leaving little room for air circulation to enhance passive cooling	• Use 40 photovoltaic panels each 0.5x1.5 wide.	Rainwater collection tanks capable of storing 108000 litres of water.
• Re –vegetation of site using indigenous flowering plants.	• Use of renewable roofing materials. • Use of flat roofs for additional insulation.	• The units are situated to maximize natural ventilation.	• Wind vane and 11kw propane backup generator	
• Vines and shrubs have been used to assist in reduction	• Buildings are circular in shape to present only a small section perpendicular to direction of the sun's rays	• Swimming pool by the garden side of the main house.		

of soil erosion as well as for the enjoyment of their natural beauty	• Use of materials with high thermal mass for comfort. • High cathederal ceiling and light-weight roofs for rapid dissipation of any heat build-up.			
•	• Use of heavy weight concrete structure which are too expensive and not very efficient in energy saving. •	•	•	

CASE STUDY FOUR:TRAPPCO RANCH AND RESORT.KADUNA.

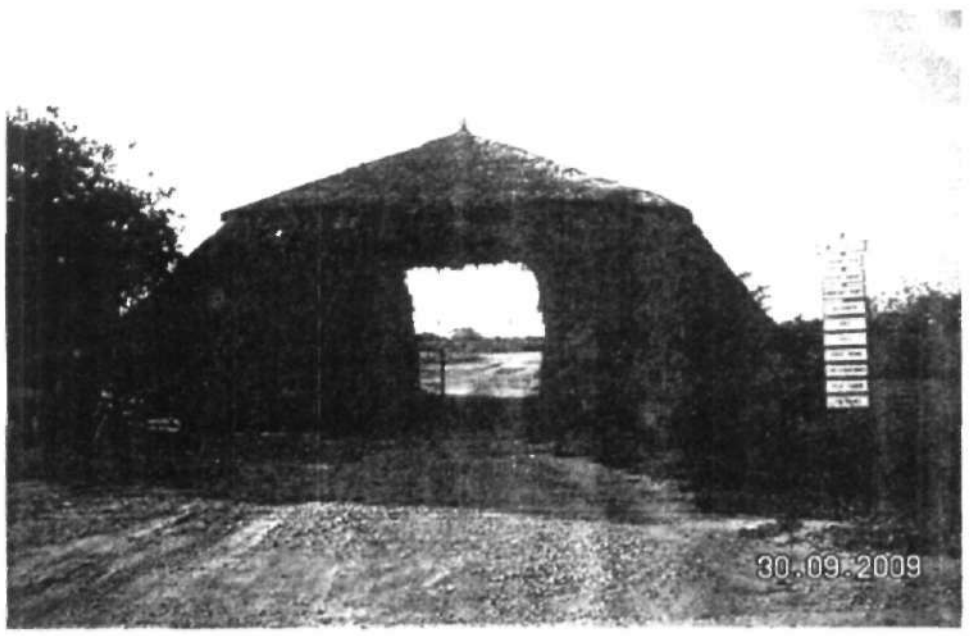


Plate 4.29 Resort gate

Sourrce Author"s field work

Architect/designer: Not standardized to one firm.

GENERAL DESCRIPTION

Trappco ranch and resort is an eco-friendly located just a few metres away from Kaduna International Airport, The idea of this resort was conceived by the Imani Brothers and it was developed as a resort in 1995.Trappco is isolated from the hustle and bustle of the city in a naturally secure environment which ensures memorable experience with the bliss and tranquility a business or leisure trip deserves. It can also be accessed from Rigajikun express way.

Security, beauty, tranquility and unequalled peace are blended into the concept of Trappco Ranch & Resort which has now become Kaduna's flagship relaxation and holiday spot. The resort is an enchantingly peaceful and quiet resort.

PRINCIPAL ATTRACTIONS

The large water body and the lush tropical grassland.

FACILITIES

Reception: The reception is located by the entrance of the resort gate it is linked to the car park, the reception comprises of a receptionists desk, a waiting area and a mini shop.



Plate 4.30 Reception

Sourrce Author"s field work

Accommodation Trappco ranch and resort offers a variety of accommodation types

The resort has 32 rooms consisting of 8 single rooms, 7 studios, 4 two bedroom

charlets and 3 three bedroom charlets all tastefully furnished. Each bedroom type features:

Sleeping area.

Sitting area.

Bathroom with shower.

Air conditioners or electric fans.

Colored TV with DVD player and films.

CD player with radio.

Refrigerator.

Coffee-tea making facilities.



Plate 4.31 Eterior view of two bedroom units.

Sourrce Author"s field work



Plate 4.32 a Interior view of two bedroom units.

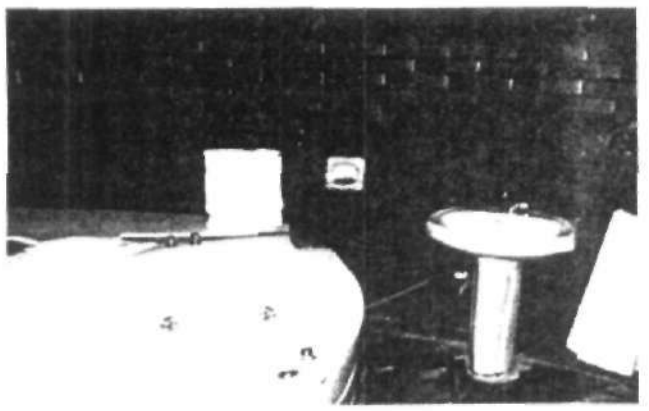


Plate 4.32 b Bathroom and /toilet



Plate 4.32c Kitchen area.



Plate 4.33 aSingle bedroom units

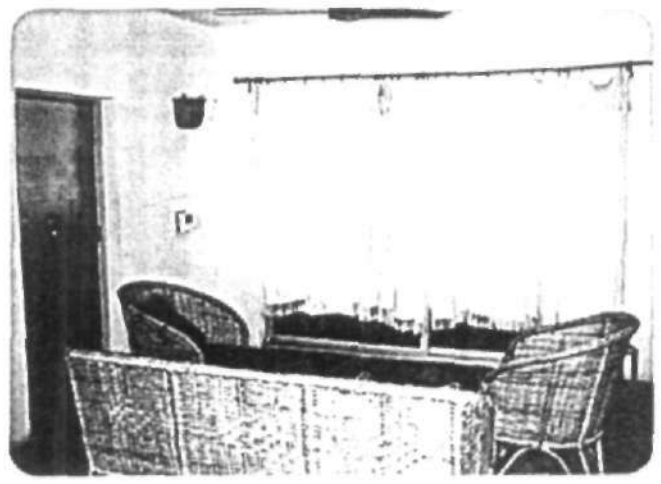


Plate 4.33 b Living area for Single bedroom units



Plate 4.33c Sleeping area.

OUTDOOR RECREATIONAL FACILITIES

The resort offers facilities for swimming with sun loungers horseback riding, Volleyball, Basketball, Football and Polo pitches, Quad biking, Snooker, Bird watching, Board games, Camping, Children's activities, Cultural shows, Hydro biking, Fishing, Nature walks , boating, jogging e.t.c



Plate 4.34a view of horses for polo and ranch.



Plate 4.34.b Out door play areas

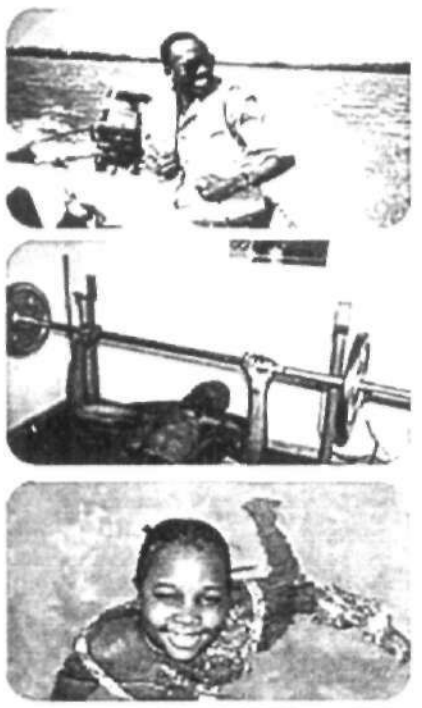


Plate 4.35 Recreational activities

Source google.com



plate 4.36 view of children swimming pool

Source google.com



plate 4.37 . view of riding facilities

WEDDINGS, CONFERENCES & EVENTERTAINMENT

Trappco ranch and resort provides the perfect destination for memorable meetings and successful conferences, along with **entertainment** activities.These include

Restaurant:

The resort has one restaurant and it located close to the chalets and the beach front.





Plate 4.38 Exterior view of Restaurant

Source google.com

Conference Hall

The conference hall has a seating capacity for 150 people theatre style and 80 people banquet style. Added to these is a meeting room for brain storming with sitting capacity for 1 12 and 6 respectively. Business centre facilities are also provided on request.



Plate 4.39 Interior view of conference hall

Source google.com

Open stage

The resort has an open stage used for barbeques, **parties**, cultural dances and other live performances. The open stage is a located close to the restaurant and the swimming pool.

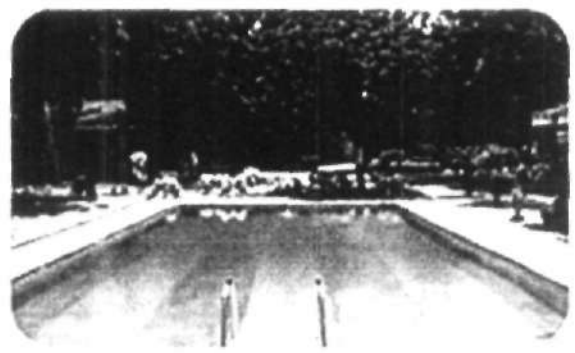


Plate 4.40 view of open stage

Source google.com

.APPRAISAL

The resort is tries to incorporate some principles of eco-friendly architecture in its design.The reception is situated close to the parking area at the entrance gate. The chalets are well linked together in a circular arrangement and are centralized in the resort which gives room to a clear view of the natural attractions. The furnished bungalows spread out over 60 square meters of virgin green tropical land.

The communal facilities such as the restaurant, swimming pools e.t.c. are located around the chalets, other sports facilities such as the as natural swimming pool, horseback riding, fishing, boating, volleyball, basketball, jogging paths, bird watching,

football and polo pitches, quad biking, snooker and other indoor games are located around the countryside.

In terms of the building materials,the chalets are raised on rocky grounds built of red burnt bricks .Wood and glass were used for the window sills, bamboo was used for as walls and columns in some structures such as the site-outs, open stages e.t.c tiles were used for the floors.The roofs are gable in shape and are made of Long aluminum roofing sheets and treated thatch in some areas, The buildings are well linked with other functional spaces with soft landscape, carpet grass shaded by towering long trees in an attempt to blend in with the natural environment.

MERITS

The site planning allows for a clear and interesting view of the natural attractions.

The main building material is for the chalets is concrete is an eco-friendly building material and good for such climate.

DEMERITS

The guest units rely on air-conditioning for most of the time.

Concrete and steel are used in some areas these materials are not eco-friendly.

Table 4.4 Summary of findings in relation to eco-friendly architecture

Site Planning	Construction	Passive Cooling	**Renewable energy sources**	**Rainwater harvesting**
• Minimal disruption a of the site because large area has been left virgin. • Ehancing shading with the use of towering palm trees.	• Use of burnt bricks which has high thermal mass. • Use of renewable building materials such as thatch. • Use of long span aluminium roofing sheets which has high embodied energy and high thermal conductivity • Buildings are rectangular in shape	• Swimming pools are built around chalets to enhance passive cooling • Buildings are well spaced out to ensure adequate passive cooling.	• Use of a stand -by generator.	None.
•	•	•	•	

CASE STUDY FIVE:TREASURE OF THE UNIVERSE RESORT,KADUNA

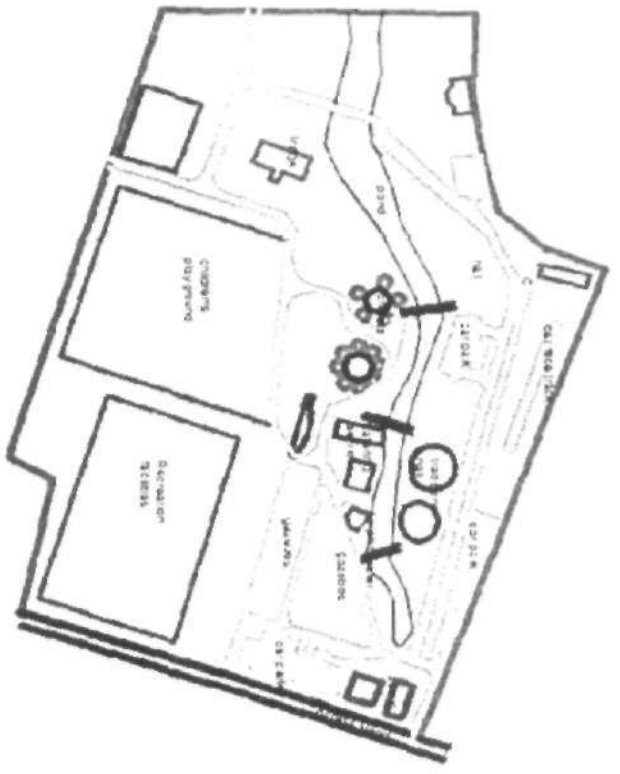


Plate 4.41 Site plan Treasures of the Universe resort, Kaduna
Source: Authors field work

Architect/designer: Not standardized to one firm.

GENERAL DESCRIPTION

Treasure of the universe is located at Mahuta-Sabon Tasha, Kaduna. The land is easily accessible by road .The resort has a tranquil environment and offers varied recreational

facilities which could aid weekend experiences for workers as well as vacation for tourist. The resort is about two years old and offers a rich display of the cultural heritag of Nigeria. The resort has sparse vegetation with relatively average height trees typical of a guinea savanna. The open nature of the site allows free movement of air and the undulating nature of the site create interesting views. The vegetation around the pond channels creates interesting views as it meanders' through the site into the dam.The car park is situated at the entrance to the resort. A ring road exist which will take you through the whole site. A drive through route also exist which takes you directly to the reception while passing through a couple of gazebos placed for rest and relaxation. The reception and the restaurant are adjacent to each other. There exists an amphitheater which has the pond passing directly behind it. The chalets are well linked together in a circular arrangement and are centralized in the resort which gives room to a clear view of the dam and open view. The furnished chalets are all ensuite, having a little living room. The proposed hotel will be located adjacent to the chalets. The recreational area is beside the chalets with a children's play ground which has an African museum and a zoo.

The social facilities such as the restaurant, conference halls, traditional meeting halls, and a chapel could be easily accessed from the chalets.

.PRINCIPAL ATTRACTION

The dam,lush guinea savannah vegetation,the sloping topography of the site, and the small ponds of water.

498623

FACILITIES

Accommodation

The chalets are circular in shape and are placed around a courtyard. There are eight chalets around each well landscaped courtyard. Each chalet is ensuite and furnished with all the necessary facilities for convenience.

Sleeping area.

Sitting area.

Bathroom with shower.

Air conditioners or electric fans.

Colored TV with DVD player and films.

CD player with radio.

Refrigerator.

Coffee-tea making facilities.



