BUILDING PERFORMANCE & TECHNOLOGY LABORATORY

Ark+ Satra Jiva

Central of Fishery

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FINAL ARCHITECTURAL DESIGN STUDIO

DESIGN OF FISH MARKET AND SEAFOOD CULINARY
IN PARANGTRITIS WITH EARTHQUAKE AND TSUNAMI
RESISTANT STRUCTURAL SYSTEM

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DEPARTEMEN ARSITEKTUR
FAKULTAS TEKNIK SIPIL DAN PERENCANAAN
UNIVERSITAS ISLAM INDONESIA
2022

STUDIO AKHIR DESAIN ARSITEKTUR

PERANCANGAN PASAR IKAN DAN KULINER SEAFOOD
DI PARANGTRITIS DENGAN SISTEM STRUKTUR ANTI GEMPA DAN TSUNAMI

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DEPARTMENT OF ARCHITECTURE
FACULTY OF CIVIL ENGINEERING AND PLANNING
UNIVERSITAS ISLAM INDONESIA
2022

PAGE OF APPROVAL

Bachelor Final Project Entitled:

Design of Fish Market and Seafood Culinary in Parangtritis with Earthquake and Tsunami Resistant Structural System

Student's Full Name : Aris Ryant Kurniawan

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FOREWORD

Assalamu'alaikum Warahmatullahi Wabarakaatuh

Praise and gratitude I pray to Allah SWT because with the abundance of His grace, I was able to complete a Final Architectural Design Studio with title " Design of Fish Market and Seafood Culinary in Parangtritis with Earthquake and Tsunami Resistant Structural System". This Final Architectural Design Studio was prepared and submitted as a condition for obtaining a Bachelor of Architecture (S.Ars) degree at the Faculty of Civil Engineering and Planning at the Universitas Islam Indonesia.

This Final Architectural Design Studio was completed through many difficulties, the completion of the Final Architectural Design Studio cannot be separated from the guidance, motivation, and material and non-material assistance from various parties. Therefore, I do not forget to say thank you to:

1. Allah SWT, who has given smoothness and health in the work of the Final Architectural Design Studio.
2. My Beloved family for the prayer, moral support and for the blessing that has been given to me.
3. Prof. Noor Cholis Idham, ST., M. Arch., Ph. D. as the supervisor for the Final Architectural Design Studio who has provided opportunities, helped and guided patiently so that Final Architectural Design Studio could be completed.
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5. My fellow THE BOYSS friends at Architecture UII; Bryan Putra Parsada Sinaga, Muhammad Kemal Adro, Muhammad Tofan Azema Joanditra, and Muhammad Farhan Nurjaman.
6. My friends, who always give me enthusiasm in doing my Final Architectural Design Studio.
8. All my friends in Architecture 2017.
9. All parties who have helped me without being able to write one by one.

I realize that this Final Architectural Design Studio is still far from perfect and there are many shortcomings due to various limitations. For this reason, I will accept constructive criticism and suggestions afterwards. I hope that Final Architectural Design Studio can be useful for all those who read it. May Allah SWT always give mercy and guidance to all of us, Amin.

Wassalamu'alaikum Warahmatullahi Wabarakaatuh.

Yogyakarta, 13 January 2023

Aris Ryant Kurniawan

ORIGINALITY STATEMENT PAGE

I, the undersigned below:

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I state that this Final Architectural Design Studio Project that I write and work on is my own work, not the transfer of other people's writings or thoughts that I acknowledge as my own results or thoughts. As for the Final Architectural Design Studio work there are parts of quotes from other people's work that I have written down according to the norms, rules, and ethics in writing.

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The one that made the statement

Aris Ryant Kurniawan
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Assalamualaikum Wr. Wb.

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Judul Karya Ilmiah	: DESIGN OF FISH MARKET AND SEAFOOD CULINARY IN PARANGTRITIS WITH EARTHQUAKE AND TSUNAMI RESISTANT STRUCTURAL SYSTEM

Karya ilmiah yang bersangkutan di atas telah melalui proses cek plagiasi menggunakan **Turnitin** dengan hasil kemiripan (*similarity*) sebesar **11 (Sebelas) %.**

Demikian Surat Keterangan ini dibuat untuk dapat dipergunakan sebagaimana mestinya.

Wassalamualaikum Wr. Wb.

Yogyakarta, 10/21/2022

Direktur

Muhammad Jamil, SIP.

ABSTRACT

This project will be designing a fish market and seafood culinary on the seafront of Parangtritis beach. Therefore, this area has the potential to be struck by earthquake and tsunami disasters, considering fish markets and seafood culinary is a place of gathering people in a large groups. These disasters will be a significant threat if we do not prevent them from the beginning. To prevent it, the spatial and structural system of the building is the most crucial parameter in design. An experimental design method will be used by utilizing the rhinoceros 3d program to achieve the design. Furthermore, it inputs the parameter needed for the spatial and structural system to resist earthquake and tsunami disasters. Therefore, this final architecture design studio is expected to make fish market and culinary seafood designs that will be safe from earthquake and tsunami disasters on the seafront of Parangtritis.

Keywords: *Fish market and seafood culinary, Earthquake and tsunami disasters, Spatial and structural system, Parangtritis seafront building*

ABSTRAK

Proyek ini akan merancang pasar ikan dan kuliner seafood di pinggir laut pantai Parangtritis. Oleh karena itu, kawasan ini berpotensi terkena bencana gempa dan tsunami, mengingat pasar ikan dan kuliner seafood merupakan tempat berkumpulnya orang dalam kelompok besar. Bencana-bencana ini akan menjadi ancaman yang signifikan jika kita tidak mencegahnya sejak awal. Untuk mencegahnya, sistem tata ruang dan struktur bangunan merupakan parameter terpenting dalam desain. Metode desain eksperimental akan digunakan dengan memanfaatkan program 3d badak untuk mencapai desain. Selanjutnya input parameter yang dibutuhkan untuk sistem spasial dan struktural untuk menahan bencana gempa bumi dan tsunami. Oleh karena itu, studio desain arsitektur tugas akhir ini diharapkan dapat membuat desain pasar ikan dan kuliner seafood yang aman dari bencana gempa dan tsunami di pinggir laut Parangtritis.

Kata Kunci: *Pasar ikan dan kuliner seafood, bencana gempa dan tsunami, tata ruang dan struktur bangunan, bangunan pinggir laut Parangtritis*

LIST OF CONTENT

LIST OF CONTENT

LIST OF TABLE

LIST OF FIGURE

Chapter 1.
INTRODUCTION

Contents

1.1 TITLE CLARITY

1.1..1 Title :

Design of Fish Market and Seafood Culinary in Parangtritis with Earthquake and Tsunami Resistant Structural System

1.1.2 Emphasis :

Depok Fish Market is located near beach shore in the Parangtritis area. The area also has seafood culinary restaurants, fish auction, etc. Due to the location, the area is susceptible to both earthquakes and tsunami. To prevent fatalities, a resistant structural system needs to be implemented in both fish market and the seafood culinary area.

1.1.3 Definition :

- Fish Market
  A fish market is a place where fish and fish products are sold. It can focus on selling seafood to individual customers, on wholesale transactions between fish merchants and fishermen, or on both. Street food is frequently offered in retail fish markets, a category of wet market.
- Seafood
  Any type of marine life that humans consider to be food is considered seafood, with fish and shellfish topping the list.
- Culinary
  The practice of utilizing heat to prepare food for eating is known as cuisine. In order to reflect local conditions, cooking methods and ingredients vary greatly, from grilling food over an open flame to utilizing electric burners to baking in a variety of ovens.
- Earthquake
  A abrupt release of energy in the Earth's lithosphere that results in seismic waves causes an earthquake, which is the shaking of the planet's surface. Earthquakes can range in strength from those that are so small that no one can feel them to those that are so powerful that they upend entire cities and send people and objects flying.
- Tsunami
  A tsunami is a succession of waves in a body of water brought on by the shifting of a significant amount of water, typically in an ocean or a sizable lake. A tsunami can be produced by earthquakes, volcanic eruptions, and other underwater events (such as detonations, landslides, glacier calvings, meteorite impacts, and other disturbances) that occur above or below water.
- Resistant
  The capacity to generally prevent something from happening.
- Structural System
  In structural engineering, the load-resisting component of a building or item is referred to as the structural system or structural frame. Through connected parts or members, the structural system distributes loads.

1.2 DESIGN PREMISE

Depok Fish Market is located near beach shore in the Parangtritis area. The area also has seafood culinary restaurants, fish auction, etc. Due to the location, the area is susceptible to both earthquakes and tsunami. To prevent fatalities, a resistant structural system needs to be implemented in both fish market and the seafood culinary area.

On May 27, 2006, an earthquake with a moment magnitude of 6.4 hit close to Java's southern coast, inflicting significant damage. The tragedy had the greatest impact on Bantul Regency. More than 2,000 people lived in Bantul; thousands were injured; and 80% of the dwellings there were either damaged or destroyed.

The places near beaches in Yogyakarta need more safety considerations to disaster because Yogyakarta is a tourist city, and the most visited area is the beach. And Yogyakarta is also located on an active line ring of fire with a high volcanic and tectonic activity that is one of the causes of earthquakes and tsunamis. The fish market and seafood culinary design needs to accommodate safeness from the earthquake and tsunami , because of that this matrix indicator will help to guide the design provides good performance on accessibility, structure, material, building form, and also landscape to reach the optimal design.

1.3 BACKGROUND

The project will be designing a fish market and seafood culinary in Jl. Pantai Parangkusumo, Pantai, Parangtritis, Kec. Kretek, Kabupaten Bantul, Daerah Istimewa Yogyakarta, that located on potential for earthquakes and tsunamis beach area. In this case, the distance between the building and the water is too narrow and makes the threat level is on high risk.

The south side of Yogyakarta is one of the most frequent areas of earthquake activity. One of the most severe and fatal incidents occurred in 2006 (Nugroho, Sri C.,2017), and the earthquake's impact can cause a tsunami at any time. Because of that, Parangtritis beach, especially in Kretek districts, was classified as a bit vulnerable to tsunamis (Qoriadi, M. Taufan,2013).

Because of that, we need to know how to prevent these disasters in fish markets and seafood culinary buildings. In architectural aspects, the most important preventive measure in the building is the spatial and structural system. It is because the damage dealt by the building is the force of an earthquake, and the wave of the tsunami that impacts the building, and one aspect of structural systems is the foundation since it will directly face the wave of tsunami and earthquake forces from the ground (T.A. Belash,2018). And to measure the success of prevention of these disasters, Teddy mentions the level definition of resistance building by three-level, light, mid, and high levels (Teddy,2009). This will be explained furthermore in the literature review. And earthquake-resistant buildings also to prevent victims also minimize property loss (Rinaldi et al. 2015).

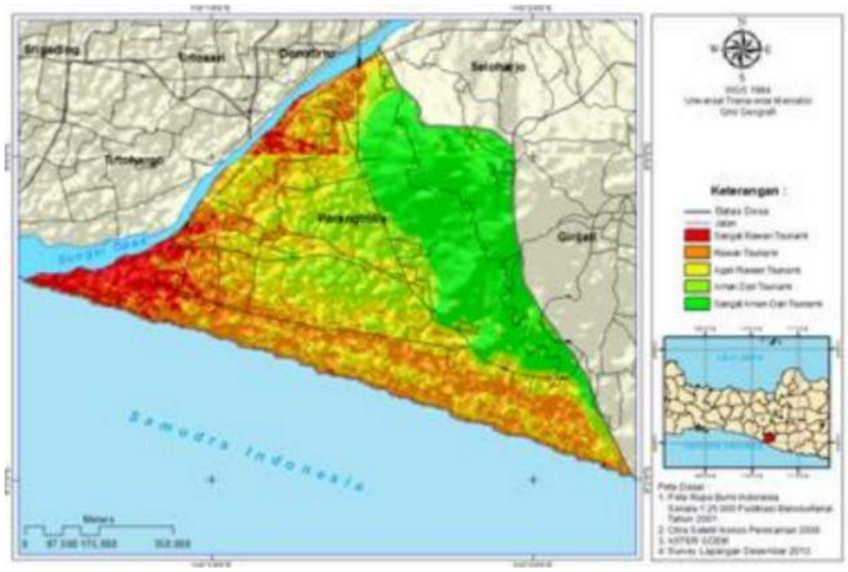


Figure 1.1: Threat level map of Parangtritis, Kretet District, Bantul Region, DIY Source: Handoyo et al., Peta Kerawanan Tsunami, 2017

The spatial systems of the fish market and seafood culinary also needed to be considered as the integration of function between building and the safeties related to the disaster prevention system.

To know the parameter of spatial systems aspect, first we need to understand the typology of fish market and seafood culinary. In this project the function of fish market and seafood culinary must provide a safe haven for the users inside. The activity, type of users need to be considered more. And in this matter, spatial aspect is strong related to evacuation route of the building.]

So, there is the risk of disasters that happened to the seafront fish market and culinary seafood building in Parangtritis. However, there is also potential to prevent this by designing fish markets and culinary seafood buildings by focusing on the spatial and structural system of the building to hold the forces of earthquake and tsunami waves.

This design must be considered to minimize the victims and property losses when disasters occur. Therefore, this project is expected to design a seafront fish market and seafood culinary building to prevent victims and minimalize the property losses to the earthquake and tsunami.

1.4 PROBLEM FORMULATION

1.4.1 General Problems

1. How to maximize functions of fish market based on spatial organization?
2. How to design an integrated fish market, and seafood culinary in a meso area scale?

1.4.2 Specific Problems

1. How to design the fish market and seafood culinary that could withstand earthquake and tsunami disasters?
2. How to integrate the spatial system of a fish market and seafood culinary with a responsive structural system to the earthquake and Tsunami?

1.4.3 Goals

1. To design an efficient fish market with good spatial organization.
2. To integrate the meso-organization of fish market and seafood culinary in a single area.
3. To design fish market and seafood culinary that could withstand earthquake and tsunami disaster.
4. To design fish market and seafood culinary that could integrate the spatial system with responsive structural system that response to the earthquake and tsunami.

1.5 PROBLEMATIQUE

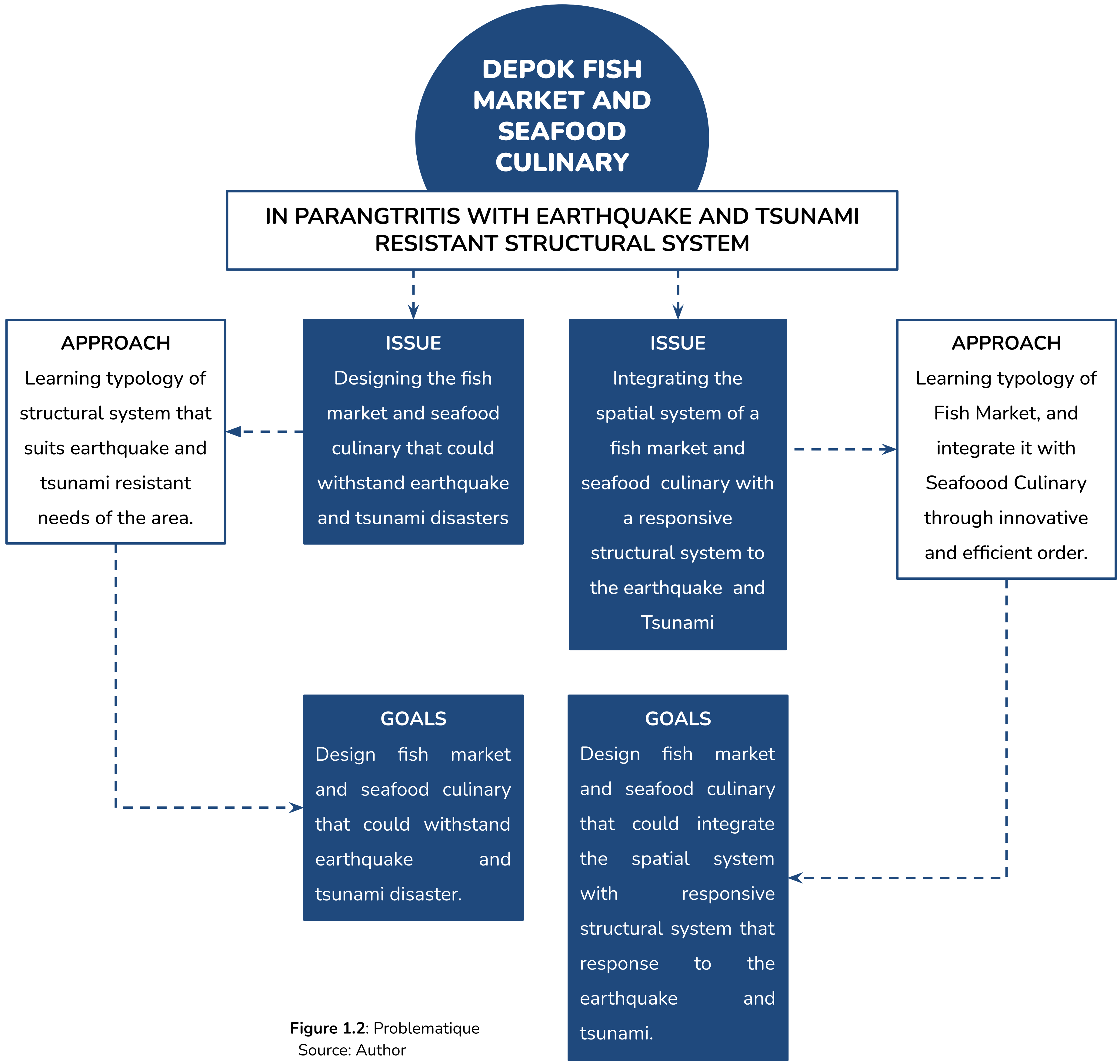


Figure 1.2: Problematique
Source: Author

1.6 DESIGN METHOD

The following design phases' flow is intended to address the concerns already mentioned:

Phase 1: Design Studies

The first step is to find the data about the seafront building. This step is intended for learning the typology also the technology of the building, in order to apply the lesson to the spatial and structural systems of the building to handle earthquakes and tsunamis.

Phase 2: Design Variable Analysis

The second step is to find data about the risk of the earthquake and tsunami, specifically for the Parangtritis area. This step is intended to find the potential cause that impacts the structural system on the seafront building and be used on spatial systems integration on the building.

Phase 3: Conceptual Design

The third step is to make a guideline on how to design a seafront fish market and seafood culinary building that could prevent victims and property losses by using the data collected before. This guideline is a foundation and a parameter of the design development in the next step.

Phase 4: Design Synthesis

The fourth step is developing ideas into design to protect people from disasters. To achieve the design, this step will use parameters from the step before. And then synthesize it into a rhinoceros 3d design program or others building performance program to find optimal spatial and structural systems that could minimize the victims and property losses. After finding the optimal design, the design will be developed more into a seafront fish market and seafood culinary building, that can be a safe haven from earthquake and tsunami disasters in Parangtritis.

Matrix Indicator								
Variables	Indicator	Siteplan& Neighborhood	Building Systems	Building Infrastructure	Building Material	Spatial Planning	Building Envelope	Building Structure
Fishmarket	Accessibility	o				o		
	Earthquake Safety		o	o	o	o	o	o
	Tsunami Safety		o	o	o	o	o	o
	Sustainability	o		o	o	o		
Seafood Restaurant	Accessibility	o	o			o		
	Earthquake Safety		o	o	o	o	o	o
	Tsunami Safety		o	o	o	o	o	o
	Sustainability	o	o	o	o			

Table 1.1: Matrix of Design Indicator
Source: Author

1.7 THOUGHT PROCESS

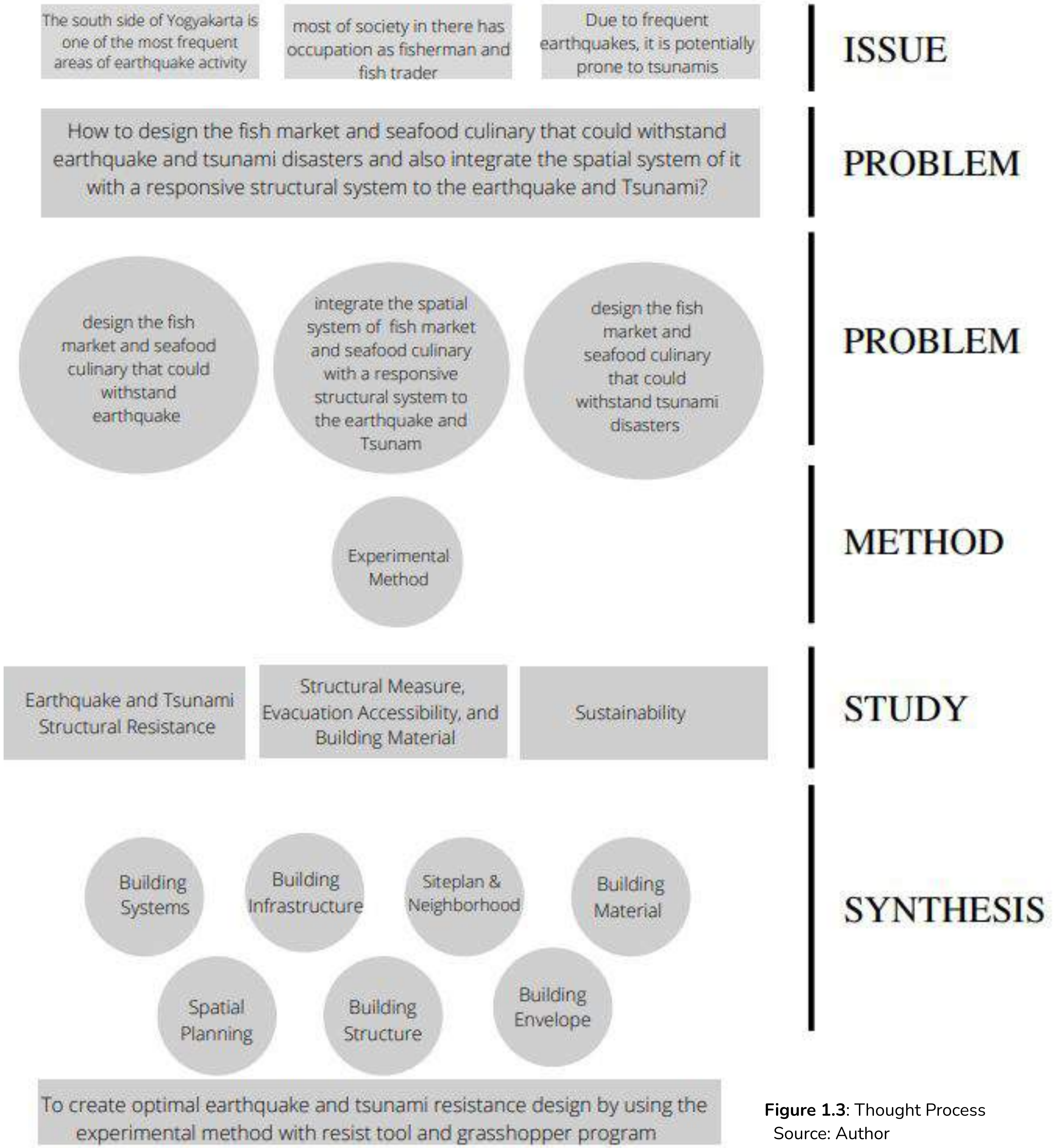


Figure 1.3: Thought Process
Source: Author

1.8 ORIGINALITY

Other projects with similar approach or function and the difference with this project.

A.

Title : Perancangan Wisata Pasar Ikan Higienis Di Pelabuahan Kota Pasuruan Dengan Pendekatan Arsitektur Organik

Authors : Yofieta Cahya Amara, 16512114

Location : Yogyakarta

Approach : Organic

Institution : Universitas Islam Indonesia

Problem : Lack of higienity and cleanness in fish markets..

Similarity : Intend on re-designing fish market to be better..

Differences : Different approach, with this project having organic architecture approach.

B.

Title : Pasar Ikan Angke, Perancangan Pasar Ikan Modern di Muara Angke Jakarta Utara (Dengan Konsep Arsitektur Apung)

Authors : Kusumawardhany, Hanny Thirza

Location : Yogyakarta

Approach : Structural System

Institution : Universitas Islam Indonesia

Problem : Flood can be hard for fish seller as it makes their storage tainted and damage their goods

Similarity : Structural system being the strongest point of the project.

Differences : Different kinds of disaster, here it is againts flood.

C.

Title : Perencanaan Mitigasi Risiko Pada Rantai Pasok Ikan di Pasar Ikan Tradisional(Studi Kasus: Pasar Nganjuk 1 Kabupaten Nganjuk Jawa Timur)

Authors : Silvia Febriani, 15522325

Location : Yogyakarta

Approach : Disaster Mitigation

Institution : Universitas Islam Indonesia

Problem : Chain of risk that is being exposed in fish markets.

Similarity : Try to understand fish sellers and try to help them with a solutive design.

Differences : Different approach, with this project discussion is used to be foundation of the design.

Chapter 2.
DESIGN STUDY

Contents

2.1 CONTEXTUAL REVIEWS

2.1.1 Location Context

Figure 2.1: Map of Indonesia
Source: Author

The Special Region of Yogyakarta is located in Indonesia's south-central region of the island of Java, and Yogyakarta is its major city. Yogyakarta is considered as a significant hub for classical Javanese fine arts and culture, including ballet, batik textiles, theater, literature, music, poetry, silversmithing, visual arts, and wayang puppetry. Yogyakarta is the only Indonesian royal city remaining under the control of a monarchy. Kretek is a Kapanéwon in Bantul Regency, Yogyakarta Special Region Province, Indonesia.

Depok Fish Market is located far down in Kretek faced another variant of disaster not just earthquake, but also tsunami. Due to it’s direct proximity to the South Ocean, earthquake resistant and tsunami resistant design is needed to minimalize the impact of these disasters to people, building, etc.

Figure 2.2: Map of Yogyakarta
Source: Author

2.1.2 Site Study

Pasar Ikan Depok

- Location : X7QR+6V8, Pantai, Parangtritis, Kretek, Bantul Regency, Special Region of Yogyakarta 55772
- Site Area : +- 25.000m2

Reasons :

- Located near beach and has many supporting facilities as small harbour, big access, etc.
- Surrounding buildings are benefiting from the fish market as they supply goods from them (restaurants, ect)

Existing Condition :

There is already building with exact function on the site, the fish market will be redesigned while the other buildings will be demolished and changed to something new.

Figure 2.3: Site Location
Source: Google Map

2.1.3 Existing Location

Figure 2.4: Site Condition
Source: Author

Figure 2.5: Site Condition
Source: Author

Figure 2.6: Site Condition
Source: Author

Figure 2.7: Site Condition
Source: Author

Figure 2.8: Indoor Condition
Source: Author

Figure 2.9: Site Condition
Source: Author

Figure 2.10: Site Condition
Source: Author

Figure 2.11: Site Condition
Source: Author

Figure 2.12: Site Condition
Source: Author

2.1.4 Interview with Local People

- The place for selling fish is at a separate auction market, some of the fish sold in the market are from the auction catch, some are sent from Semarang, around the fish market there are many stalls that provide cooking services for raw materials from the market.
- Access to fish delivery can be from the front or back door, most of the visitors are there every weekend, on normal days it's between 8 am or 4 pm.
- The fish storage area only uses an ice box and just put it in the market at night, there is no special place.
- Waterways tend to get clogged,
- The wind is very strong there so that many parts of the building structure or infrastructure (cables, lights, etc.) are damaged.
- For evacuation routes rely on sirens from Parangtritis beach which is about 3.8 .km.

Figure 2.13: Interview
Source: Author

2.1.5 Site Surrounding

Figure 2.14: Site Surrounding
Source: Author

2.1.6 Site Data

Cloudy, Sunny, and Precipitation Days

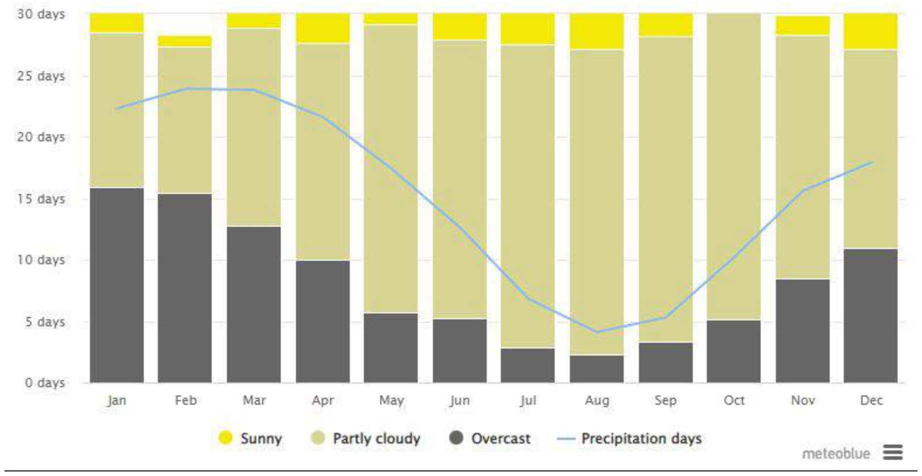


Figure 2.15: Cloud Data
Source: Meteoblue

The graph shows the number of sunny, partly cloudy, overcast, and precipitation-free days during a month. Days that are sunny have a cloud cover of less than 20%, partly cloudy days have a cloud cover of 20–80%, and gloomy days have a cloud cover of more than 80%.

