

ECOLOGY CENTRE

THESIS

Submitted in partial fulfilment of the requirements for the award of
Bachelor of Architecture degree

By

DHAKSHAYANI K
3621901



**DEPARTMENT OF ARCHITECTURE SCHOOL OF BUILDING AND
ENVIRONMENT**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

**Accredited with Grade "A" by NAAC
JEPPIAAR NAGAR, RAJIV GANDHI SALAI,
CHENNAI - 600 119**

JUNE 2021



DEPARTMENT OF ARCHITECTURE
BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of Dhakshayani K (3621901) who carried out the project entitled “Ecology Centre” under our supervision from January 2021 to June 2021.

Internal Guide

(Ar.Shobana)

Internal Review Member

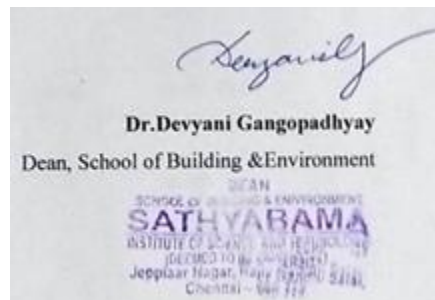
(Ar. Sukirtha)

External Guide

(Ar.Hariesh K Sankaran)

Dean and Head of the Department

Dr. DEVYANI GANGOPADHYAY



Submitted for Viva voce Examination held on _____

Internal Examiner

External Examiner

DECLARATION

I, **Dhakshayani K** hereby declare that the Project Report entitled “**Ecology Centre**” done by me under the guidance of **Ar.Shobana** (Internal Guide), **Ar.Sukirtha** (Internal Review Member) and **Ar.Hariesh K. Sankaran** (External Guide). Sathyabama Institute of Science and Technology is submitted in partial fulfilment of the requirements for the award of Bachelor of Architecture Degree.

DATE:

PLACE: Chennai
ACKNOWLEDGEMENT

Dhakshayani K
SIGNATURE OF THE CANDIDATE

I am pleased to acknowledge my sincere thanks to Board of Management of **Sathyabama Institute of Science and Technology** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my thanks to **Dr. Devyani Gangopadhyay**, Dean and Head of the Department, **Dr. Suresh Kuppuswamy**, Design Chair of School of Building and Environment, Department of Architecture and providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Project Internal Guide **Ar.Shobana**, Internal Review member **Ar.Sukirtha** and External Guide **Ar.Hariesh K. Sankaran** their guidance, suggestions and constant encouragement which paved the way for the successful completion of my project work.

I wish to express my thanks to all Teaching and Non-teaching staff members of the **Department of Architecture** who were helpful in many ways for the completion of the project.

TABLE OF CONTENTS

CHAPTER-1-INTRODUCTION 1.1 General - 1 1.2 Aim and Objectives - 5 1.3

Background Study -Biodiversity - 6

-Vegetation - 11

-Mangroves - 14

-Geology - 15

-Occupation - 17

CHAPTER- 2 - LITERATURE STUDY

2.1 Research centre- Building attributes - Architectural considerations - 18

2.2 Research facilities-Rules and standards - 24

2.3 Restaurant, library and office facilities-Rules and standards - 31

2.4 User behavior and Circulation - 32

2.5 Display anthropometry and techniques - 32

2.6 Fire safety - 33

2.7 Services, security and storage - 33

2.8 Greenhouses - 34

2.9 Statutory norms - 34

CHAPTER- 3 - CASE STUDIES

3.1 NOAA Southwest Research Center La Jolla, California - 38

3.2 Coastal Marine Research station, El tabo, Chile - 49

(i)

3.3 Kaladham Interpretation centre, Hampi - 54

3.4 Jayaprakash Narayan Interpretation centre - 62

3.5 Bulembu Vocational Training centre - 68

3.6 Vaghaldhara Vocational Training centre - 72

3.7 Comparative Analysis - 75

CHAPTER- 4 - SITE STUDY AND ANALYSIS

4.1 Context and Site Analysis - 77

4.2 SWOT Analysis - 79

CHAPTER- 5 – PROGRAM

5.1 Program Research - 80

5.2 Design Program - 81

CHAPTER- 6 – CONCEPT & DESIGN

6.1 Concept - 81

6.2 Master Plan - 82

6.3 Plans, Sections, Elevations - 82

6.4 Views - 86

LIST OF FIGURES

Fig – 1.1.1-Gokarna Landform - 4

Fig – 1.3.1 Goldspot mullet - 6

Fig – 1.3.2 Olive ridley turtles - 6

Fig – 1.3.3 Dendrophyllia - 6

Fig – 1.3.4Carpiliusconvexus - 6

(ii)

Fig – 1.3.5 Dictyotadichotoma - 7

Fig – 1.3.6 Macacasilenus - 7

Fig – 1.3.7 Pavocristatus - 7

Fig – 1.3.8 Eudocimus - 7

Fig – 1.3.9 Dendrocygna - 7

Fig – 1.3.10 PhalacrocoraxAlbusjavanica - 7

Fig – 1.3.11 Plesiastrea - 8

Fig – 1.3.12 Donaxscortum - 8

Fig – 1.3.13 DictyotaVersiporadichotoma - 8

Fig – 1.3.14 Halisarca - 9

Fig – 1.3.15 Leptastrea - 9

Fig – 1.3.16 Faviafavus - 9

Fig – 1.3.17 Symphyllia - 9

Fig – 1.3.18 Loligoduvauceli - 10

Fig – 1.3.19 Acromitus - 10

Fig – 1.3.20 Vegetation Map - 11

Fig – 1.3.21 Rhizophoraapiculata - 12

Fig – 1.3.22 Porteresiacoarctata - 12

Fig – 1.3.23 Bruguieragymnorhiza - 13

Fig – 1.3.24 Rhizophoramucronata - 13

Fig – 1.3.25 Rhizophoramucronata - 14

Fig – 1.3.26 Laterite Soil - 15

Fig – 1.3.27 Laterite Blocks - 16

Fig – 1.3.28 Fishing - 17

Fig – 1.3.29 Agriculture - 17

Fig 2.1.1 - Single corridor lab design with labs and office adjacent to each other. - 20

Fig 2.1.2 - Single corridor lab design with offices clustered together at the end and in the middle - 21

Fig 2.1.3 - Single corridor lab design with office clusters accessing main labs directly''

(iii)

Fig 2.1.4 - Mobile casework - 22

Fig 2.1.5 - Mobile base cabinet - 23

Fig 2.1.6 - Conventional design vs. interstitial design - 24

Fig – 2.2.1 Laboratory design -30

Fig – 2.3.1 Restaurant, Library and Office facilities- Rules and Standards - 31

Fig – 2.4.1 User behavior and Circulation - 32

Fig – 2.5.1 Display anthropometry and techniques - 32

Fig – 2.6.1 Fire Safety - 33

Fig – 2.7.1 Services, Security and Storage - 33

Fig – 2.8.1 Greenhouses - 34

Fig – 2.9.1 Statutory Norms - 34

Fig – 3.1.1 Site Location - 38

Fig – 3.1.2&Fig – 3.1.3- Site features - 39

Fig – 3.1.4 &Fig – 3.1.5- Response to Topography - 40

Fig – 3.1.6 Underwater canyon - 41

Fig – 3.1.7 Coastline - 41

Fig – 3.1.8 Site topography - 41

Fig – 3.1.9 Built form - 41

Fig – 3.1.10 Block out program - 42

Fig – 3.1.11 Open up to views - 42

Fig – 3.1.12 Open up to light - 43

Fig – 3.1.13 North Elevation - 43

Fig – 3.1.14 South Elevation - 43

Fig – 3.1.15 Floor Plan - 44

Fig – 3.1.16 Plan@ Level 2 - 44

Fig – 3.1.17 Plan@ Level 3 - 44

Fig – 3.1.18 Plan@ Level 4 -44

(iv)

Fig – 3.1.19 Section - 45

Fig – 3.1.20 Sustainability - 46

Fig – 3.1.21 & Fig – 3.1.22 - 47

Fig – 3.2.1 – 3 - 49

Fig – 3.2.4 Ground Floor Plan - 50

Fig – 3.2.5 First Floor Plan - 50

Fig – 3.2.6 Sections - 51

Fig – 3.2.7 Elevations - 52

Fig – 3.2.8 -11 Views - 53

Fig – 3.3.1 Site Plan - 54

Fig – 3.3.2 Accessibility maps - 55

Fig – 3.3.3 Site Contour - 56

Fig – 3.3.4 Site Zoning - 56

Fig – 3.3.5& 6Circulation - 57

Fig – 3.3.7-9 Views - 58

Fig – 3.3.10 Floor Plan - 59

Fig – 3.3.11 Elevation - 59

Fig – 3.3.12 Rainwater harvesting - 60

Fig – 3.3.13 Materials - 61

Fig – 3.4.1 Site Plan - 62

Fig – 3.4.2 Concept - 63

Fig – 3.4.3 Building Form - 63

Fig – 3.4.4 Elements of design - 64

Fig – 3.4.5 Floor Plan-FF - 64

Fig – 3.4.6 Floor Plan-SF - 64

(v)

Fig – 3.4.7 & 8 - 65

Fig – 3.4.9 Materials - 67

Fig – 3.4.10 Water - 68

Fig – 3.5.1 Site location - 69

Fig – 3.5.2 Floor Plan - 70

Fig – 3.5.3 From Top Left- West Elevation, East Elevation, Entrance feature detail, Section, North elevation, South elevation - 71

Fig – 3.6.1 Site Plan - 72

Fig – 3.6.2 Ground Floor Plan - 73

Fig – 3.6.3 First Floor Plan - 74

Fig – 3.6.4 & 5 Views - 74

Fig – 4.1.1 Context and Site Analysis - 77

Fig – 4.1.2 Site Analysis-Climate considerations- 78

LIST OF TABLES

Table – 3.7.1 Overview

Table – 3.7.2 Site

Table – 3.7.1 Building and Services

Table – 4.1 SWOT Analysis

REFERENCES

(vi)

CHAPTER 1 – INTRODUCTION

1.1 GENERAL

India is surrounded by sea on 3 sides and has a large coastline on the southern side along the Arabian Sea. The East coast is more about delta formations and the West coast is about Natural Harbours and Estuaries and other coastal ecosystem like the coral reef, saltwater wetland and mangrove ecosystems rich in marine life and countless marine species.

So marine life is one of the most important resource of any country and there is an increasing demand for the development and conservation of a healthy coastal and marine ecosystem. There is no state of a facility available in the region for the appropriate research and awareness.

Also, Living along the coastline brings the inhabitants with close contact to the sea every now and then. Around the world we see development along the coasts, small islands countries earn huge amount of money from tourism due to this coastal development. The reason is the sea; so the beaches are an attraction all around the globe for people.

Gokarna in Uttara Kannada being a place of special geographic and historic interest, encompasses a broad range of saltwater ecosystems, from estuaries and coral reefs to rocky shores and mangrove forests providing an ideal opportunity

for the ecological research and conservation through awareness. Also the tourist activity along this coast has experienced an exponential growth in the past decade due to its laid-back, unspoiled and rustic nature that has brought as a consequence an intensive. And generally an unstructured occupation of the coastline.

Marine waters cover more than 70% of the surface of the Earth and account for more than 97% of Earth's water supply and 90% of habitable space on Earth. Scientists divide marine ecosystems into several broad categories, although there are discrepancies depending on the source about what qualifies as a marine ecosystem.

Open Marine Ecosystems

The first thing many people think of upon hearing the term “marine ecosystem” is the open ocean, which is indeed a major type of marine ecosystem. This category includes types of sea life that float or swim, such as algae, plankton, jellyfish. Many creatures living in the open ocean inhabit the upper layer of the ocean where the sun's rays penetrate. This is known as the euphotic zone and extends to a depth of about 150 meters (500 feet).

Coral Reef Ecosystems

Coral reefs are a special subtype of seafloor ecosystem. Found only in warm tropical waters and at relatively shallow depths, coral reefs are among the most productive ecosystems on the planet.

About one-quarter of marine species depend on coral reefs for food, shelter or both. While coral reefs are famous for attracting brightly colored exotic fish, a plethora of other species -- snails, sponges and seahorses, to name a few -- inhabit coral reefs. The reefs themselves are produced by simple animals that build external skeletons around themselves

Estuary Ecosystems

The term “estuary” typically describes the shallow, sheltered area of a river mouth where freshwater intermingles with saltwater as it enters the sea, although the term can also refer to other areas with flowing brackish waters, such as lagoons or glades. The degree of salinity varies with the tides and the volume of outflow from the river.

2

The organisms inhabiting estuaries are specially adapted to these distinct conditions; hence, the diversity of species tends to be lower than in the open ocean. However, species which generally inhabit neighboring ecosystems may occasionally be found in estuaries.

Estuaries also serve an important function as nurseries for many types of fish and shrimp.

Saltwater Wetland Estuary Ecosystems

Found in coastal areas, saltwater wetlands may be considered a special type of estuary, as they also consist of a transition zone between land and sea. These wetlands can be divided into two categories:

saltwater swamps and salt marshes. Swamps and marshes differ in that the former are dominated by trees while the latter are dominated by grasses or reeds. Fish, shellfish, amphibians, reptiles and birds may live in or seasonally migrate to wetlands. Additionally, wetlands serve as a protective barrier to inland ecosystems, as they provide a buffer from storm surges.

Mangrove Ecosystems

Some tropical and subtropical coastal areas are home to special types of saltwater swamps known as mangroves. Mangroves may be considered part of shoreline ecosystems or estuary ecosystems.

Mangrove swamps are characterized by trees that tolerate a saline environment, whose roots systems extend above the water line to obtain oxygen, presenting a

mazelike web. Mangroves host a wide diversity of life, including sponges, shrimp, crabs, jellyfish, fish, birds and even crocodiles.

3



Fig – 1.1.1-Gokarna Landform

WHY GOKARNA?

-We rely on coastal and marine ecosystems, for food, recreation, transportation, and more. Coastal ecosystem of Gokarna region encompasses a broad range of saltwater ecosystems, from estuaries and coral reefs to rocky shores and mangrove forests and

provides an opportunity for ecological research and conservation through awareness along the coastline.

-Tourist activity in the coast of Gokarna has experienced an exponential growth in the past decade due to its laid-back, unspoiled and rustic nature and this has brought as a consequence an intensive, and generally unstructured, occupation of the coastline.

4

-Gokarna is one of the rare places that are holy pilgrimage centres which also attract leisure tourists with equal ease. The attractive beaches and the beautiful temples make Gokarna a prominent tourist destination.

Known for its idyllic beaches and pristine waters, Gokarna is a favorite among travelers who seek a peaceful vacation. It is the more laid-back and less commercialized version of Goa.

Hence, the sites were selected in this region, a place of special geographic and historic interest serving as an ideal platform for the design ideology - research, tourism and community.

1.2 AIM AND OBJECTIVE

The Ideation- Research-Tourism- Community-Incorporation of humanity in a context of change takes the form of sustainable ecosystem management, environmental education and the promotion of livelihood. Creating an expression in the formulation of a program that is heavily specific to the regions, the site and the people.

Knowledge and Leisure- a sustainable tourism approach along with other recreational facilities with a central educational facility for the user and target groups.

The end goal is to achieve a programmatic application to the built component that is not too far away from establishing direct relations to the people, providing a net community

benefit through specific site conditions and necessities that also allows the biodiversity of the place in particular to be rich and non-intervened by construction.

The experience and the reveal of the design is to create an architectural program that provides a platform for research while aiding the local community issues and thereby leaving an impact of awareness in the visitors, those who seek leisure and knowledge

5

1.3 BACKGROUND STUDY

BIODIVERSITY

For any ecosystem to thrive, the key importance must be placed on diversity. Nature functions primarily on dependency and this interdependent nature of an ecosystem is what helps sustain its character.



*Fig – 1.3.1 Goldspot mullet**Fig – 1.3.2 Olive ridley turtles*



Fig – 1.3.3 Dendrophyllia Fig – 1.3.4 Carpilius convexus

All along the coast, the variation in the flora and fauna is reminiscent of the local conditions that vary vastly along the coast- from north to south. The landforms support a specific type of vegetation in response to the high heat and humidity, which in turn support a specific species layer that are forms the base of existence.

6

These then support a second layer of species that are heavily dependent on base layer. Subsequently, the third layer then has the opportunity for a better chance of survival as they are now dependent on the permutation and combinations of the previous two layers, and so it goes on.



Fig – 1.3.5 Dictyota dichotoma Fig – 1.3.6 Macaca silenus Fig – 1.3.7 Pavo cristatus

A large degree of variation in the wildlife is also brought about by the in and out migrations of the birds and animals- locally and globally that either feed to or take away from the biodiversity. The concentration has been placed on the thriving populations of the birds as well as the deteriorating populations of specific genus species of animals such as the Olive Ridley turtles and the corals.



Fig – 1.3.8 Eudocimus Fig – 1.3.9 Dendrocygna Fig – 1.3.10 Phalacrocorax
Albusjavanica

7

The bird population is augmented by the migratory patterns that lead up to cycles of various bird communities populating the same local region at different times of the year. This cycle also hugely alters throughout the year due to the variation in the prey population- in this case being the vast multitude of the available fish. A layer of danger has also foreshadowed populations of turtles and the corals due to a shift from artisanal fishing techniques to damaging technologies such as trawling, motorized fishing boats, etc. that prove harmful to the sea bed as well as pollute the coastal water edge.



Fig – 1.3.11 Plesiastrea Fig – 1.3.12 Donax scortum Fig – 1.3.13 dictyota
Versipora dichotoma

Therefore, prominence is placed on the knowledge of their existential patterns in order to have a better understanding of their presence in order to be sensitive to the smallest fragments that contribute to the region's diversity.

The diversity in the marine life found in this region is because of the presence of the estuary where the Aghanashini River meets the Arabian Sea. There is a constant inflow of the diverse marine life. Seasonally, different types of fishes use this estuary as a breeding ground.

The river water carries large quantity of organic materials from the forests in the catchment area of the Western Ghats and deposits the same in the estuary. The debris becomes important base for food chains operating in the estuary.

The rich mangrove vegetation of the estuary plays significant role in nutrient supply for the diverse faunal community and provide shelter for birds and act as nurseries for many species of fishes and prawns. The rich bird community (over 120 species) associated with the estuary contributes to the nutrient cycling through their potash and nitrogen rich castings

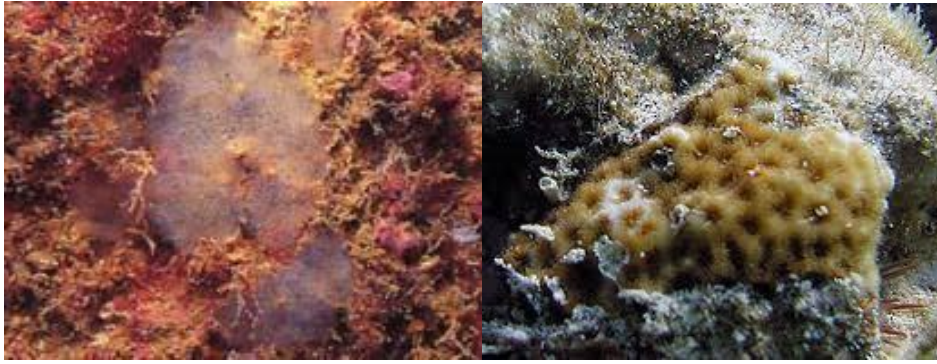


Fig – 1.3.14 *Halisarca* Fig – 1.3.15 *Leptastrea*



Fig – 1.3.16 *Favia favus* Fig – 1.3.17 *Symphyllia*

The constant churning and circulation of waters due to flow of fresh water from one side and the tidal influx from the Arabian Sea oxygenates the water and circulates the nutrients. One of the most notable economic and subsistence output of the Aghanashini estuary is the bivalves (Phylum: Mollusca). The meat of these invertebrates is used as a protein rich food by thousands of people along the coastal areas of Karnataka and Goa

Total annual production: Estimated at 22.006 tons, valued at Rs. 57.8 million per annum. Most of the bivalves harvested belong to *Paphia malabarica*, although six months edible species are also gathered in lesser quantities. Bulk of the bivalve harvest is from mudflats bordering the village by name Aghanashini. Close to the

mouth of the river (bearing the same name). Collectively these bivalve harvesting areas measure about 229 ha. It is significant to note that so much of food production is without any investment or supply of feeds by humans.



Fig – 1.3.18 Loligo duvauceli *Fig – 1.3.19 Acromitus*

The Aghanashini or Tadri River, 121 km long, originates at Manjuguni near Sirsi in Uttara Kannada Western Ghats. It meets the tide at Uppinpatna in Kumta taluk. Elements of mangrove vegetation begin here and increase in numbers and diversity for the next 24km of the river's course.

From the village of Mirjan, the river forms a vast expanse of estuary or backwaters that runs parallel to the coast.

The estuary is 13km long and 2 to 6 km broad. The expansive and shallow nature of the estuary and the presence of several mudflats make it ideal habitat for mangroves. The river mouth at Tadri is narrow and situated between 2 hills of Gokarna and Kagal villages. Mangroves, broadly can be classified into high salinity (>15 ppt) tolerant, medium salinity (5-15 ppt) tolerant and low salinity (<5 ppt) tolerant

VEGETATION

Due to the vast variation in topography, influenced by a high degree of rainfall and higher level of heat, a vast populace of vegetation thrives in accordance to this variation. The broader category is named as semi evergreen and evergreen forests, which only pays little heed to the diverse flora and fauna that exists within the region.

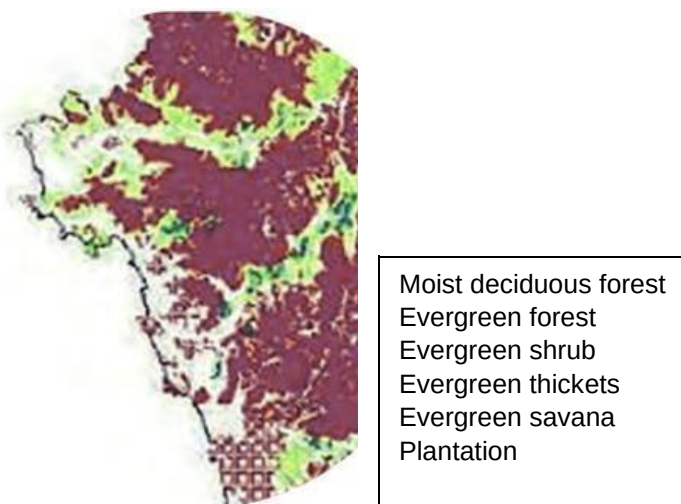


Fig – 1.3.20 Vegetation Map

Semi evergreen often merges with the evergreen and the moist deciduous type of vegetation, and it is almost an extension of the evergreen forests of the Western Ghats.

