Ferry for gateway of India to Elephanta

Submitted in partial fulfillment of the requirements
of the degree of

Masters of Design

by

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IDC School of Design
INDIAN INSTITUTE OF TECHNOLOGY BOMBAY
(2024)

APPROVAL SHEET

This Mobility & Vehicle Design Project II titled 'Ferry for gateway of India to Eliphanta' by Sangeeth Sivan M is approved in partial fulfillment of the requirements for Master of Design Degree in Mobility & Vehicle Design, IIT Bombay.

Project Guide:

Internal Examiner:

External Examiner

DECLARATION

I declare that this written submission represents my ideas in my own words and where others ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited of from whom proper permission has not been taken when needed.

Sangeeth Sivan M
22m2285

Date: 01/12/2023

Mobility and Vehicle Design
IDC School of Design, IIT Bombay

ACKNOWLEDGMENT

My project Design of 'Ferry for gateway of India to Eliphanta' has been a great experience overall. It has taught me how to look at the problems faced by users on day to day basis and how to design for the people. All these wouldn't be possible without proper guidance so I would like to sincerely thank my guide, Prof. Unni Mohan and Prof. Nishant Sharma for thier valuable guidance through out this project. I would also like to thank Naval architect Mr Sony TL for his valuable inputs. A big thank you for all the users and the people who contributed to my project. Finally a huge thanks to all my classmates for the valuable inputs and feedback throughout the project.

ABSTRACT

This project focuses on the conceptualization and design of a modern ferry service to enhance transportation between the Iconic Gateway of India and the historically significant Elephanta Caves. The proposed ferry aims to provide a seamless, safe, and enjoyable maritime experience for tourists and locals alike. The design process encompasses several key considerations, including vessel specifications and exterior visual appearance around gateway of India and taj hotel. The vessel design also prioritizes accessibility and comfort, ensuring a pleasant journey for passengers of all ages and abilities.

CONTENTS

1. INTRODUCTION

Image source-internet

This project focuses on the conceptualization and design of a modern ferry service to enhance transportation between the Iconic Gateway of India and the historically significant Elephanta Caves. The proposed ferry aims to provide a seamless, safe, and enjoyable maritime experience for tourists and locals alike.

The design process encompasses several key considerations, including vessel specifications and exterior visual appearance around gateway of India and taj hotel. The vessel design also prioritizes accessibility and comfort, ensuring a pleasant journey for passengers of all ages and abilities.

This ferry design project aligns with the broader goal of creating sustainable and accessible transportation options while preserving the natural and cultural heritage of the Mumbai harbor.

Image source-internet

Nestled along Mumbai's lively shores, the Gateway of India stands as a picturesque symbol of the city's history. Its grand arch, reminiscent of Indo-Saracenic design, gracefully frames the bustling cityscape against the backdrop of the Arabian Sea.

Adjacent to this regal landmark, the Taj Mahal Palace Hotel adds another layer of elegance, boasting Moorish, Oriental, and Florentine design elements that weave together in a stunning tapestry of architectural beauty.

Imagine, boats adorned with intricate details gently navigating the azure waters, offering a serene voyage from the Gateway to the ancient caves of Elephanta. This seamless blend of architectural marvels and tranquil boat rides paints a vivid picture of Mumbai's cultural richness and natural beauty, creating an unforgettable experience for locals and visitors alike.

2. RESEARCH

From ticket collecting to getting into boat takes minimum of 30 minutes to 1 hour. There will be some random guys or some agency based ticket counter in frond of gate.

In the in travel of every half hour one boat will goes to Eliphanta.

ticket collector is randomly filling the boat and when ever a guy from the boat shouts he stops and tell passengers that will go in next ferry.

Image source-sancharam,https://www.youtube.com/watch?v=PncsrR_MoSw&ab_channel=Safari

Image source-internet,pintrest

2.1 History

It has gone evolved a lot from this primitive design which have long hull and single deck.

2.2 Experience

People really enjoyed feeding The seagulls. The food they were given was packet food, which is unhealthy for them, also we can see seagulls only in November and December

Image source-Internet,own footage.

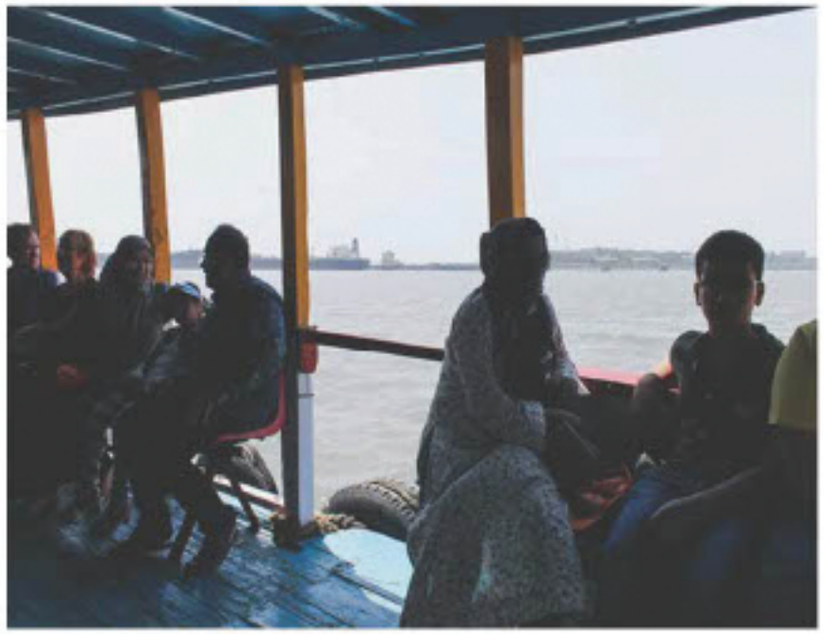


Image source-internet,pintrest

seats, facilities and over all ambiance is shown here

2.3 Safety

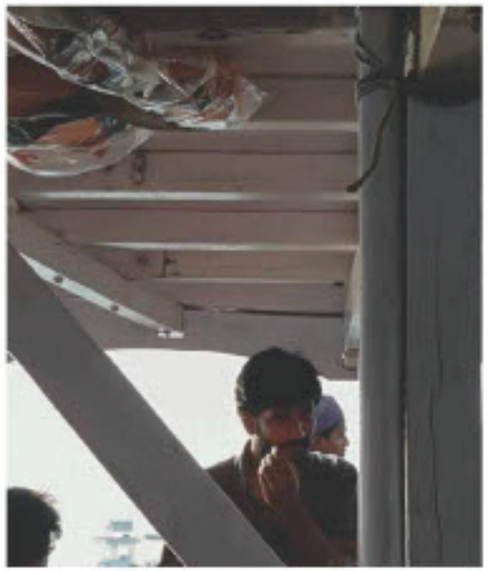


Image source-internet,Own footage

Safety equipments in the boat, which includes life buoys, life jackets and tires.

2.4 Ferrys in the coast

Image source-internet,pintrest

other ferry in Mumbai harbor

Image source-own footage

after 10 minutes to left of the journey can see the naval base.

after 1 hour to the right the island will visible in the cloudy smog.

primary research

Image source-own footage

3.2 Current scenario

It took almost 45 minutes to get into the ferry.

Elder people finds slight difficulty while getting into the ferry, because of the rocking ferry.

primary research

3.3 Space allocation

space allocation for passengers, crew, toilet and kitchen.

Image source-own footage

The kitchen and toilet are facing each other.

3.4 Safety and capacity

	FAIR WHEATHER	FOUL WHEATHER
	90	55
CREW	05	05
TOTAL	95	60

Image source-own footage

In fair whether it shows that it can accommodate 95 people, we are 80 in that journey. it felt too crowded. also they have banned going to upper deck.

3.5 Cockpit and engine

Image source-own footage

steering and engine controlling

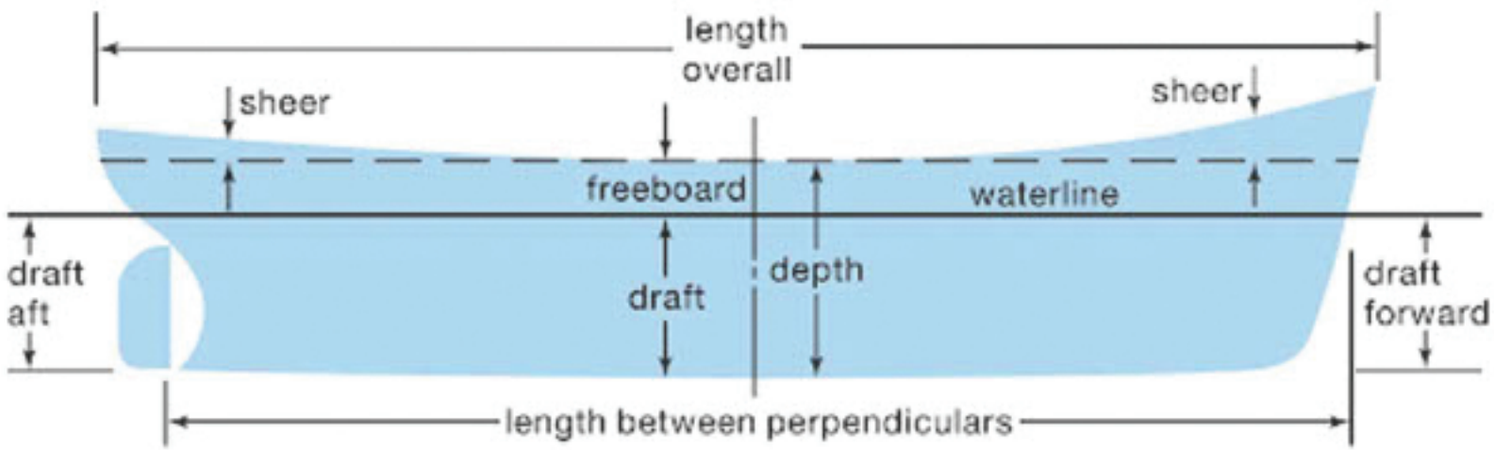
Speed and gear is controlled by the mechanic with the reference from pilot by a bell.