Plate 4.42Exterior view of conference hall

Source google.com



Plate 4.43 view of clustered chalets at Treasures of the Universe resort, Kaduna
Source: Authors field work

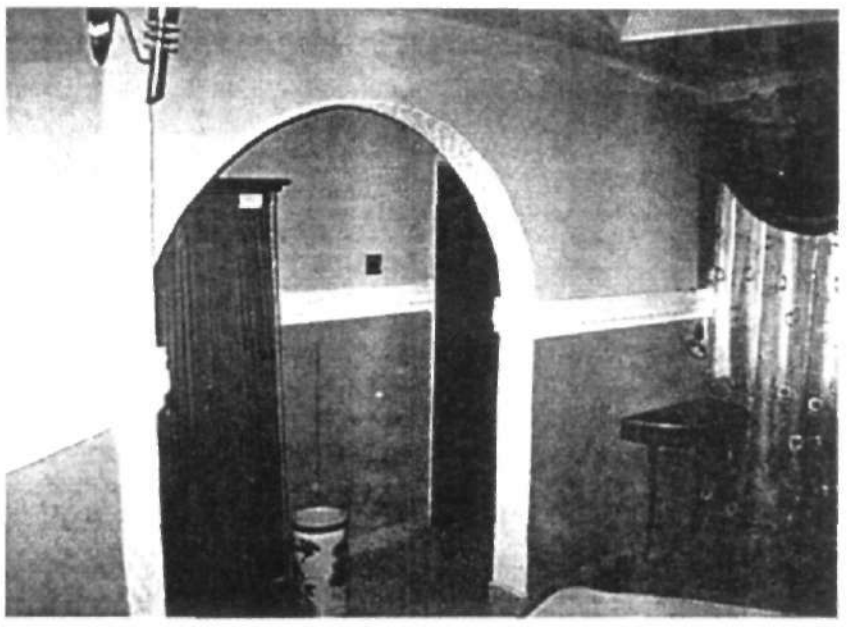


Plate 4.44 Interior chalet at Treasures of the Universe resort, Kaduna

Source: Authors field work

OUTDOOR RECREATIONAL FACILITIES

Some recreational activities that take place in the resort include football/soccer, aerobics, Bird watching, Board games, Camping, Children's activities, picknicking, Cultural shows, car racing, Fishing, Nature walks and jogging.



Plate 4.45 Picnic /barbecue area at Treasure of the Universe resort, Kaduna
Source: Authors field work



Plate 4.46 mini car race track at Treasure of the Universe resort, Kaduna
Source :Authors foeld work

WEDDINGS, CONFERENCES & EVENTERTAINMENT

Trappco ranch and resort provides the perfect destination for memorable meetings and successful conferences, along with **entertainment** activities.These include:

Amphitheater: the resort has an open hall which could use for cultural dances and other live performances. The amphitheater is located at around the restaurant area and has the pond right behind the stage.

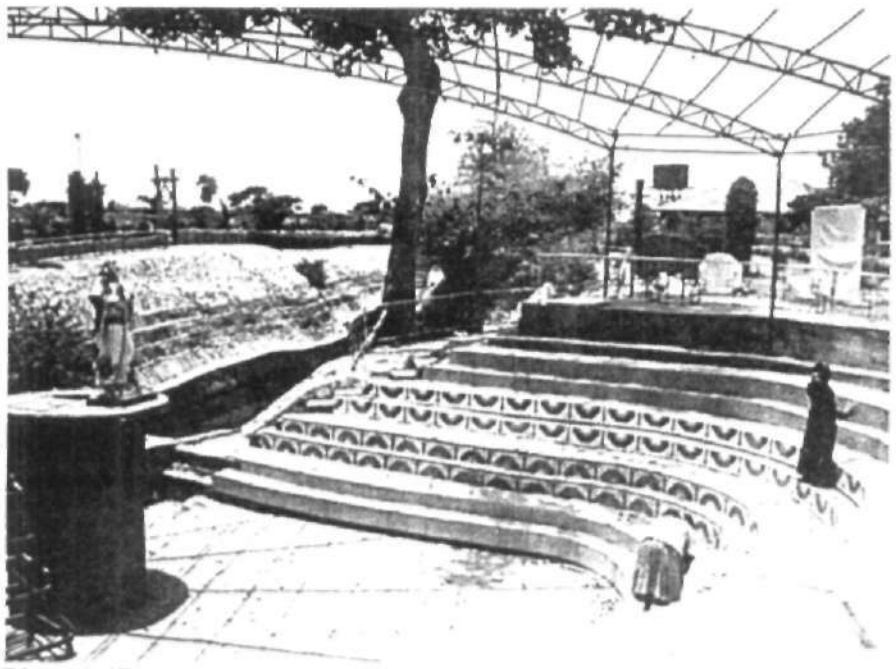


Plate 4.47 Amphitheater at Treasures of the Universe resort, Kaduna
Source: Authors field work



Plate 4.48 pond at Treasure of the Universe resort, Kaduna

Source authors field work.

Restaurant: The resort has one restaurant and it located next to the reception. It offers both international and continental dishes.



Plate 4.49 Exterior view of restaurant at Treasures of the Universe resort,Kaduna
Source: Authors field work

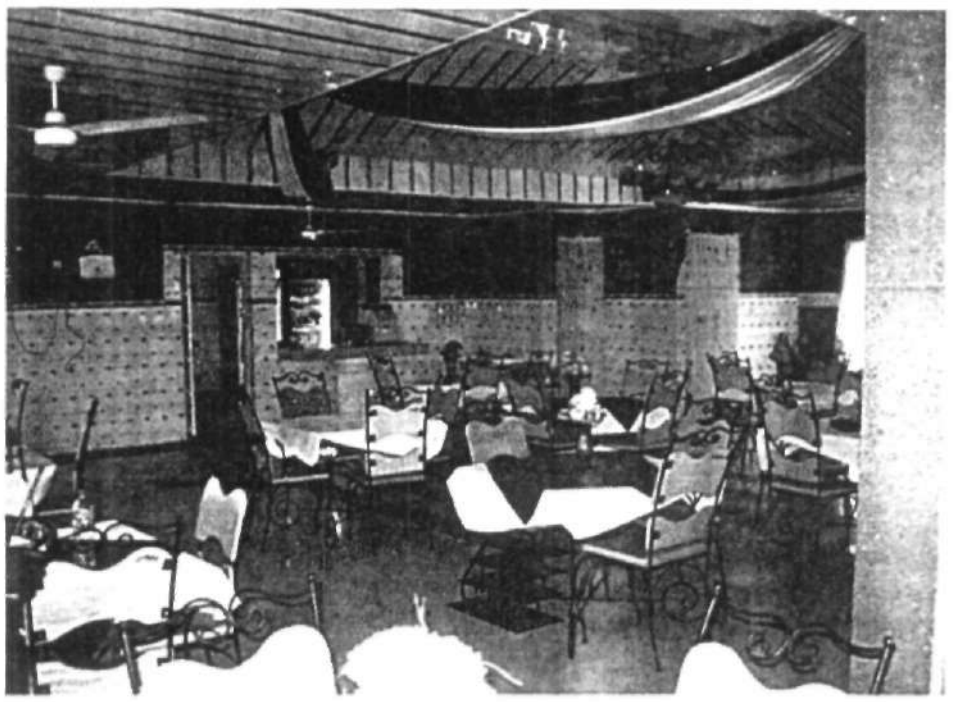


Plate 4.50 Interior view of restaurant at Treasures of the Universe resort ,Kaduna
Source: Authors field work



Plate 4.51 Reception Hall at Treasures of the Universe Resort, Kaduna
Source: Authors field work



Plate 4.52 Thatched gazebos for relaxation at Treasures of the Universe Resort, Kaduna.
Source: Authors field work



Plate 4.53 exterior view of conference hall built with sancrete blocks at Treasures of the Universe resort,Kaduna
Source: Authors field work

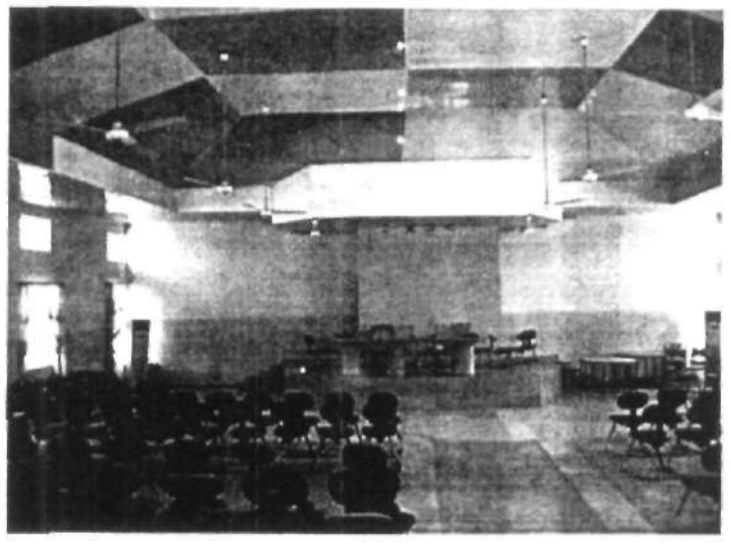


Plate 4..54 Interior view of conference hall at Treasures of the Universe resort,Kaduna
Source: Authors field work



Plate 4..55 traditional meeting hall at Treasures of theUniverse resort, Kaduna

Source: Authors field work

APPRAISAL

The chalets are circular in shape . They are made up of a combination of sandcrete blocks and plaster of paris finishing. The ceilings are made from plastics and the roofing is of long span aluminium roofig sheets. The windows are made from aluminium and glass. Some structures such as the restaurant have ceramic tiles on the walls. The buildings are well linked with other functional spaces with soft landscape and interlocking tiles. The paths are channeled by some hedges around them.

MERITS

The site planning allows for a clear and interesting view of the natural attractions.
Provision of the basic facilities that are needed in any type of resort.

DEMERITS

The guest units rely on air-conditioning for most of the time.
The materials used for the construction of this resort are not eco-friendly.

The resort is not well landscaped and the buildings do not blend with the natural setting of the site . chalets are clustered up in one place.

CASE STUDY SIX: SHERATON MIRAMAR EL GOUNA, EGYPT

Architect: World famous architect Michael Graves.

GENERAL DESCRIPTION

Sheraton Miramar Resort El Gouna is located on the shores of the red sea, the shore line is approximately 500m and 300m wide. The shoreline surrounds the site in all sides. It is in the village of El Gouna, just 20 kilometres north of the popular tourist town of Hurghada.It is an oasis of peace and tranquility which leaves a long lasting experience to anyone who visits it. . It's an inviting, magical mix of Arabic and Egypt's Nubian styles,

PRINCIPAL ATTRACTIONS

Nine islands surrounded by gardens, The red sea to the east, a lagoon to the west and channels connecting the lagoon to the red sea on the north and south edges of the site. The connections between the lagoons and the red sea as well the

Landscape of the site allow each room to have a view of the waterfront.

. APPRAISAL

Casa Our 339 rooms are true retreats, reached by crossing small bridges and walking along garden paths. Created for spreading out and relaxing, with secluded terraces and balconies, rooms look out onto the lagoons, pools, or private beach. Two restaurant with bar, an exciting swimming pool , excercise pools, children;s pool, and hotel

grounds featuring lagoons and canals. Private beaches, live entertainment, outdoor heated pool, and water sports Room

The characteristic of the building is massing, materials, facades, interior and furnishing is an interpretation of Egyptian traditional vernacular style to give the impression of a village. Made up of individual units differentiated by colours , heights, domes, arches and columns.

The building of which the hotel complex is composed ad, with the solid wall prevailing over the voids. This is compensated by an unusual and varied typological repertoire of openings



Plate 4.56 The swimming pool area at Sheraton Miramar El Gouna Resort, Egypt
Source: Mostaedi (1999)

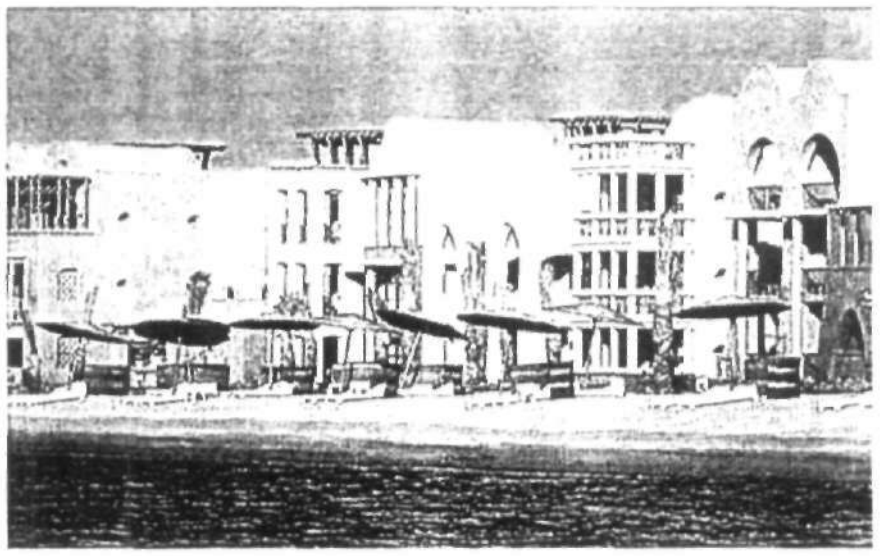


Plate 4.57 water front area at Sheraton Miramar El Gouna Resort, Egypt
Source: Mostaedi (1999)

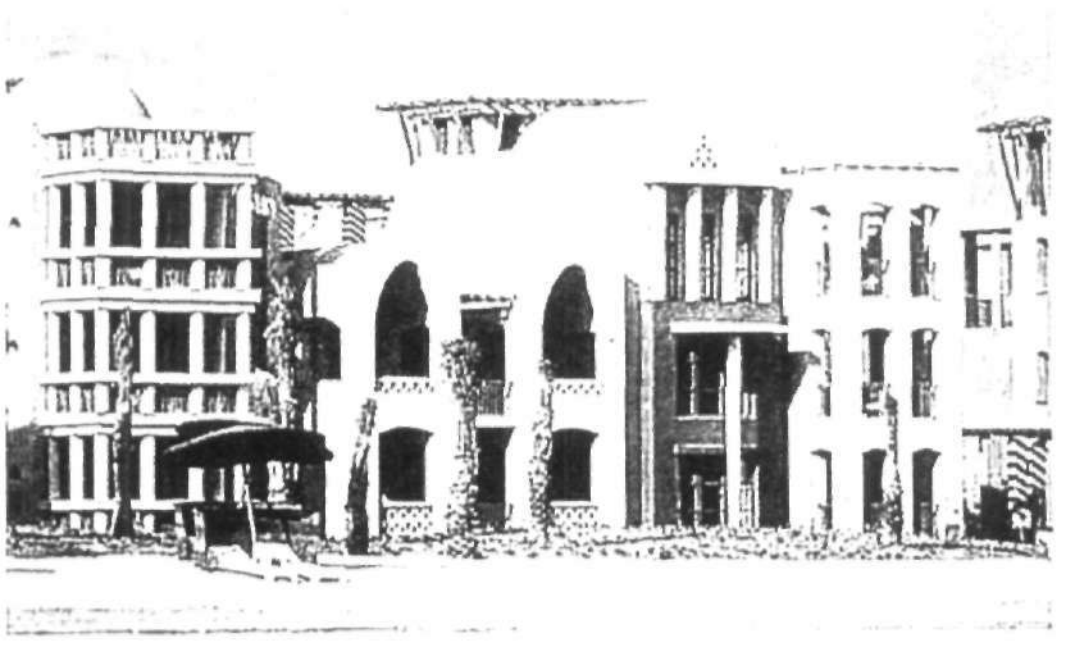
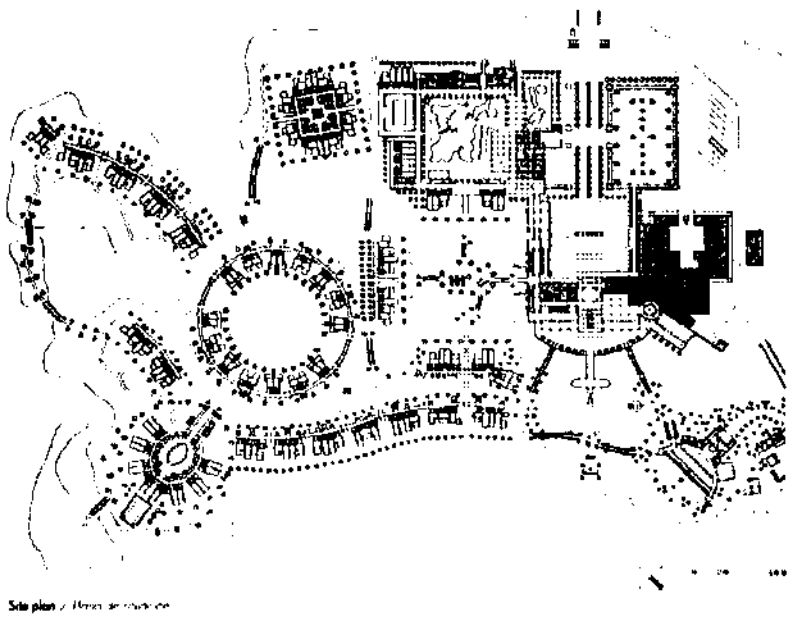


plate 4.58Use of local indigenous building material Sheraton Miramar El Gouna Resort, Egypt
Source: Mostaedi (1999)



plate 4.59 relaxation gazebos facing waterfront Sheraton Miramar El Gouna Resort, Egypt
Source: Mostaedi (1999)