With a rainfall of 4000-5000mm supporting the vegetation, it sustains many different species of the semi-evergreen type, namely

- Cinnamomum malabaricum
- Holigarna arnottiana
- Dalbergia latifolia
- Ficus spp
- Pterocarpus marsupium
- Aglaia roxbhurgiana



Fig – 1.3.21 *Rhizophora apiculata* Fig – 1.3.22 *Porteresia coarctata*

Moist deciduous

- Terminalia paniculata
- Terminalia tomentosa
- Xylia xylocarpa
- Careya arborea
- Spondias spp
- Tectona grandis
- Lagerstroemia parviflora
- Dillenia pentagyna
- Strychnos nuxvomica

-Bambusa arundinaceae

Dry deciduous- Acacia catechu, Sepium insigne, Anoegissus spp, Bauhinia racemosa, Bombax ceiba.

The natural vegetation also supports the cultivation of food and cash crops with large expanses of land converted into plantation fields.

Plantations include- Tectona grandis

- Areca catechu
- Cocos nucifera
- Casuarina equisetifolia
- Acacia auriculiformis
- Acacia nilotica
- Eucalyptus spp

All the various species then form the collective vast vegetation that thrives in the region.



Fig – 1.3.23 *Bruguiera gymnorhiza* Fig – 1.3.24 *Rhizophora mucronata*

MANGROVES

These are usually woody, evergreen, salt tolerant plants of soft and swampy mud of tropical sub-tropical coastal zones preferring river mouths, lagoons and creeks. They are found in stagnant swampy coastal waters.



Fig – 1.3.25 Rhizophora mucronata

They have special adaptations like physiological and structural mechanisms to combat excessive salt in the medium, special aerial root systems for support in unstable slushy substratum and for gaseous exchange as they are anchored in anoxic water-logged conditions. They play a very important role in ecosystem functioning and are of great economic importance for fisheries. They contribute to the stabilization of the shoreline and prevention of shore erosion. They act as a barrier against storms so as to lessen damage to coastal land and residents.

GEOLOGY

The constant inundation provided by the sea, ocean and the river systems has helped shape one of the most ancient metamorphic rocks in India, being rich in iron and manganese. The soils of the district are basically divided into two distinct zones based on topography

- The coastal alluvial soil
- The upghat lateritic and granite soils

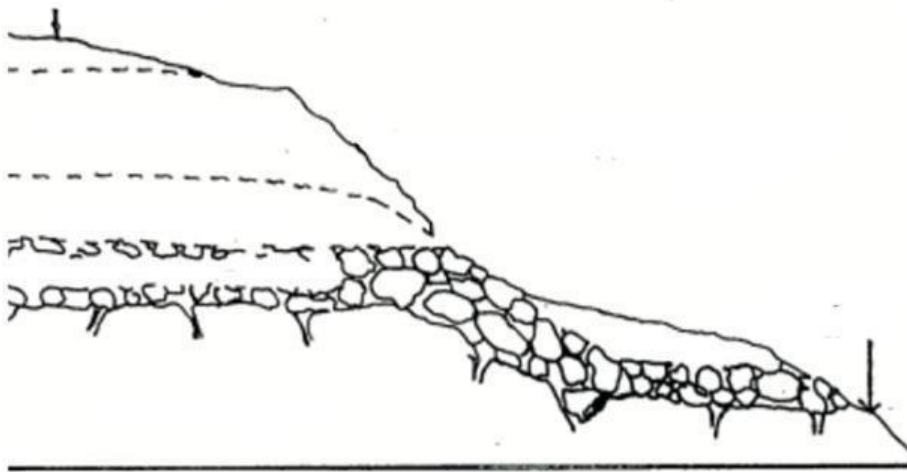


Fig – 1.3.26 Laterite Soil

The lateritic soils are highly leached, reddish brown in colour, shallow to medium in depth and loamy in texture.

The rock types of the region could be classified into -high grade schists

- migmatites, granites and gneisses of peninsular complex

-metal volcano-sedimentary sequence

Extensive lateritisation during the Tertiary Quaternary period has given rise to 15-20m thick cappings of laterite on all the lithounits in the district. Coastal sands and "Teri" sands are seen in the coastal plains as parallel sand flats consisting of coarse sands mainly of quartz with limonite coating. These soils are found in Kumta and few other regions aiding the diverse population of vegetation and making way for the growing of cash and food crops for the purpose of agriculture.



Fig – 1.3.27 Laterite Blocks

OCCUPATION

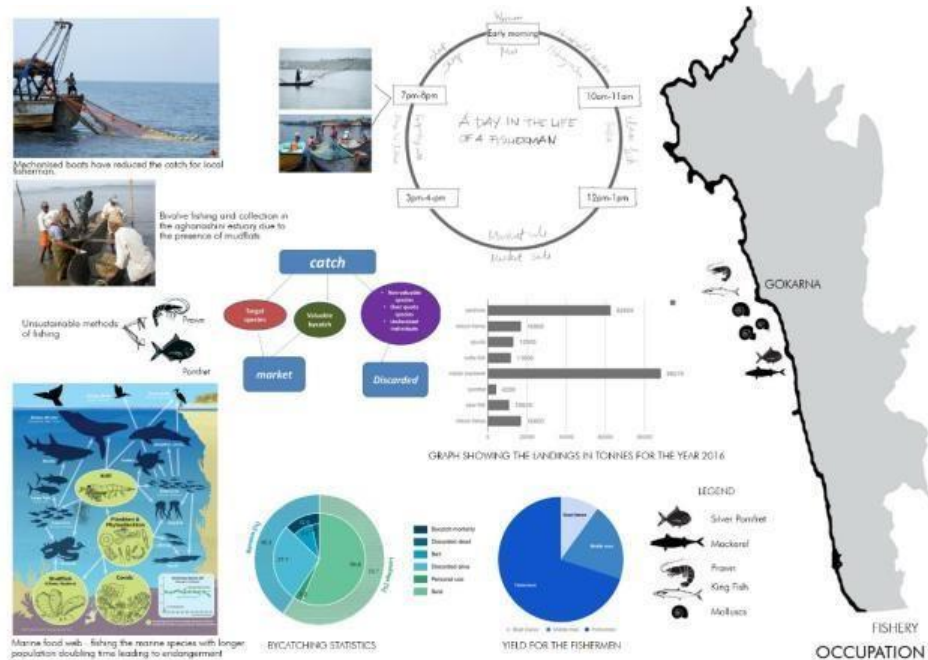


Fig – 1.3.28 Fishing



Fig – 1.3.29 Agriculture

CHAPTER 2—LITERATURE STUDY

2.1 RESEARCH CENTRE- BUILDING ATTRIBUTES - ARCHITECTURAL CONSIDERATIONS

LAB PLANNING MODULE

The laboratory module is the key unit in any lab facility. When designed correctly, a lab module will fully coordinate all the architectural and engineering systems. A well-designed modular plan will provide the following benefits:

Flexibility—The lab module, as Jonas Salk explained, should "encourage change" within the building. Research is changing all the time, and buildings must allow for reasonable change. Many private research companies make physical changes to an average of 25% of their labs each year. Most academic institutions annually change the layout of 5 to 10% of their labs.

Expansion—The use of lab planning modules allows the building to adapt easily to needed expansions or contractions without sacrificing facility functionality.

A common laboratory module has a width of approximately 10 ft. 6 in. but will vary in depth from 20–30 ft. The depth is based on the size necessary for the lab and the cost effectiveness of the structural system.

The 10 ft. 6 in. dimension is based on two rows of casework and equipment (each row 2 ft. 6 in. deep) on each wall, a 5 ft. aisle, and 6 in. for the wall thickness that separates one lab from another. The 5 ft. aisle width should be considered a minimum because of the requirements of the Americans with Disabilities Act (ADA).

Two-Directional Lab Module—Another level of flexibility can be achieved by designing a lab module that works in both directions. This allows the casework to be organized in either direction. This concept is more flexible than the basic lab module concept but may require more space.

The use of a two-directional grid is beneficial to accommodate different lengths of run for casework. The casework may have to be moved to create a different type or size of workstation.

Three-Dimensional Lab Module—The three-dimensional lab module planning concept combines the basic lab module or a two-directional lab module with any lab corridor arrangement for each floor of a building.

This means that a three-dimensional lab module can have a single-corridor arrangement on one floor, a two-corridor layout on another, and so on. To create a three-dimensional lab module:

A basic or two-directional lab module must be defined.

All vertical risers must be fully coordinated. (Vertical risers include fire stairs, elevators, restrooms, and shafts for utilities.)

The mechanical, electrical, and plumbing systems must be coordinated in the ceiling to work with the multiple corridor arrangements.

LAB PLANNING CONCEPTS

The relationship of the labs, offices, and corridor will have a significant impact on the image and operations of the building. Do the end users want a view from their labs to the exterior, or will the labs be located on the interior, with wall space used for casework and equipment?

Some researchers do not want or cannot have natural light in their research spaces. Special instruments and equipment, such as nuclear magnetic resonance (NMR) apparatus, electron microscopes, and lasers cannot function properly in natural light.

Natural daylight is not desired in vivarium facilities or in some support spaces, so these are located in the interior of the building. Zoning the building between lab and non-lab spaces will reduce costs. Labs require 100% outside air while non-lab spaces can be designed with re-circulated air, like an office building. Adjacencies with corridors can be organized with a single, two corridor (racetrack), or a three corridor scheme. There are number of variations to organize each type.

Illustrated, are three ways to organize a single corridor scheme. Open labs vs. closed labs. An increasing number of research institutions are creating "open" labs to support teambased work.

The open lab concept is significantly different from that of the "closed" lab of the past, which was based on accommodating the individual principle investigator. In open labs, researchers share not only the space itself but also equipment, bench space, and support staff. The open lab format facilitates communication between scientists and makes the lab more easily adaptable for future needs.

A wide variety of labs—from wet biology and chemistry labs, to engineering labs, to dry computer science facilities—are now being designed as open labs.



Fig 2.1.1 - Single corridor lab design with labs and office adjacent to each other.

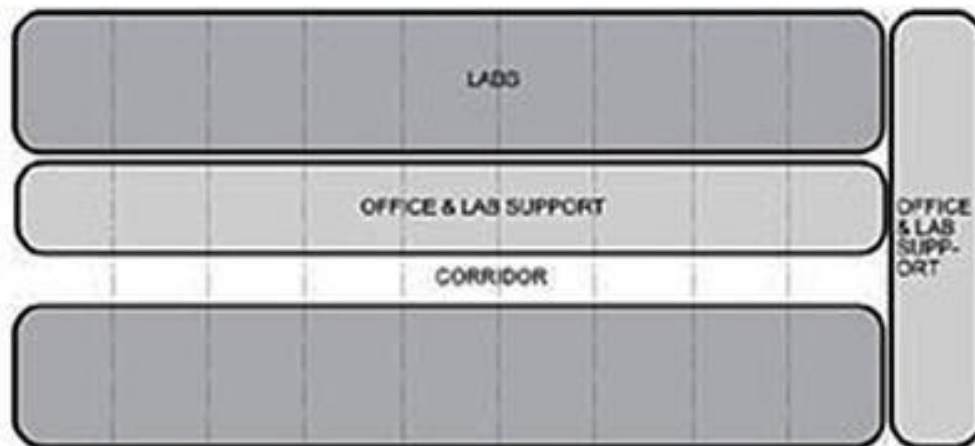


Fig 2.1.2 - Single corridor lab design with offices clustered together at the end and in the middle.

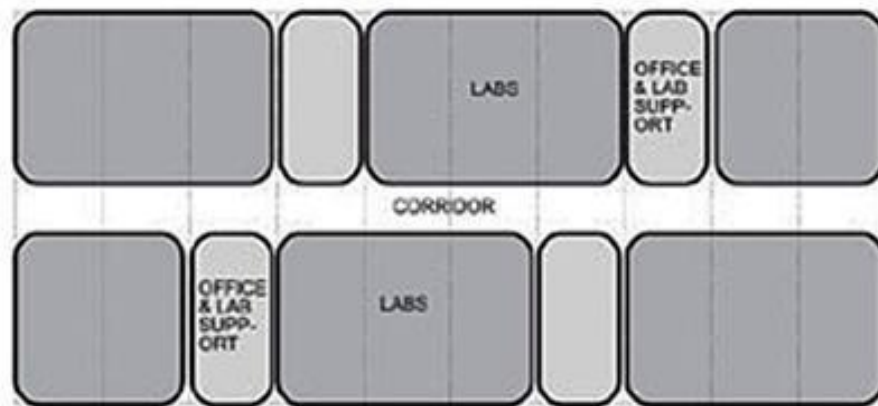


Fig 2.1.3 - Single corridor lab design with office clusters accessing main labs directly.

FLEXIBILITY

In today's lab, the ability to expand, reconfigure, and permit multiple uses has become a key concern. The following should be considered to achieve this:

FLEXIBLE LAB INTERIORS

Equipment zones—These should be created in the initial design to accommodate equipment, fixed, or movable casework at a later date.

Generic labs

Mobile casework—this can be comprised of mobile tables and mobile base cabinets. It allows researchers to configure and fit out the lab based on their needs as opposed to adjusting to pre-determined fixed casework.

Flexible partitions—these can be taken down and put back up in another location, allowing lab spaces to be configured in a variety of sizes.

Overhead service carriers—these are hung from the ceiling. They can have utilities like piping, electric, data, light fixtures, and snorkel exhausts.

They afford maximum flexibility as services are lifted off the floor, allowing free floor space to be configured as needed.

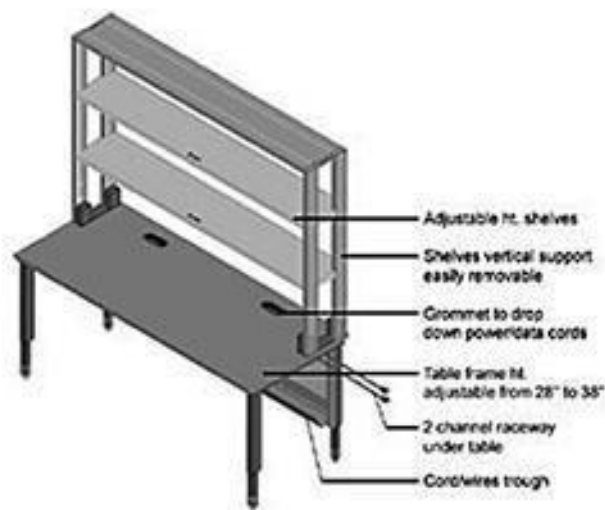


Fig 2.1.4 - Mobile casework



Fig 2.1.5 - Mobile base cabinet

Photo Credit: Kewaunee Scientific Corp.

BUILDING SYSTEMS DISTRIBUTION CONCEPTS

INTERSTITIAL SPACE

An interstitial space is a separate floor located above each lab floor. All services and utilities are located here where they drop down to service the lab below.

This system has a high initial cost but it allows the building to accommodate change very easily without interrupting the labs.

SERVICE CORRIDOR

Lab spaces adjoin a centrally located corridor where all utility services are located.

Maintenance personnel are afforded constant access to main ducts, shutoff valves, and electric panel boxes without having to enter the lab. This service corridor can be doubled up as an equipment/utility corridor where common lab equipment like autoclaves, freezer rooms, etc. can be located.

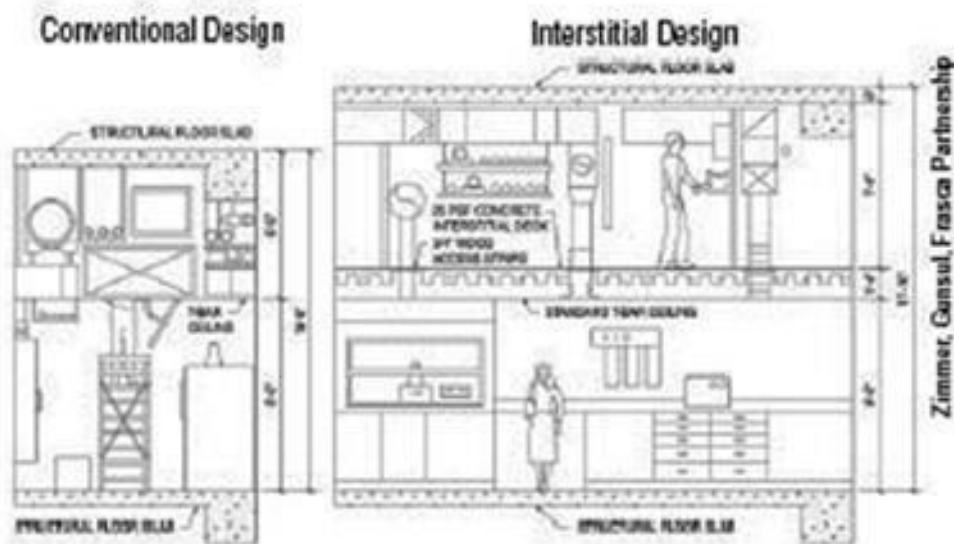


Fig 2.1.6 - Conventional design vs. interstitial design Image

Credit: Zimmer, Gunsul, Frasca Partnership

2.2 RESEARCH FACILITIES-Rules and standards

The design, scope, and size of an animal facility depend on the nature of the research activities to be conducted therein, the number of animals to be housed, the requirements, for flexibility in the housing of different species, its physical relationship to the rest of the institution, and its geographical location. The following functional areas are considered essential in a modern animal facility

1. A separate building, a separate wing, one or more floors, or separate rooms where animals can be housed apart from areas of human occupancy. A sufficient number of animal rooms or areas are required to assure separation of species when necessary, or isolation of individual projects; to provide for the receipt, quarantine, and isolation of animals; and to provide for their routine and specialized housing.

2. Specialized laboratories or areas contiguous with or near the animal housing areas for activities such as surgery; necropsy ; intensive postsurgical care ; radiography; preparation of special diets; and the diagnosis, treatment, and control of laboratory animal diseases . If radioisotopes, toxic substances, or pathogens are to be used, special facilities or areas must be provided.
 3. Receiving and storage areas for food, bedding, supplies, and equipment.
 4. An office for the administration, supervision and direction of the facility.
 5. Showers, sinks, lockers, and toilets for personnel.
 6. An area for washing and sterilizing equipment and supplies.
- Depending upon the volume of work, a well-equipped cleaning area includes facilities such as a cage-washing machine; a bottle- or glassware- washing machine; a rackwashing machine or area; a waste can-washing machine or area; a utility sink; an autoclave for equipment, food, and bedding; and separate areas for holding soiled and clean equipment.
7. An incinerator capable of burning all animal waste and refuse, or facilities for safe and sanitary storage of such waste prior to removal.
 8. An area suitable for food consumption should be provided if personnel regularly eat in the facilities that house animals.

SERVICE AREAS IN RELATION TO THE TOTAL SIZE OF THE FACILITIES

1. An area or areas equal in square feet to atleast 25 percent of the animal housing space should be set aside for the service functions of the animal facility. The service functions include such activities as cage washing andsterilization, storage, diagnostic laboratory and office activities, receiving and quarantining of animals, end refuse disposal.
2. Where an animal facility is 1,000 sq. ft. or less in size, it may be possibly to carry out the service functions in an area that serves other activities as well. However, a separate facility should be available for washing and sanitizing animal cages.
3. In a facility up to 10,000 sq. ft. in size, separate rooms or areas should be provided for the following service activities:

- a. Receipt and quarantine of newly received animals
 - b. Receipt and storage of animal food and supplies, including refrigeration
 - c. Cleaning, sanitizing, and storage of cages and equipment
 - d. Incinerator or protected area for refuse
 - a. Lavatory facilities for personnel
 - f. Office for supervisory and administrative personnel
 - g. Laboratory facilities
4. In institutions having several separate animal housing facilities, or one large area, which total more than 10,000 sq ft, rooms or areas should be provided for all of the service functions listed in item 3 above. In addition, clinical laboratory facilities should be provided for the diagnosing of animal diseases.
- Some duplication of service areas may be required if the animal facilities are widely dispersed

CONSTRUCTION GUIDELINES

Maintenance costs as well as initial construction costs should be considered when selecting building materials, and these materials should facilitate efficient and hygienic operation of the animal quarters. Durable, waterproof, fire-resistant seamless materials are most desirable for interior surfaces. Points and glazes, in addition to being highly resistant to chemical solvents, cleaning agents, and scrubbing, should be highly resistant to high-pressure sprays and impact.

CORRIDORS

Corridors should be at least 7 ft wide to permit easy flow of personnel and equipment. The floor-wall junction should be coved to facilitate cleaning. Provisions should be made for curbs or guardrails or for bumpers on equipment to protect the walls from damage.

Exposed corners should be protected by reinforcing them with steel, or another durable material up to a height of 6 ft.

Corridors leading to dog kennels should be provided with a noise trap such as a double-door entry lock. Where ever possible, access to utilities such as waterlines, drainpipes, and electrical connections should be through service panels or shafts located in the corridors outside the animal rooms.

EXTERIOR WINDOWS

Exterior windows and skylights are not needed in the animal rooms if adequate ventilation and lights are provided .If windows are provided, it is preferable that they be non-opening, without sills or horizontal surfaces where dust can collect, of an insulating construction (in areas of temperature extremes), and sealed with a material that will withstand repeated washing and disinfecting .

If windows are opened for ventilation purposes, effective screening is essential.

FLOORS

Floors should be smooth, waterproof, Non-absorbent, nonslip, wear resistant, acid and solvent resistant, capable of being scrubbed with detergents and disinfectants, and capable of supporting racks, equipment, and storage areas without gouging, cracking, or pitting. Depending upon the functions carried on in specific areas, the materials specified should be of a monolithic nature or should have a minimum of joints. Some materials that have proven satisfactory are terrazzo, cupric ox chloride cement, smooth hard-surfaced concrete, neoprene terrazzo, and special hardened rubber-base aggregates.

