



ACHARYA'S NRV SCHOOL OF ARCHITECTURE
SOLADEVANAHALLI, BENGALURU -560107

MARINE EXPLORATORIUM
ARCHITECTURE DESIGN PROJECT (THESIS) – 2024-25

Submitted in partial fulfillment of the Requirements for the
“Bachelor of Architecture” Degree Course

Submitted by	: Deeksha B
USN	: 1AA20AT013
Guide	: Ar Neha Sahay

A project report submitted to
VISVESHVARAYA TECHNOLOGICAL UNIVERSITY
“Jnana Sangama”, Machhe, Belgaum – 590018

ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ - ೫೯೦೦೧೮



CERTIFICATE

This is to certify that this thesis report titled MARINE EXPLORATORIUM by DEEKSHA B of X SEMESTER B. Arch, USN No. 1AA20AT013, has been submitted in partial fulfillment of the requirements for the award of under graduate degree **Bachelor of Architecture (B.Arch)** by Visveshwaraya Technological University VTU, Belgaum during the year 2024- 25.

Guide: Ar. NEHA SAHAY

Principal

Examined by :

1)Internal Examiner :

2)External examiner 1 :

3)External examiner 2 :

DECLARATION

This thesis title “MARINE EXPLORATORIUM”, submitted in partial fulfillment of the requirement for the award of the under graduate of Bachelor of architecture is my original work to the best of my knowledge.

The sources for the various information and the data used have been duly acknowledged.

The work has not been submitted or provided to any other institution/ organization for any diploma/degree or any other purpose.

I take full responsibility for the content in this report and in the event of any conflict or dispute if any, hereby indemnify Acharya's NRV School of Architecture and Visveshwaraya Technological University, Belagavi, and its official representatives against any damages that any raise thereof.

(Signature)

DEEKSHA B

1AA20AT013

ACKNOWLEDGEMENT

I would like to express my heartfelt gratitude to all those who supported and guided me throughout the completion of this thesis.

First and foremost, I extend my deepest appreciation to my thesis guide, **Ar Neha Sahay**, for her invaluable guidance, constructive criticism, and continuous encouragement.

I am also thankful to our respected Principal, **Prof. Ar Sanjyot Shah**, for providing a conducive academic environment and for their constant support in all academic endeavours.

A special mention goes to the **institute's library and staff**, whose extensive collection of resources and assistance from the staff proved to be a vital asset throughout my research.

I would also like to thank my family and friends, whose unwavering support, motivation, and understanding throughout this journey.

Lastly, I am grateful to everyone who has contributed, directly or indirectly, to the success of this thesis. This accomplishment would not have been possible without their collective efforts.

Thank you all.

ABSTRACT

The oceans cover more than 70% of the Earth's surface, yet they remain largely unexplored. One such key ecosystem comprises the coral reefs. Coral reefs are present in the areas of Gulf of Kutch, Gulf of Mannar, Andaman & Nicobar, Lakshadweep Islands and Malvan. They are not only critical to our planet's health, influencing climate, weather, and the overall biosphere, but also are vital for promoting blue economy in various places.

Despite their importance, they are often out of sight and mind for the general public. In recent years, they have been prone to immense coral bleaching, especially in the Gulf of Munnar region due to various factors. There is also a tourism community who used to be fishermen near Kunthukkal harbour. But they do not have proper infrastructure that neither aids them with eco-tourism nor attracts tourists that visit Rameshwaram.

There is need for innovative and immersive marine research facilities to bridge the gap between scientific inquiry and public engagement with the marine environment. Hence, such experience centers serve as a source for fulfilling our curiosities and exploration of the marine world in a favorable and comfortable manner that work symbiotically help restore the deteriorating coral reefs. Constant involvement of researchers allows to keep a check on natural conditions and lookout for illegal activities.