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Plate4.40 Plan of site and view of site waterfront of Sheraton Miramar El Gouna Resort, Egypt
Source: Mostaedi (1999)

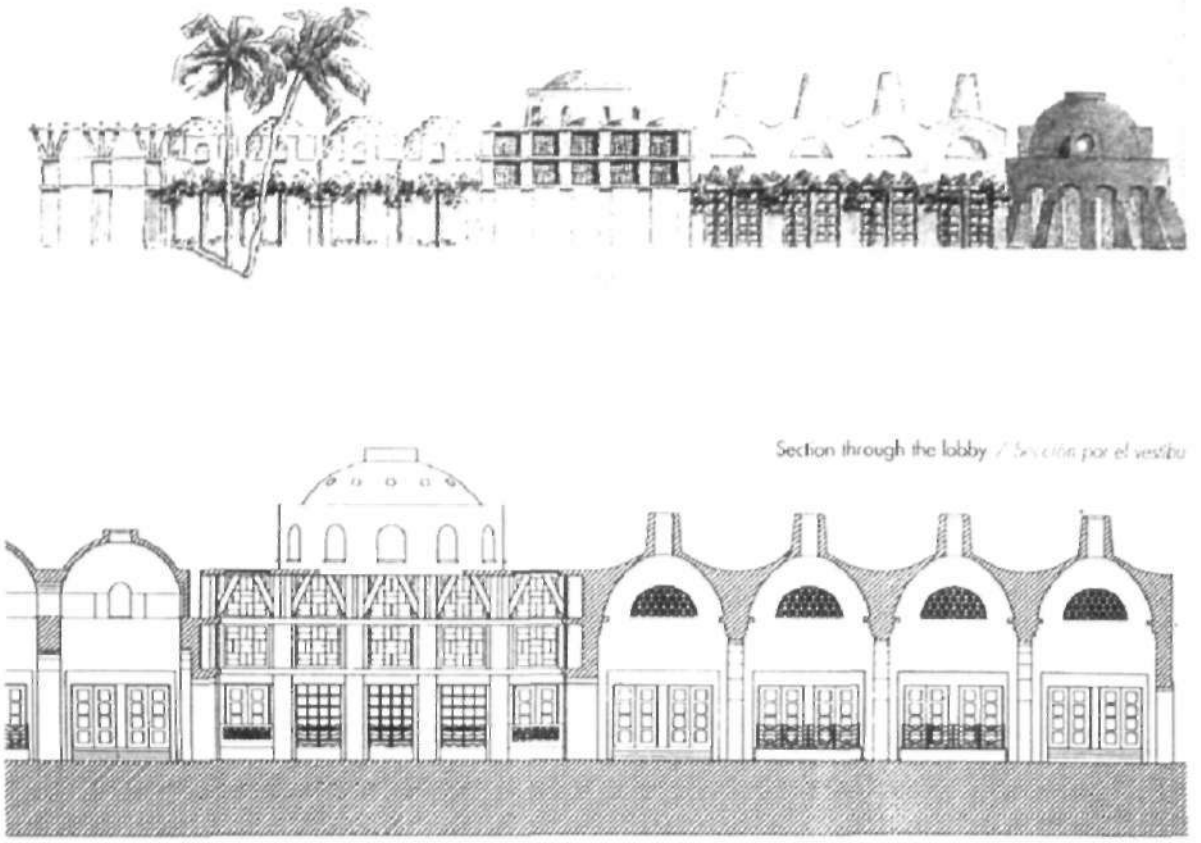


Plate 4.60. Section through the hotel reception and lobby at Sheraton Miramar El Gouna Resort, Egypt
Source: Mostaedi (1999).

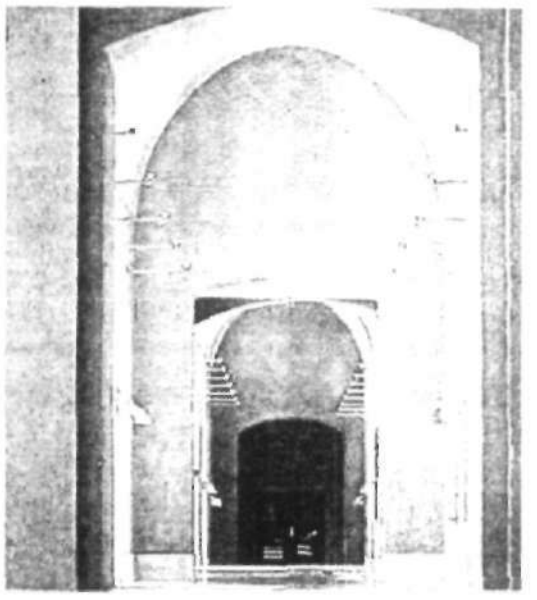


Plate 4.63 Lobby with natural daylight at Sheraton Miramar El Gouna Resort, Egypt
Source: Mostaedi (1999)

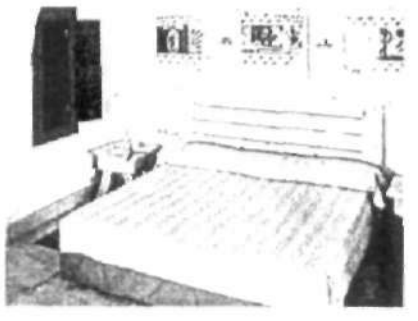


Plate 4.464 typical room at Sheraton Miramar El Gouna Resort, Egypt
Source: Mostaedi (1999)

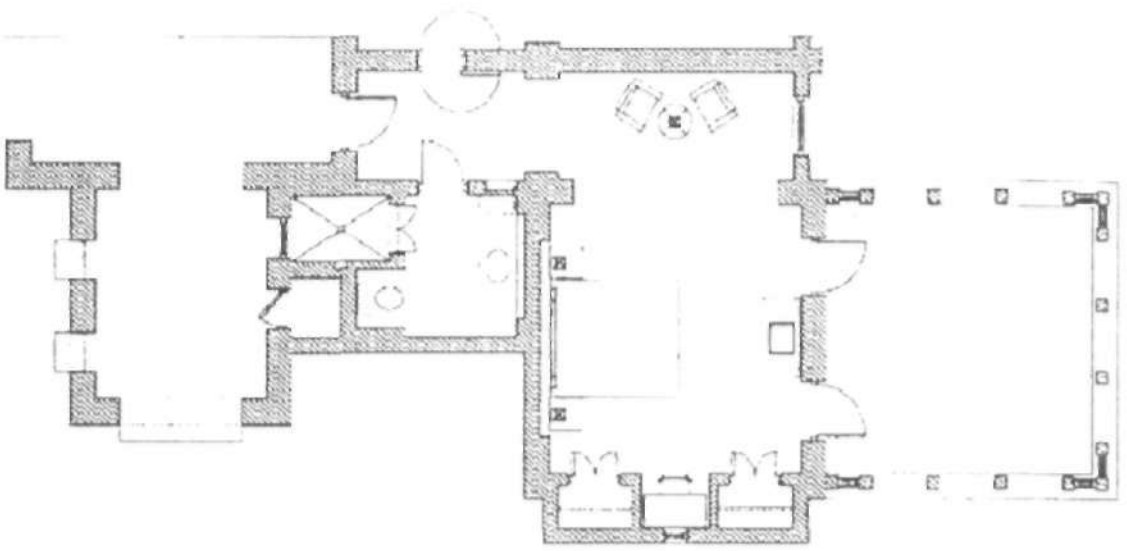


Plate 4.65. Typical room plan at Sheraton Miramar El Gouna Resort, Egypt
Source: Mostaedi (1999)



Plate 4.66. Restaurant at Sheraton Miramar El Gouna Resort, Egypt
Source: Mostaedi (1999)

Table 4.6 Summary of findings in relation to eco-friendly architecture

Site Planning	Construction	Passive Cooling	**Renewable energy sources**	**Rainwater harvesting**
• Spatial organization of the resort is organic • Maximum retention of existing trees on site.	• The buildings in a vernacular plan and layed such that passive cooling is enhanced. • Use of earth on walls which is of high thermal capacity, reduces the penetration of solar radiation., • Use of renewable building materials like stone,and earth.	• Swimming pools are built around chalets to enhance passive cooling • The buildings are layed such that passive cooling is enhanced • Buildings use single banking design method thus enhances cross ventilation in the interiors.	• None	None.

Rating = Excellent Good Fair Poor

Site planning and landscaping:70% of the resorts have enhanced the natural environment through proper landscaping and site planning.

Construction techniques: 60% of the resorts used eco-friendly construction techniques .

Evapourative cooling: 50% of the resorts adopted evapourative cooling techniques in their planning .

CHAPTER FIVE

5.0 LAKE CHAD BASIN NATIONAL PARK

5.1 SECTORS OF THE LAKE CHAD BASIN NATIONAL PARK

1. Bade –Nguru Wetlands
2. Chingurmi-Duguma
3. Sabisa Game Reserve
4. Kilboa Forest Reserve

Chingurmi Duguma game reserve has an area of of 1,228sq km.Bade-Nguru wetlands has an area of 938 sq km and Kilboa forest reserve has an area of 92 sq km.

Chingurmi D uguma game reserve is the only area in the country where Giraffe is found.Other animals like the Topi, fronted gazette,ostritch,crowned crammed,spotted hynae and jackal are also found there.

The Bade-Nguru wetlands are part of the extensive Hadejia-Nguru flood plain and are useful for the large number of water birds found around the area which migrate each year to the area from Europe.

The Kilboa forest reserve lies in the extreme North of Yobe State.It has unique series of oasis which lie among extensive sand dunes.That is the only place where flamingoes have been recorded in Nigeria.

5.2 PHSICAL CHARACTERISTICS OF THE LAKE CHAD BASIN

5.2.1 Climate

The climatic conditions experienced in the area is the dry and arid type with annual temperature of 48 degrees celcius on the onset of rains.The highest temperature is experienced between December and Febuary with a mean temperature of 20 degrees celcius to 23 degrees celcius.The annual rainfall in the Sahel is 180mm/pa

It commences in July and ends in October.The dry season lasts for 7-8 months from November to June.

5.2.2 Topography

The Lake Chad Basin is an undulating drift of irregularly shaped sand dunes ,depressions and sandy flats which alternate with hummocky terrain.Generally,the north has two reliefs with sucession of sand dunes and loamy clay or loamy peneplains

5.2.3 Fauna And Flora

The lake chad basin is important for the birdlife.the birds are frequently found in large numbers .these include the gargery,pintails,pelicans,spur-winged geese,black-tailed godwit,glossy-ibis european stock and variety of waders.The National Park is the only place where Giraffe and Ostrich are found in Nigeria.

The vegetation is Sudano-Sahelin type.It can be described as an association of acacia and combretaceous scrub with little or no trees in the area.Common plant species are Acacia Senegal,A.Notalica.The Bade-Nguru wetland support unique ground water

forest characterized by trees adopted to the seasonal submergence in water.Thes include the mitranya inermis,tamarandus indica and khaya senegalensis.

5.2.4 Scenic Quality

The park has excellent views of the colorful wildlife along the shores of the lake in the Bade–Nguru wetlands with the unique series of oasis with the sucession of sand dunes in some areas.A beautiful view of the flowing water body is also experienced.

5.2.5 Accessibility Routes

Air link to the Lake Chad Basin National Park is via Maiduguri through the following routes:

Lagos-Maiduguri

Abuja-Maiduguri

Kano-Maiduguri

By road

Kano-Nguru-Dagona

Jos-Bauchi-Gashua-Jakusko-Dagona

CHAPTER SIX

6.0 DESIGN REPORT

6.1 The Site

Yobe State was created on 27th of August,1991. It covers an area of about 47,153Sq kilometers. It shares an international border with the Republic of Niger to the north. Within the country, it shares borders with Jigawa and Bauchi states to the west, Borno to the east and Gombe to the South.

It has a population of about 2.5Million, which comprises Manga, Kanuri, Fulani, Karai-karai, Bolewa, Bade, Ngizim, Ngamo, Babur, Maga, Hausa and several other ethnic groups from different parts of the country. The official language in the state is English, but Hausa, Kanuri and Fulani have gained wide acceptability. Most of the people are peasant farmers with quite a number engaged in livestock rearing/production, fishing and trading. The people are known for the world famous durbar and other rich cultures and traditions that find routes from their historical linkages with the Arab lands.

The state has 17 Local Government Area Tourist attractions in the state include among others, the following; Dokshi spring water in Gulani, Dagona birds sanctuary in Bade, Old Gorgaram city in Jakusko, Birnin Gazargamo in Gaidam, Tulo-tulowa village in Yusufari, Old Daniski settlement and Goya valley in Fika, 8000 year old Dufuna canoe in Fune, Grave yard of past Emirs of Fika, wetlands and Bade fishing and cultural festival in Jakusko.

The main means of transportation to this area is by road and foot, the Bade people are mainly fishermen, famers and hunters .They have existing tradition of a fishing festival that takes place once every year.

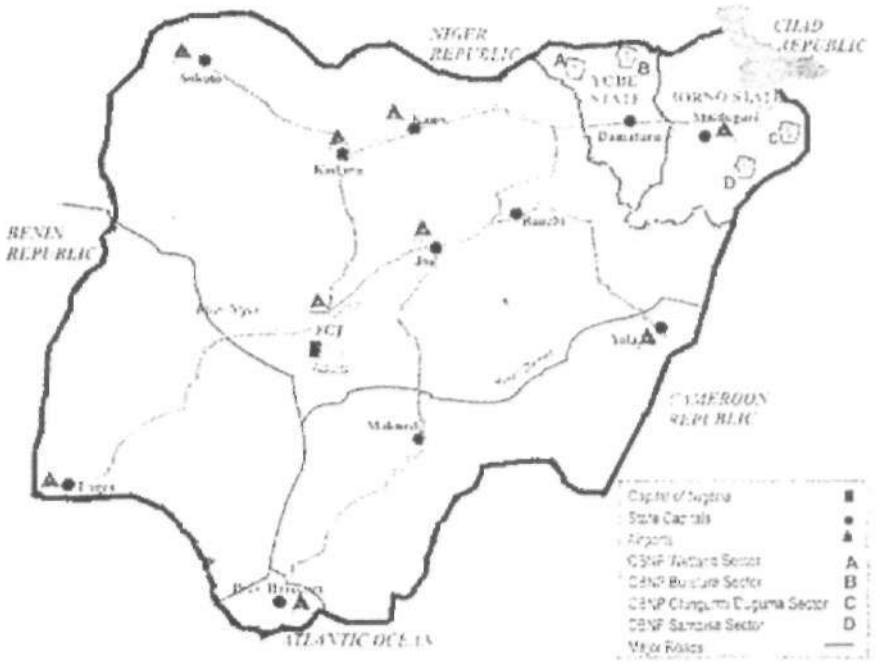


Fig 6.1Map Of Nigeria Showing Yobe State

Source:google

6.1.1 Site selection criteria and features

Site selection

Three (3) alternative sites were chosen for this research, based on purposive sampling

Site selection criteria

The following criteria were considered in the site selection

Acessibility to the site

Transportation to Dagona village from Potiskum is by road.Ohter means of transportation like donkeys and camels are also used.

