

Architecture for Socio-Economic Revitalization: Sustainable Reformation of Ship-Decommissioning Industry in Chittagong, Bangladesh

A Thesis

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By

ASHIF TANBIN

Miami University

Oxford, Ohio

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Advisor _____
(Craig Hinrichs)

Reader _____
(Gerardo Brown-Manrique)

Reader _____
(Murali Paranandi)

TABLE OF CONTENTS:

THESIS PAPER

ADDENDUM

PROCESS WORK

FINAL DESIGN

Architecture for Socio-Economic Revitalization: Sustainable Reformation of Ship-Decommissioning Industry in Chittagong, Bangladesh

Ashif Tanbin

MIAMI UNIVERSITY, OXFORD, OHIO

ABSTRACT

The current volume of global shipping stands over 1.8 billion tons per year; an enormous amount of waste is being generated from and of the old ships. The large amount of waste is created by the shipping industry is becoming a great area of concern for the environment and for this reason, ship recycling is now a global necessity and matter of industrial reality. For various reasons over the last few decades, South Asian country's beaches are becoming the key place for dismantling ships; in 2016 over 25% of the old vessels were dismantled in Bangladesh alone. Though theoretically, ship recycling should be a major step towards the sustainable global environment; but in Chittagong, Bangladesh the ship recycling industry does not generate any positive impression of environmental sustainability from any perspective. Rather Bangladeshi ship recycling industry had been infamous for its environmental negligence, poor infrastructure and above all for highly dangerous working environment. In brief, the situation in Bangladeshi ship recycling facilities are dreadful. Here in Chittagong, workers are being forced to work in a highly toxic and hazardous environment without proper safety and infrastructure. To tackle this problem, a drastic change in ship recycling culture and physical

organization of the industry is an immediate requirement. The goal of the proposed thesis is to explore the opportunity and find the best solutions to create a suitable physical environment for a sustainable ship recycling model.

INTRODUCTION

Ocean going ships are one of representatives of modern civilization. With the help of vast improvement of science and technology and dynamic rise of global trade and commerce; the quality and quantity of ocean going ships have rapidly mounted. As of January 2016, there are around 51400 ships currently operated by various ship liners globally and this number is still increasing. In terms of volume current global shipping stands over 1.8 billion tons per year. After 20-30 years being operational, this enormous number of ships are no longer viable to use. As dumping the old ships in the middle of ocean is not a suitable option at all; all these ships need to be broken down and need to be recycled. Ship-decommissioning yards in third world countries are becoming a popular destination for the old ships due to various factors. One of the largest ship-decommissioning industry for these old ship recycling is the "Chittagong Ship-Decommissioning Yard."

So, what is ship-decommissioning? What are the good and bad about it? In brief, ship-decommissioning is an industrial process or methodology through which ships are being dismantled and the obtained materials are made ready for recycling. With the rapid increase in modern global maritime trade, ship-decommissioning and recycling is a very important for environmental sustainability. However, with all the positive aspects of ship-decommissioning, deep down there is a dark side of this process which is taking place in the out of date ship-decommissioning facilities of the developing countries. In these facilities, the standard is hitting the lowest point in terms of environmental pollution and worker's welfare. With the mixture of economic, social and environmental aspects; the ship-decommissioning yards located in developing countries are being operated with in very complex scenario. In Chittagong, it has been criticized as of the most dangerous place to work. According to 'International Labor Organization', ship-decommissioning in Chittagong, Bangladesh is one of the most hazardous occupation in the world. And addition to that, the 22000 'ship breakers' involved here through year in and year out putting their life on line for the least income in return. Currently international governing authorities for maritime industry and the concerned environmentalist organization are calling for the standardization and rectification of the contemporary ship - decommissioning practices. As a result, there are strict restriction from the 'International Maritime Organization' and EU not to send old vessel to Chittagong ship-decommissioning yards unless the standard and infrastructure

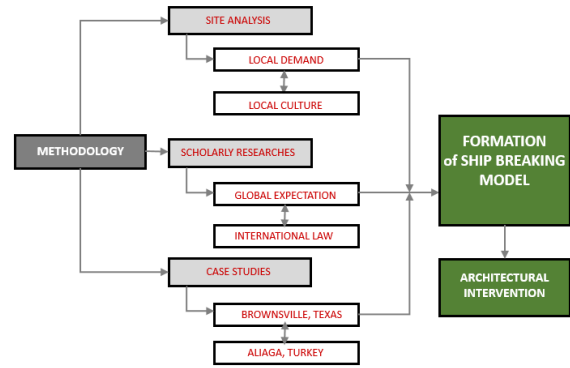
gets improve here. In the awake of socio-environmental challenges and global embargo, it is a great opportunity for Chittagong ship-decommissioning yard to improve its standard and modernize itself. The proposed thesis will explore the areas and opportunities for Chittagong ship-decommissioning industry to improve and to create a futuristic model for sustainable ship-decommissioning in this part of the world.

When I first started working on my thesis proposal, I was eager to research and work on the ship recycling facilities in Chittagong, because this topic is something which is very sensitive and emotional to me from my personal level. While growing up in Chittagong, I had the opportunity to closely observe this deprived part of the world. To me the benefit of sustainable architecture practice is not only to help the advanced part of the world, rather sustainable development equally important to improve the overall socio-economic and environmental condition of the deprived sectors such as the ship-decommissioning industry of Chittagong, Bangladesh. Addition to that, I feel that there has not been much work been done in this industry in terms of physical development and planning which is a great opportunity to explore new ideas and philosophy to research and implement. All these reasons in mind, I am determined to work out sustainable solutions for the given scenario of the problematic ship-decommissioning industry in Bangladesh.

METHODOLOGY

The objective of the thesis is to find the right solution for a sustainable ship-decommissioning environment which will comply with the

standard set up by 'International Maritime Organization' and design such a ship-decommissioning model with great amount of infrastructure development, hazard and risk elimination and environment protection elements incorporated. Research is to be conducted in three phases. Firstly, current site for ship-decommissioning industry in Bhatiyari, Chittagong is to be thoroughly analyzed and studied for the information such as local geographical condition, geological data, local socio-culture phenomena and economy of the surrounding areas. Scholarly Research is another critical task to be done which include study of global laws, regulations and expectations. Communication with government and non-government organizations to be established during this phase to review their current policy about the industry and to establish the sensibility of the perspective proposals on the industry. The last phase of the research to be consist of case study of present global ship-decommissioning practices in different countries such as substandard practice in Gadani, Pakistan and standard practice in Brownsville, USA. The outcome of these research will dictate the direction of the thesis and final architectural design goal to be established which must drive the local ship recycling industry of Chittagong, Bangladesh towards the positive path.



CURRENT INDUSTRY SCENARIO

Current world-system allows rich and developed countries to dispose their hazards or environmental pollutions on other peripheral and disadvantaged part of the world. For example, major developed countries dump their industrial wastes and greenhouse gases into the global basins and some of the hazardous products and wastes are displaced to the peripheral zones of the world. Since developing countries have limited concerns and resources to manage such hazards, the transfer of hazards to the developing countries are already having a dangerous socio-economic and environmental consequences. Most discussions on the globalization problem have failed to address and find solution on this specific harmful practice of the industrially developed countries. If we need to address these problems mentioned above, we need to look at the specific locations of ship-decommissioning at the yards in Alang-Sosiya, India; Chittagong, Bangladesh and Gadani, Pakistan. Attention centers around the nature and scope of ship-decommissioning in these three locations, major drivers operating in the world-system, adverse consequences, the unequal mix of costs and benefits, and the failure of existing political responses at the domestic and international levels to reduce

adequately the adverse consequences of ship-decommissioning.

The World Bank have conducted a complete study and in-depth report to analyze the actual scenario in the ship- decommissioning yards of developing countries. The report praised the principle of ship-decommissioning and recycling as the most environmentally sustainable way of disposing of old vessels, with virtually every part of the hull and machine complex being reused or recycled as scrap metal. The report also highlighted the importance of ship recycling from socio-economic aspects with dependents on the ship recycling industry in extended families estimated to reach over 500,000 in Bangladesh alone. However, the report raised concern about "global shift" in the industry to countries with comparatively weaker regulatory systems as ships contain many hazards that can have significant detrimental effects on humans and the environment if not dealt with properly. Thus, the report focused on in depth economic and environmental statistics related to the industry. Also, international maritime regulation which been incorporated in the Hong-Kong convention has been highlighted in the report. At the end, there were specific proposal made as the solution for the sustainable ship recycling.

CONTEMPORARY PRACTICE

Presently there are four kinds of methods being used for ship recycling around the world. These are Beaching method, Slipway method, alongside method and Dry-dock method. These specific methods are being practiced in the different region of the world based on context and socio-economic condition of the region.

Such as Beaching is the most common practice in the South Asian countries as this method requires very less modern infrastructure and investment which is lacking in the South Asian countries. On the other hand, Dry-dock method is a very safe and technology based method. As it sounds, this method is being practiced in developed countries. All these four methods of recycling have been standardized in the international regulations known as the Hong Kong Convention and the Basel Convention. Also, EU and the International Labor Organization are trying to tighten up the safety and environmental issue in the ship recycling yards.

SHIP-DECOMMISSIONING INDUSTRY IN BANGLADESH

Life in the ship-decommissioning yards in Bangladesh is hard, on the one hand it is a job full of death trap, pollution and risk. On the other hand, the workers have to work for minimum wages. Despite the heavily unpleasant nature of the industry; more than 50% of the world's ships break in Bangladesh's Chittagong ship yard which stretches along 11 miles of shore. There are questions remain about the large quantity of ships being broke in Bangladesh. And the answer lies within this million-dollar business itself. Bangladesh has no natural iron mine. As a result, there is a great demand of scraped steels from old ships which can go directly to the steel mills to as raw materials to produce recycled steel bar etc. In the developed countries, these ship-decommissioning would cost the decommissioning company a great fortune where as in Bangladesh the labors are cheap and the ship-decommissioning companies are

taking advantage of that situation. Therefore, it is understandable that the industry will not disappear from here anytime soon. Indeed, given the current skyrocketing prices of raw materials, buying up disposed vessels at bargain prices for scrap looks like the best answer. For example, the ship-decommissioning and recycling industry in Chittagong provide more than half of Bangladesh's steel supply, making it a strategic industry for the country. It is also undeniable that, for the job seeking population of Bangladesh, ship-decommissioning creates a great employment and economic opportunity. So far, the industry created hundreds of thousands of direct and indirect jobs for some of the poorest and most marginalized segments of the population of Bangladesh, with dependents is has been estimated to reach over 500,000. However, the worker who are giving everything for this industry need for care and attention. Also, a positive reorganization can be the only way to move forward.

CASE STUDY:

GADANI, PAKISTAN

During 1980s, Gadani ship yard was considered as world's largest ship yard, with 06 miles stretched, Gadani ship yard use to employee around 30000 workers. However, after the emergence of Ship yard in India and Chittagong, Bangladesh; the ship yard has fallen far behind in terms of annual scrap production. The ship yard still decommissioning around 100 ships per year with the annual contribution of around 1,000,000 tons. The Gadani ship-decommissioning yard lies along the coast of Arabian Sea, 50 kilometers North-West of Karachi. The Gadani beach is subject to high

costal tide. Also, climate of the area is highly suitable to work all season round the year. Due to this geographical factor, Gadani served as the perfect place for the development of ship-decommissioning facilities. Just like other ship-decommissioning yards situated in the developing nations, Gadani ship lacks proper infrastructure. In terms of ship-decommissioning method, the ship-decommissioning companies still rely on manual labor rather than mechanical facilities. This specific method which is also followed by other South Asian ship-decommissioning yards is called the beaching method of ship-decommissioning; ships are forced to drive towards the beach with their own power and get anchored on the beach. At the beginning the ships remain too heavy to drag onto the shore. Therefore, they are cut into pieces to reduce the weight of the main hull. These small pieces and the lighten hull are dragged onto the shore and dismantle into small pieces ready to transport for recycling facilities. Due to the ship-decommissioning process and the methodology, here in the diagram below we can see all the ship-decommissioning yards are located parallel to the coastline. This remains one of the prominent features for all the beaching method-based ship yards in terms of planning and growth of these.



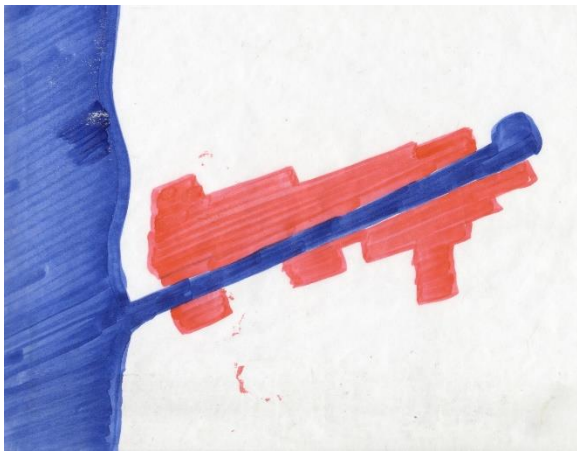
Plan: Diagram of Gadani Ship-Decommissioning Yards

Here in the diagram it is clearly shown how the ocean and the continental land mass are being divided by the close lying ship-decommissioning yards. It is also clear that all the environmental hazards and pollution in the ship-decommissioning facilities are being exposed to the environment especially to the marine environment. The ocean here is being used as the garbage-can of ultimate industrial wastes. All the toxic chemical compounds are being dropped on the shore and eventually being allowed to wash away by the ocean tidal waves. There are no physical barriers to control all the toxic pollutions as the openness towards the ocean made it very difficult to control these. The white region in the diagram are the spaces behind the red colored ship-decommissioning yards which also can be mentioned as the pockets currently under development. These space behind the yards also, critically important and contain great potential. Currently small business to serve the yard are being developed here. Such as the housing facility for the workers, social-economic facilities, small intermediate business districts such as machine parts and other shops for the components obtained from the ship yards etc.