Average Temperature

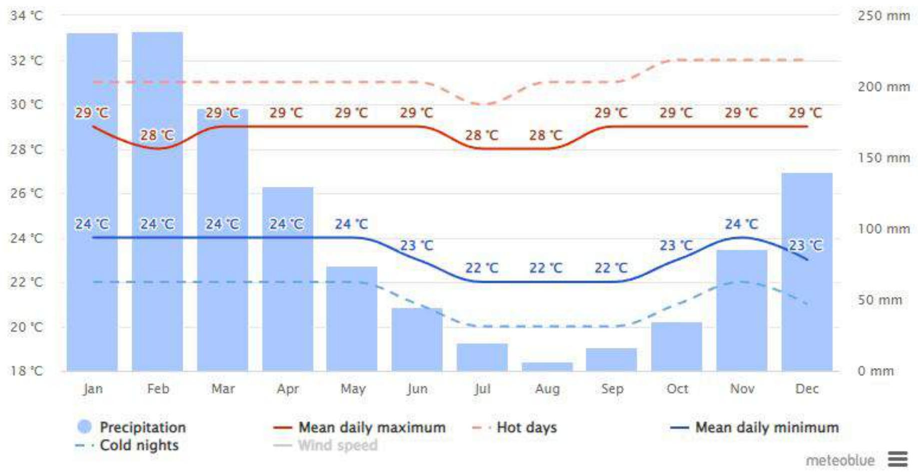


Figure 2.16: Temperature Data
Source: Meteoblue

As previously mentioned, the amount of rain has an impact on the microclimate of the area, with temperatures falling from June to August as a result of the drier weather during the dry season. Given the accompanying graph of Yogyakarta's annual temperature conditions, building opening designs would be altered to allow for unrestricted airflow.

Precipitation

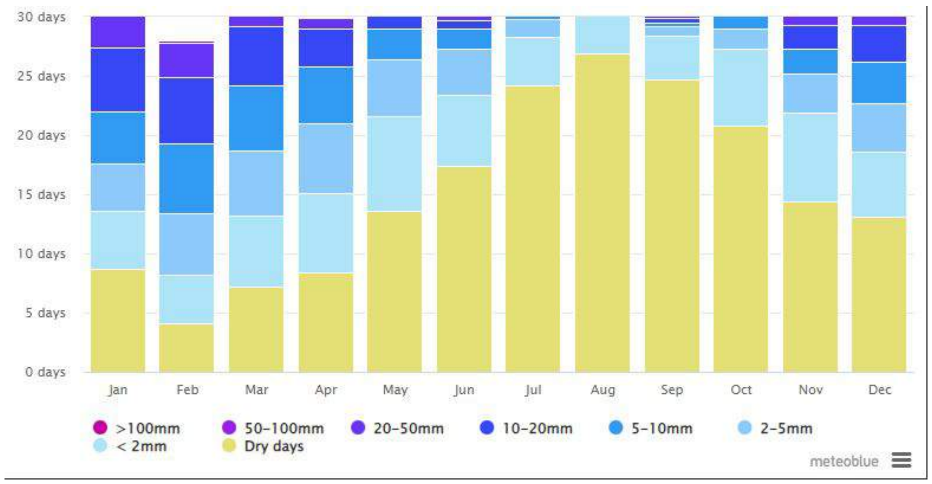


Figure 2.17: Rain Data
Source: Meteoblue

The graph shows the intensity of precipitation in a year. Rain water can affect the amount of water that can be channeled throught water canals. The data can be used to maximilize if heavy rain to happen with tsunami and or earthquake.

Max Temperature

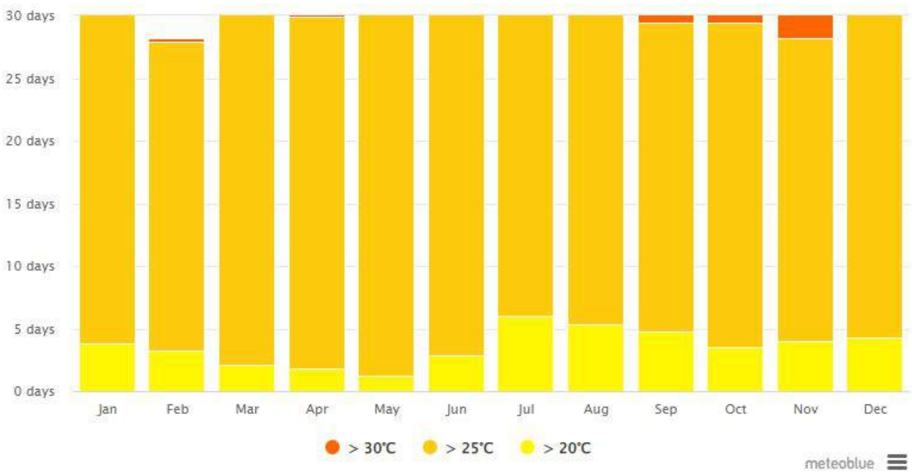


Figure 2.18: Temperature Data
Source: Meteoblue

The graph shows the maximum temperature in a year. Sufficient temperature is needed for fish storage, this data can be used to optimize temperature control in the fish related buildings.

Windspeed

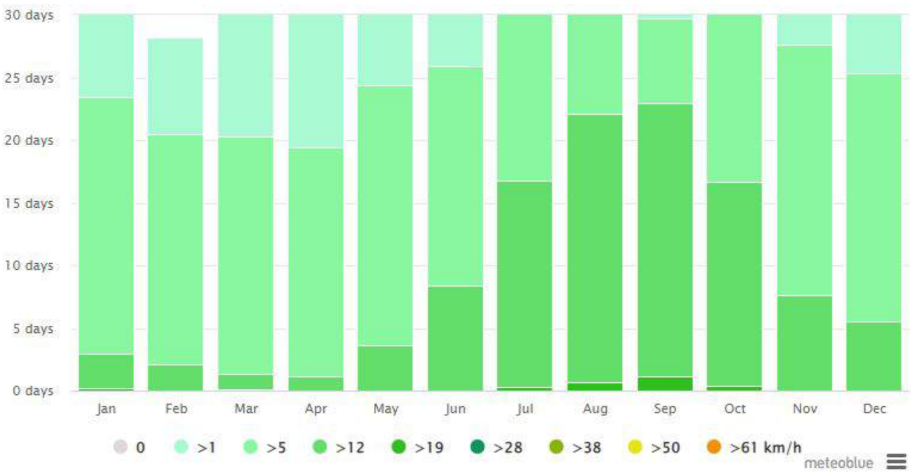


Figure 2.19: Wind Data
Source: Meteoblue

The most frequent windspeeds are 1 ms, 5 ms, and 12 ms.

It might be challenging because the raw data is somewhat harsh. The speed might be somewhat slower, though, because the structure is flanked by other surrounding buildings.

Windrose

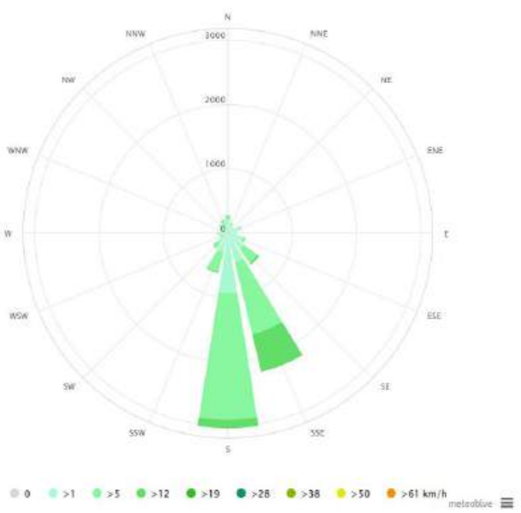


Figure 2.20: Wind Data
Source: Meteoblue

The Yogyakarta region has the highest rate of wind exposure from the north, south, and southeast, according to the windrose map. The form and envelope of a building's design can be impacted by the wind's direction, particularly when it comes to the building's orientation.

2.2 THEMATIC REVIEWS

2.2.1 Earthquake and Tsunami Structural Resistance

Zoning Area

Inland buildings may not be as visually beautiful, but they provide various benefits for their owners, including lower construction and maintenance costs. On the other hand, an oceanfront location may offer better vistas but is more likely to be destroyed by high tides or tsunami waves, increasing the expense of construction and upkeep.

Figure 2.21: Coastal Area
Source: andhitapradipta.github.io

2.2.1.2 Seafront Area

From some of the opinions, it can be concluded that the meaning of a waterfront is a dynamic area bordering water that has physical and visual contact with seawater, rivers, lakes, and other bodies of water. In general, the waterfront area functions as a place where the community gathers to hold an event or festival, usually held in an open or grassy field where everyone feels welcome to come.

So seafront building is categorized in waterfront terminology, in relation to this project, it can be learned that seafront buildings will be dense by activity. The dynamic function itself could be an idea for developing the design of seafront buildings, in tsunami disasters. With the dense activity area, there will be more focus on spatial and structural systems consideration.

Figure 2.22: Seafront Area
Source: Archdaily

Figure 2.23: Seafront Area
Source: Archdaily

2.2.1.2 Coastal Area

Coastal area building should have some sort of power to withstand both earthquake and tsunami by its own. It is possible to use concrete structure for more cheaper yet strong option rather than using steel bracing and such. Buildings in this area tend to be smaller in size for easy evacuation and somewhat big opening for temperature comfort.

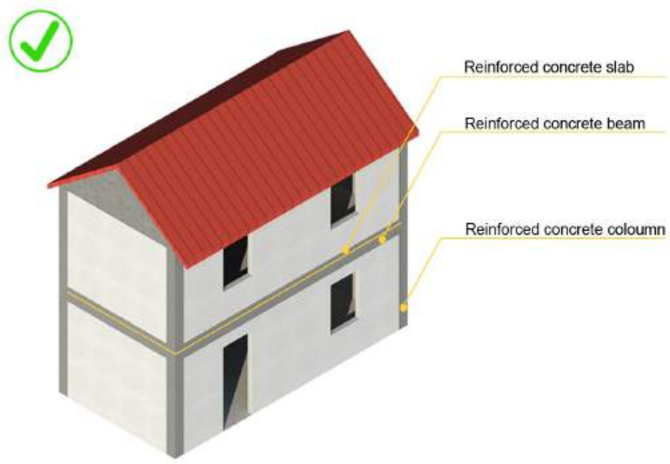


Figure 2.24: Building Material
Source: andhitapradipta.github.io

2.2.1.3 Inland Area

Building in this area can be huge main building that will work both as Shelter / Save haven if there's to be a tsunami. The building can implement a standing column or void ground floor for waterway in tsunami cases. The space can be used for other usage in resting positing / standby mode. The huge open floor configuration will make it easier to adopt many functions.

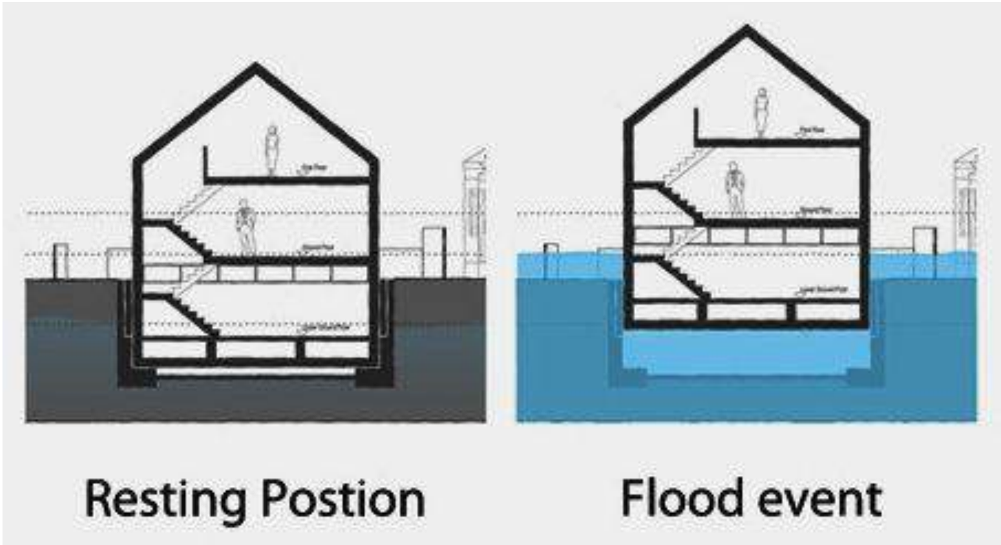


Figure 2.25: Flood Cases
Source: cherrymortgages.com

Figure 2.26: Building Example
Source: cherrymortgages.com

2.2.2 Foundation Types

Building foundations must be deep enough to withstand the effects of scouring and erosion. They also need to be strong enough to withstand the impact of floods, tsunamis, and debris. Finally, it must be able to transmit wind and seismic forces to the ground.

2.2.2.1 Pad Foundation

Pad foundations are rectangular or circular blocks used to support localized loads such as columns. They are more commonly found in large purpose-built structures such as industrial plants and other commercial buildings to support large covered structures.

2.2.2.2 Strip Foundation

A trip foundation is a type of shallow foundation commonly used in low to mid-rise residential buildings. Strip foundations are suitable only for stable load-bearing subsoil conditions and can be erected quickly and cheaply.

2.2.2.3 Pile Foundation

Pile foundations, a type of deep foundation, are actually slender columns or long cylinders made of materials such as concrete or steel that support structures and carry loads at desired depths through end bearings or surface friction. used to convey. Pile foundation is recommended to prevent overturning of the superstructure due to scouring.

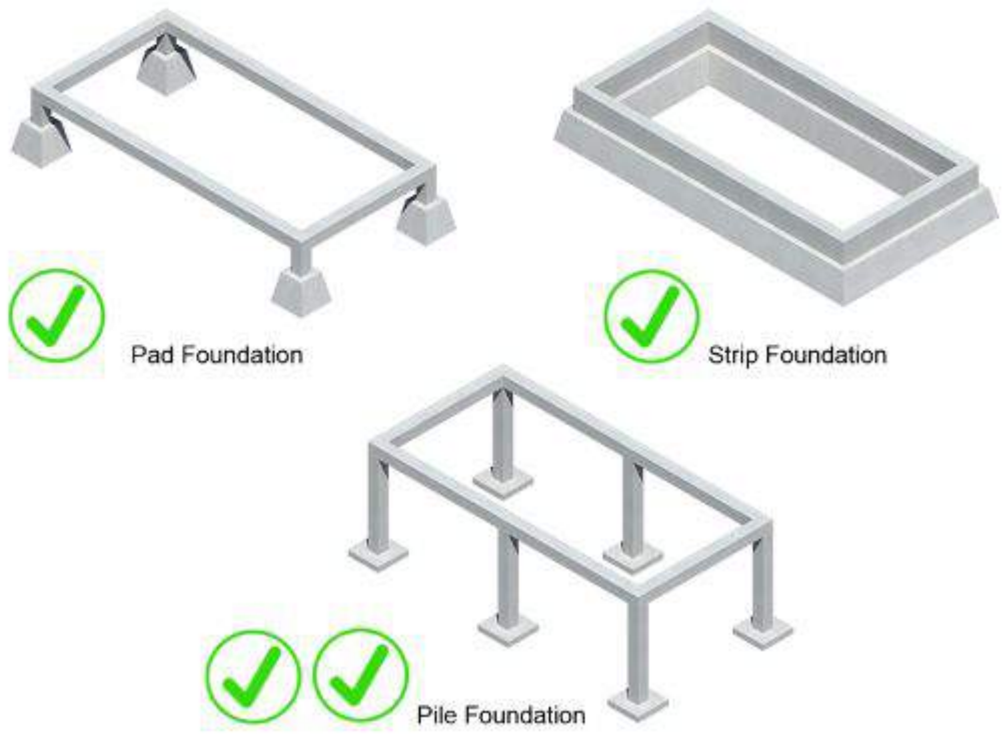


Figure 2.27: Foundation Types
Source: andhitapradipta.github.io

2.2.3 Tsunami Evacuation

The planning steps		Topics to be discussed	Output
Step 1:	Prepare for the planning	Mandates, planning team and resource persons, data and information, resources, planning process and timeframe	Work plan
Step 2:	Understand your community's tsunami risk	**Hazard**: inundation area and arrival time **Vulnerability**: physical exposure of population and facilities, capability to evacuate, preparedness and readiness to evacuate, early warning system Potential evacuation routes and shelter, high risk areas	Maps, data inventory, mind map, and assessment report
Step 3:	Design your evacuation strategy and map	**Evacuation strategy**: evacuation time, evacuation zone(s), safe areas, assembly areas, modes of evacuation, evacuation shelter buildings, evacuation routes, when to (self-)evacuate **Support during evacuation**: traffic management, vulnerable facilities, evacuation signage	Preliminary evacuation plan: document that includes map, strategy and recommendations; draft public evacuation map
Step 4:	Assess, endorse and diss-eminate your evacuation plan	Public assessment of the plan, endorse-ment by local authorities, dissemination to institutions and public, outreach strategy	Endorsed evacuation plan, dissemination and outreach plan
Step 5:	Test, evaluate and improve your evacuation plan	Tsunami simulation exercises, means of observation and evaluation, revision of evacuation plan	Plan to test, evaluate and improve the evacuation plan

Figure 2.28: Tsunami Evacuation
Source: Guidebook Planning for
Tsunami Evacuations

A method for identifying possible locations for vertical shelters is proposed, providing each shelter with useful information such as: Tsunami arrival time, response time, time available for evacuation, and coverage distance for both population velocities. Combining this information with the number of people evacuated gives us the capacity these shelters should have. Finally, the proposed framework allows us to organize, categorize and prioritize the collected information in order to better define the different risk management actions included in the evacuation plan.

For some of the results from Indonesian Communities calculation, the current response time is 45 minutes (RT45, i.e. 30 minutes alert time, 15 minutes response time), but the evacuation model could improve the process to ensure alerts. It is emphasized that you should Successful evacuation as most coastal communities had been hit by the tsunami before they were warned. A 15 minute reduction in response time indicated a high percentage of the displaced population (indicating the importance of addressing this issue). However, communities closer to the coast were unable to reach safer locations. For these communities, attempts are suggested to find alternatives to ensure evacuation such as: Construction of new evacuation routes and new vertical shelters. These combined measures (reduced reaction time and reduced distance traveled) have been shown to help achieve desired outcomes.

2.2.4 Tsunami Resistance Building System

2.2.4.1 Tsunami Data

Fault types and normal east-west strain values are displayed larger than normal north-south strain values. This is because the research area is stressed by north-south subduction. The opaque faults tend SW-NE, so the eastern block tends to the NE and the western block to the SW. Maximum shear strain analysis results showed positive anomalies at three locations, but the anomaly east of Bantul was analyzed as the main epicenter of the May 27, 2006 earthquake.

The displacement pattern and maximum shear direction pattern of the extensional anomalies in the study area indicate the presence of SW-NE trending faults, which are left transverse layer style faults. This failure is known as Opak failure. Opacity fault activity that caused the May 27, 2006 earthquake Location of the epicenter on May 27, 2006 The estimated location is 10 km east of Bantul. The 2006 Yogyakarta earthquake has a seismic moment (Mo) value of 8.1385 x 1025 dyne cm and a moment magnitude (Mw) of 6.5. The normal elongation value in the east-west direction is larger compared to the normal elongation value in the north-south direction.

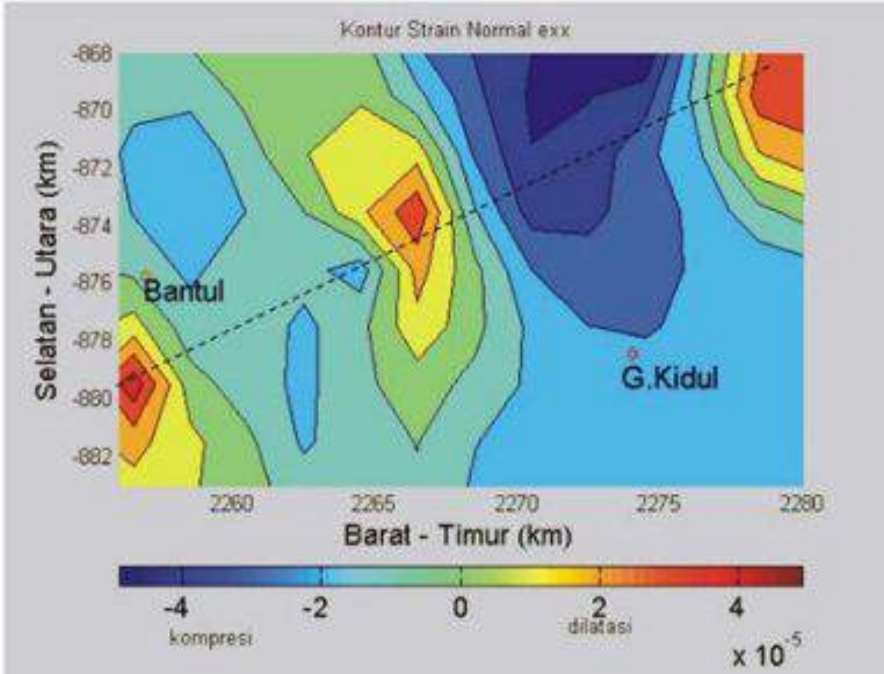


Figure 2.29: Normal Conture
Source: Yogyakarta BMKG

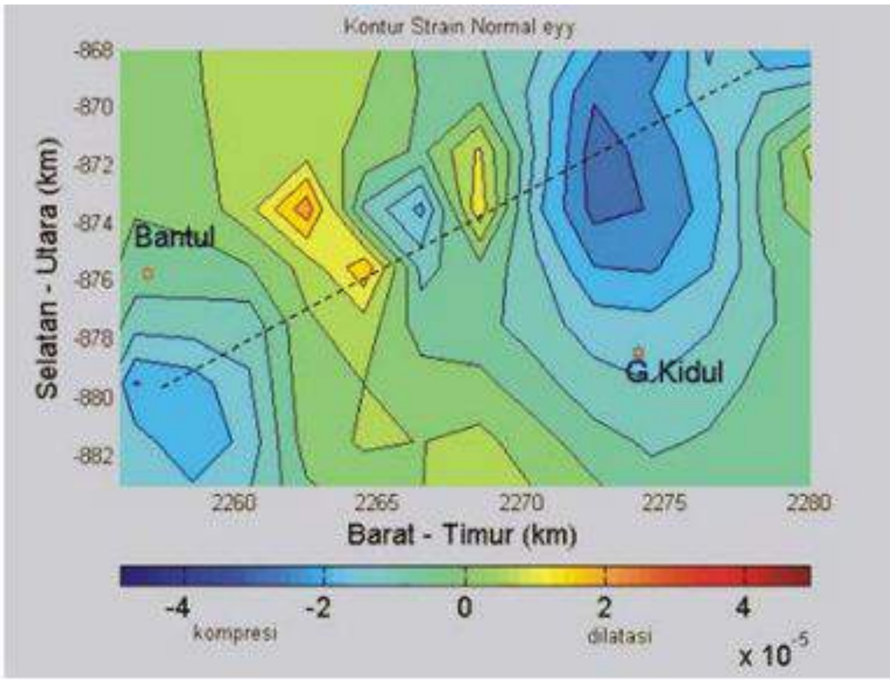


Figure 2.30: Normal Conture
Source: Yogyakarta BMKG

The speed of a tsunami is greatly affected by the depth of the seafloor. At great depths, tsunamis can reach hundreds to thousands of kilometers per hour and have small amplitudes (wave heights); increase. There is a tendency to be vigilant from the east to Saden, as wave propagation speeds can cause larger tsunamis than in the western part of the study area. Characteristically, the beaches in the southern coastal region of Yogyakarta can be divided into two beach types. Namely, beach type 1 covers the coastal area from the eastern end (Gulf of Sudden) to Parantritis Beach, while beach type 2 begins in the western study area. From Parantitis beach in the west to Pasir Kongot beach.

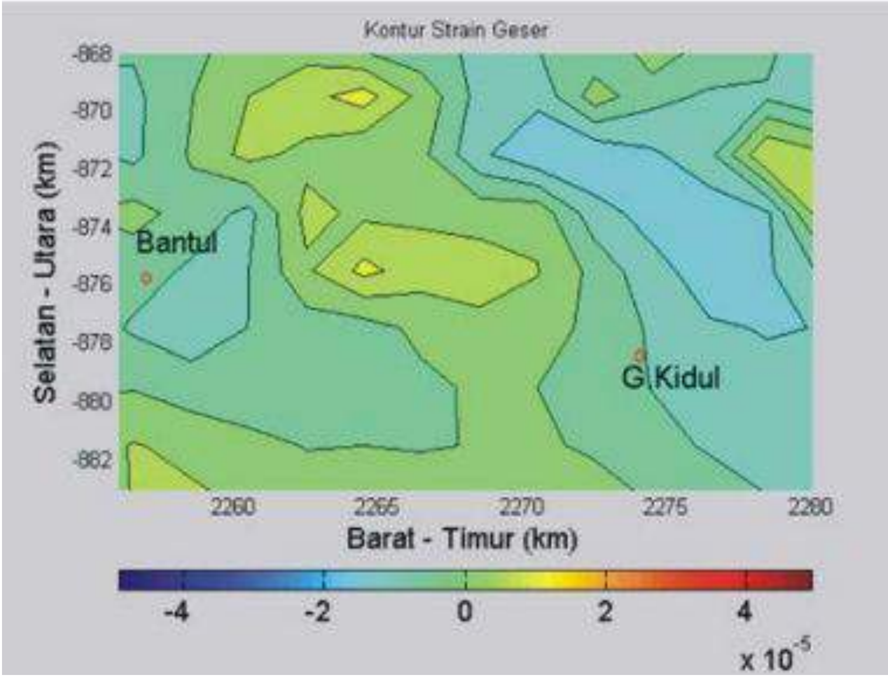


Figure 2.31: Friction Conture
Source: Yogyakarta BMKG

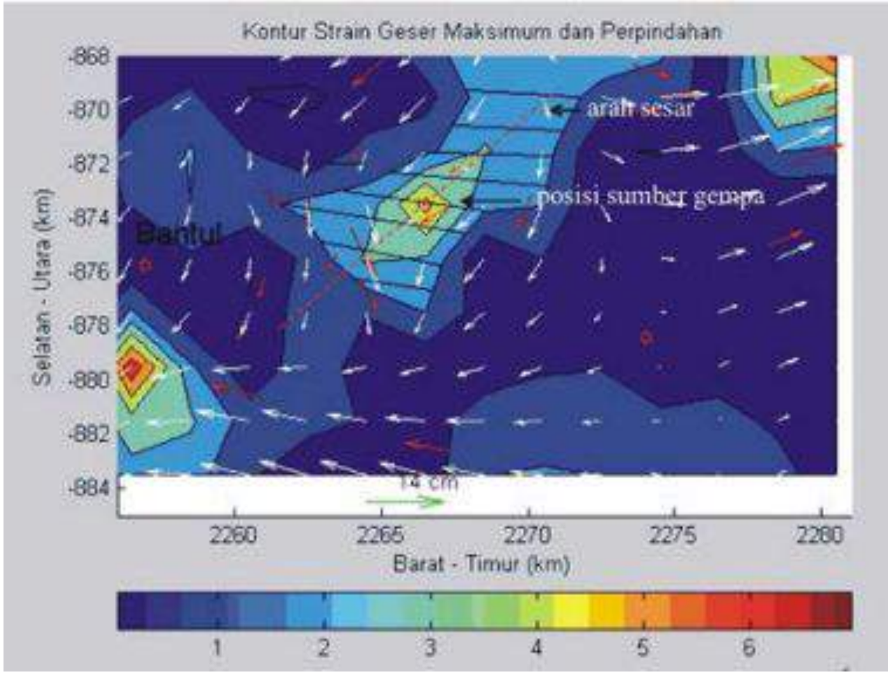


Figure 2.32: Max Friction Conture
Source: Yogyakarta BMKG

Based on beach characteristics, Yogyakarta beach areas can be divided into two tsunami risk zones.

(1) The high-risk zone is the area along the coast from the east of Palangendok to Suden Beach, especially the beaches used as tourist or residential areas by fishermen in relatively close proximity to the beach with bays and pockets (pocket beaches). It is shaped and built on the coast.

(2) From the west of Parantritis

Pasir Kongot Beach has a straight coastline and a relatively sloping beach form, but houses and tourist buildings are built relatively far from the coastline, and it is located behind the sand dunes (sand dunes). doing. Shield from natural tsunamis.