Scenic beauty

Views on and from the site

Services

Nearness to existing power lines, water supply e.t.c.

Ecological characteristics of the site

To what extent has the site been degraded by previous buildings, Industrial and Agricultural uses.

Nearness to existing settlements

Where human labour / services can easily be provided



Fig 6.2 Google Image Of site

Source google.com

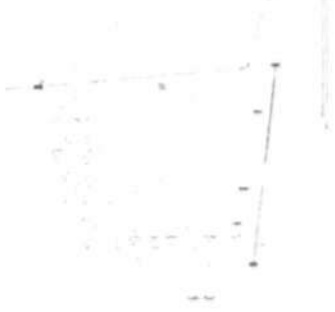


Fig 6.3 Site location

(Source: field work)

This site is located on the shores of the lake chad basin..

There are existing access foot paths to the site.

The sloping nature of the site provides scenic views and natural landscaping

The site is endowed with sporadic trees.

There are minimal existing services, but this can be tapped from nearby developments.

The site has not been degraded.

The site is close to existing settlements.

COMMENT – the site is suitable for this research.

6.2 Site Analysis

6.2.1 Climatic analysis

Dagona village is located on the shores of the lake chad basin and has a hot dry climate which characterizes Sudano-Sahelian climate.

The climate has the following characteristics:

Temperature

The mean temperature of the site is usually high all year round in Yobe State.March and April are the hottest months with maximum temperatures of 41 degrees celcius.Late November to Febuary are the harmattan periods with minimum temperatures of about 30 degrees celcius.The site has a unique microclimate of its own which is due to the nearness of the site to the water bodies.

The design of some of the structures such as the chalets will be located close to the water (ocean) inorder to take advantage of the microclimate created by the sea breeze, this is to enhance passive cooling and thermal comfort in the buildings.

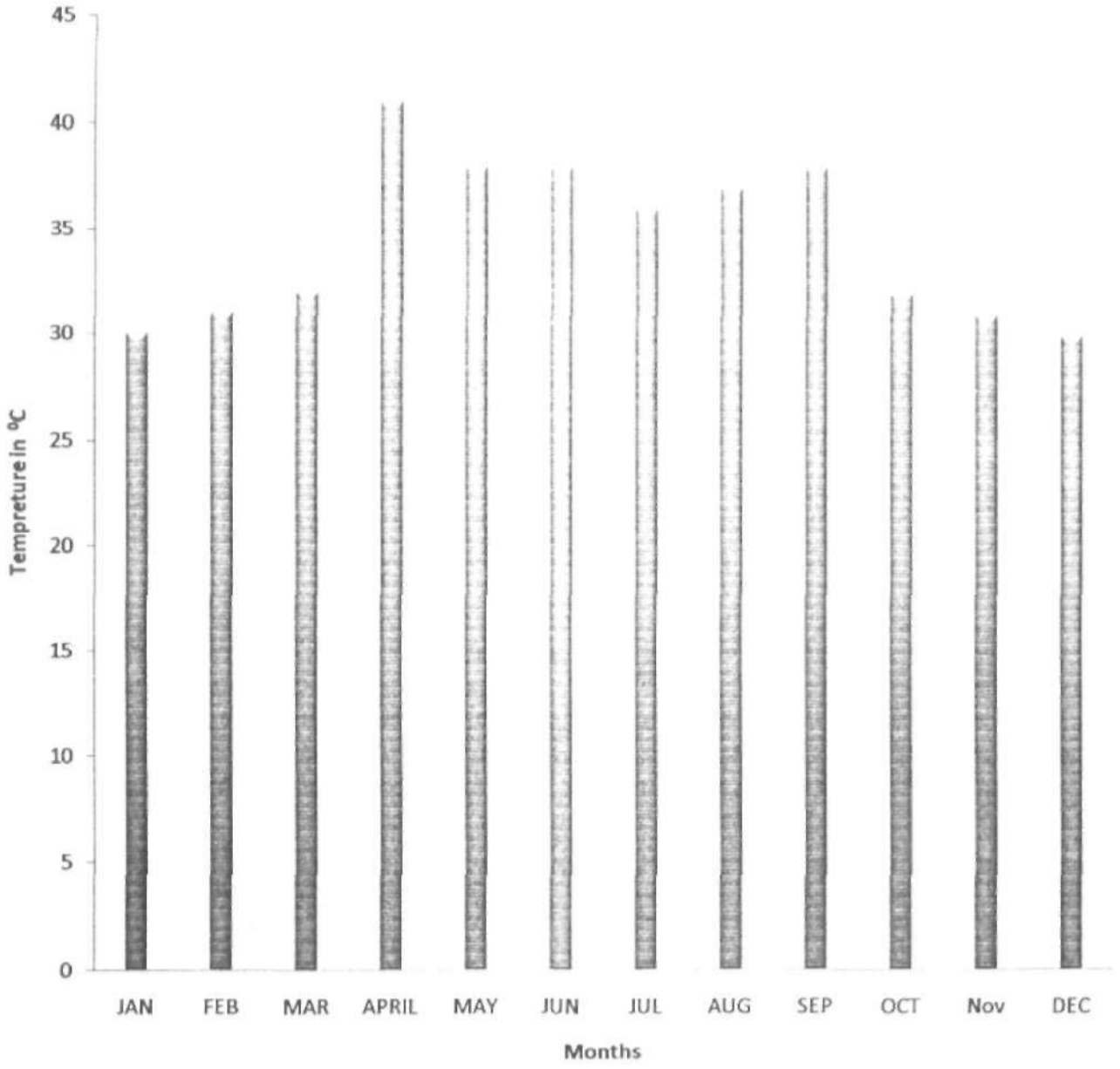


Figure 6.4 graph showing Temperature

Source: Min. of Land and survey ,Yobe state

Rainfall

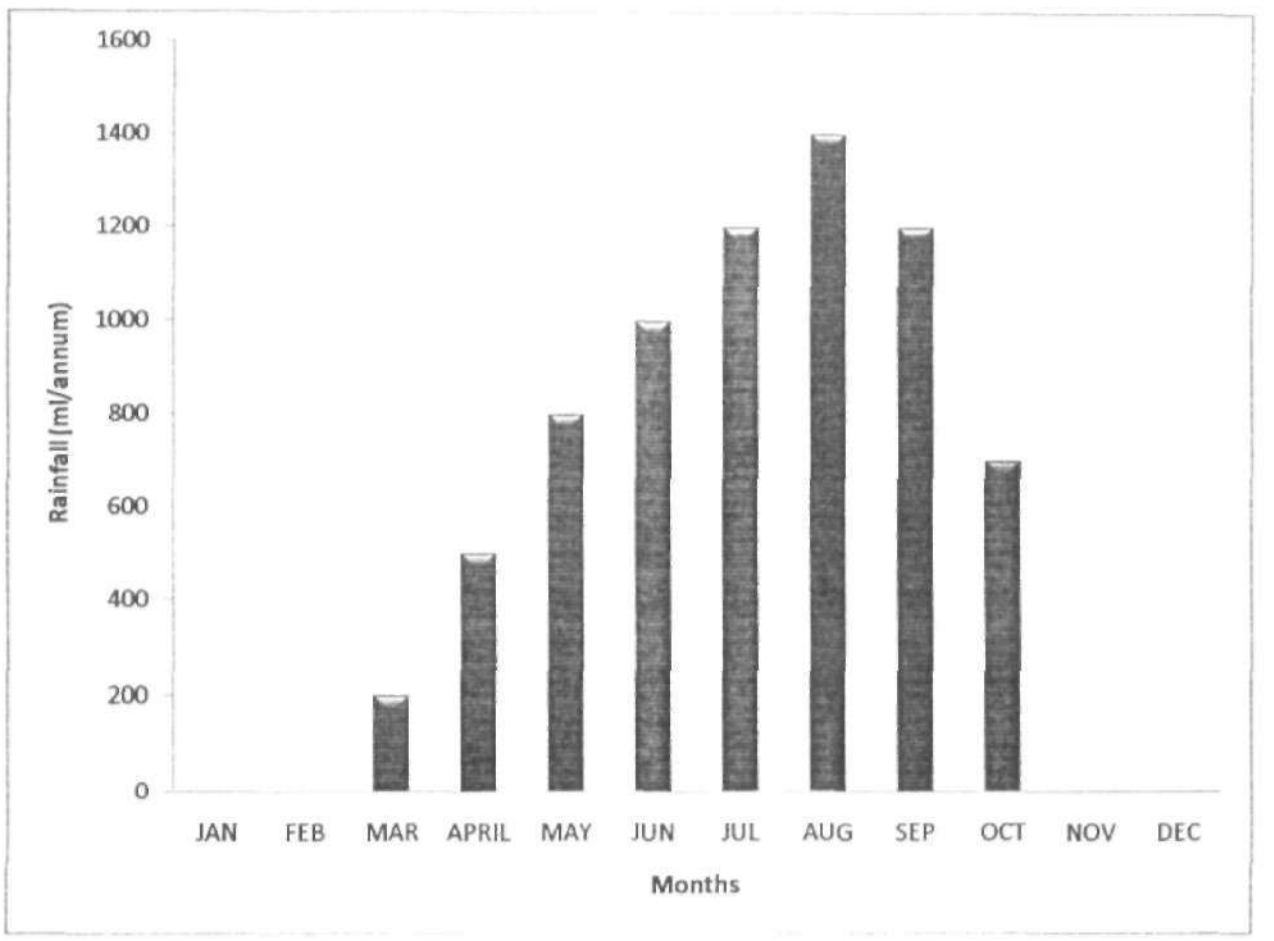


Fig 6.5 graph showing Monthly rainfall

Source: Min. of Land and survey ,Yobe state

Rainfall generally lasts for about 120 days .It falls between the months of March and October peaking in August.The amount varies from year to year and range from about 200mm in drought year to 600mm in very rainy year.

Sunshine

Difference in hours of daylight every month is minimal, artifitial lighting will not be needed to make for this.

Prevailing winds

The North-East trade winds blowing over the lake into the site allows for passive cooling and enhances thermal comfort.this wind will be taken advantage of to provide natural ventilation.

The South-West trade wind brings strong winds and flooding this will be prevented by landscape buffers and the design will have the chalets located at this area especially inorder to make use of the cool amd pleasant bearing humidity air blowing over the lake into into the site.

Topography

The site slopes gently towards the lake . Drainage will take this course. The nature of the site provides scenic views and natural landscape. Facilities such as the restaurant, administrative area e. t.c will be located on the highest point of the slope in order to provide magnificent view of the lake.

6.2.2 Vegetation Site Analysis

The vegetation on the site comprises of various types, this includes:

Vegetal cover is sparse as the grass grows in individual tufts leaving bare surfaces in between. The grasses in the Sahel are short and tussocky, 0.5m to 1.0m high. They are interspersed with sand dunes are the most common types here.

The acacia is a thorny, narrow leafed tree, fairly short and sometimes umbrella shaped. In the Sudan Savannah, the actual vegetation is made up of short grasses, 1.5m to 2.0m high, and some stunted tress. Typical trees include the acacia, dum palm, silk cotton and baobab.

The baobab stores water in the trunk like a sponge and it draws water from this source during the dry season. It has short and undersized branches shooting out from the head of a fat juicy trunk.

The dum palm has tall straight branches and fan shaped foliage.

The silk cotton tree is the tallest of the group, and grows to a height of 9m to 15m. It is from this tree that silk cotton, which is used for making local mattresses and pillows, is obtained. The vegetation is also exploited for a number of medicinal and other purposes. The vegetation site analysis is shown in Figure 6.6 below:

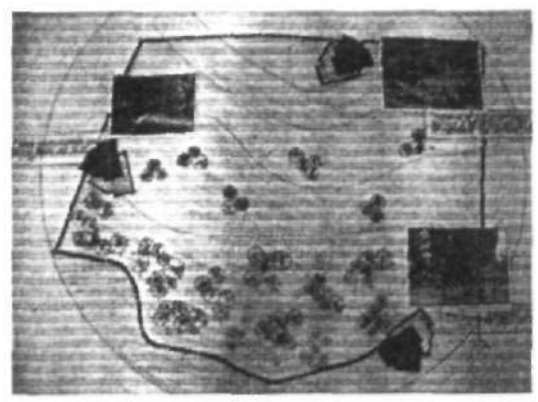


Fig: 6.6: vegetation site analysis
Source: Author's work

Scenic quality

The site is endowed with scenic views comprising of North- West side beautiful view of the lake with flying birds.

6.3 Design brief:

Site zoning

Understanding zoning for an eco development site, in particular one selected for a resort, is critical. Zoning for tourism is important. An intensive tourism development zone occurs in popular mass tourism destinations, such as this proposed resort. This proposed resort can be categorized into three main zones: Private, public and services.

Private spaces: Lodging units

1. Sleeping area
2. Living area

Public spaces

1. Parking area
2. Reception
3. Shops
4. First aid room
5. Gymnasium
6. Spa/ Massage area
7. Bar
8. Sport area
9. Sit outs

10. Restaurants

Services

1. Kitchen
2. Laundry
3. Generator house
4. Offices

6.4 Design concept

As eco-friendly architecture describes an expression of individuality, it explores our needs to connect to nature. Predominant site characteristics

- The presence of flying birds.

- Sandy lake shores

- Presence of water body

Plan concept

Presence of both resident and migratory birds

The wavy pattern of the flying birds is adopted.

Figure 6.7 below shows the wavy pattern of flying buds that has been adopted as the concept for the building forms.

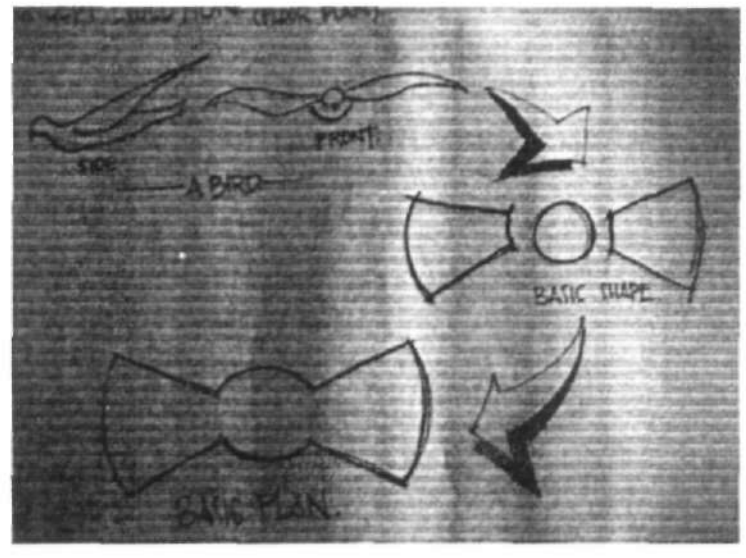


Fig. 6.7 : Floor Plan Concept
Source : Autours Work.

Elevation concept

Eco-friendly resort design should consider the nature and culture of the region being conscious of the need to preserve what is left. (Bromberek, 2009).

Yobe State has rich cultural heritage and tourism spots. The concept of this resort adopts the use of some major forms of the Hausa architecture to design an eco-friendly resort which fits in the region and utilizes its local resources.