CASE STUDY- BROWNSVILLE, TEXAS, USA

In terms of location, socio-economic reason for the evolvement of the ship-decommissioning facilities and almost of all the standard, Brownsville ship recycling yards are totally different from Gadani and other ship-decommissioning yards of South Asia. With the current global economic scenario, hazardous industries such as ship-decommissioning are gradually finding it's place in Asian countries where the labor is comparatively cheap than Western world. However, Brownsville did not follow the rule. The reason because Brownsville ship-decommissioning facility grew only to serve US navy ship. Because of federal laws, aging US navy ships are not allowed to dismantle outside US as these are considered sensitive subjects for national security. Therefore, the Brownsville ship-decommissioning facility took place, which still though being owned and operated by private investors. The fact is that, ship-decommissioning is the primary economic activity of Brownsville. The town of Brownsville was established to facilitate this industry. Being close to the border of Mexico, a comparative low cost labor is being available around Brownsville which is one of the key reason of the development of the industry in Texas. Thus this small town of around 200000 people of Hispanic origin found a unique opportunity for their economic growth. Also the geographical reasons such as the high tide of Mexican Gulf and the climate of Texas played a great part. Addition to that, adjacent South Padre Island provide a critical protection and works as the natural buffer zone between Brownsville and the Gulf. Today there are five companies involved in ship-decommissioning in Brownsville. It is considered

as one of the standout facility around the world for because of high standard ship-decommissioning method followed here. The typical beaching method is completely absent here. Rather there is a 17 miles long inland channel being created to bring the ships as much as possible away from the Gulf. First, this allows Brownsville to control the highly toxic materials going to the ocean. Secondly this allows the ship breaker to access the ship with more mechanical facilities as they don't need to depend on natural tides and other factors.



Plan: Diagram of Brownsville Ship-decommissioning Yards

As in the diagram above we can see how the narrow inland channel being created and also how the ship-decommissioning facilities grew around it. It is noticeable that, unlike the beaching method which we have seen the earlier case study, ship-decommissioning facilities are growing on the both side of the subjected ship and channel. The white area around the red facilities are the space behind where all the facilities to support the industry are taking place. These involves all kind of residential and commercial facilities which had ultimately lead to a standout town which is not

economically healthy but also sound in terms of working environment and basic human needs.

STANDARDIZATION INITIATIVES

So far, I have learnt about several standardization program working on ship-decommissioning industry located on the developing nations. DIVEST program which refers to "Dismantling of Vessels with Enhanced Safety and Technology" is one of these standardization programs. The program initiated by European authority to introduce enhanced safety and safer technology and also to deal with the complexity of the ship recycling industry. The ultimate goal of this program is to transform the industry into a sustainable recycling system. Their works include risk assessment activity, training, creating knowledge exchange platform and also to understand the decision support tools. Currently they have started working in Indian ship-decommissioning yards. And after ward they aim to shift their focus to the other critical ship-decommissioning yards in South Asia such as Chittagong, Bangladesh and Gadani, Pakistan.

CONCLUSION

Here in a developing country like Bangladesh the resource is limited, by the challenges are huge and increasing. Bearing this in mind Standardization of Ship-Decommissioning Industry is a stipulation of contemporary time. It is very critical that continuous research about the sustainable issues such as ship recycling are to be conducted. If the thesis leads to a successful research and resolution that can surely play a great role to address one of the pivotal socio-environmental complications of the developing countries like Bangladesh.

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ADDENDUM

INSPIRATION

I grew up in an economically under developed country, Bangladesh. Here in Miami when I was asked to propose my thesis topic, my interest was focused on such a project which has the potential to massively to the economic development of Bangladesh in future. Therefore, the ship-decommissioning industry in Chittagong fits the bill perfectly.

THESIS PAPER

My written thesis proposal was concentrated on researching the work environment of the industry in Chittagong. Here I tried to explore the current working procedure of the industry which is very conventional and far from standard. Research on environment pollution was also checked. After that I tried to explore worldwide practice and issues of sustainability related to ship-decommissioning throughout my research paper.

REPHRASED THESIS QUESTION AT THE BEGINNING OF DESIGN PROCESS

My written thesis proposal was concentrated on researching the work environment of the industry in Chittagong. Here I tried to explore the current working procedure of the industry which is very conventional and far from standard. Research on environment pollution was also checked. After that I tried to explore worldwide practice and issues of sustainability related to ship-decommissioning throughout my research paper.

DESIGN PROCESS

SITE ANALYSIS

My design process started with existing site analysis. After analyzing the existing site, I understood that the site is not suitable to support the advanced technological equipment such as drydock, gantry crane, decommissioning shed etc. Therefore, I proposed a new site adjacent to the Karnaphuli channel which also serve the maritime activity of Chittagong port and has enough depth to support large vessels. The was a 3700 acres vacant lot defined as 'DPZ 12' in the Chittagong City master plan which was proposed for future industry development. In my thesis I proposed this site for the overall master plan of the ship-decommissioning industry.

PROGRAM ANALYSIS

In my research I found that the existing industry is totally ignorant of standard ship-decommissioning industry. Rather I had to look at the industry practice around the world. As there were not a lot of examples to look at, my own generated program was based on balanced use of manual labor and technological equipment to support the work force.

MASTER PLAN

After finalizing the program, I realized that I can develop a prototype industry which can be replicated and flexible enough to accommodate within a proposed masterplan. Therefore, at this stage of my design process I focused on developing masterplan for the industry in the proposed site 'DPZ 12'. For masterplan my intention was to establish the land use and road

connection for the area. The proposed land uses were as follows:

Ship-decommissioning Industry Belt,
Environment Management Zone,
Industrial Commerce,
Social Commerce,
Residential Zone.

DEVELOPMENT OF THE INDUSTRY PROTO-TYPE

My designed industry proto-type was primarily based on functionality and technical aspects. During design I tried to develop a decommissioning line which will bring the whole industry into a common discipline. The proto-type industry was consisting of the following zones:

Dry-Dock Area,
Preparation Shop Area,
Stock Area.

Among these zones, Dry dock and Stock area is as open to sky space. But it is the Prep area where most on the manual dismantling will be done and thus it requires an environmentally sustainable and healthy work space.

DESIGN OF PREP SHOP AREA

The prep Shop area is an open space with a minimum span of 400 ft; surrounded by enclosure and shaded by roof. Rail tracks are coming in to this area from the dry-dock area bringing in large segment of ships which require further dismantling. Sustainability of material, natural ventilation and lights played a vital role in my design. Therefore, I decided to design the enclosure using decommissioned shipping containers. The benefits of using shipping

container is that, these are the most available materials can be found in ship, these can be recycled, and I can also use the interior of the shipping containers to accommodate some of my functions related to administrative activities. Using shipping container, I have developed such a façade which is very perforated and can be repeated as module.

For roofing I went for tensile roof system because it is lightweight, can take a long span and allows comfortable natural light and ventilation.

CONCLUSION

Throughout my entire process I tried to keep in mind that this specific industry is for a specific economic and social environment like Chittagong. Therefore, I prioritized the practical aspects of architecture rather than the aesthetical aspects. I hope that research and thesis work like this will show the pathway to the betterment of the industry and to the community that in involved with it.

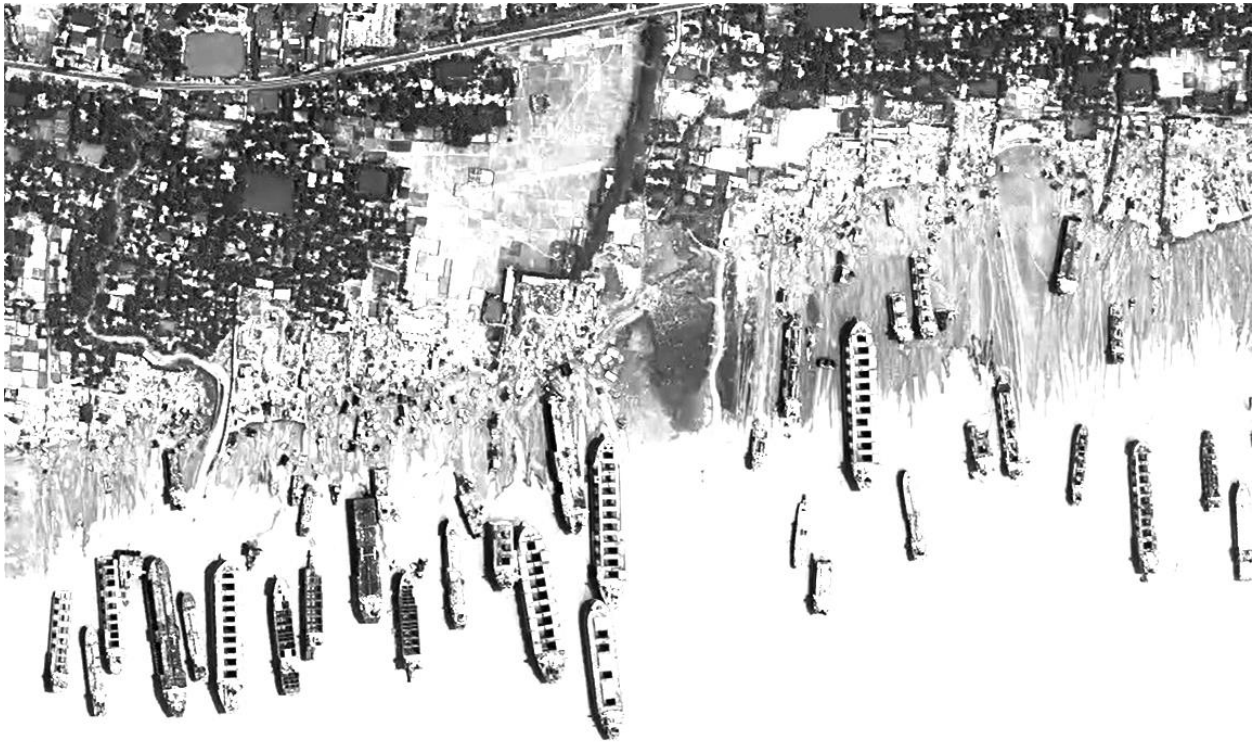
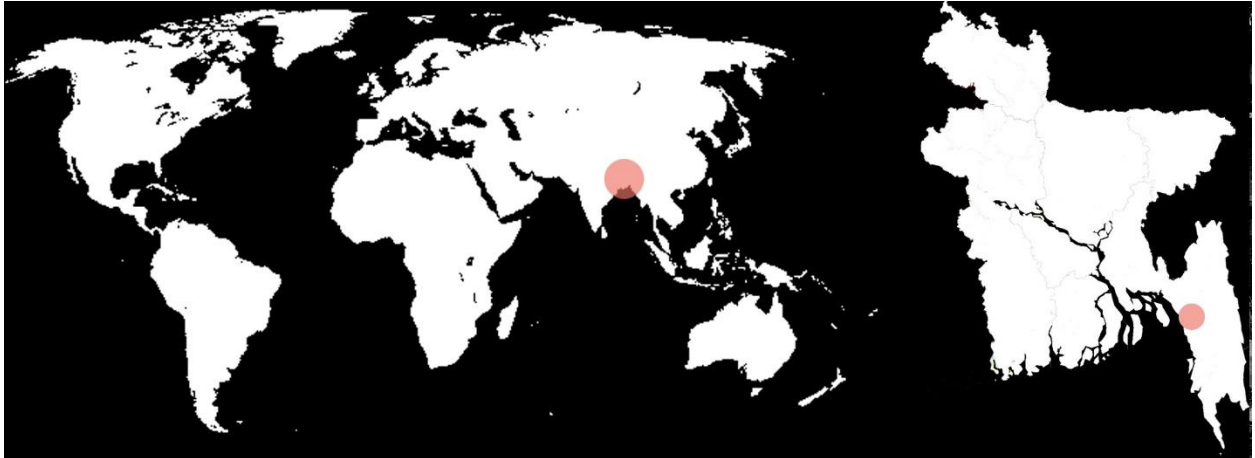
THANKS

There are many people that I would like to thank for their continuous support and encouragement. I would like to thank my committee, my advisor Craig Hinrichs and readers Gerardo Brown-Manrique and Murali Paranandi. I would like to thank my studio teachers John Becker and Raffi Tomassian. I would also like to thank my thesis colleagues. Special thanks to Diane Fellows for introducing me to this thesis work and passionate support throughout the process. And finally, thanks to my family and my beautiful wife for believing in me. Thank you all.

PROCESS

SITE

CURRENT SITE LOCATION AND EXISTING CONDITION



Chittagong has one of the largest ship-decommissioning industry in the world. The industry is vital for the socio-economic development of the region but also has been heavily criticized for polluting the environment and enforcing low-paid work force to risky working condition.

