

**Marine Research Institute and Public Aquarium**

**Sadat Hamid**

**06108017**

**Department of Architecture**

**BRAC University**

## **ABSTRACT**

The site chosen for the Marine Research Institute and Aquarium is in Cox's Bazaar, one of the prime tourist locations in our country. The project was envisioned as bringing new life to the waterfront area in which the site is located as well as providing a point of interest for the entire region itself. The lack of awareness regarding marine ecosystems even in professional sectors is a huge gap which remains due to the lack of resources and opportunity to further our knowledge of the Bay of Bengal. The site was chosen for its close proximity to the ocean due to the large supply of water that is required to maintain the Aquarium exhibits. The project was segregated into two sections, an administrative and research oriented section that was closed to the public and an exhibition space that was accessible to the general public. Case studies were carried out and the "Ozeaneum", a German Oceanographic Museum was chosen as the overseas case study. The Ozeaneum was selected because of its strong formal expression and relation to context. "Modern Hatchery" is a local project that was chosen for the case study.

**Keywords:** Marine Ecosystem, Research Institute, Aquarium, Public space, Cox's Bazaar

## **Acknowledgement**

I would like to take this opportunity to thank my teachers Ms. Rubaiya Sultana and Ms. Rabeya Rahman. Dr. Zainab Faruqi Ali, Ehsan Khan, Sajjad Hossain and Shakil Ahmed Shimul for helping me throughout the thesis, as well as all the members of the faculty of the Department of Architecture.

I would like to thank my family and friends for their support and inspiration throughout these years. All of this is possible because of your continued support

## Contents

### CHAPTER 01: INTRODUCTION

1.1 Introduction.....	01
1.2 Background of the project .....	01
1.3 Reasons for choosing the site .....	01
1.4 Reasons for choosing the program.....	02

### CHAPTER 02: SITE APPRISAL

2.1 Environmental Considerations.....	03
2.1.1 Site and surrounding.....	03
2.1.2 Topography.....	05
2.2 Historical and Social .....	06
2.3 SWOT analysis of the site.....	06
2.4.1 Strength.....	06
2.4.2 Weakness.....	07
2.4.3 Opportunities.....	07
2.4.4 Threat.....	07

### CHAPTER 03: LITERATURE REVIEW AND CASE STUDIES

3.1 Marine Research institute and Aquarium.....	08
3.2 The objective of the Marine Research Institute and Aquarium.....	08
3.4 Case study	
3.4.1 Case study 01: Modern Hatchery.....	09
3.4.2 Case study 02: Ozeaneum German Oceanographic Museum.....	11

### CHAPTER 04: PROGRAM DEVELOPMENT

4.1 Rationale of the program.....	17
4.2 Detail Functional program.....	17

## **CHAPTER 05: CONCEPT AND DESIGN DEVELOPMENT**

5.1 Concept.....	23
5.2 Design development.....	25
5.3 Design phases.....	25
5.4 Final design.....	26
<b>CHAPTER 06: CONCLUSION.....</b>	<b>56</b>

### **Contents**

Fig 01: Site and Surroundings
Fig 02: Permissible building heights
Fig 03: Panaromic views of site
Fig 04: Flow chart of Modern Hatchery process
Fig 05: The Ozeaneum
Fig 06: The Ozeaneum concept sketches
Fig 07: The Ozeaneum plan
Fig 08, 09: The Ozeaneum interior
Fig 10,11, 12, 13, 14, 15: Concept sketches
Fig 16, 17: Images of the final model
Fig 18: Final elevations and Sections

## **CHAPTER 1: INTRODUCTION**

### **1.1 Introduction**

The stretch of beach area in Cox's Bazaar is the longest uninterrupted sea beach in the world(120 km). It is an important tourist spot in the country with a steady influx of tourists visiting every year. The beaches with rolling green hills as their backdrop provides a picturesque setting for a tourist spot and the Marine Research Institute and Aquarium is designed to renew interest that was waning in a zone of the beach that had fallen into neglect.

### **1.2 Background of the project**

The project was until recently under the supervision of Chittagong Development Authority. However, due to increased budget constraints and other limitations, the project was ultimately abandoned.

### **1.3 Reasons for choosing the site**

The site for the institute is towards the North-west of the main town. It is near the Cox's Bazaar Airport and located near the beach at a distance of 1600 feet from the high water line. There is a hatchery to the south and a canal and Cox's bazaar airport to the east. The total site area is 18.5 acres. The site was chosen for several reasons. Primarily it was the location close to the waterfront that would be ideal for providing a fresh supply of water necessary for the aquarium exhibits. The other factor were that it was already situated at a tourist location albeit one that had seen more use in the past. The fact that the site was in a state of neglect was another factor as the plans for the revitalization of the area due to the inception of the project became a part of the project aim. The beach near the proposed site is still in a very good condition for use. The creation of an important public building such as the Research Institute and Aquarium might result in an extension of the waterfront that is used.. The proximity of the site to the airport allows great tourist potential for the Research Institute and Aquarium. The presence of a road between the beach and the site provides strong access into the site.

### 1.3 Reasons for choosing Program

The following list shows the program chosen for the project:

#### Aquarium

- Exhibition Spaces
- Scientists' Room
- Photography
- Machine Room
- Lobby
- Administrative and Maintenance Section

#### Restaurant

#### Research Institute

- Administration
- Research Laboratories
- Library
- Hatchery

The Aquarium is accessible to the public and the research and administration zones are closed off to the general public. The restaurant remains the common ground between the two zones. The Bay of Bengal sees its ecosystems natural way of being endangered as pollution and over-fishing are beginning to take their toll on the inhabitants of the Bay. The research material regarding the fresh water fishes of Bangladesh is quite extensive in stark comparison to the almost non-existent amount of data regarding the Marine sector of our country's waters.

The program was created in order to provide the general public with an opportunity to educate themselves regarding the rare and endangered species that live in the Bay of Bengal as well as the dangers that they face. The restaurant and the outdoor dolphin park were created as supporting elements for the indoor exhibition spaces.