Figure 6.8 illustrates this;

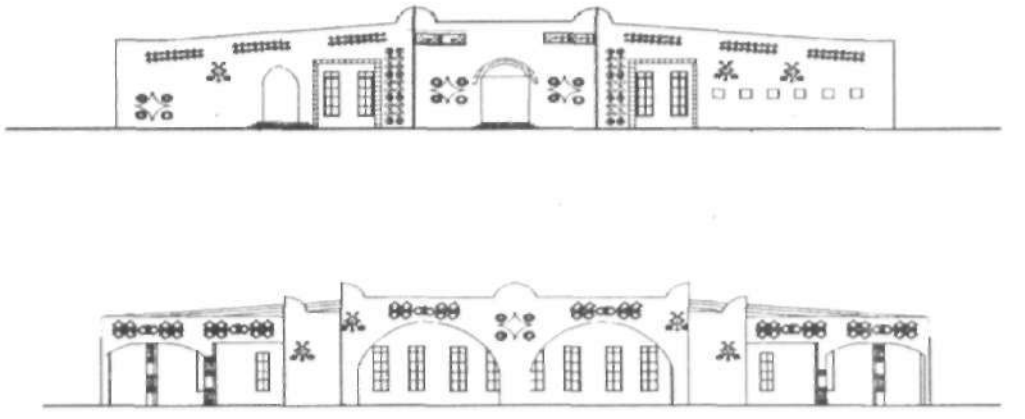


Figure 6.8: Elevation (cultural centre)

Source: Author's wok

In the design earth is being used in form of stabilized earth bricks which is environmentally friendly and durable and design techniques have been used to ensure passive cooling and natural day lighting. Simple planning is also used for the buildings to allow for proper passive means. Photovoltaic panels are also incorporated in the design as alternative renewable energy source.

6.5 Schedule of Accommodation

Administrative section

This section caters for the management and organization of all activities in the resort

Functional space	Area
Reception	25m2
Store	40m2
Offices	28m2
Cashier	25m2
Assistant manager's office	28m2
Personnel office	28m2
Manager	28m2
Shops	75m2

ACCOMMODATION

Functional space	Area
Small chalets	35m2
Big chalets	58.5m2
Luxury chalets	72m2

CATERING FACILITIES

Functional space	Area
Open restaurant	360m2

Enclosed restaurant	133m2
Bar	180m2

SPORTS SECTION

This include all the sports facilities

Volley ball courts

Tennis courts

Swimming pools

Play areas

indoor and outdoor therapy facilities

Massage rooms

Spa

Gymnasium

ANCILLARY FACILITIES

Functional space	Area
Laundry	225m2
Dirty linen store	15m2
Clean linen store	19m2

Generator house 30m2

6.6 PLANNING PRINCIPLES

The concept for the site plan is Khaya senegalensis tree which is the dominant tree specie on the site. The trunk is the supporting system for this tree it provides nutrients to the branches and leaves. Taking that into consideration, the reception, research centre and restaurant are the support for the resort while the accommodation units are linked up with branching road networks. The concept for the site plan is shown in figure. 6.9

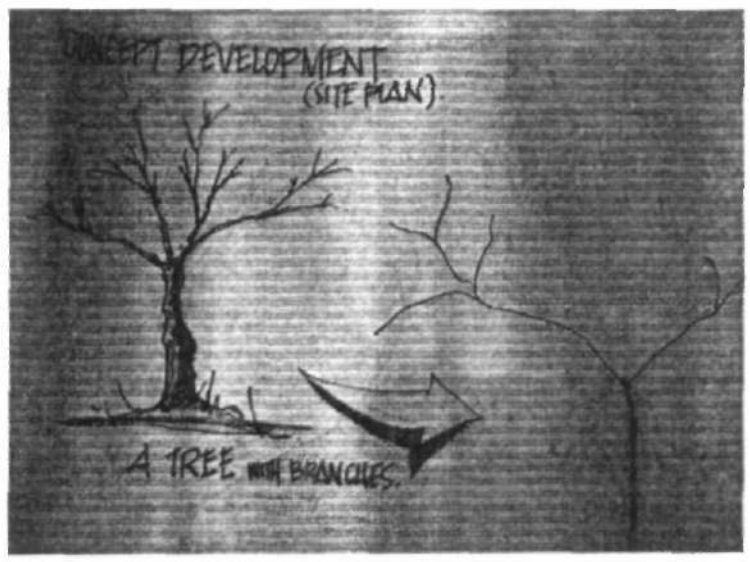


Fig. 6.9: Site plan concept

Source: Author's work

The road network is designed to be windy for the purpose of reducing vehicular speed and reducing the effect of water erosion. This is shown in figure 6.10 below. Being an eco-friendly design the roads are paved with gravel which is a natural and renewable material. Rainwater drainage pipes are channeled along the roads with a catchment area for storage in underground storage tanks.

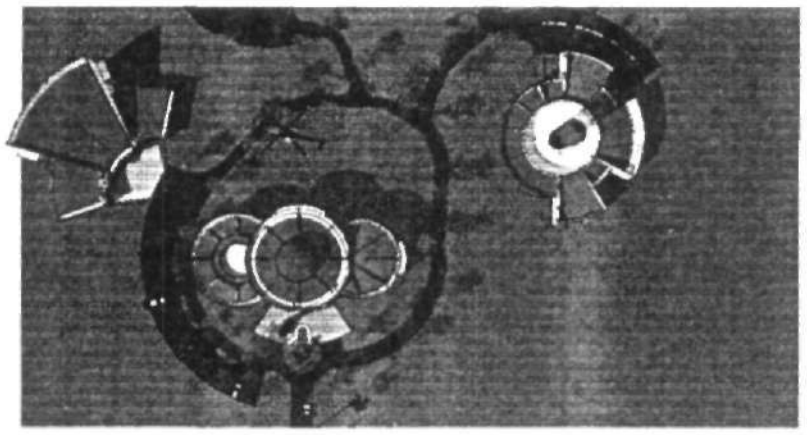


Fig 6.10: Site plan

Source: Author's work

To bring the tourist into close contact with nature, the individual buildings in are linked up with outdoor sitting areas and recreational facilities in between to enhance the appreciation of the environment and to act as transition spaces between the buildings units. This is illustrated in the figure below:

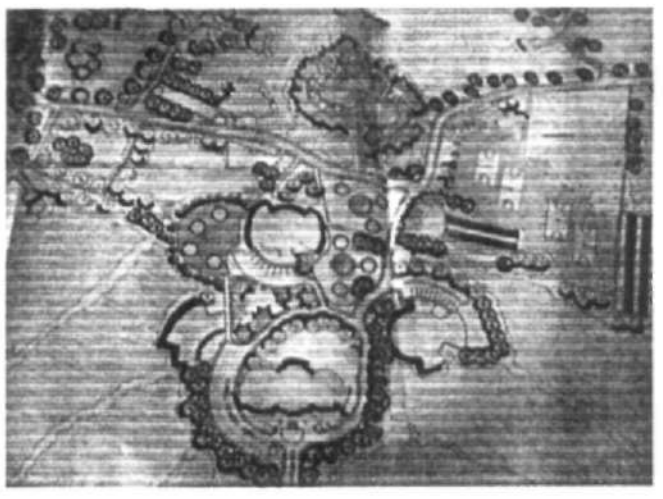


Fig: 6.11: Site plan

Source: Author's work

Birds attracting plants like Yellow birch, hackberry, sand cherry, and common buttonbush. The buildings closest to the lake are the accommodation units and the outdoor games which are at a distance of 350m from the shores of the lake.

Careful consideration has been given to the issue of security in the planning of the various facilities. The chalets are designed to take advantage of the views of the lake and lush tropical gardens.

The chalets are arranged in clusters of 3 and are planned along a loop road with a small water body for enhanced view and for passive cooling as shown below in figure 6.12.

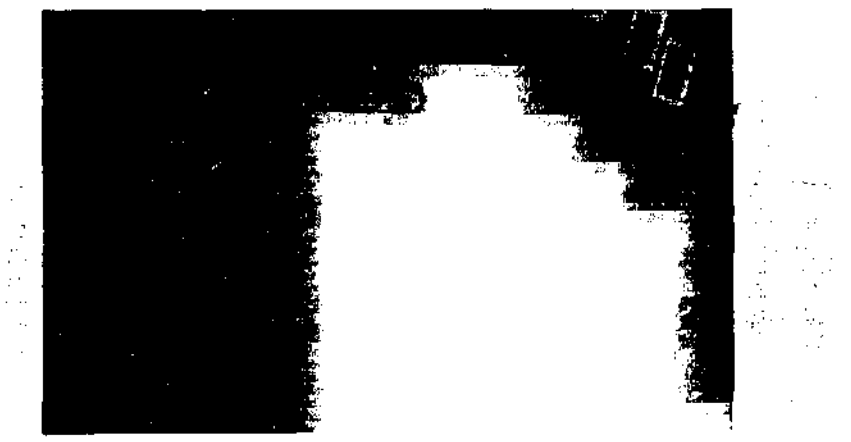


Fig: 6.12: Site plan

Source: Author's work

Over 85% of the site has been preserved as virgin land to preserve the native fauna and flora, scenic outlooks and sight-seeing.

6.7 BUILDING FORMS

The concept of the design forms the basis of the building form the design is not imposed on the site .Free flowing forms were used which depict the wavy patterns of the flying birds These forms grow out , harmonize with nature and provide more amiable spaces. This is illustrated in the figure below.



Fig: 6.13: Building forms

Source: Author's work

6.8 LANDSCAPING

The landscaping for this resort is done to enhance the native flora so that the natural outlook is preserved. The natural vegetation is also used to act as air purifiers, wind breakers and sound buffers.

6.9 INTERIOR SPACES

The interior spaces are designed to complement the outside surroundings by integrating natural features in the interiors like fountains, natural flowers with open sky-lighted atriums.Cross

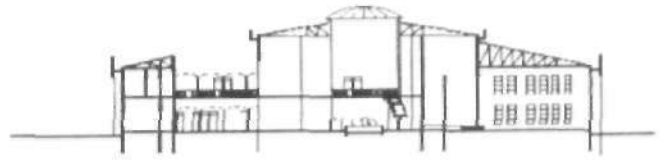
ventilation is achieved in all the spaces. Clay and marble tiles are used for all the sitting areas and planters. Wood is used for the ceilings and some of the interior spaces.

6.10 BUILDING MATERIALS

Both indigenous and modern building materials will be used in the construction of the buildings. The main building material is compressed earth bricks with a supporting system of concrete beams and columns. Synthetic plastic and synthetic thatch roof covering on timber frame will be used for the roofing system.

6.11 STRUCTURAL CONCEPT

The chalets have column and tie beam mode of construction .Expansion joints are at intervals of 15m and at the point of connection of curved walls. Wide strip foundation will be used for the foundation because of the nature of the existing soil. The figures below show the structural concepts used design.



Section

Fig: 6.14: Section through reception
Source: Author's work

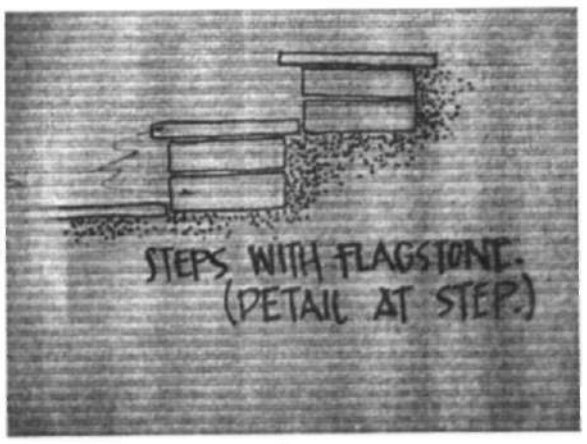


Fig: 6.15a: Details at steps
Source: Author's work

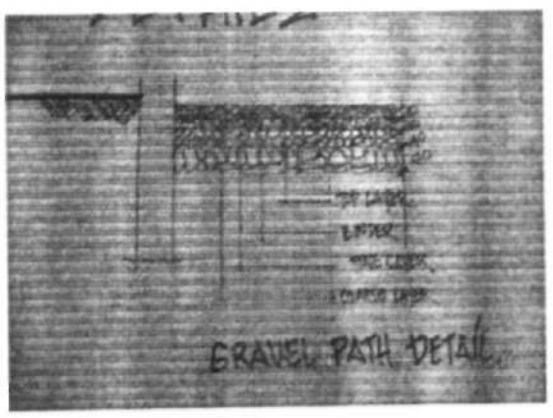


Fig: 6.15b: Details at walk ways
Source: Author's work

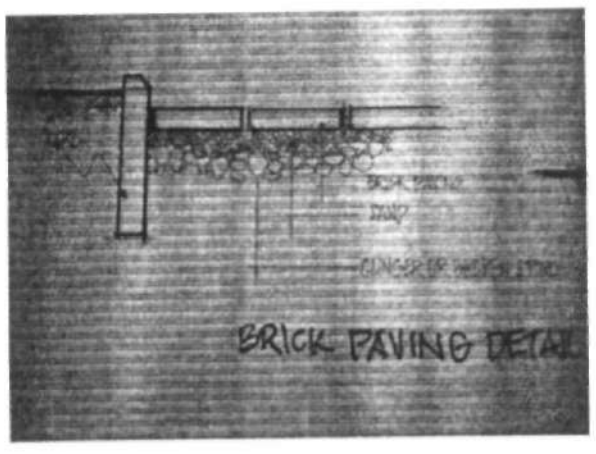


Fig: 6.15c: Details at paved walk ways
Source: Author's work

6.12 SERVICES

Air-Conditioning And Ventilation

The building will be ventilated by a combination of natural and mechanical systems of ventilation. Natural cross –ventilation is enhanced in all the spaces while mechanical ventilation is by a means of split air conditioners.

A. Communication system

All the accommodation units will be connected to an intercom system of communication which will be connected to the main communication system of the resort.

B. Power supply

The primary source of power supply is the P.H.C.N which is going to be supplemented by photo-voltaic solar panels for the accommodation units.

C. Water supply

Water supply fort the resort will be from a borehole which will be used for cleaning the restaurant laundry and the swimming pool while the fish pond, water fall, fountains and the surrounding landscape will obtain water supply from the harvested water. The figure below show the rain water collection systems.

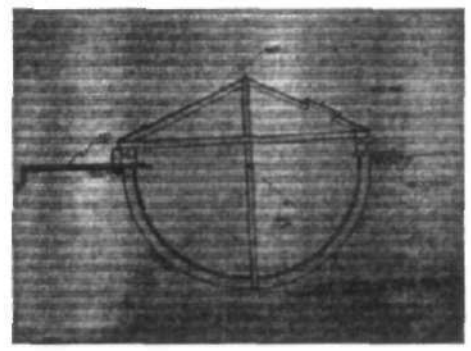


Fig: 6.16a: Details at rain water collection hemispherical tank
Source: Author's work

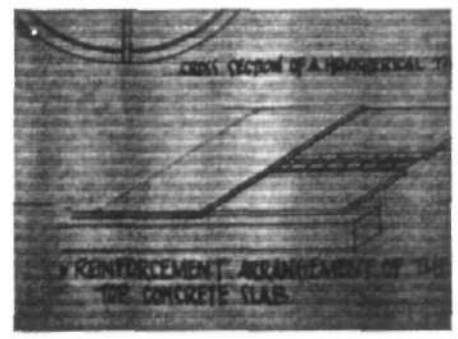


Fig: 6.16b: Details at slab
Source: Author's work

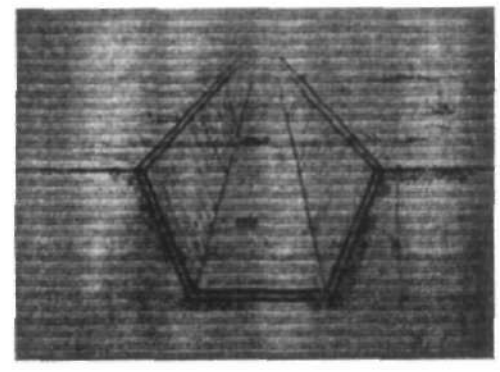


Fig: 6.16c: Details at drainage.
Source: Author's work

D. Sewage disposal

Septic tanks and soak-away pits will be used. The sewage collection chamber will be equipped with treatment plant to prevent contamination of the environment.