3.6 Mooring

Boats are parallel parked

cleaning of vomit and life in boat

Image source-own footage



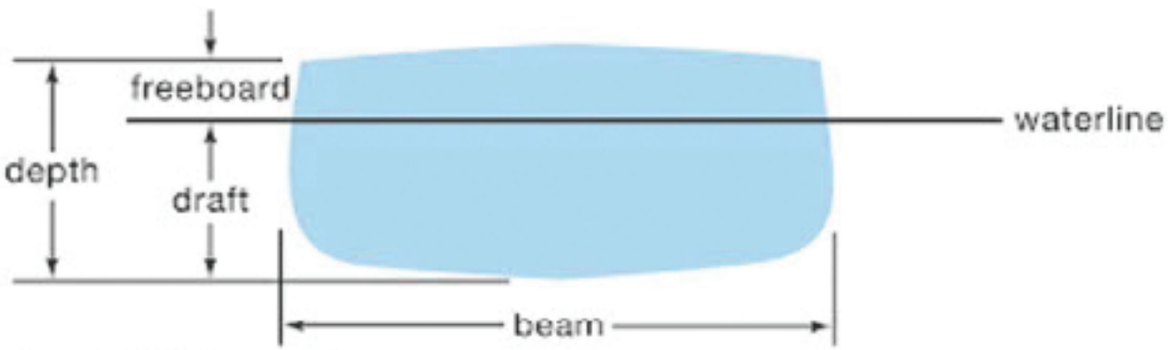


Image source-Internet

Terminologies used in boat design

3.7 Terminologies

Calculating Your Boat's Capacity

On boats less than 20 feet in length with no capacity plate, use the following rule of thumb calculate the number of persons (weighing 150 pounds each, on average) the boat can carry safely in good weather conditions.

$$\text{Number of people} = \frac{(\text{boat length (ft.)} \times \text{boat width (ft.)})}{15}$$

For example, for a boat 18 feet long by 6 feet wide, the num 108) divided by 15, which equals seven 150-pound persons or 1050 pounds).

Changing Water Levels

High-water levels may be caused by upstream rains or water released through a dam. High water usually means swifter currents. Stay out of swift currents unless you are sure you can paddle through safely. If you planned only a leisurely trip, high water can be hazardous.

Low-water levels can cause you to run aground or scrape submerged objects such as rocks. Stay in deeper channels when possible.

Be aware of seasonal changes in water levels.

Type III PFDs: Wearable Flotation Aids

These vests or jackets are good for calm waters when quick rescue is likely. They will *not* turn most unconscious wearers face up. They are used for water sports such as canoeing, kayaking, or paddleboarding. Some Type III life jackets are designed to inflate when you enter the water.

Read and follow the label instructions on all PFDs.

Length and Width

The length and width of a paddlecraft affect its speed and maneuverability.

Length:

- Longer paddlecraft have greater speed and tracking.
- Shorter paddlecraft are more maneuverable.

Width:

- Wider paddlecraft provide greater stability but tend to be slower. Narrower paddlecraft provide less stability but tend to be faster.
- The width of a stand-up paddleboard is especially important since it will affect your stability. You also want to make sure that the width of the board suits your height so that you can paddle more easily.

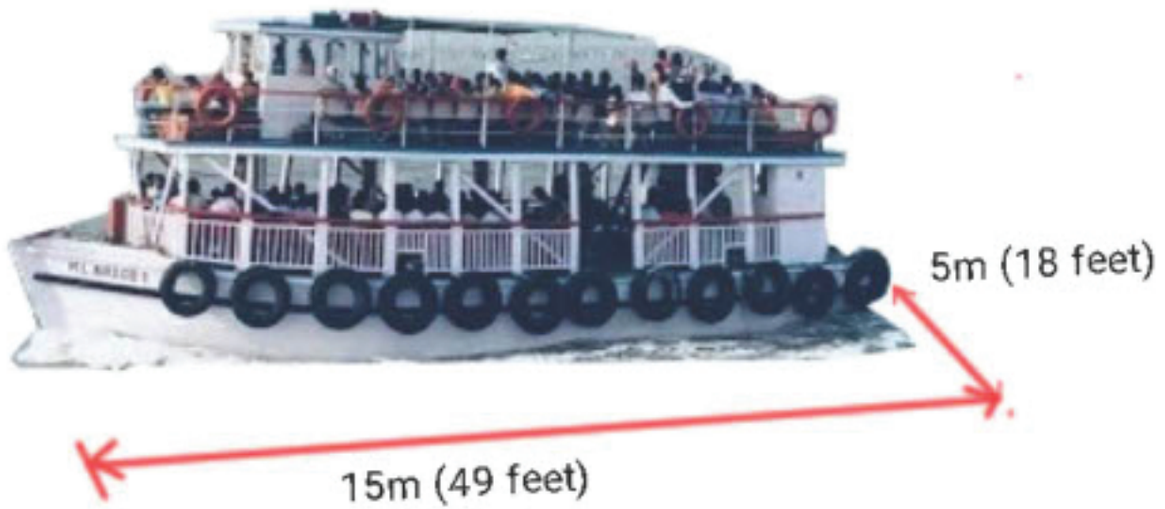
https://www.boat-ed.com/indiana/studyGuide/Calculating-Your-Boat-s-Capacity/10101602_35133/

source-Internet

Standardizing dimensions and capacity based on guidelines.

3.8 Dimension of ferry

Approximate dimension of ferry of Elephanta



According to safety standers, it can only accommodate 58 people.

Max. people can accommodate = 58 people (usually they take 70 to 90)

Image source-Internet

4. OBSERVATIONS

4.1 Accidents

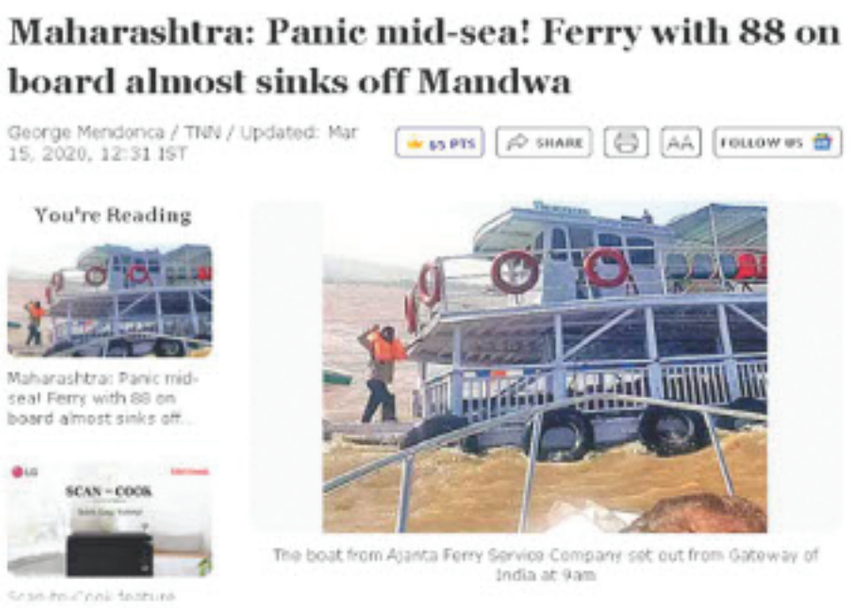


Image source-internet,times of india

accidents in Mumbai shore

My observations

01 Almost took 20 min. To evacuate 88 people.

02 Lack of safety equipments.

03 No hazzard alarm or lights.

04 No distress call or radio equipments.

05 People came to rescue by hearing screaming of women

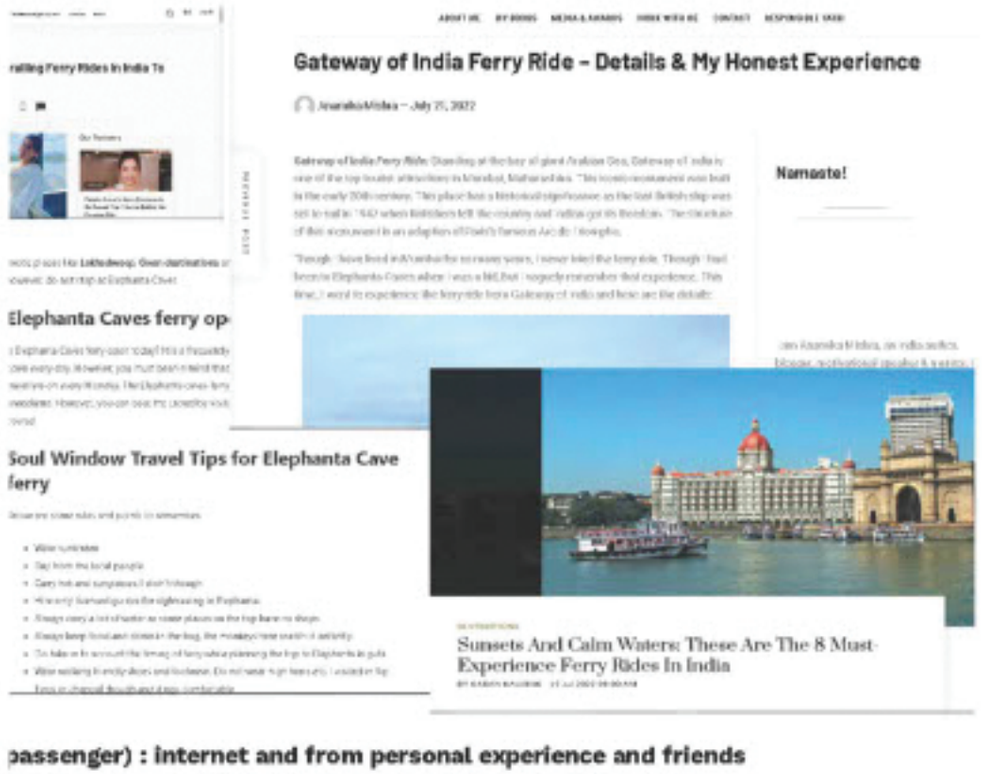
06 Most of these incidents are rescued by nearby vessels

07 No other ways to signal for help

08 Lack of periodic maintenance.

accidents in Mumbai shore

With crew



passenger) : internet and from personal experience and friends

Image source-internet,times of india and own footage

user review from Online and from primary research

Anamika mishra

01 Felt little low when saw crowd

02 Loves the view of sea from boat

03 Had refreshments from boat

04 Felt like it over too soon

Abhinav (a soul window)

01 Preferred to sit in lower deck

02 Felt awkward as a solo traveler by sitting with group

03 Hard to find a safe place to keep bag

04 So he felt comfortable in upper deck

user review from Online and from primary research

My observations

01 Does Not have washroom and mostly crowded

02 There is minimal sea sickness

03 Hard to find a fixed specific seat(always take over by some one)

04 Lack of safe feeling and bad maintenance

05 Over crowded almost 80- 90 passengers in single boat

06 No space for handicapped people

07 Have a feeling of adventure, by the rocking of boat

08 30 minute waiting time is there, there is chances of splitting of groups.

user review from Online and from primary research

My observations

09 lack of storage space to keep things for backpackers.