TABLE OF CONTENTS

CHAPTER NO.	TITLE	PAGE NO.
	ACKNOWLEDGEMENT	iii
	ABSTRACT	iv
	LIST OF TABLES	v
	LIST OF FIGURES	vi
1	INTRODUCTION	
1.1	General	1
1.2	Focus of the thesis	
1.2.1	Title	1
1.2.2	Aim	1
1.2.3	Objectives	1
1.2.4	Need	1
1.2.5	Gap	2
1.3	Justification	
1.3.1	Coral reefs in India	3
1.3.2	Types of reefs	4
1.3.3	Importance	4
1.3.4	Blue Economy	6
1.3.5	Coral Bleaching	7
1.3.6	Threats	7
1.3.7	Impacts	
1.3.8	Restoration strategies	8
1.3.9	Bleaching in Gulf of Munnar	8
1.3.10	Reef distribution	10
1.3.11	Biodiversity	10
1.3.12	Religious and leisure tourism	12
1.3.13	Eco tourism	13
1.3.14	Government proposals, conservatyion and protection measures	14
1.3.15	Site selection	15
1.3.16	Proposal	19

1.4	Design methodology	21
1.5	Scope and limitations	22
2	LITERATURE REVIEW	
2.1	Restoration strategies implemented around the world	23
2.1.1	Integrating coastal infrastructure	24
2.1.2	Coral gardening and propagation	25
2.1.3	Biorock technology	26
2.1.4	Artificial reef structures	26
2.1.5	Mimicking substrate	27
2.1.6	Eco- mooring system	28
2.2	Psychology and architecture creating architectural stimuli	
2.2.1	Light	29
2.2.2	Colour	29
2.2.3	Space and layout	29
2.2.4	Texture and materials	30
2.2.5	Sound and acoustics	30
2.2.6	Nature and biophilia	30
2.2.7	Circulation and movement	30
2.2.8	Privacy and personal space	30
2.2.9	Symbolism and meaning	31
2.3	Creating experiences	
2.3.1	Approach	32
2.3.2	Transition	32
2.3.3	Memory	33
3	SITE ANALYSIS	
3.1	Location	34
3.2	Climatic analysis	34
3.3	Typology of context	37
3.4	Ecology byelaws	37
3.5	Noise control	38
3.6	Vegetation	38

3.7 Accessibility	39
3.8 Hydrology	40
3.9 Edge condition	40
3.10 Views to site	42
3.11 Views from site	43
 4 CASE STUDY - PUBLIC AQUARIUMS	
4.1 Literature case studies	
4.1.1 Georgia aquarium	44
4.1.2 Shanghai aquarium	49
4.1.3 Blue planet aquarium	54
4.2 Live case study	
4.2.1 VGP marine kingdom	59
4.3 Comparative analysis	66
4.4 Parallel study- Australia	67
 5 SPECIAL STUDY	
5.1 Space frame- Hyder Aliev	69
5.2 Cyclone resistant strategies	74
5.3 Circulation systems	77
5.4 Filtration systems	78
5.5 Tanks	81
 6 DESIGN	
6.1 Tamil Nadu byelaws	84
6.2 Area requirements	85
6.3 Zoning	87
6.4 Bubble diagram	88
6.5 Water circulation process	89
6.6 Concept	
6.6.1 Programmatic level	90
6.6.2 Site level	92
6.6.3 Building level	94

6.7 Detailed drawings	96
-----------------------	----

6.7.1 Masterplan

6.7.2 Site plans

6.7.3 Plans, elevations, sections and views

7	BIBLIOGRAPHY	97
----------	---------------------	-----------

8	PLAGARISM REPORT	98
----------	-------------------------	-----------

LIST OF FIGURES

FIGURE	PAGE NO
Fig. 1 Coral distribution in India	3
Fig. 2 Types of reefs	4
Fig. 3 Reef area v/s Blue economy	6
Fig. 4 Coral bleaching	7
Fig. 5. Coral restoration techniques	8
Fig. 6.1 Extent of bleaching in various region	9
Fig. 6.2 Documented hotspots	10
Fig. 7 Gulf of Munnar with its important biodiversity	10
Fig. 8.1 Coral reef and seagrass distribution	11
Fig. 8.3 Sea turtle and dugong	12
Fig.9.1 Religious and Leasure circuit	12
Fig.9.2 Data comparison of both circuit	12
Fig.10 Eco tourism zone in Gulf of Munnar	13
Fig.11.1 Location of site	15
Fig.11.2 Access to site	15
Fig.11.3 Key tourist landmarks near site	16
Fig.11.4 Shoreline characteristics	17
Fig.11.5 CRZ zoning	17
Fig.12.1 Cost, efficiency and scalability comparison of various restoration strategies	23
Fig.12.2 Technique and material performance analysis	24
Fig.12.3 Coral planting on structures	25
Fig.12.4 Coral garde	25
Fig.12.5 Biorocks	26
Fig.12.6 Artificial reef structure	26
Fig.12.6 Substrate created with limestone and cement	27
Fig.12.7 Eco mooring systems	28
Fig.13.1 Location and dimensions of site	34
Fig.13.2 Site elements with sun and wind direction	34
Fig.13.3 Climatic chart of Rameshwaram	35