CHAPTER SEVEN

7.0 SUMMARY

The research work is built on the subject of the use of eco-friendly design strategies in the design of tourist resorts. The natural environment is being threatened by man and his activities. The use of eco-friendly principles in resort design needs to be given more conscious thought. Architects and all professionals in the building sector should ensure that holistic approach should be used in design and construction of resort. This will help in minimizing environmental degradation.

Review of relevant literature writings on eco-friendly design principles and resorts was carried out. The relevant eco-friendly principles were used to access certain tourist resorts. Case studies were accessed using a field form based on the eco-friendly principles applicable to tourist resort and specific variables analyzed.

The concept used in this design looks at the region in which this design is to be situated and uses the local resources available such that the design is environmentally conscious and fits into the environment.

This design has been able to apply eco-friendly design principles in tourist resort design

7.1 RECOMMENDATION

This thesis has been able to apply eco-friendly design strategies in tourist resort. This strategies used the use of passive cooling in design, natural daylight, use of locally available resources, respect for site, water and waste management and the use of alternative energy sources(solar).

Eco-tourism being the new trend in resort design, there is a growth in the number of tourist resorts across the globe. Thus the need for a environmentally conscious in design is important.

The use of eco-friendly architecture should be recommended in developing resort designs in Nigeria. This will help in protecting our natural environment and provide a healthy atmosphere.

7.2 CONCLUSION

Based on findings eco-friendly design were not widely used in resort designs in Nigeria. This can be seen in the case study summary sheet in chapter 3, where it shows that only a few resorts have taken positive steps in exploring eco-friendly design strategies in their design.

The new trend in tourism has now shifted towards nature appreciation, nature conservation and the promotion of historic and cultural heritage. There is therefore a need to minimize the negative effect of human activities on the environment as well as promoting the native heritage of the society. A good resort design should acquire its own identify and character serves as a channel to enjoy other resources.

The site is interesting due to its virgin nature, the presence of the water body, and the colorful array of flying birds.

7.3 CONTIBUTION TO KNOWLEDGE

The main purpose of this thesis is to contribute eco-friendly architecture by highlighting and applying the strategies of eco-friendly architecture in resort design. Bird-friendly design guidelines have also been highlighted to ensure environment and as well conserving it, to produce a serene atmosphere for mental and physical relaxation, leisure, and entertainment.

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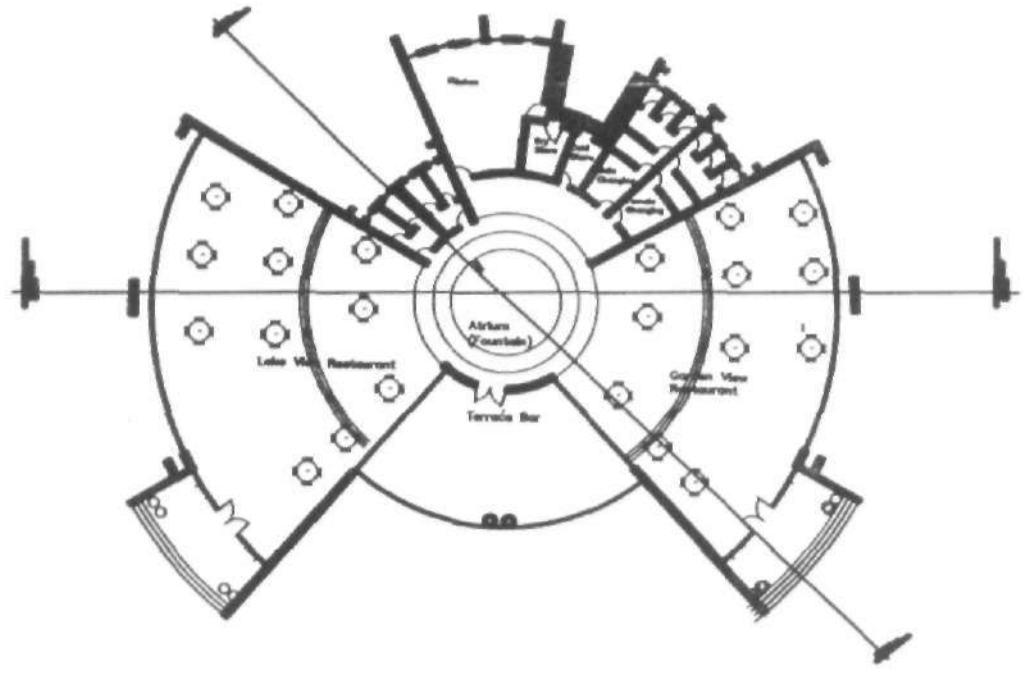
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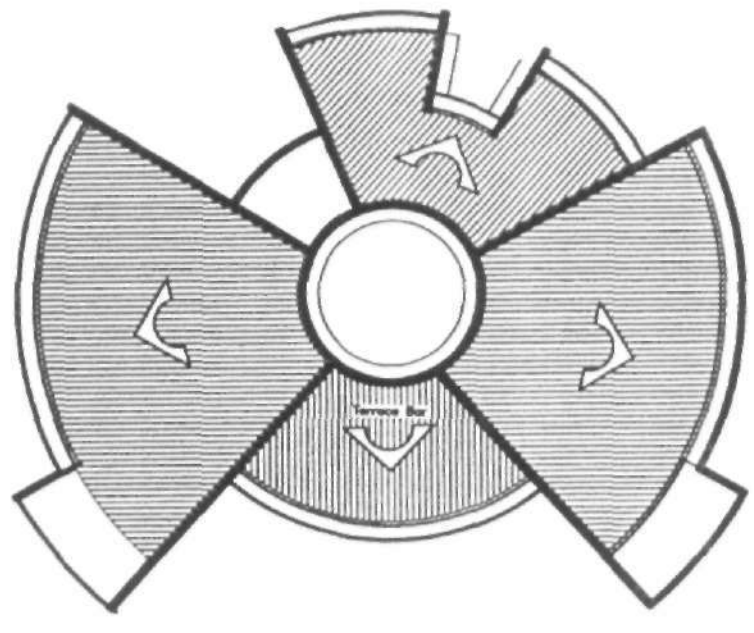
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APPENDIX

Resturant

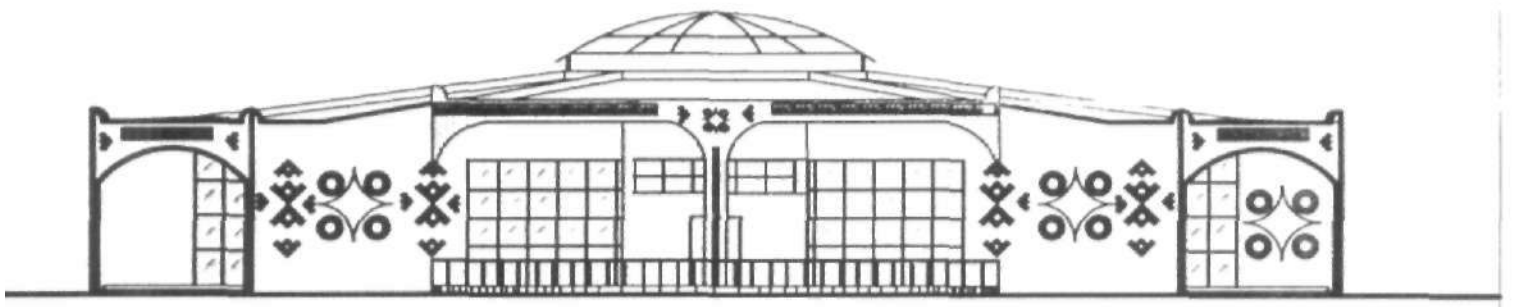


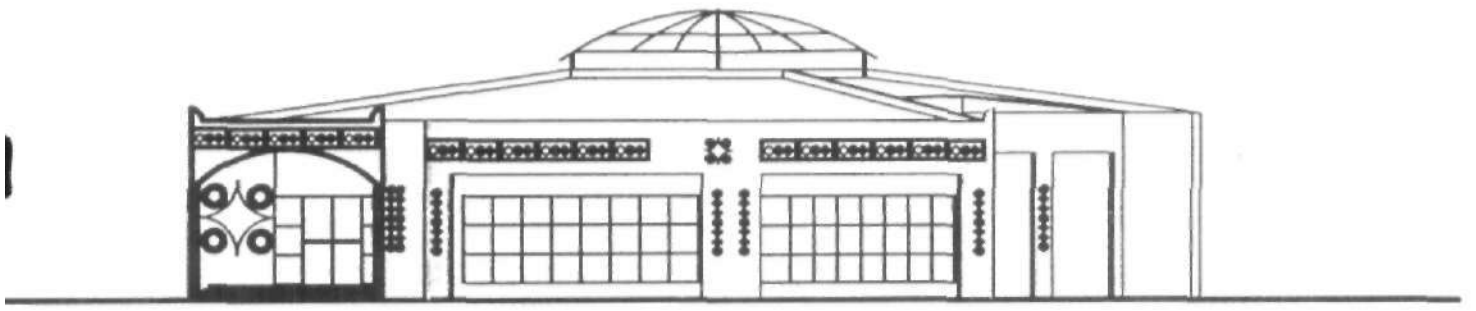
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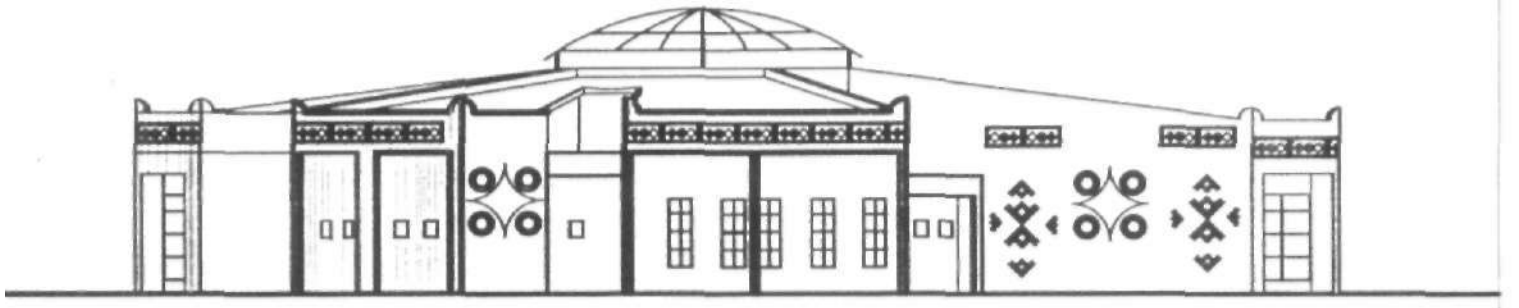