10 Sometimes crew don't allow to go top of it.

11 Packet food are unhealthy for birds

user review from Online and from primary research

4.3 Target users

Image source-Internet, own footage

Target users

5. OBSERVATIONS

5.1 Insights and mitigation

Insights	Desired experience	Barriers for desired experience	How to mitigate barriers
Random seating	Can leave seat and roam around	Lack of space	By providing seats that can change orientation
Safety issues	Should have safe feeling	Cost and equipment positioning	Placing equipments bellow seat
Rocking of ship in wind and wave	Mild rocking of ship is enjoyable (adventure feel)	Should be comfortable for everyone.	Semi displacement hull and double canopy design
Improper bird feeding	Should feed healthy food	Unawareness among people	Providing special bird feeding space(jun-aug)

Based on the research data

Insights	Desired experience	Barriers for desired experience	How to mitigate barriers
Crowd management Ingress and egress	Reduced waiting time, getting in and out	Size of boat (15 m avg. <80 people)	Increase size to 22m (100 people)convertible ramp like door
Passengers really enjoy sea travel	More travel time Site seeing	Sea sickness	Open windows, Speed (10 to 15 knots)
2 in 3 prefers upper deck	Airy and better view	Over exposed to sun, is affect CG of boat	More open and airy cabins. With minal obstruction (steel wires)
Lack of privacy	Groups and individuals should be comfortable	Should be social at same time.	Small exposed spaces with great views to sea.

Based on the research data

Business analysis

There will almost 30 boats will be there for duty every time(let's assume avg 15 trips will be there per day), with only one trip per day. Ferry is operated by 5 crew members who are living in the boat itself.

280 rs per ticket, one boat can accommodate avg 85 people every time. Ferry will active on 7 months without every mondays.

So per year revenue generated is = 64,974,000rs (15*280*85*7*26)

Salaries for crew are 18k for 3 sailors and 25k each for mechanic and pilot ,

so per year expense of crew	= 10,920,000rs (104000*15*7)
Other expenses	= 10,000,000rs (assumption)
There for annual income gen.	= 44,054,000rs (profit per year)

Based on primary research

Size and dimensions

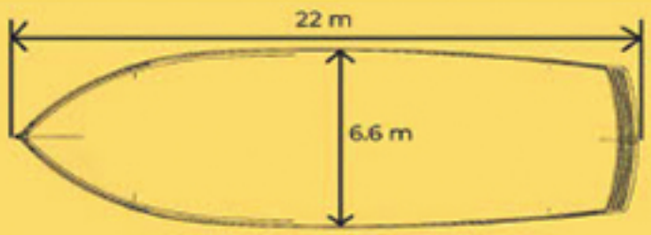
Requirements

- Maximum comfort and smooth ride in waves
- Enough space for 100 passengers
- Reduce traffic in coast

Wider boat roll minimum,less chance of capsizing and work well in medium speed condition.
So taking maximum beam\length ratio= .30
beam= **6.6m**(21.65 feet) and length= **22m** (72.17 feet)

There for no of people became **104.16 people**

$$\text{Number of people} = \frac{(\text{boat length (ft.)} \times \text{boat width (ft.)})}{15}$$



104 people carrying capacity

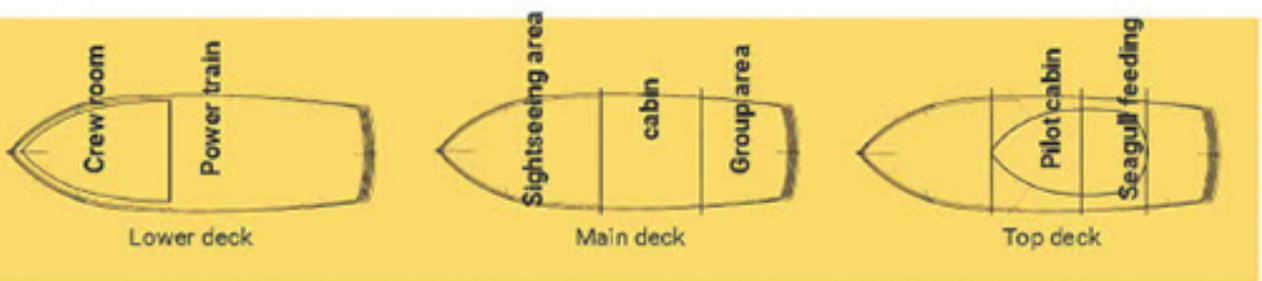
Design of space

Requirements

- Should have a better experience to all type of user
- Socialised cabin with little bit of privacy on demand.
- Crew should get better life in ship

Should reduce motion sickness by lot of **open areas**, AC cabin should placed in a way that it should be near the centre of gravity.
Old people and handicapped should get nearby place to the entry,exit and easy **ingress, egress.**

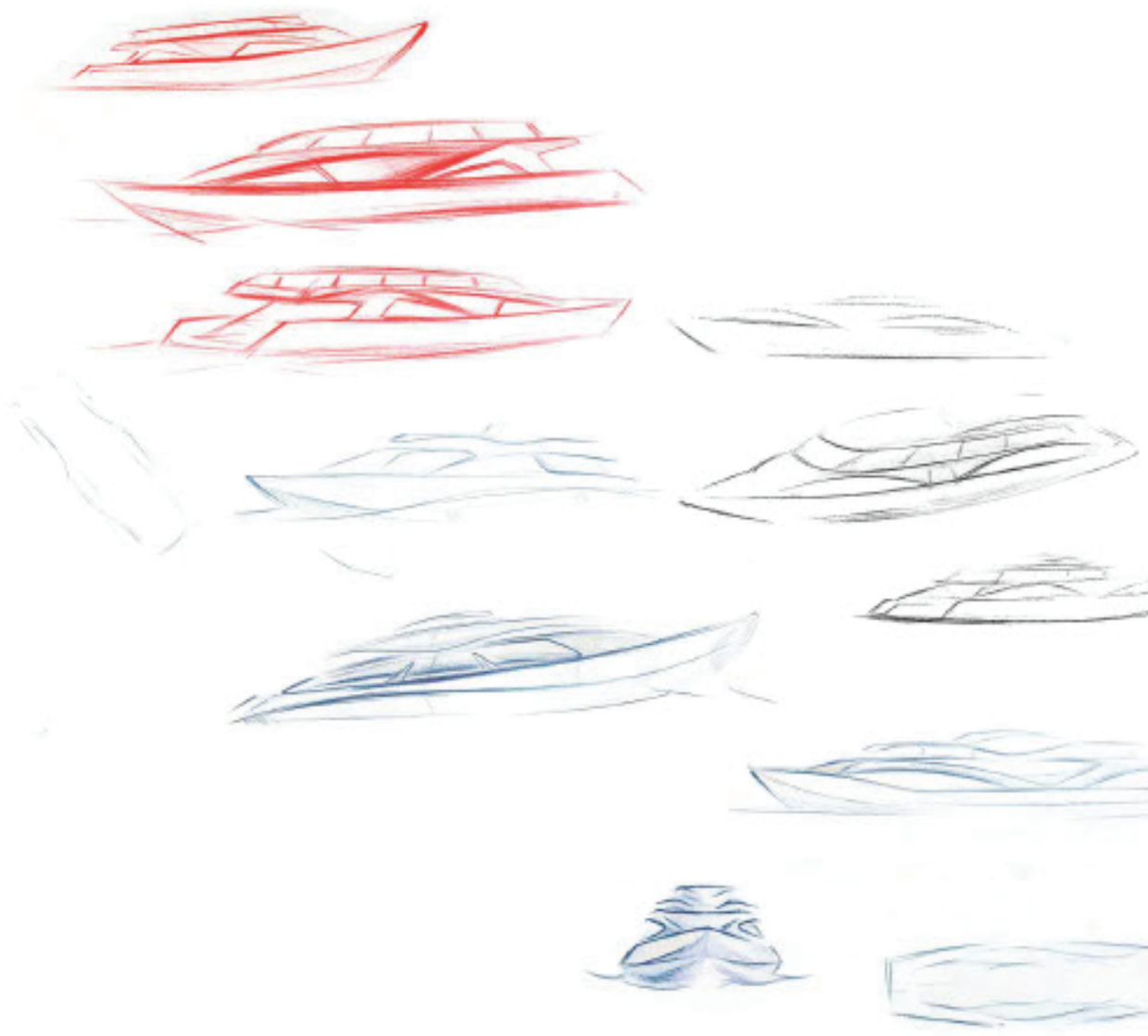
Need a space which people can interact each other and should have calm peaceful area in same time. Also small AC cabin to limited passengers.