A continuous waterproof membrane should be provided. Where sills are installed at the entrance to the room, they should be designed so as to allow for the passage of equipment.

WALLS

Walls should be monolithic, waterproof, painted, glazed or smooth, free of cracks or imperfect junctures at the door, ceiling, corners, or utility penetrations .

27

Materials should be acid or solvent resistant, capable of withstanding scrubbing with detergents and disinfectants. The walls must be capable of withstanding water under high pressure. Provision should be made to protect walls from damage by movable equipment.

CEILINGS

Ceilings formed by the concrete floor above are satisfactory if properly smoothed, sealed, and painted. Furred ceilings of plaster or fire code plasterboard should be sealed and painted with a washable finish. Exposed pipes and fixtures at ceiling level are undesirable, especially in nonhuman primate rooms, because of the problems created by escaped species.

DRAINAGE

All waste fixtures and equipment should be connected to soil and waste pipes through traps. If floor drains are used, the drain pipes should not be less than 4 inches in diameter. In heavy-use areas such as dog kennels, drains at least 6 in. in diameter are recommended. A flushing drain, much like an ordinary toilet bowl, set in the floor, is an effective aid in the disposal of solid waste. A porous trap bucket to screen out solid waste provides an effective alternative to removal of solid materials through the drain. All drain pipes should have short runs to the main, or they should be steeply pitched from the opening. When drains are not in use they should be capped and sealed to prevent any backflow of sewer gases. Lockable drain covers are useful in preventing use of the drains for disposal of materials which should be swept up and removed by other means. Floors in such rooms can be maintained satisfactorily by wet vacuuming, or by sweeping and mopping with appropriate disinfectants or cleaning compounds. The recommended minimum pitch of floors, where floor drains are used, is 1/4 in per foot. Proper pitching of the floor is an essential element in

establishing good drainage in rooms particular attention should be paid to this detail in planning research facilities.

STORAGE AREAS

Food and Bedding, Refuse, Equipment In areas where delivery schedules are reliable, the amount of space required for food and bedding storage can be held to a minimum. The best utilization is achieved by maintaining constant turnover. Bulk supplies of food and bedding should not be stored in animal rooms. A separate area or room should be available in which food and bedding can be stored off the floor on pallets, racks, or carts. A continuing pest control program is essential. It is most desirable for the storage areas to be vermin proof. Food storage areas should be physically separated from refuse areas. Temperatures in the storage rooms may be the ambient temperature. However, it is good practice to hold packaged animal feeds (pellet rations) at 50° F or less. Refrigerated storage should be available for meats, fruits, vegetables, and other perishable items. Separate storage for animal waste and dead animals is essential. Refuse storage areas should preferably be kept below 45° F to reduce putrefaction of waste or animal carcasses. Obnoxious materials should be covered or packaged. The area should be constructed so that it can be kept clean and free of vermin. Adequate space for storing equipment is essential. This is an effective way to prevent clutter in animal rooms. All storage areas should be kept clean.

FACILITIES FOR WASHING AND STERILIZING EQUIPMENT AND SUPPLIES

An area for washing and sterilization is essential to keep equipment physically clean, reduce obnoxious odors, minimize the spread of infectious diseases, and provide for the comfort of experimental animals. Washing and sterilizing are best done outside of the animal rooms in an area specifically designed for the purpose and centrally located, if possible. Consideration should be given to such factors as:

- a. Location with respect to animal rooms, traffic flow that separates "clean" and "dirty" areas, elevators, ease of access, and disposal of waste.
- b. Soundproofing.

- c. Utilities such as hot and cold water, steam, floor drains, and electric power.
- d. Proximity to cage and equipment storage areas. It is essential to provide separate holding areas for soiled and clean equipment

29

- e. Insulation of walls and ceilings where necessary.
- f. Ventilation with installation of proper vents and provisions for dissipation of steam.
- g. Access doors of sufficient width to assure free movement of equipment.

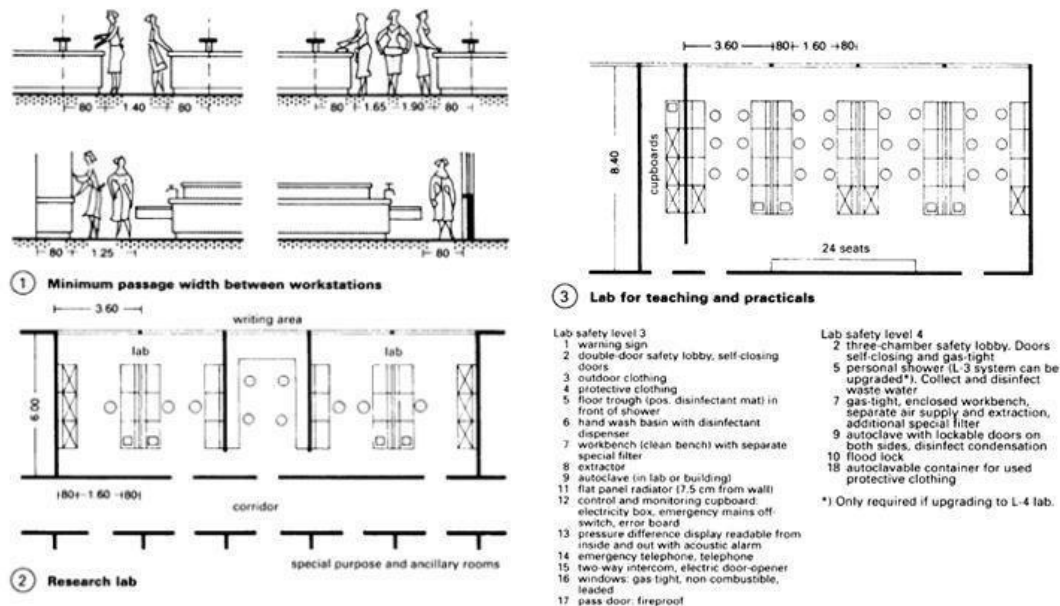


Fig – 2.2.1 Laboratory design

Laboratories differ according to type of use and discipline

According to use:

Laboratories for teaching and practicals, comprising a large number of workstations, usually with simple basic equipment. Research labs are usually in smaller spaces with special equipment and additional rooms for activities rooms for activities such as

2.4 USER BEHAVIOUR AND CIRCULATION

USER BEHAVIOUR

In order to create a useful and effective interpretative exhibition, all its creators, designers and curators have to be well acquainted with the target group.

VISITOR'S CIRCULATION

The spectrum museum visitors is very diverse and there is no general and universal classification. Visitors, however, have some common features upon which we can build our categorization.

i Socio-demographic characteristics: motivation for the visit (professional, informational), knowledge of the topic, potential of the tour to engage.

ii Interpretative characteristics: motivation for the visit (professional, informational), knowledge of the topic, potential of the tour to engage.

iii Range characteristics: individual visitor (various types of groups of museum visitors, frequency of visits, timescale of museum visit).

iv Psychological or Psychological characteristics: reception, intelligent, memory, imagination, visual, auditory, motoric.

Visitors can also be categorized in three broad and much simpler categories:

i Casual visitors: people who move through a gallery quickly and who do not become heavily involved in what they see.

ii Curiosity visitors: show instead a more genuine interest in the experience and collections of an interpretation centre.

iii Study visitors: a minority of visitors who thoroughly examine exhibits with much more detail and attention. They are learners who will spend an abundance of time in galleries, read the text and labels, and closely examine the objects.

CIRCULATION

The circulation of public and staff, service areas has to be separated from each other, and the visitor should be able to approach a particular gallery of his or her choice as directly as possible. He should not be obliged to return or proceed through the galleries he is not interested in.

The location of the temporary exhibit hall should take into consideration the possibility of a large number of visitors. A separate entrance is advisable.

Circulating pattern should be designed keeping in mind that there is a general tendency to turn right to enter a exhibit hall.

TYPES OF CROWD FLOW

Depending upon the rate of flow of visitors the areas inside the gallery can be described below:

i Areas of constant crowd flow: These are the areas where time repetitive exhibits that can be easily understood by the visitors are placed.

ii Areas of crowd slope area: These are characterized by the general display of nature along with the exhibits of conceptual nature requiring time to absorb.

iii Areas of variable crowd flow: The exhibits allow visitors to choose among simple and complex exhibits.

VISITOR'S CIRCULATION

Chain: The main aim is to allow visitors to navigate in regard to their interest in displayed exhibits.

Block: It provides navigation voluntarily and in a random fashion.

Window: From the central point, visitors are allowed to move towards the room according to their interests.

Brush: The main aim is to allow visitors to move through the rooms.

CIRCULATION PATTERNS

The circulation within the interpretation centre can be attributed to one of the following types:

Open Plan

Large autonomous exhibits, free circulation.
Bays and columns-scale, structure and proportion.
Level changes-circulation, mechanical axis.
Roof spans-single/multiple.
Service spaces-under floor/overhead area.
Air circulation- environmental control, energy consideration.



Fig. 2.4.1(a) Open plan



Fig. 2.4.1(b) Core and satellite

Core and Satellites

Core space for orientation to interpretation centre / subject/collections.
Satellite spaces for autonomous exhibits/themes/collections.
Core/Satellite - setting of temporary changing exhibit or special exhibitions.
Free circulation from core to specific satellite.

Linear Procession

Linear sequence of spaces, controlled circulation, tunnel show.
Setting of large key exhibits.
Separate entrance and exit-relationship to associated activities.



Fig. 2.4.1(c) Linear procession

Loop

Linear sequence of spaces, controlled circulation, tunnel show.
Thematic exhibitions/storyline organizations.
Setting of large key exhibits.
Circulation returns to exit.



Fig. 2.4.1(d) Loop

Complex:
Combines group of spaces with features of above mentioned plans.
Complex organizations of collections.
Complex communication strategy.
Orientation is disorientation-critical factor.



Fig. 2.4.1(e) Complex

Shed/Run pattern

The central part is generally continuous, but path leads to a series of self-contained units which have a more varied path within them.

Arterial pattern

The main path is continuous and no option exists for it is used where the presentation is dependent upon a fixed sequence.

Block pattern

This is the most commonly used pattern in the interactive spaces of science and technology centres. It offers a relatively unrestricted pattern which can be random and self-directive as desired by a visitor.

Comb pattern

Main circulation path and optional droves and provided which a visitor may enter or bypass.

Radial pattern

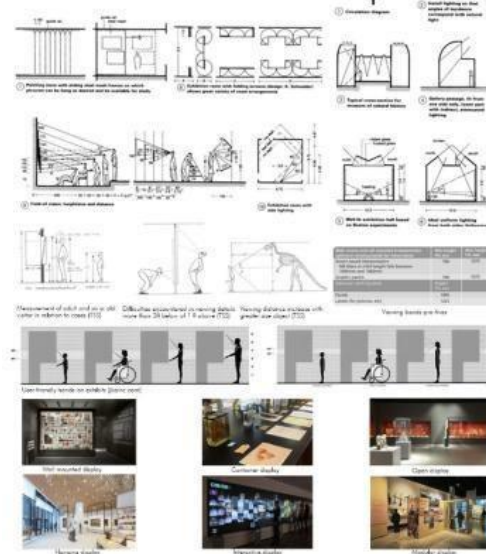
This pattern is a series of alternatives from a central area.

Fig – 2.4.1

2.5 DISPLAY ANTHROPOMETRY AND TECHNIQUES

DISPLAY AND ANTHROPOMETRY

Although size seems like a straightforward matter, it is surprising how often the dimensional aspects of an exhibit is clearly wrong. Getting the size of the exhibit and the physical placement of components dimensionally correct is fundamental to user comfort.



DISPLAY TECHNIQUES

The idea of exhibits considerably changed during years rather than a remarkable display of exhibits with "do not touch" restriction, the display has formed a series of inactive, active and interactive types.

ACTIVE COMMUNICATION

-Audio - Spoken word, oral testimony, music, foreign languages

-Video - Film, interviews, archive film, moving image effects

REACTIVE COMMUNICATION

-User activated (Push button, pressure pad, proximity switch)

-Lighting Effects - Sequenced presentations

-Immersive Effects - Sequenced presentations with audio

-Films - Movies, documentaries and videos

PASSIVE COMMUNICATION

-Graphic panels - Incorporate text and images

-Object labels - For individual objects

-E-labels - Incorporate text, images, video, audio and interactivity

-Images and Illustration - Photographs, maps, drawings and diagrams

-Models - Scale models, dioramas, props, reconstructions

INTERACTIVE COMMUNICATION

-Educational Technology, microprocessor controlled devices, online databases

-Low-tech Interactives - Incorporate text, film, flipbooks, audio

-Live Interpretation - Staff or actors in role play

-High-tech Interactives - Programmed and computerized

INTERPRETATIVE COMMUNICATION METHOD

-Graphic Panels - Incorporate text and images for individual objects

-Object Labels - Incorporate text, images, video, audio and interactivity

-E-labels - Incorporate text, images, video, audio and interactivity

-Images and Illustration - Photographs, maps, drawings and diagrams

-Models - Scale models, dioramas, props, reconstructions

-Staff or actors in role play

-Programmed and computerized

-Incorporate text and images for individual objects

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

-Incorporate text, images, video, audio and interactivity

Fig – 2.5.1

32

2.6 FIRE SAFETY

FIRE SAFETY

A fire protection system is an important component of a building's safety plan, regardless of whether it's a commercial facility, hospital or educational facility.

ACTIVE FIRE PROTECTION

-uses systems that do require a certain amount of motion or action in order to work properly.

These systems use some amount of action to notify of the fire and smoke conditions, help slow the growth of the fire or to help put out the fire altogether.

Examples: Fire alarm systems, Sprinkler Systems, Fire Extinguishers/Hydrant, Fire fighters etc.

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

Fire alarm system

EXIT CONDITIONS

Minimum of 2 staircases

One of them shall be an enclosed stairway and the other shall be on the external side of the building and shall open directly to the entrance

Exit shall be located so that the travel distance on the floor shall not exceed 30m

No part of the room or area should be more than 15m from the door measured along the natural path of travel

Fire doors with 2h fire resistance shall be provided at appropriate places along the escape route and particularly at the entrance to lift lobby

Minimum width provisions for stairways : 1.5m. Minimum width provisions for passageway/ corridors : 1.5m

Fire doors with 2h fire resistance shall be provided at appropriate places along the escape route and particularly at the entrance to lift lobby

Minimum width provisions for stairways : 1.5m. Minimum width provisions for passageway/ corridors : 1.5m

Fire doors with 2h fire resistance shall be provided at appropriate places along the escape route and particularly at the entrance to lift lobby

Minimum width provisions for stairways : 1.5m. Minimum width provisions for passageway/ corridors : 1.5m

Fire doors with 2h fire resistance shall be provided at appropriate places along the escape route and particularly at the entrance to lift lobby

Minimum width provisions for stairways : 1.5m. Minimum width provisions for passageway/ corridors : 1.5m

Fire doors with 2h fire resistance shall be provided at appropriate places along the escape route and particularly at the entrance to lift lobby

Minimum width provisions for stairways : 1.5m. Minimum width provisions for passageway/ corridors : 1.5m

Fire doors with 2h fire resistance shall be provided at appropriate places along the escape route and particularly at the entrance to lift lobby

Minimum width provisions for stairways : 1.5m. Minimum width provisions for passageway/ corridors : 1.5m

Fire doors with 2h fire resistance shall be provided at appropriate places along the escape route and particularly at the entrance to lift lobby

Minimum width provisions for stairways : 1.5m. Minimum width provisions for passageway/ corridors : 1.5m

Fire doors with 2h fire resistance shall be provided at appropriate places along the escape route and particularly at the entrance to lift lobby

Minimum width provisions for stairways : 1.5m. Minimum width provisions for passageway/ corridors : 1.5m

Fire doors with 2h fire resistance shall be provided at appropriate places along the escape route and particularly at the entrance to lift lobby

Minimum width provisions for stairways : 1.5m. Minimum width provisions for passageway/ corridors : 1.5m

Fire doors with 2h fire resistance shall be provided at appropriate places along the escape route and particularly at the entrance to lift lobby

Minimum width provisions for stairways : 1.5m. Minimum width provisions for passageway/ corridors : 1.5m

Fire doors with 2h fire resistance shall be provided at appropriate places along the escape route and particularly at the entrance to lift lobby

Minimum width provisions for stairways : 1.5m. Minimum width provisions for passageway/ corridors : 1.5m

Fire doors with 2h fire resistance shall be provided at appropriate places along the escape route and particularly at the entrance to lift lobby

Minimum width provisions for stairways : 1.5m. Minimum width provisions for passageway/ corridors : 1.5m

Fire doors with 2h fire resistance shall be provided at appropriate places along the escape route and particularly at the entrance to lift lobby

Minimum width provisions for stairways : 1.5m. Minimum width provisions for passageway/ corridors : 1.5m

Fire doors with 2h fire resistance shall be provided at appropriate places along the escape route and particularly at the entrance to lift lobby

Minimum width provisions for stairways : 1.5m. Minimum width provisions for passageway/ corridors : 1.5m

Fire doors with 2h fire resistance shall be provided at appropriate places along the escape route and particularly at the entrance to lift lobby

Minimum width provisions for stairways : 1.5m. Minimum width provisions for passageway/ corridors : 1.5m

Fire doors with 2h fire resistance shall be provided at appropriate places along the escape route and particularly at the entrance to lift lobby

Minimum width provisions for stairways : 1.5m. Minimum width provisions for passageway/ corridors : 1.5m

Fire doors with 2h fire resistance shall be provided at appropriate places along the escape route and particularly at the entrance to lift lobby

Minimum width provisions for stairways : 1.5m. Minimum width provisions for passageway/ corridors : 1.5m

Fire doors with 2h fire resistance shall be provided at appropriate places along the escape route and particularly at the entrance to lift lobby

Minimum width provisions for stairways : 1.5m. Minimum width provisions for passageway/ corridors : 1.5m

Fire doors with 2h fire resistance shall be provided at appropriate places along the escape route and particularly at the entrance to lift lobby

Minimum width provisions for stairways : 1.5m. Minimum width provisions for passageway/ corridors : 1.5m

Fire doors with 2h fire resistance shall be provided at appropriate places along the escape route and particularly at the entrance to lift lobby

Minimum width provisions for stairways : 1.5m. Minimum width provisions for passageway/ corridors : 1.5m

Fire doors with 2h fire resistance shall be provided at appropriate places along the escape route and particularly at the entrance to lift lobby

Fig – 2.6.1

2.7 SERVICES, SECURITY AND STORAGE

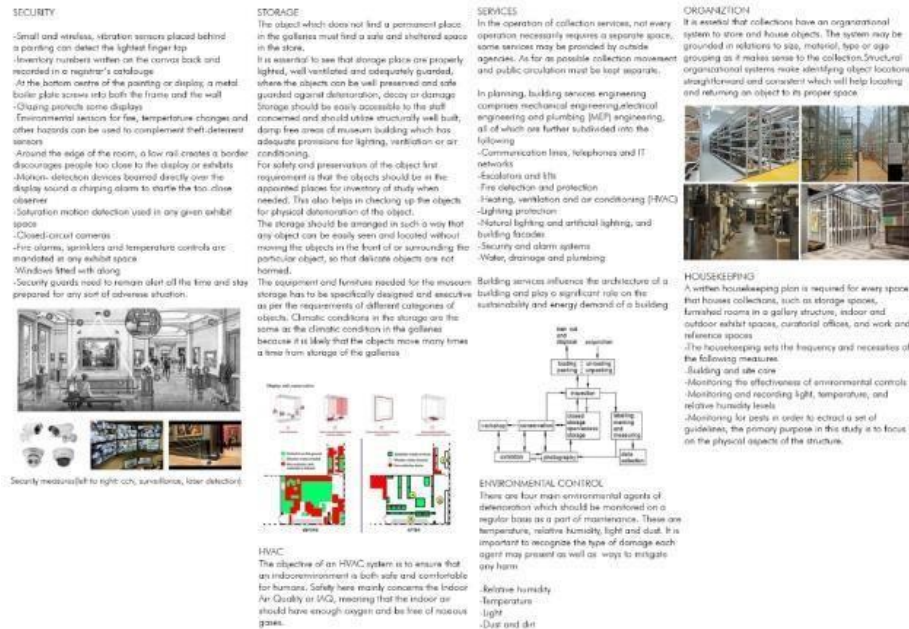


Fig – 2.7.1

33

2.8 GREENHOUSES

GREENHOUSES

A greenhouse must be so designed that it admits the **greatest possible amount of available light**. The structural system, therefore, must be minimal in built, yet strong enough to support the weight of the **glazing system**. Site selection, building orientation, and roof pitch must all be considered with this in mind. While the glazing medium selected must be capable of high light transmission, it must also be of a weight and kind and be formed so that breakage is a minimal hazard.

A greenhouse is a transparent structure and **cannot be insulated, so solar heat gain and heat loss are factors that must be considered**. In spite of the difficulties inherent in the type of structure, **temperature and humidity must be controlled to within a degree and a half in some cases**. Then, too, plant requirements vary from down to dusk to dawn, and from one stage of plant growth to another.

A temperature control system specifically designed for horticultural applications (rather than conventional heating and cooling systems) must be installed in the greenhouse to create and maintain correct environmental conditions in a consistent manner.

There must be a means of introducing fresh air into the greenhouse on demand, and circulating it in an even pattern so that temperature and humidity levels are uniform throughout the house.

Instead of simple fenestration the greenhouse must be supplied with some type of ventilating sash and/or a system by which air is introduced by negative pressure and distributed through transparent ductwork, such ventilating systems being thermostatically controlled.

Greenhouses are sometimes used for other purposes than plant production alone. Some are also teaching labs, research stations, or display houses. Some must have greater degree of aesthetic appeal than others, or conform to existing architecture.

While good light exposure, unpolluted air, and free-draining soil are all basic requirements of a plant growing environment, **greenhouses often have to be sited on crowded campuses and in industrial areas**. While the greenhouse designer does not always have a free choice when it comes to site selection, some requirements are indispensable.