Fig.13.4 Climatic chart of Rameshwaram	35
Fig.13.5 Low lying areas of Rameshwaram prone to flooding	36
Fig.13.6 Site context	37
Fig.13.7 CRZ boundaries	37
Fig.13.8 Noise on site	38
Fig.13.9 Vegetation on site	38
Fig.13.10 Accessibility to site	39
Fig.13.11 Natural drainage	40
Fig.13.12 Site edges	40
Fig.13.13 Views to site	42
Fig.13.14 Views from site	43
Fig.16.1 Exterior view of aquarium	44
Fig.16.2 Natural lighting in dolphinarium	45
Fig.16.4 Different zones in the aquarium	47
Fig.17.1 Exterior view of aquarium	49
Fig.17.2 Horizontal and vertical circulation across floors	51
Fig.17.3 Vertical zoning	53
Fig.17.4 Tunnel components	53
Fig.18.1 Exterior view and zones of the aquarium	54
Fig.18.2 Evolution of concept	55
Fig.18.3 Interior view of the aquarium	56
Fig.18.4 Structural systems of the building	57
Fig.18.5 Plan functions based on the form	57
Fig.19.1 Location and site dimensions	59
Fig.19.2 Entrance to the complex	60
Fig.19.3 Various spaces for different objectives	61
Fig.19.4 Climatic chart of Chennai	61
Fig.19.5 Conceptual plan and sections	62
Fig.19.6 Floor plans	63
Fig.19.6 Floor plans	63
Fig.19.8 Construction of tank	64
Fig.19.9 Plan of quarantine area	65
Fig.19.10 Plan of food preparation area	65

Fig.15.1 Form development from whale	67
Fig.15.2 A walkway is stretched out 2km into water leading to observatory	67
Fig.15.3 Views at each level	68
Fig.20.1 Structural system of space frame and boot columns	69
Fig.20.2 Layers of structural systems	70
Fig.20.3 Space frame and their nodes	71
Fig.20.4 Boot columns	71
Fig.20.5 Section showing space frame and pile foundation	72
Fig.14.1 Effect of wind on openings	74
Fig.14.2 Effect pf wind on overhangs	74
Fig.14.3 Effect pf wind on trees	75
Fig.14.4 Raft Foundation	75
Fig.14.5 Effect of wind on shape of building	76
Fig.14.6 Effect of wind on organization of buildings	76
Fig.14.7 General techniques for wind resistance	76
Fig.21.1 Diatomic filters	78
Fig.21.2 Fluidized bed filters	78
Fig.21.3 Sponge filters	79
Fig.21.4 Trickle filters and components	79
Fig.21.5 Backwater filters	80
Fig.21.6 UGF and components	80
Fig.22.1 Display tank	81
Fig.22.2 Display tank	81
Fig.22.3 Special tank	81
Fig.22.4 Tunnel tank	82
Fig.23 Water circulation between sea and aquarium	89
Fig.24.1 Illustration of life, land and sea	90
Fig.24.2 Human scale displays	90
Fig.24.3 Monumental scale displays	91
Fig.24.4 Epipelagic zones and species	91
Fig.24.5 Components of life, land and sea	92
Fig.24.6 Process of form generation	93
Fig.24.7 Aquaponics greenhouse	93

Fig.24.8 Wind trees to generate passive energy	93
Fig.24.9 Effect of wind on various parameters of form	94
Fig.24.10 Organic and high load bearing structures using	95
Fig.24.11 Pile foundation details	95