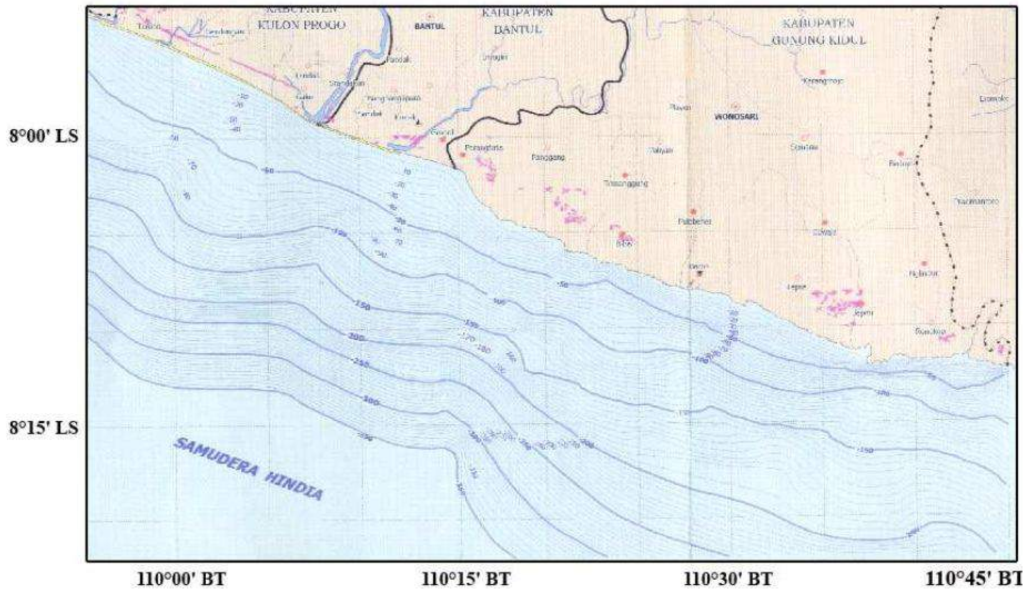


Figure 2.33: Tsunami Mapping
Source: Yogyakarta BMKG

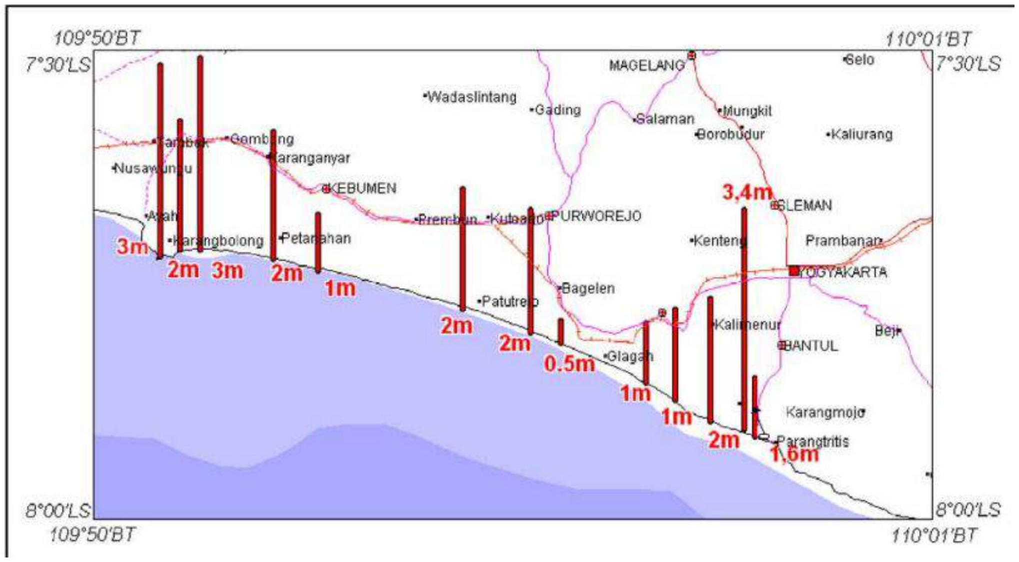


Figure 2.34: Earthquake Mapping
Source: Yogyakarta BMKG

2.2.4.2 Tsunami Simulation with Rhino

It can be seen from the Tsunami Simulation with Rhino which area are to be flooded, will most likely be heavily impacted, etc, Using these as an early identification for zoning, building structure, etc will make it better to withstand both tsunami and earthquake that will come with it.

2.2.4.3 Flood Resistance Building

Building resilience is the ability of a building to recover from flood damage by either removing it from contact with flood water or making it resilient to potential damage resulting from contact with flood water. It is the process of making This is the process of constructing a building so that flood waters do not enter the building and damage its structure, providing some protection to flood victims from inundation. These measures can either prevent water from entering the property, especially during shallow floods, or give homeowners time to move valuable possessions upstairs.

Floods can be disruptive and can cause structural and cosmetic damage to buildings that can be costly to repair.Floods can also carry pollutants that create additional health risks. there is. Shallow immersion depths may prevent significant damage to buildings and allow continued use of buildings during floods. It may also be beneficial to install flood defenses on facilities behind flood defenses to protect them if defenses breach or fail.

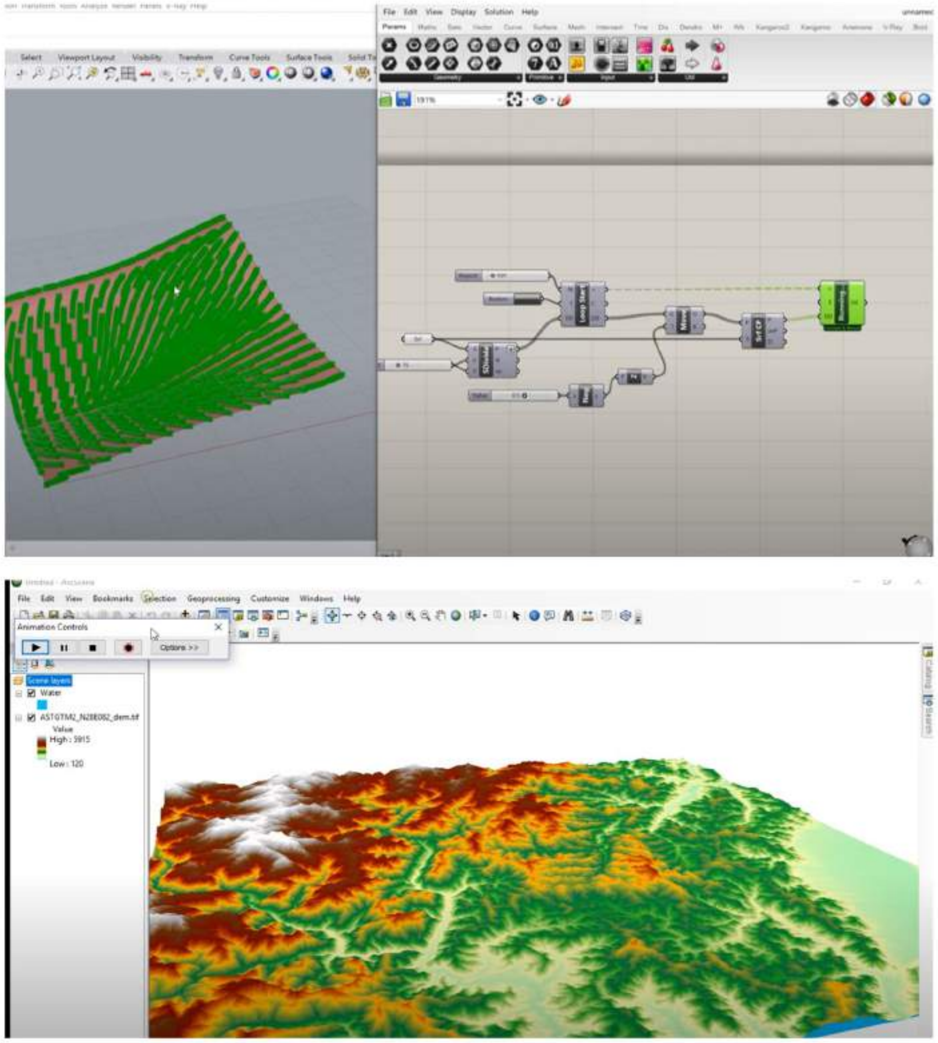


Figure 2.35 and 2.36: Flood Simulation
Source: Author

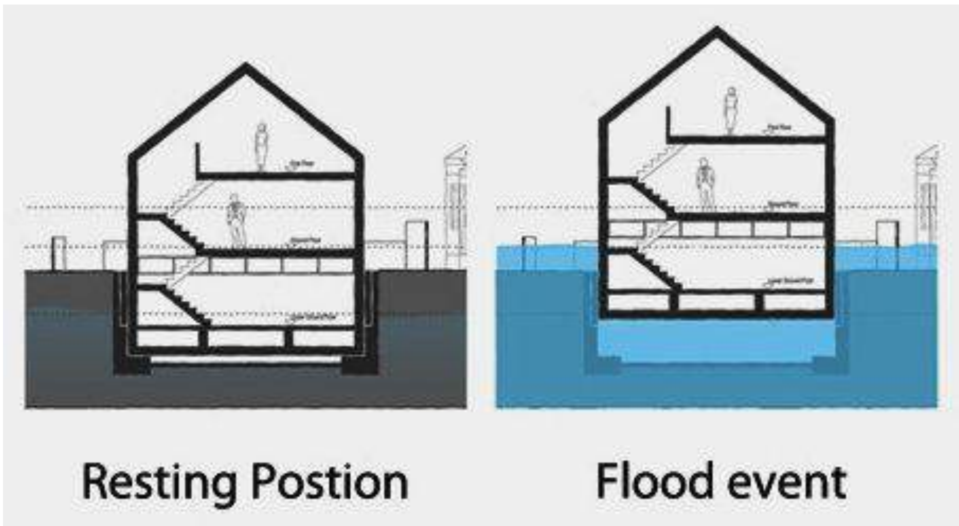


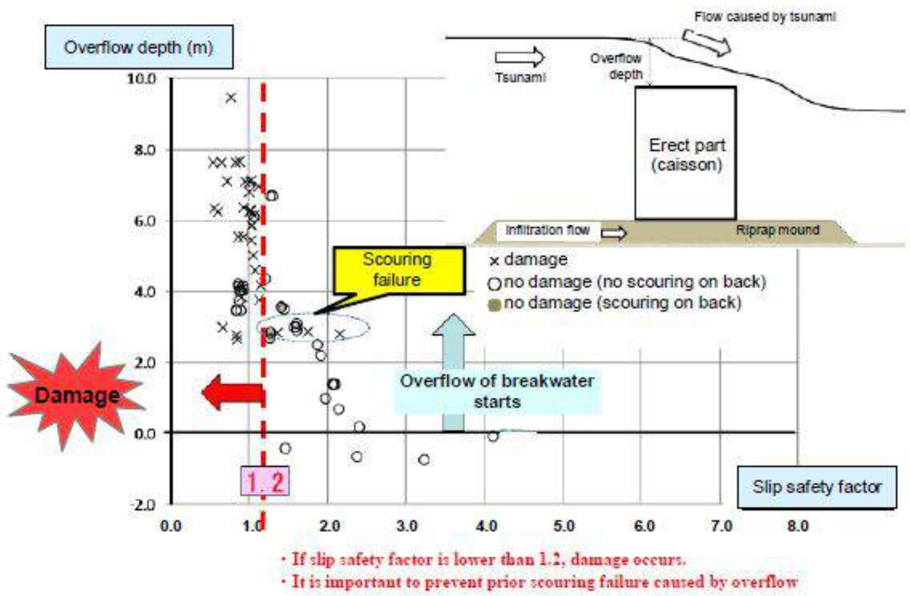
Figure 2.37: Flood Cases
Source: cherrymortgages.com

2.2.4.4 Breakwater for Tsunami Resistance Wall

Past concepts of tsunami-resistant design of port and harbour structures have been revised from their foundations. Two levels of tsunami are hypothesized and based on its concept, the aim is, for tsunamis which occur frequently, to provide disaster protection using structures to do all possible to protect human lives and property, and for the largest class of tsunami, which occur extremely rarely but have catastrophic damage when they do occur, the aim is to minimize damage under the goal of, at the very least, protecting human lives. If a structure has toughness which prevents its overturning even as it is deformed under a tsunami large enough that it exceeds tsunami which occur frequently, it will restrict the quantity of water flowing into the area behind the structure, delaying the arrival of the tsunami behind the structure, and thereby reducing damage. So structures that can provide this toughness are necessary in cases of a tsunami higher than the design tsunami.

The overall stability of a breakwater in the case where the tsunami and the earthquake motion preceding the tsunami act on the breakwater first sets the initial section under actions other than the tsunami or other waves. Next, the section specifications are set based on the wave design for the design tsunami. Finally, for a tsunami with scale greater than that of the design tsunami, the section of the tough structure is set based on an overall judgment made considering the importance of the facility and cost-benefit performance. The structure analysis factor when stability under the design tsunami is verified can be set with reference to a value in Table 1, because

Figure 2.38: Earthquake Analysis
Source: Yogyakarta BMKG



Reference Values of
Structural Analysis Factor

Item verified	Structural analysis factor
Slip of erect part	1.2
Overturning of erect part	1.2
Bearing capacity of foundation	1.0

Table 2.1: References Value
Source: Yogyakarta BMKG

according to the example of damage shown in Figure 1, damage occurs when the slip safety factor is lower than approximately 1.2.

The partial revisions to technology standards and the Tsunami-Resistant Design Guideline for Breakwaters, were prepared based on comprehensive study of survey and research etc. done immediately after the earthquake, but not all of the many challenges have necessarily been clarified. In the future, as new knowledge is obtained, it must be reflected in the Guideline, and we must promote further research and technology development in the field of tsunami-resistant design.

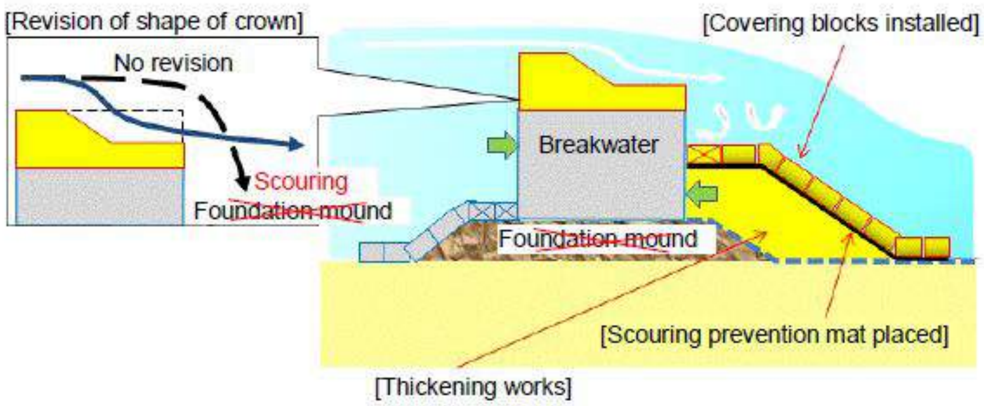


Figure 2.39: Earthquake Analysis
Source: Yogyakarta BMKG

2.2.5 Earthquake Resistance Building System

2.2.5.1 Definition

The project is mainly discussing the building that should withstand the earthquake forces, so based on the literature review of earthquake resistance building, in general, is construct buildings that can withstand earthquakes is not economical. Therefore, the main priority in constructing earthquake-resistant buildings is the creation of a building that can prevent victims as well minimize property loss (Rinaldi et al. 2015). Definition of the resistant building to earthquakes according to Teddy (2009) are:

1. For the light class Earthquake, the building should not be damaged by structural even non-structural.
2. For the mid-class earthquake, the non-structural of the building may be damaged (ceiling, cracked wall), but the structure should not be damaged (column, sloof, beam).
3. For a high-class earthquake, the non-structural and the structural part of the building may be damaged, but the occupants inside the building should get out in time before the building is damaged, so the safety of the occupants is still on priority.

based on the classification above, this project was located in the Kretek district, which means is located on a bit vulnerable level area to the earthquake. This literature review can be used for the capability of the building based on the classification above.

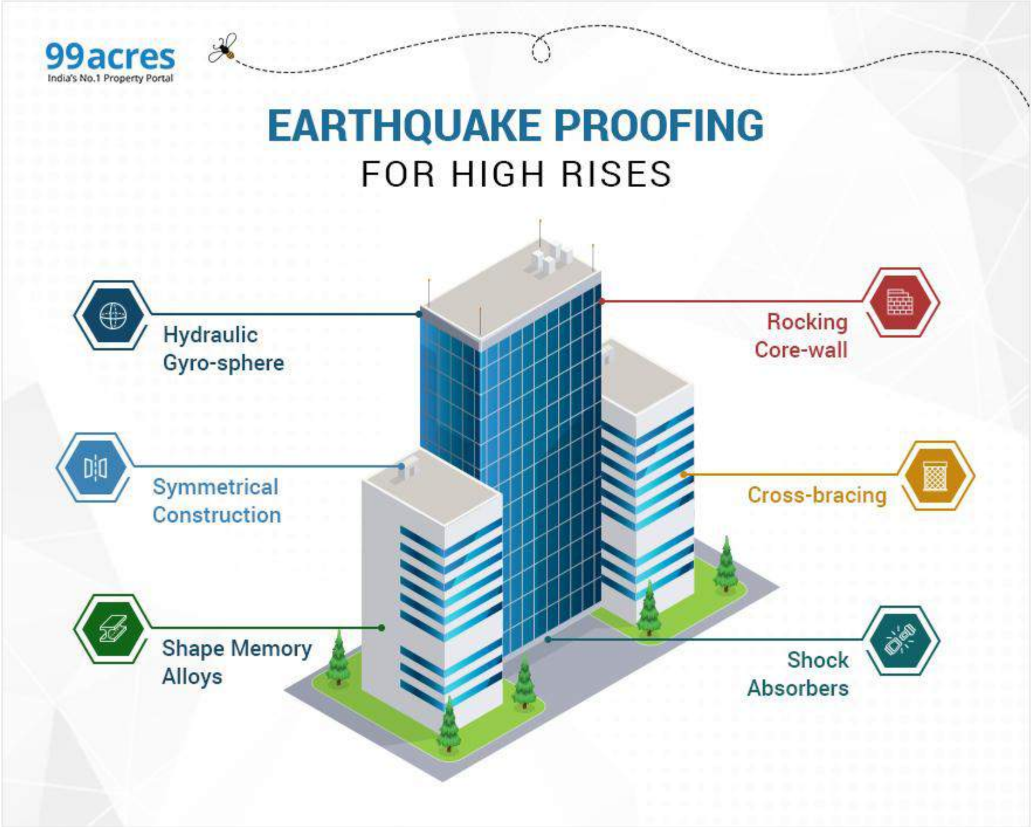


Figure 2.40: Earthquake Proofing
Source: Google

2.2.5.2 SNI Standards

Based from SNI – 1726 - 2002

The building structure can be classified into a regular building structure, if it fulfills the provisions given in the SNI. This regular building structure is generally symmetrical in the plan with the structural system formed by lateral load-bearing subsystems whose directions are perpendicular to each other and parallel to the main orthogonal axes of the plan. If for 3D analysis the coordinate axes are taken parallel to the directions of the main axes of the structure plan, then free vibration analysis is carried out, then in a regular building structure the first variance motion will be dominant in translation in the direction of one of the main axes, while the second variance motion will be dominant in translation. in the direction of the other principal axis. Thus, the 3D structure of a regular building behaves as a 2D structure in each of its principal axis directions. It will be explained later (see A.6.1.1) that the effect of an earthquake on a regular building structure by applying the Variety Analysis method can be considered as if it were an equivalent static earthquake load calculated as the dynamic response of the fundamental variance only.

Testing Performance Scheme:

Performance Table:

Unsur sekunder dan unsur arsitektur	Faktor kinerja unsur P
1. Dinding dan sekat pemisah	
- Dinding yang berbatasan dengan jalan keluar atau tempat umum atau yang disyaratkan memiliki ketahanan tertentu terhadap kebakaran :	4
- Dinding kantilever dan sandaran (parapet) :	4
- Dinding dan sekat pemisah ruangan :	2,5
2. Ornamen, panel beton pracetak dan penutup luar gedung, berikut alat penambatnya :	8
3. Sistem langit-langit yang digantung pada struktur gedung dengan lempengan penutup yang beratnya melampaui 20 N per buah :	3
- di atas ruang penting (ruang bedah di rumah sakit), jalan keluar dan tempat umum atau yang disyaratkan memiliki ketahanan tertentu terhadap kebakaran :	2
- di atas ruang kerja dan penghunian biasa :	
4. Perlengkapan ruang pada jalan keluar atau yang dapat membahayakan jika mengalami pengaruh gempa :	
5. Tangki air bersih dan cerobong yang menyatu dengan gedung dengan berat tidak lebih dari 10% dari berat gedung :	2,5
6. Struktur rumah atap atau ruang mesin pada puncak gedung :	2,5

Instalasi mesin dan listrik	Faktor kinerja unsur P
1. Tangki tekanan tinggi, ketel uap, tungku, pembakar, pemanas air atau alat-alat lain yang memakai sumber energi pembakaran dengan suhu tinggi :	6
2. Tangki cairan atau gas di atas menara untuk :	
- cairan dan gas beracun, alkohol, asam, alkali, logam pijar atau bahan-bahan lain yang berbahaya	6
- sistem penyemprot air kebakaran	6
3. Pengatur roda gigi (switchgear), transformator, gardu listrik, alat kontrol motor listrik.	6
4. Gantungan dan tambatan lampu :	
- tambatan erat	2,5
- tambatan ayunan (bandul)	3,5
5. Sistem pipa distribusi berikut isinya :	
- yang ditambat erat untuk cairan beracun dan berbahaya	6
- yang ditambat erat untuk air bersih	3
- yang ditambat fleksibel untuk cairan beracun dan berbahaya	8
- yang ditambat fleksibel untuk air bersih	5
6. Rak-rak untuk menyimpan batere dan barang-barang berbahaya	4
7. Mesin lift, rel pengarah	3
8. Peralatan siap jalan pada keadaan darurat, yang harus segera berfungsi setelah gempa terjadi :	6

Table 2.2: SNI Table
Source: Yogyakarta BMKG

2.2.5.3 Construction Methods and Material

In the journal of Komala Dewi *et al*, 2019 agrees with this theory. It is explained about the design construction that implied the earthquake building resilience, which also refers to the building that uses these rules as it building construction system. The design of earthquake-resistant buildings has rules that must be met, including;

1) Simple and symmetrical building plan,

2) Regular arrangement of symmetrical arrangement and the plane of the partition walls in the building,

3) Attachment between the wall plane and other walls or the wall-bound to the column,

4) The use of lightweight materials in roof construction,

5) The strength of the roof truss frame rests on the wall or column as a pedestal,

6) The location of the foundation on solid and flat ground,

7) There are binding beams (connecting) between columns or walls,

8) there are beams as stiffeners connected to the field of walls and poles,

9) There is reinforcement at the junction of columns, ring beams, etc.

10) there is a hook between the wall and the pole. These factors are in line with Gutierrez, there are 4 (four) rules in the design of earthquake- resistant buildings, namely:

1) simple and symmetrical in the building plan or shape,

2) The use of lightweight materials,

3) rigid and flexible in the connection system, and

4) unity of structure and construction systems, between the structure of the roof, walls, until the foundation (Triyadi, 2010).

From this literature review, the 10th characteristic and 4 rules in the design of earthquake-resistant buildings could be used as preliminary parameter analysis, before being processed into development.

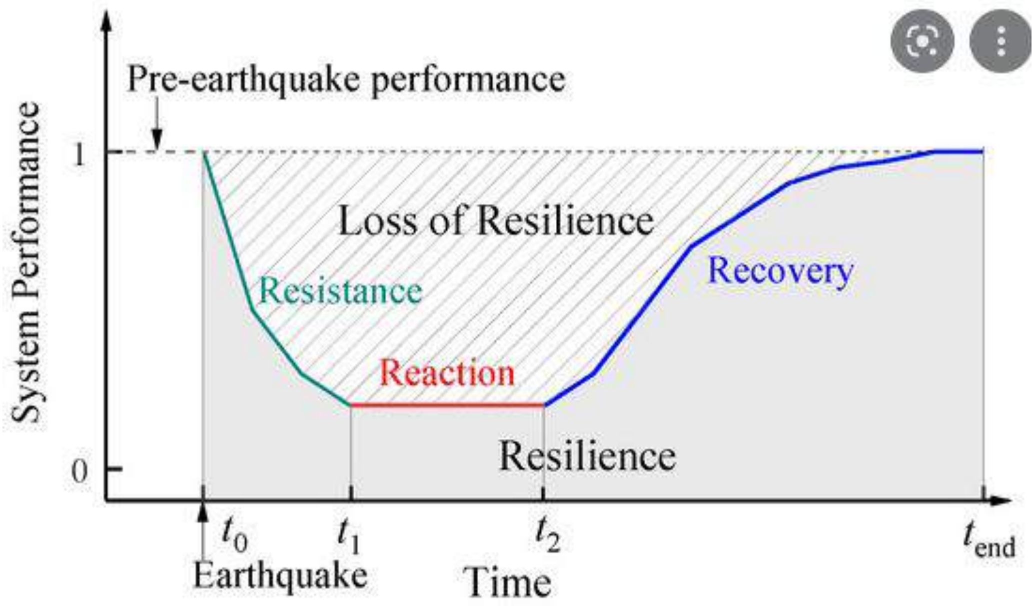


Figure 2.41: Earthquake Performance
Source: Yogyakarta BMKG

2.2.6 Design Guidelines

Based on what have been learned, some of the conclusions that can be pulled are:

1. Integral Action of soil-foundation-Superstructure system.
2. The building should be light in weight and avoid unnecessary masses.
3. The structure should not have a large height/width ratio.
4. Columns and walls should be continuous without offsets from the roof to the foundation.
5. Beam and column should be of equal width.
6. The structure should be Ductile as far as possible.
7. The structure should have a uniform floor height.
8. The structure should be designed on the Strong column Weak beam concept.
9. The load should be uniformly distributed.
10. Columns and beams should be co-axial.
11. The structure should have balanced lateral resistance.
12. Shear walls should be provided for increased stiffness.
13. The structure should have a low center of mass relative to the ground.
14. Avoid ground floor soft storey.
15. There should be a uniform distribution of mass, stiffness, and strength.
16. The structure should not be large in length nor should they have a large plan area.

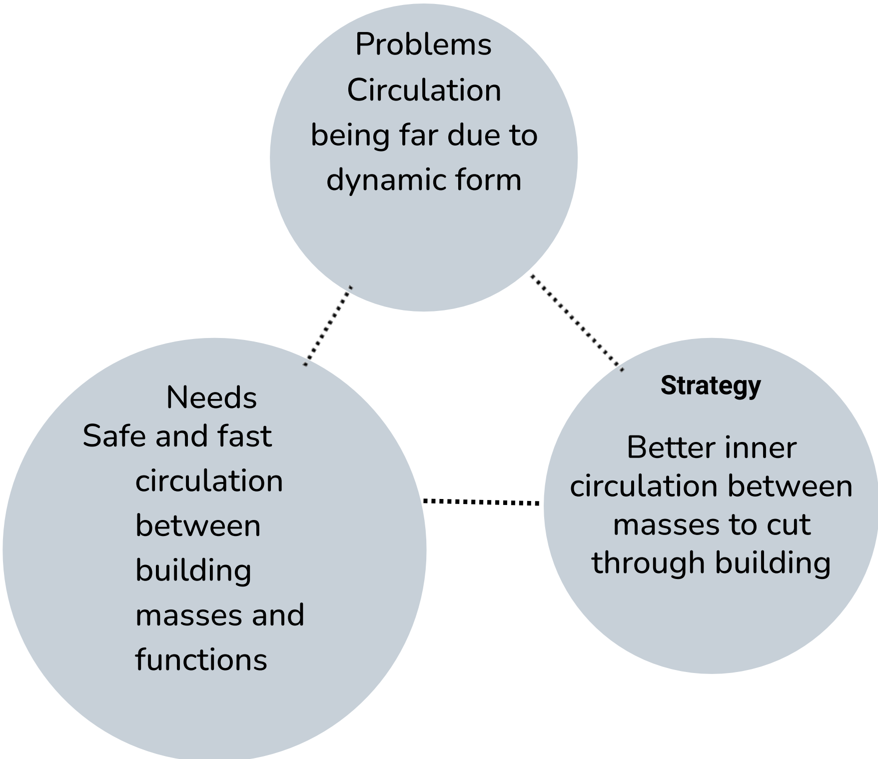
2.3 PRECEDENT REVIEWS

2.3.1 Kuta Beachwalk

Kuta beachwalk is one of the trademark of Bali. It has fluid form and circulation while still having great placement of functions. This building can be taken as an example in circulation design and space programming regarding user needs. The function may differs but the concept of mobility and direct access can be learned.

Figure 2.42: Kuta Beachwalk
Source: Google Maps

Lesson Learned:



2.3.2 Disaster Oasis Training Center

Disaster Oasis is one of the good examples that implementing the disaster mitigation consideration with the function of the building. This building serves as a shelter for people at the foot of Mount Merapi from disaster. So this building has a function as a residential and can become a shelter during Mount Merapi on eruption. From this, it can be learned that the integration between space and structural systems can work well in facing a disaster. Furthermore, this integration should be implemented in this project.

Lesson Learned:

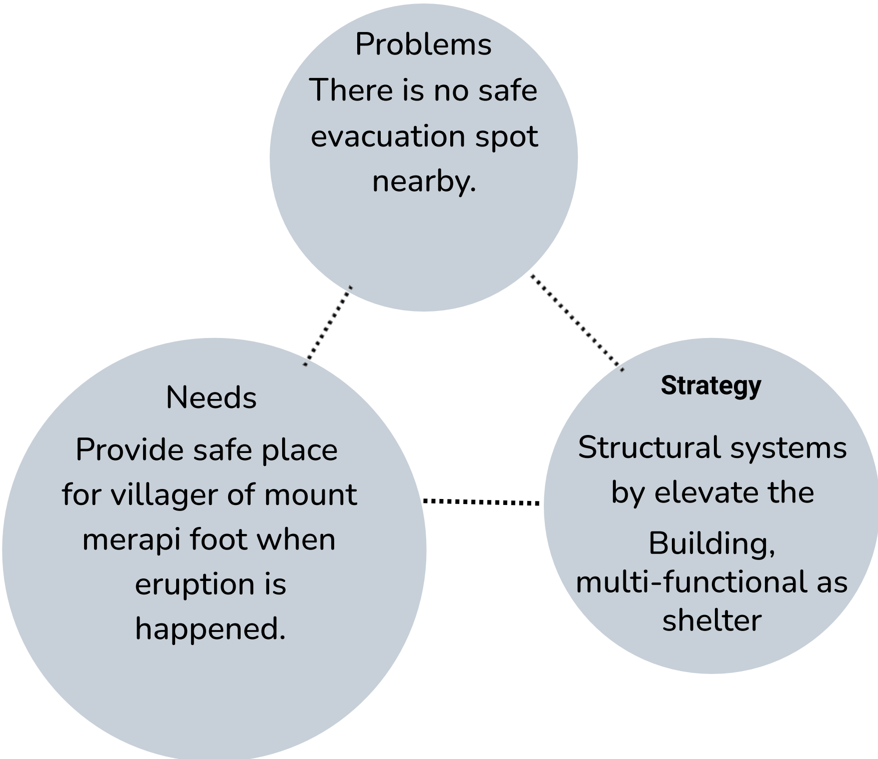


Figure 2.43: Disaster Oasis
Source: Google Maps

2.3.3 Tsunami House

This is a Tsunami house located in the united states. This house has functioned as residential. This house was made with the capability to withstand the tsunami waves forces. So these houses were integrated with tsunami-resistant structural systems, such as material that could breakaway the waves forces, and also spatial systems that utilized the 1st-floor area as a “flood room” and multipurpose room. It can be learned that the structural systems are also affected by the materials, and spatial systems could adapt to disasters.