For instance, the greenhouse site should not be shaded by buildings or trees. Good natural exposure is preferable to a site where hills cut off late afternoon sun. A windbreak 100 or more feet away in the direction of the prevailing wind can help reduce heating costs.

Avoid sites downwind of a heating plant or incinerator stack, or where toxic fumes from chemical laboratories can be drawn into the greenhouses. Proximity to fruit or vegetable storage areas should be avoided because plants are sensitive to ethylene. If greenhouses are to be near other buildings, avoid if possible dark paved surfaces and heat-absorbing walls, which contribute to summer heat buildup.

Low-lying ground has a tendency to flood during thawing out periods. And for obvious reasons **greenhouse should not be located adjacent to playgrounds or playing fields**.

Greenhouse Guidelines

Greenhouse for use by	Function of greenhouse operation	Greenhouse design considerations
Vocational school	Providing basic experience in commercial crop production.	Space-20 sq ft per student enrolled in course. Greenhouse should be small-scale edition of commercial operation with three separate temperature zones: 50-55° min., 60° min., & 65 + ° min.



Fig – 2.8.1

2.9 STATUTORY NORMS

SIZE

The area of habitable room shall not be less than 9.55sqm, where there is only one room with a minimum width of 2.4 m. Where there are two rooms, one of these shall not be less than 9.55sqm and the other not less than 7.55sqm, with a minimum width of 2.1 m.

Minimum height requirement for educational and industrial buildings

Sr.	Type of Occupancy	Ceiling height
1	Educational Buildings	Ceiling height 3.4m for all regions.
2	Industrial Buildings	Ceiling height 3.4m, except where air-conditioned. In February Act 1949 and Rules thereon shall govern such heights, where applicable.

PUNTH

The plinth or any part of a building or outhouse shall be so located with respect to the surrounding ground level that adequate drainage of the site is assured. The height of the plinth shall be not less than 450 mm from the surrounding ground level, in case of independent houses and not less than 300mm in case of other buildings.

Interior Courtyards and Covered Parking: Every interior courtyard shall be raised at least 150 mm above the determining ground level and shall be satisfactorily drained.

PARAPET

Parapet walls and handrails provided on the edges of roof terraces, balcony, verandah, etc. shall not be less than 1.0 m and not more than 1.2 m in height from the finished floor level.

ROOFS

The roof of a building shall be so designed and constructed as to effectively drain water by means of sufficient rain-water pipes of adequate size, whenever required, so arranged, jointed and fixed as to ensure that the rain-water is carried away from the building without causing dampness in any part of the walls, roof or foundations of the building or an adjacent building.

a. The Authority may require rain-water pipes to be connected to a drain or sewer to a covered channel formed beneath the public footpath to connect the rainwater pipe to the road gutter or in any other approved manner.

b. Rain-water pipes shall be affixed to the outside of the external walls of the building or in recesses or chases cut or formed in such external walls or in such other manner as may be approved by the Authority.

c. It is desirable to conserve rain water using suitable rain water harvesting techniques including by roof water collection. In this context, reference may be made to Part 9 "Plumbing Services, Section 1 Water Supply, Drainage and Sanitation (Including Solid Waste Management)" of NBC, 2005.

MEANS OF ACCESS

-No Building shall be erected as to deprive any other building of its means of access.
-Every person who erects a building shall not at any time erect or cause or permit to erect or re-erect any building, which in any way encroaches upon or diminishes the area set apart as means of access.

The Means of Access prescribed in the Zonal Regulations shall be considered while sanctioning Building Licence. The portion of the plot required for widening the road to the proposed width shall be relinquished free of cost without claiming any compensation (including CR), before sanctioning Building Licence.

BOUNDARY WALL

The requirements of the boundary wall shall be as follows:

a) Except with the special permission of the Authority, the maximum height of the compound wall shall be 1.5 m above the Centre line of the front street. Compound wall up to 2.4 m height may be permitted if the top 0.9 m is of open type construction of a design to be approved by the Authority.

b) However, the provisions are not applicable to boundary walls of pails. In electric sub-stations, transformer stations, institutional buildings like sanatoria, hospitals, industrial buildings like workshops, factories and educational buildings like schools, colleges, including hostels and other uses of public utility undertakings and strategically sensitive buildings, a height up to 2.4 m may be permitted by the Authority.

STAIRCASE REQUIREMENTS

The minimum clear width, minimum tread width and maximum riser of staircases for buildings shall be as given as below

A	Residential buildings (dwellings) of apartment buildings	1.5m
B	Hotel - For room having with 2 steepers, the min. width shall be 1.7m	1.7m
C	Hotel buildings, Lodging House	1.5m
D	Assembly buildings like theatres, cinemas and mosques	1.8m
E	Educational buildings	1.5m
F	Government buildings	1.5m
G	All other buildings	1.5m

The minimum width of staircase

MINIMUM TREAD

The minimum width of tread without nosing shall be 250 mm for residential buildings. The minimum width of tread for other buildings shall be 300 mm.

MAXIMUM RISER

The maximum height of riser shall be 190 mm for residential buildings and 150 mm for other buildings and these shall be limited to 12 per flight.

The minimum head-room in a passage under the landing of a staircase shall be 2.1 m.

The minimum clear head-room in any staircase shall be 2.1 m

NORMS

KARNATAKA MUNICIPALITIES MODEL BUILDING BYE-LAWS 2017

Fig – 2.9.1

34

EXIT REQUIREMENTS

All aspects of exit requirements for corridors, doors, stair cases, ramps, etc. in respect of widths, travel distance shall be as prescribed in these Byelaws.

NUMBER AND SIZE OF EXITS

The requisite number and size of various exits shall be provided, based on the occupants in each room and floor based on the occupant load, capacity of exits, travel distance and height of buildings as prescribed in these Byelaws.

At least one primary entrance to each building shall be usable by individuals in wheelchairs and shall be indicated by a sign. At least one entrance usable by individuals in wheelchairs shall be on a level that would make the elevators accessible.

ARRANGEMENT OF EXITS

a) Exits shall be so located so that the travel distance on the floor shall not exceed 30 m for residential, educational, institutional assembly, business, mercantile and storage occupancies, 45.0 m for industrial occupancy and 22.5m for hazardous building. For fully sprinklered building, the travel distance may be increased by 50 percent of the above values. Whenever more than one exit is required for a floor of a building they shall be placed as remote from each other as possible. All the exits shall be accessible from the entire floor area at all floor levels, where separate fire separation walls are not provided.

b) The travel distance to an exit from the dead end of the corridor, if applicable, shall not exceed half the distance as stated above except in the case of institutional occupancy in which case it shall not exceed 6.0 m.

CAPACITY OF EXITS

The capacity of exits (staircase, ramps and doorway) indicating the number of persons that could be safely evacuated through a unit exit width of 50 cm shall be as given below:

Sr. No.	Series	Number of Occupants	Exit Width (m)
1	Residential	20	1.0
2	Educational	50	1.5
3	Assembly	20	1.0
4	Industrial	50	1.5
5	Commercial	50	1.5
6	Storage	50	1.5
7	Public	50	1.5
8	Healthcare	50	1.5
9	Government	50	1.5

Occupants per unit Exit width

Minimum Width Provisions for Passage/Way/Corridor

The following minimum width provisions shall be made for each passage way/corridor:

- Residential buildings, upto 4 dwelling units 1.00 m.
- Assembly buildings like auditorium theatres and cinemas 2.00 m.
- All other buildings including hotels 1.50 m.

VENTILATION SHAFT

For ventilating the spaces for water closets and bathrooms, if not opening on the front side, rear and interior open spaces, shall open on the ventilation shaft, the size, of which shall not be less than the values given below

Height of Building (m)	Size of ventilation shaft (sqm)	Minimum size of shaft (sqm)
Up to 10.0	1.2	0.9
Up to 12.0	1.5	1.2
Up to 14.0	1.8	1.5
Up to 16.0	2.1	1.8
Up to 18.0	2.4	2.1
Up to 20.0	2.7	2.4
Up to 22.0	3.0	2.7

Note

- For buildings above 20.0 m. height, mechanical ventilation system shall be installed besides the provision of minimum ventilation shaft.
- For fully air-conditioned buildings the ventilation shaft need not be isolated space, provided the air-conditioning system units to an unobstructed roadway, also provided there is no alternative source of power supply. However, it is not necessary in case of buildings where ventilation is mechanical.

Size of Ventilation Shaft

BUILDING SERVICES

Electrical, Air conditioning, Lift & Escalator installations Planning, design and installations of electrical, air-conditioning and lift installations

NUMBER AND TYPES OF LIFTS

Lift shall have to be provided for buildings with more than ground plus three floors.

REQUIREMENTS OF ELECTRICAL SUBSTATION

The provision of electric sub-station shall also require approval from Electricity Board concerned.

PLUMBING AND SANITARY SERVICES

Planning, design, construction and installation of Water supply, drainage and sanitation and gas supply system

NORMS FOR DIFFERENTLY-ABLED WITHIN SEGREGATED TOILETS:

- One special W.C. in a set of toilet shall be provided for the use of differently abled persons, with essential provision of wash basin near the entrance.
- Minimum clear opening of the door shall be 900 mm. and the door shall swing out.
- Suitable arrangement of vertical/horizontal handrails with 50 mm. clearance from wall shall be made in the toilet.
- The W.C. seat shall be 500 mm. from the floor.

NORMS

KARNATAKA MUNICIPALITIES MODEL BUILDING BYE-LAWS 2017

Fig – 2.9.2

SANITATION REQUIREMENTS

Sl. No.	Sanitary Unit	For Public	For Private
1	Water Closet (WC)	One for every 20 persons or part thereof	One for every 20 persons or part thereof
2	Water Closet (WC)	One for every 20 persons or part thereof	One for every 20 persons or part thereof
3	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
4	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
5	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
6	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
7	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
8	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
9	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof

Sanitation requirements for admin

Sl. No.	Sanitary Unit	For Public	For Private
1	Water Closet (WC)	One for every 20 persons or part thereof	One for every 20 persons or part thereof
2	Water Closet (WC)	One for every 20 persons or part thereof	One for every 20 persons or part thereof
3	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
4	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
5	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
6	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
7	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
8	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
9	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof

Sanitation requirements for restaurants

Sl. No.	Sanitary Unit	For Public	For Private
1	Water Closet (WC)	One for every 20 persons or part thereof	One for every 20 persons or part thereof
2	Water Closet (WC)	One for every 20 persons or part thereof	One for every 20 persons or part thereof
3	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
4	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
5	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
6	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
7	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
8	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
9	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof

Sanitation requirements for interpretation centre

Sl. No.	Sanitary Unit / Fittings	For Personnel
1	Water closet	One for every 20 persons or part thereof
2	Drinking Water Fountains	One for every 100 persons with a minimum of one in each floor
3	Urinals	One for every 20 persons or part thereof
4	Urinals	One for every 20 persons or part thereof
5	Urinals	One for every 20 persons or part thereof

Sanitation requirements for shops and offices

Table 5.11 Sanitation Requirements for Educational Occupancy

Sl. No.	Sanitary Unit	For Public	For Private
1	Water Closet (WC)	One for every 20 persons or part thereof	One for every 20 persons or part thereof
2	Water Closet (WC)	One for every 20 persons or part thereof	One for every 20 persons or part thereof
3	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
4	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
5	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
6	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
7	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
8	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof
9	Urinals	One for every 20 persons or part thereof	One for every 20 persons or part thereof

Sanitation requirements for educational occupancy

Fig – 2.9.3

35

SETBACKS

Setbacks for building Height up to 11.5m & Plot size of up to 4000sq.m

Width/Depth of site (m)	Width of site		Depth of site	
	Right side	Left side	Front side	Rear side
Up to 6.0	1.0 m	1.0 m	0	0
Above 6.0 up to 9.0	1.0 m	1.0 m	0	0
Above 9.0 m	8%	8%	12%	8%

- For plot over size of 4000 sq.m, a minimum setback of 5.0 m on all sides shall be insisted.

All around setbacks for buildings above 11.5 m height

Sl. No.	Height of the bldg (m)	Front, rear and side setbacks (Min. in m)
1	Above 11.5m up to 15.0 m	5.00
2	Above 15.0m up to 18.0 m	6.00
3	Above 18.0 up to 21.0 m	7.00
4	Above 21.0 up to 24.0 m	8.00
5	Above 24.0 m up to 27.0 m	9.00
6	Above 27.0 up to 30.0 m	10.00
7	Above 30.0 up to 35.0 m	11.00
8	Above 35.0 up to 40.0 m	12.00
9	Above 40.0 up to 45.0 m	13.00
10	Above 45.0 up to 50.0 m	14.00
11	Above 50.0m	16.00

WIDTH OF THE ROAD:

- While determining the width of the road the distance between the boundaries of a road including foot paths, drains measured at right angles at the center of the plot.
- In case of roads having service roads in addition to the main roads, the width of the roads shall be aggregate width of service roads and main roads for determining the FAR.

GROUND COVERAGE:

The total area covered by building immediately above the plinth level. Swimming pool, pump tank, pump house and electric substation, utilities are not included.

TWO OR MORE BUILDINGS ON THE SITE:

- For more than one building on a given site, the distance between the buildings shall be 1/2 the height of the tallest building, between the buildings under consideration.
- In case, two or more buildings with different heights are proposed on a single site, then setbacks shall be applied with reference to the tallest building.

Sl. No.	Size of the plot (sq. m)	Ground cover	FAR
1	Up to 500	60%	1.50
2	Up to 1000	55%	1.75
3	Above 1000 up to 2000	50%	2.00
4	Above 2000	45%	2.25

FAR and Ground Coverage in Public and Semi public

NORMS

KARNATAKA MUNICIPALITIES MODEL BUILDING BYE-LAWS 2017

PARKING REQUIREMENTS

Sl. No.	Type of use	One car parking space shall be provided for
1	Residential and institutional buildings	24 beds of accommodation subject to a minimum of 10
2	Medical buildings	15 seats of accommodation subject to a minimum of 10
3	Industrial and warehouse buildings	10 sq. mtr. of floor area
4	Shopping, retail and service buildings	25 sq. mtr. of floor area plus 1 car parking space measuring 4 x 6 mtr. for every 100 sq. mtr. of floor area
5	Logistics and warehouse buildings	4 rooms
6	Office buildings (Govt./Semi-Govt. & Pvt.)	80 sq. mtr. of office floor space
7	Hotels	10 rooms
8	Industrial buildings	100 sq. mtr. of floor area plus 1 car parking space measuring 4 x 6 mtr. for every 1000 sq. mtr. of floor area
9	Shopping centres	4 beds
10	Single Family Dwellings	60 sq. mtr. of floor area plus 1 car parking space measuring 4 x 6 mtr. for every 1000 sq. mtr. of floor area
11	Multi Family Dwellings	60 sq. mtr. of floor area plus 1 car parking space measuring 4 x 6 mtr. for every 1000 sq. mtr. of floor area
12	Residential buildings	10 sq. mtr. of floor area plus 1 car parking space measuring 4 x 6 mtr. for every 1000 sq. mtr. of floor area
13	Commercial buildings	100 sq. mtr. of floor area plus 1 car parking space measuring 4 x 6 mtr. for every 1000 sq. mtr. of floor area
14	Other public and semi-public buildings	100 sq. mtr. of floor area plus 1 car parking space measuring 4 x 6 mtr. for every 1000 sq. mtr. of floor area

STORAGE AREA SIZE

Project Built Up Area	Size of storage area
<5000 Sq. ft.	83 Sq. ft.
5001 - 15,000 Sq. ft.	125 Sq. ft.
15,001 - 50,000 Sq. ft.	175 Sq. ft.
50,001 - 100,000 Sq. ft.	225 Sq. ft.
100,001 - 500,000 Sq. ft.	275 Sq. ft.
> 500,001 Sq. ft.	300 Sq. ft.

MINIMUM WIDTH PROVISIONS FOR PASSAGEWAY/CORRIDORS

- The following minimum width provisions shall be made for each passage way/corridor.
- Residential buildings, up to 4 dwelling units
- Apartment buildings, hotels, etc.
- Assembly buildings like auditorium theatres and cinemas
- All other buildings including hotels
- Hospital, Nursing Homes, etc.

NORMS

KARNATAKA MUNICIPALITIES MODEL BUILDING BYE-LAWS 2017

Fig – 2.9.4

SANITATION REQUIREMENTS

Sl. No.	Sanitary Unit	For Males	For Females
1	Urinal (Public Use)	One for every 10 persons or part thereof.	Not for every 10 persons or part thereof.
2	Water Closet (W.C.)	One for every 10 persons or part thereof.	One for every 10 persons or part thereof.
3	Wash Basins	One for every 20 persons or part thereof.	One for every 20 persons or part thereof.
4	Baths with Shower	One for every 10 persons or part thereof.	One for every 10 persons or part thereof.
5	Chamber's Sink	One for every 10 persons or part thereof.	One for every 10 persons or part thereof.
6	Kitchen sink & dish rack	One for every 10 persons or part thereof.	One for every 10 persons or part thereof.
7	Drinking water fountain	One for every 10 persons or part thereof.	One for every 10 persons or part thereof.

Sanitation requirements for admin

Sl. No.	Sanitary Unit	For Males	For Females
1	Urinal (Public Use)	One for every 10 persons or part thereof.	Not for every 10 persons or part thereof.
2	Water Closet (W.C.)	One for every 10 persons or part thereof.	One for every 10 persons or part thereof.
3	Wash Basins	One for every 20 persons or part thereof.	One for every 20 persons or part thereof.
4	Baths with Shower	One for every 10 persons or part thereof.	One for every 10 persons or part thereof.
5	Chamber's Sink	One for every 10 persons or part thereof.	One for every 10 persons or part thereof.
6	Kitchen sink & dish rack	One for every 10 persons or part thereof.	One for every 10 persons or part thereof.
7	Drinking water fountain	One for every 10 persons or part thereof.	One for every 10 persons or part thereof.

Sanitation requirements for restaurants

Sl. No.	Sanitary Unit	For Males	For Females
1	Urinal (Public Use)	One for every 10 persons or part thereof.	Not for every 10 persons or part thereof.
2	Water Closet (W.C.)	One for every 10 persons or part thereof.	One for every 10 persons or part thereof.
3	Wash Basins	One for every 20 persons or part thereof.	One for every 20 persons or part thereof.
4	Baths with Shower	One for every 10 persons or part thereof.	One for every 10 persons or part thereof.
5	Chamber's Sink	One for every 10 persons or part thereof.	One for every 10 persons or part thereof.
6	Kitchen sink & dish rack	One for every 10 persons or part thereof.	One for every 10 persons or part thereof.
7	Drinking water fountain	One for every 10 persons or part thereof.	One for every 10 persons or part thereof.

Sanitation requirements for interpretation centre

Sl. No.	Sanitary Unit / Fittings	For Personnel
1	Water closet	One for every 20 persons or part thereof.
2	Drinking Water Fountain	One for every 100 persons with a minimum of one in each floor.
3	Wash basin	One for every 20 persons or part thereof.
4	Urinal	One for every 10 persons or part thereof.
5	Chamber's Sink	One for every 10 persons or part thereof.

Sanitation requirements for shops and offices

Sl. No.	Sanitary Unit	For Boys	For Girls
1	Water Closet (W.C.)	One for every 10 persons or part thereof.	One for every 10 persons or part thereof.
2	Urinal	One for every 10 persons or part thereof.	Not for every 10 persons or part thereof.
3	Wash Basins	One for every 20 persons or part thereof.	One for every 20 persons or part thereof.
4	Baths with Shower	One for every 10 persons or part thereof.	One for every 10 persons or part thereof.
5	Chamber's Sink	One for every 10 persons or part thereof.	One for every 10 persons or part thereof.
6	Kitchen sink & dish rack	One for every 10 persons or part thereof.	One for every 10 persons or part thereof.
7	Drinking water fountain	One for every 10 persons or part thereof.	One for every 10 persons or part thereof.

Sanitation requirements for educational occupancy

NORMS
KARNATAKA MUNICIPALITIES MODEL BUILDING BYE-LAWS 2017

Fig – 2.9.5

36

ENVIRONMENTAL CONDITIONS FOR BUILDING AND CONSTRUCTION
(BUILDING CATEGORY 'I': 5,000SQM TO < 20,000SQM)

Sl. No.	Medium	Environmental conditions
1	Topography Natural Drainage	The natural drain system should be maintained for ensuring unrestricted flow of water. No construction shall be allowed to obstruct the natural drainage through the site. No construction is allowed on wetland and water bodies. Check dams, bio swales, landscape, and other sustainable urban drainage systems (SUDS) are allowed for maintaining the drainage pattern and to harvest rain water. Buildings shall be designed to follow the natural topography as much as possible. Minimum cutting and filling should be done.
2	Water conservations- Rain Water Harvesting and Ground Water Recharge	A complete plan for rain water harvesting, water efficiency and conservation should be prepared. Use of water efficient appliances should be promoted with low flow fixtures or sensors. The local bye-law provisions on rain water harvesting should be followed. A rain water harvesting plan needs to be designed where the recharge bores of minimum one recharge bore per 5,000 Sq.m of built up area and storage capacity of minimum one day of total fresh water requirement shall be provided. In areas where ground water recharge is not feasible, the rain water should be harvested and stored for reuse. The ground water shall not be withdrawn without approval from the Competent Authority.
2(a)		All recharge should be limited to shallow aquifer.
2(b)		At least 20% of the open spaces (setback area) shall be pervious. Use of Grass pavers, paver blocks with at least 50% opening, landscape etc. would be considered as pervious surface.
2(c)		Water efficient appliances shall be used. Low flow fixtures or sensors be used to promote water conservation.
3	Solid Waste Management	Separation of grey and black water should be done by the use of dual plumbing system. In case of single stack system separate recirculation lines for flushing by giving dual plumbing system be done.
3(a)		Solid waste: Separate wet and dry bins must be provided in each unit and at the ground level for facilitating segregation of waste. The provisions of the Solid Waste (Management) Rules 2016 and the e-waste (Management) Rules 2016, and the Plastics Waste (Management) Rules 2016 shall be followed.
3(b)		All non-biodegradable waste shall be handed over to authorized recyclers for which a written tie up must be done with the authorized recyclers.
3(c)		Treatment of wet waste and sanitary waste on site (organic dry waste also is preferred) using Organic waste compostor/Vermiculture pit or any other approved technology shall be installed with a minimum capacity of 0.3 kg /person/day must be installed.