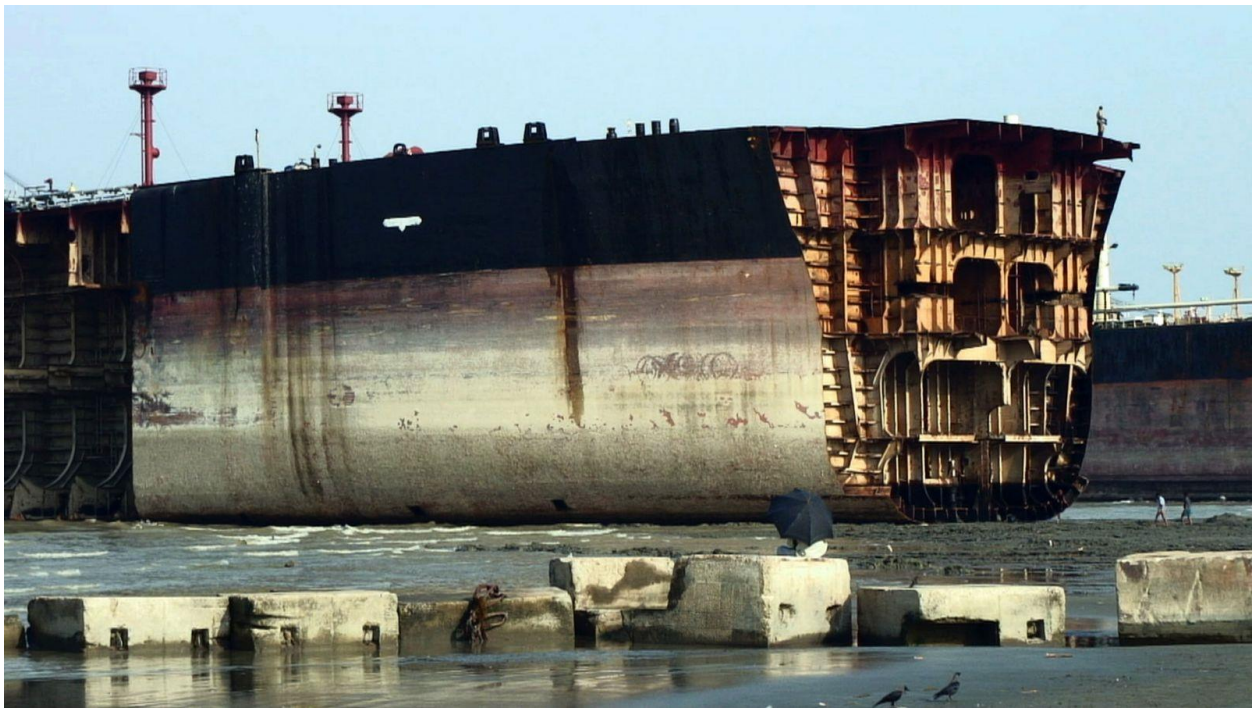
SITE

CURRENT SITE: EXISTING CONDITION



SITE

CURRENT SITE: EXISTING CONDITION



SITE

PROPOSED NEW SITE: KEPZ SHIP-DECOMMISSIONING SITE

Due to the unsuitable condition to accommodate dry dock and other technical heavy equipment in the existing site, a new site been proposed along with masterplan for facilitating workforce and community of 300000 related with the industry.



Proposed New Site

SITE

SITE ANALYSIS



KEPZ: Socio-Economic Structure

CASE STUDY

REVITALIZATION OF TANNERY INDUSTRY, DHAKA, BANGLADESH

Proposed Revitalized Industry

Proposed Masterplan (first Phase)

Proposed Relocation

Earlier Situation

Planned Zoning Characteristics

Section of First Phase Development (East-West)

Section Through Connecting Corridor (East-West)

Section Through Connecting Corridor (North-South)

Creation of Road Infrastructure and Connectivity

Masterplan Principles

Proposed Masterplan

Industry (First Phase)
Green Belt
Housing and Other Facilities
Industry (Second Phase)

ANALYSIS OF SHIP BUILDING INDUSTRY

Hyundai Ship Building Industry

Program of Ship Building Industry

Program Analysis Section

Dry Dock
Shop
Technical Shop
Worker Facility

Old Concept

Worker Movement in Old Concept

Clusters

Re-organization of Functions

Worker Movement in Modern Concept

DRY DOCK

CASE STUDY

SHIP-DECOMMISSIONING IN DEVELOPED COUNTRIES



Brownsville, Texas, USA



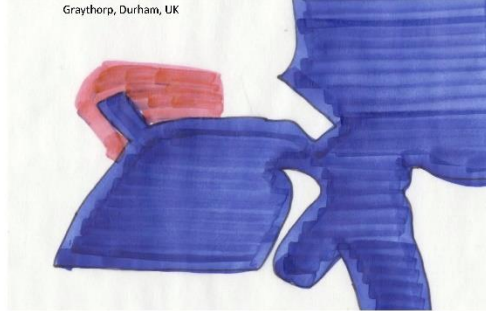
Graythorp, Durham, UK



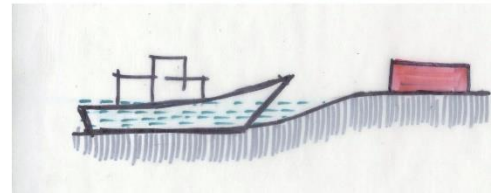
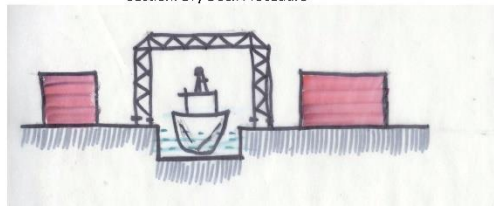
Chittagong, Bangladesh