Lesson Learned:

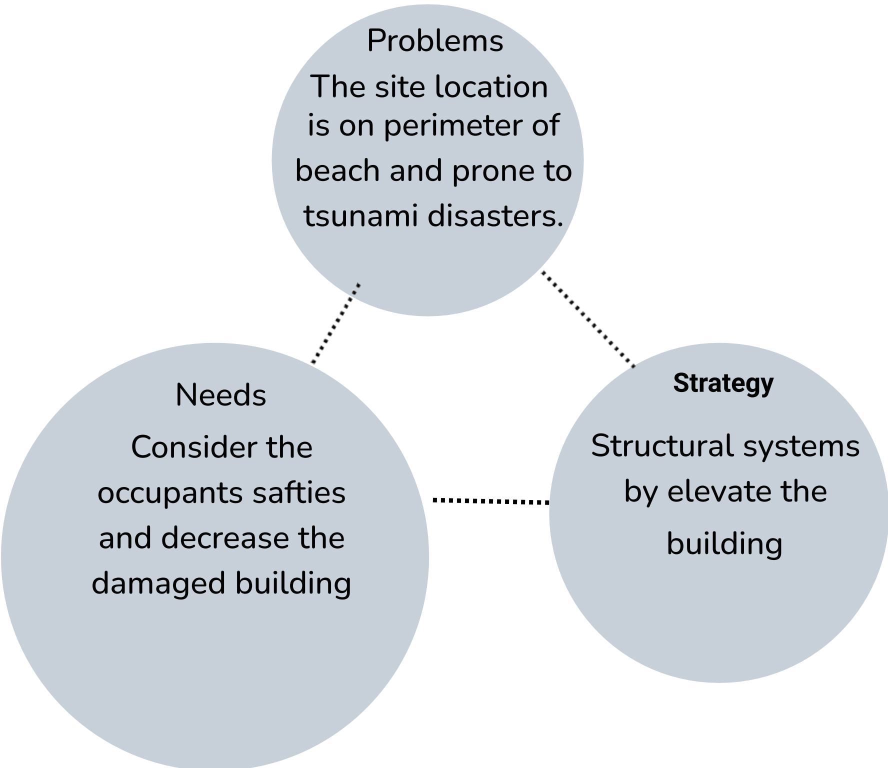


Figure 2.44: Tsunami House
Source: ArchDaily

Figure 2.45: Building Section
Source: ArchDaily

2.4 BUILDING CODES

REGIONAL REGULATION OF THE CITY OF YOGYAKARTA NUMBER 8 OF 2021 CONCERNING BUILDINGS

Paragraph (5)

Letter a

What is meant by "Buildings in dense locations" are Buildings in locations generally located in trade areas/city centers and/or areas with KDB of more than 60% (sixty percent).

Letter b

What is meant by "Buildings in medium locations" are Buildings in locations generally located in residential areas and/or areas with an KDB of between 40% (forty percent) to 60% (sixty percent).

Letter c

What is meant by "Buildings in tenuous locations" are Buildings in locations generally located in outskirt areas of the city or areas that function as water catchments and/or areas with an KDB of 40% (forty percent) or below.

Paragraph (6)

Letter a

What is meant by "high-rise buildings" are buildings with more than 8 (eight) floors. - 39 -

Letter b

What is meant by "medium-rise buildings" are buildings with a total of 5 (five) to 8 (eight) floors.

Letter c

What is meant by "low-rise buildings" are buildings with a number of floors up to 4 (four) floors.

Chapter 3.
DESIGN CONCEPT

Contents

3.1 EXISTING DESIGN

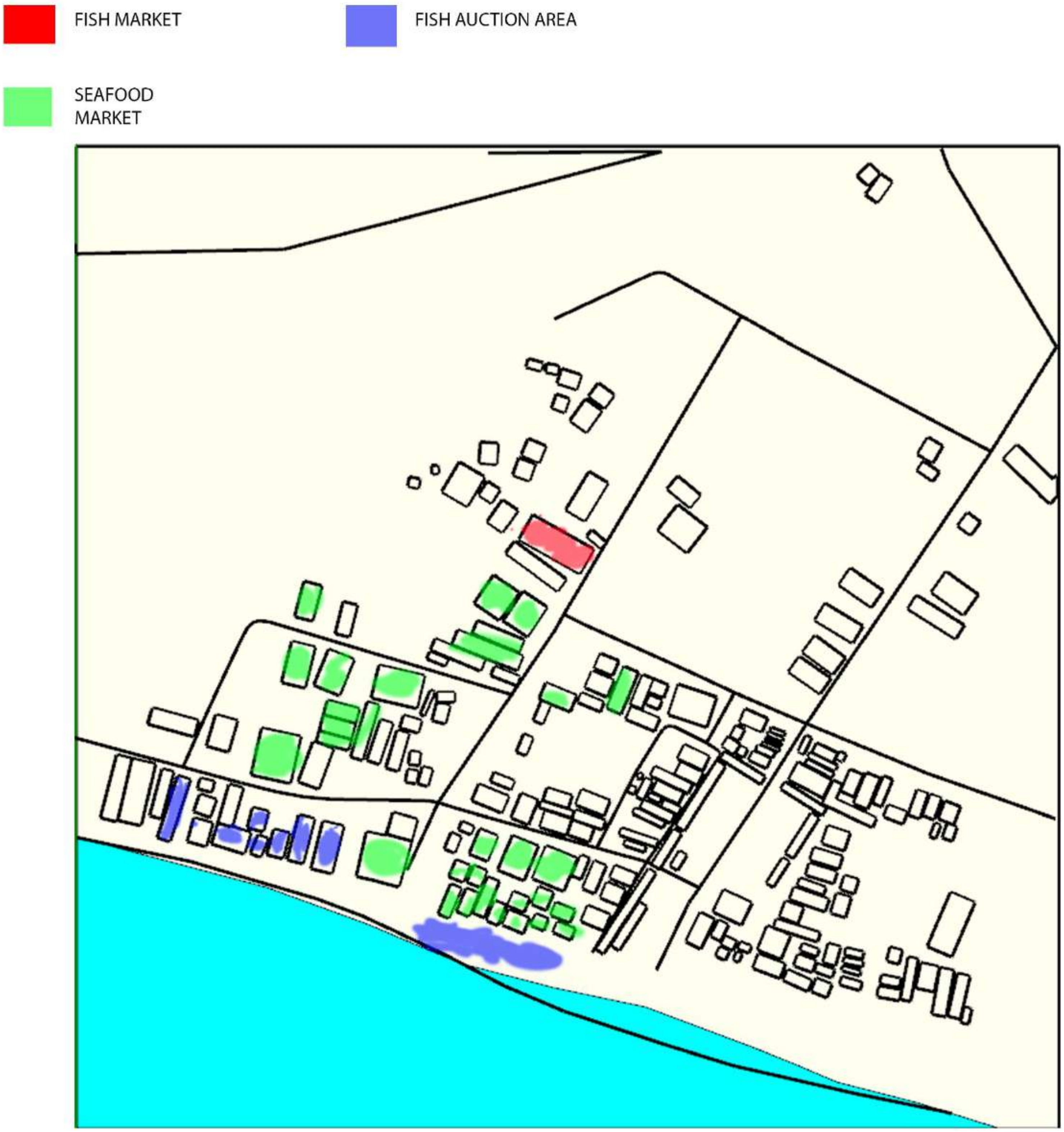


Figure 3.1: Existing Mapping
Source: Author

This is the existing mapping of fish market, fish auction area, and seafood restaurant. The new design will consider the existing location and try to replicate the soul of the space design whilst making sure the tsunami waterway is efficiently integrated.

3.1.1 Situation and Siteplan

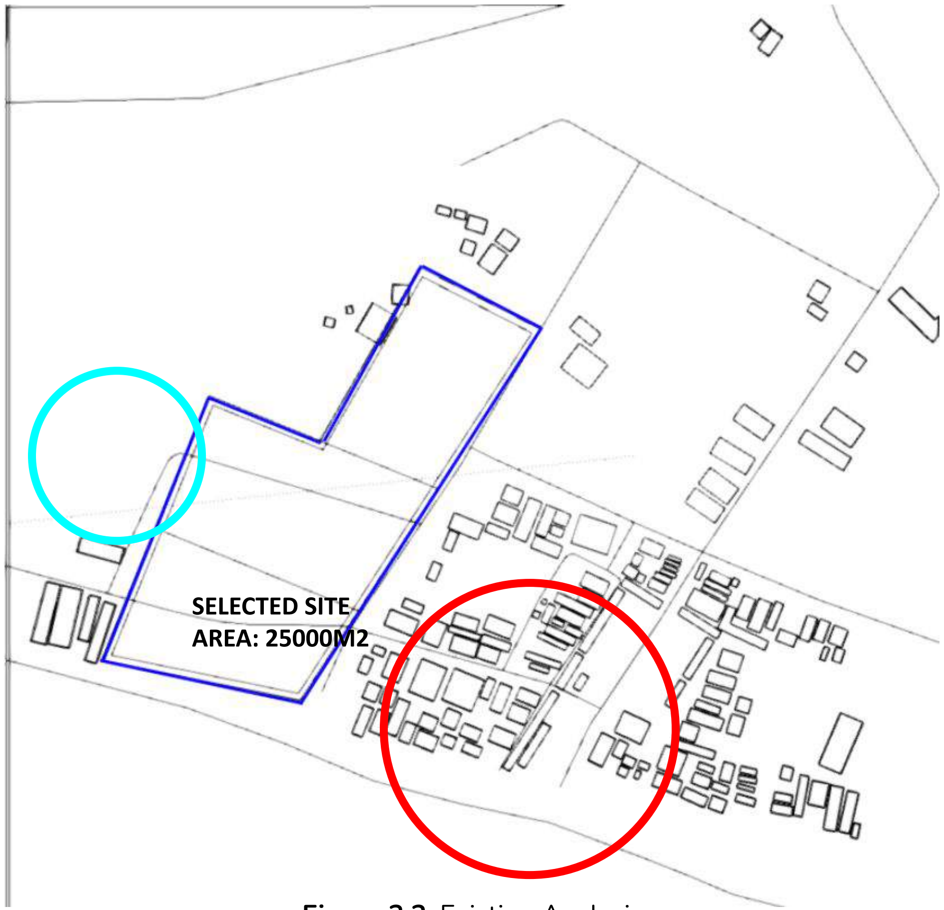


Figure 3.2: Existing Analysis
Source: Author

The selected site are located on X7QR+6V8, Pantai Parangtritis, Kretek, Bantul Regency, Special Region of Yogyakarta 55772. The surroundings of this area mostly commercial place such as seafood restaurant and housing of the locals. The area didn't have many vegetation, but the area also have high wind velocity from the south.

From the site analysis, on the east side of the site have high density because of small buildings. Whereas on the west side are mostly filed by remote land. The site also have distance around 10 meters from the sea. Based on the data that have been found, the site will not be severe to much by the tsunami, because the tsunami height on this area are estimated to 3 meters height.

So there are several advantage and disadvantage that exist on the site:

(+) The site area have wide open area, easy access for evacuate

(+) The site near the sea and also commercial area.

(-) The land of the site mostly are sand

(-) The site have less vegetation, high wind velocity

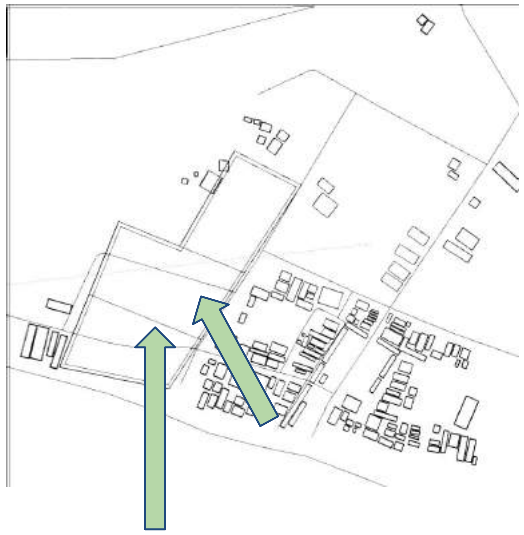


Figure 3.3: Existing Analysis
Source: Author

So there are several advantage and disadvantage that exist on the site:

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(+) The site near the sea and also commercial area.

(-) The land of the site mostly are sand

(-) The site have less vegetation, high wind velocity

3.1.2 Fish Market Typology

Matrix Indicator								
Variables	Indicator	Siteplan& Neighborhood	Building Systems	Building Infrastructure	Building Material	Spatial Planning	Building Envelope	Building Structure
Fishmarket	Accessibility	o				o		
	Earthquake Safety		o	o	o	o	o	o
	Tsunami Safety		o	o	o	o	o	o
	Sustainability	o		o	o	o		
Seafood Restaurant	Accessibility	o	o			o		
	Earthquake Safety		o	o	o	o	o	o
	Tsunami Safety		o	o	o	o	o	o
	Sustainability	o	o	o	o			

Table 3.1: Matrix Indicator
Source: Author

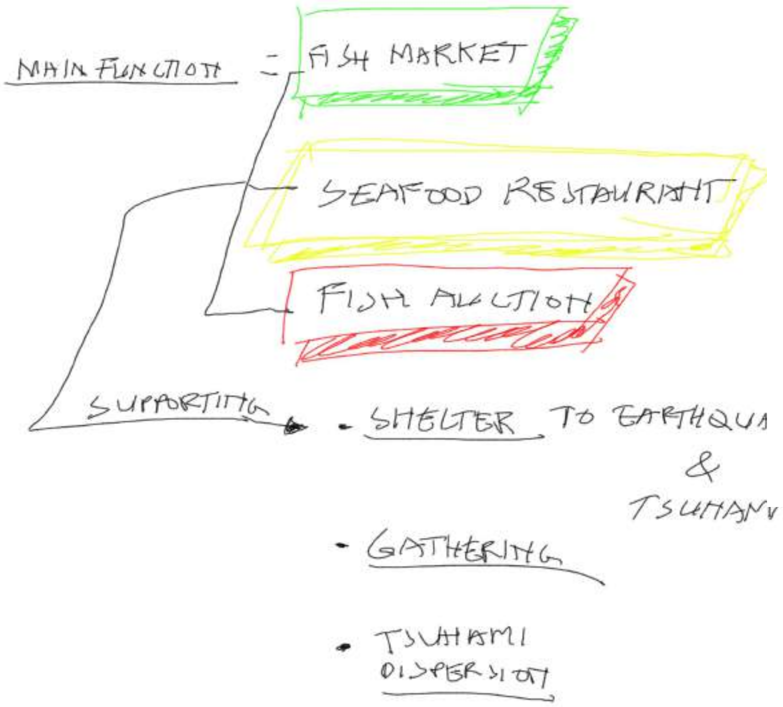


Figure 3.4: Main Functions
Source: Author

Main functions that are being designed are Fish Market, Seafood Restaurant, and Fish Auction. While the supporting functions are shelter for earthquake and tsunami, gathering spaces for social activities, and tsunami dispersion waterway to remove water from the site.

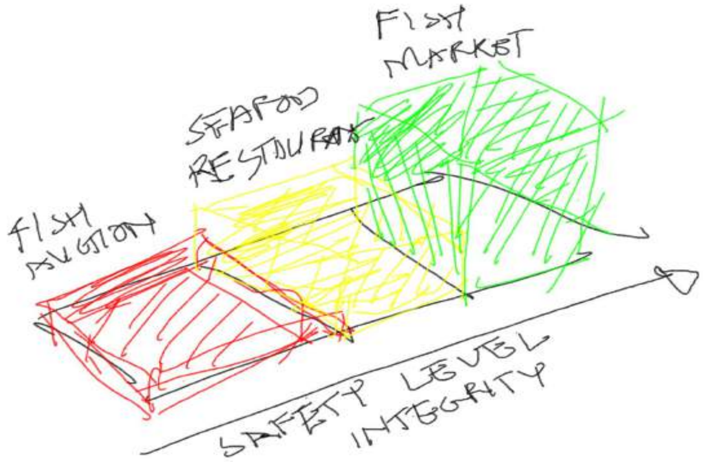


Figure 3.5: Safety Level
Source: Author

These are the level of safety integrity in the site. Fish auction is the first entry as it marks the first function used by the fisher man, then the fish will be transported either to seafood restaurant or fish market.

3.1.3 Space Programming

NO.	NAMA RUANG	ZONASI	UKURAN RUANG		KAPASITAS	LUAS	TOT. LUAS M
1.	Ruang kepala	privat	4	3	1	12	12,0
2.	Ruang sekertaris	privat	3	2	1	6	6,0
3.	Ruang pengurus	semi publik	1,4	1,5	6	2,1	12,6
4.	Ruang rapat	privat	0,8	1,5	8	1,2	9,6
5.	Ruang tamu	semi publik	4	3	1	12	12,0
6.	Ruang pentimpanan	private	3,6	3	1	10,8	10,8
7.	Ruang informasi	publik	4	4	1	16	16,0
8.	Ruang pemasaran	semi publik	1,4	1,5	2	2,1	4,2
9.	Pantry	semi publik	2,1	1,5	1	3,15	3,2
10.	Toilet	semi publik	3,15	1,8	2	5,67	11,3
11.	Janitor	semi publik	2	3	2	6	12,0
12.	Ruang cleaning serv.	semi publik	1	1	6	1	6,0
							115,7
13.	Area penjualan kering	publik	3	3	23	9	207,0
14.	area penjualan basah	publik	2,3	2,5	69	5,75	396,8
15.	ruang pendingin	semi publik	11	8		88	88,0
16.	area bongkar muatan	publik	2	2	20	4	80,0
17.	toilet publik	publik	3,15	1,7	4	5,355	21,4
18.	toilet difabel	publik	1,6	2,3	1	3,68	3,7
19.	janitor	semi publik	2	3	1	6	6,0
20.	kamar mandi publik	publik	1,65	1,2	4	1,98	7,9
21.	ruang istirahat/ santai	publik	1,7	1,7	10	2,89	28,9
22.	musholah	publik	7,7	6	29	46,2	46,2
23.	ruang wudhu	publik	1	0,8	6	0,8	4,8
24.	TPS sementara	publik	3,5	4,5		15,75	15,8
							906,4
25.	transfomator	private	5,5	3,5	1	19,25	19,3
26.	Ruang MDP	private	6	3	1	18	18,0
27.	Ruang SDP	prvate	2	2	2	4	8,0
28.	Ruang pompa	private	6	6	1	36	36,0
29.	Water tank	private	4	3	1	12	12,0
30.	upper water tank	private	2,5	2,5	1	6,25	6,3
31.	IPAL	private	3	2,5	1	7,5	7,5
32.	Shaft plumbing	private	0,6	0,8	1	0,48	0,5
33.	Ruang Panel SDP lt.2	private	2,5	2	1	5	5,0
34.	Ruang genset	private	3	4	1	12	12,0
35.	ruang keamanan	private	3,6	3,6	1	12,96	13,0
36.	ruang ME	private	3	3	1	9	9,0
37.	gudang barang	private	7,5	4	1	30	30,0
							176,4
38.	parkir mobil	publik	2,5	5	22	12,5	275,0
39.	parkir motor	publik	1	2	88	2	176,0
							451,0

Table 3.2: Space Programming
Source: Author

3.2. PROPOSED DESIGN CONCEPTS

3.2.1 Massing Area Safety for Tsunami

This is the proposed massing, each zone has different usage based on the level of safetiness that can be explored. The different zones will also have different ways of both earthquake and tsunami mitigation.

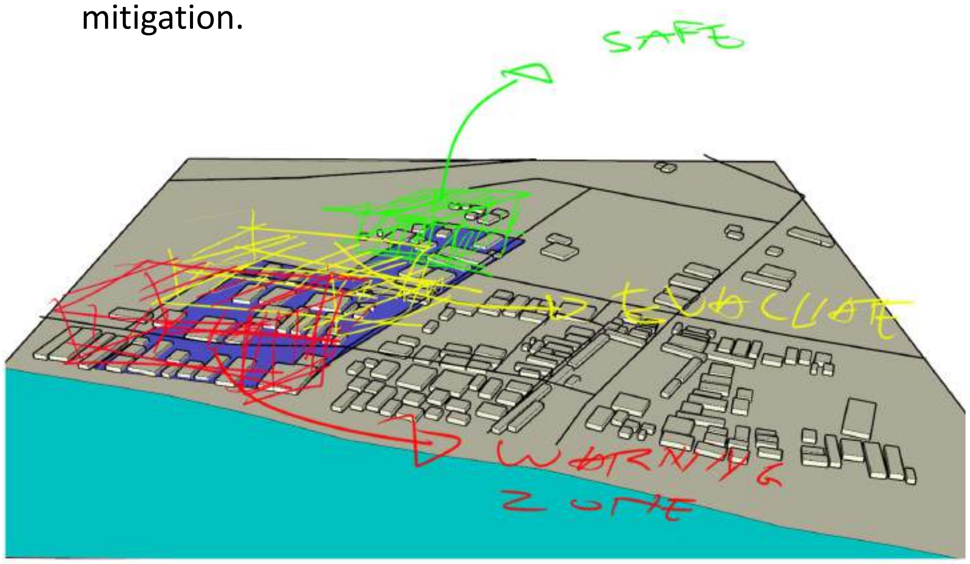


Figure 3.6: Site Zoning
Source: Author

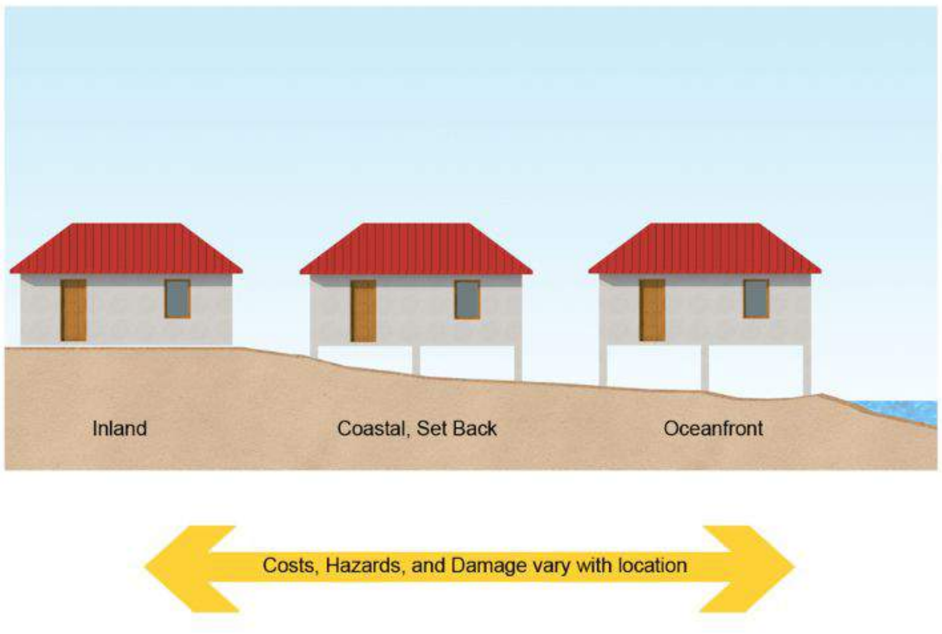


Figure 3.7: Coastal Area
Source: andhitapradipta.github.io

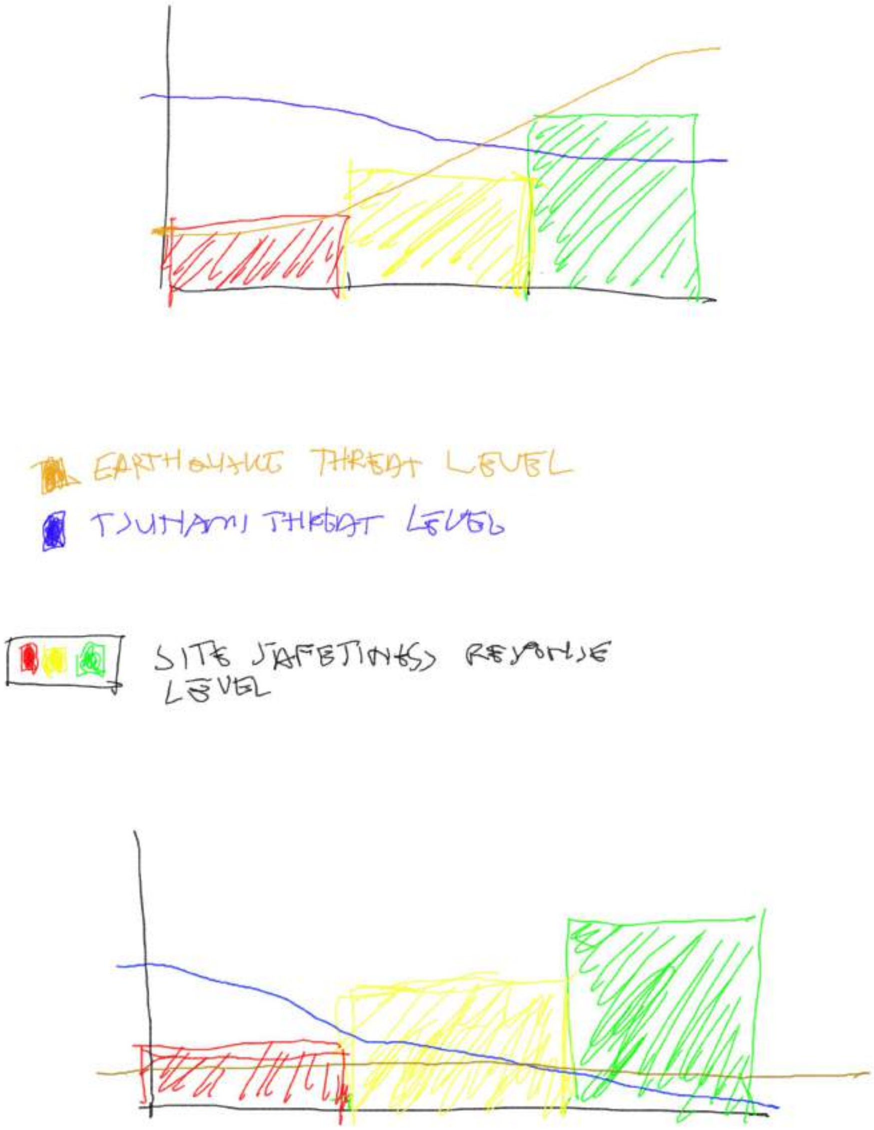


Figure 3.8 and 3.9: Safety Level
Source: Author

This is the projected correlation between tsunami and earthquake threat level to site safetiness response level. Each function is made sure to be safe from both of the tsunami and earthquake, hence the difference in height of the scale.