The program for the research institute was planned according to the needs of the labs.

## CHAPTER 2: SITE APPRAISAL

### 2.1 Environmental Considerations

At the initial stage, the site was studied in detail taking the environmental issues into consideration. The surrounding structures were studied as well as the topography of the land. Meteorological reports considering wind speeds and flooding levels were collected. The co-ordinates of the site are 21° 27' 18"N, 91° 57' 58"E.

#### 2.1.1 Site and surrounding plans

The site is oriented with the longer side facing west towards the Bay of Bengal. A road of width 20' separates the site from the beach. The road was used to provide access at two points into the site. One of these points was reserved for access to the public zone whereas the other was used to provide entry to the administrative/research zone which was restricted to the public. As access towards the site from the Cox's Bazaar city is from the south, it was decided that the public functions would be placed in that portion of the site. The research institute would be placed in the northern portion due to light conditions being more favorable.



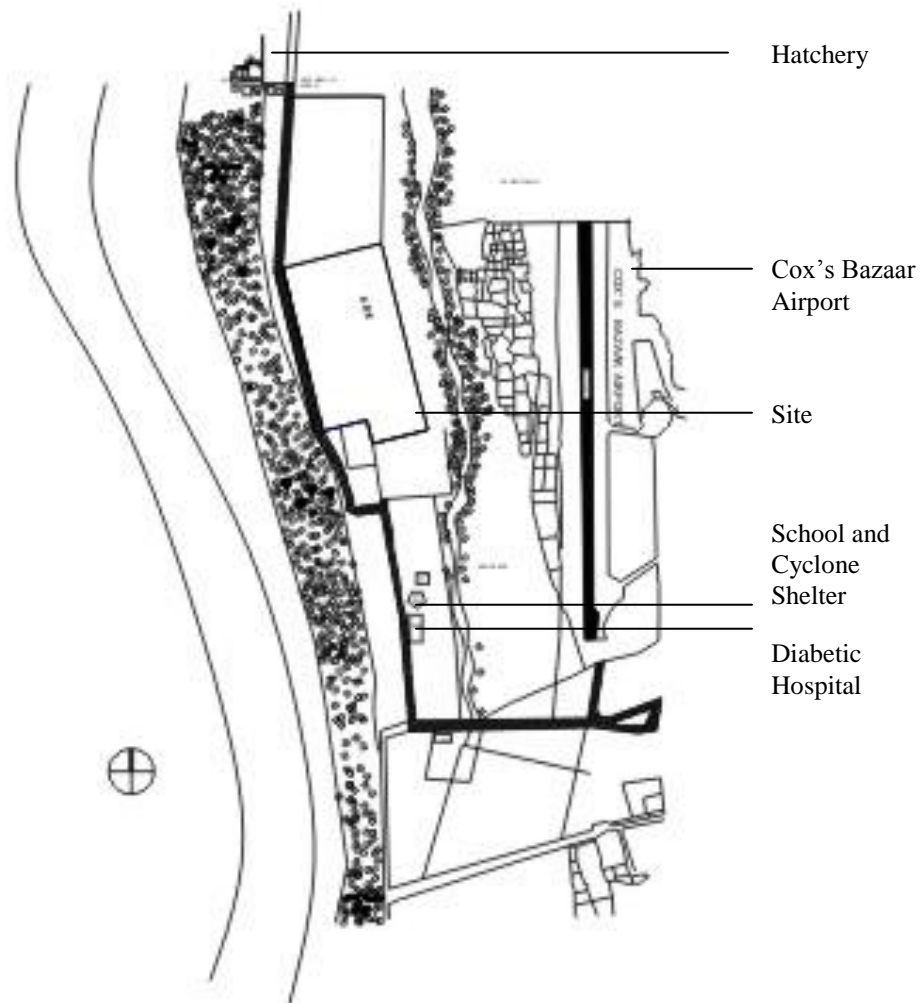


Fig 01: Site and surroundings

Source: Amer Rashid

The proximity of the airport meant that certain height restrictions might be imposed on design. However, the runway of the airport was oriented adjacent to the site. According to the Architects' Data (Neufert 446), the permissible building heights immediately beside runways increase by a ratio of 1: 7 as shown in Figure 3. As the site is at a distance of 317 m from the airport, the permissible building height was calculated to be 45.29m or 148.59'.



Figure 02 (Neufert 446)

### 2.1.2 Topography

The forest of trees between the adjacent road of the site and the beach provides a buffer zone for strong coastal winds. The “Jhau” trees that make up the forest are tall, slender trees with sparse foliage. The topography of the site is quite flat and vegetation is few and scattered. Vegetation mainly consists of coconut trees scattered over the entire area of the site. The topsoil is sandy and covered in grass in certain portions.



Figure 03: Panoramic Views of the Site

Source: Amer Rashid

Wind speeds and tidal floods were studied as cyclones and typhoons pose a major threat to built structures in these areas. Maximum structural wind speeds may be as high as 240 km/h. On a more positive note, the constant coastal winds

create a favourable environment and it was decided that proper utilization of these winds was required in design.

## **2.2 Historical and Social Background**

The site is located next to the Cox's Bazaar airport. The land around the site is mostly vacant. Important structures such as the airport to the west and the hatchery to the north are placed at a reasonable distance from the site. The nearby school doubles as a cyclone shelter in times of need, becoming a sort of iconic structure within the local community. The Diabetic Hospital towards the south of the site is visited quite regularly by people from all over Cox's Bazaar. This area of the beach has turned out to be of a more secluded nature in recent times, with a few scattered tourists being catered to by the vendors on the beach, with the business of the existing hotels in the area seeing a fall in their business. The site is also on the verge of being taken over by the armed forces which would see restrictions being placed upon the area discouraging further economic growth for the zone.

## **2.3 SWOT Analysis**

A SWOT Analysis was carried out considering the site, existing resources and future potential. The Strengths, Weaknesses, Opportunities and Threats were separately listed and weighed against each other.