Section: Dry Dock Procedure

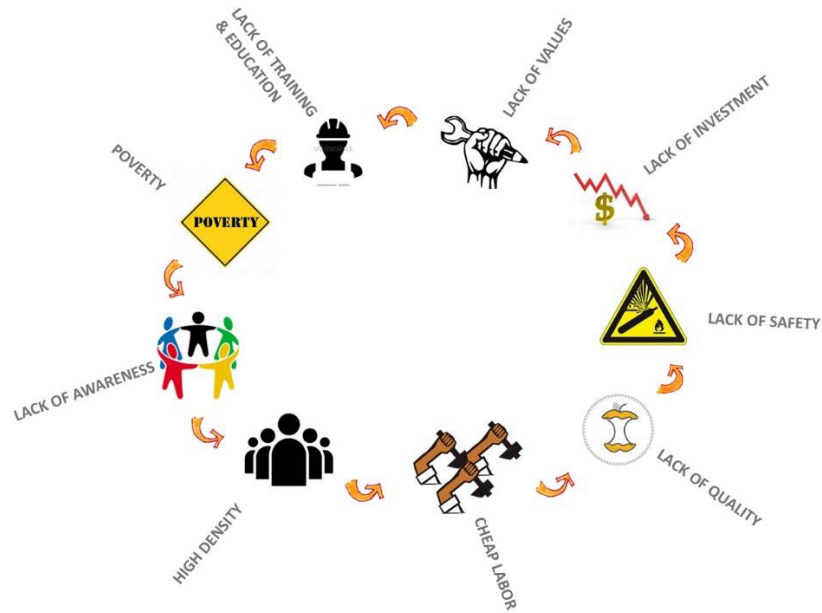


Section: Beaching Procedure

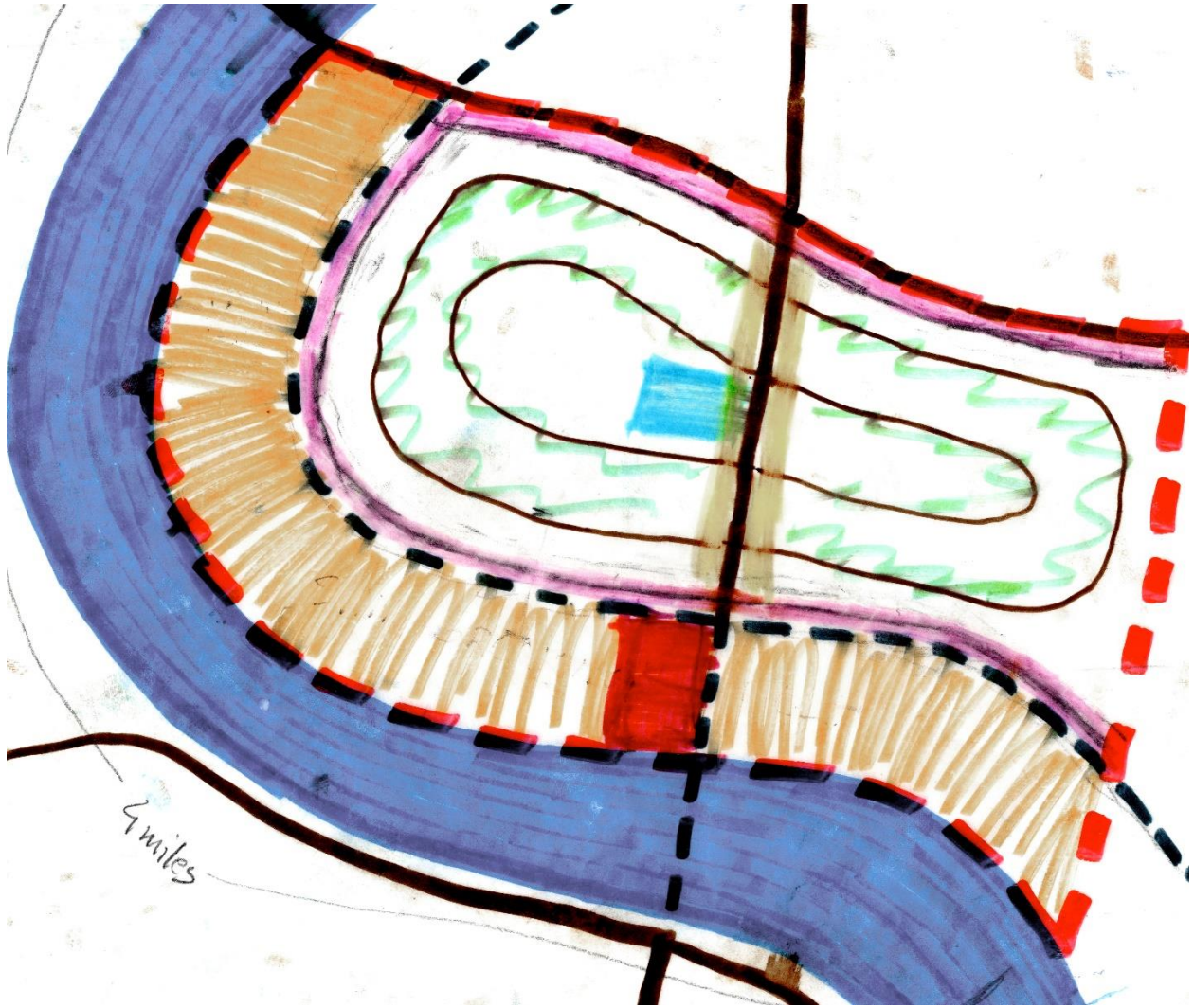


CONCEPT

ELIMINATING POVERTY CYCLE THROUGH INVESTMENT AND EDUCATION



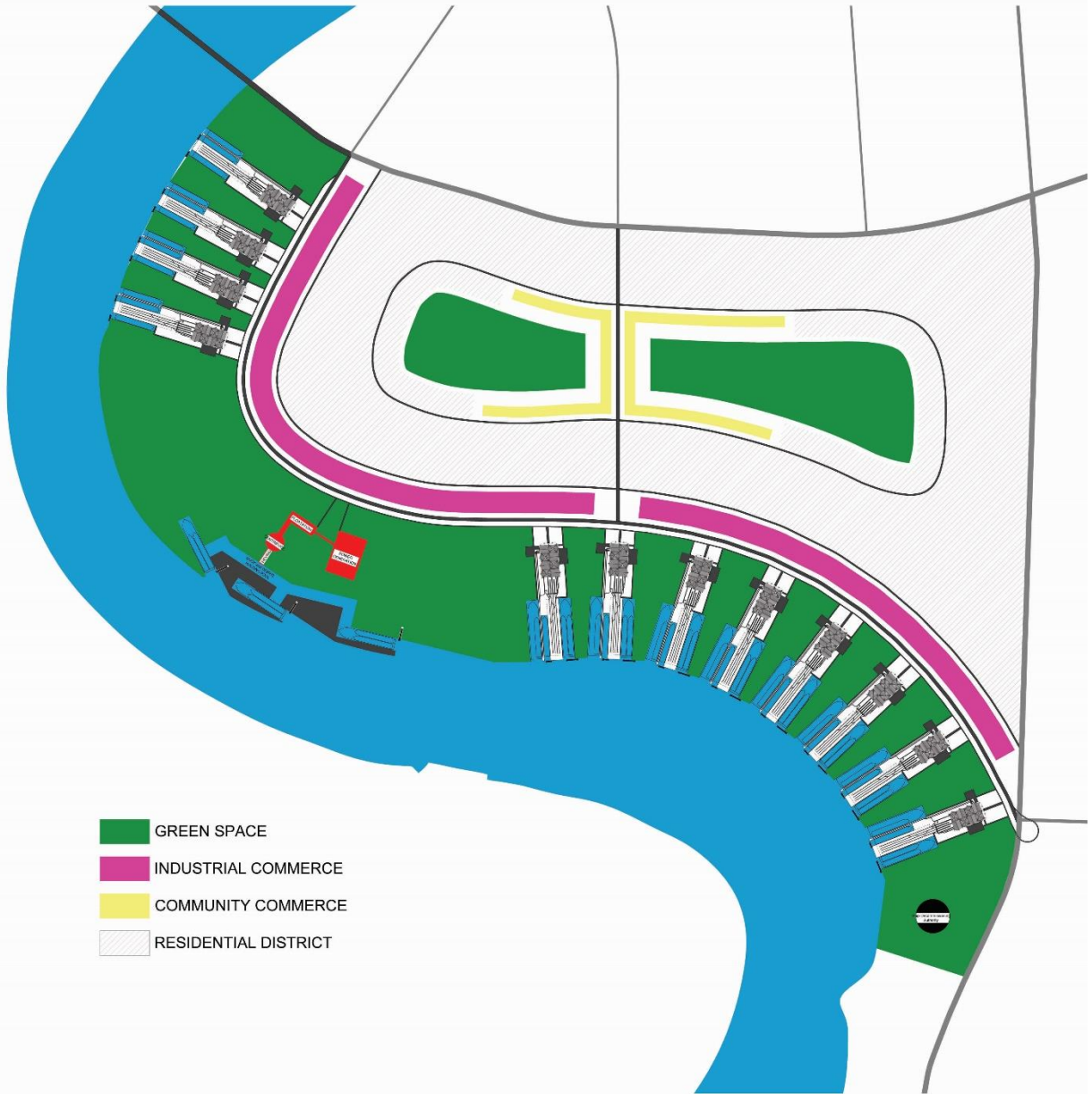
MASTERPLAN
PROPOSED ZONING



Sketch

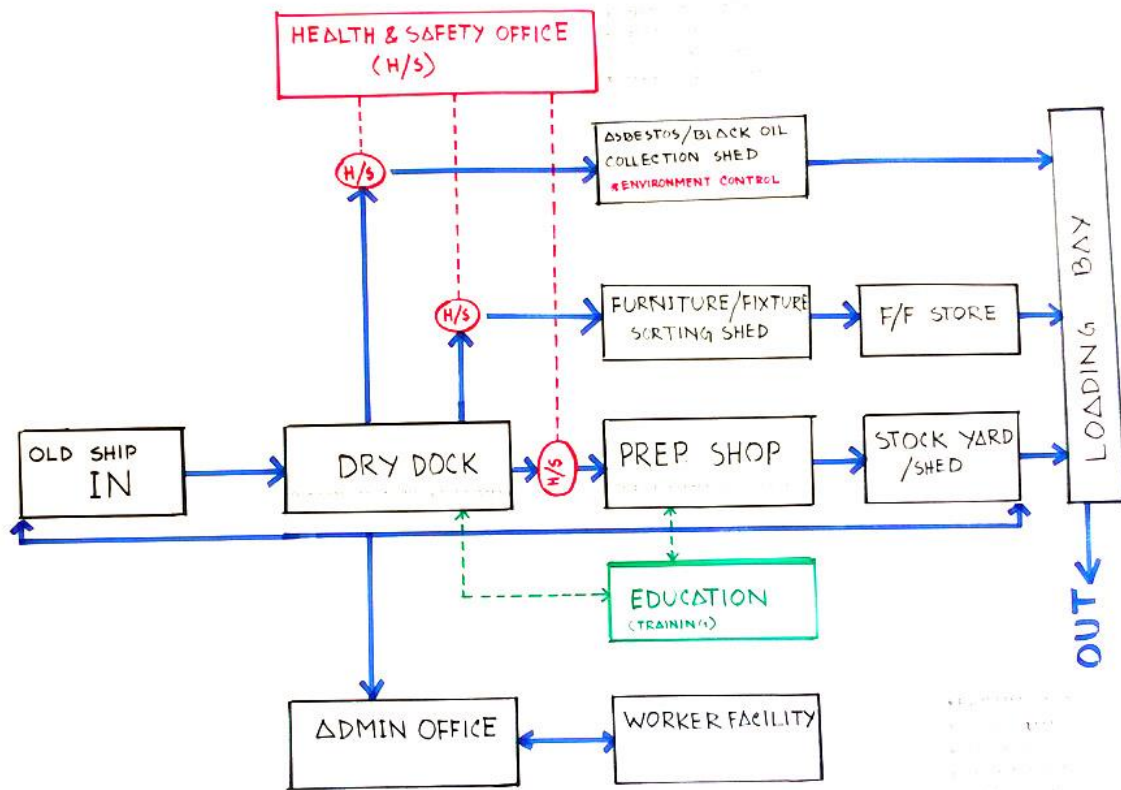
MASTERPLAN

PROPOSED ZONING



PROGRAM

PROPOSED FUNCTIONAL FLOW-CHART



PROGRAM

STANDARDIZED WORK PHASES

STEP 01
Ship into Dry-Dock.

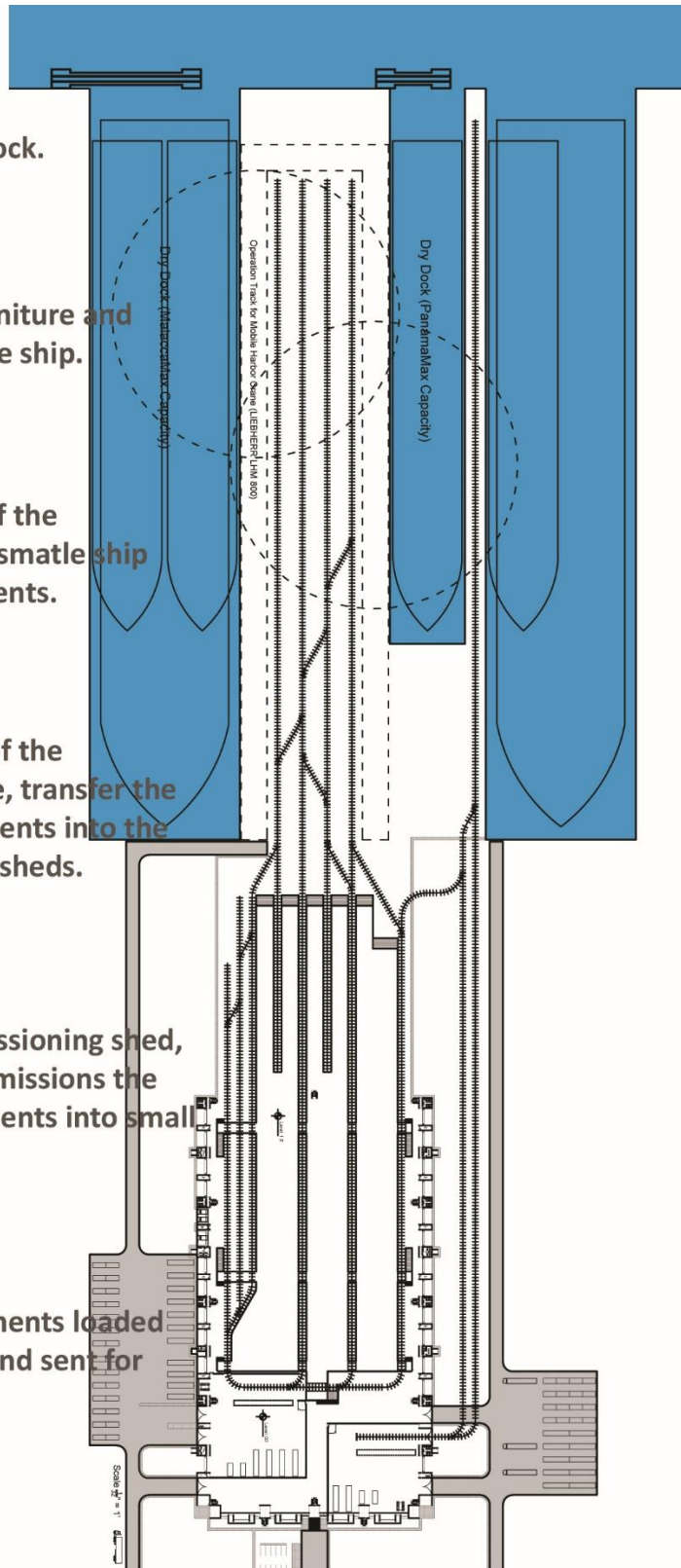
STEP 02
Remove the furniture and fixtures from the ship.

STEP 03
With the help of the Gantry Crane dismantle ship into large segments.

STEP 04
With the help of the Transfer Vehicle, transfer the large ship segments into the decommissioning sheds.

STEP 05
In the decommissioning shed, workers decommission the large ship segments into small segments.

STEP 06
Small ship segments loaded into the truck and sent for recycling.



TECHNICAL EQUIPMENTS

USED AS SUPPORT TO THE CONVENTIONAL MANPOWER



Gantry Crane LHM 800



Transfer Vehicle



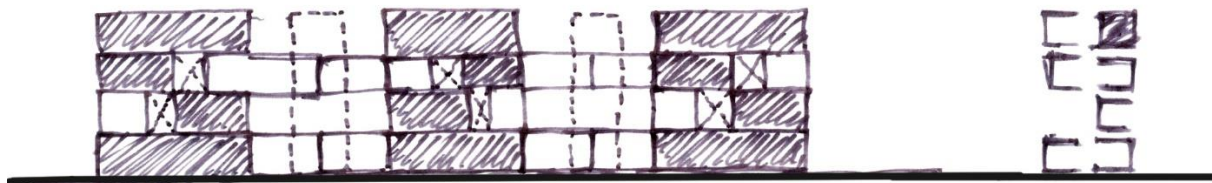
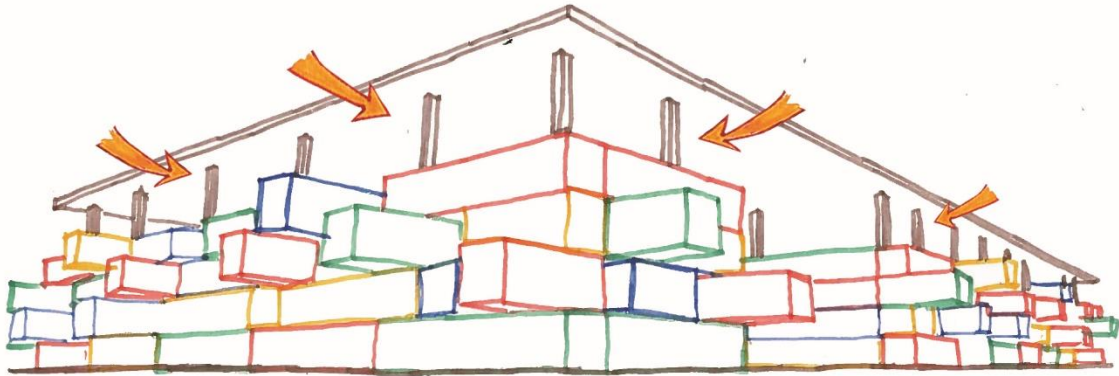
Handling Crane



Straddle-Carrier

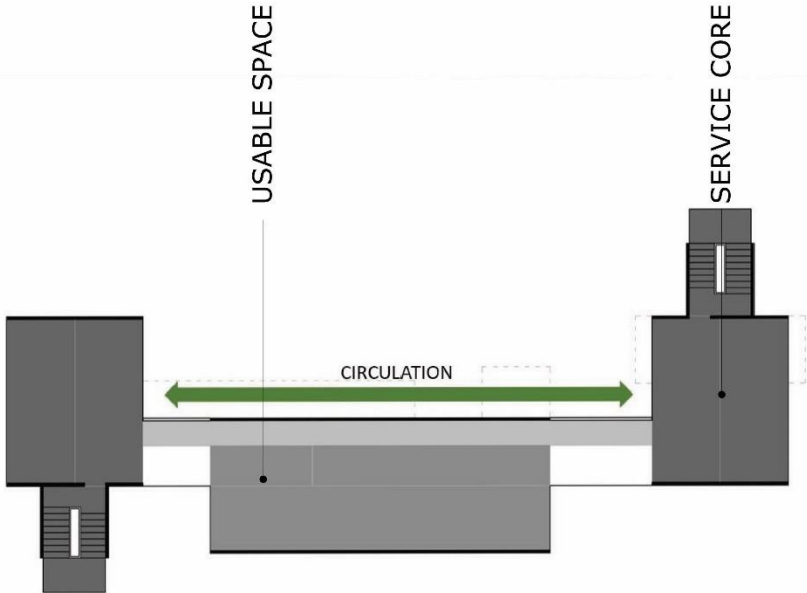
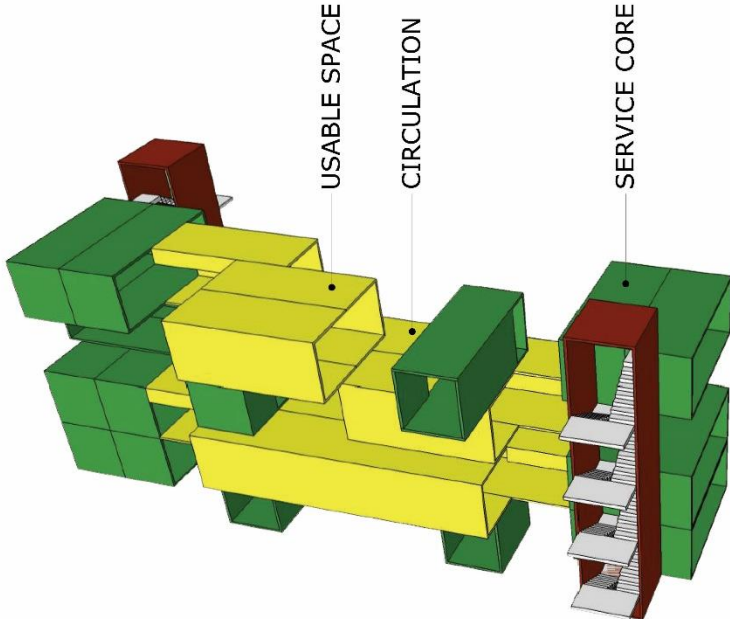
GENERATION OF THE BUILDING