4	Seepage Treatment Plant	Onsite sewage treatment of capacity of treating 100% waste water to be installed. Treated waste water shall be reused on site for landscape, flushing, cooling tower, and other end-uses. Excess treated water shall be discharged as per CPCB norms. Natural treatment systems shall be promoted. Sludge from the onsite sewage treatment, including septic tanks, shall be collected, conveyed and disposed as per the Ministry of Urban Development, Central Public Health and Environmental Engineering Organisation (CPHEEO) Manual on Sewerage and Sewage Treatment Systems, 2016.
5	Energy	Compliance with the Energy Conservation Building Code (ECBC) of Bureau of Energy Efficiency shall be ensured. Buildings in the States which have notified their own ECBC, shall comply with the State ECBC. All lighting and other electric fixtures shall be of low energy consumption (Electrical Appliances – BEE Star and Energy Efficient Appliances). Concept of passive solar design that minimize energy consumption in buildings, by using design elements, such as building orientation, landscaping, efficient building envelope, appropriate fenestration, increased day lighting design, and thermal mass etc. shall be incorporated in the building design.
5(a)		Solar, wind or other Renewable Energy shall be installed to meet electricity generation equivalent to 5% of the demand load calculated based on the peak load calculated from the hourly power load chart prepared for the project by considering permissible diversity in usage and occupancy. If the required power generation cannot be done within the project site, the same can be generated from outside the project site and the credit can be availed for the project.
5(b)		Solar water heating shall be provided to meet 20% of the hot water demand of the commercial and institutional building or as per the requirement of the local building bye-laws, whichever is higher. Residential buildings are also recommended to meet its hot water demand from solar water heaters, as far as possible.
5(c)		Use of environment friendly materials in bricks, blocks and other construction materials, shall be required for at least 20% of the construction material quantity. These include fly ash bricks, hollow bricks, AACs, Fly Ash Lime Gypsum blocks, Compressed earth blocks, and other environment friendly materials. Fly ash should be used as building material in the construction as per the provisions of the Fly Ash Notification of September 1999 as amended from time to time.
6	Air Quality and Noise	Dust, smoke & other air pollution prevention measures shall be provided for the building as well as the site. These measures shall include screens for the building under construction, continuous dust/ wind breaking walls all around the site (at least 3 m height). Plastic/ tarpaulin sheet covers shall be provided for vehicles bringing in sand, cement, murrum and other construction materials prone to causing dust pollution at the site as well as taking out debris from the site. Sand, murrum, loose soil, cement, stored on site shall be covered adequately so as to prevent dust pollution. Wet jet shall be provided for grinding and stone cutting. Upgraded surfaces and loose soil shall be adequately sprinkled with water to suppress dust. All construction and demolition debris shall be stored at the site and not dumped on the roads or open spaces outside before they are properly disposed. All demolition and construction waste shall be managed as per the provisions of the Construction and Demolition Waste Rules 2016.
6(a)		All workers working at the construction site and involved in loading, unloading, carriage of construction material and construction debris or working in any area with dust pollution shall be provided with dust mask. For indoor air quality, the ventilation provisions as per National Building Code of India shall be made. The location of the DG set and exhaust pipe height shall be as per the provisions of the CPCB norms.
7	Green cover	A minimum of 1 tree for every 80 Sq.m. of land should be planted and maintained. The existing trees will be counted for this purpose. Preference should be given to planting native species. Where the trees need to be cut, compensatory plantation in the ratio of 1:3 i.e. planting of 3 trees for every 1 tree that is cut shall be done and maintained.
7(a)		

NORMS
KARNATAKA MUNICIPALITIES MODEL BUILDING BYE-LAWS 2017

Fig – 2.9.6

37

CHAPTER 3–CASE STUDY

3.1 NOAA Southwest RESEARCH Center La Jolla, California

Location: California, United States

Typology : Education, Community

Architect : Gould Evans

Project Area : 124,000 sq.ft (office and labs)

90,000 sq.ft (covered parking)

Project Year: 2013

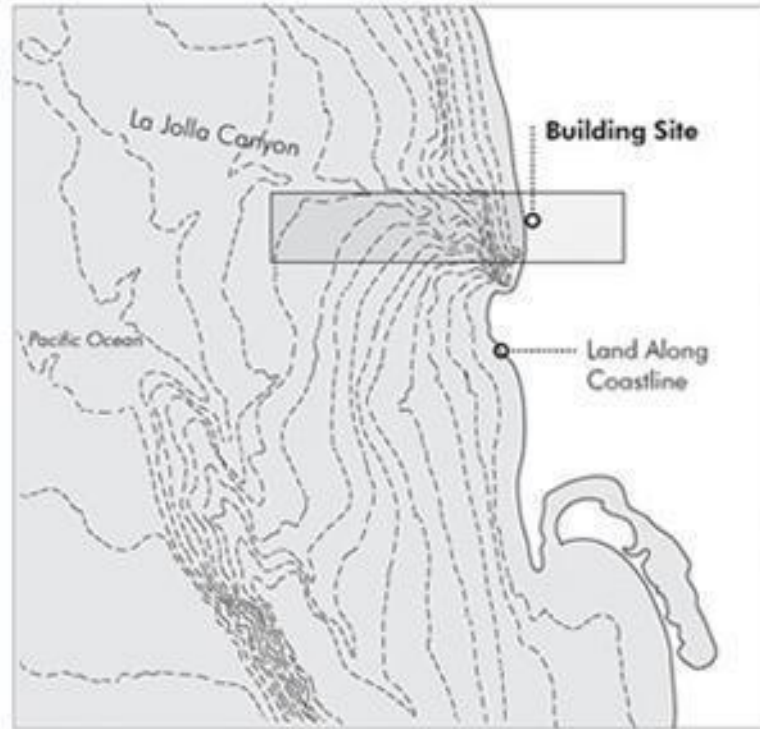
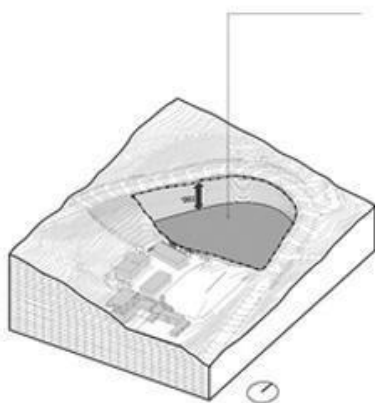


Fig – 3.1.1

The NOAA Southwest Fisheries Science Centre, is a research facility helped to recruit talented scientists and also support ongoing research for the management and conservation of the region's living marine resources.

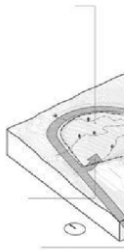
38



The Site

Situated on the cliffs of the La Jolla shore line, the line for the replacement of the facility is on an undeveloped site on the inside of a hairpin curve. It is an unspoiled plot of land overgrown with native coastal landscape and uninterrupted views of the Pacific Ocean

Fig – 3.1.2



Existing pedestrian Way

Currently the site is a n for students, neces movement of foot traff site.

Hairpin curve:

The site is situated on a prominent hairpin curve, making the building visible on all four sides.

Fig – 3.1.3

Point of Entry:

The site's extreme topography provides only one location for access by pedestrians, by car, and by service vehicles.

39

Existing Buildings:

Research buildings house the Scripps Institute of Oceanography



Fig – 3.1.4

Response to Topography

The vacant lot is perched at the top of the La Jolla canyon, an underwater topographic feature that's a critical landmark for the work on Southwest Fisheries.

This canyon, and therefore the adjacent San Diego-La Jolla Underwater Park and Ecological Reserves, allow researchers quick access to the deep sea of the Pacific . As designers, felt the building should answer this topography, and utilize massing anomalies to make outdoor gathering spaces, rooftop terraces, and courtyards. As a result, the building responds as a contextual extension of the Canyon, while it creates different levels of activity for researchers.

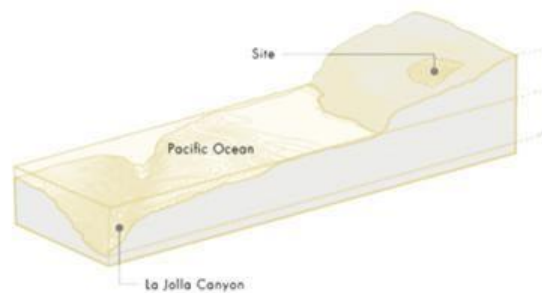


Fig – 3.1.5

Emulating the topography of the underwater canyons and therefore the coastal bluff, the laboratory orients itself to the Pacific during a way that creates it the topic and object of its research

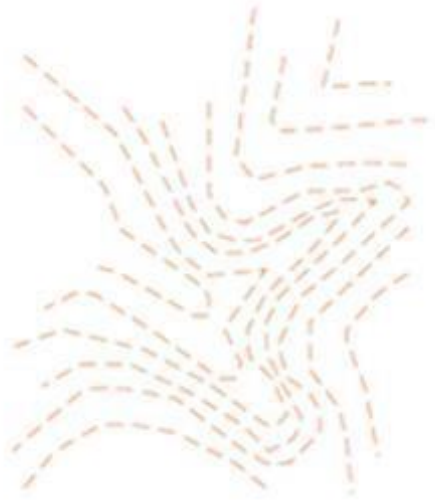


Fig – 3.1.6 Underwater canyon

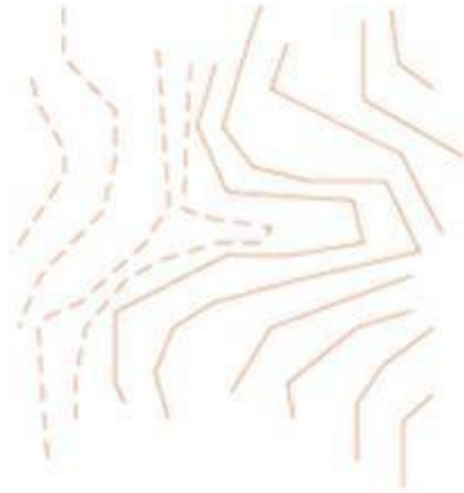


Fig – 3.1.7 Coastline



Fig – 3.1.8 Site topography
ARRANGEMENT OF PROGRAM

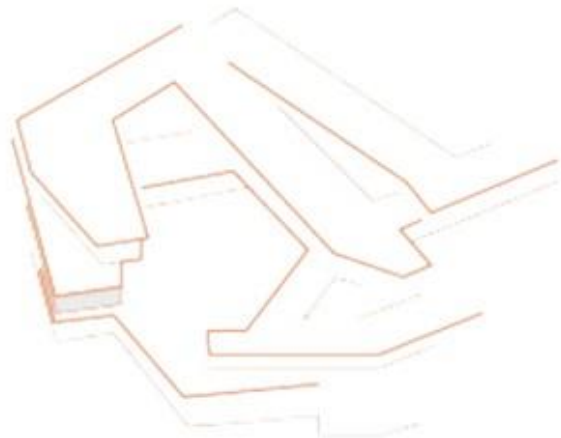


Fig – 3.1.9 Built form

Block out program

First the program was stacked to fit it onto the site, adding more 'daylight intensive' ones on the top

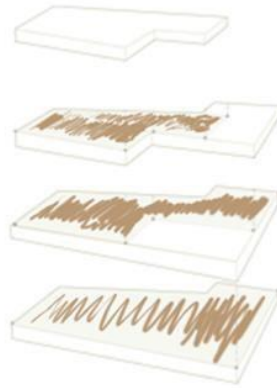


Fig – 3.1.10

Open up to views

For allowing daylight and natural ventilation into the offices and laboratories, the buildings were opened up. The angles were done by orienting them to views.

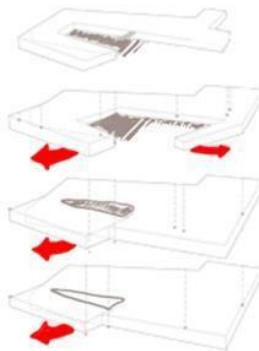


Fig – 3.1.11

Open up to light

To respond to the pleasant southern California climate, and to usher in natural light and ventilation; open courtyards are dig the center of the offices.

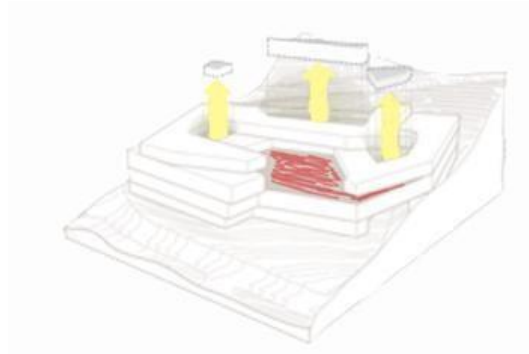


Fig – 3.1.12

The modern facility is weakened into smaller structures which are clustered in “villages” no quite two stories tall so as to avoid the sensation of one large building.

The smaller elements are organized around atrium courtyards. These are the centres of activity that enable researchers to attach for impromptu meetings. The courts and patios compliment the mild climate and improve natural ventilation. This plan with narrow floor plates maximizes sunlight and views possibilities



Fig – 3.1.13 North Elevation



Fig – 3.1.14 South Elevation

The 124,000 sq ft building was inserted into a steep contour to take care of ocean views from the road above and efficiently accommodate a posh program of offices, laboratories, conference rooms, parking, a library, and a 528,000 gallon ocean technology development tank – the most important of its kind within the world. Through its siting, materiality and use of green space, the five-story building never appears larger than three stories from the outside . It also never seems taller than three stories to the scientists who work there, fostering a sense of scientific community



Fig – 3.1.15 Floor Plan



Fig – 3.1.16 Plan@ Level 2

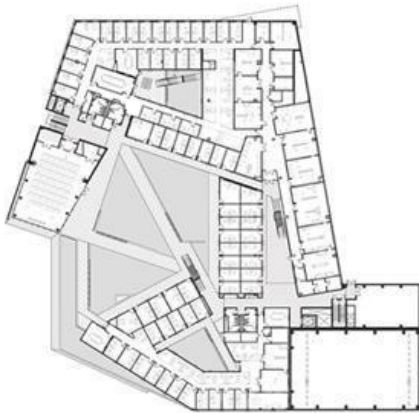


Fig – 3.1.17 Plan@ Level 3



Fig – 3.1.18 Plan@ Level 4

DESIGN DEVELOPMENT

Challenged to relocate an existing facility threatened by coastal erosion, the team designed a stunning new research environment that appears to grow from the surrounding bluffs. The building is perched at the head of the La Jolla Canyon, a bathymetric feature that provides researchers with access to the deep Pacific Ocean. The architecture reacts to this topography, utilizing massing anomalies to create outdoor gathering spaces, rooftop terraces, and courtyards that reinterpret the beloved “courtyard culture” of NOAA’s former facility.

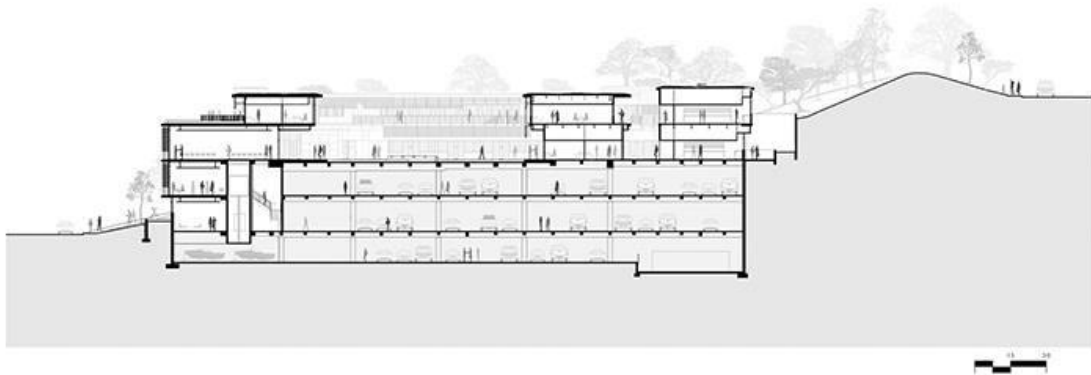


Fig – 3.1.19 Section

The Southwest Fisheries building takes advantage of the local microclimate while respecting the ever changing needs of the research scientists. The new facility continues the California-style legacy of an open architectural environment,

For a building dedicated to marine ecosystem health, sustainable design was critical. However, laboratories consume about five times more energy per square foot than a typical office building. To offset this, the building has narrow floor plates that permit daylight to permeate the spaces, fan-assisted natural ventilation, and high-efficiency equipment and lighting.

The green roof has been planted with a variety of native species, including coastal chaparral and sage. Solar shading on the west- and south-facing windows contribute to reducing the building's cooling loads to 69% less than that required by ASHRAE 90.1-2004 standard.

A large photovoltaic array on the roof offsets 7% of the building's energy needs: equivalent to the energy that would power 40 typical houses in the region. Altogether, these features reduce projected energy use by 33% compared to similar buildings.



Fig – 3.1.21



Fig – 3.1.22



Fig – 3.1.23

PURPOSE

- To understand the design approach, working of spaces of a research center
- Also the design contributes to a thriving maritime community in San Diego for current and future generations, which is one ideation among the proposed design

INFERENCE

- The design of the building captures the 'courtyard culture' with natural light, natural ventilation and numerous areas for people to gather and exchange ideas.
- It lets in light and air, views of the ocean and the hills, the scent of the sea.
- There is clear zoning and circulation pattern for what the user is meant to experience of the building.
- The building design infuses the laboratory with light, fresh ocean air, and sweeping coastal views while the green building features create a less-impactful human footprint.

3.2 COASTAL MARINE RESEARCH STATION, EL TABO, CHILE

Location : EL TABO, CHILE

Typology : Research Centre

Architects : Martin Hurtado Arquitectos

Year : 2010

Site Area : 2.4 Há



Fig – 3.2.1



Fig – 3.2.2



Fig – 3.2.3

The project is understood to complement existing facilities in Las Cruces for scientific research and post-doctorates. The current building responds to the needs of scientists with prolonged residences according to the duration of their respective investigations.



Fig – 3.2.4 Ground Floor Plan

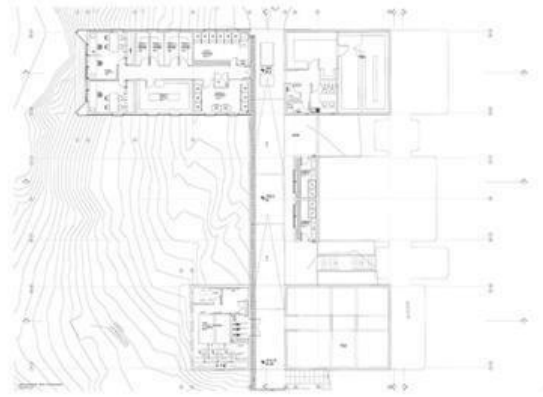


Fig – 3.2.5 First Floor Plan

PROGRAM

For the program, three areas were requested: research area, multipurpose area and the International Laboratory for Global Change (LINC-Global).

Considering this and the shape of the lot (a peninsula with steep slopes, declared a nature reserve with human exclusion, enclosing a 1 km area of coastline in 1982, being one of the first of its kind in the world), the project has three volumes parallel and far between, which privilege the views of the sea (the goal of

work and research), each corresponding to the requested areas, so as to make autonomous the volumetric of the program and gain freedom to adapt to the specific needs of each section.

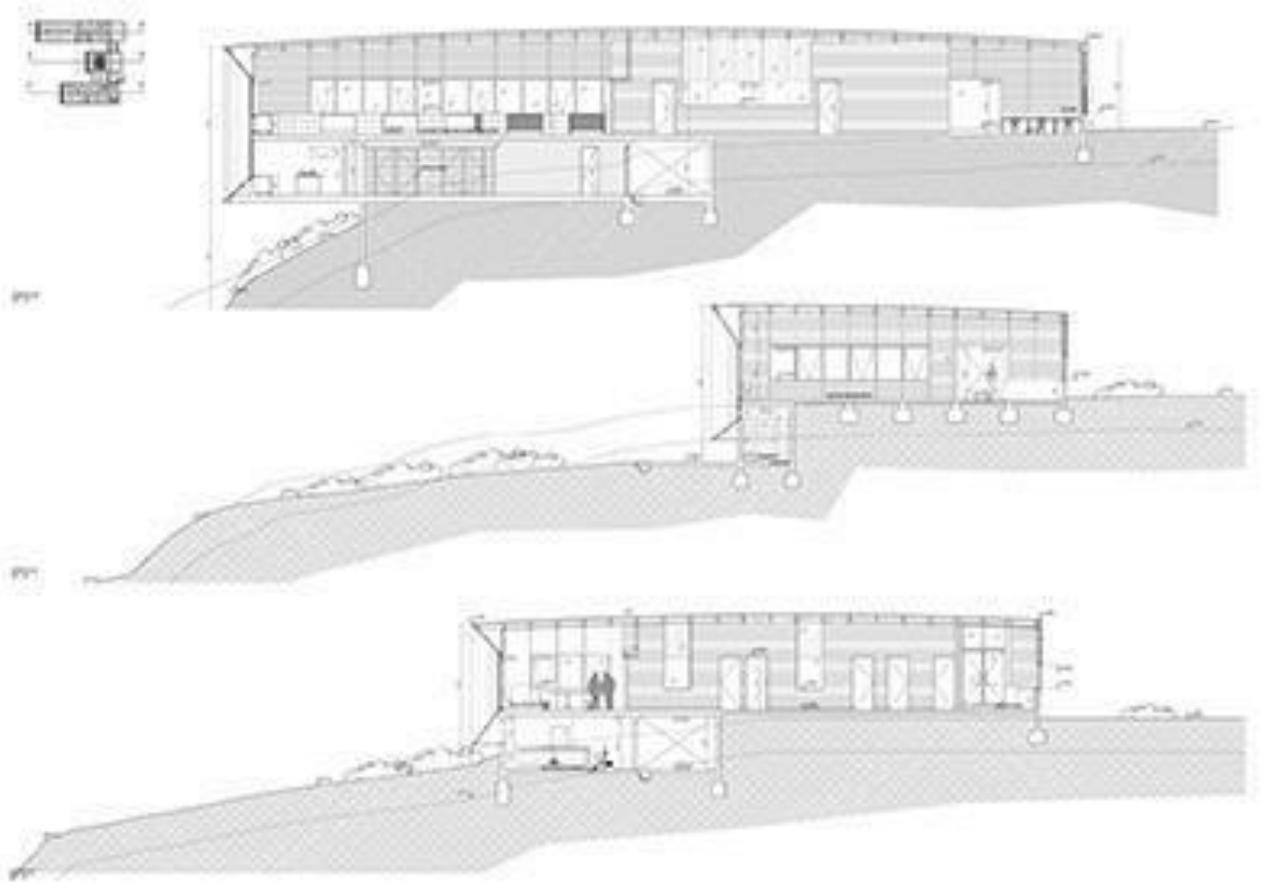


Fig – 3.2.6 Sections

FUNCTION

Unlike the existing building, the proposed building meets the requirements of the new Marine Biology undergraduate degree from Universidad Catolica. As its headquarters are located in Santiago, the undergraduate facilities of the Coastal Marine Research Station have an occasional use, with a period of greatest use in the months between November and March, not exceeding 40 students using the facilities at any one time, including research laboratories and complementary laboratories.