### *Strengths:*

- A road of width 20' runs between the beach and site providing a strong access into the site.
- Easy access from Cox's Bazaar hotel-motel zone (Laboni and Kolatoli) (20 Taka Rickshaw ride)
- Proximity to the airport allows great tourist potential
- Location of Jhinuk Market, some hotels and shops for dried fish create movement of people towards the location of the site.
- Proximity to sea allows an easy access to sea water for use in aquariums and hatcheries.

*Weaknesses:*

- Location near the airport may have noise problems even though the airport is not busy and coastal winds tend to dampen noise
- It is a bit “out of the way” for conventional tourists.
- Strong coastal winds lead to structural difficulties

*Opportunities:*

- This part of the beach was once very widely used. Creation of a facility such as an aquarium may allow this part of the beach to become active once again.
- Proper utilization of coastal winds can create a very pleasant environment.

*Threats:*

- Some of these barren sites near the beach are being taken over by the air force, navy or army.

Maximum Structural Wind Load is very high and cyclones and typhoons are a major threat.

### **3.1 Marine Research Institute and Aquarium**

The marine research institute is an organization dedicated to furthering the knowledge of the oceans of our world and the organisms that inhabit them. It is in these labs that the knowledge of the oceans is analyzed and the new findings are discovered.

The public aquarium has been quite popular among the general populace since the inception of the first public aquariums and remain popular to this day. It would be a safe bet to say that public aquariums not only educate the public and plant seeds of interest within them but they are also capable of generating revenue.

### **3.2 The objective of the Marine Research Institute and Aquarium**

The main goal of the project is to further the knowledge of the oceans by providing the research facilities and equipment that are lacking in this area of research in Bangladesh. The lack of general awareness as to the situation of the Bay of Bengal regarding over-fishing and pollution is staggering and immediate steps must be taken to remedy the situation unless something irreversible might occur. The goal to educate the public was set up to be undertaken by the exhibition spaces containing the live exhibits as well as museum displays of fossilized remains. The public zone which is accessible to the public therefore performs a dual task of educating and as well as generating revenue.

### 3.4 Case study

#### 3.4.1 Case study 01: Local Case Study

##### Modern Hatchery

Modern Hatchery is a Hatchery in Cox's Bazaar. It deals with the breeding of lobsters, shrimps etc. to spawn. The products are exported.



### Modern Hatchery : The Complete Process

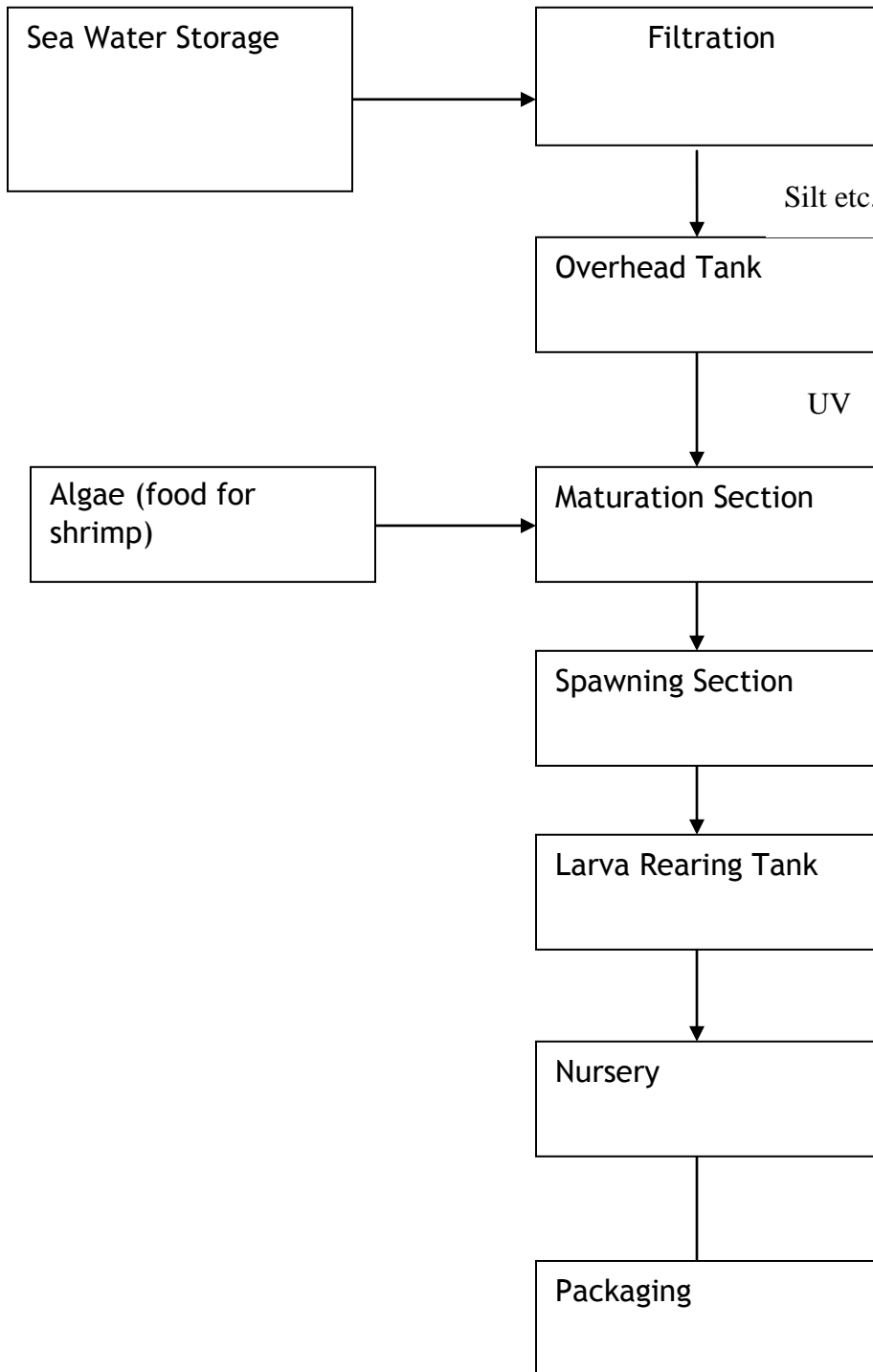


Fig 04: Flow chart of the Modern Hatchery process  
Source: Hamid,2010

### 3.2 Overseas Case Study

Ozeaneum German Oceanographic Museum  
Behnisch Architekten



Fig 05: The Ozeaneum  
Source: Behnisch Architekten, 2010



Germany-based architecture and planning firm [Behnisch Architekten](#) has designed a very large public aquarium in the German city of Stralsund - **Ozeaneum German Oceanographic Museum**. The new museum is an open structure flooded from all sides by light, similar to the way stones in the sea near the water's edge are flooded by the surrounding water. Its fluid form has successfully created a new city image in the historical site and become a new landmark at the Baltic coast.