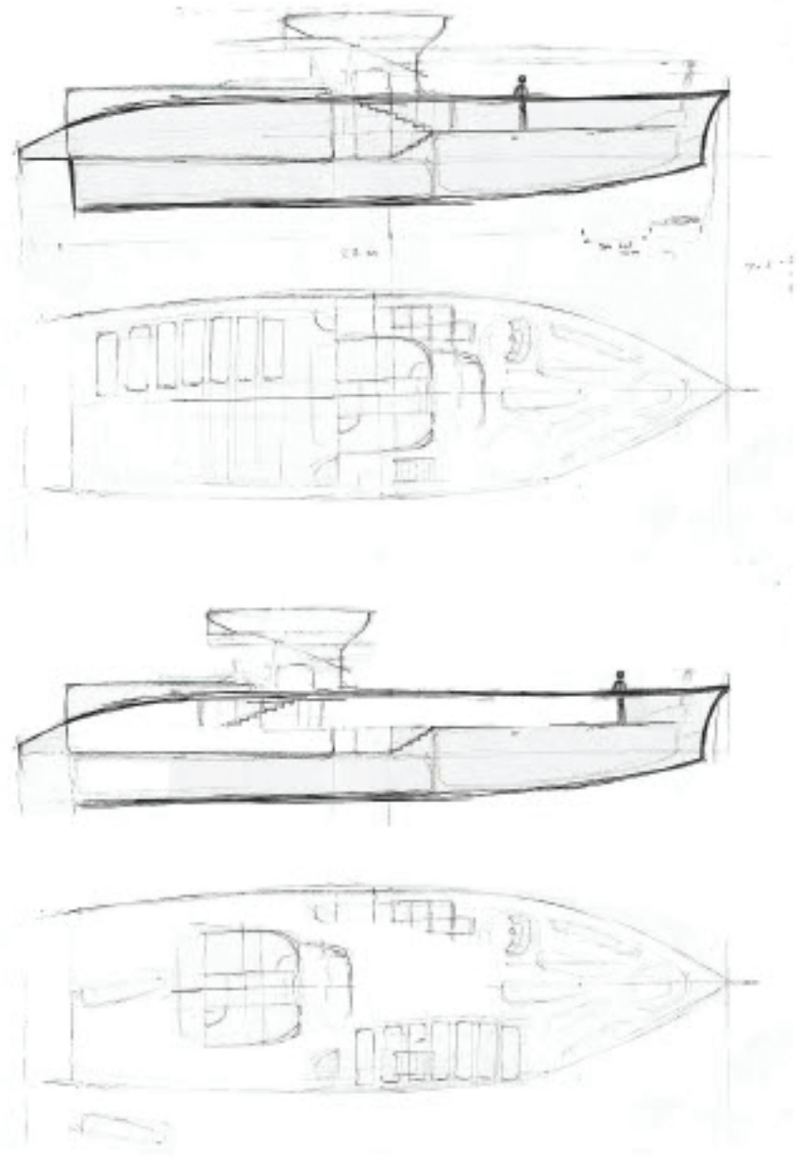


5.3 Nominal size

Based on the research data table

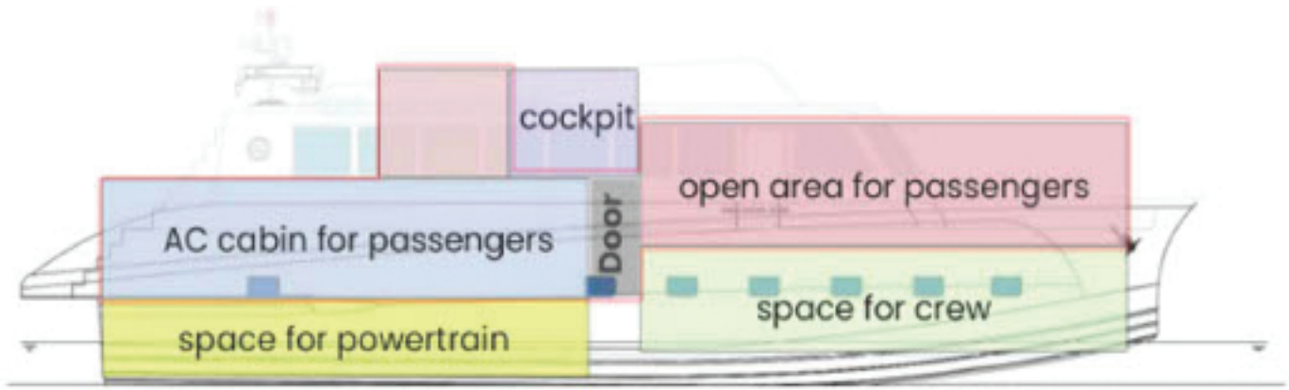
5.4 Exploration of space



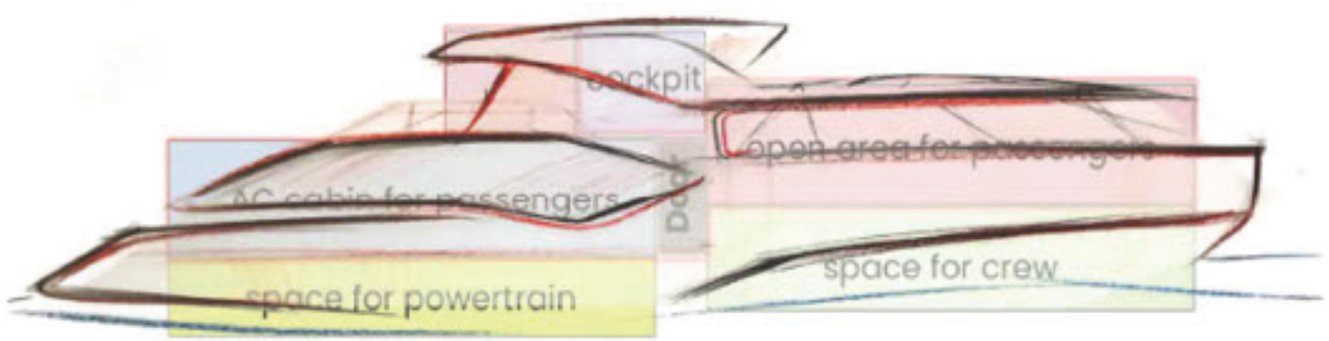


exploration of space and throwing of ideas

5.4 Exploration of space



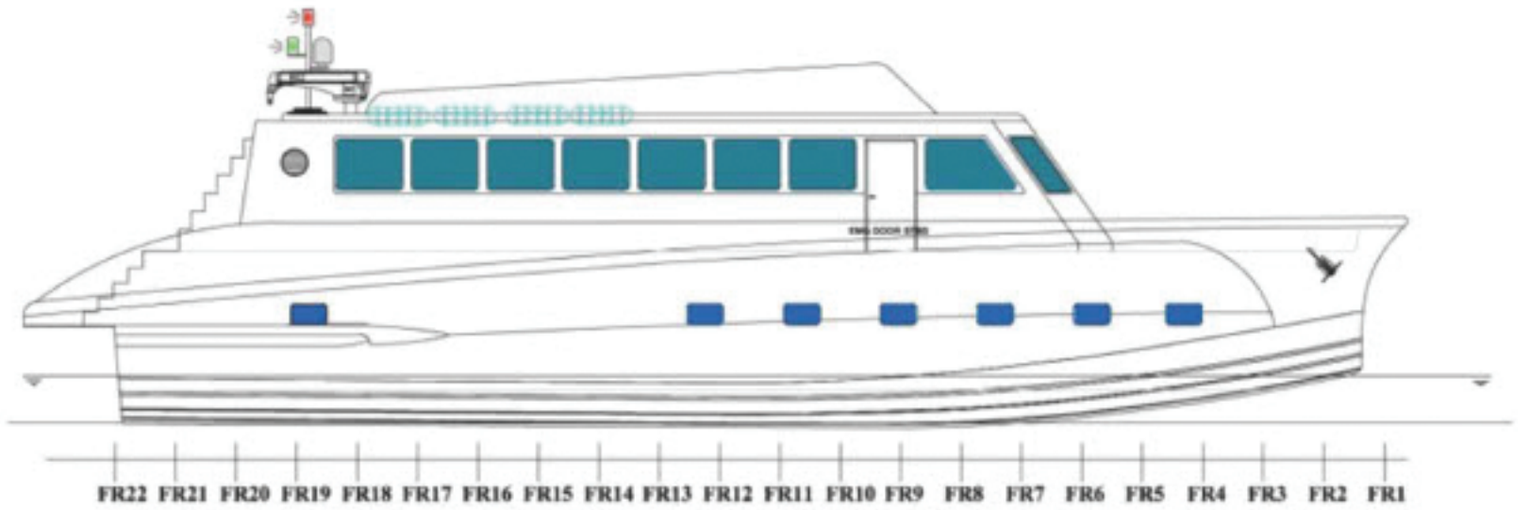
Got an opportunity to interact with naval architect Mr Sony T. L. Who is a close friend of Prof. Unni Mohan sir. we had discussed about the size and space allocation of vessel.

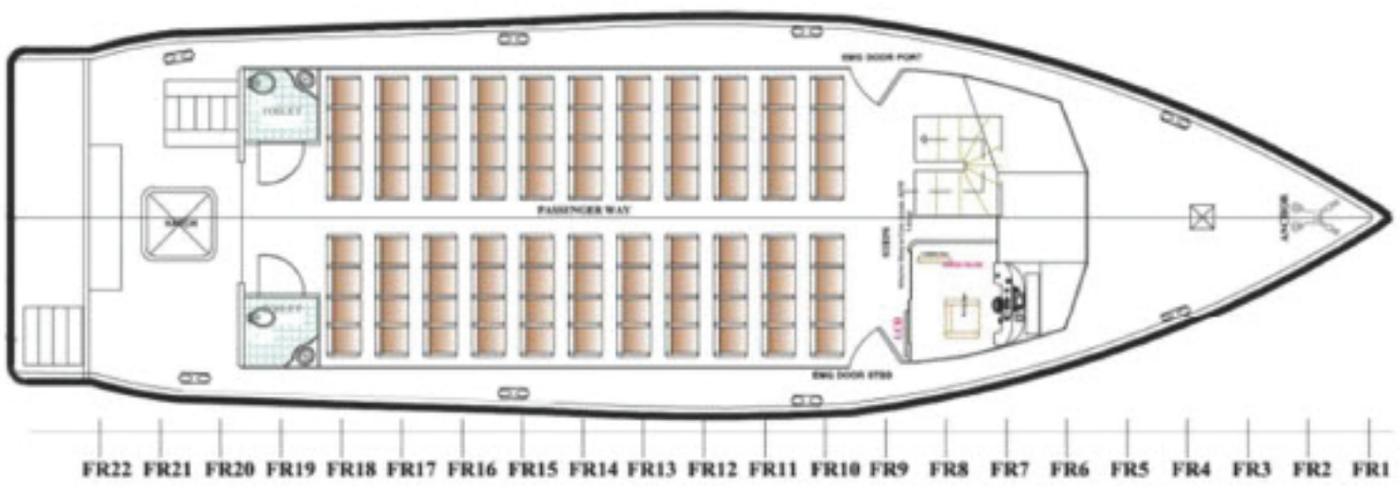


The feedback i got from the meeting where:

Can keep the length to beam ratio

the nominal size and shape of vessel is determined by the wave dynamics(like size, direction of wave wind speed etc.) and should figure out which zone is the coast is(zone 1, zone 2 etc..)