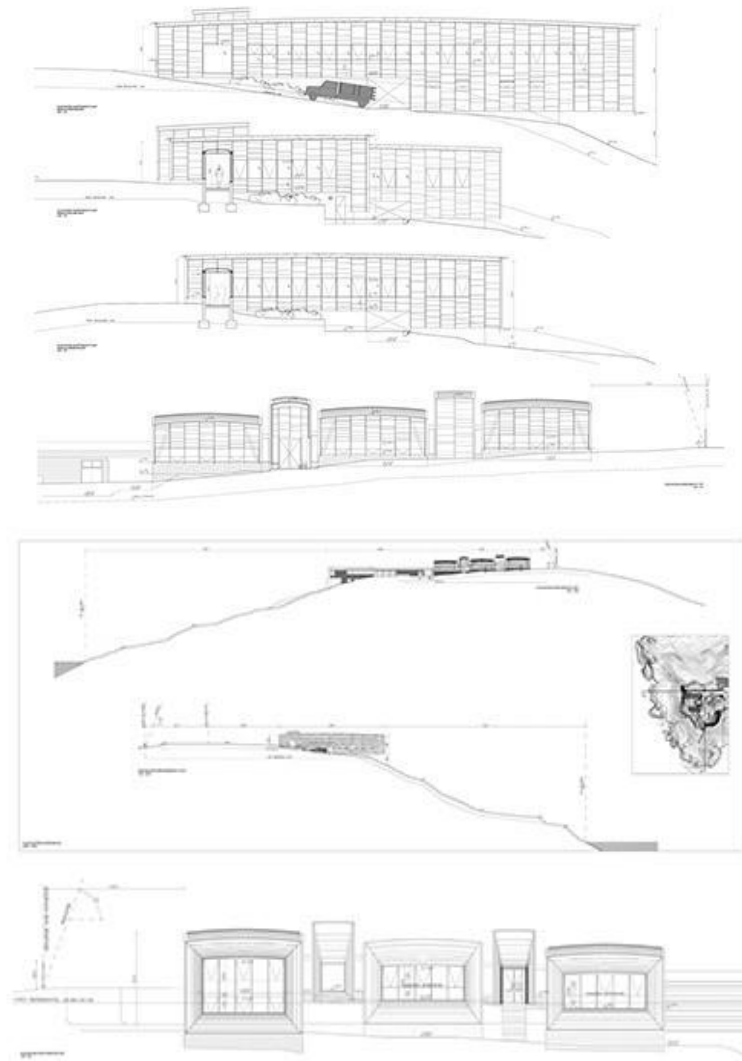


Fig – 3.2.7 Elevations

These volumes are made up of a sequence of plywood frames supported on concrete bases partially buried in the slope. These bases house technical facilities for the building, such as Filtering Area, Carpentry Workshop, storage, and Diving Pañol.

This project emphasizes the use of Fiber-cement Permanit Wood exterior cladding from Pizarreño. This exterior cladding solution is part of a dry construction and rapid execution system, which generates thermal, fire, and acoustic resistances.



Fig – 3.2.8



Fig – 3.2.9



Fig – 3.2.10



Fig – 3.2.11

3.3 KALADHAM INTERPRETATION CENTRE, HAMPI

Location : Toranagallu, Karnataka

Typology : Educational/ Recreational

Architect : Sanjib Chatterjee

Site Area : 72912 sq m/ 18 acres

Builtup Area : 5820 sq m

Types of users : Tourists



Fig – 3.3.1 Site Plan

SITE AREA - 72912 sq m

BUILT UP AREA - 5860 sq m

LEGEND

- 1 Entry
- 2 Arrival court
- 3 Water body

- 4 Interactive museum
- 5 Conference hall
- 6 Souvenir shop
- 7 Library
- 8 Cafe
- 9 Lawn
- 10 Amphitheatre
- 11 Dancing hall
- 12 Rainwater reservoir

Kaladham is located at Vijayanagar, 25kms from Hampi. Inaugurated in 2012, the Interpretation Centre is an initiative of Mrs. Sangita Jindal and the JSW Foundation. It is a unique contribution to the visual and acoustic record of the Hampi precinct. Kaladham draws upon the products of the archeological imaginary and the visual languages of archaeology, photography and new media. In this Interpretation Centre these elements converge to present the ancient Hindu kingdom of Vijayanagara from a myriad of perspectives.



Fig – 3.3.2 Accessibility maps

The site is easily accessible by various means. Apart from private transports, it is very close to public transportation points as well. Every point is within 15 mins travel from the site

CONTOUR

The site has a gradual descent from the road level. The road being the highest point and considered as 0 lvl. The water bodies have been carefully planned at the lowest point of the site.

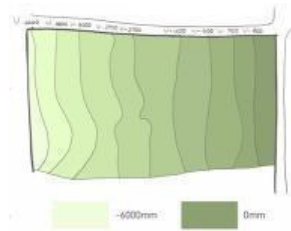


Fig – 3.3.3 Site Contour

ZONING

The site has a distinctively worked out zoning of the program with a water body connecting all the spaces

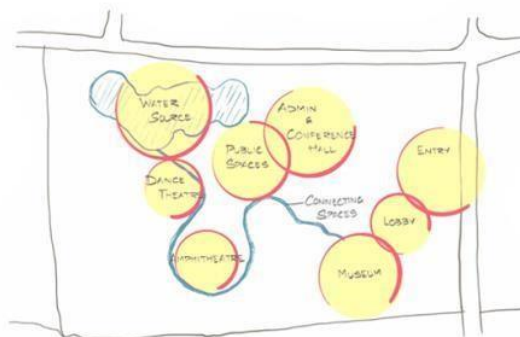


Fig – 3.3.4 Site Zoning

The program has been predominantly divided into

- Entry
- Interpretation Centre
- Congregation spaces
- Admin block
- Theatre block
- Recreational features

The campus celebrates the vernacular style of the region - and has explored many ways of including the arts and crafts of the region in the spaces. The building design resonates the local arts in its design. Contemporary interpretations of local crafts were developed as elements of the building as well as to be displayed in the crafts store and museum.

Artisans are invited from all over the region to practice their art and craft at the Kaladham Interpretation Centre.



Fig – 3.3.5

CIRCULATION

- The site entry has a set of stone hedges arranged in certain pattern implying the relation to the remains of Hampi
- From the entry the space directly leads to the interactive museum which is the crux of the complex
- The spaces that adhere to the museum follow it. These are the common congregational spaces like restaurant, souvenir shop, library etc.

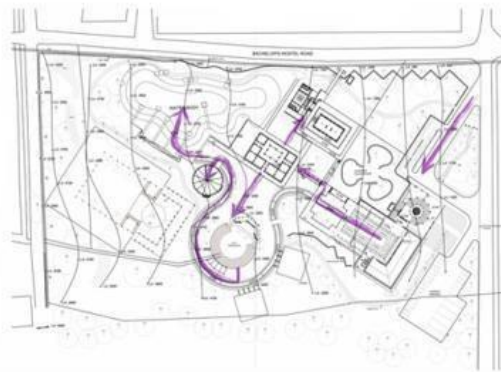


Fig – 3.3.6

- People can split to either the theatre or the admin block depending on their needs. There is a separate dance hall which caters to promoting the culture
- In addition there is a water feature which is enclosed by these structures on one side and the site edge on the other.



Fig – 3.3.7



Fig – 3.3.8



Fig – 3.3.9 Kaladham

was built with the idea of 'building responsibly'. Making environment as the first priority for sustainable living. Maximizing use of materials and skills available locally, minimizing the use of materials shifted from afar. Maximizing connection

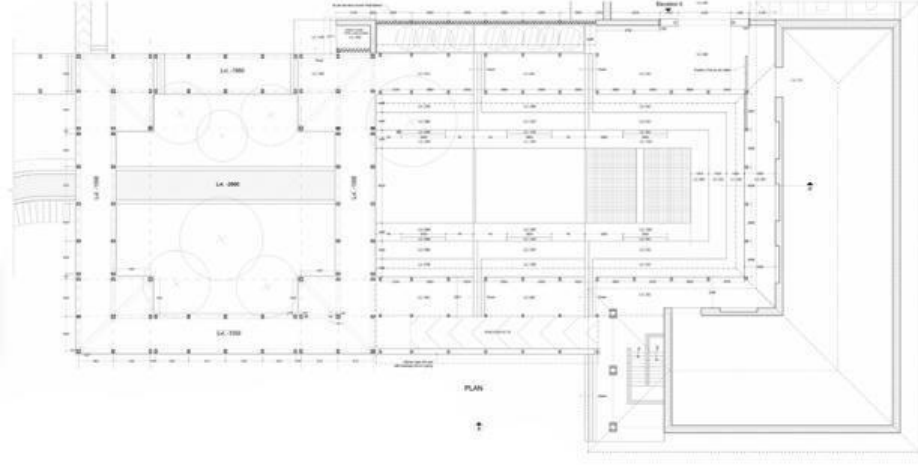


Fig – 3.3.10 Floor Plan



Fig – 3.3.11 Elevation

ECONOMIC REGENERATION

Through Kaladham the local economy would be revived in a sustainable fashion that encourages the community to grow culturally while providing avenues for them to earn their livelihoods

ACCESS CONSTRAINT

The site is located 36km from Hampi and for a tourist visiting Hampi it is not possible to visit Kaladham and get a gist of Hampi and then visit Hampi. So tourists usually skip Kaladham and visit Hampi directly and the structure fails to serve its purpose and besides this as the structure is in Jindal city it is tough to visit the museum for an outsider without permission

RAINWATER HARVESTING

The water is stored in a lake that was created as a catchment for the site (made by reclaiming the soil and piling it up in other places within the site).



Fig – 3.3.12 Rainwater harvesting

MATERIAL

Instead of using resource intensive concrete and cement which have now become the norm, local granite in various forms and treatments. Kaddapah, Bethamchellah were used. Rapidly renewable bamboo, highly multifunctional in its properties lends itself to a very high degree of structural and aesthetic qualities. The roof of a dance hall was constructed completely out of Bamboo and thatch.



Fig – 3.3.13 Materials

Kaladham is an International Arts and Cultural Centre, part of the JSW Foundation's initiative for bringing awareness about India's living heritage. It is a hub that inspires traditional as well as contemporary artists and performers across boundaries in India to collaborate, learn and try out new narratives from within existing domains of creativity.

PURPOSE OF STUDY

To understand the design approach, working of an Interpretation Centre. Also, the study is in relation to the scale of the design aimed

INFERENCE

- Supports only commercial art and dance forms
- Located very far off from Hampi
- Main source of employment and techniques used for construction
- The Intangible heritage has been completely ignored
- Parking provided only for the visitors

3.4 JAYAPRAKASH NARAYAN INTERPRETATION CENTRE

Location : Lucknow

Typology : Educational/Recreational

Architect : Sourabh Gupta, Studio Archohm

Site area : 3269 sq m

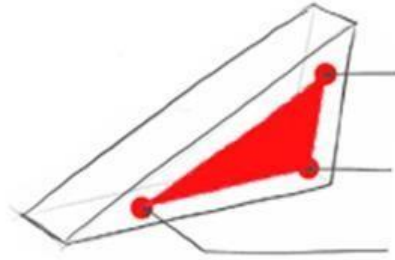
Types of users : Tourists, Residents



Fig – 3.4.1 Site Plan

ORIENTATION

The JPN Museum is a gateway framing the centre placed as a wedged-shaped monument with a massive arch carved out of the mass. The building oriented in such a way that the longer side faces north and south while the shorter edges face east and west.



EQUALITY
FREEDOM
BROTHERHOOD

Fig – 3.4.2 Concept

CONCEPT

The wedge shaped museum is actually a slice of the same shape and size carved out from the mass of the international centre building - leaving in its place, a void that opens up the centre. It then takes a seat on the site in a way that is majestically juxtaposed with the International Centre, thus creating its own identity even while owing allegiance to it.

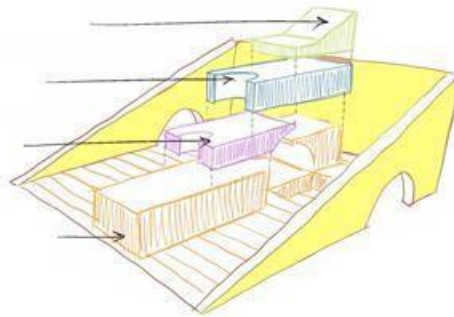
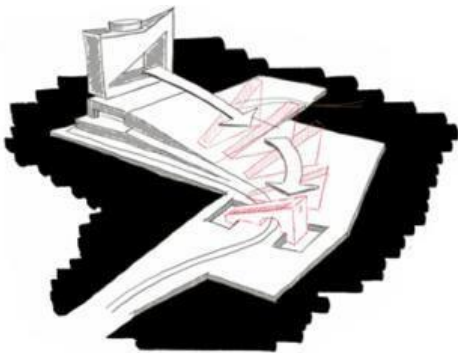


Fig – 3.4.3 Building Form

FORM

The wedge shaped museum is actually a slice of the same shape and size carved out from the mass of the interpretation center building. Despite, the scale and the unconventional shape, the building with its clean and clear lines is deceptively simple.

ELEMENTS OF DESIGN

The monolithic and bold form of the building takes a stance, and exudes empowerment, saying that, be it a building or man, one must be undaunted while envisioning and realizing a dream. The profound depth and complexity is revealed on the inside and it only reinforces the notion of simplicity being rooted in deep-thought and reflection.

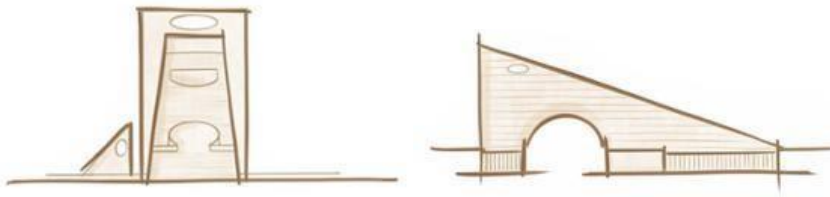


Fig – 3.4.4

CIRCULATION

Spaces are distributed in the horizontal and vertical plan in cohesion so that the journey although in parts and in sync with the prescribed zones of experience, seems like a singular one. Spatial distribution is thematic in nature.

The transition from one-space to another is ironically seamless yet punctuated from floor to floor by stairs and ramps.

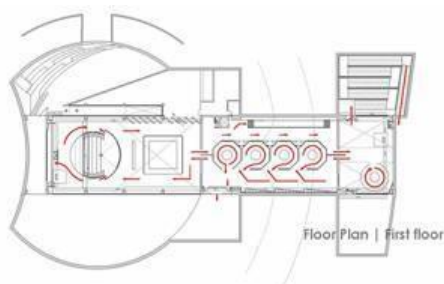


Fig – 3.4.5 Floor Plan-FF

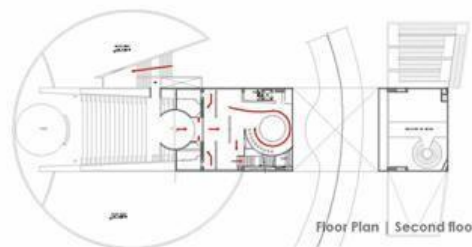


Fig – 3.4.6 Floor Plan-SF

SUSTAINABILITY ASPECTS

Once inside, light is sent on a wild goose chase so that when it returns, it is controlled and its tonality is most appropriate for the visual spread and to enlighten the minds absorbing it. Water is used as a medium of reflection; reflection of the building reiterating its mission and of oneself in an introspective mood.

Contrary to the expansive blank walls implying a sense of constricting ventilation, large slits along the entire stretch of the steps of congregation bring in the required light and ventilation to the volumes beneath it and across floors.



Fig – 3.4.7

The experience is made interesting, complex and layered by the use of the third dimension that involves not a play of voluminous spaces, but also of levels. A deceptive singular platonic outer shape belies the complexity of the play of levels inside

Large voluminous spaces enable the creation of bespoke back-drops for the thematically designed experiences while providing the necessary curatorial flexibility needed by a typology of this nature.

Platonic volumes try to induce clarity into the visceral experience of space; this clarity also echoes JP's character. Additionally, their three-dimensional property supports a

multi-dimensional and more meaningful experience; even adding a dose of surrealism to it.

Natural light is designed to express that it is not easy to come by but at the same time, allowed to exercise leverage and make its presence felt, understood and valued. With an introverted character required of the institution, the facades have been designed as black walls on the exterior

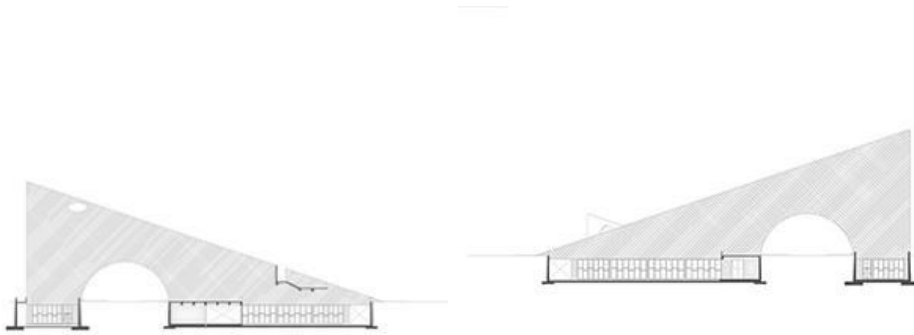


Fig – 3.4.8

MATERIALS

The material choice conveys a certain timelessness and ease of maintenance, both elements much needed for a public space of this nature.

- a. The building is itself sculptural in nature, it seemed best to construct in concrete.
- b. Terracotta cladding throws light on its desire to cohabit - it's warm, earthy and deep texture is very indigenous.
- c. Granite also reiterates the grounded and strong personality. It is employed as a pattern of inflamed and honed textures on the steps of contemplation for visual appeal.

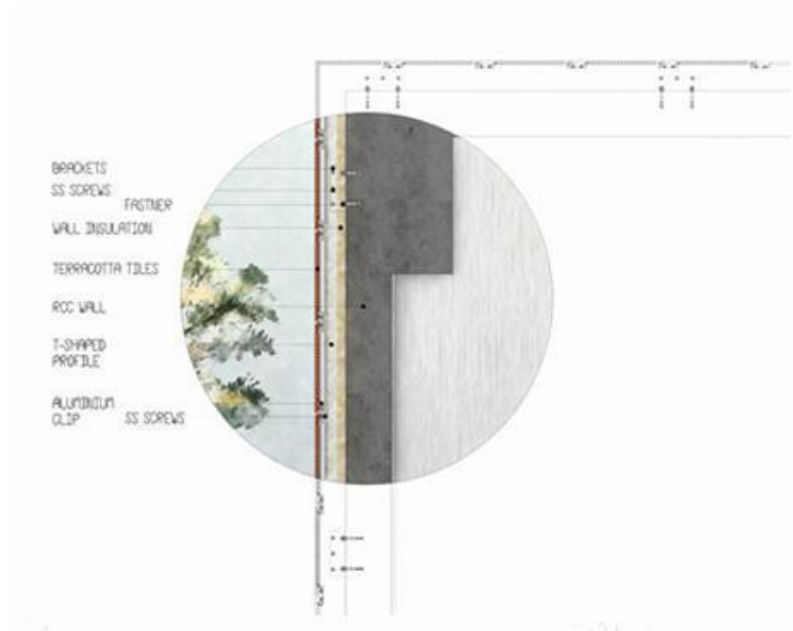


Fig – 3.4.9 Materials

Water has been used as a landscape element from an ecological point of view as well; it is a simple and passive means of cooling air, the air cooled as a result of contact with water rises and ventilates the spaces environment without much ado.

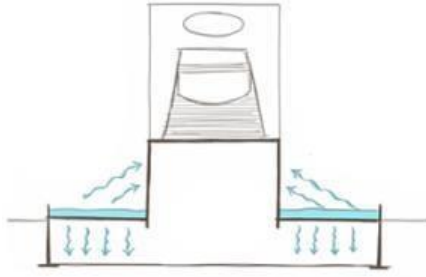


Fig – 3.4.10 Water

INFERENCE

- The entire building follows a narrative influenced by the life of Jayaprakash Narayan
- A lot of exhibits are based on the use of electricity and there is not enough backup power.
- Therefore such displays are just in display but not in working condition
- It is located in a prime location within the city to show the people the immense power they possess; the power to bring about a change
- Usage of materials has been carefully chosen to adhere to the expression of the building

3.5 BULEMBU VOCATIONAL TRAINING CENTRE

Location: Bulembu, Swaziland

Architect : Bell Architects, Ireland

Developer : Canadian International Development

Agency, Sahee

Year : 2011

Function : Vocational training centre

Total floor area : 200 m²



Fig – 3.5.1 Site location

The overall objective of the Bulembu Vocational Training Centre is to alleviate poverty and unemployment by providing vocational training and job-creation projects for unemployed youth- especially those from historically disadvantaged communities.