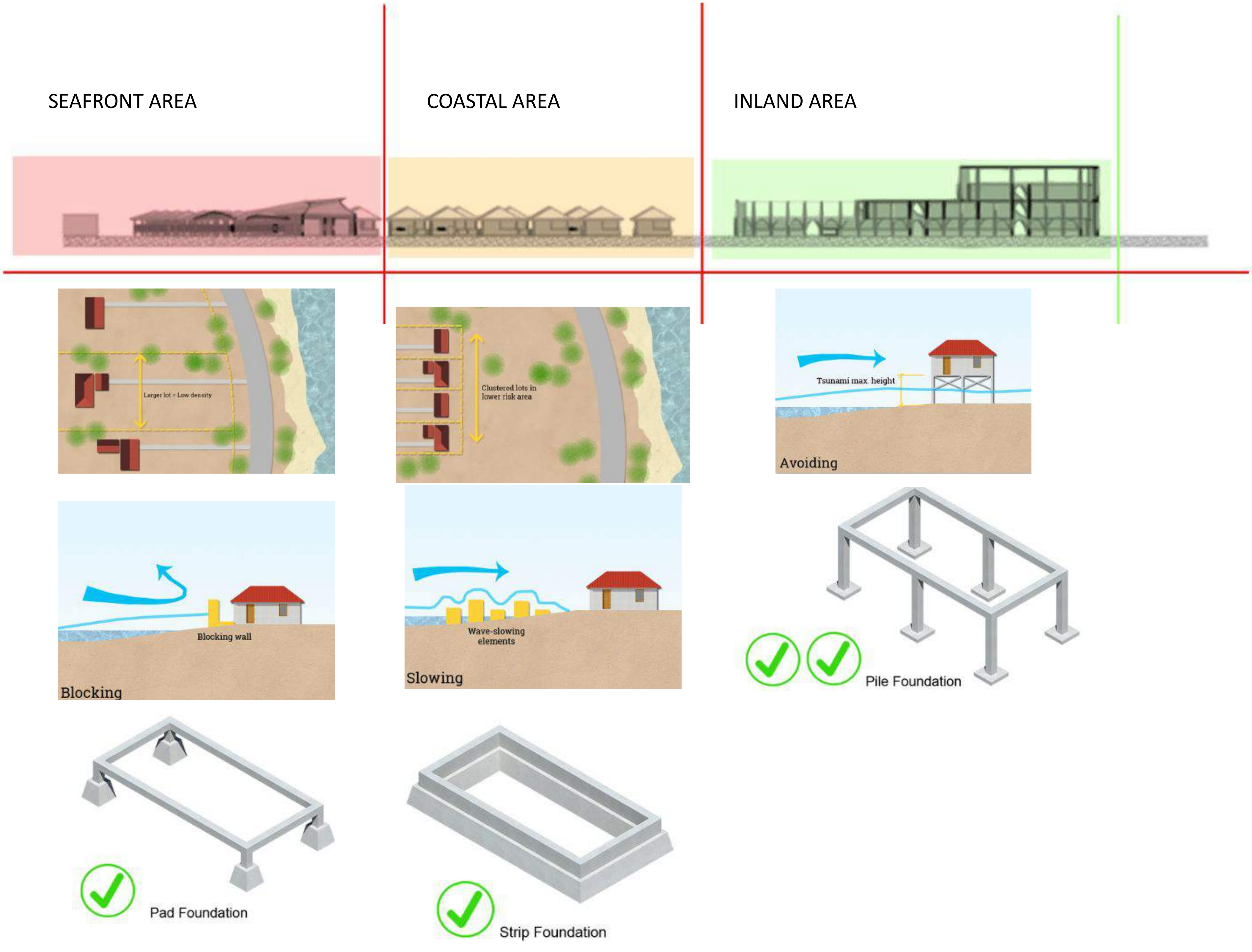


Table 3.3: Zoning Classification
Source: Author

3.2.2 Seafront Area Safety for Tsunami

This is the new fish auction area concept, as it will be the first area to be hit by tsunami (due to shore location). The need of tsunami break-design is needed to ensure other zones are safe and to be able to utilize tsunami waterway.

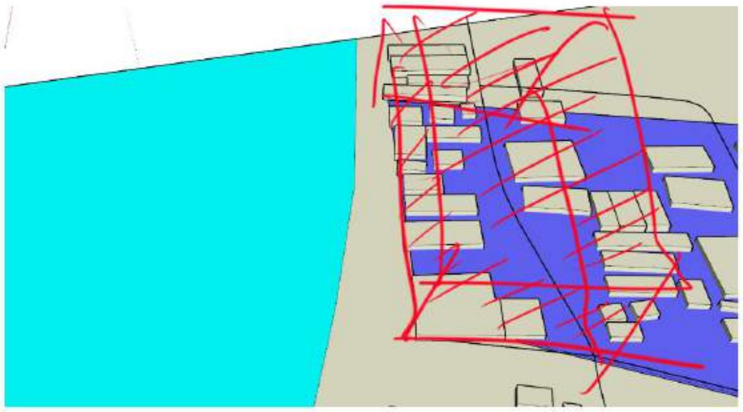


Figure 3.10: Seafront Area
Source: Author

Figure 3.11: Tsunami Case
Source: Author

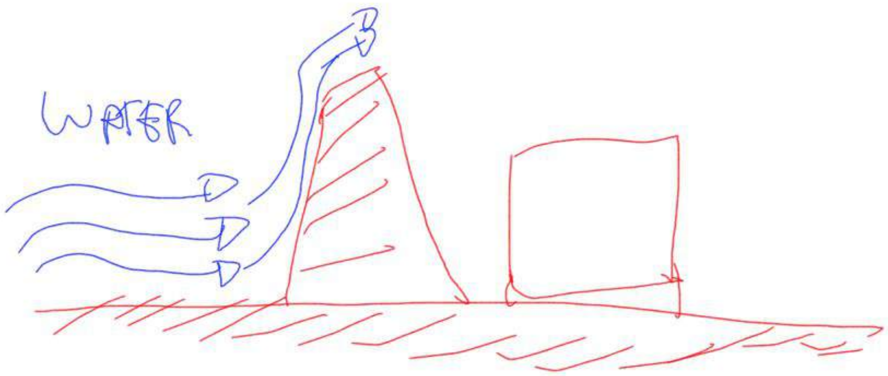
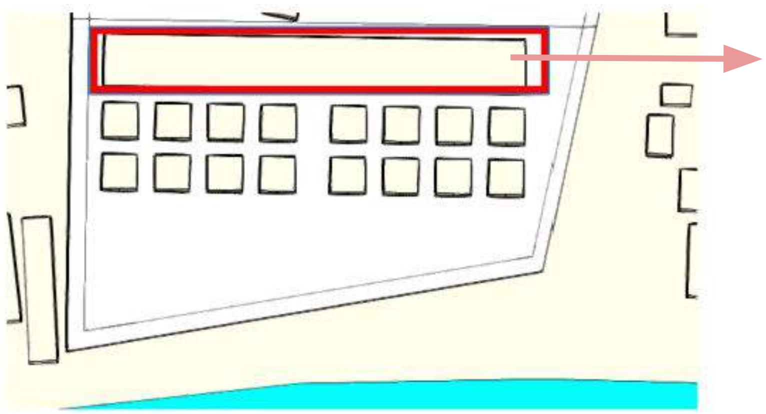
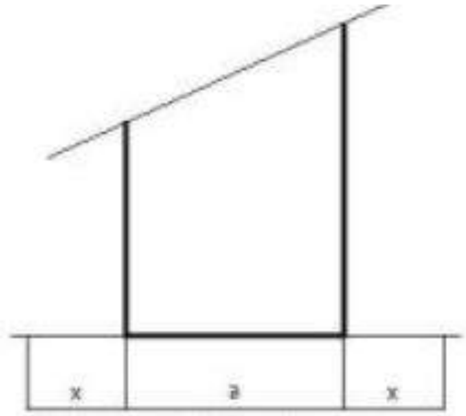
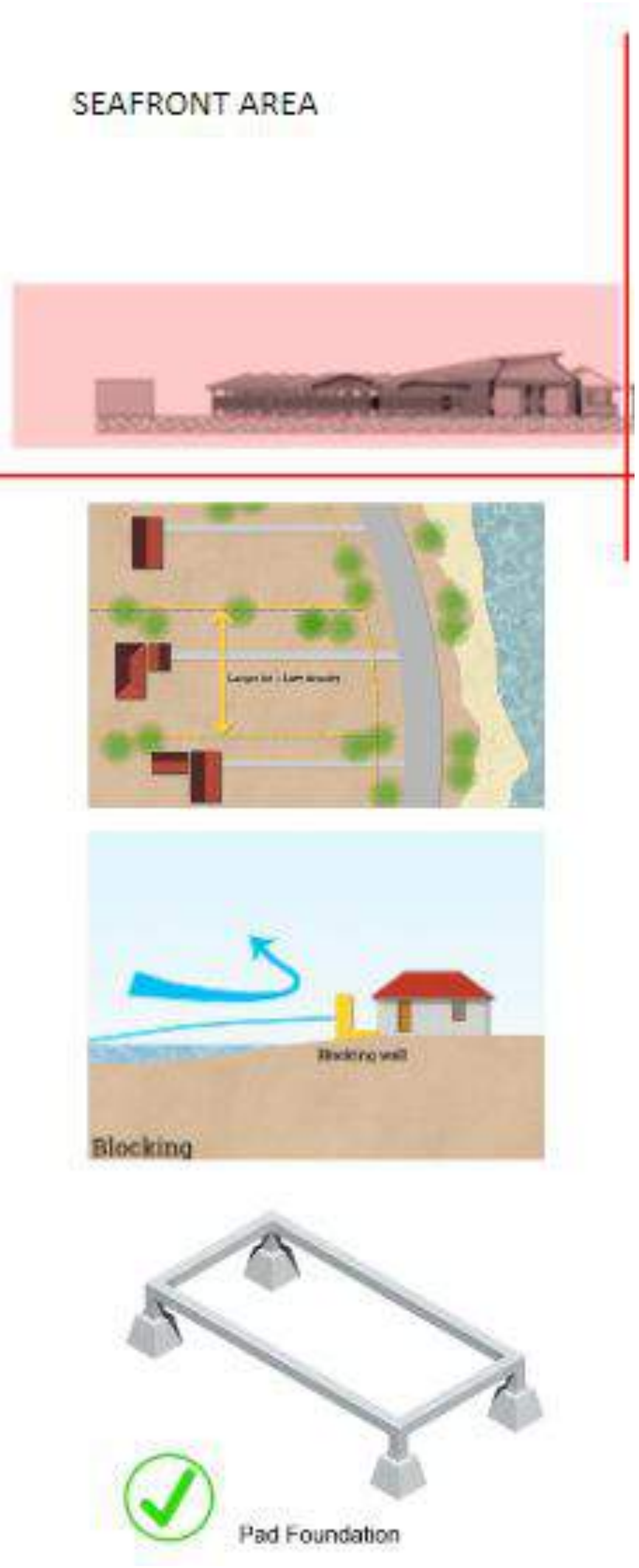


Figure 3.12: Elevated Sea Wall
Source: Author







Because the seafront area became the first one that face tsunami, the area made for less activity. The low density building designed to prevent significant damage from the tsunami.

To reduce the flow of tsunami to the coastal area, there will be implemented high wall on the seafront area. The fish auction building designed as high wall.

On seafront area, the foundation for the building, instead of using pile foundation, it will be using pad foundation, because its good to hold tsunami force, but it can hold the flow of the tsunami on the ground.

Table 3.4: Seafront Classification
Source: Author

3.2.3 Coastal Area Safety for Tsunami

This is the new seafood restaurant concept, as it is in the center of the site, the spread and the proportion of each mass is important for efficient circulation and to minimize damage from tsunami or earthquake if to happen.

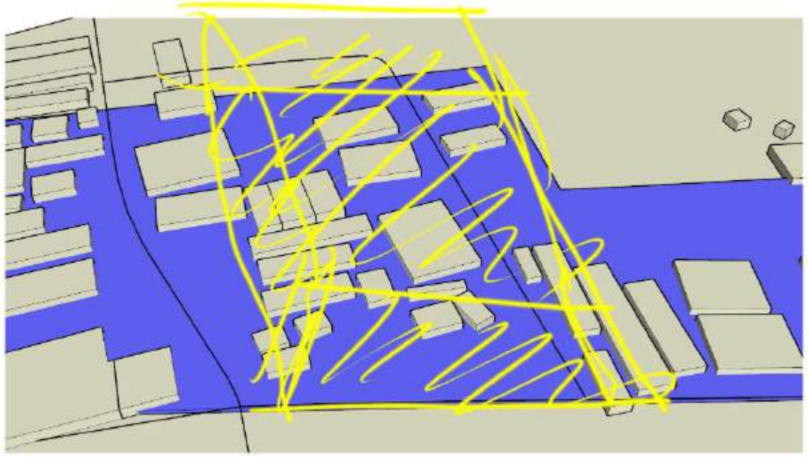


Figure 3.13: Coastal Area
Source: Author

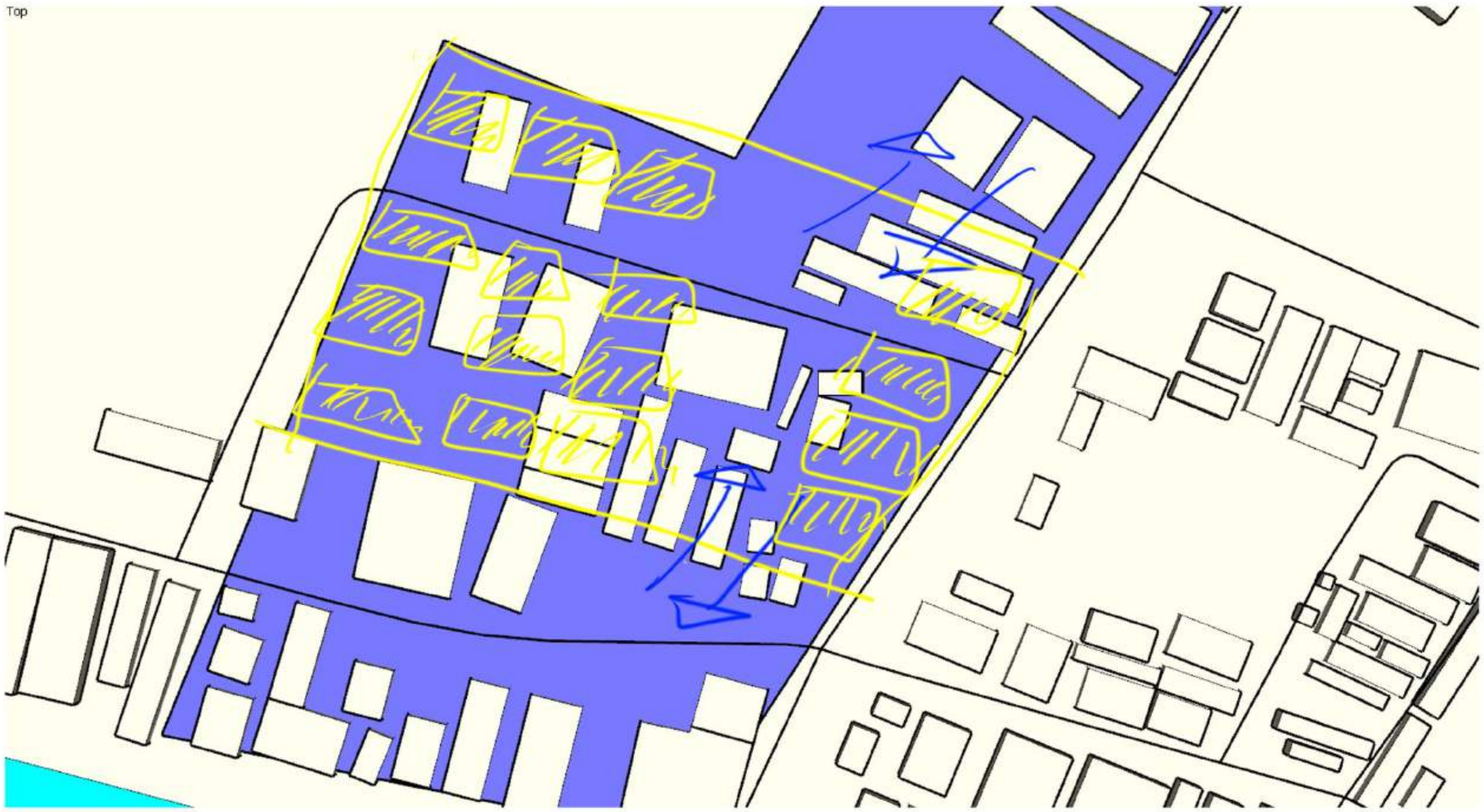


Figure 3.14: Coastal Area
Source: Author

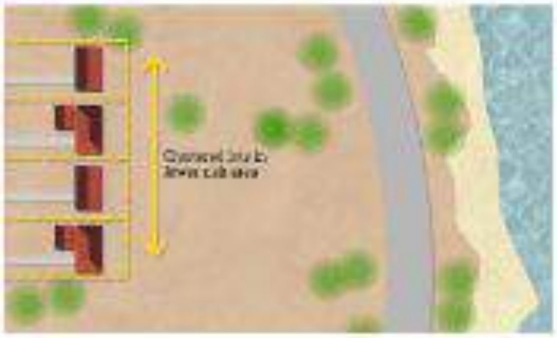
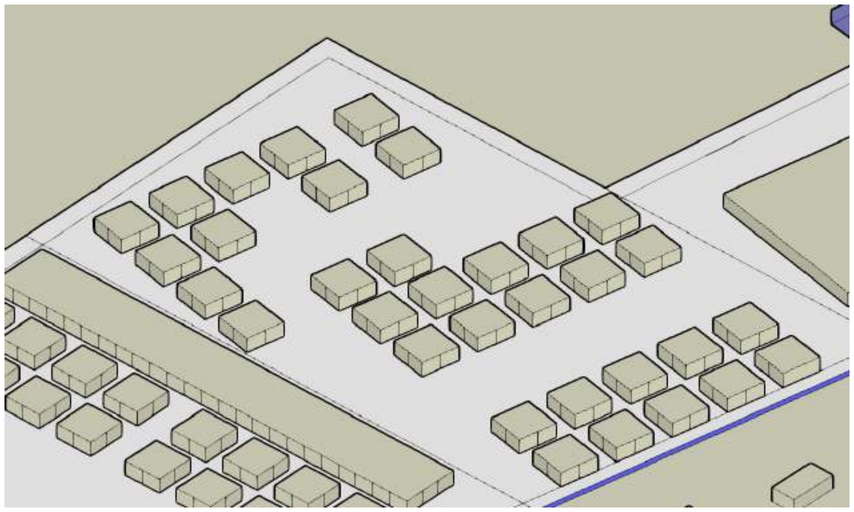


Table 3.5: Coastal Classification
Source: Author



The configuration of the building on the coastal area will be more dense. Clustered building on this area will be as prevention on tsunami to slowing it down into inland area.

Beside to slowing down the tsunami, this cluster configuration was made to move the tsunami flows to the outside of main area, so there will be minimum impact on inland area.

The strip foundation will be used in this coastal area, this foundation also good to held tsunami forces, also this makes the wave of tsunami dispersed and slowing down.

3.2.4 Inland Area Safety for Tsunami

This is the new fish market area. As it is located in the most safe zone of the site, it is safe to be constructed in 2 story height. Some of other existing features will also be moved inside as the new function will be projected as the main building of the whole site.

Figure 3.15: Inland Area
Source: Author

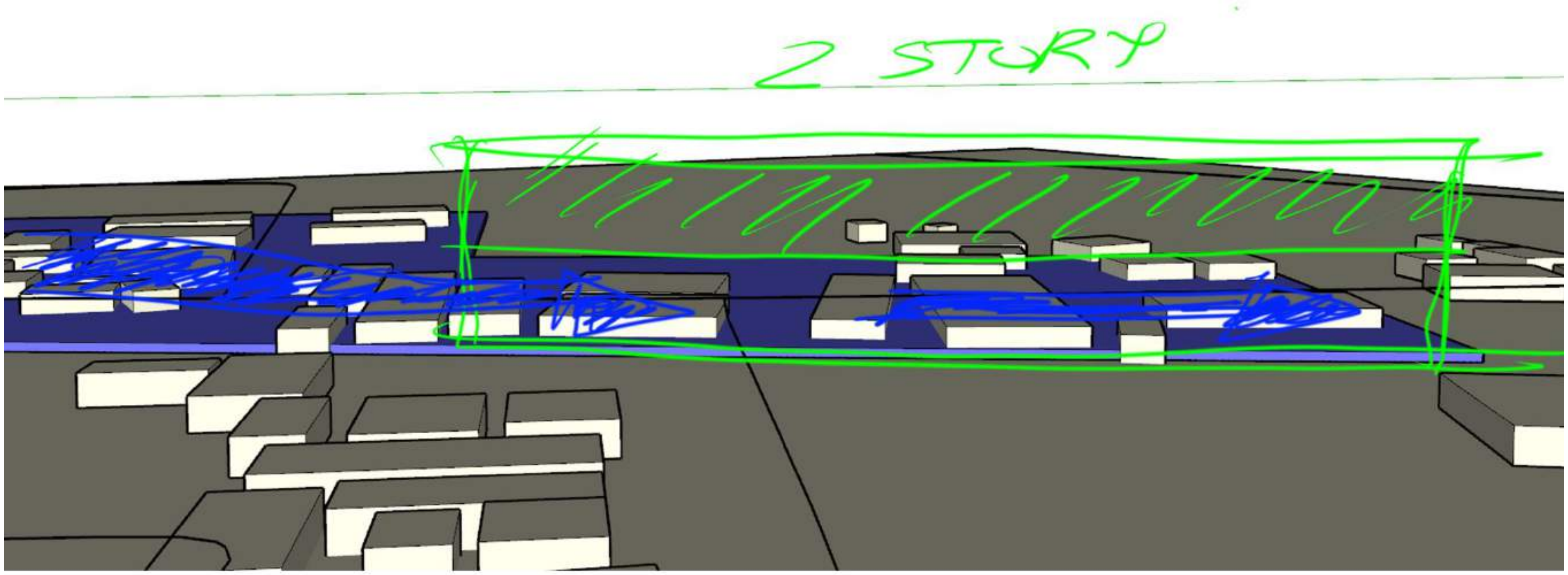
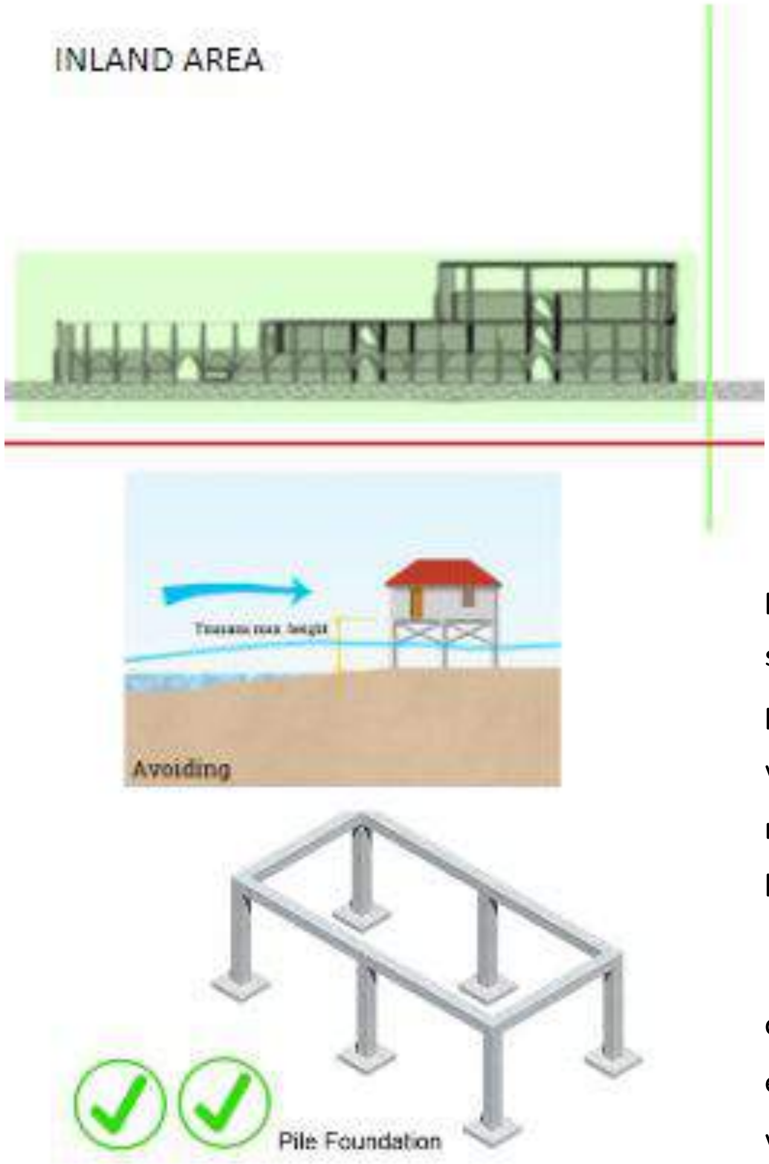
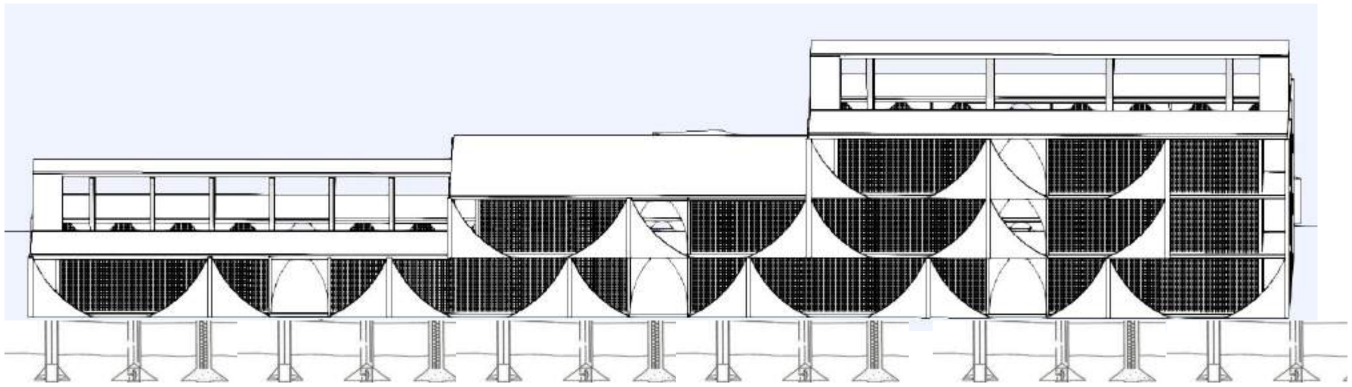


Figure 3.16: Inland Area
Source: Author





The inland area was provide to be a final place as shelter, so after several process of protection from tsunami, this area was elevated in order to let the remaining wave get through the building.

The pile foundation used in order to elevate the building. This elevated building will makes the wave let through the building, and makes the upper level of the building safe from the wave.

Table 3.6: Inland Classification
Source: Author

3.2.5 Fish Market Tsunami Building System

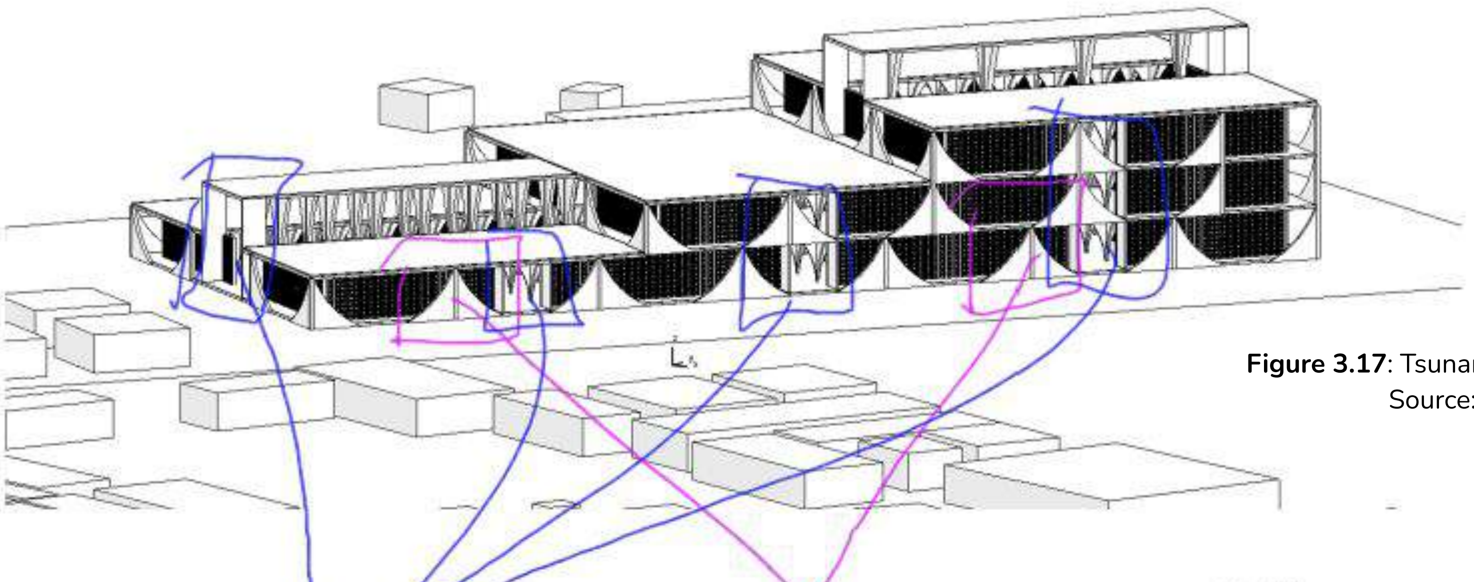


Figure 3.17: Tsunami Implementation
Source: Author

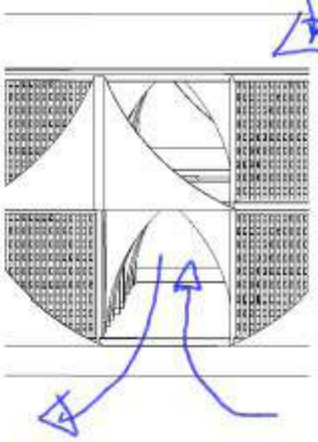


Figure 3.18: Facade
Source: Author

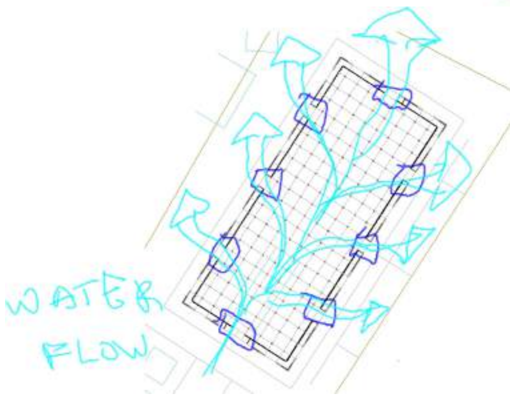


Figure 3.19: Inland Area
Source: Author

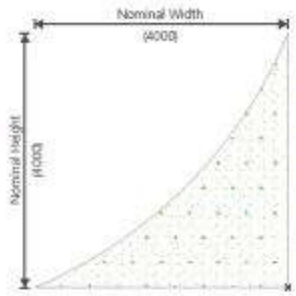


Figure 3.20: Facade
Source: Author

Quarter circle column as a wave like building system that can hold the water coming into the building. And this column also can be functioned as building bracing.