### Site

The aquarium lies at a harbor promenade surrounded by historic warehouses, and is oriented toward the sea.

### Program

The design of the external areas emphasizes the role of the museum as a landmark for Stralsund, giving evidence of the new activities on the northern harbor island. The complex incorporates large aquaria, comprehensive exhibitions about the Baltic Sea, the world's oceans, and marine research and resources, and a special display accommodating "Giants of the Sea." Functional areas, such as parking spaces for bicycles, needed to be integrated into the plan. The architects were also challenged to highlight the museum's most prominent asset, the sea.

The competition brief posed a diverse range of challenges: a technically and architecturally ambitious natural history museum complex incorporating large aquaria; a modern landmark facility to be integrated into the largely intact urban environment of a traditional Hanseatic city; the **German Oceanographic Museum's** educational mission to familiarize visitors with underwater flora and fauna and the importance of conserving their natural habitats.

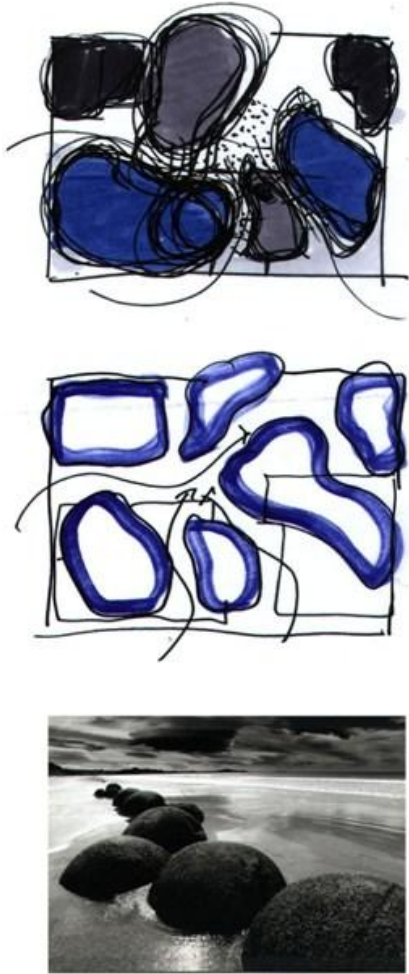


Fig 06: The Ozeaneum concept

Source: Behnisch Architekten,2010

## Design

Behnisch Architekten's German Oceanographic Museum "Ozeaneum" is an open structure flooded from all sides by light, similar to the way stones in the sea near the water's edge are flooded by the surrounding water. The museum's particular shape and prominent location on the promenade make it an attractive and memorable feature in Stralsund's urban silhouette and city image.

The building comprises four major exhibition sections. This arrangement assures the successful integration of Ozeaneum into the surrounding historic architecture. The height of new structures responds to that of existing buildings. New structures were aligned with neighboring buildings either by staggering the surface area of some upper stories, or, wherever technically feasible, by flattening them.



Fig 07: The Ozeaneum plan

Source: Behnisch Architekten,2010

Plan courtesy Behnisch Architekten

The design of each section of the **Ozeaneum** was essentially led by the building's functional requirements. The aquaria are set around a central core of maintenance and technical amenities. This optimizes the use of space, shortens timeframes for the daily feeding and care of marine stock, and also offers visitors a neat circuit of the inner aquarium core. The outer form of the building corresponds to the trace of the tours, which lead visitors from the aquaria to the exhibition areas, through the "Giants of the Sea" display, and then back to the foyer, from where they may embark on an alternate tour.

While the separate elements of the building were inspired by stones in the water, the exterior is reminiscent of sails in an ocean breeze as they wind their way around the façades of both the exhibition and aquarium sections. The large, pre-formed steel sheets called for ship-building technology indigenous to this port city. They are secured at isolated points on the building's steel frame, without any further structural support; overhangs are braced yet appear to be freestanding. The steel sheeting's surface was treated with several coats of highly resilient white paint to create a further connection between the building

and its maritime environment. The white façade draws together the various sections of the building, weaving manifold buildings together and giving them a strong, unified profile.



Fig 08: The Ozeaneum interior

Source: Behnisch Architekten,2010

The main entrance to the **Ozeaneum** lies on the new harbor promenade. The ground floor of the foyer—a self-contained area distinct from the exhibition areas and accessible to non-ticket holders—accommodates a shop and a café, as well as the museum’s front-of-house services. A 30-meter suspended escalator diagonally traverses the entire breadth of the foyer, past genuine whale skeletons, to bring visitors to the upper floor. From there, a splendid view opens across the Strela Sound and the new Rügen Bridge to Rügen Island.

Three exhibition levels, oriented to the sea, illustrate the oceans of the world, the Baltic Sea, and marine research and resources. Two aquaria devoted to the Baltic Sea and the North Sea are set on the inland side of the museum complex.

The centrepiece of the North Sea Aquarium is the tank of schooling fish, which contains nearly 2.6 million liters of water. Its glass front offers visitors remarkable insight into the infinity of the sea. The upper floor of the North Sea Aquarium accommodates the children's exhibit, which will be enhanced later by the addition of a rooftop penguin compound.