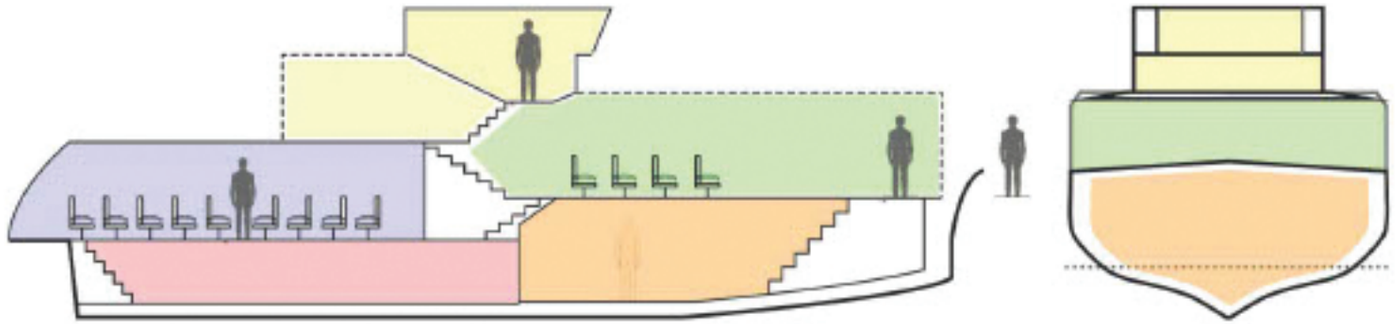




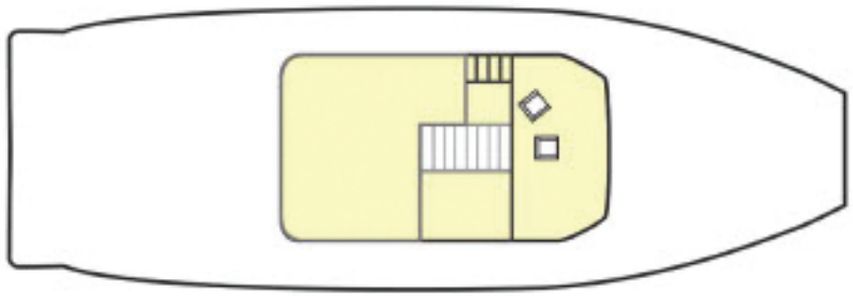
Bench marked hull

Image source-https://www.smartown.ae/ferry-75/

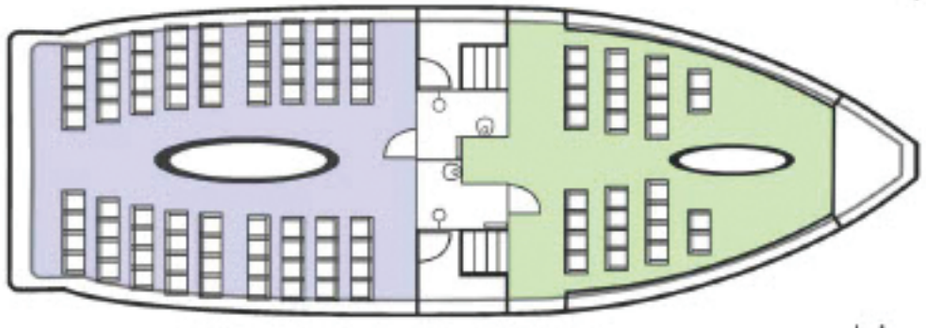
5.4 Exploration of space



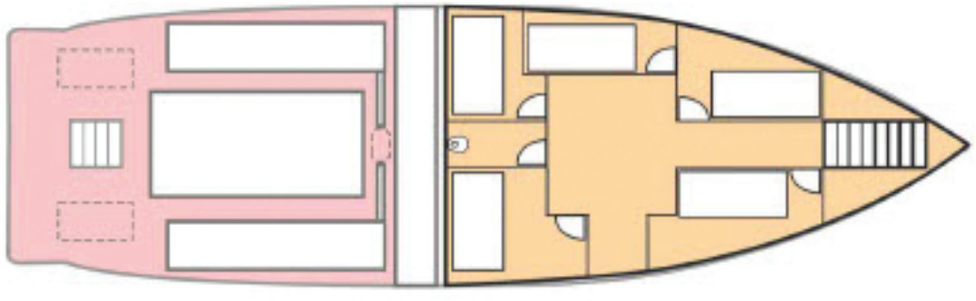
side view



pilot cabin



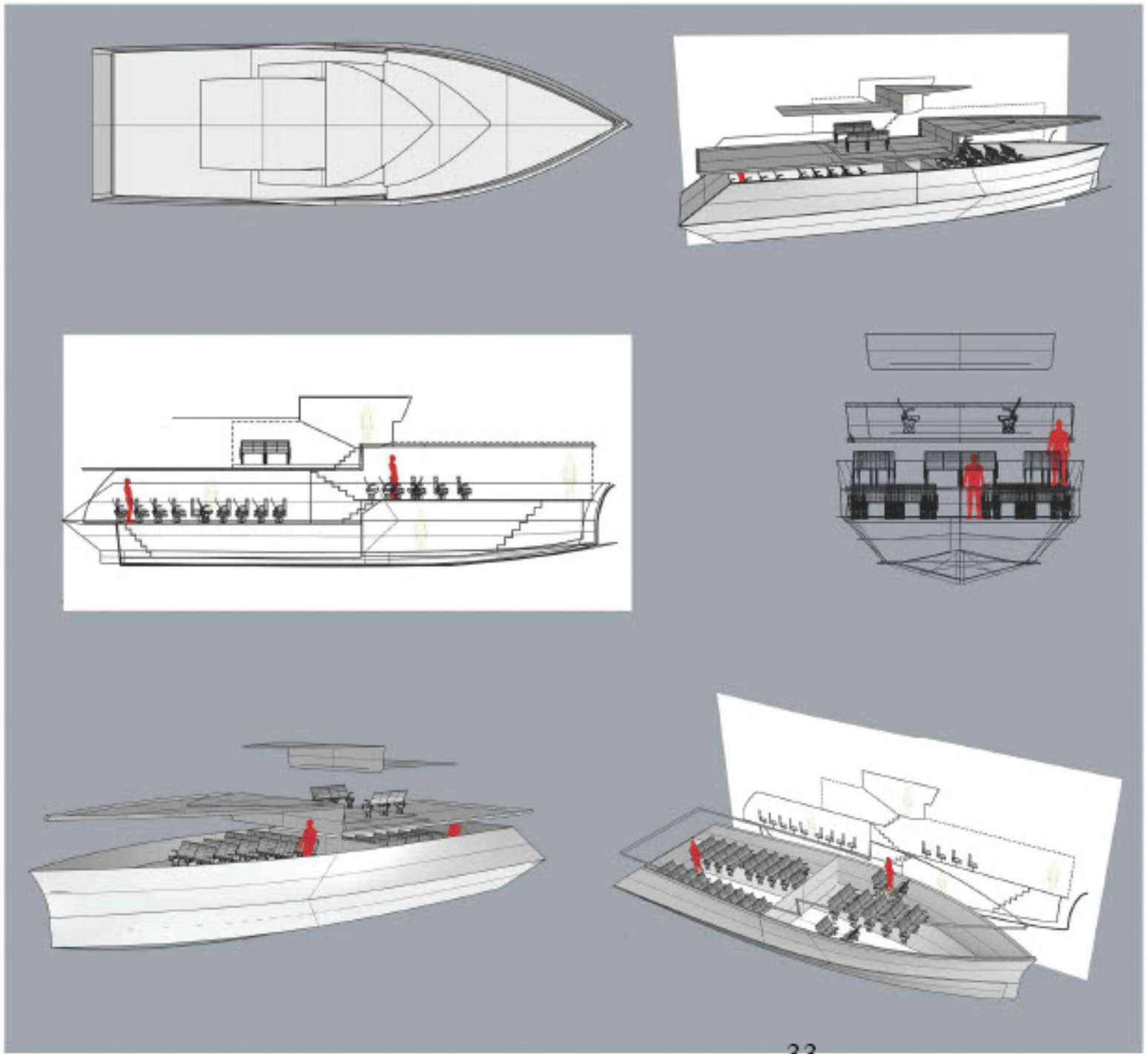
passenger cabin



engine and crew area

Final layout

5.5 Finalised layout in CAD



exploring space in Rhino

Length Overall : 22.9 mtr

Length Waterline : 20.0 mtr

Beam : 6.5 mtr

Hull Depth : 2.9 mtr

Draft : 0.8 mtr

Hull and deck materials : GRP

Fuel capacity : 3,000 liter aluminum fuel tank

Water capacity : 500 liter aluminum water tank

Engine power : 2000 hp

Drive : hybrid (fuel cell with thermal or solar assistance)

Passengers capacity : 100 passengers

finalized specifications

5.6 Inspiration for Design

Vessel should have certain amount of belongingness with respect to surroundings and should have certain amount of contrast.

As like shikara and Kerala house boat.