There will be acces on every side of the building to make an ease of user to evacuate into the building or exit the building. And this opening also functional for water flow circulation when tsunami occurred.

Figure 3.21: Water Dispersion
Source: Author

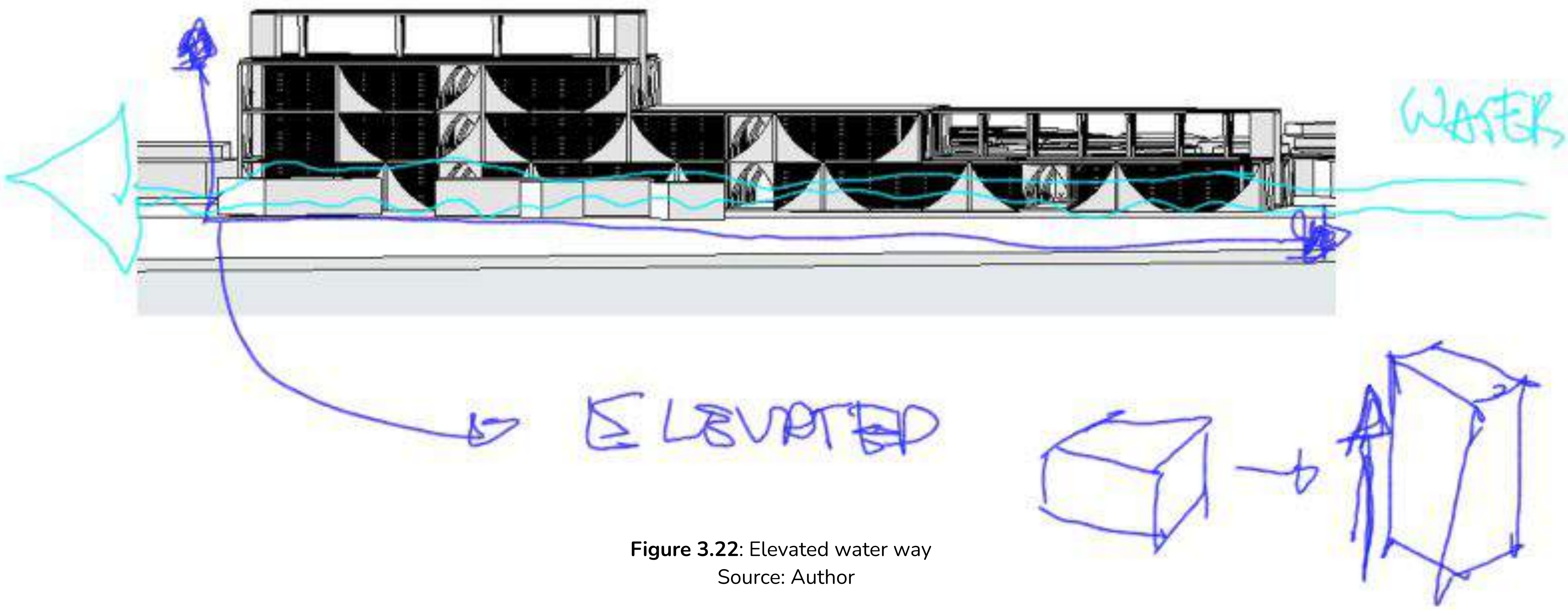


Figure 3.22: Elevated water way
Source: Author

The fish market building are elevated in order to response the water flow effect from tsunami. Because the building is elevated, the upper level building supposed to be the shelter from tsunami disaster.

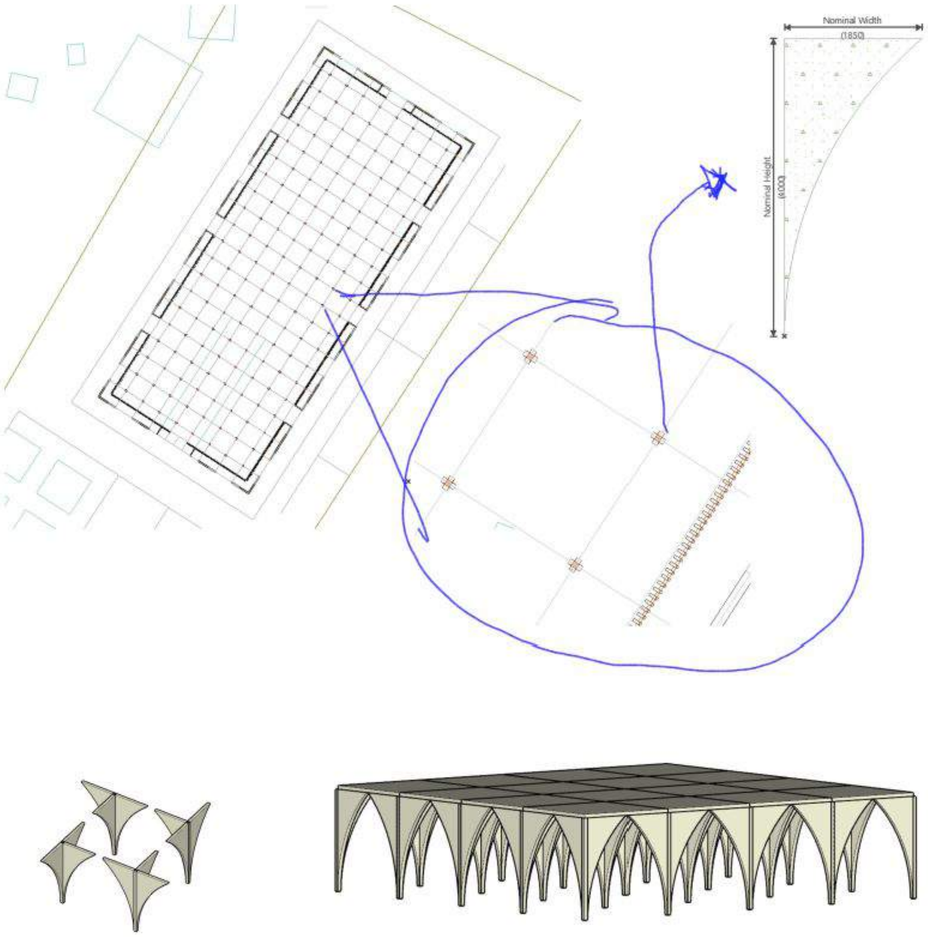


Figure 3.23: Column Detail
Source: Author

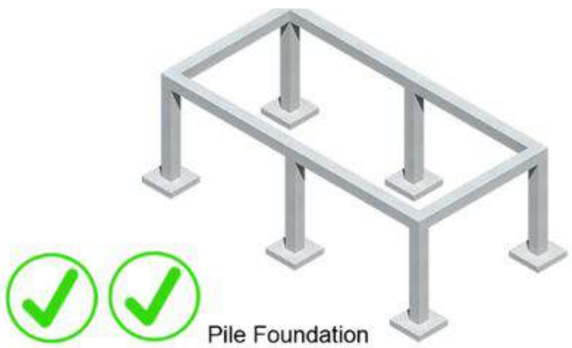


Figure 3.24: Foundation detail
Source: Author

Building column design have a function as bracing of the building. And every 4 meters grid repetition to create strong bracing against earthquake forces.

So the form of the column basically take the original form of pile foundation, and then modified it into triangular bracing system on the column to create stronger ability to hold the forces of the earthquake.

And then this elevated column system was made for prevention from tsunami. This design was expected to make the building and occupants avoid the flow of water from tsunami on the ground.

3.2.6 Fish Market Earthquake Structure System

4x4 Concrete Module

This is a result simulation of the building final plan using 4x4 module with concrete construction. As can be seen the building is rigid and can withstand eathquake good enough, the only point that is not efficient is the room programming as the module is kinda small for public space / wide span building. It is though still can be used as module for the building's side.

RESIST Simulation

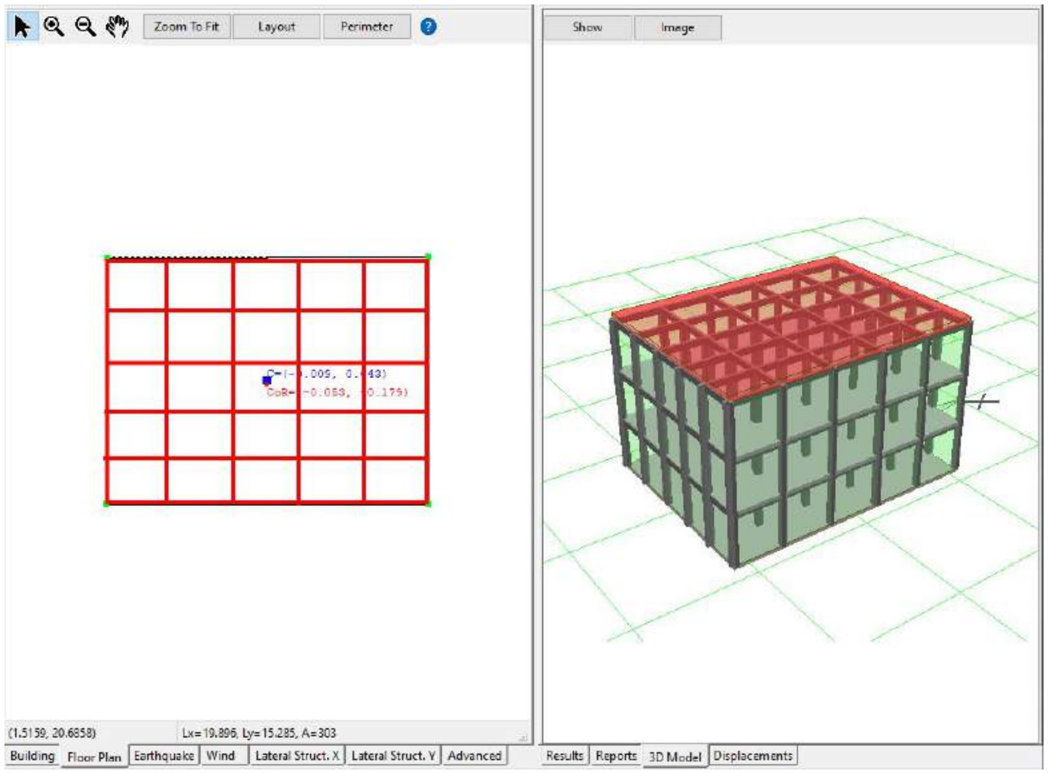


Figure 3.25: RESIST 3D
Source: Author

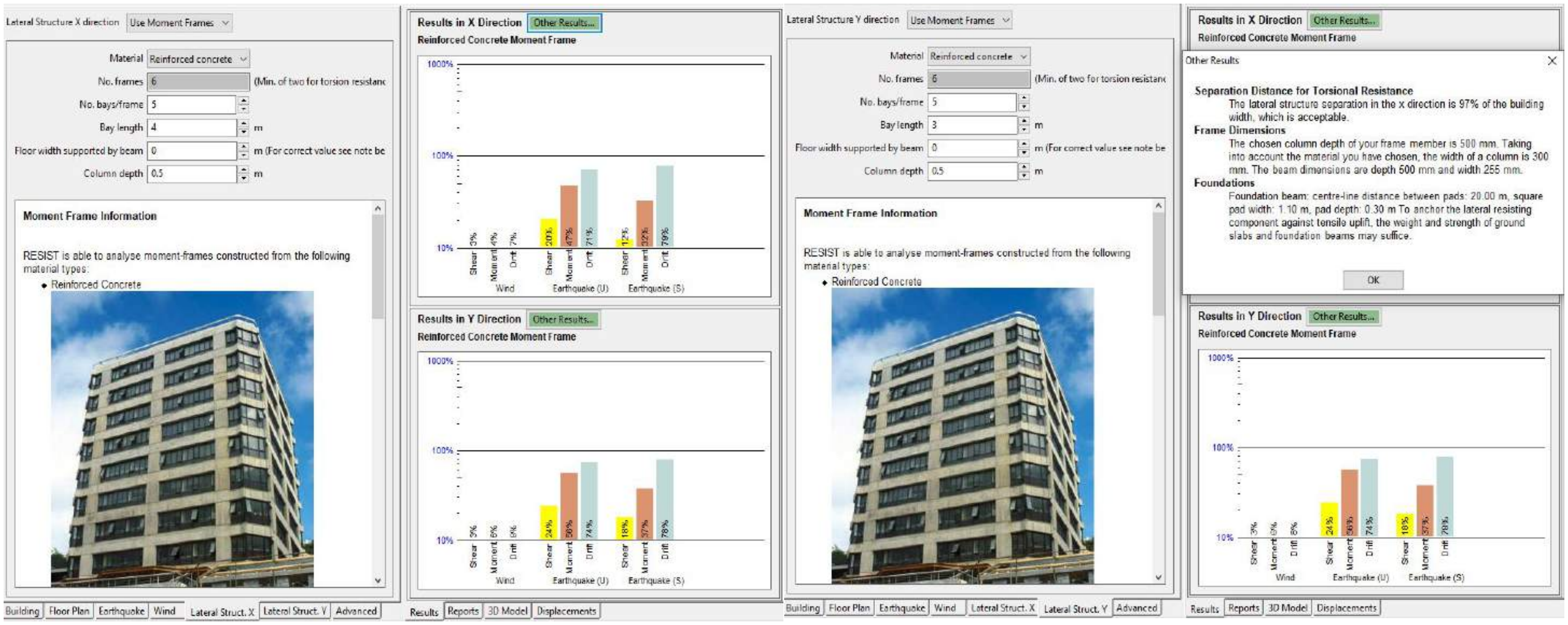


Figure 3.26 and 3.27: RESIST Profiles
Source: Author

RESIST Simulation

4x5 Concrete Module

This is a result simulation of the building final plan using 4x5 module with concrete construction. As can be seen the building is rigid and can withstand eathquake rather risky, the only point that is not efficient is the size of the column is quite big. It is though efficient in room programming as it provide big spaces for public usage and fit the wide span building function.

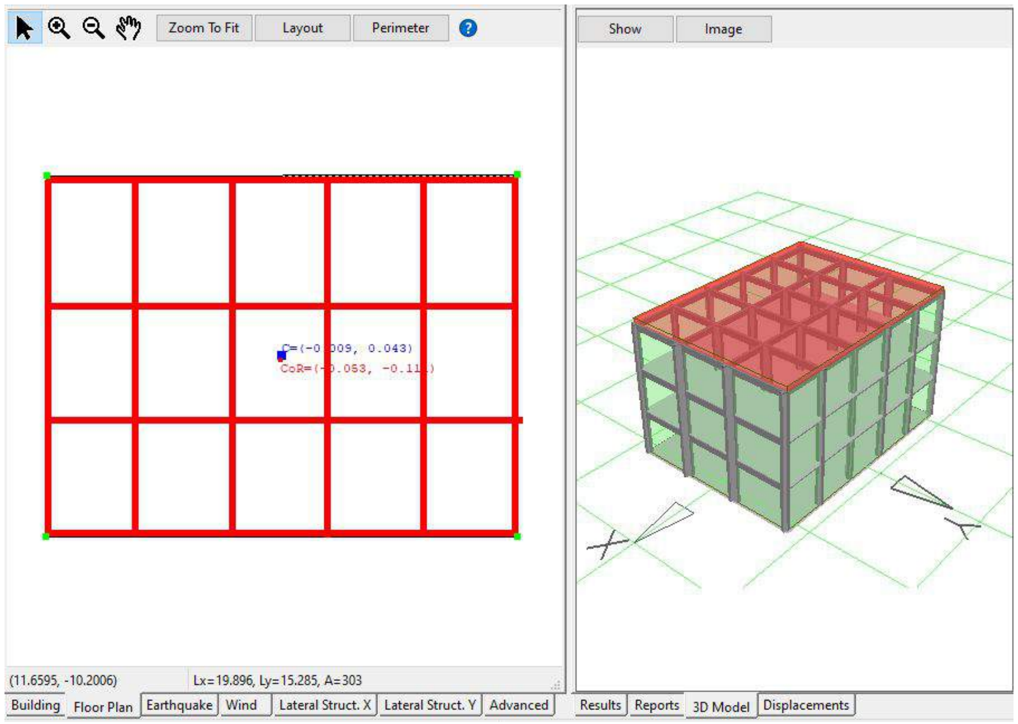


Figure 3.28: RESIST 3D
Source: Author

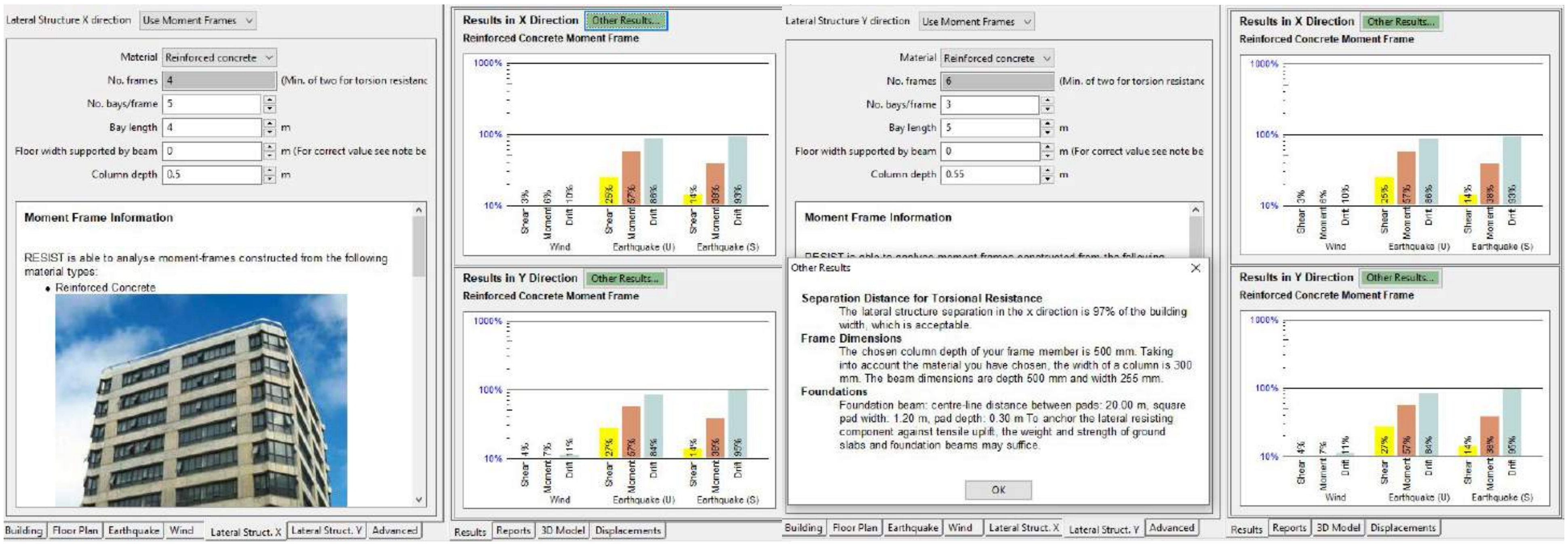


Figure 3.29 and 3.30: RESIST Profiles
Source: Author

RESIST Simulation

4x4 Steel Module

This is a result simulation of the building final plan using 4x4 module with steel construction. As can be seen the building is rigid and can withstand eathquake rather effectively, the only point that is not efficient is the room programming as the module is kinda small for public space / wide span building. It is though still can be used as module for the building's side.

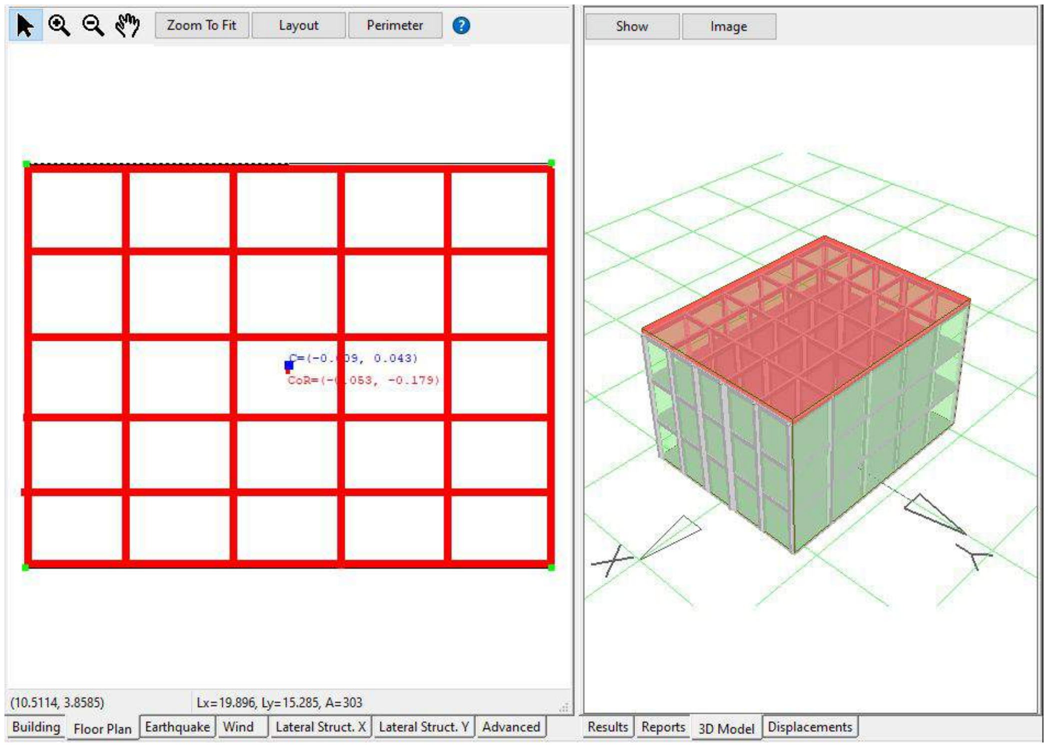


Figure 3.31: RESIST 3D
Source: Author

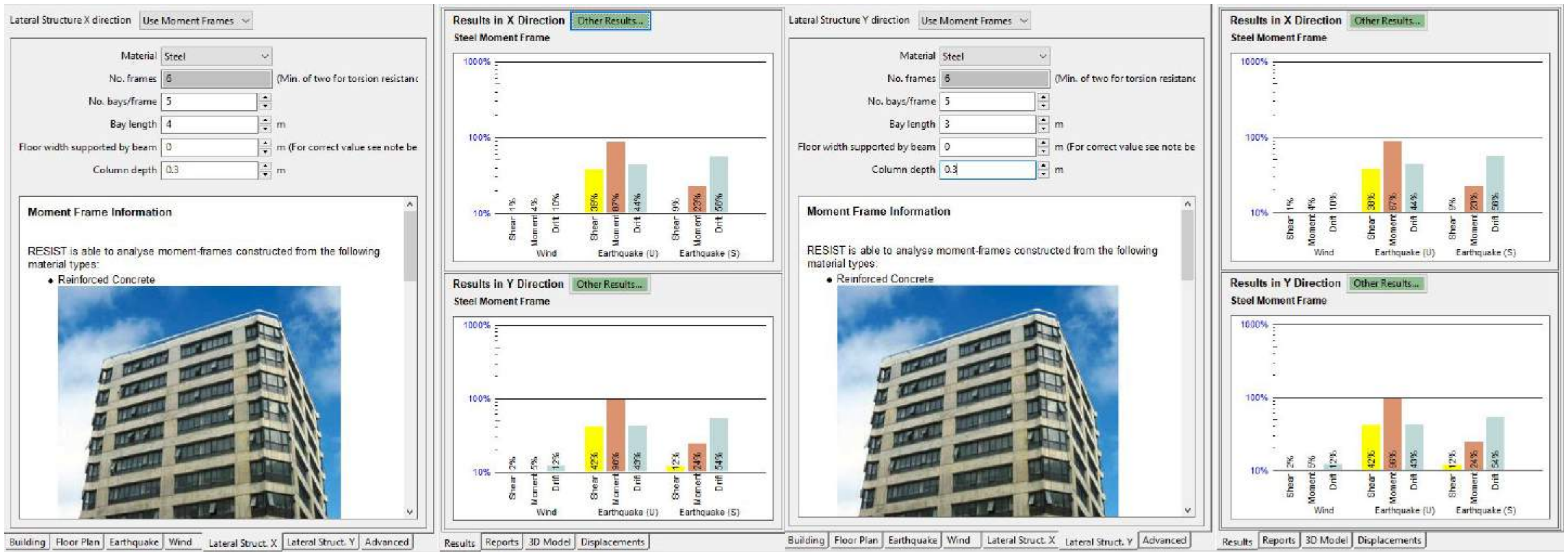


Figure 3.32 and 3.33: RESIST Profiles
Source: Author

RESIST Simulation

4x5 Steel Module

This is a result simulation of the building final plan using 4x5 module with steel construction. As can be seen the building is rigid and can withstand eathquake rather effectively, the only point that is not efficient is the size of the column is quite big. It is though efficient in room programming as it provide big spaces for public usage and fit the wide span building function.

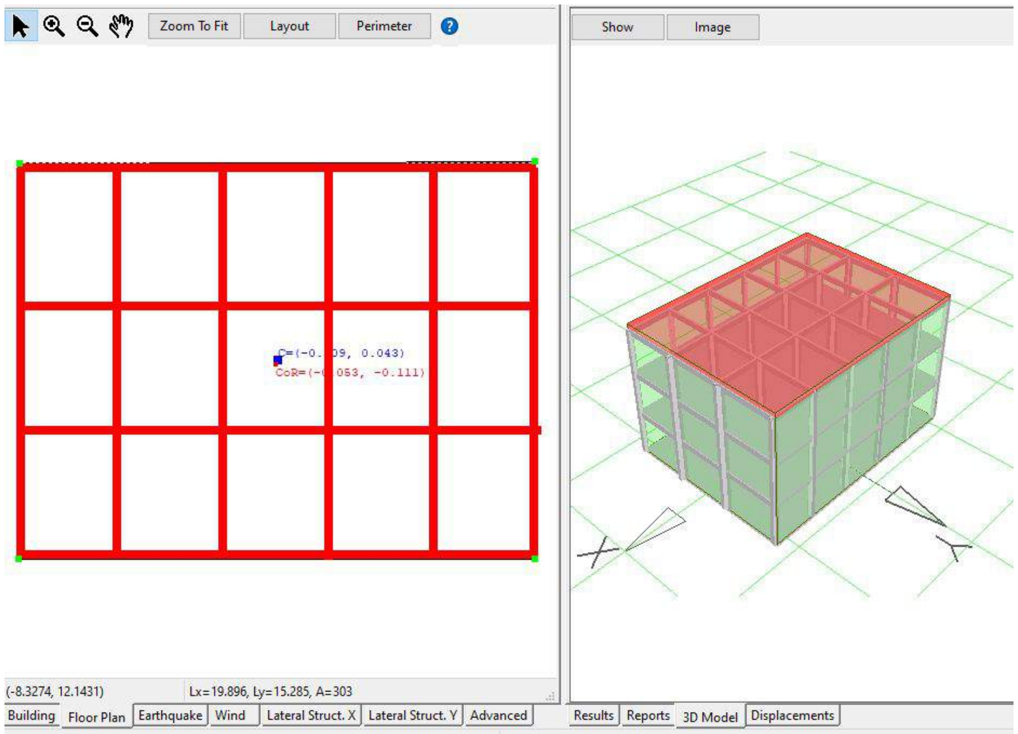


Figure 3.34: RESIST 3D
Source: Author

Figure 3.35 and 3.36: RESIST Profiles
Source: Author

3.2.7 Circulation Evacuation for Tsunami

The poly linear route makes the user have multidirectional circulation to evacuate.

Figure 3.37: Evacuation Route
Source: Author

Figure 3.38: Evacuation Route
Source: Author

Figure 3.39: Evacuation Route
Source: Author

The site circulation is pretty straightforward. There will be a main access route that branch to all of the 3 functions (fish market, fish auction, and seafood restaurant. In order to make the flow of circulation in the site clear and fluent, parallel connection between building to another building implemented into this design just like picture on the side.

The parallel connection started from the seafront building area, to the coastal building area, and finally reach the inland area. This connection means to create the efficient way on evacuation route when the tsunami or earthquake happens.

So just like the picture below, that is how the evacuation route will be implemented in the design. So the main building will be a shelter for people on the site. The main building meant to be the safest area in there when tsunami happens. To make the building safe enough from the disaster, so there will be needed a design that could handle the forces.