INCEPTION SKETCHES: USE OF SHIPPING CONTAINER SOURCED FROM THE INCOMING OLD SHIPS



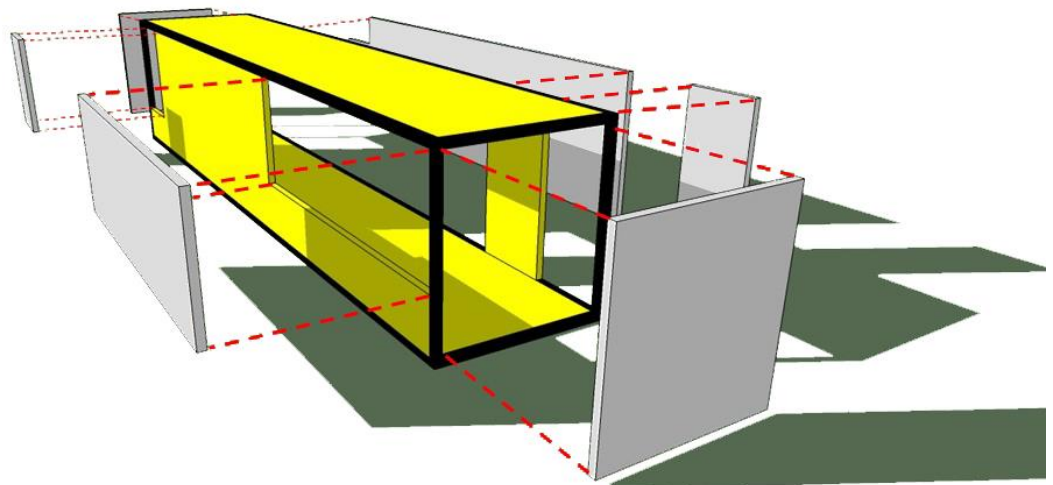
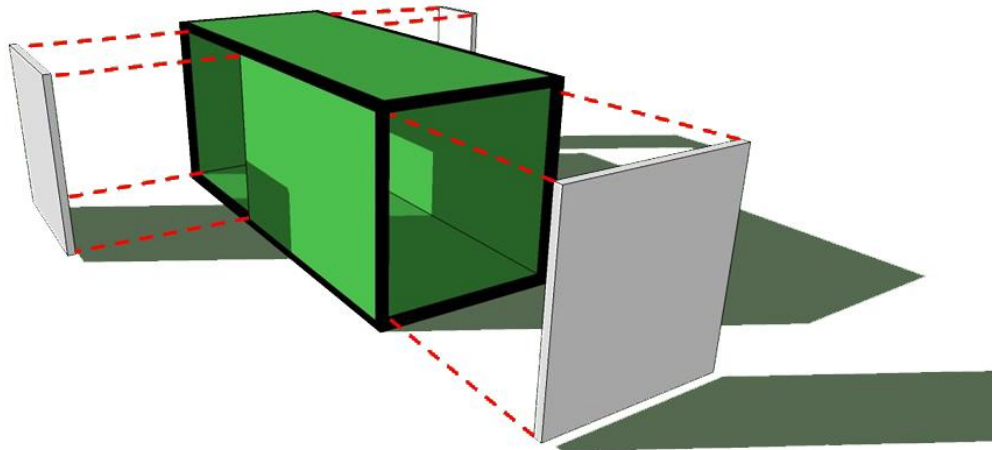
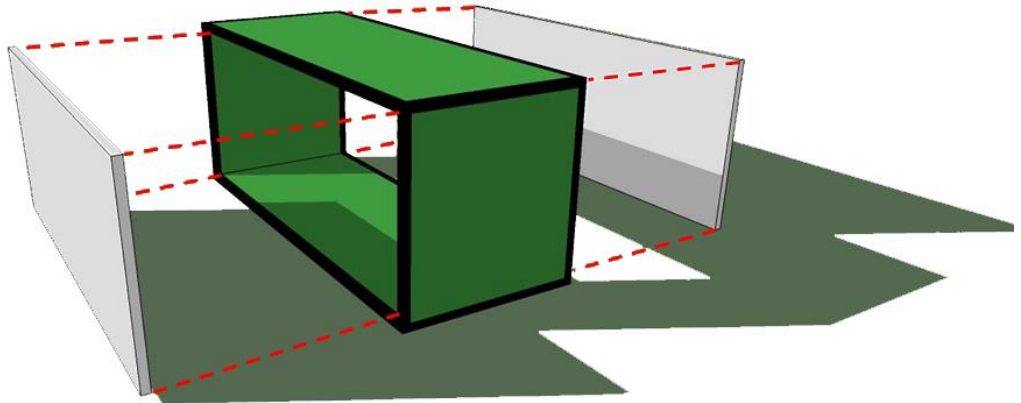
GENERATION OF THE BUILDING

FORMATION OF CLUSTER SYSTEM



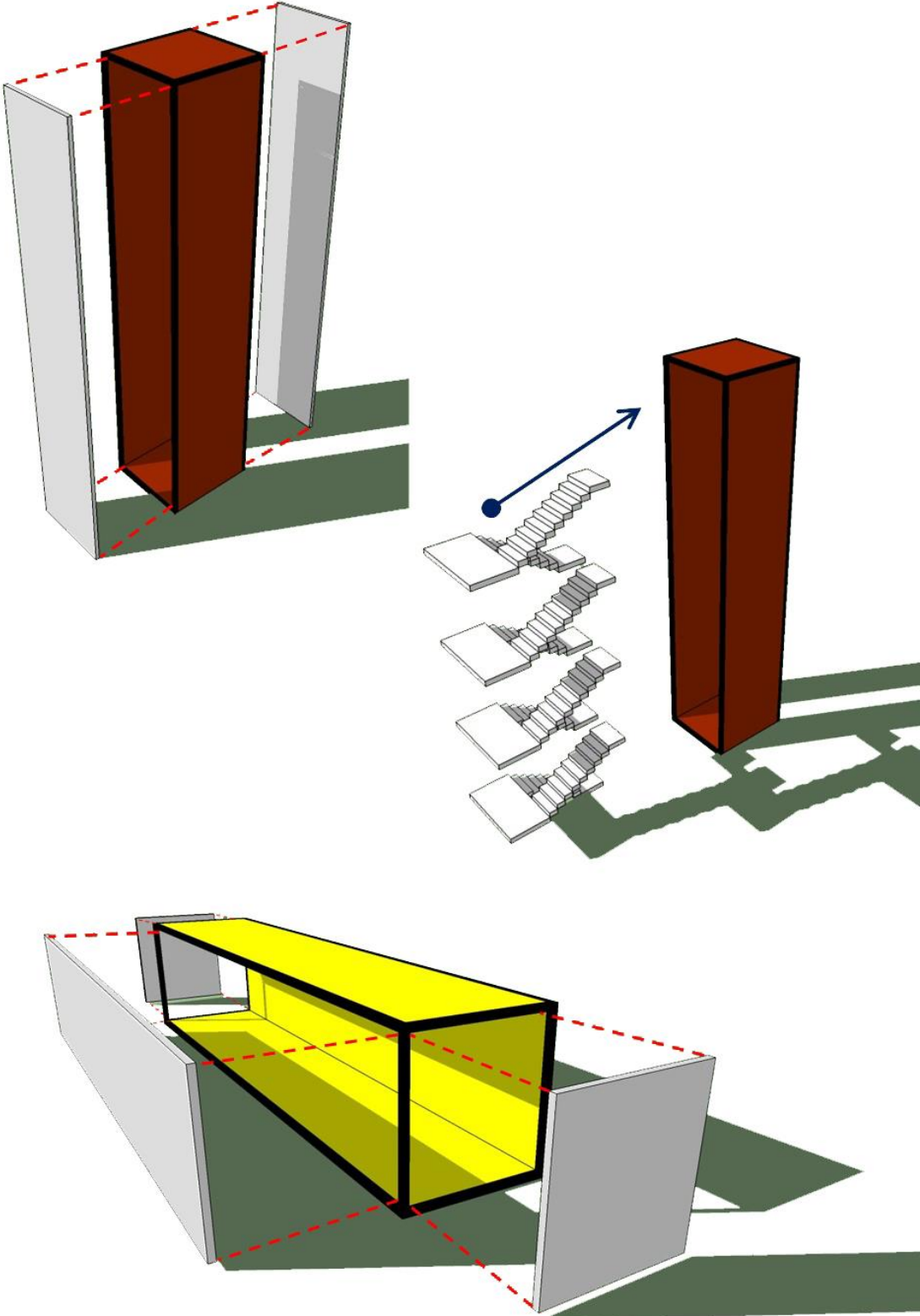
GENERATION OF THE BUILDING

FORMULATION OF CONTAINER SPACES



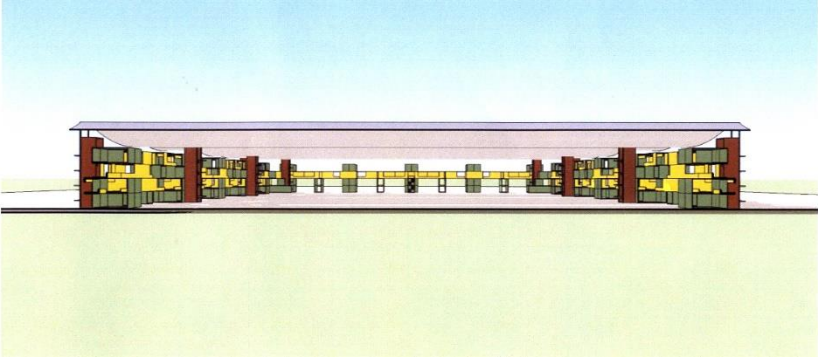
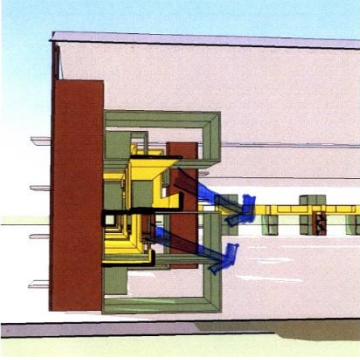
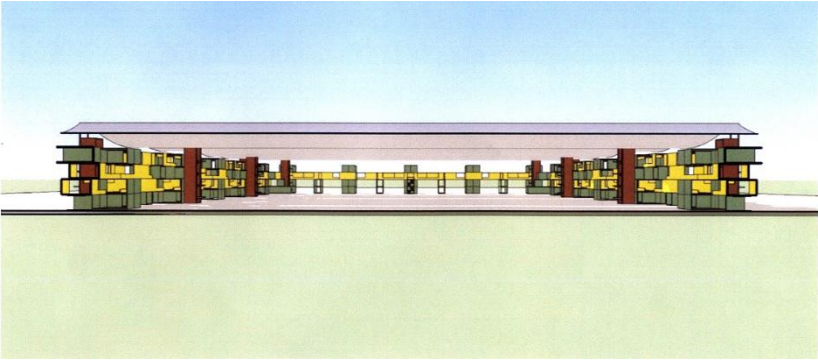
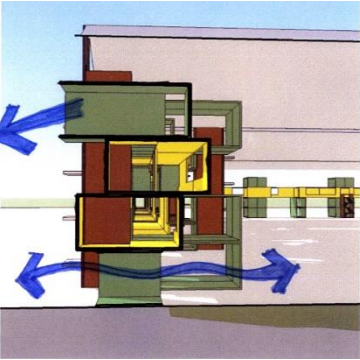
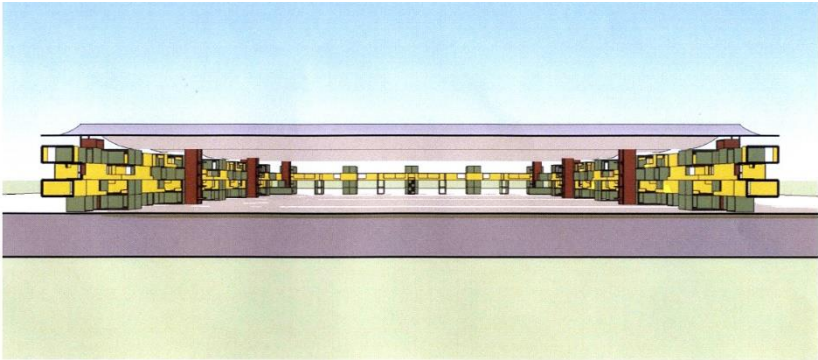
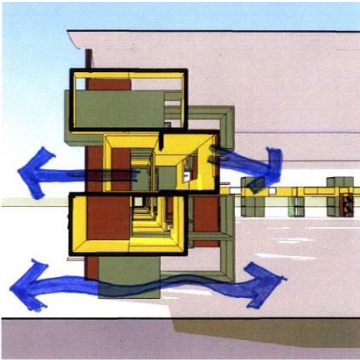
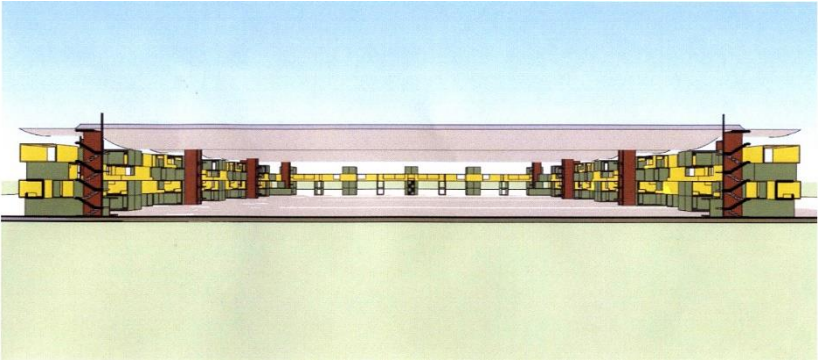
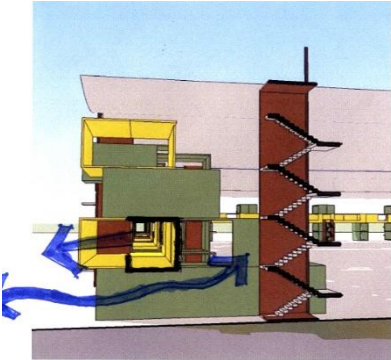
GENERATION OF THE BUILDING