5.7 Mood board

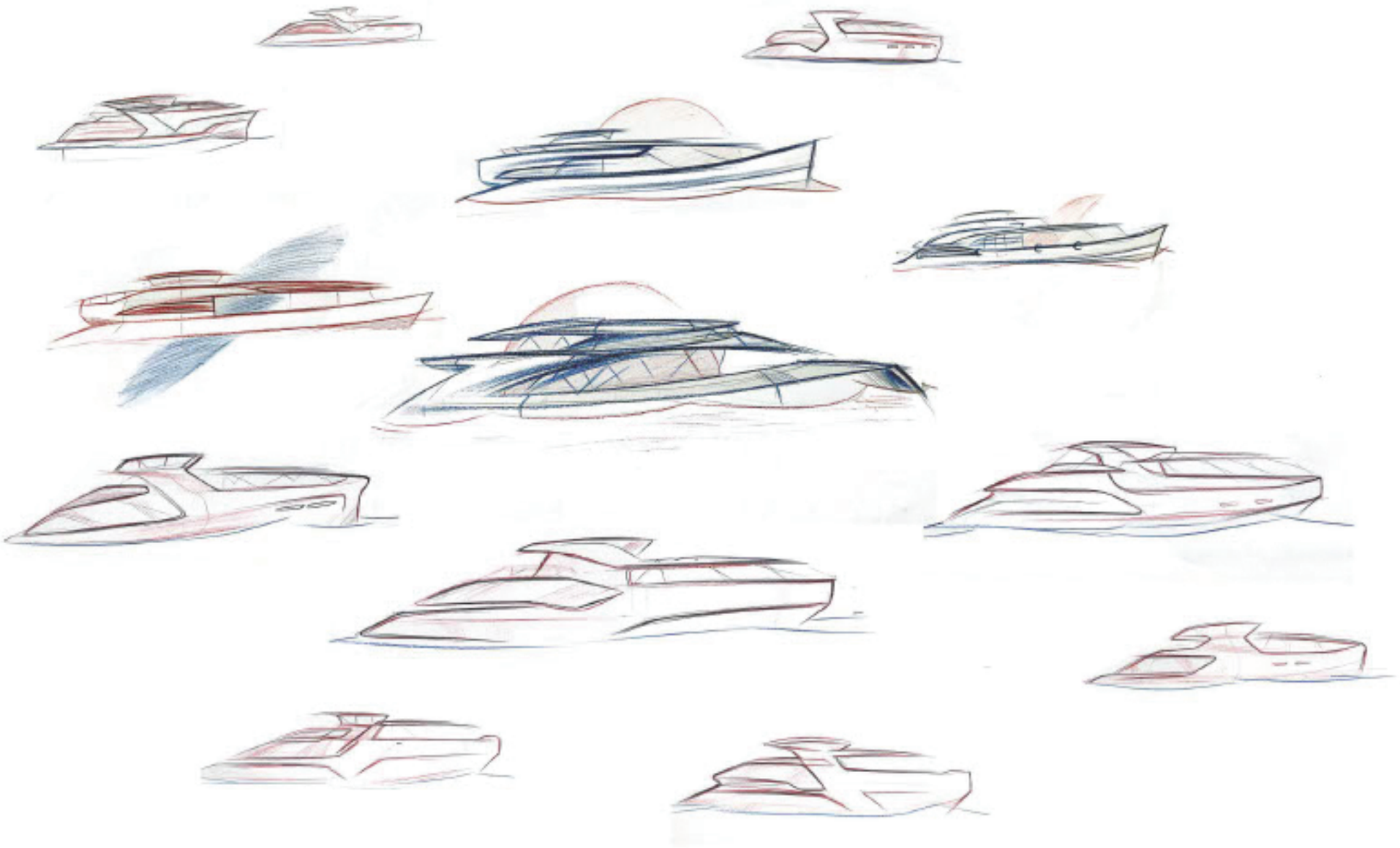
The contrast will represent with the fusion of modern taj and the primitive gate way of India.
At the same time it should be approachable to every one.

5.7 Image board

Explore in bringing harmony in vibrant environment.