In the “Giants of the Sea” exhibition, visitors are confronted by life-size replicas of whales, evoking an impression of being able to splash about underwater with the planet’s biggest creatures. The dimly lit room is designed to plunge visitors into an experience of the infinite depths of underwater worlds.

One of the three historic warehouses on the site was incorporated in the **Ozeaneum**. The warehouse—with much of its historical materials still in place—accommodates the museum administration, a multi-purpose hall for educational projects, a self-contained, multi-purpose hall for public events and, a café.

jms Bildbegleitung und Einweisung am Behnisch Architekten, Stuttgart  
 Copyright Johannes-Maria Schlorke, 2006

Fig 09: The Ozeaneum interior

Source: Behnisch Architekten, 2010

#### 4.1 Rationale of the programme

The following programme was developed according to the needs of the research institute and the aquarium. The needs of the research labs and the exhibition spaces vary from lab to lab and from exhibit to exhibit. Therefore some flexibility was allowed into the design of the exhibition spaces.

#### 4.2 Detail functional program

Post	number	Sft	Size	Total
<b>1.Administration</b>				
		380		300
Director General		500		500
Storage		180		180
Private Secretary				
	2	300x2		600
director	2	180x2		360
Private Secretary	3	200x3		600
Secretary	3	150x3		450
Asst. Secretary	2	200x2		400
Section office	8	64x8		512
Typist				
		200		200
Asst. Engineer	2	100x2		200
Sub Asst. Engineer		100		100
Super Visor	3	100x3		300
Store				
		150		150
Sales Manager		100		100
Sales Asst				
		150		150
Chief security officer		100		100
Asst. security officer		80		80
Store				

	2	100x2		200
Accountant	6	80x6		480
Others				
		200		200
Planning officer		150		150
Planning Asst				
		250		250
Maintenance officer		150		150
Upper division clerk		190		190
Lower division Clerk				
		200		200
Medical Officer		300		300
Patient examination room		200		200
Waiting		100		100
Store For Equipments		200		200
Dispensary				
		2000		2000
Conference Room		1500		1500
Seminar Room				
Toilet				
Circulation Space 30% of TA				
Total				23500
<b>2. Academic</b>				
Post	Number	Space rq	Size	Total Sft
Chief Faculty Members	6	200x6		1200
Senior Faculty Members	6	150x6		900
Associate faculty members	12	150x12		1800
Asst. Faculty members	6	110x6		660
Research Asst	2	100x2		200

Class room	6	450x6		2700
Research room	3	300x3		900
Programmed officer		120		120
Typist	6	64x6		384
Conference room		3000		3000
Staff rh		1500		1500
Toilet				
Circulation area 20% pf TA				
Total				16650
<b>3. Research Lab</b>				
Post	Number	Space rq	Size	Total
Analytical Lab				3500
Toxicology/ Pathology lab				3000
Hatchery Lab				3500
Demonstration / Field lab				3000
Hydro biological lab				3000
Biochemical lab				3000
Oceanographic lab				3000
Total				22,000
<b>4. Library</b>				
Post	No	Space rq	Size	Total
Entrance & information				1000
Audio visual, micro-film & computer centre				1600
Research study				800



General reading				4000
Reference , Journal				600
Stack area				5500
Rare book				300
Librarian				300
Asst. librarian	2			500
Cataloguer				100
Office				800
Binding & Preparing				1000
Storage				600
Engineering plant				400
Toilet				
Circulation Space 20% of TA				
Total				25,000
<b>5. Ancillary</b>				
Post	No	Space rq	Size	Total
<b>5.1. Restaurant</b>				
Eating area				8000
Service area				900
Kitchen 30% of eating area				2500
Toilet & Wash				1500
Entry & circulation area-30%				
Total				15,000
<b>5.2. Sales( Hatchery)</b>				4,000
<b>5.3. Nature theatre</b>				

Sitting 100				2000
Foyer				400
Stage				800
Workshop & store				800
Exhibition space				1000
Circulation Space-20%				
Total				4,000
<b>6. Marine Aquarium</b>				
Post	NO	Space rq	Size	Total
<b>6.1.. Administrative</b>				
Director room				300
Asst. director room				200
Superintendents room				200
Chief scientific room				750
Principal Scientific Officers room				450
Scientific Officers room				300
Senior Aquarists Room				350
Curators room				300
General store				1000
Office Store				100
toilet				150
Lobby				300
Circulation space-20%				
Total				10,200
<b>6.2.. Exhibition Tank</b>				
Dolphin tank & theatre				20,000

Shark tank				15,000
Aquarium display				25,000
Museum				7,500
Scientists room				3,000
Photography				4,000
Machine room				400
Touch pool				300
Lobby				1,500
Circulation-30%				
Toilet				
Total				76,700
Total				

### 5.1 Concept:

The concept behind the project was the search of knowledge, the search to discover more about the ocean which may be argued as the point from where life originated. So essentially it becomes a search for the origins from whence we came. The ocean was set as the stage and form and function followed, being set up in a manner fluid and organic reflecting the way of the ocean. Striving to be as smooth and streamlined as the exhibits themselves, the design seeks to evoke some of the smoothness and the flow of the ocean and its currents.