FORMULATION OF CONTAINER SPACES



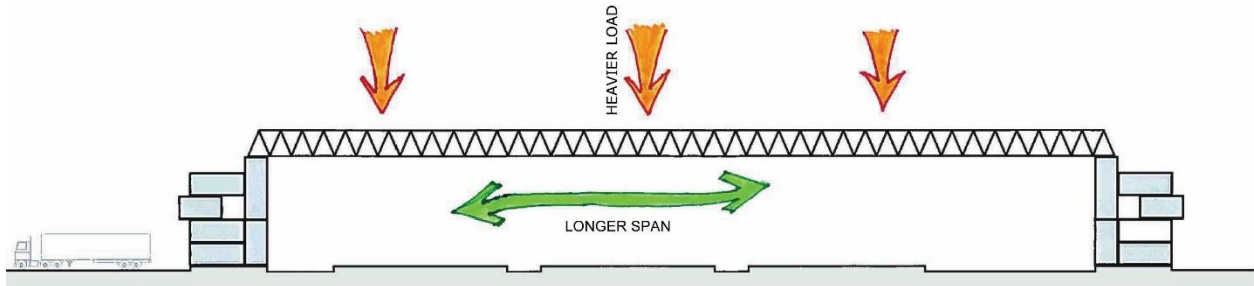
GENERATION OF THE BUILDING

FORMULATED BUILDING SECTIONS

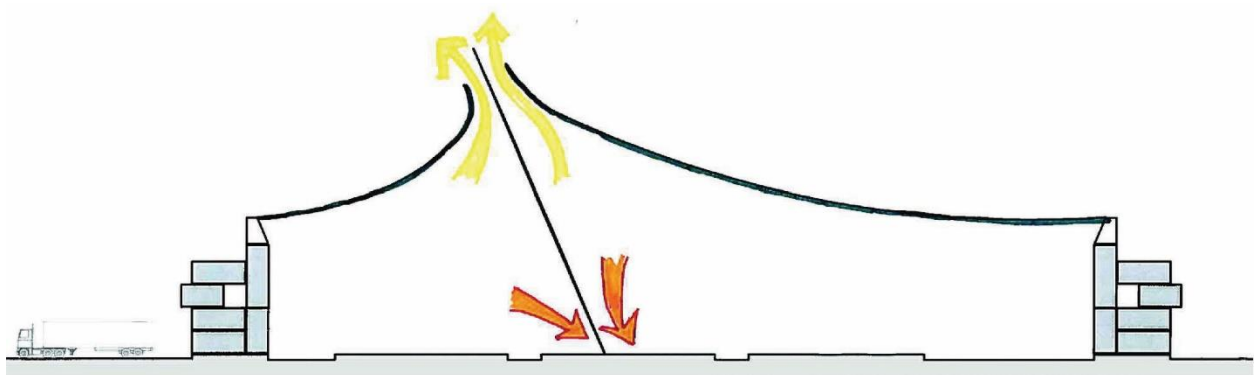


GENERATION OF THE BUILDING

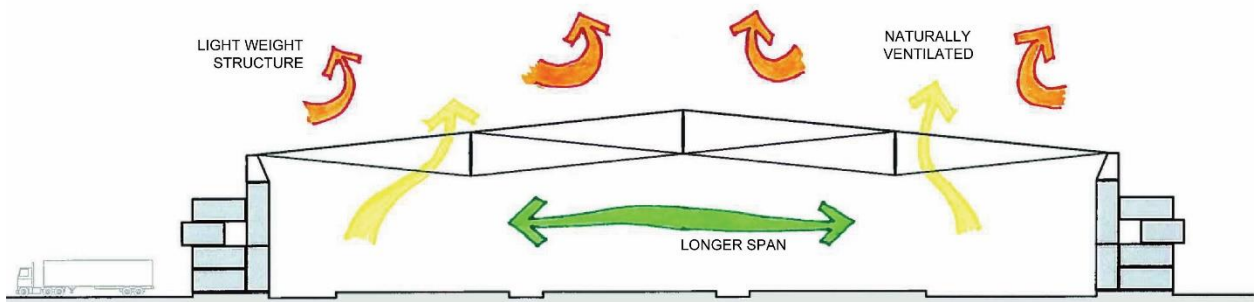
FORMULATED OF THE ROOF STRUCTURE



Limitations of Conventional Steel Truss Roof System



Limitations of Conventional Tensile Roof System