3.2.8 Site Water Flow for Tsunami

Simulation with Grasshopper and Rhino3D visualization

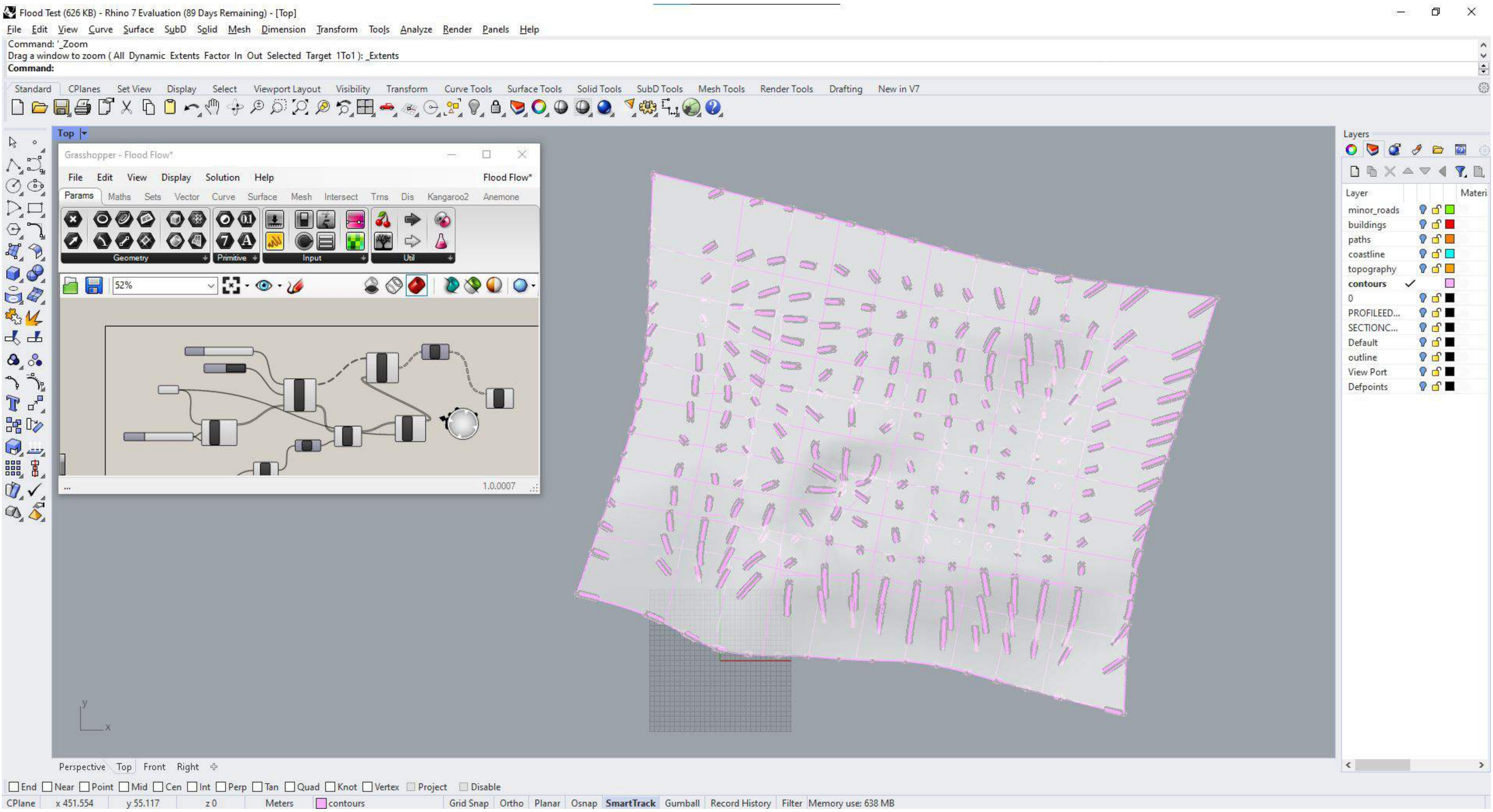
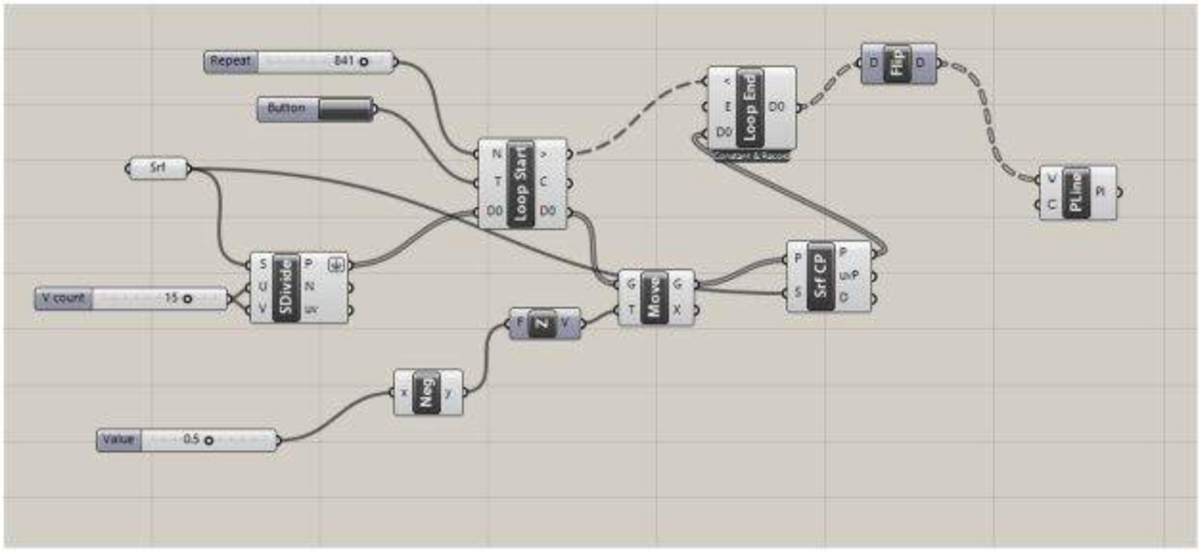
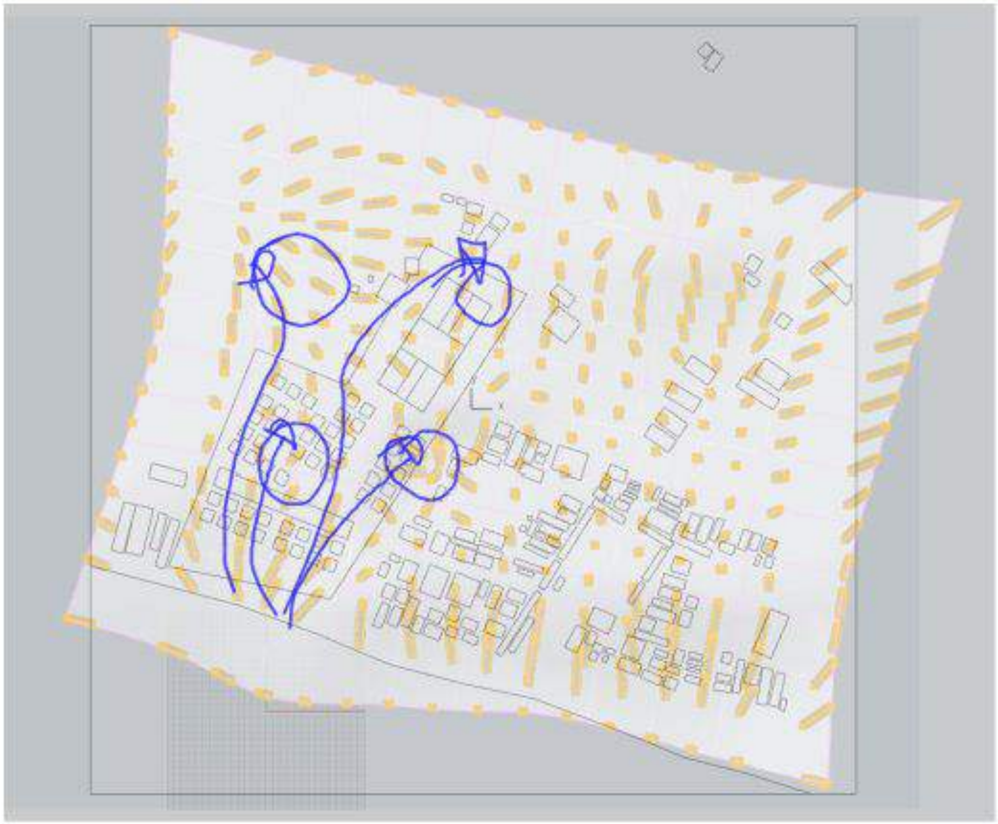
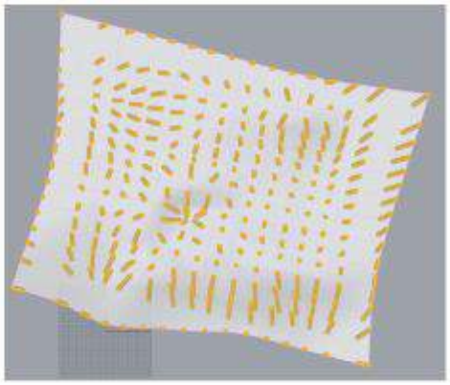


Figure 3.40: Tsunami Simulation
Source: Author







The water flow test based on grasshopper and rhino program, the blue area has the most drowned area.

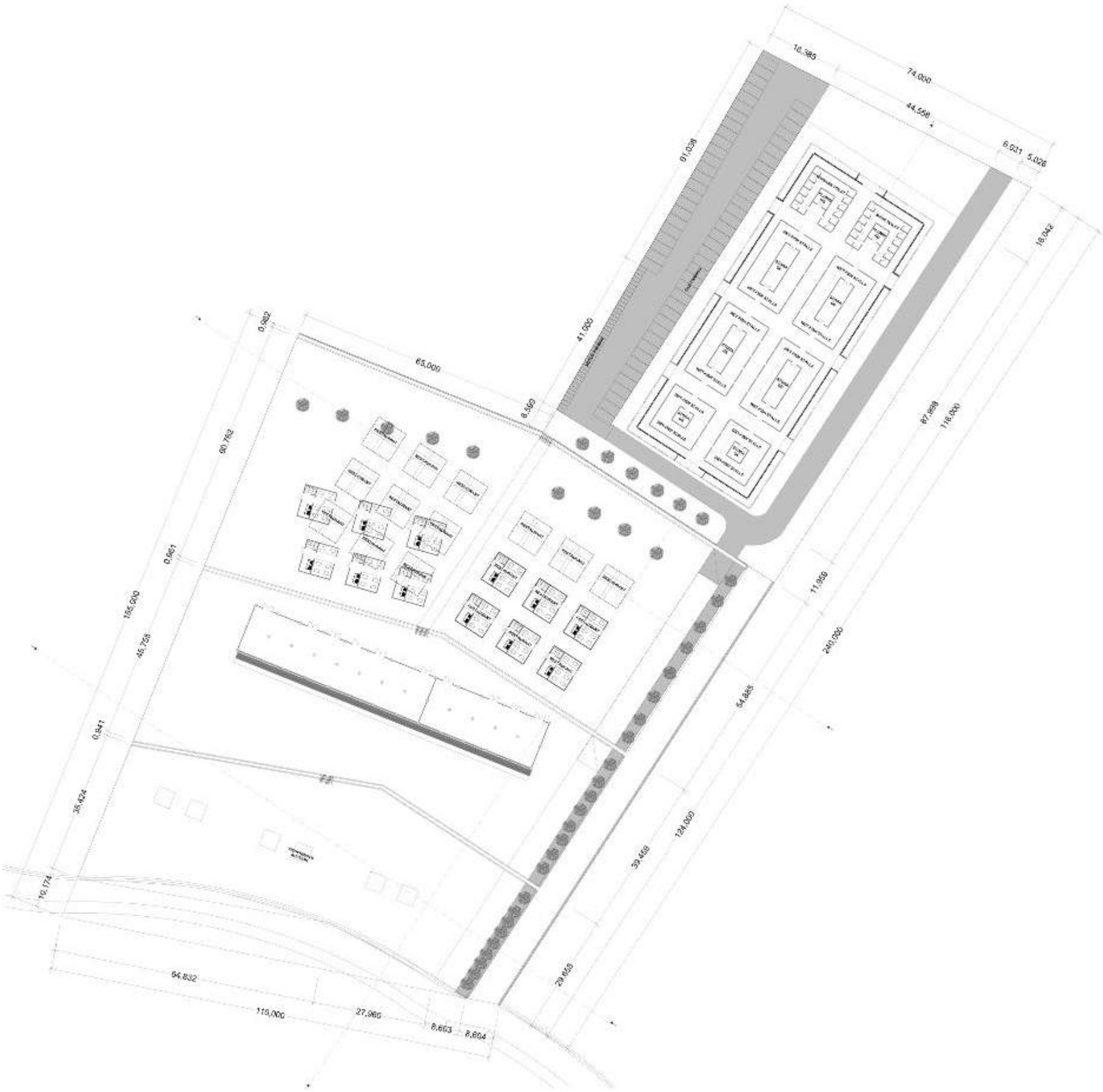
Figure 3.41, 3.42, and 3.43: Tsunami Simulation
Source: Author

Chapter 4.
BUILDING DESIGN

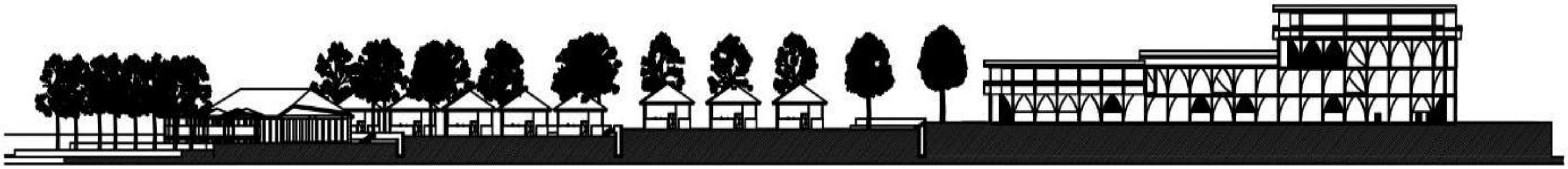
Technical Drawings

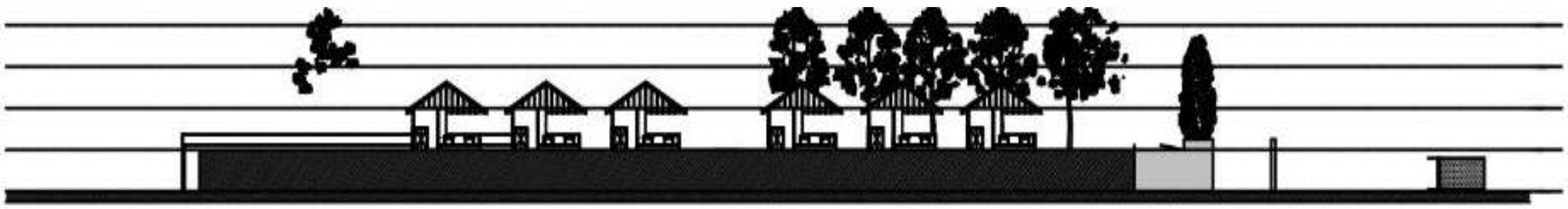
Contents

4.0.1 MASTERPLAN

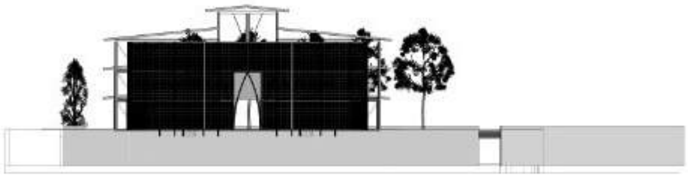


4.0.2 SITE SECTIONS

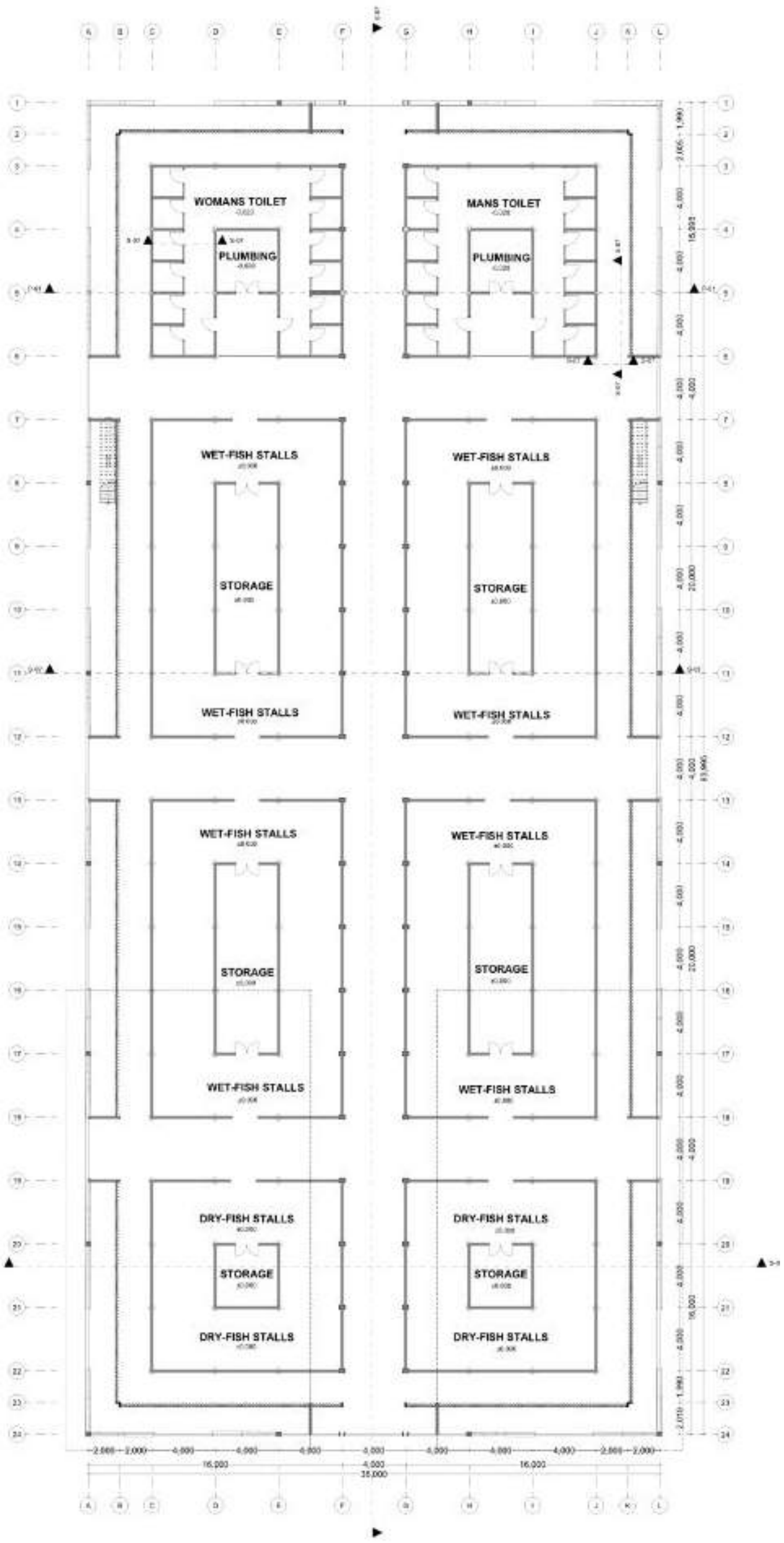


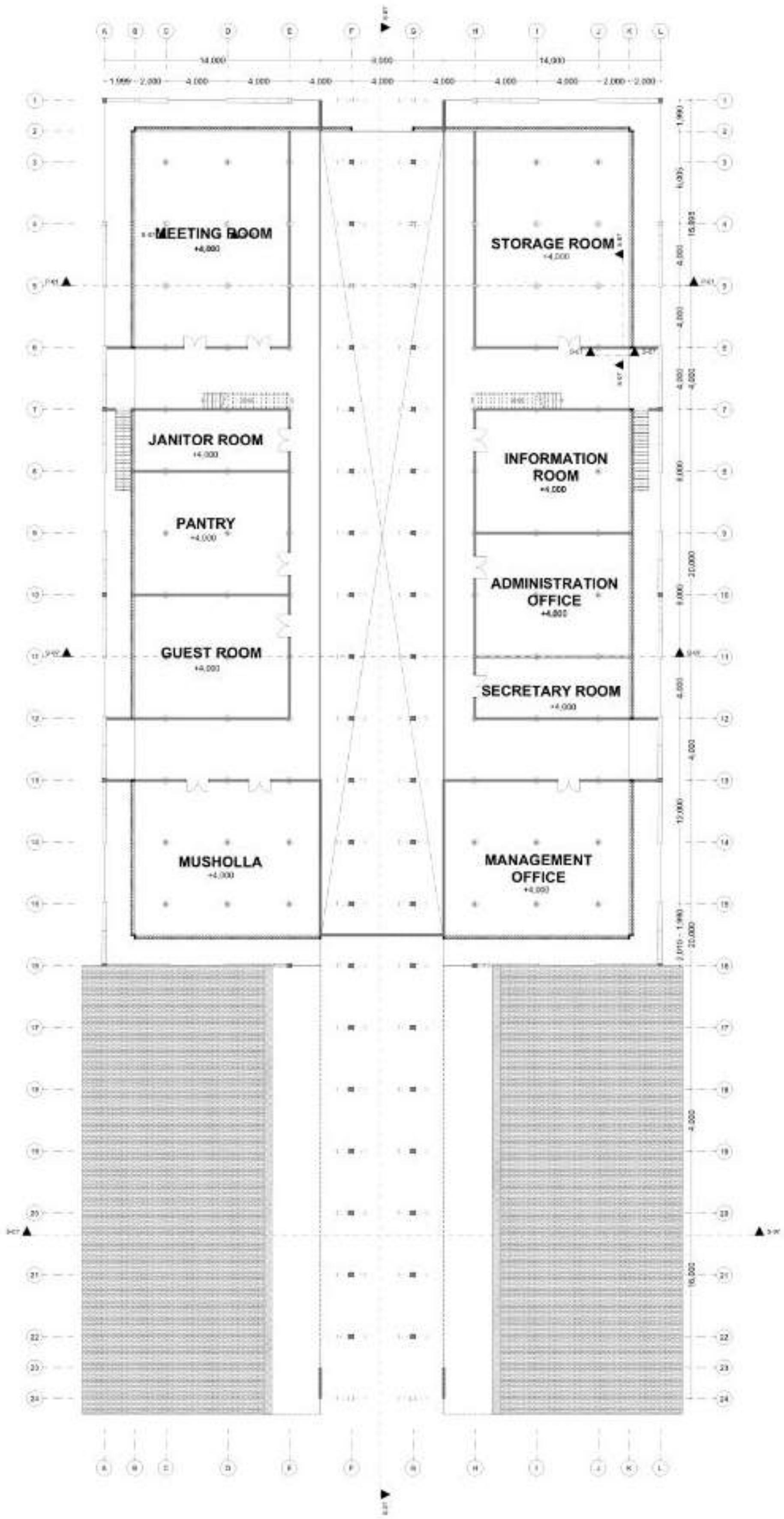


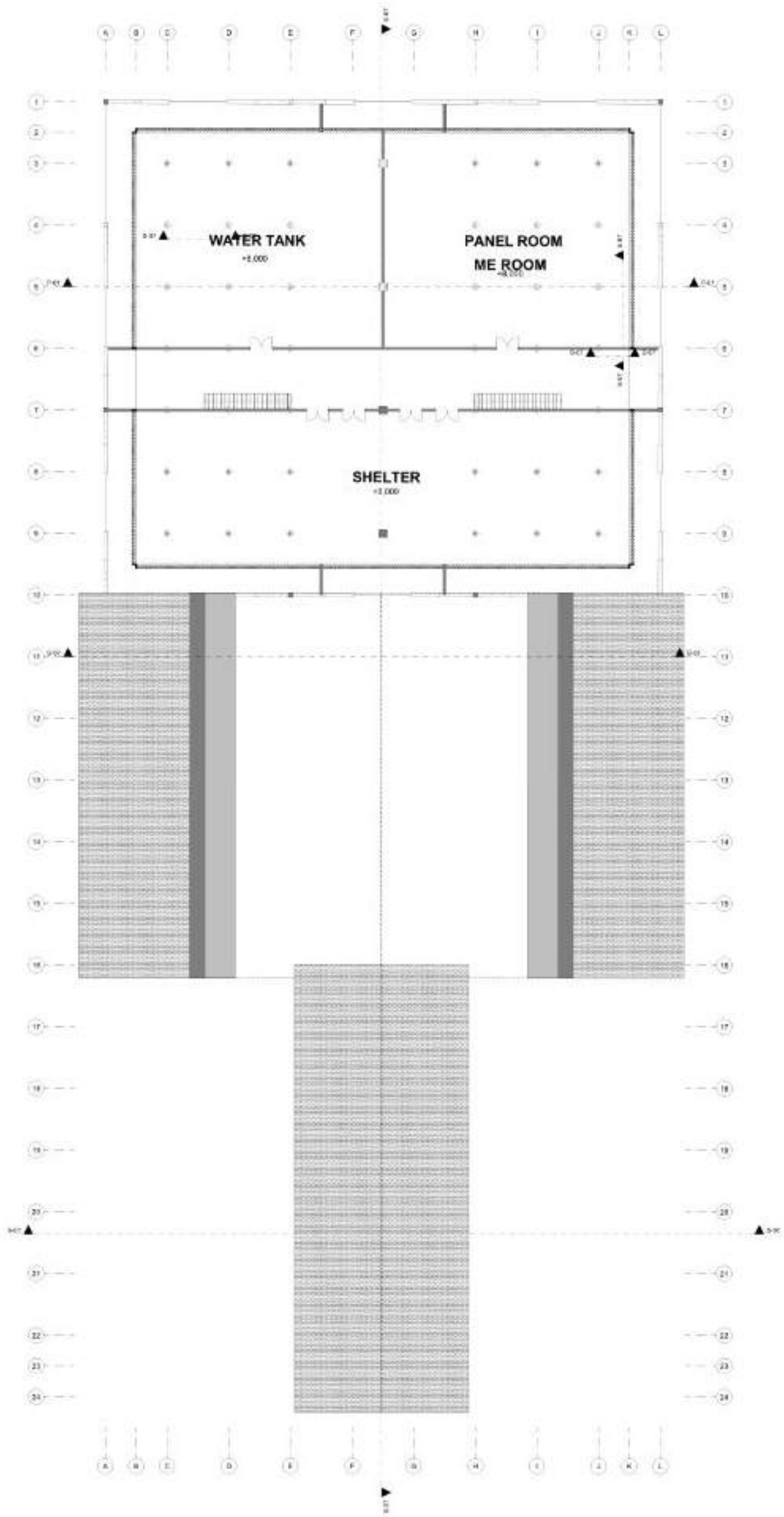
4.0.3 SITE ELEVATIONS

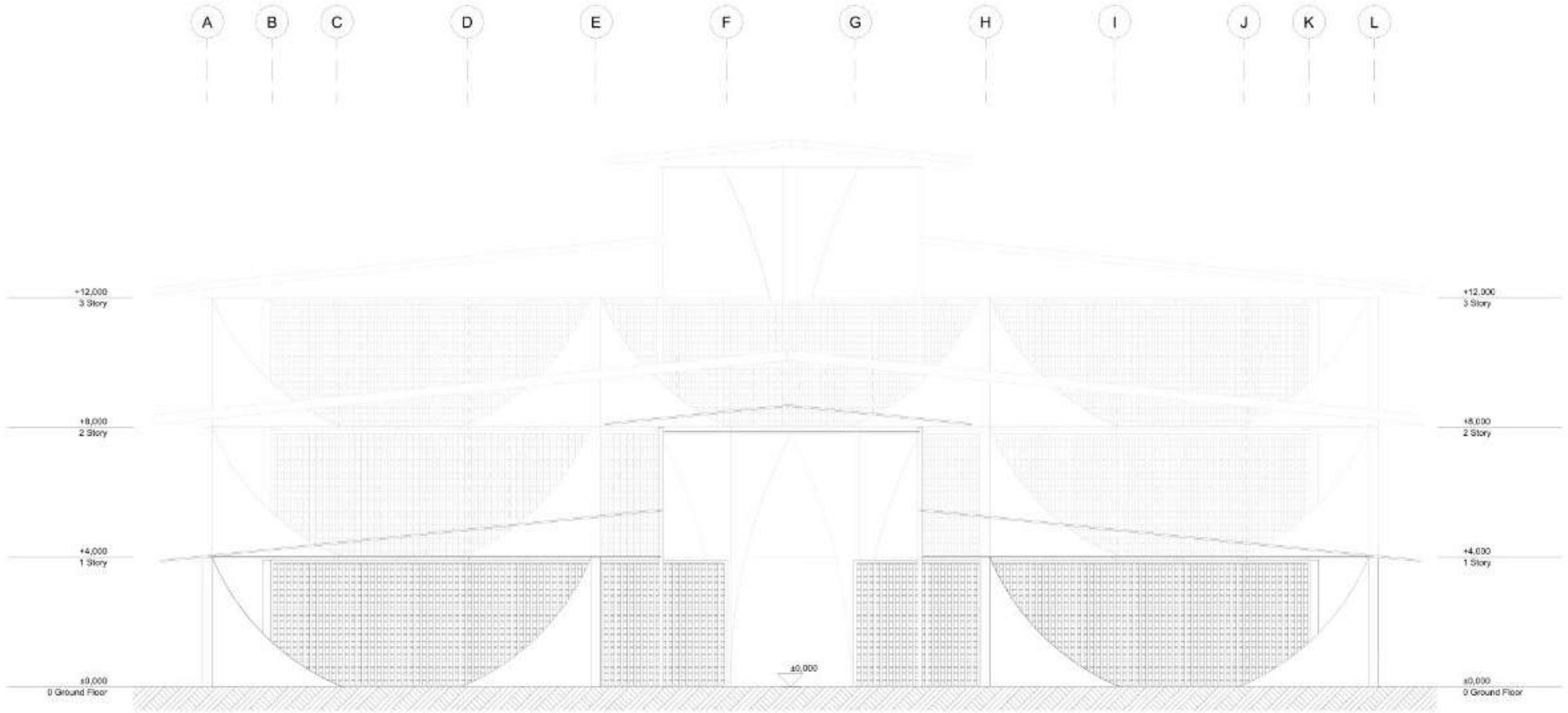


4.0.4 FISH MARKET PLANS, SECTIONS, ELEVATIONS




MEETING ROOM
STORAGE ROOM
JANITOR ROOM
INFORMATION ROOM
PANTRY
ADMINISTRATION OFFICE
GUEST ROOM
SECRETARY ROOM
MUSHOLLA
MANAGEMENT OFFICE