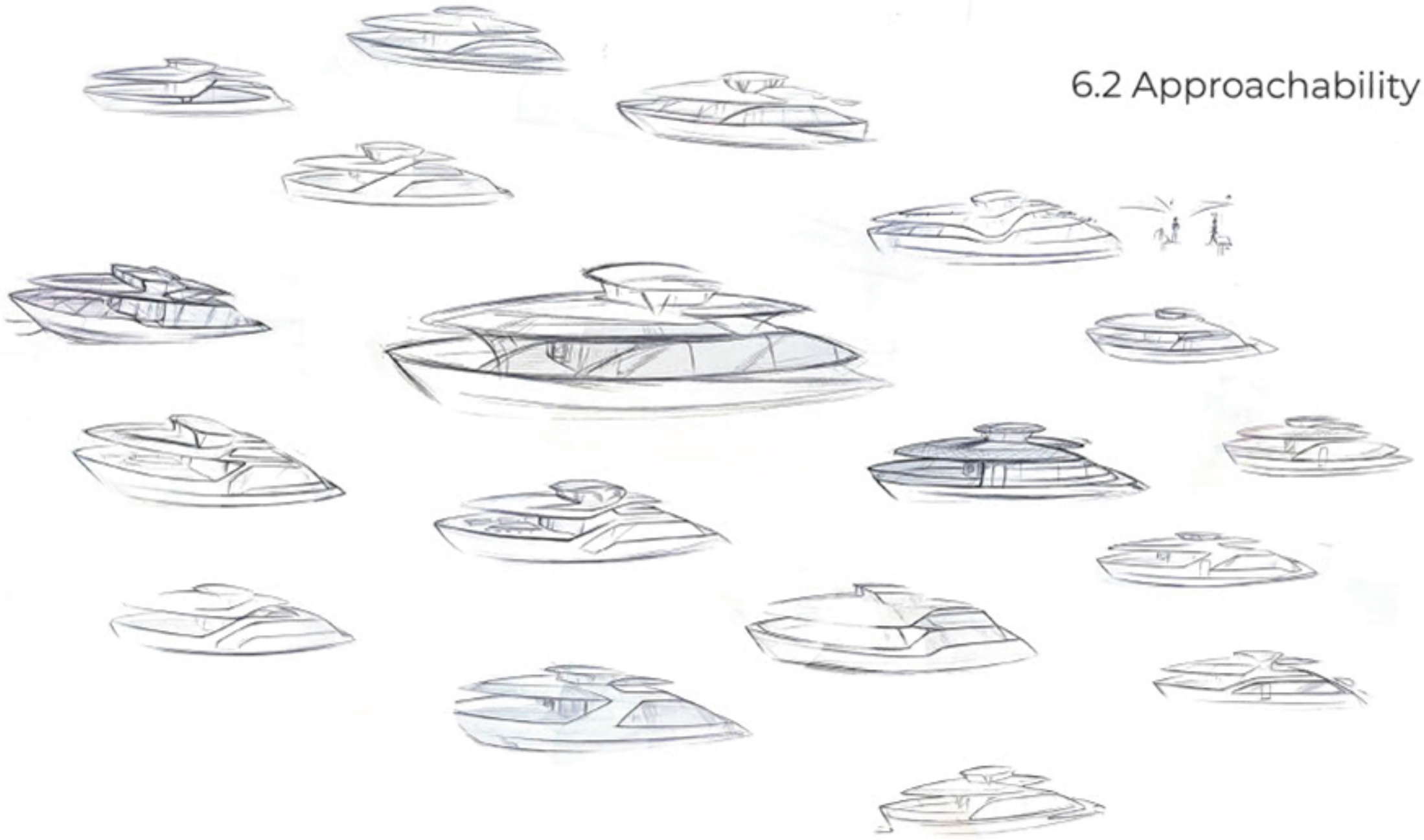
6. IDEATION

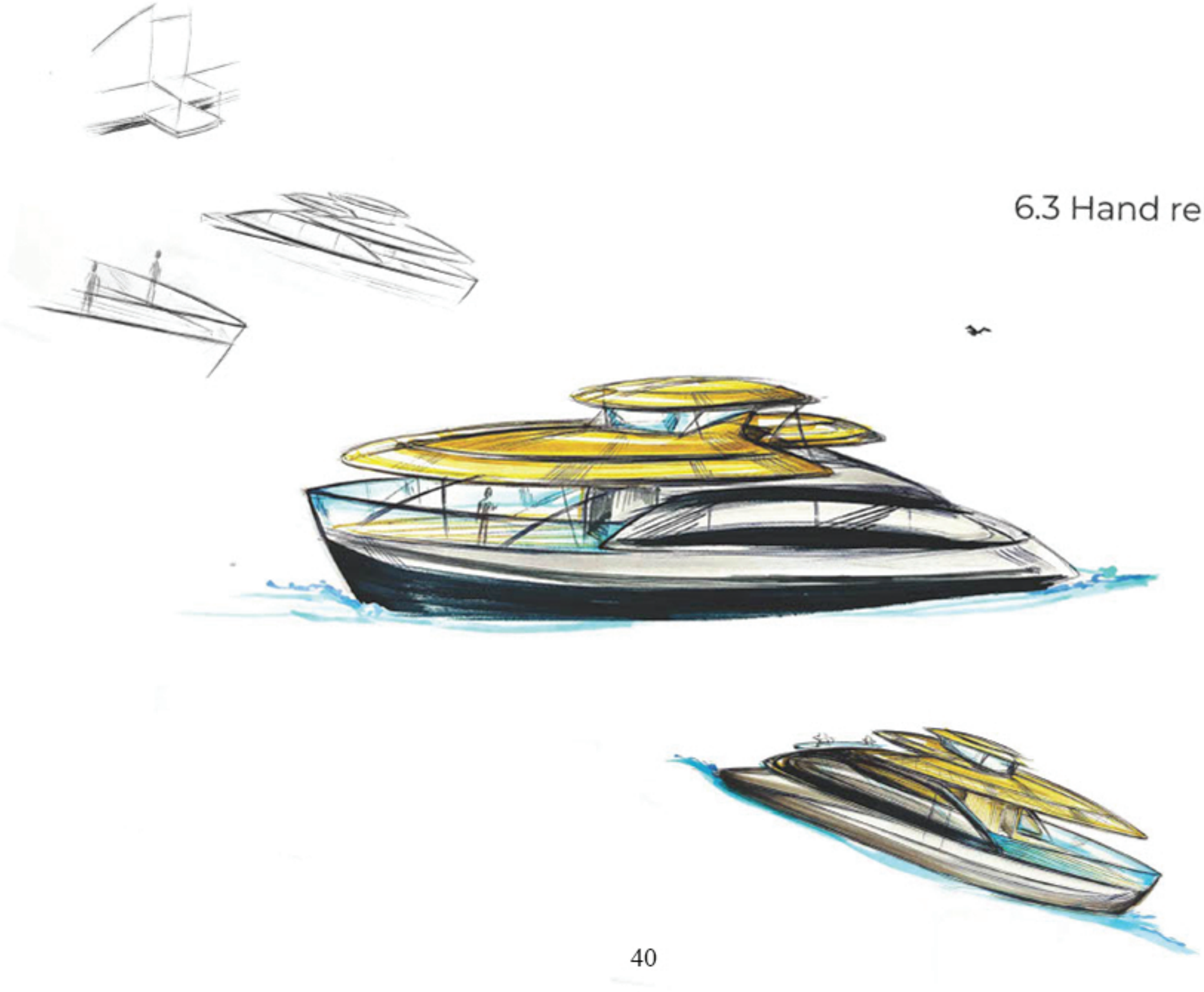
6.1 Contrast in Design



Exploration in bringing contrast

6.2 Approachability

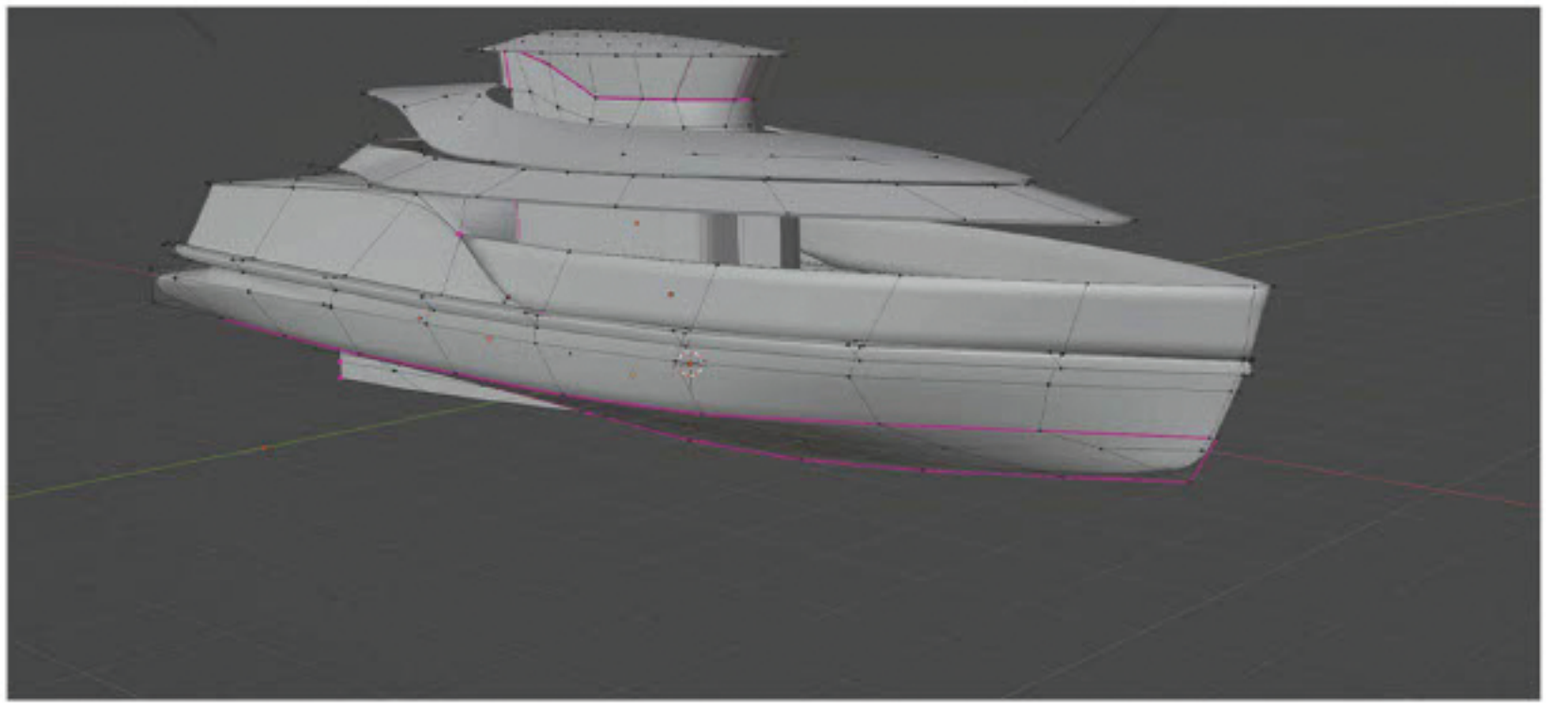


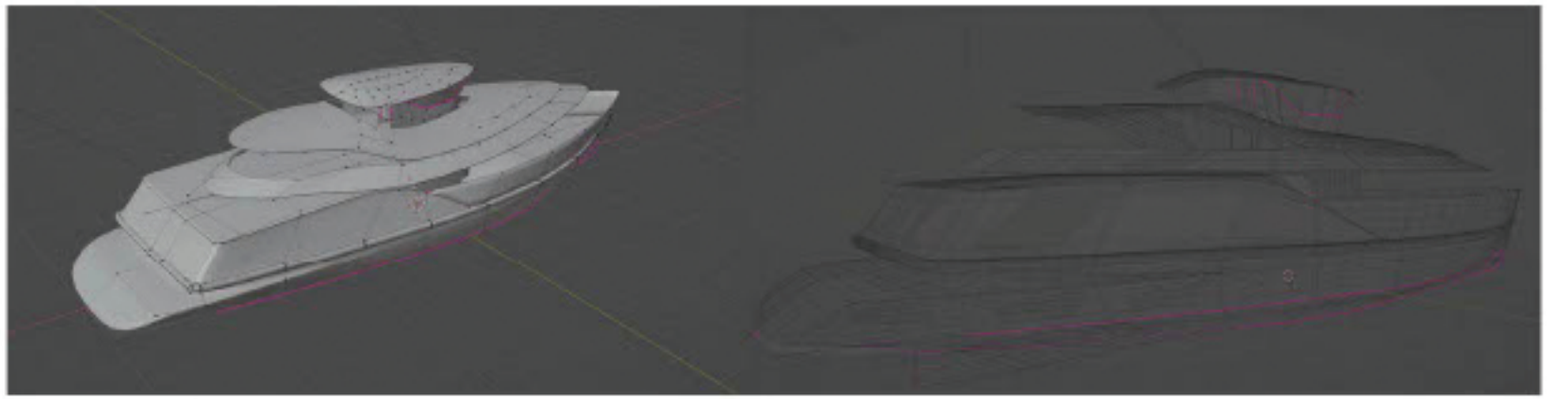


6.3 Hand render

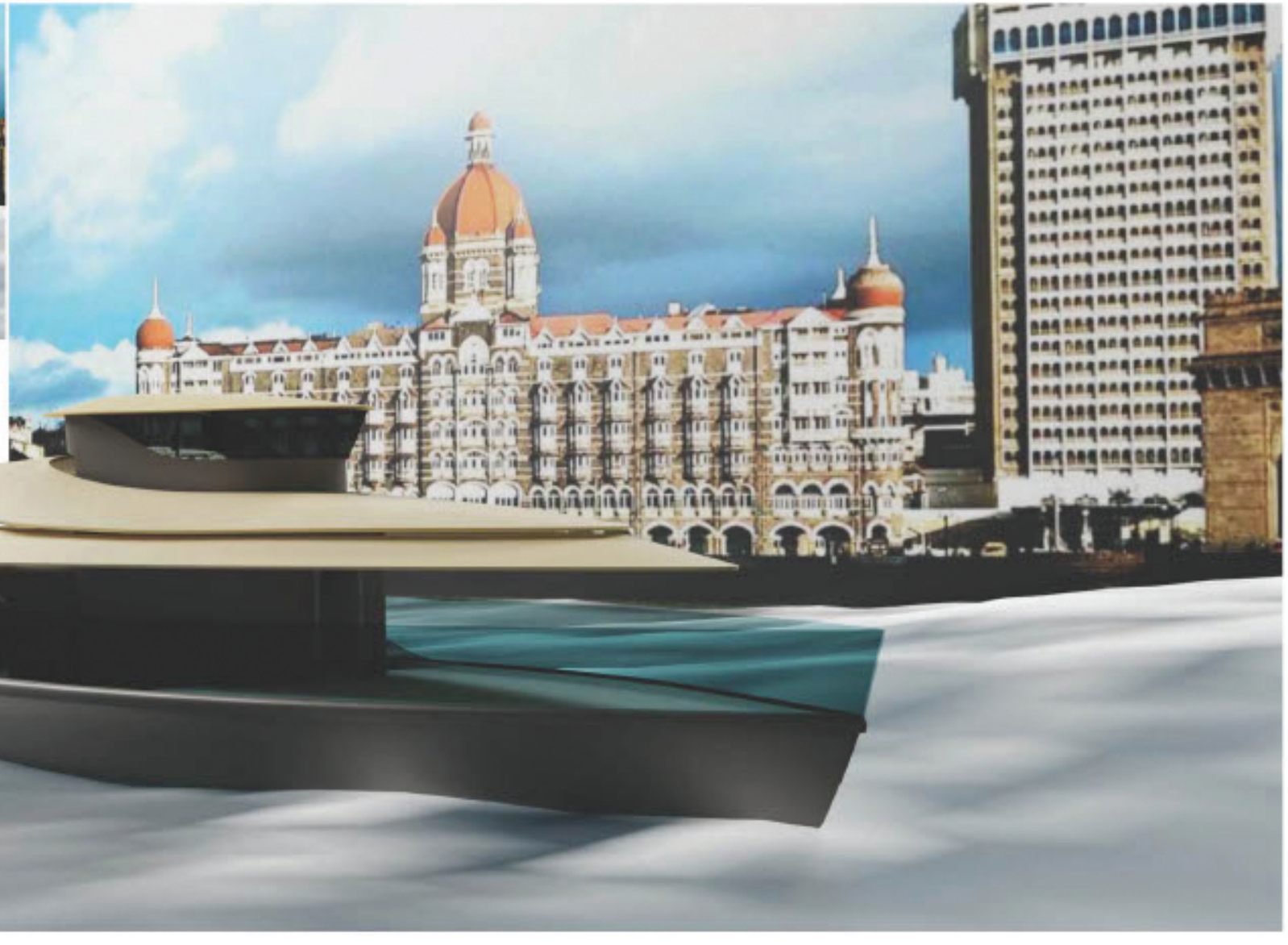
CAD model

6.4 CAD model



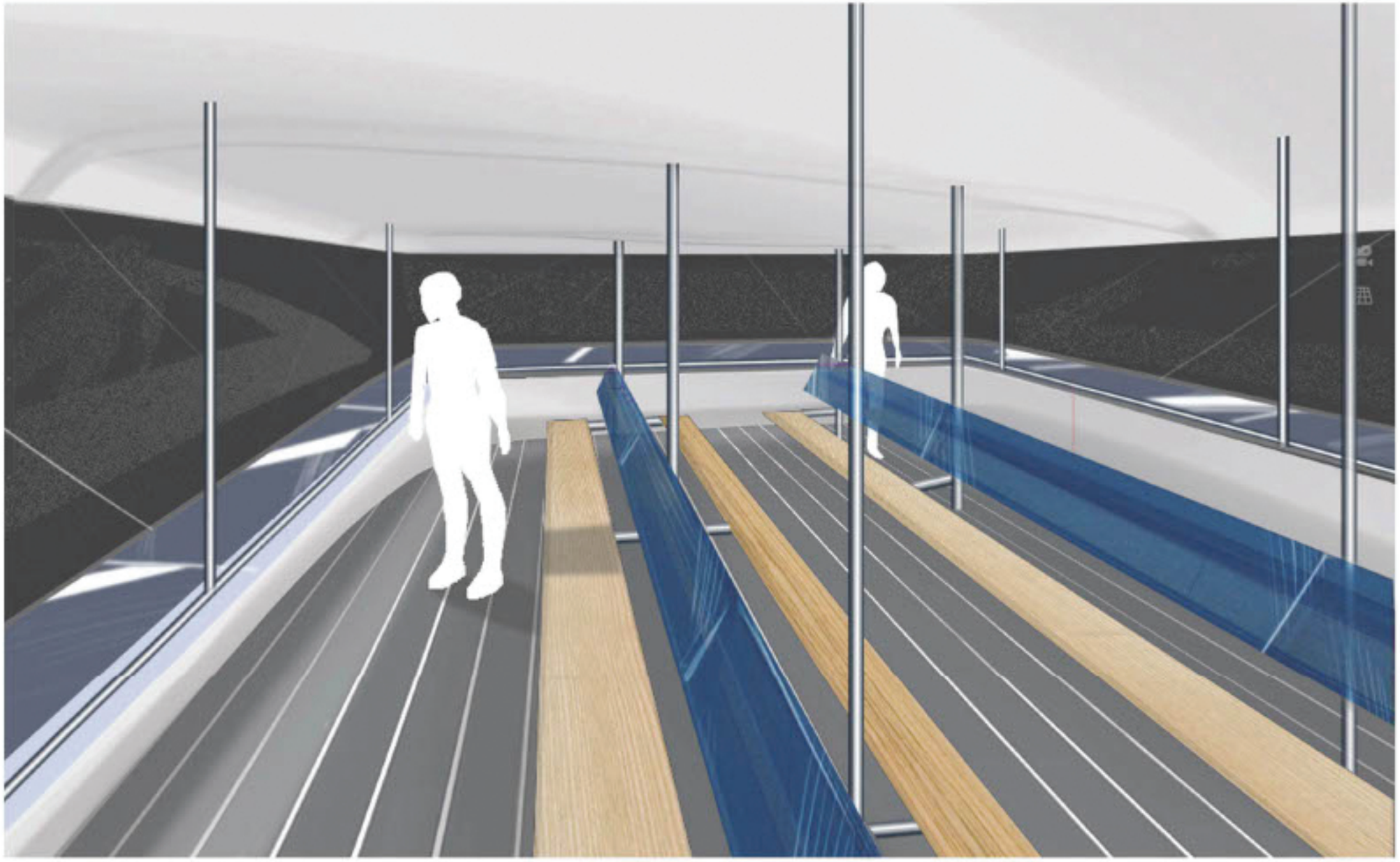


6.5 Renders of 3D model