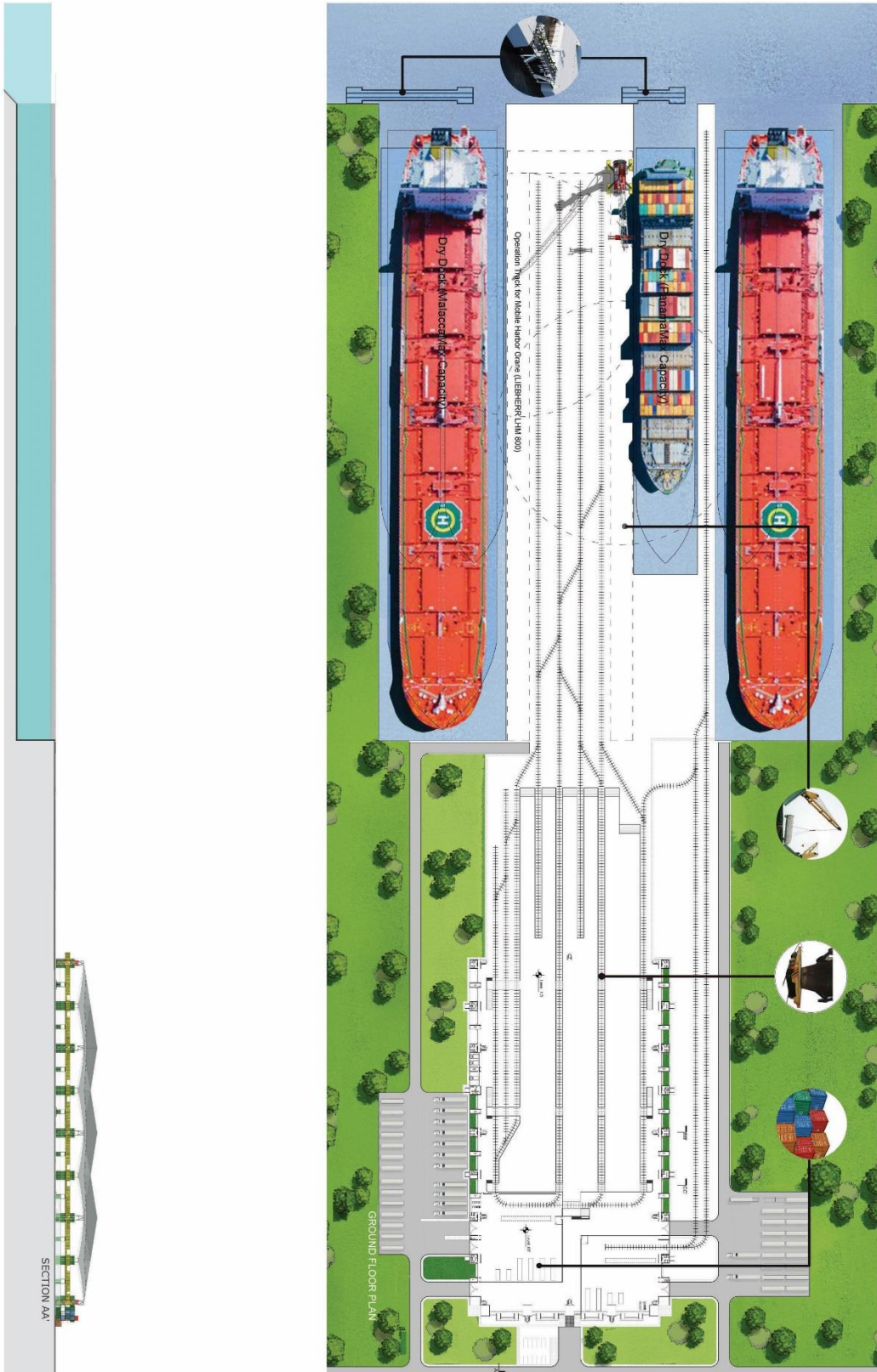


Proposed Tensile Roof Structure

FINAL DESIGN

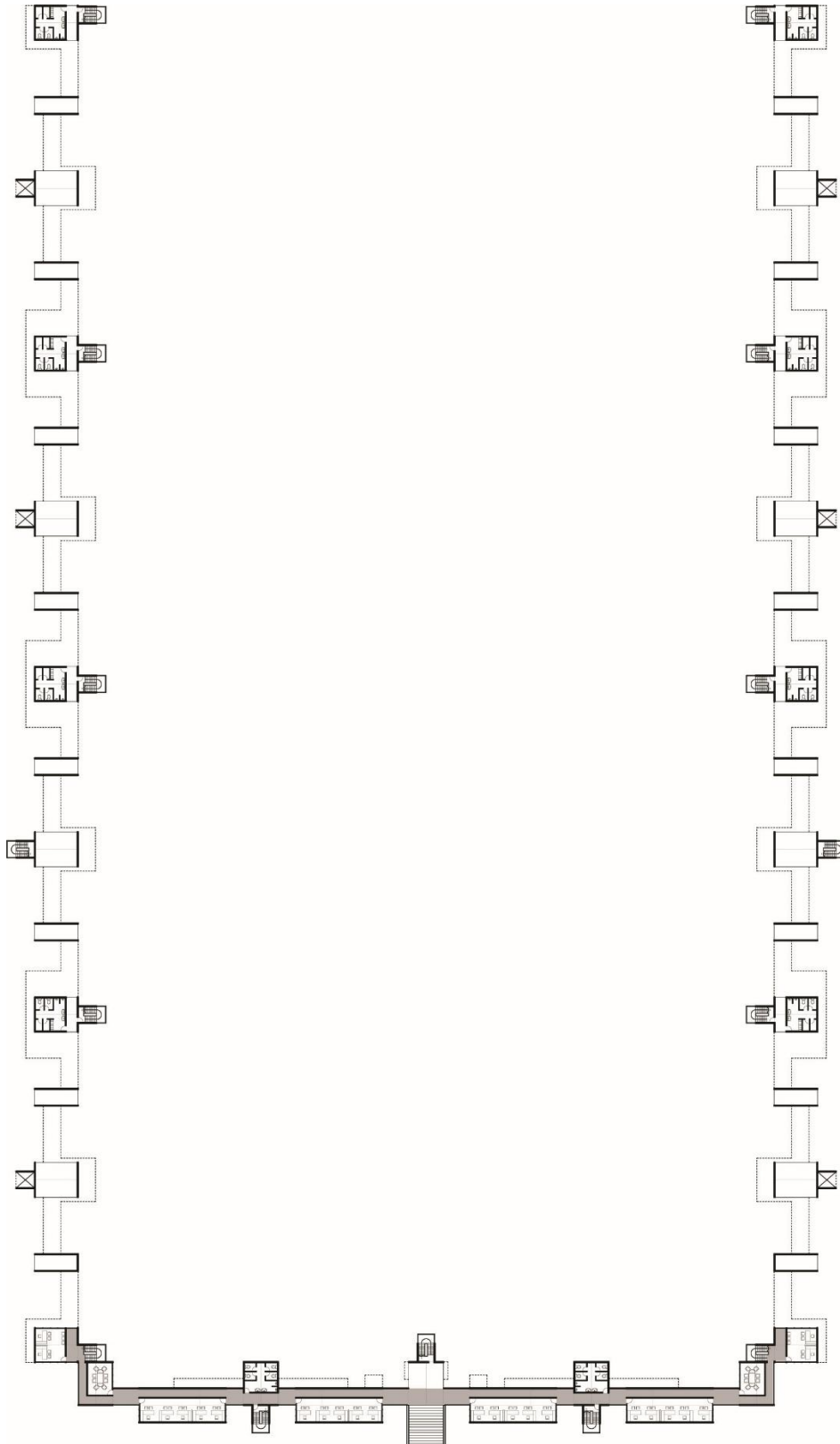
PLANS

GROUND FLOOR PLAN AND LONG SECTION



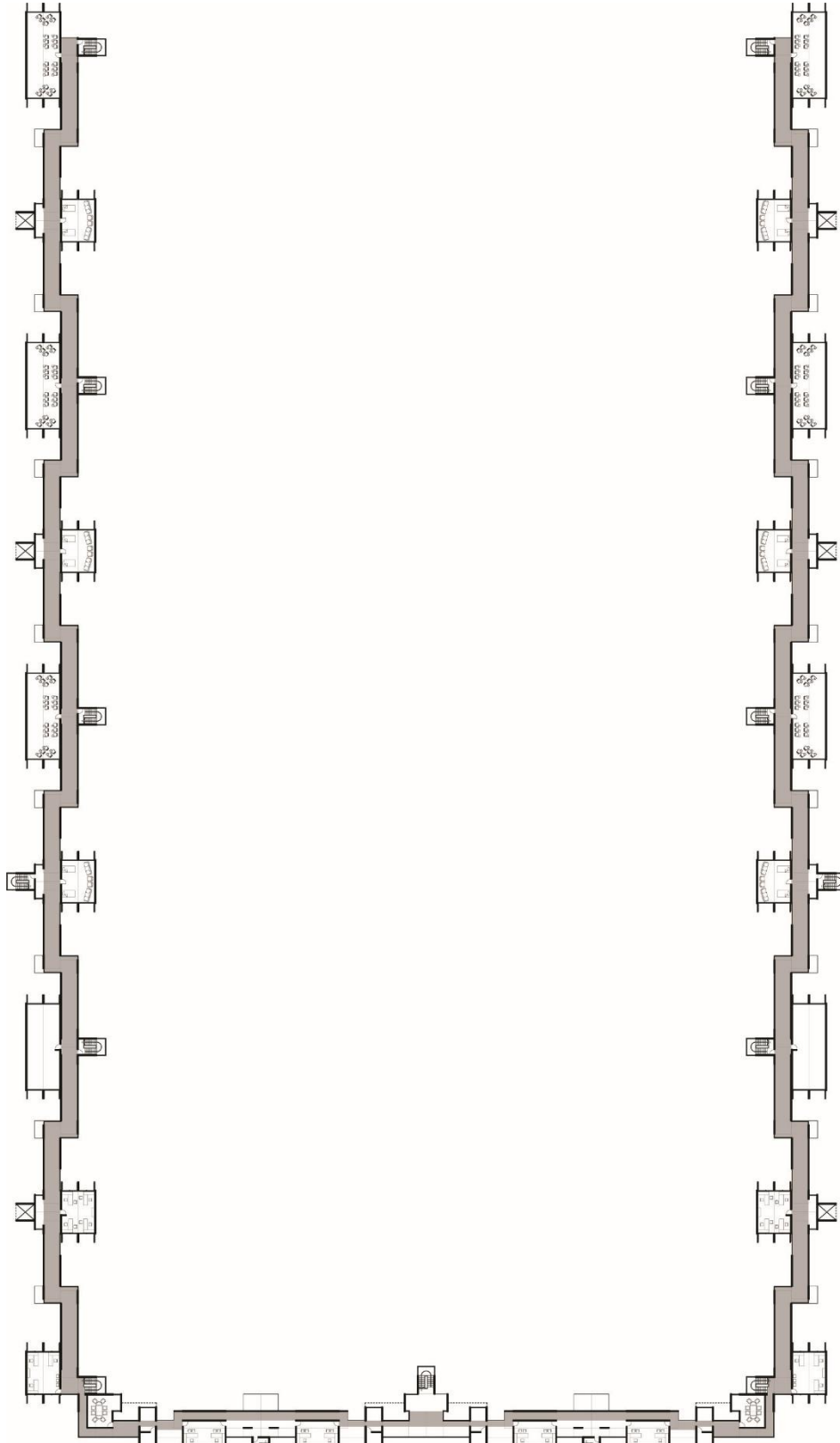
PLANS

SECOND FLOOR PLAN



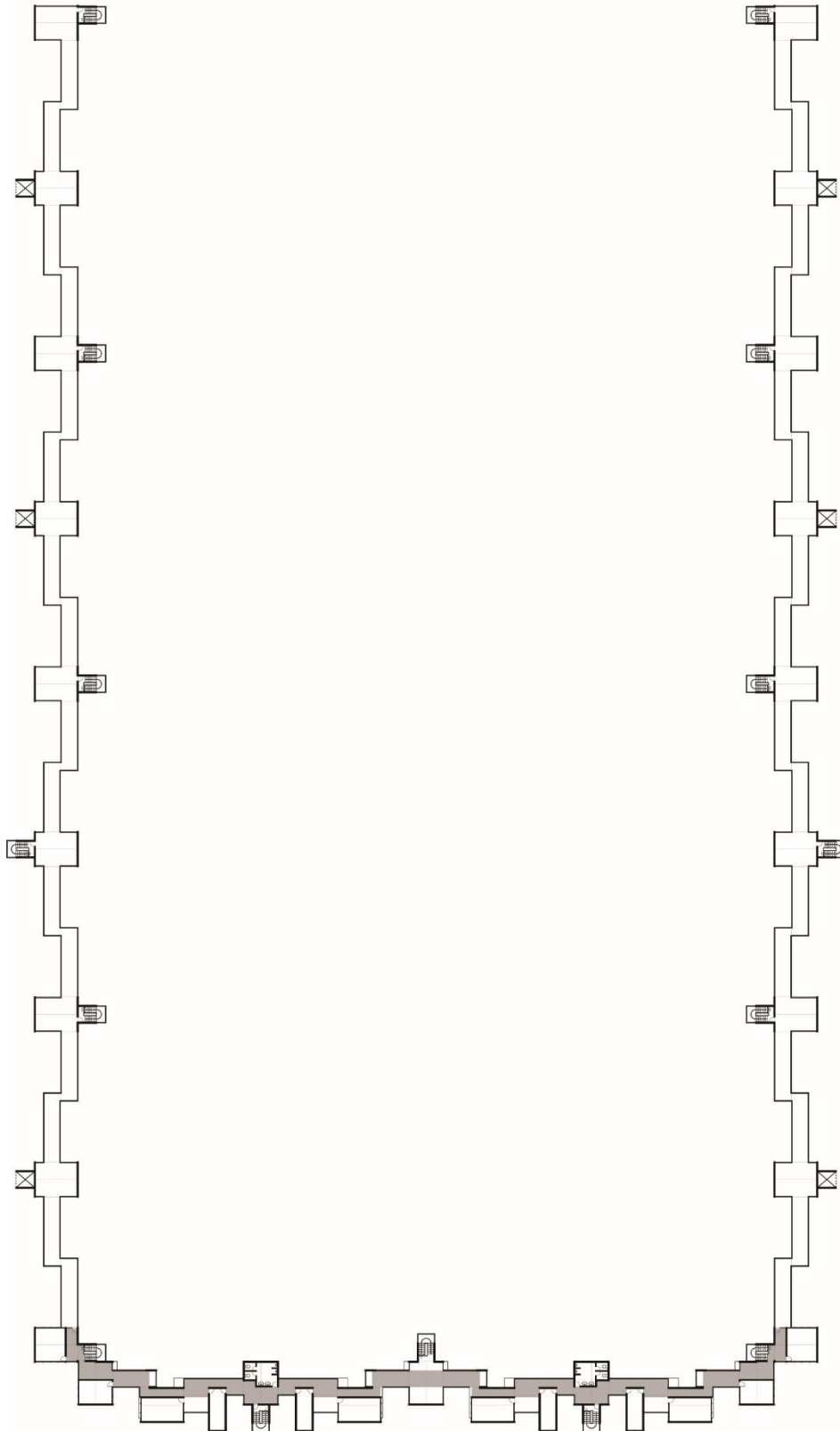
PLANS

THIRD FLOOR PLAN

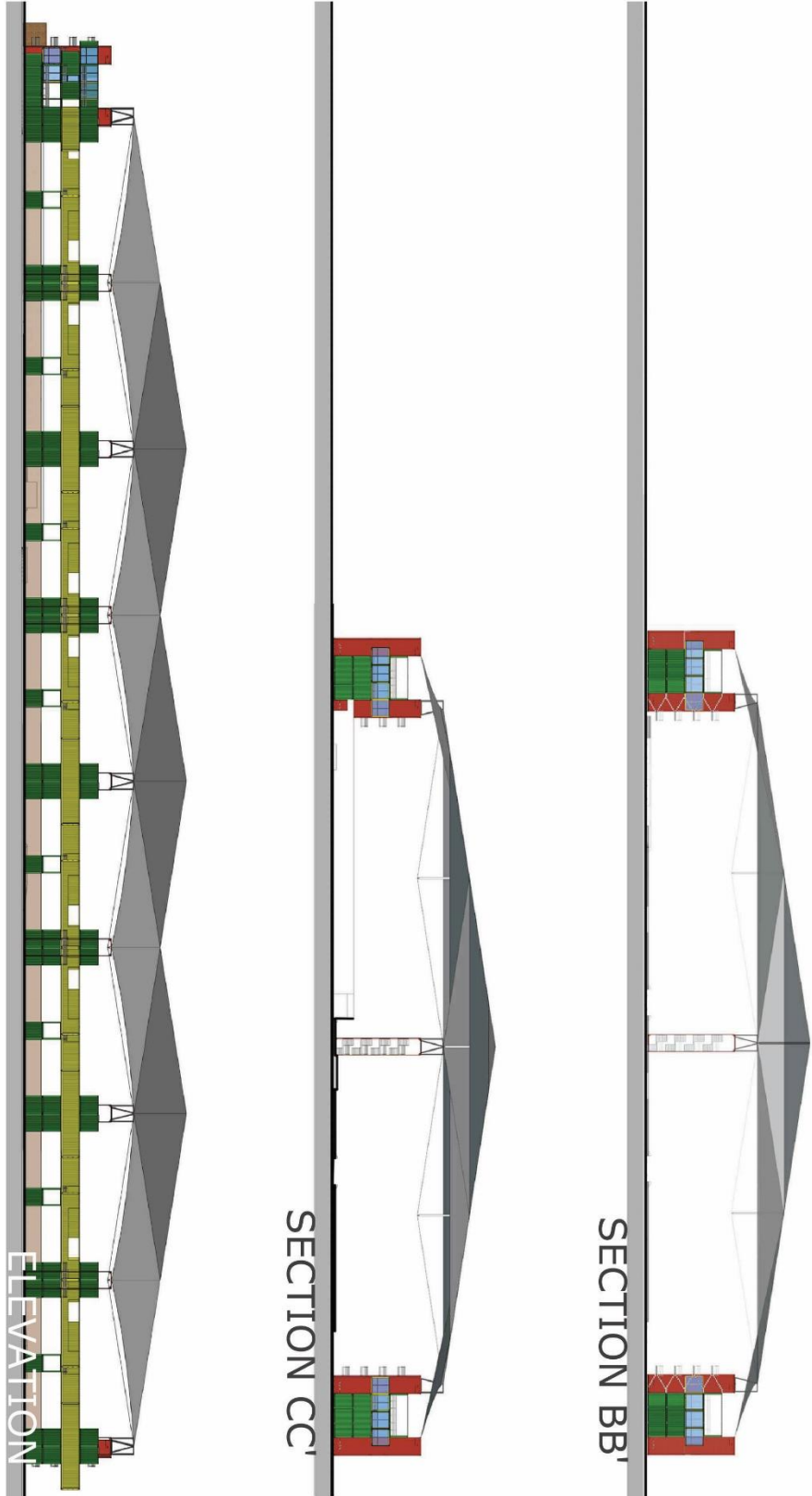


PLANS

FOURTH FLOOR PLAN



SECTIONS AND ELEVATION