Roof Plan

Resturant

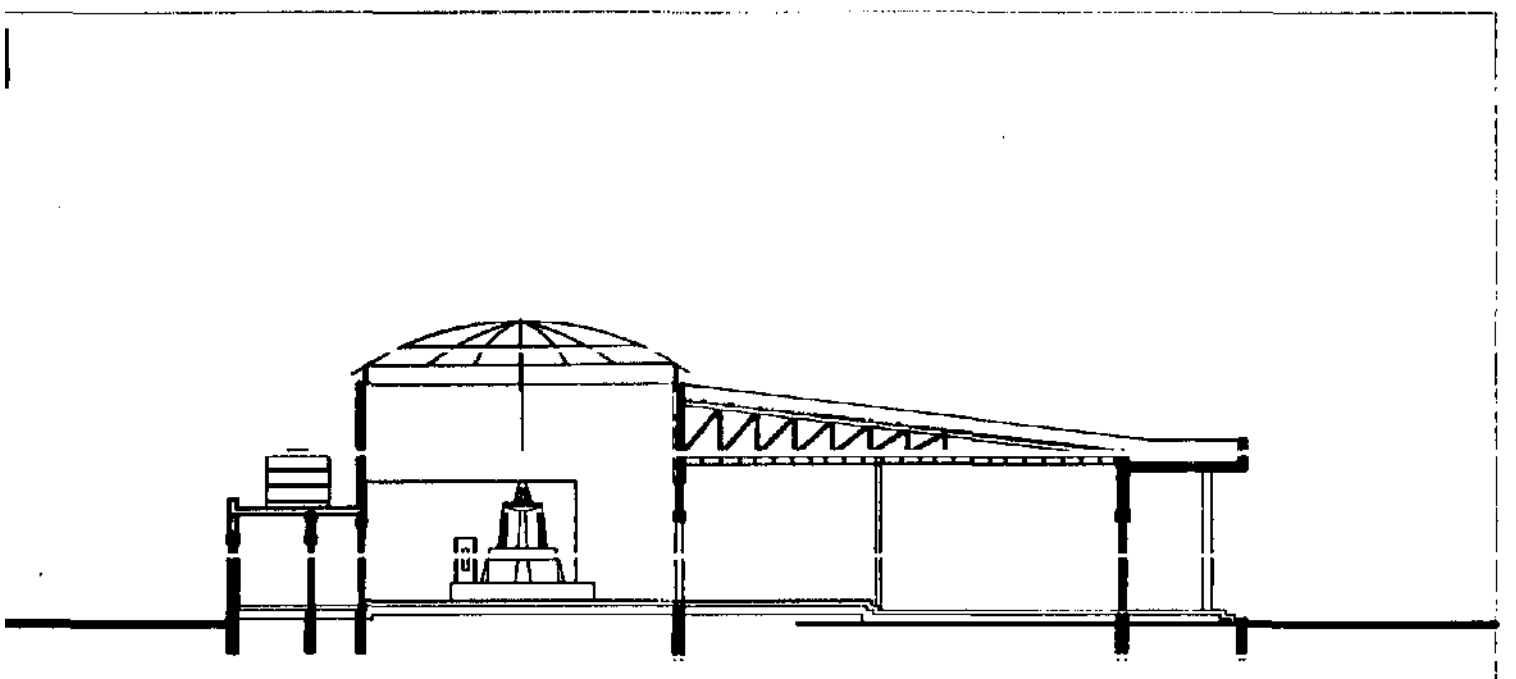


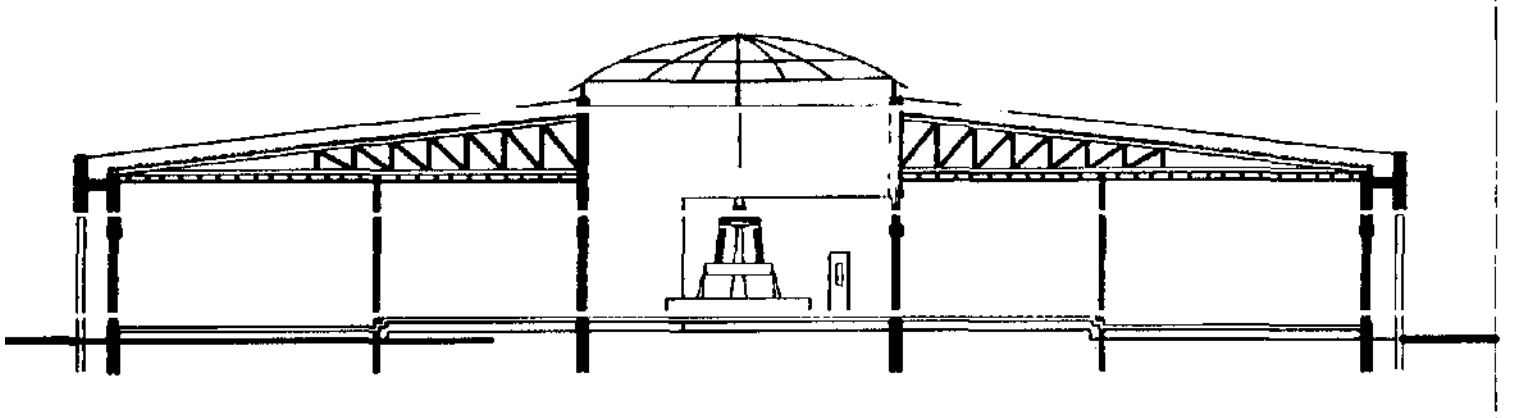




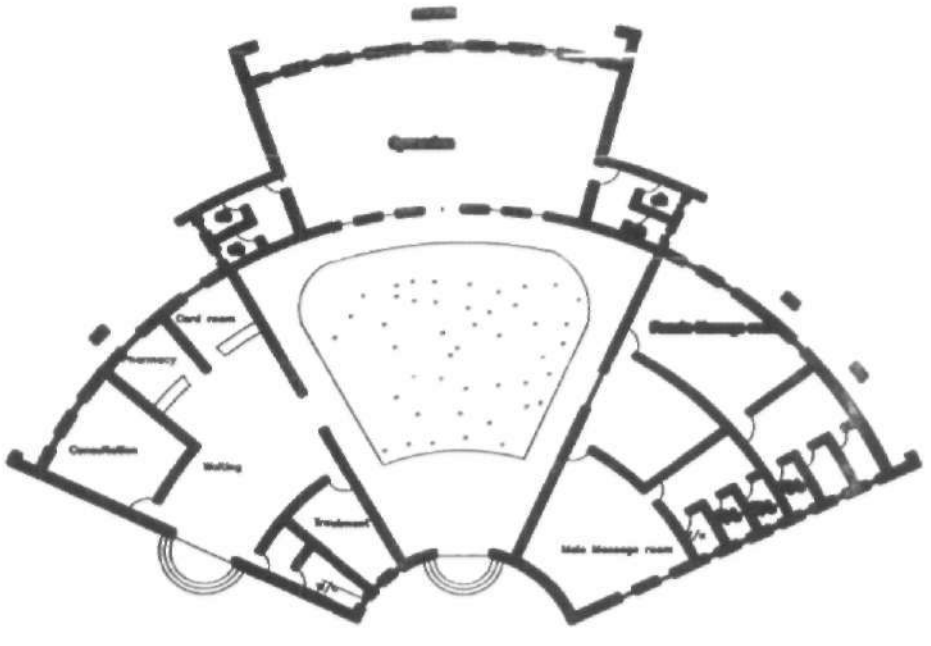
Elevation

Resturant

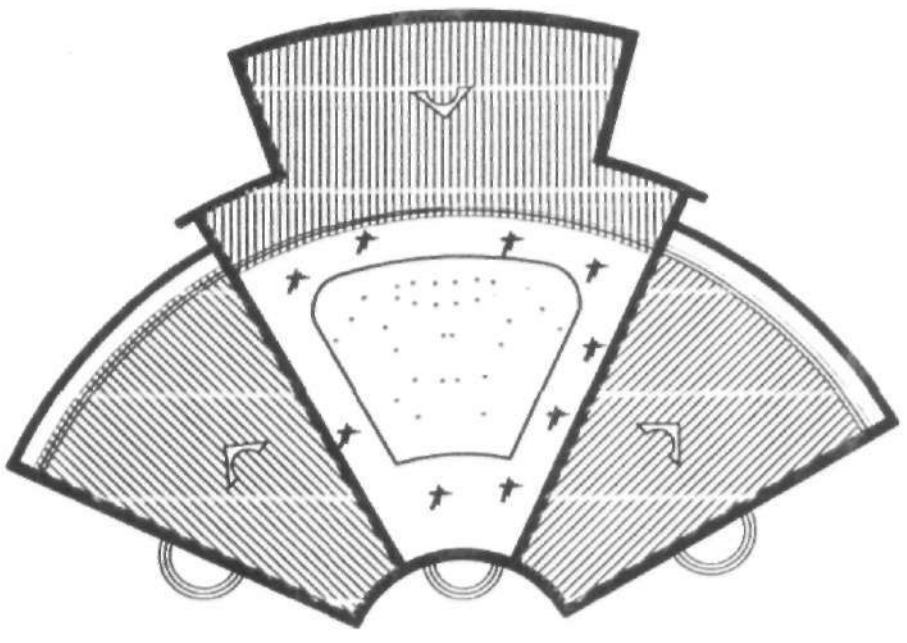




Section

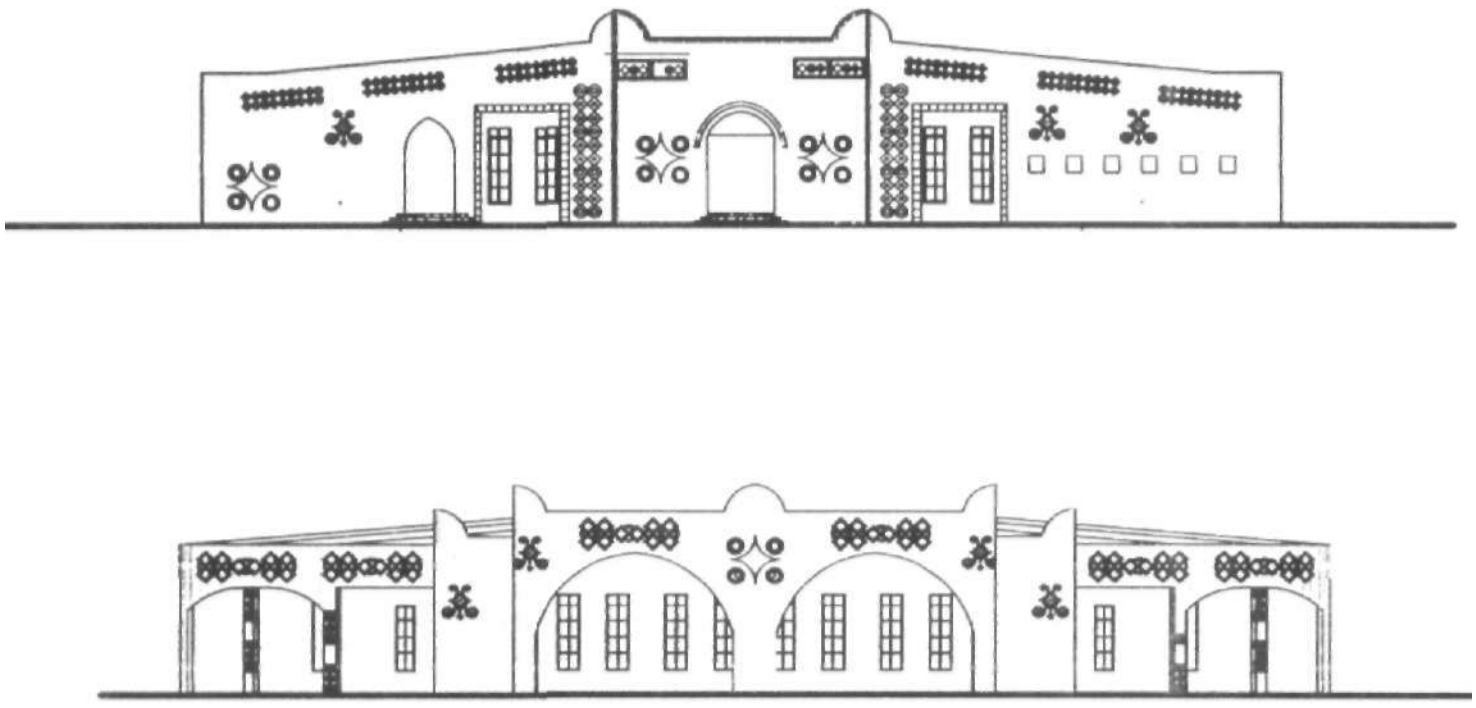


Floor Plan



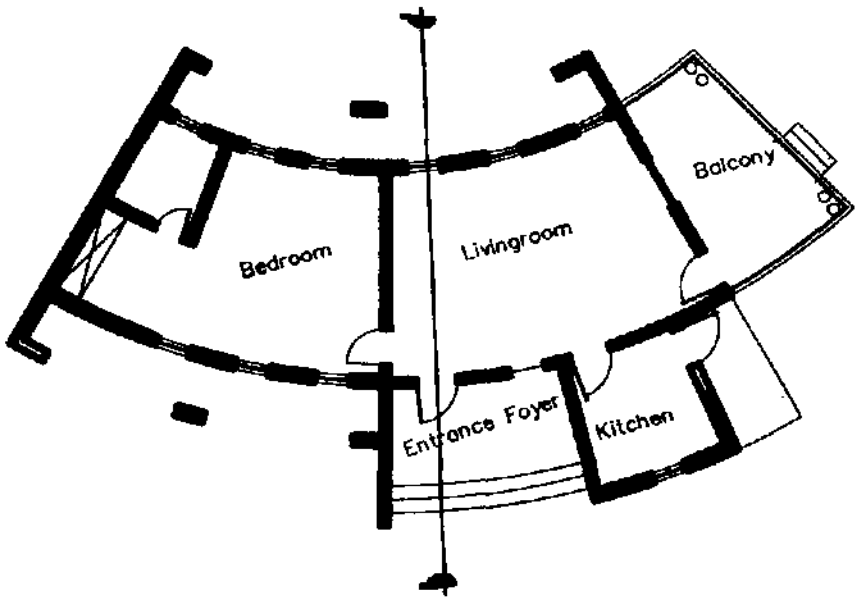
Roof Plan

Gymnasium and Clinic

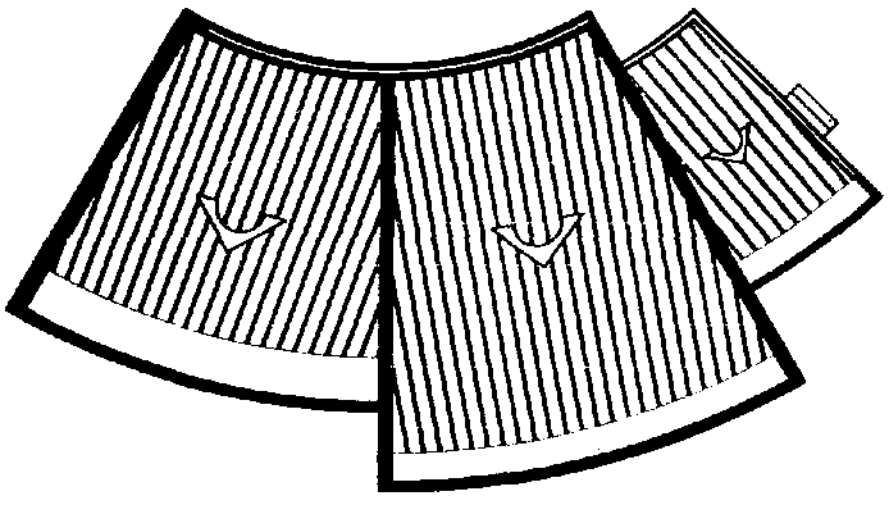


Elevation

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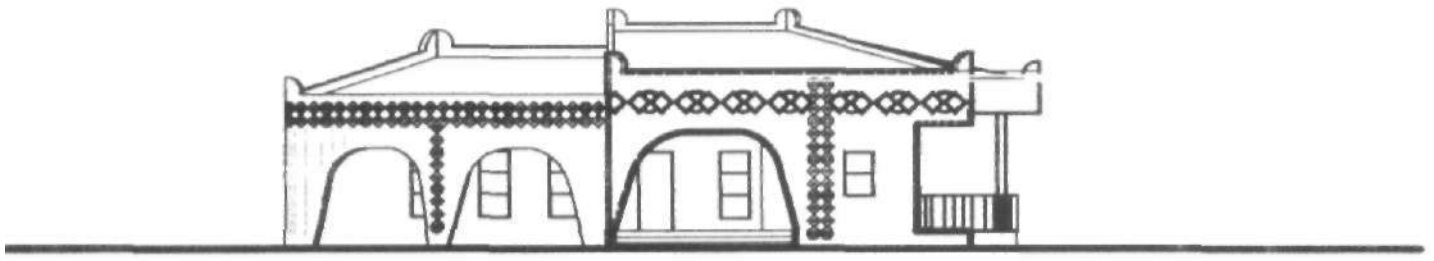