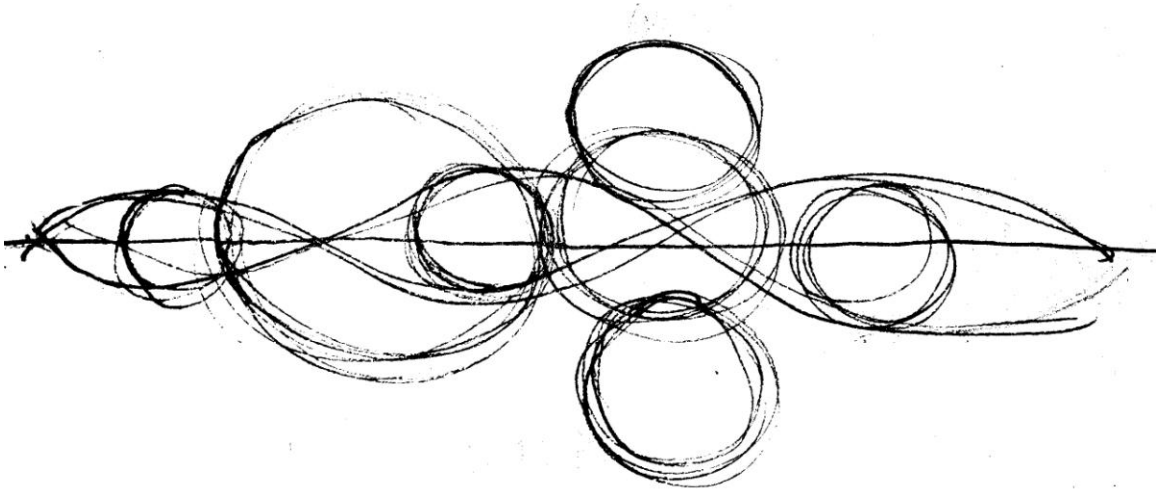


Fig 10: Conceptual drawing  
Source: Hamid,2010

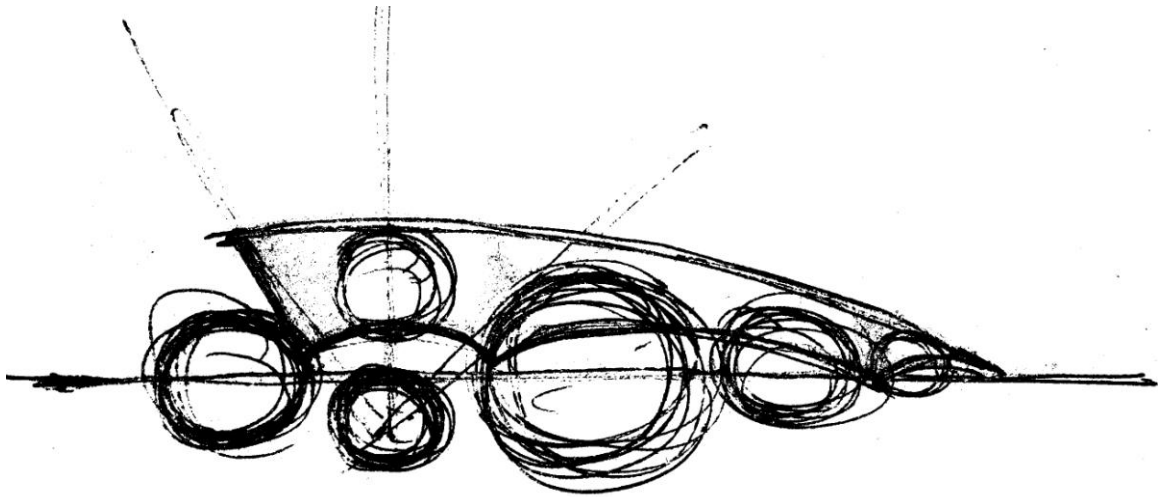


Fig 11: Conceptual drawing  
Source: Hamid,2010

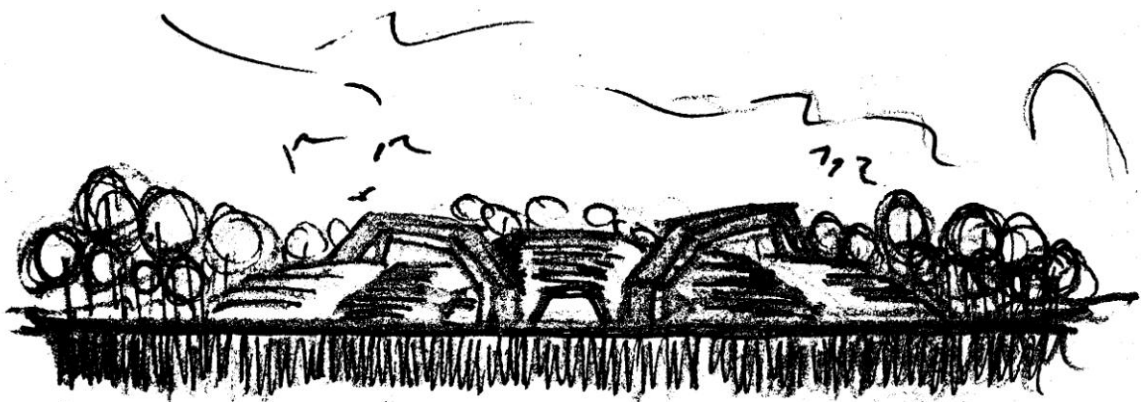


Fig 12: Conceptual drawing  
Source: Hamid,2010

## 5.2 Design development

The need for exhibit spaces that flowed from one to the other was accommodated by opting for a circular floor plan. Another factor that was considered when choosing the form the need for large spans of clear space for the exhibit floors. This was finally achieved by choosing geodesic domes as the structural method for construction of the project