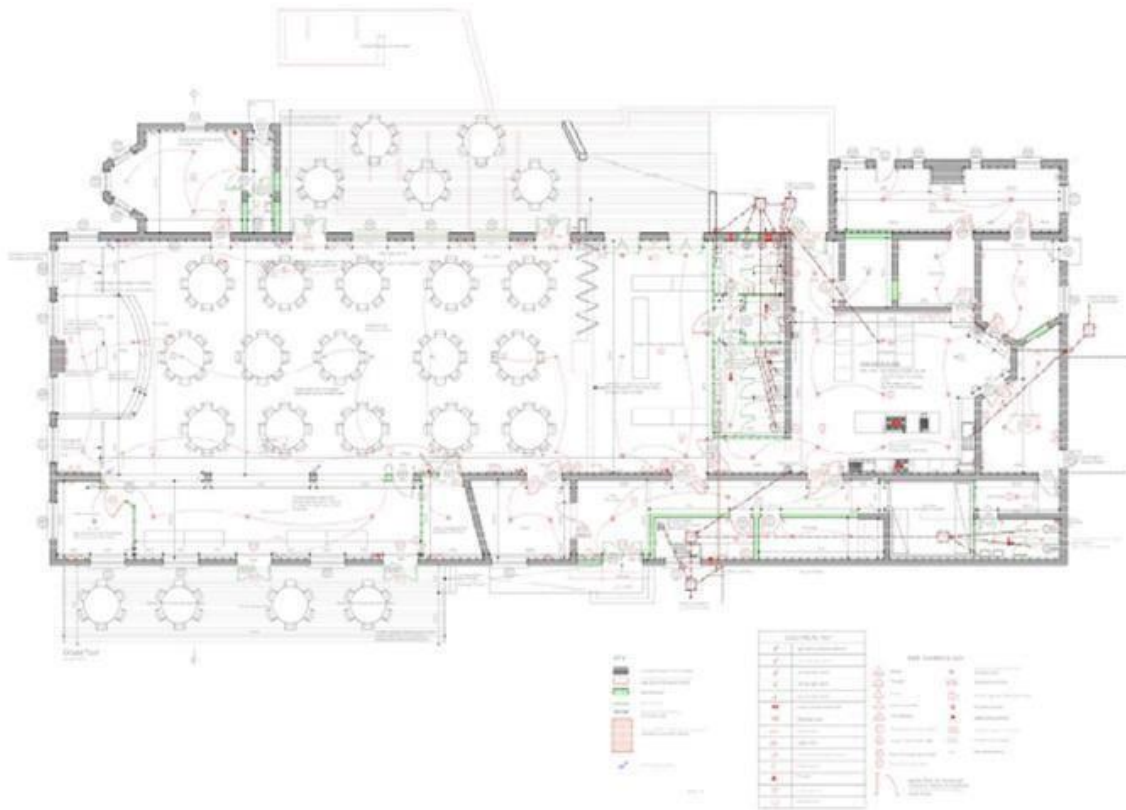


Fig – 3.5.2 Floor Plan

The Bulembu Vocational Training Centre seeks to provide youth with market driven technical job skills and training for the hospitality industry that will enable them to secure steady, well-paying jobs and become productive members of society and the community. The VTC will also provide personal and social competencies, and impart key skills and abilities required in working life both in rural and urban areas. The focus is on providing short, hands-on competency based training programs which equip trainees with skills, entrepreneurial acumen and productive competencies needed for employment.



Fig – 3.5.3 From Top Left- West Elevation, East Elevation, Entrance feature detail, Section, North elevation, South elevation

The curriculum includes areas of focus to the hospitality industry such as food preparation and culinary arts; food and beverage service; reception operations and services; accommodation operations and services; and, international tourism. Subset classes will focus on English proficiency, AIDS awareness, Entrepreneurship and Leader Development

INFERENCE

- Tourism Vocational Training Development Network has been established in order to disseminate learning, share best practices and facilitate knowledge sharing around the region.
- The facility is combined with a multi-functional hall for the use of the community

3.6 VAGHALDHARA VOCATIONAL TRAINING CENTRE

Location : Vaghaldhara, Gujarat

Architect : Vaghaldhara Vibhag Kelavani Mandal

Year : 2010

Function : Vocational training centre

Site area :18000 m²



Fig – 3.6.1 Site Plan

The vocational center is run by a charitable trust founder privileged tribal students in the Vaghaldhara area of Gujarat. The trust also runs a school in the same complex. The center offers training in (VVTC, 2013) (VVTC, 2009)

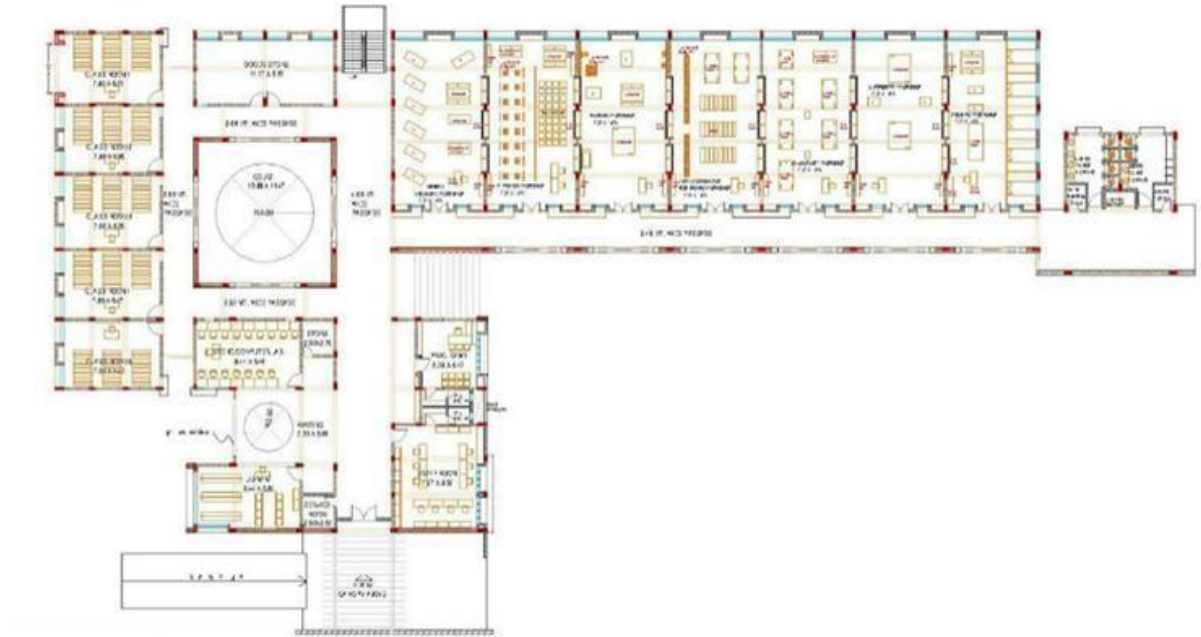


Fig – 3.6.2 Ground Floor Plan

- Electrical and house wiring
- Electrician
- Refrigeration and AC technician
- Refrigeration and AC mechanic
- Draughtsman civil
- Junior civil supervisor
- Computer operator
- Computer and tally operator

- Welder
- TIG and MIG welder
- Turner
- CNC turning operator

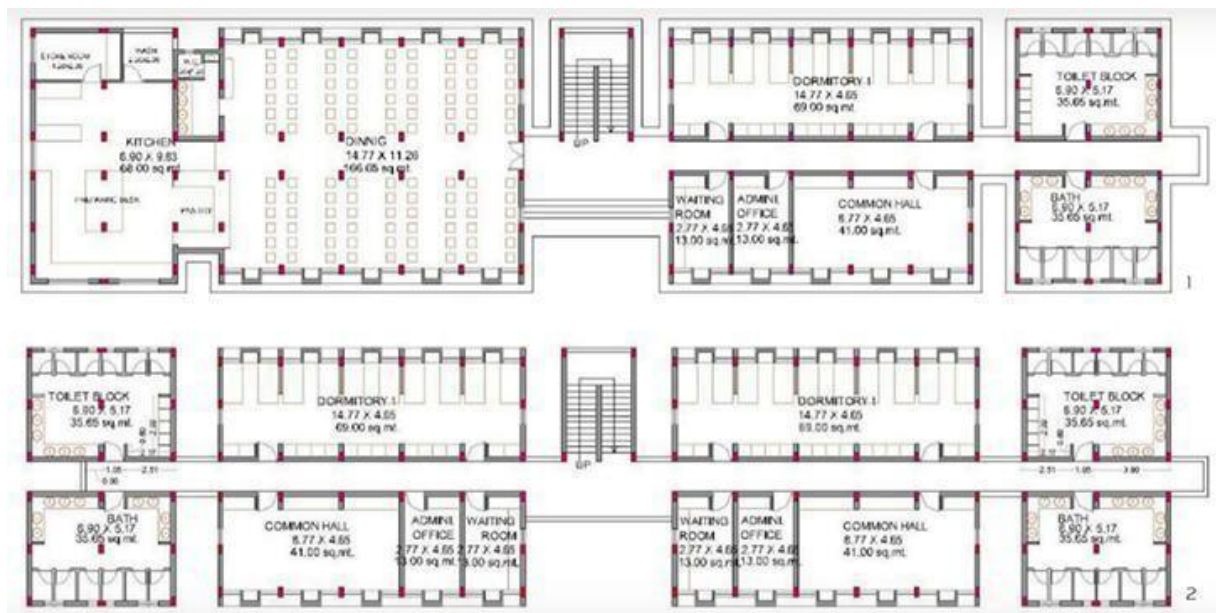


Fig – 3.6.3 First Floor Plan



Fig – 3.6.4



Fig – 3.6.5

INFERENCE

- The main intent- community development and vocational training
- All spaces open onto central courtyard, the significance of semi-open verandas and shaded areas

3.7 COMPARATIVE ANALYSIS

Comparative Analysis for all the above detailed out case studies has been tabulated below

ASPECT	NOAA SOUTHWEST RESEARCH CENTER	COASTAL MARINE RESEACH STATION	JAYAPRAKASH NARAYAN INTERPRETATION CENTRE	KALADHAM INTERPRETATION CENTRE	BULEMBU VOCATIONAL TRAINING CENTRE	VAGHALDHARA VOCATIONAL TRAINING CENTRE
TYPOLOGY	Educational, Research	Research	Recreational, educational	Recreational, educational	Community, educational	Community, educational
FUNCTION	Coastal Research Centre	Marine Research Station	Interpretation Centre	Interpretation Centre	Vocational training centre	Vocational training centre
LOCATION	California, United States	El Tabo, Chile	Lucknow, India	Toranagallu, Karnataka	Bulembu, Swaziland	Gujarat, India
ARCHITECT	Gould Evans	Martin Hurtado Arquitectos	Sourabh gupta, Studio Archelm	Sanjib Chatterjee	Bell Architects, Ireland	Vaghaladhara Vibhag Kelavani Mandal
YEAR	2013	2010	2016	2012	2011	2010
AREA	11520 sq.m	2100 sq.m	3269 sq.m	5820 sq.m	1400 sq.m	18000 sq.m
USERS	Researchers, conservation bodies, students, volunteers	Ecologist, Marine biologist, conservation bodies	Tourists, students, residents	Tourists, students	Residents, students, tourists	Students, Residents
DESIGN CAPACITY	275	80	120	200	30-40	310

OVERVIEW
COMPARATIVE ANALYSIS

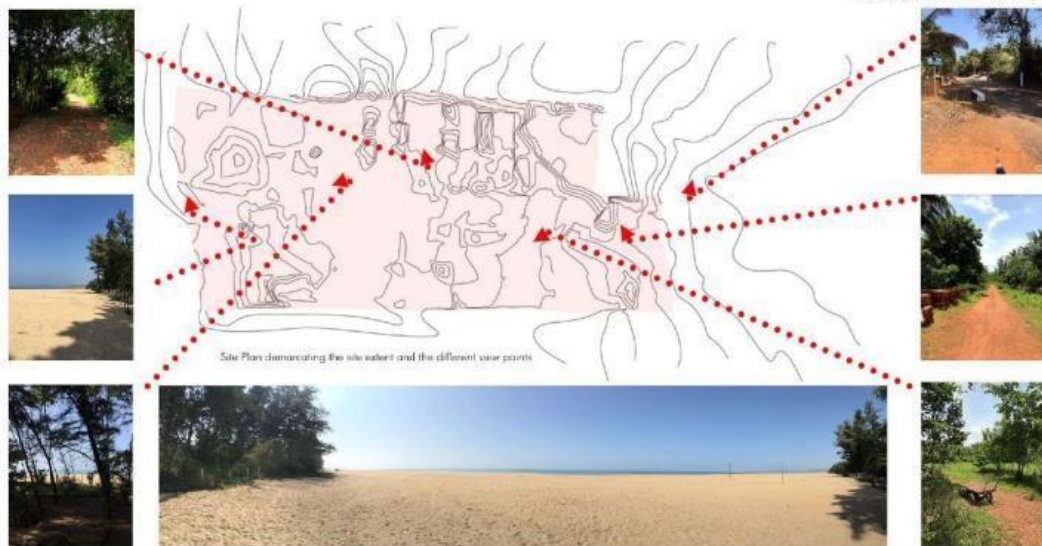
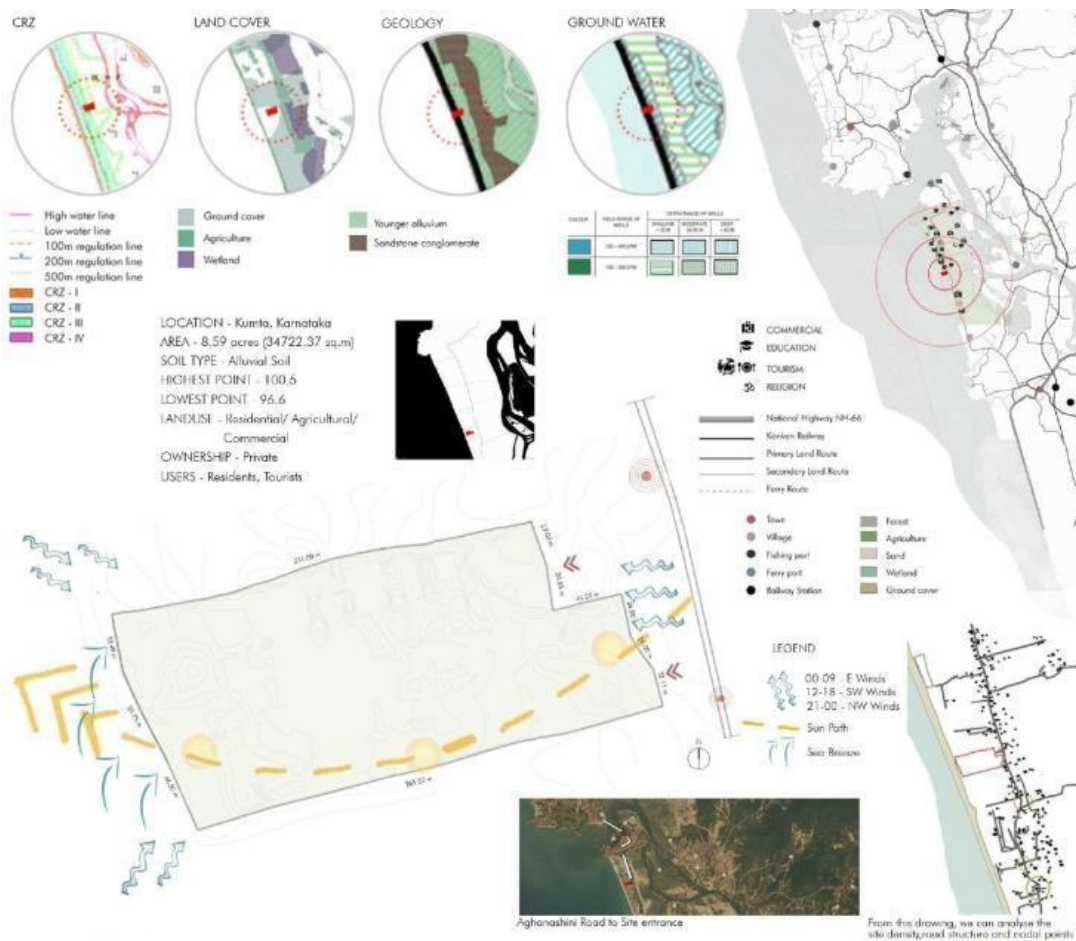
ASPECT	NOAA SOUTHWEST RESEARCH CENTER	COASTAL MARINE RESEARCH STATION	JAYAPRAKASH NARAYAN INTERPRETATION CENTRE	KALADHAM INTERPRETATION CENTRE	BULEMBU VOCATIONAL TRAINING CENTRE	VAGHALDHARA VOCATIONAL TRAINING CENTRE
SHAPE	Rectangular	Square	Trapezoidal	Square	Rectangular	Trapezoidal
ENTRANCE	Well defined	Well defined	Well defined	Well defined	Not well defined single	Defined single
CONTEXT	Along the shoreline, on the cliffs	Along the coast	Near Lucknow metro corporation	Away from the city centre, near Jindal Vijayanagar Airport	Residential area	Residential and commercial area
ACCESS	By road	By road	By road, metro and bus	By road, bus and air	By road and bus	By road and bus
LANDSCAPE	Prominent soft + hard	Prominent hard landscape	Prominent soft landscape	Prominent soft + hard	Not prominent soft landscape	Prominent soft landscape
BUILT : OPEN	1 : 1.5	1 : 5	1 : 3	1 : 4	1 : 3	1 : 2
VEGETATION- EXISTING	60%	80%	30%	40%	30%	30-40%

SITE
COMPARATIVE ANALYSIS

ASPECT	NOAA SOUTHWEST RESEARCH CENTER	COASTAL MARINE RESEARCH STATION	JAYAPRAKASH NARAYAN INTERPRETATION CENTRE	KALADHAM INTERPRETATION CENTRE	BULEMBU VOCATIONAL TRAINING CENTRE	VAGHALDHARA VOCATIONAL TRAINING CENTRE
SHAPE	Trapezoidal	Rectangular	Wedge shaped	Rectangular	Rectangular	Rectangular
MATERIAL	Concrete, steel and terracotta	Reinforced concrete, Fiber cement wood cladding	Concrete, Terracotta and Granite	Local granite like Kodappah, Berhamchellah, Bamboo and thatch	Concrete, local wood, bamboo and thatch	Exposed bricks, concrete
AESTHETICS	Good	Not Attractive	Good	Good	Not Attractive	Mediocre
CIRCULATION	Well defined	Confined	Unidirectional	Well defined	Not confined	Confined
PROGRAMME	Offices, labs, conference rooms, library, ocean technology development tank	Research area, multi purpose area and the International Laboratory for Global Change	Galleries and exhibition spaces	Interactive museum, Conference hall, library, cafe and dancing hall	Classrooms and practical training areas	Classrooms and practical training areas
AIR-CONDITIONING	Centrally	Nil	Centrally	Centrally	Nil	Nil
NATURAL LIGHTING	Excellent	Good	Good	Good	Good	Good
ARTIFICIAL LIGHTING	Good	Good	Good	Good	Low	Low
VENTILATION	Natural + Artificial	Natural	Natural + Artificial	Natural + Artificial	Natural	Natural + Artificial
EMERGENCY	Fire hazard	Fire hazard	Fire hazard	Fire hazard	-	Fire hazard

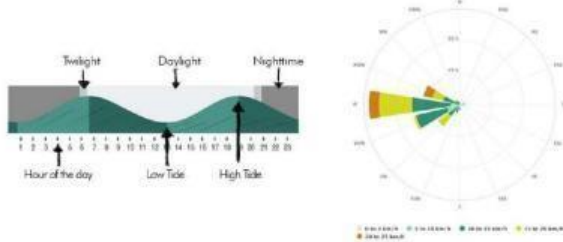
BUILDING AND SERVICES
COMPARATIVE ANALYSIS

CHAPTER 4-SITE STUDY AND ANALYSIS

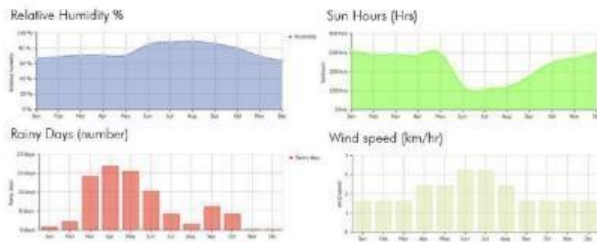


CONTEXT AND SITE ANALYSIS

CLIMATE ALONG THE COAST, AS WELL AS SITE SHOW THE HEAVY PRESENCE OF RAINS THROUGHOUT THE YEAR SUPPORTED BY HIGH PERCENTAGE OF SUNNY DAYS. THE ROCKY OUTCROP IN AND AROUND THE GOKARNA PENINSULA FORMS SMALL RAIN SOLAR REGIONS, WHILE MOST OF THE LANDFORMS ARE EXPOSED TO HIGH LEVELS OF SUNLIGHT AND RAIN



THE MICRO-CLIMATIC CONDITIONS OF THE SITE REMAINS FAIRLY SIMILAR, FOLLOWING THE SAME PATTERNS. ONLY MILDLY AFFECTED BY THE UNTIMELY CYCLONES THAT ARE QUITE RARE ALONG THE MALABAR COAST.



Warmest month (with highest average high temperature) is April (34°C). Month with lowest average high temperature is July (28.2°C).

Month with highest average low temperature is May (25.1°C). Coldest month (with lowest average low temperature) is January (20.8°C).