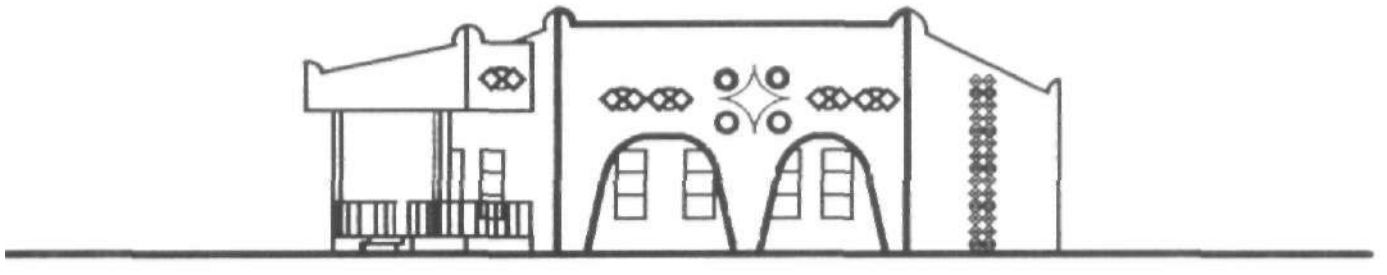
Floor Plan



Roof Plan

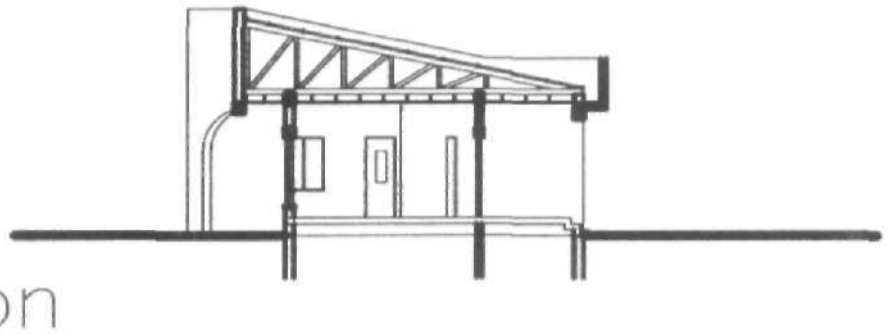
One Bedroom



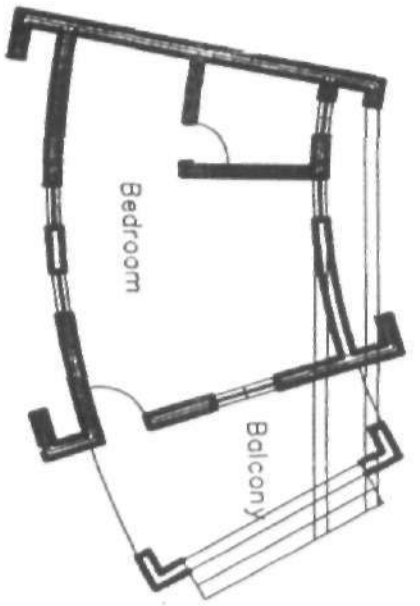




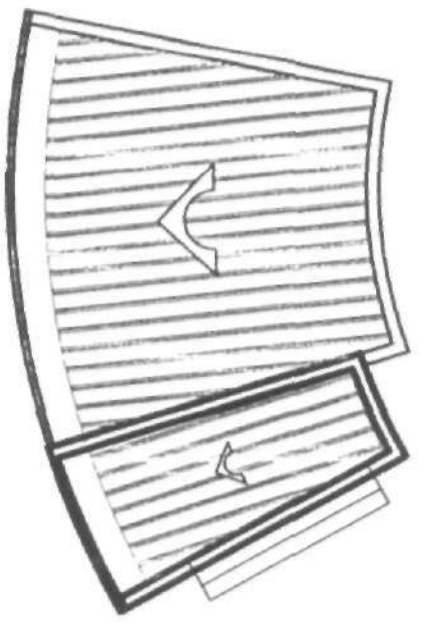
Elevation



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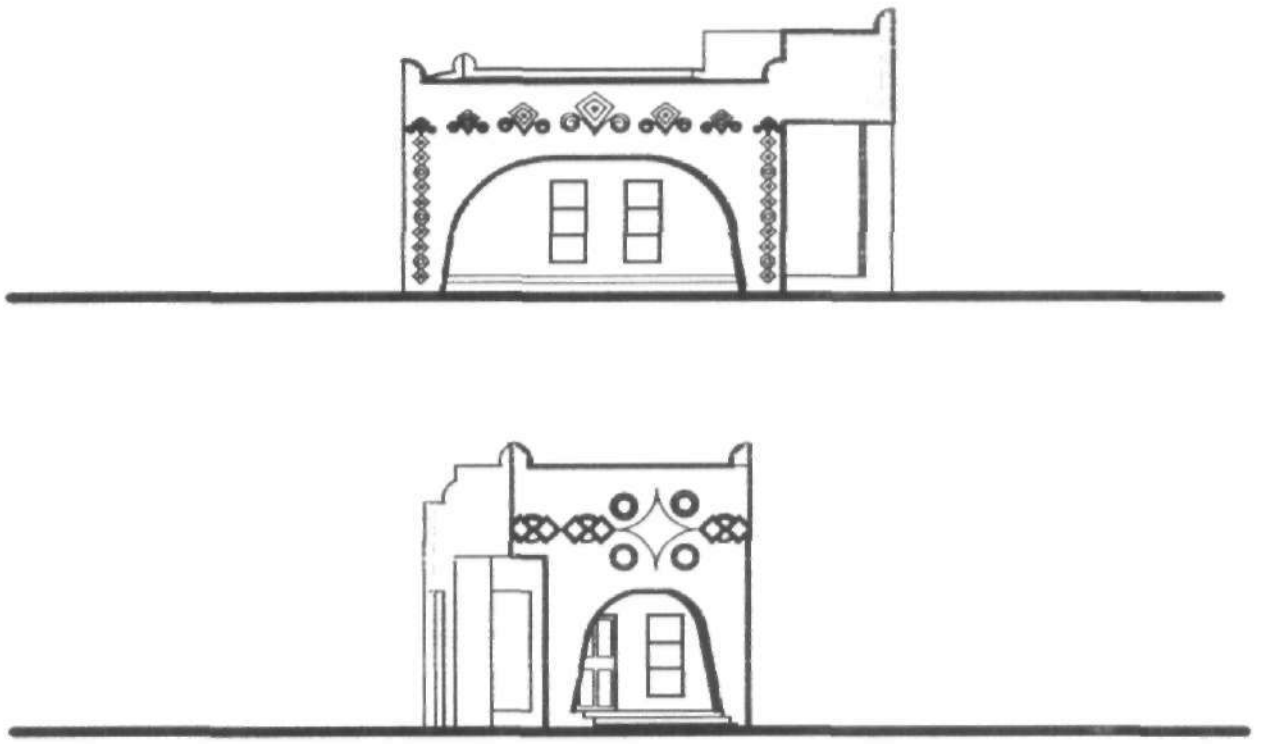


Floor Plan



Roof Plan

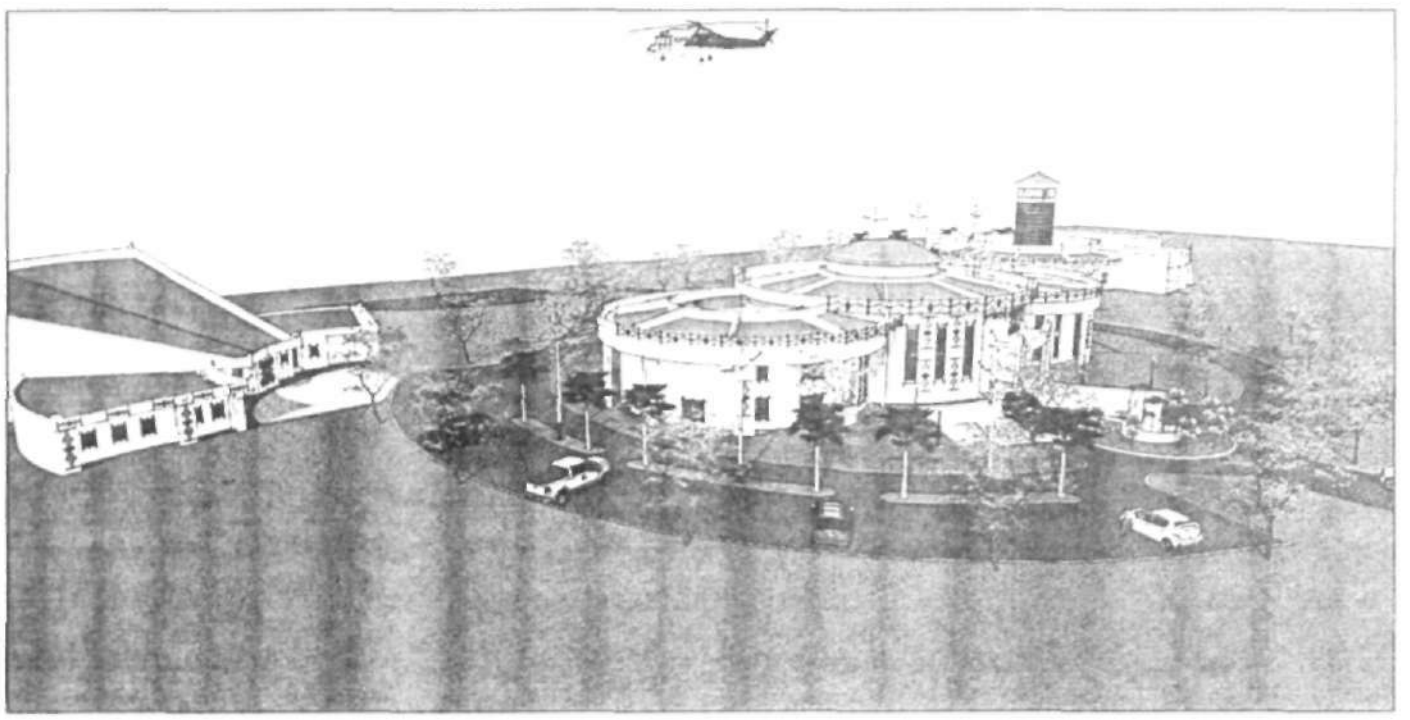
Studio Apartment

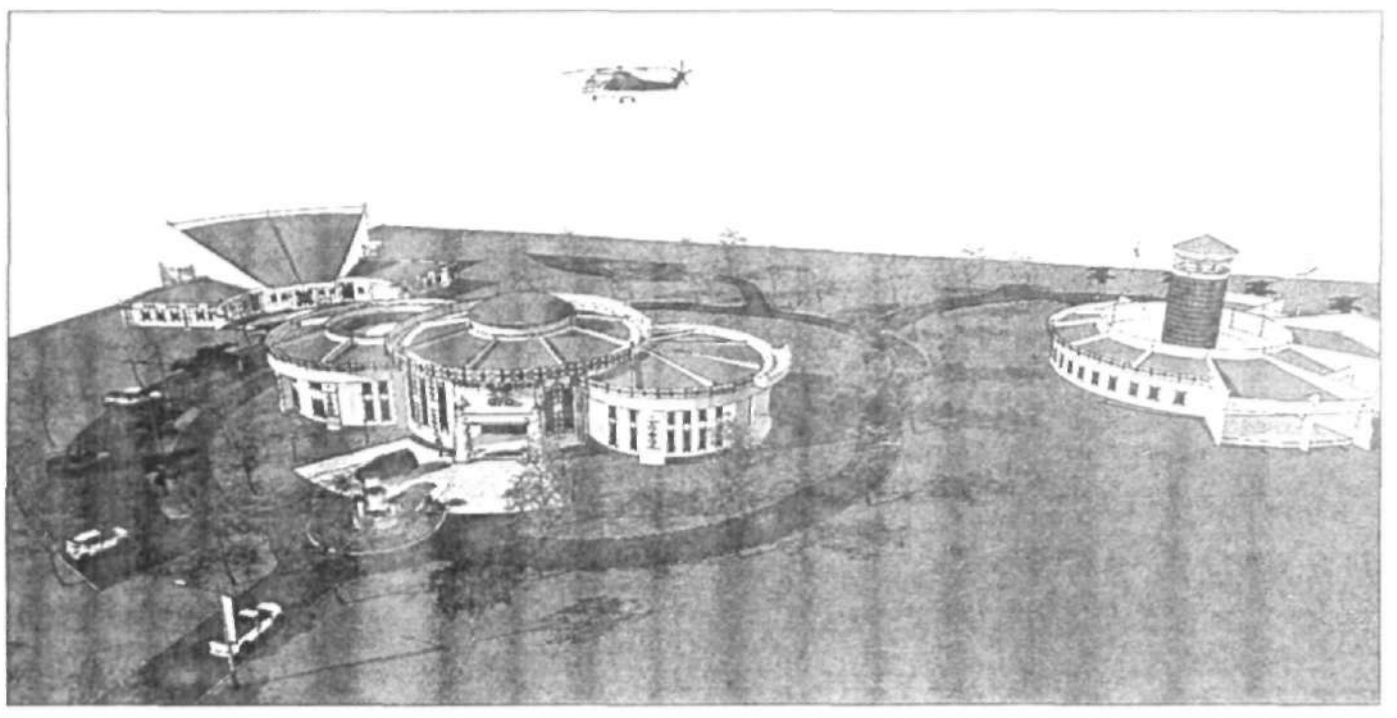


Elevation

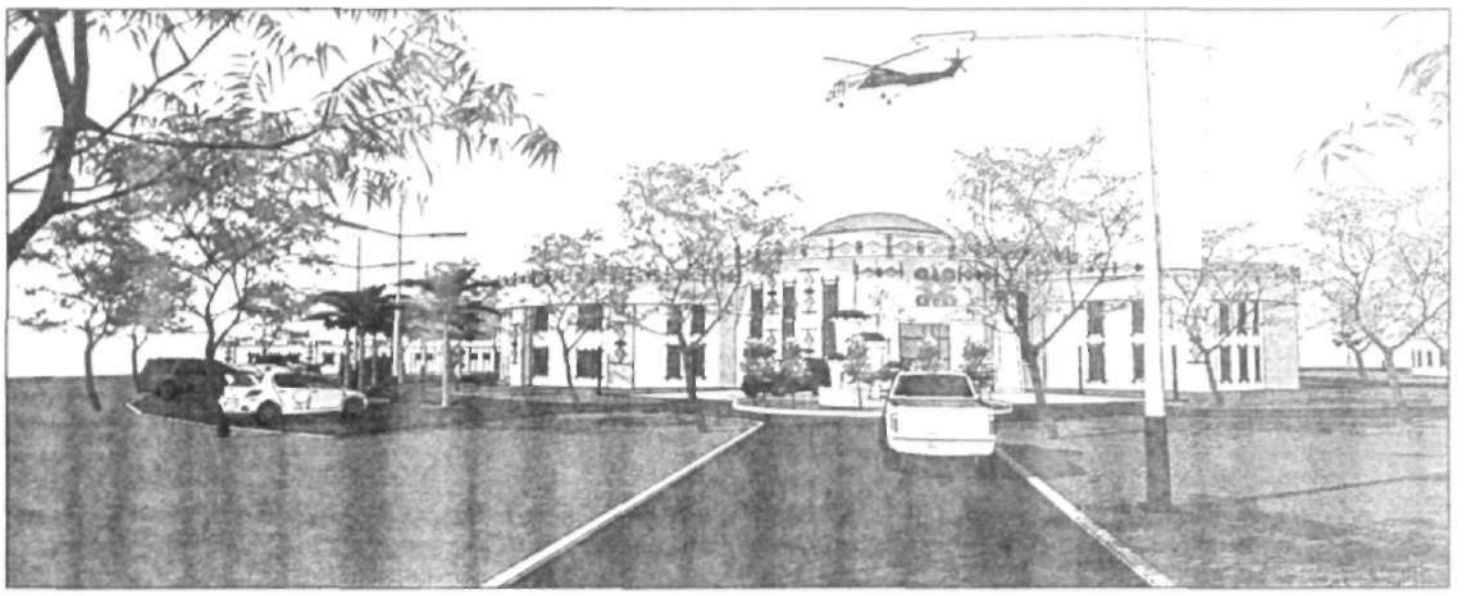
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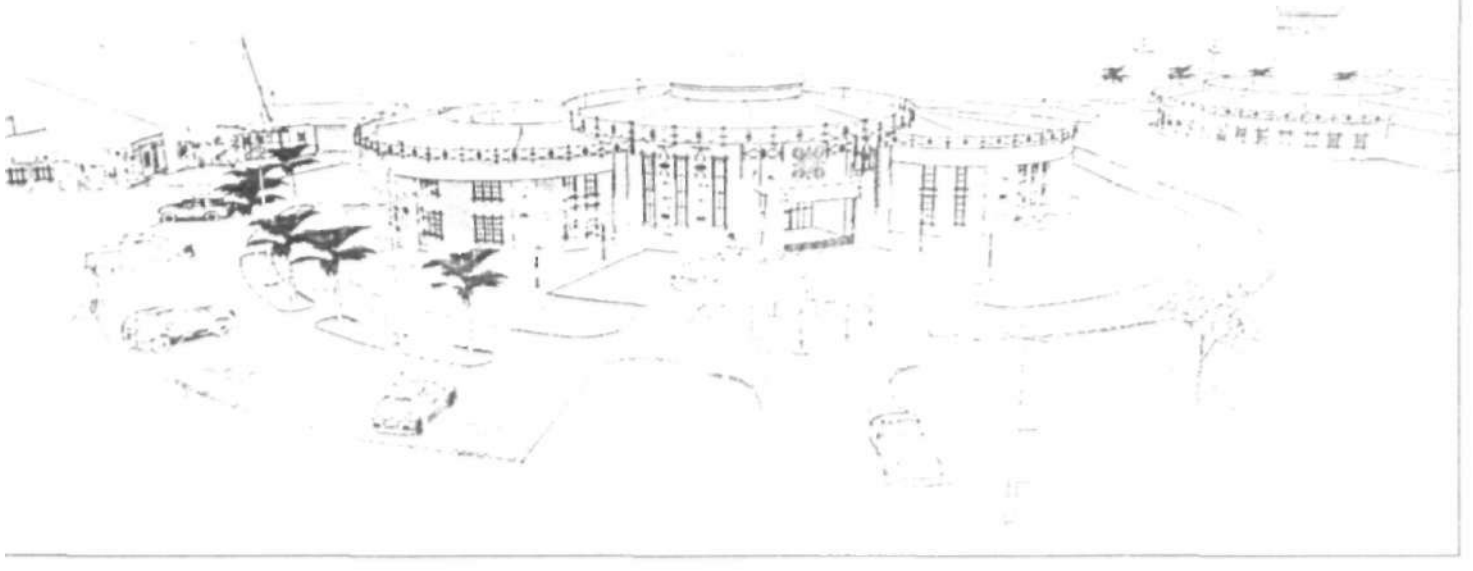
3D Views





3D Views





3D Views