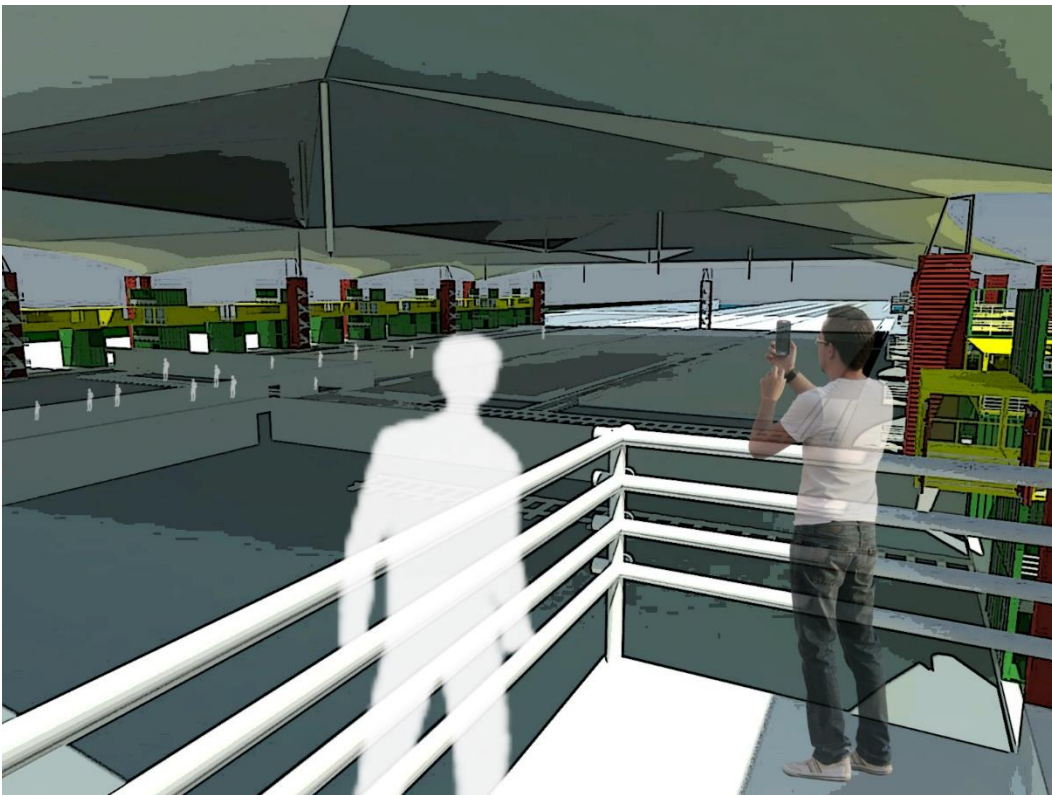


3D VISUALIZATION

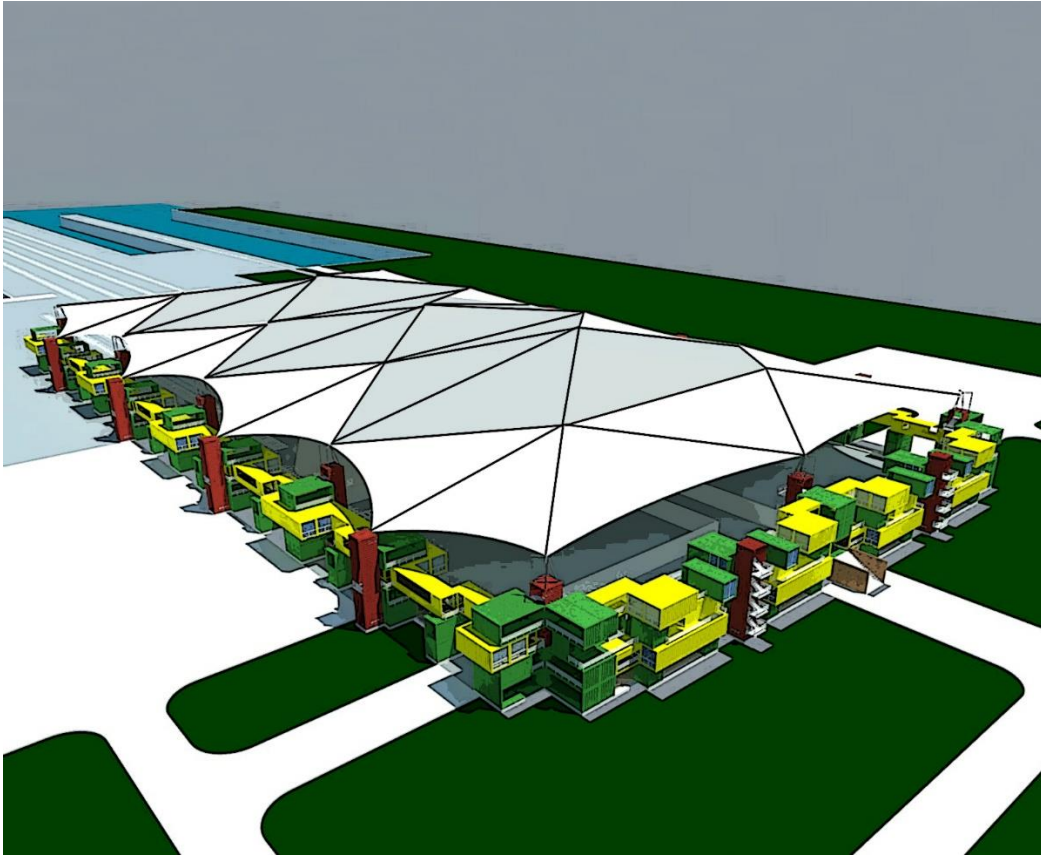
EXTERIOR PERSPECTIVES



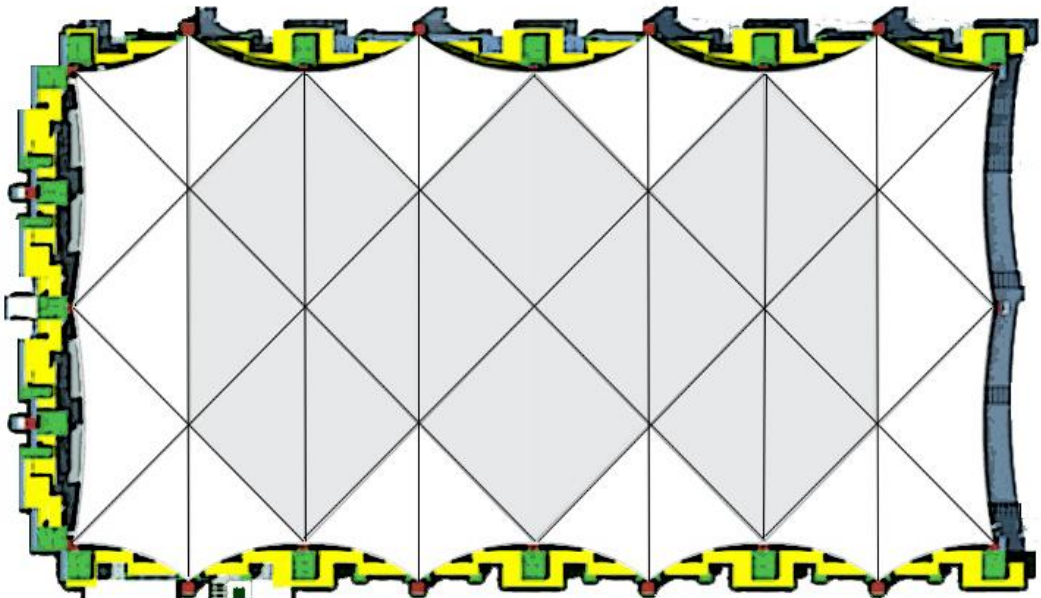
3D VISUALIZATION
INTERIOR PERSPECTIVES



3D VISUALIZATION
BIRDS EYE PERSPECTIVES



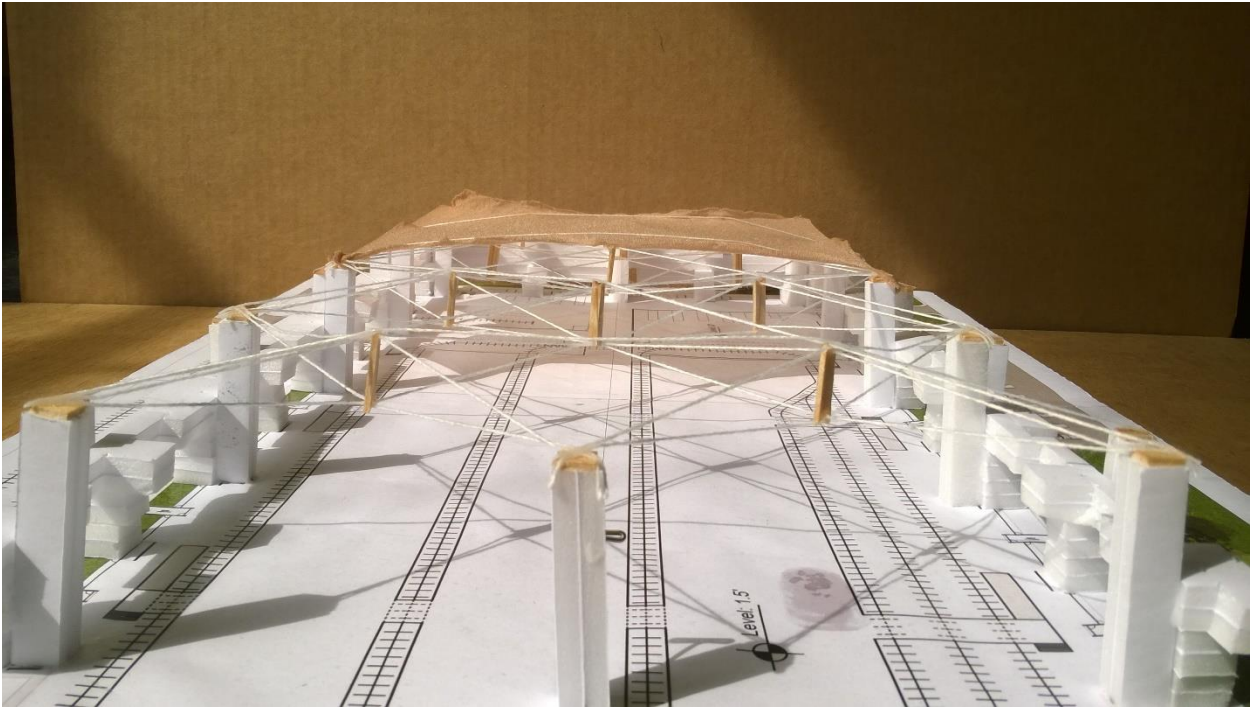
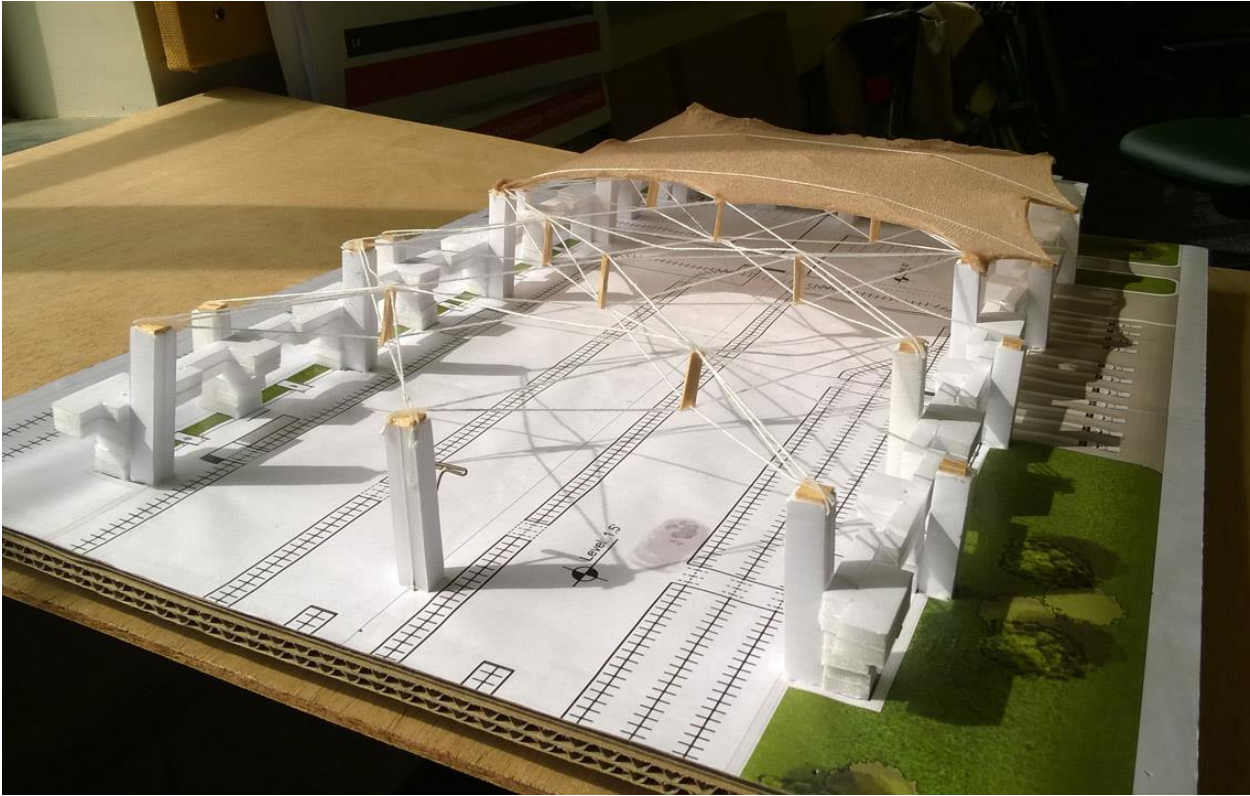
3D VISUALIZATION
ROOF PLAN



MODEL



MODEL



FINAL PRESENTATION AND REVIEW



THANK YOU