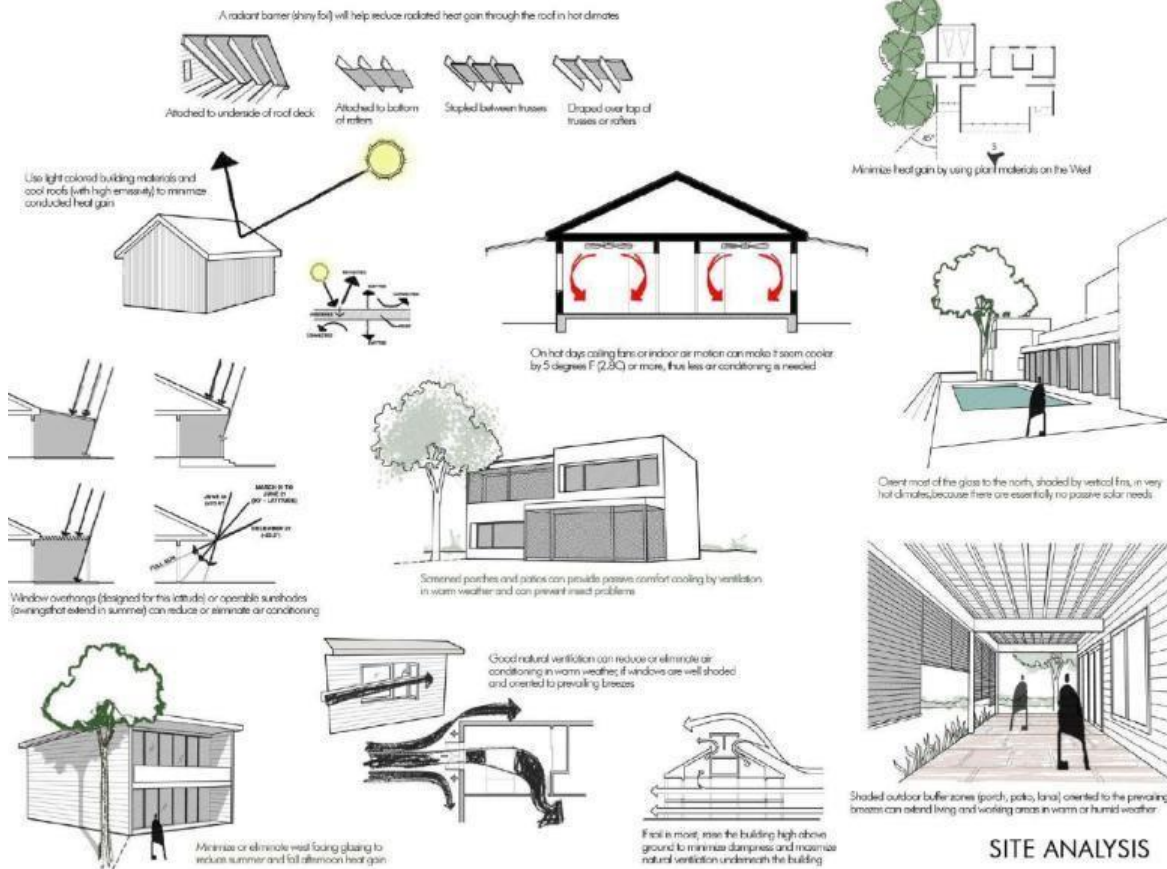


Wettest month (with highest rainfall) is July (1200.4mm). Driest month (with lowest rainfall) is February (0.2mm).



Traditional passive homes in hot humid climate used light weight construction with operable walls and shaded outdoor patches, raised above ground

ARCHITECTURAL FEATURES AND STRATEGIES TO CONSIDER FOR THE SITE BASED ON THE COLLECTED CLIMATIC DATA

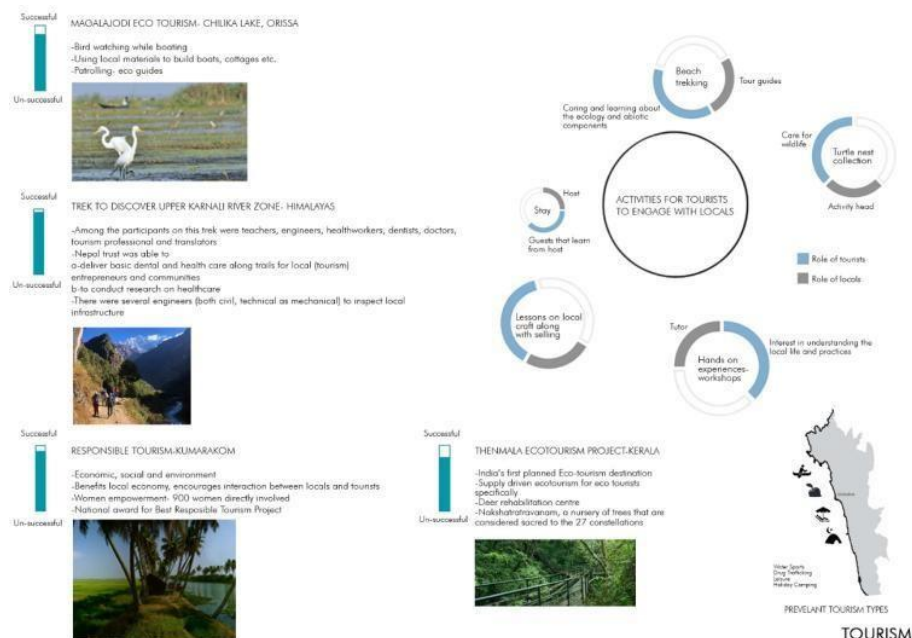
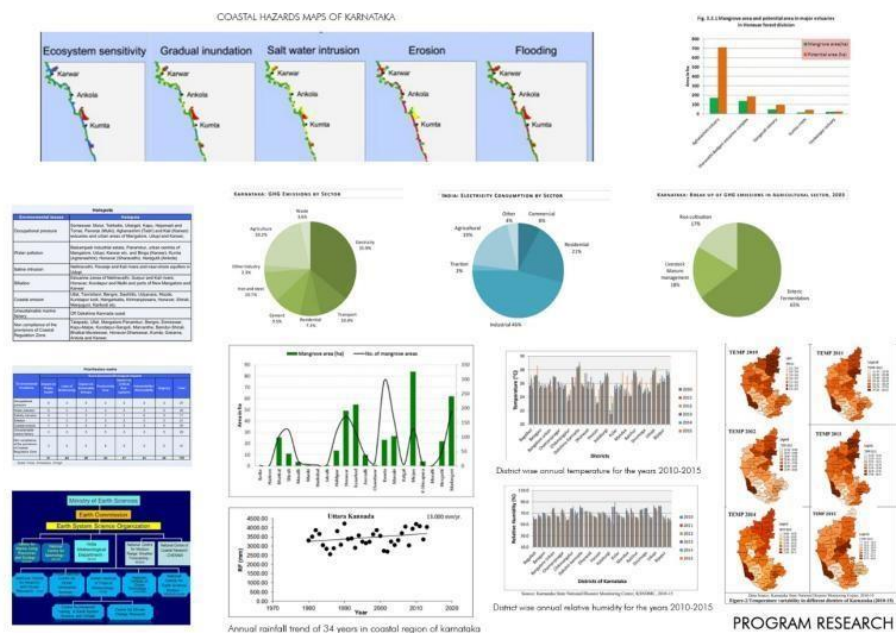


SITE ANALYSIS

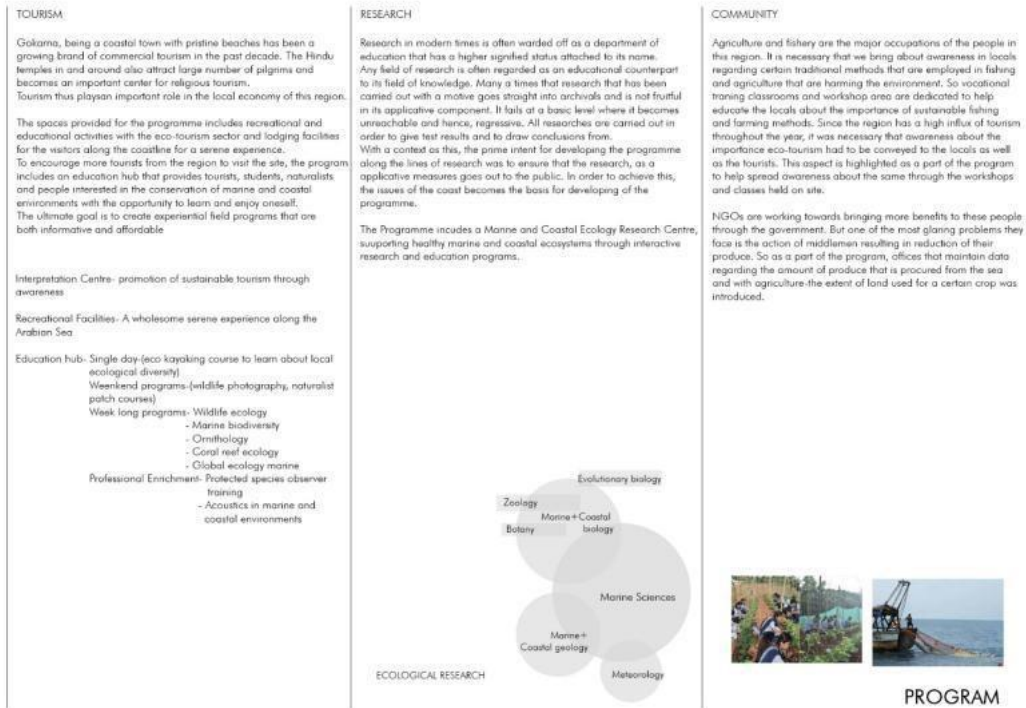
4.2 SWOT ANALYSIS

STRENGTH	WEAKNESS	OPPORTUNITIES	THREATS
The site is facing the arabian sea on one of the edges ,in other words the site leads to the beach. Reduced noise levels within the site due to buffer action of the trees surrounding it High density of local people and tourists due to preferability Buildings located adjacent provide advantages to pedestrian environment and scale for tourists Reduced congestion and traffic flow	Poor maintenance and unkeep-roads Exposed to high levels of sunlight and rain between the months June and Aug Road signage and way finding system Very mildly affected by the untimely cyclones that are quite rare along Malabar coast Chances of flooding during monsoon Some old and decrepit buildings	Interactive positioning of structures with different functions that support each other Shade provisions through the use of vegetation and shade structures Development of regional tourism Improvement in the local economy that provides net benefit to the community The requirements to provide viewscape improvements with new structures for architectural works Creation of a place, a character setting to the local area	Inadequate widths of roads and streets for larger four buses Lack of strong pedestrian environment and character for local residents Safety and drug trafficking Future developments and how they may conflict with existing public areas

5.1 PROGRAM RESEARCH

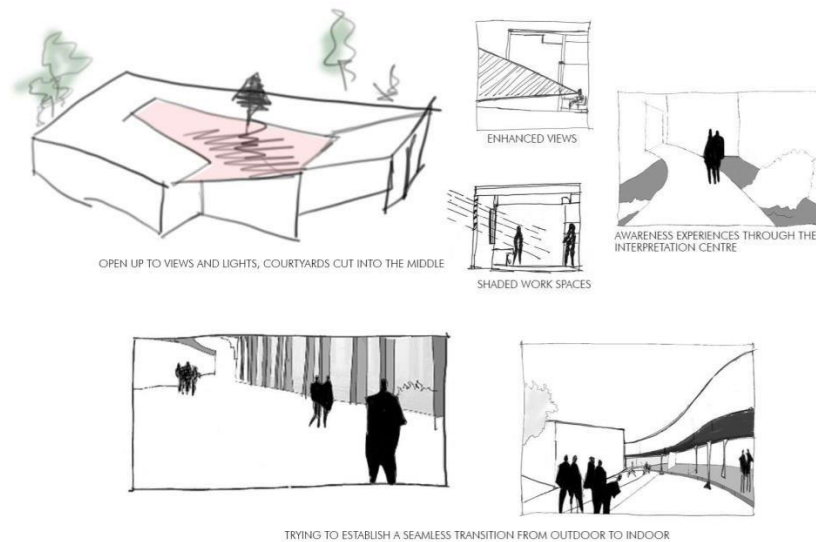


5.2 DESIGN PROGRAM



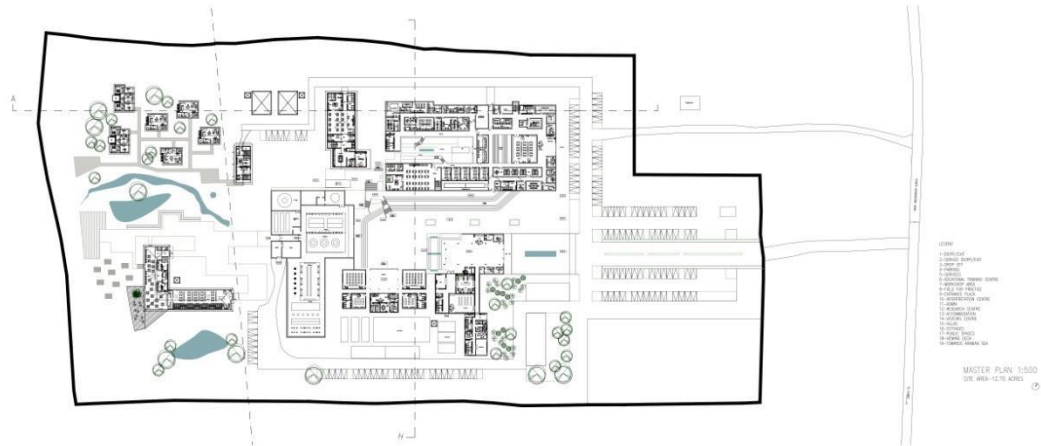
CHAPTER 6 – CONCEPT AND DESIGN

6.1 CONCEPT

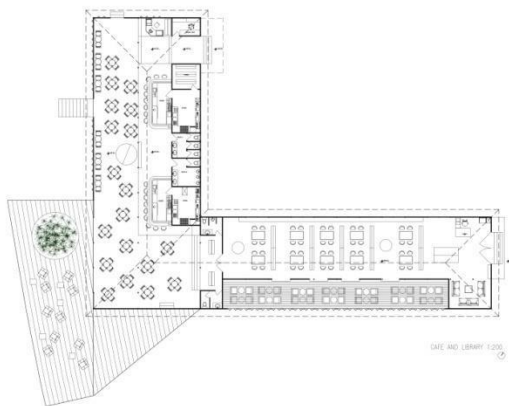


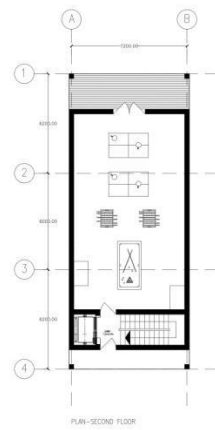
CONCEPT

6.2 MASTER PLAN



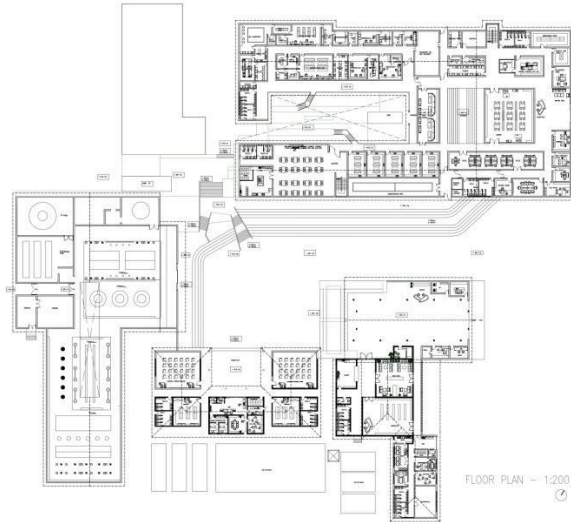
6.3 PLANS, SECTIONS AND ELEVATIONS



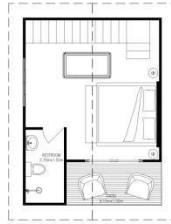
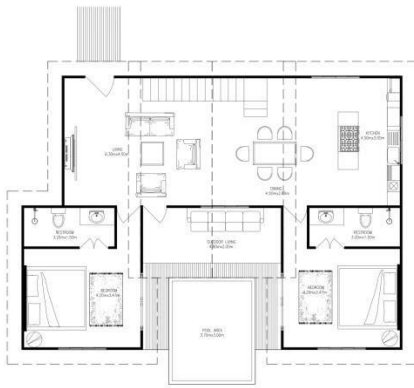


TOURISM-ACCOMMODATION 1:200

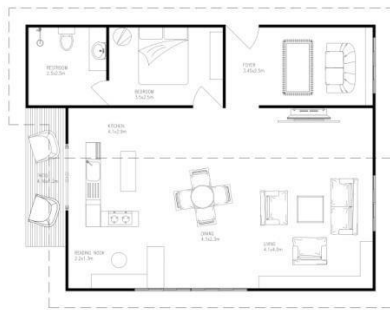




FLOOR PLAN 1:200



VILLAS 1:200

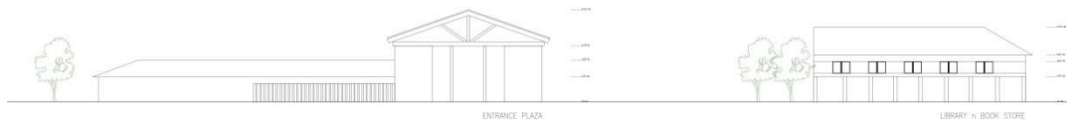


COTTAGES 1:200





SECTIONS 1:200



ELEVATIONS 1:200

6.4 VIEWS



REFERENCES

INTRODUCTION AND BACKGROUND STUDY

http://keralaczma.gov.in/pdfs/Coastal_Zones_of_India.pdf

<http://parisara.kar.nic.in/PDF/coastalzone.pdf>

https://kbb.karnataka.gov.in/storage/pdffiles/Completed%20Projects/Survey%20of%20Flora%20of%20Coastal%20Karnataka_Mangroves1.pdf

https://karunadu.karnataka.gov.in/kbb/ResearchCompletedProject/Survey%20of%20Flora%20of%20Coastal%20Karnataka_Mangroves5.pdf

<http://wgbis.ces.iisc.ernet.in/biodiversity/pubs/ETR/ETR50/ETR50.pdf>

<https://fddocuments.in/document/biodiversity-of-coastal-karnataka.html>

<http://moef.gov.in/wp-content/uploads/2017/08/Coastal-Summaries.pdf>

<https://www.irjet.net/archives/V7/i2/IRJET-V7I2168.pdf>

<http://wgbis.ces.iisc.ernet.in/biodiversity/pubs/ETR/ETR50/ETR50.pdf>

<https://www.lkouniv.ac.in/site/writereaddata/siteContent/202005052146186187SPTRIVEDI-FISHERIES-CO-OPERATIVE-SOCIETIES-OF-INDIA.pdf>

<http://wgbis.ces.iisc.ernet.in/biodiversity/pubs/ETR/ETR35/index.htm>

<http://www.flame.edu.in/images/dip/reports/gokarna.pdf>

http://wgbis.ces.iisc.ernet.in/biodiversity/sahyadri_enews/newsletter/issue40/article2/index.htm

<https://www.karnatakaturism.org/documents/karnataka-tourismpolicy-englsih.pdf> <https://tourism.gov.in/sites/default/files/2020-04/011%20karnataka.pdf>

LITERATURE STUDY

<https://bbmp.gov.in/act%20laws.html>

[http://dpal.kar.nic.in/.%5C22%20of%201964%20\(E\).pdf](http://dpal.kar.nic.in/.%5C22%20of%201964%20(E).pdf)

<https://www.mpcb.gov.in/sites/default/files/solid-waste/MSWrules200002032020.pdf>

https://archive.org/details/Architectural_Standard_Ernst_Peter_Neufert_Architects_Data

<https://archive.org/details/TimeSaverStandardsForBuildingTypes>

<https://docs.rwu.edu/archthese/29>

http://karenvis.nic.in/Database/Coastal_Karnataka_7956.aspx

[https://airandspace.si.edu/rfp/exhibitions/files/j1-](https://airandspace.si.edu/rfp/exhibitions/files/j1-exhibitionguidelines/3/Planning%20for%20Interpretation%20and%20Visitor%20Experience.pdf)

[exhibitionguidelines/3/Planning%20for%20Interpretation%20and%20Visitor%20Experience.pdf](https://airandspace.si.edu/rfp/exhibitions/files/j1-exhibitionguidelines/3/Planning%20for%20Interpretation%20and%20Visitor%20Experience.pdf)

CASE STUDIES

<https://ltser-chile.cl/red/en/study-sites/estacion-costera/>

<https://architizer.com/idea/835068/> <http://ecim.bio.puc.cl/en/ecim-uc/ecim-history/>

[https://www.jeffreyshawcompendium.com/curation/place-hampi-museum-](https://www.jeffreyshawcompendium.com/curation/place-hampi-museum-atkaladham/)

[atkaladham/](https://www.jeffreyshawcompendium.com/curation/place-hampi-museum-atkaladham/) [https://investigacion.uc.cl/en/estaciones/marine-research-coastal-](https://investigacion.uc.cl/en/estaciones/marine-research-coastal-station-las-cruces/)

[station-las-cruces/](https://investigacion.uc.cl/en/estaciones/marine-research-coastal-station-las-cruces/) [http://v-vtc.org/uploads/whatsnew/0B0B5A8E-84C6-4166-9499-](http://v-vtc.org/uploads/whatsnew/0B0B5A8E-84C6-4166-9499-E5630D2D3E29.pdf)

[E5630D2D3E29.pdf](http://v-vtc.org/uploads/whatsnew/0B0B5A8E-84C6-4166-9499-E5630D2D3E29.pdf) [https://w05.international.gc.ca/projectbrowser-](https://w05.international.gc.ca/projectbrowser-banqueprojets/projectprojet/details/s064849001?Lang=eng)

[banqueprojets/projectprojet/details/s064849001?Lang=eng](https://w05.international.gc.ca/projectbrowser-banqueprojets/projectprojet/details/s064849001?Lang=eng)

<https://www.deccanherald.com/content/350694/come-home-arts-heritage.html>

<https://avpn.asia/apfx/vaghaldhara-vocational-training-center/>

<https://kaaruu.com/issue-details/kaladham/> <https://www.nkld.co.in/page/kaladham>

<http://gnbwebserver.godrej.com/GBEmployability/Images/Documents/presentations/3>

Presentation_VVTC.pdf <https://www.theplan.it/eng/award-2017-culture/jayaprakash-narayan-interpretationcentre-museum-of-socialism-2>

<https://www.museumsofindia.org/museum/506/museum-of-socialism-jayaprakashnarayan-interpretation-centre>

<https://worldarchitecture.org/architecture-projects/hhgme/jaiprakashnarayanmuseumproject-pages.html>

https://www.mcgill.ca/ehs/files/ehs/design_of_research_space_draft_r2_20180618.pdf

f