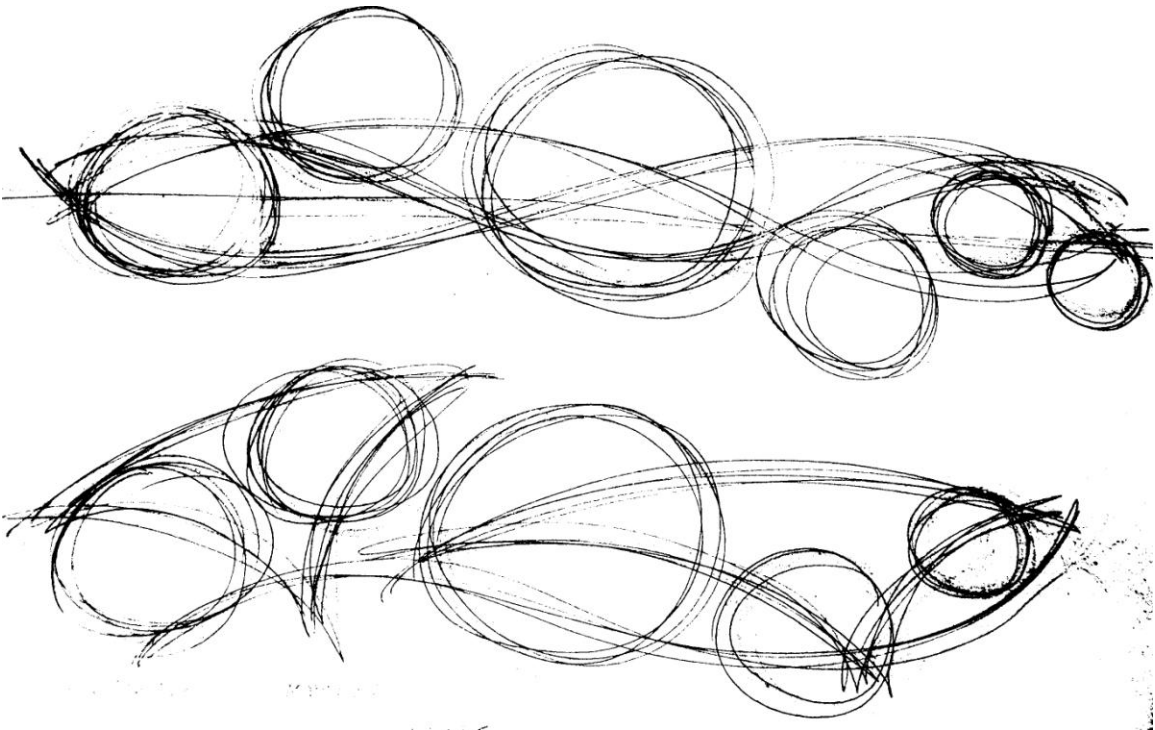


Fig 13: Conceptual drawing  
Source: Hamid,2010

## 5.3 Design phases

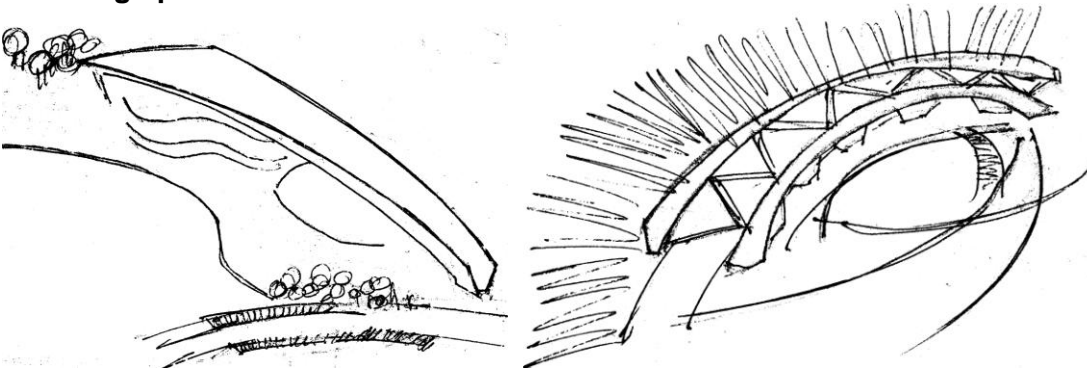


Fig 14: Conceptual drawing  
Source: Hamid,2010

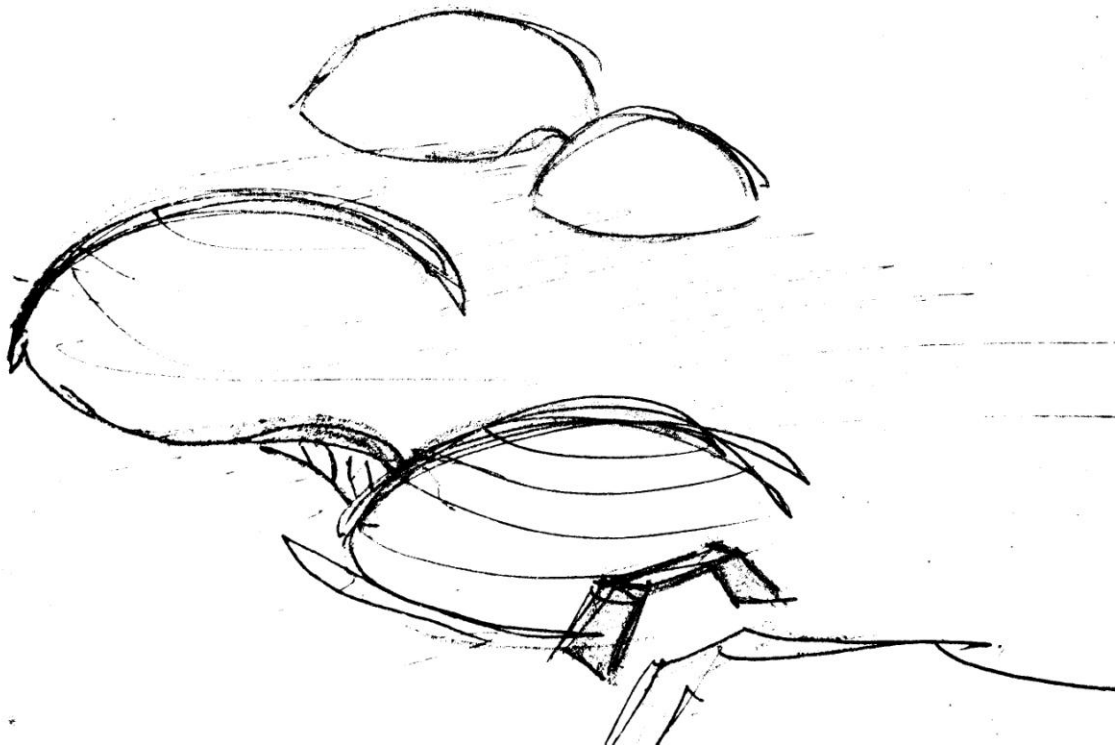


Fig 15: Conceptual drawing  
Source: Hamid,2010

#### . 5.4 Final Design

The final design see's the establishment of the geodesic dome as the dominant structural as well as formal element, being the logical choice in an area prone to cyclones and the like.