6.5 Renders of 3D model

6.5 Renders of model



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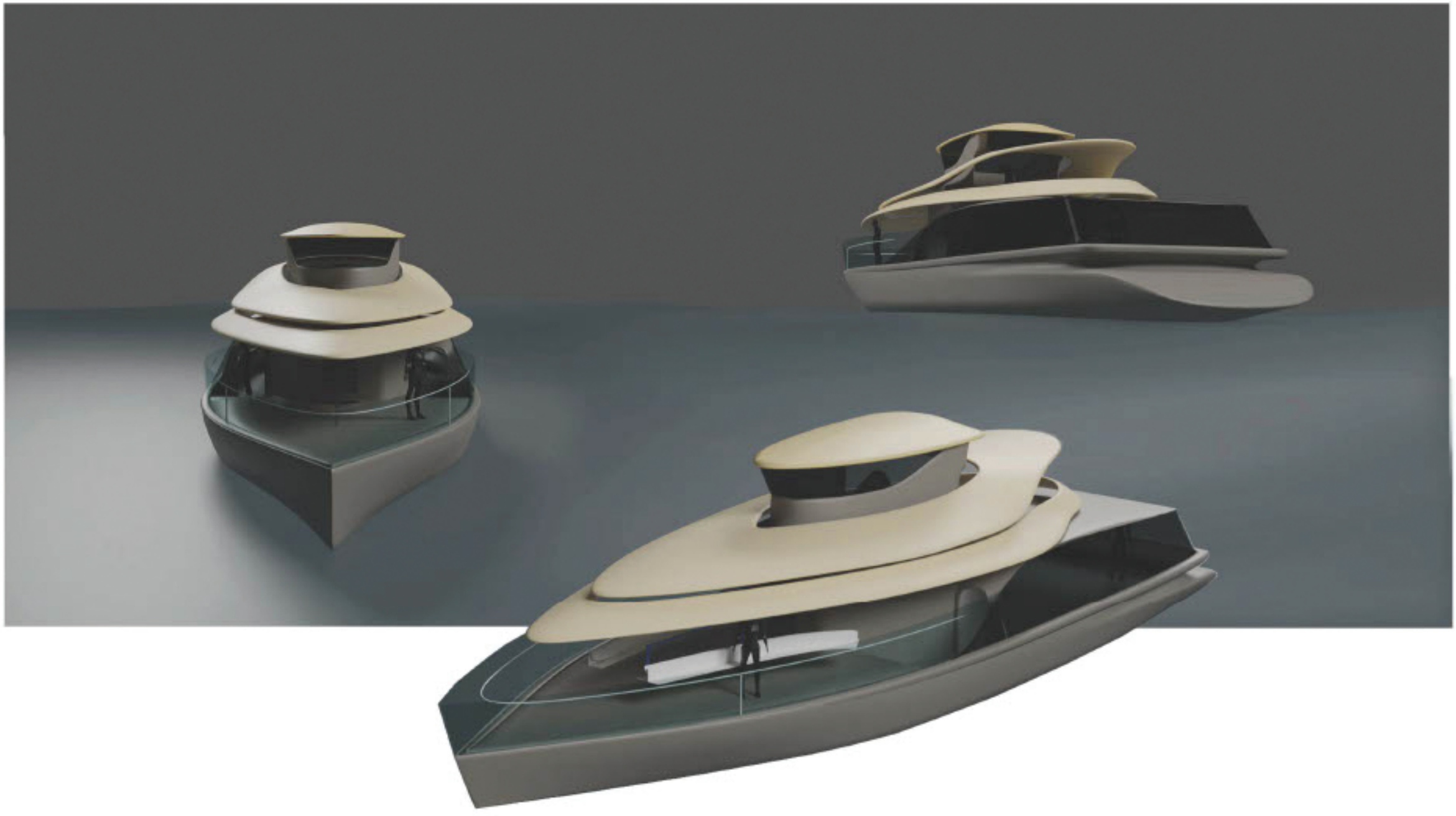
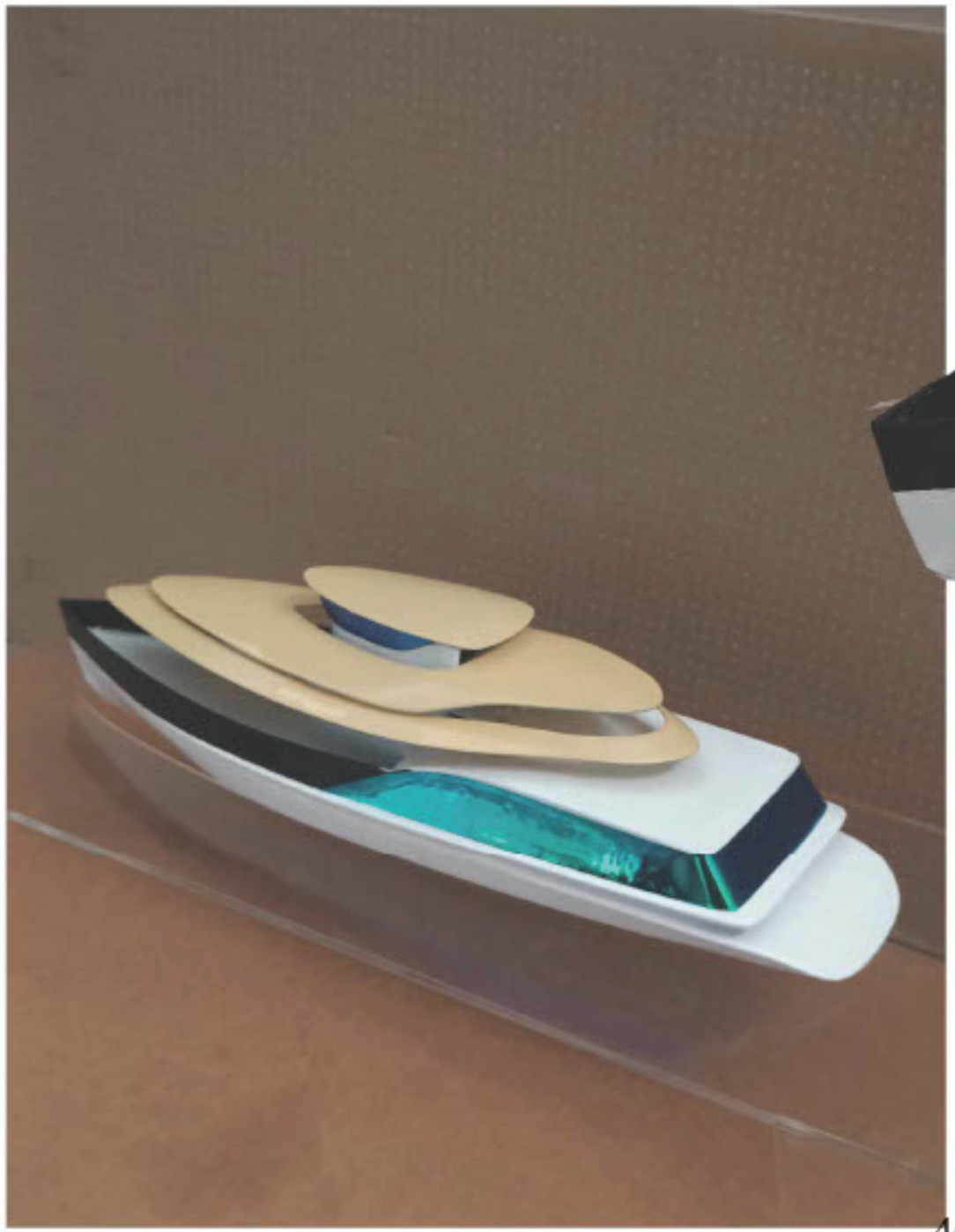


6.5 physical model



8 Reference

The following references were extremely helpful during the research phase of the project:

User review
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"Introduction to Naval Architecture" by E.C. Tupper