Fig 16: Final model  
Source: Hamid,2010

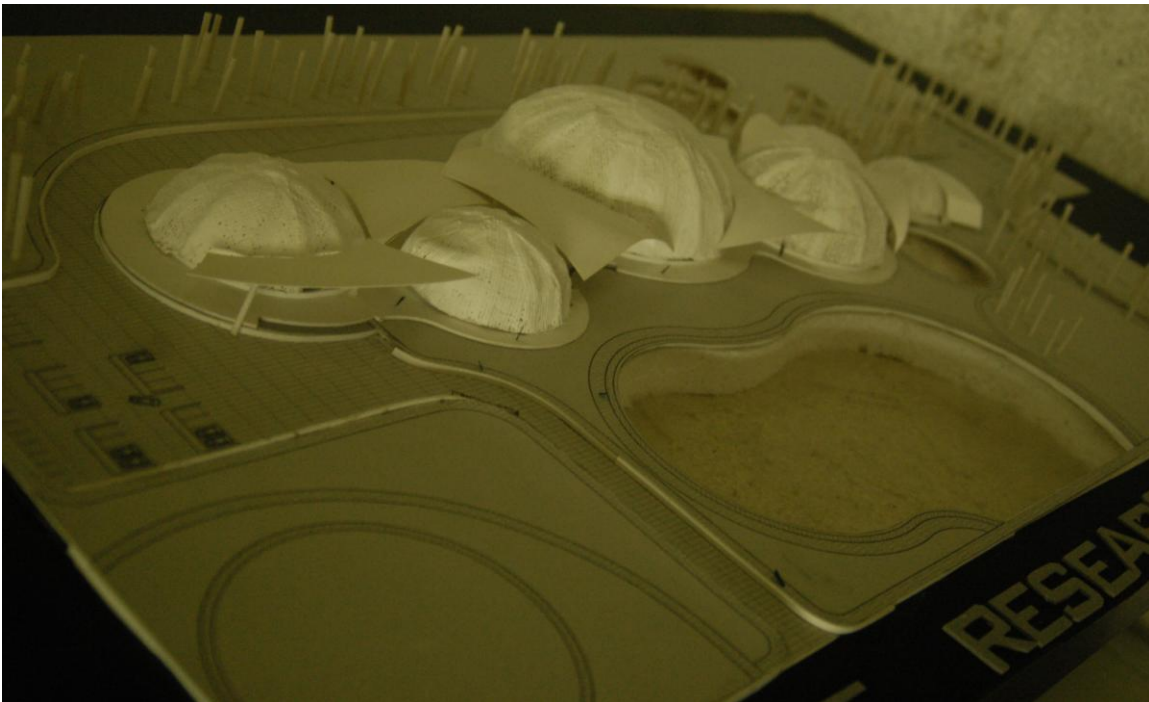


Fig 17: Final model  
Source: Hamid,2010



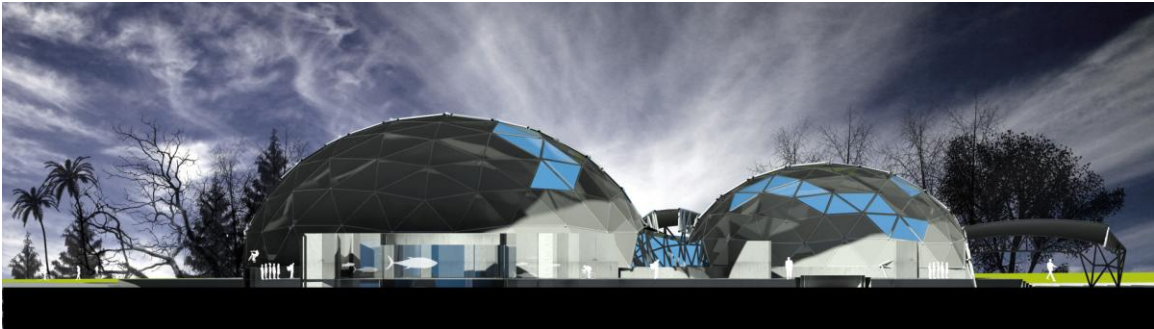
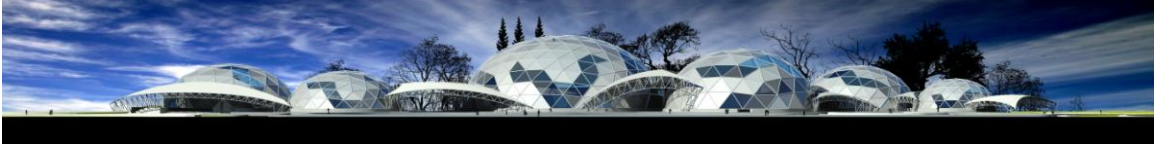


Fig 18: Final elevations and sections  
Source: Hamid,2010

## 6.0 Conclusion

The functions and form have been joined in a representation of the fluidity of the ocean and the structural system employed results in the most logical solution to this specific project. The design manages to provide the large spaces required for the attraction of the public to an institution such as an aquarium and hopefully will leave the public wanting for more experiences of the sort. A much needed addition to the research arsenal of the country as well as a much needed public space were the project aims at the beginning of the project and the design is the closest amalgamation of the two factors possible to bring out the best outcome.

### **Works Cited**

- International Society for Infectious Diseases. Bangladesh's sea snail epidemic.  
12 April 2002. 18 May 2009. <<http://www.promedmail.org/>>.
- National Tourism Organization, Bangladesh. Cox's Bazaar. 2008. 15 May 2009.  
<<http://www.bangladeshtourism.gov.bd/>>
- Neufert, Ernst, and Peter Neufert. Architects' Data. Oxford: Blackwell Sciences.  
1999.
- Oppenheim, Joanne. Oceanarium. New York: Ipicturebooks, 1993