WATER TANK
PANEL ROOM
ME ROOM
SHELTER


A
B
C
D
E
F
G
H
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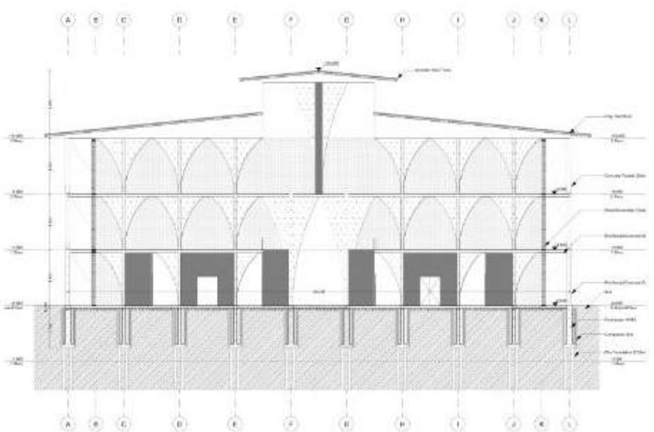
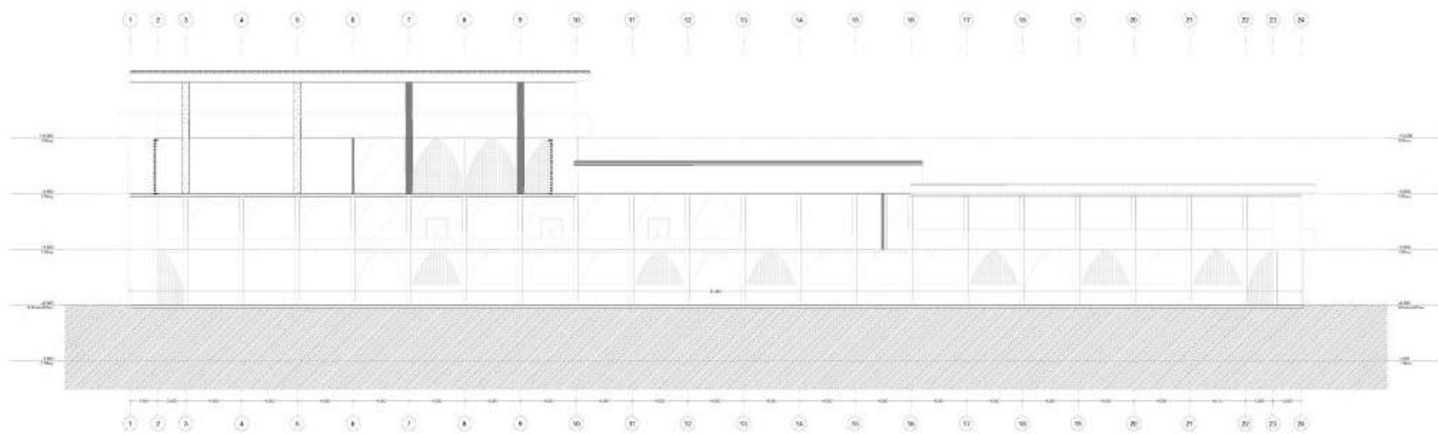
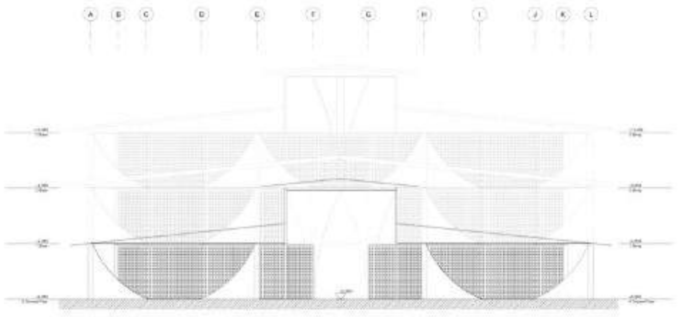
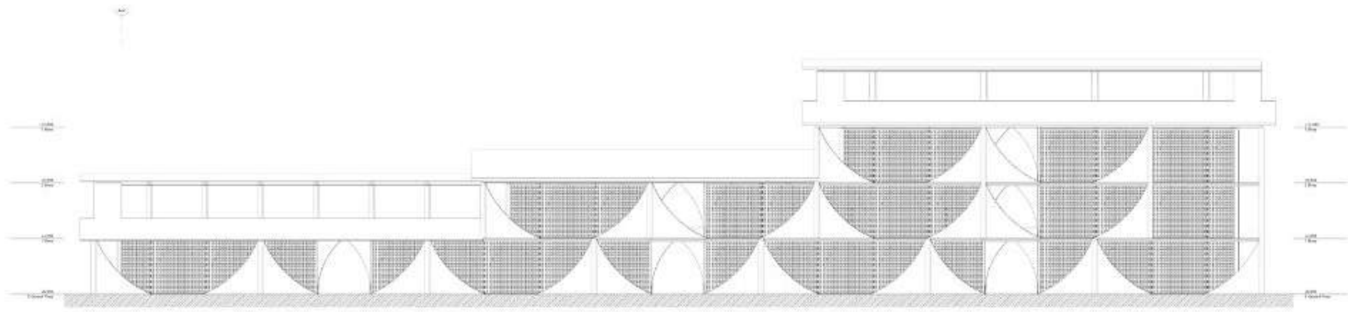
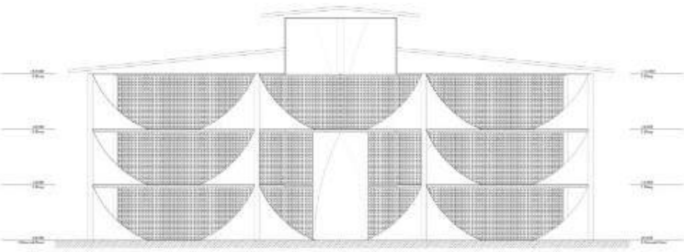
J
K
L
+12,000
3 Story
+8,000
2 Story
+4,000
1 Story
±0,000
0 Ground Floor
±0,000

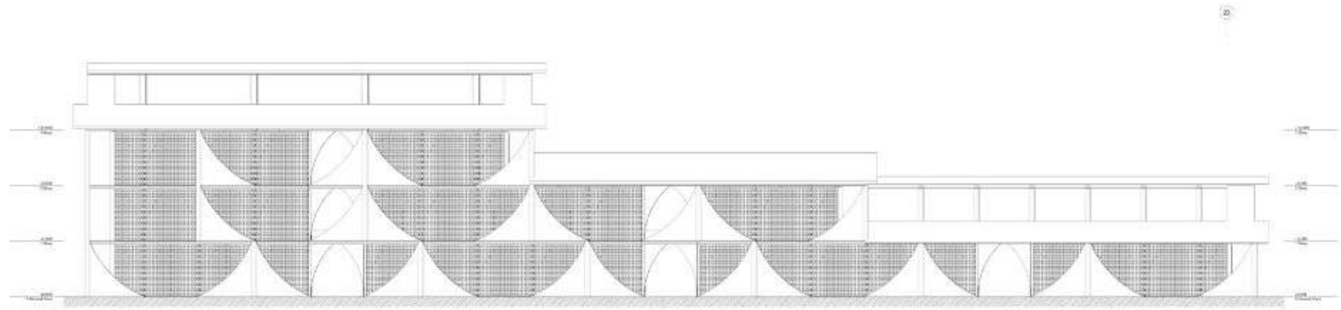




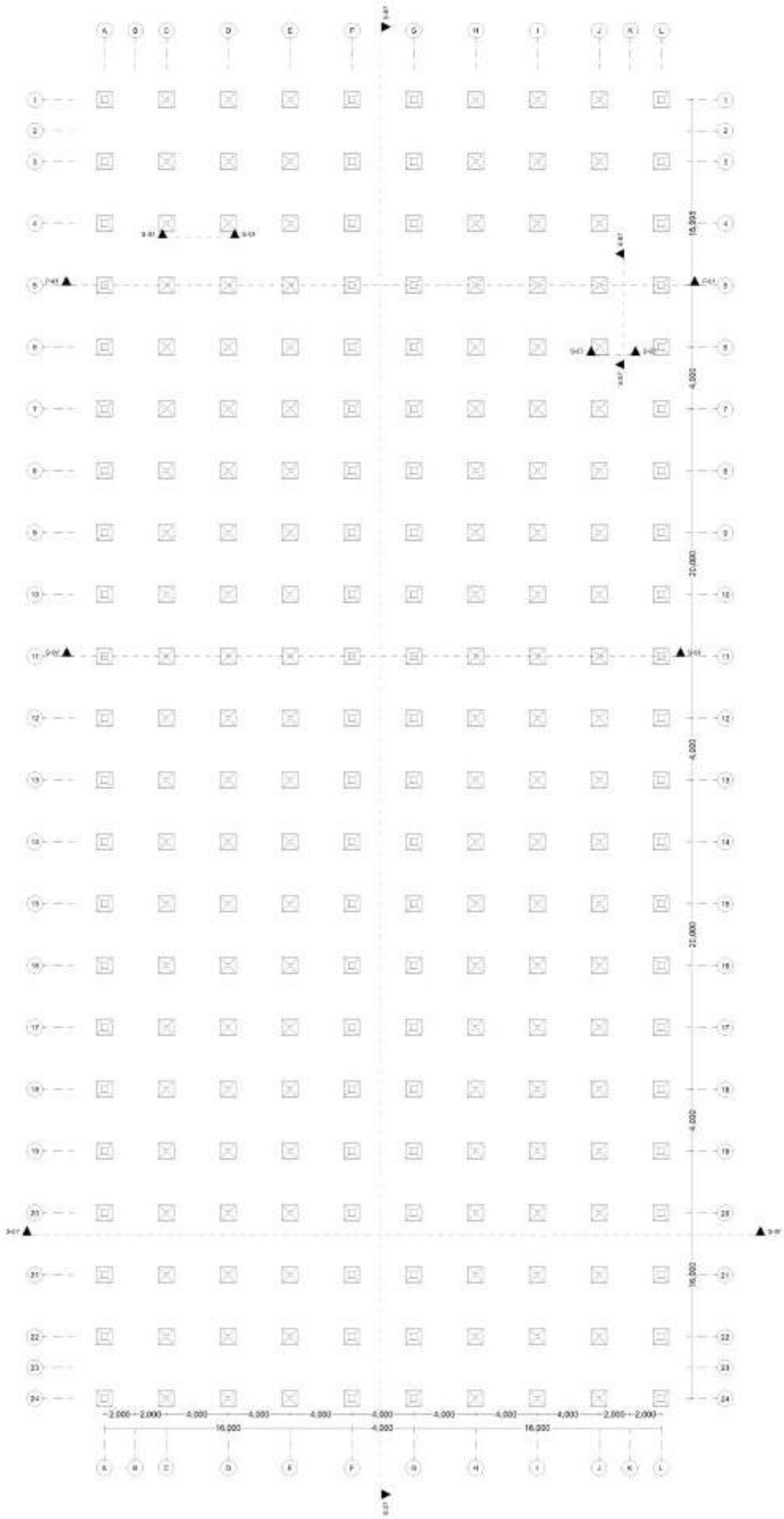


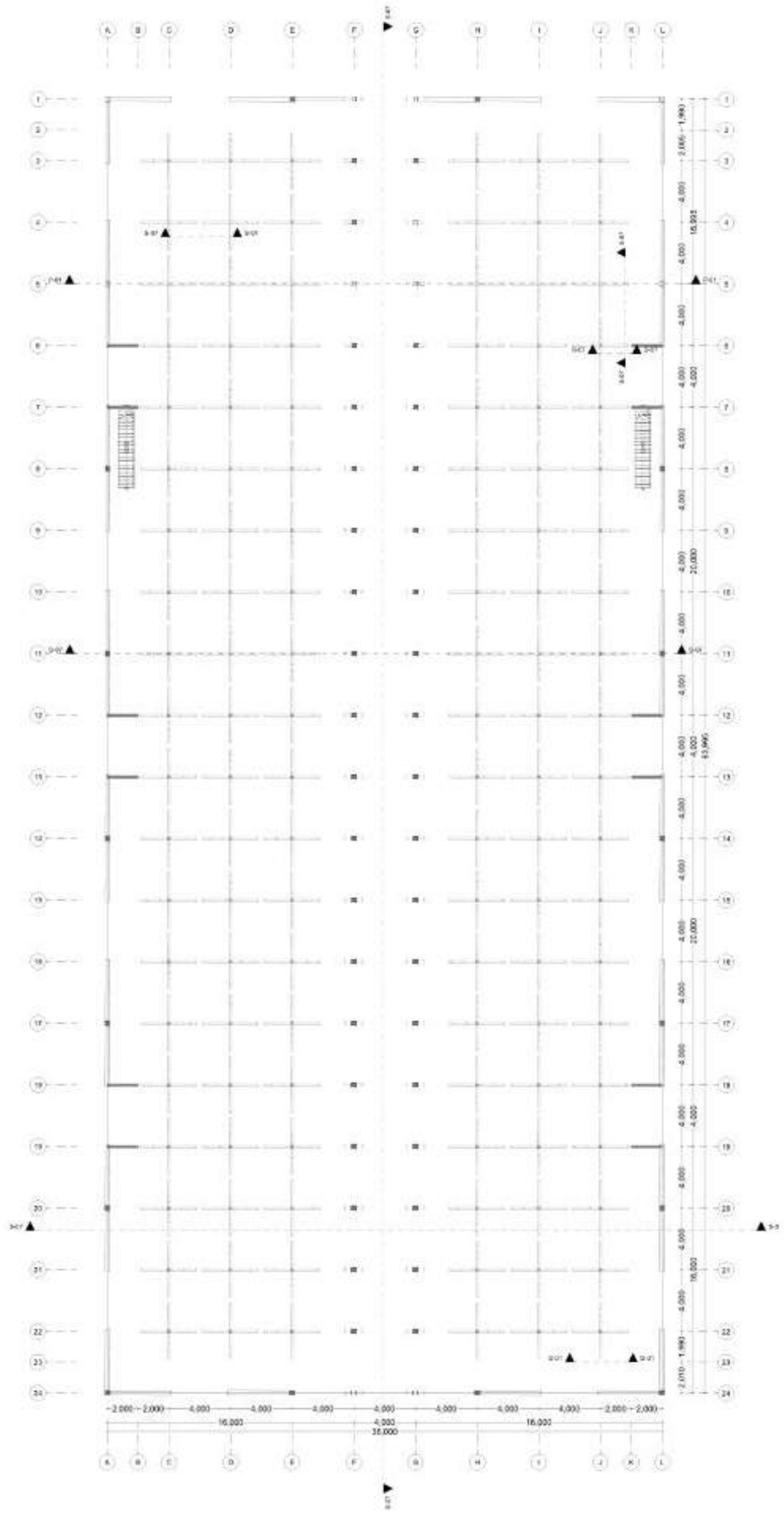






4.0.5 STRUCTURAL PLANS & DETAILS

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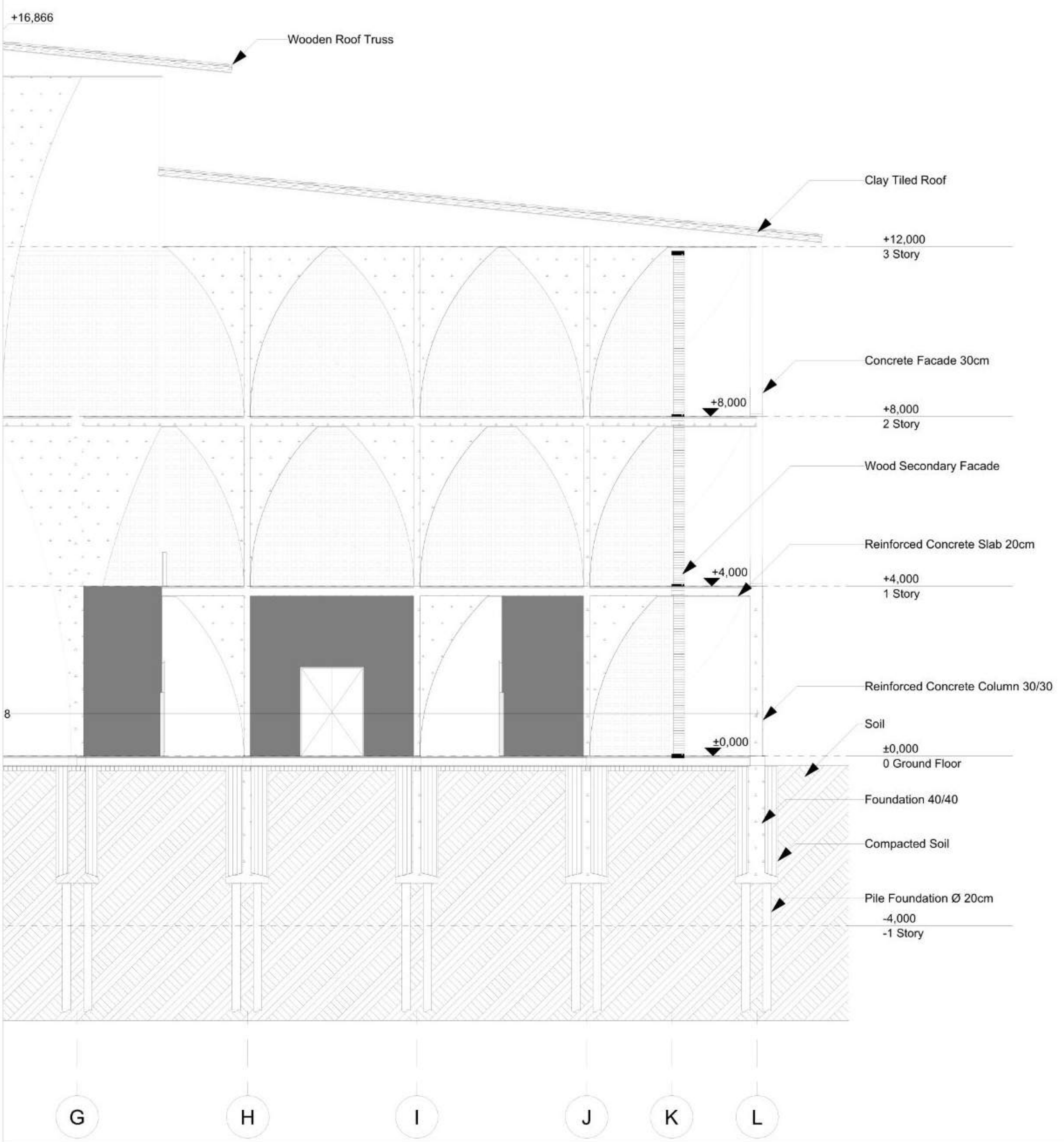
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Wooden Roof Truss
Clay Tiled Roof
+12,000
3 Story
Concrete Facade 30cm
+8,000
+8,000
2 Story
Wood Secondary Facade
Reinforced Concrete Slab 20cm
+4,000
+4,000
1 Story
Reinforced Concrete Column 30/30
8
Soil
±0,000
±0,000
0 Ground Floor
Foundation 40/40
Compacted Soil
Pile Foundation Ø 20cm
-4,000
-1 Story
G
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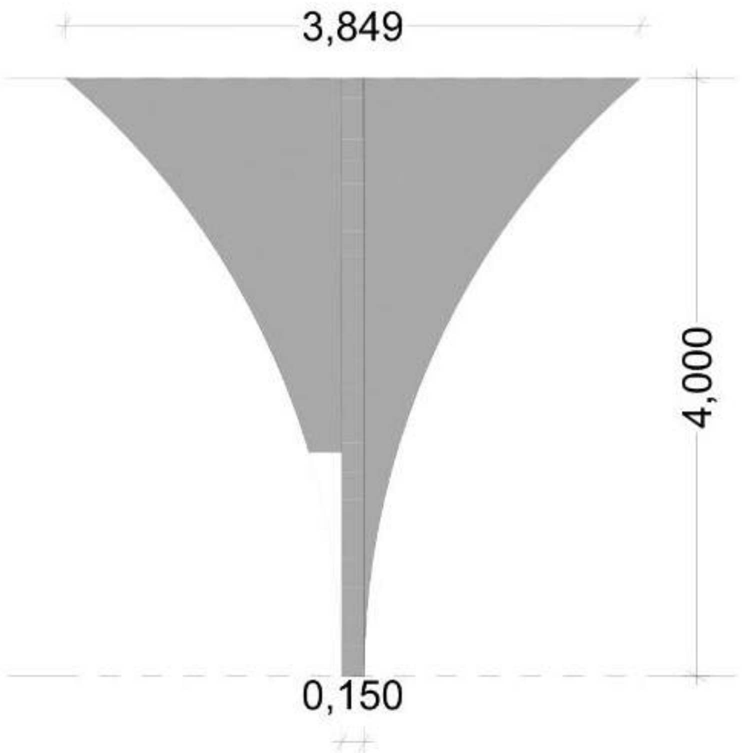
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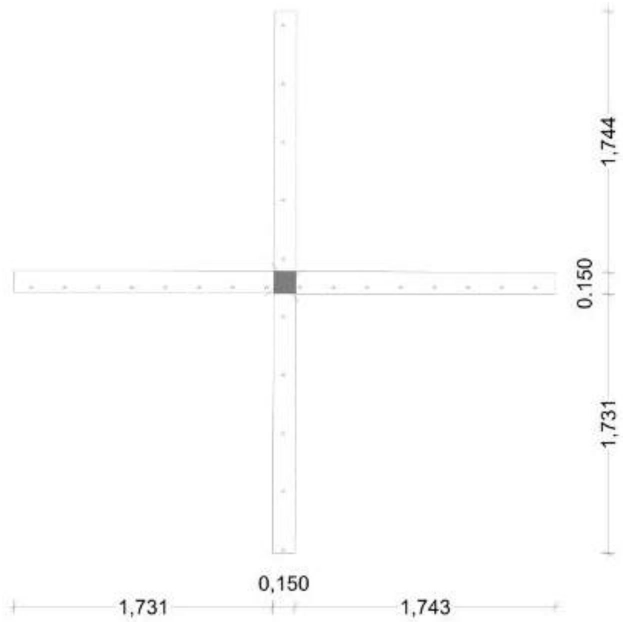
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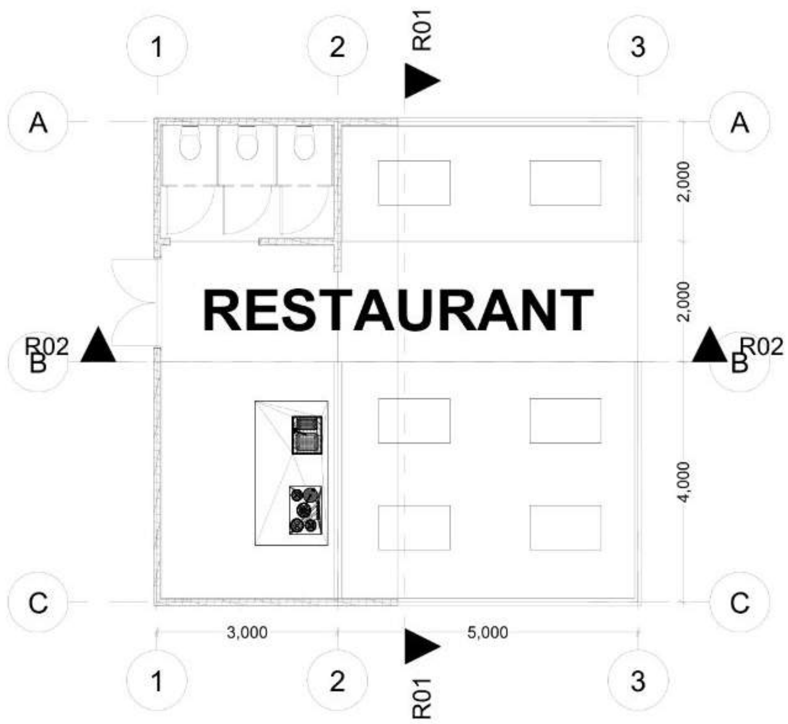
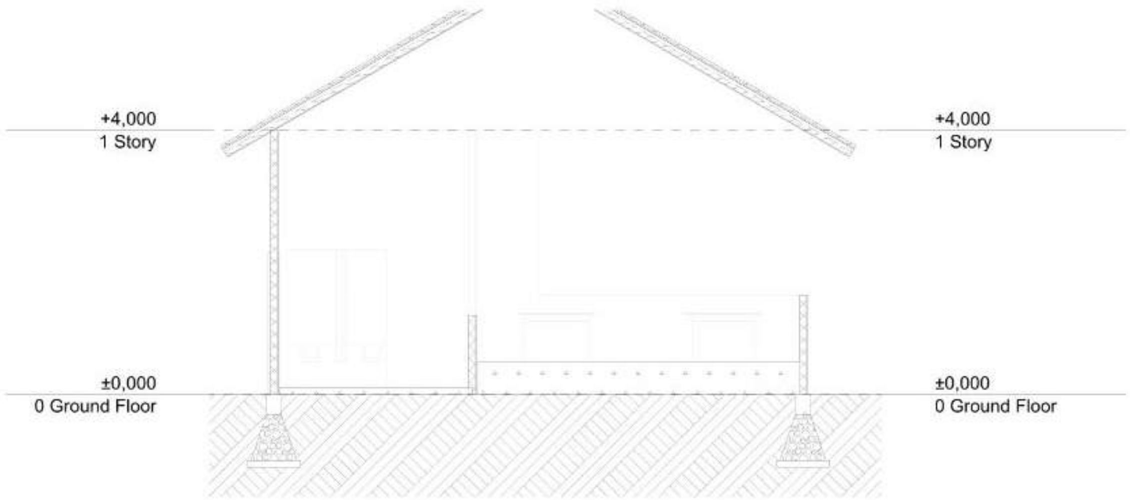
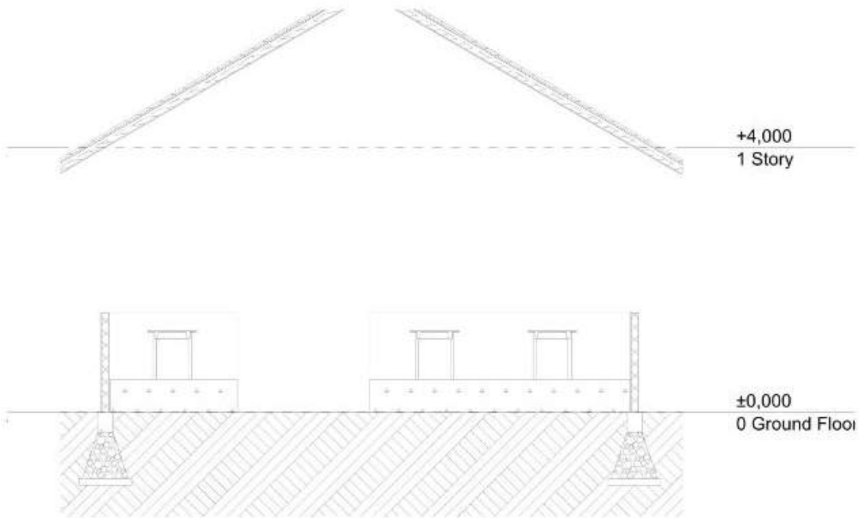
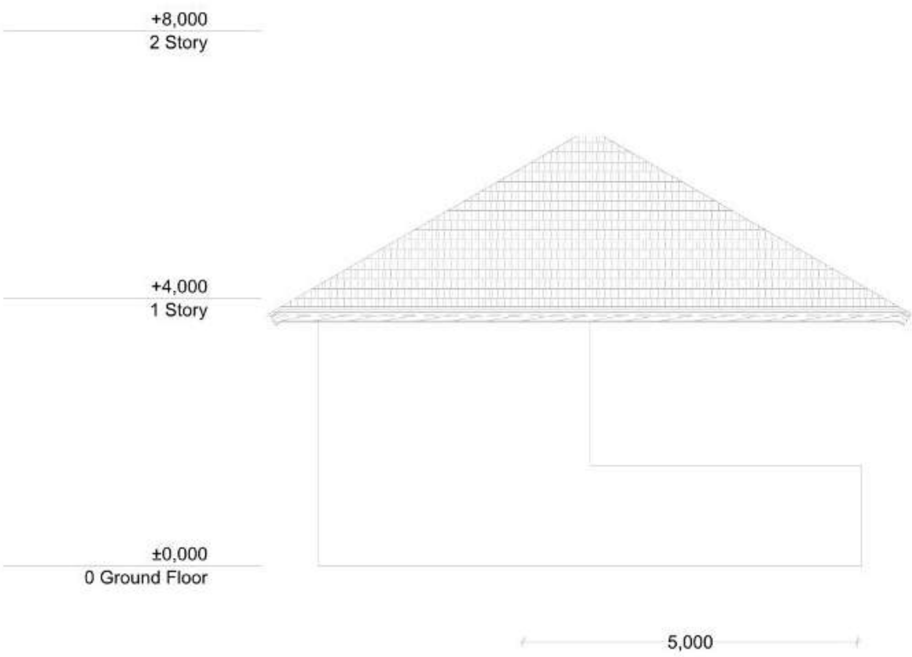
4.0.6 RESTAURANT'S PLAN, SECTIONS, ELEVATIONS

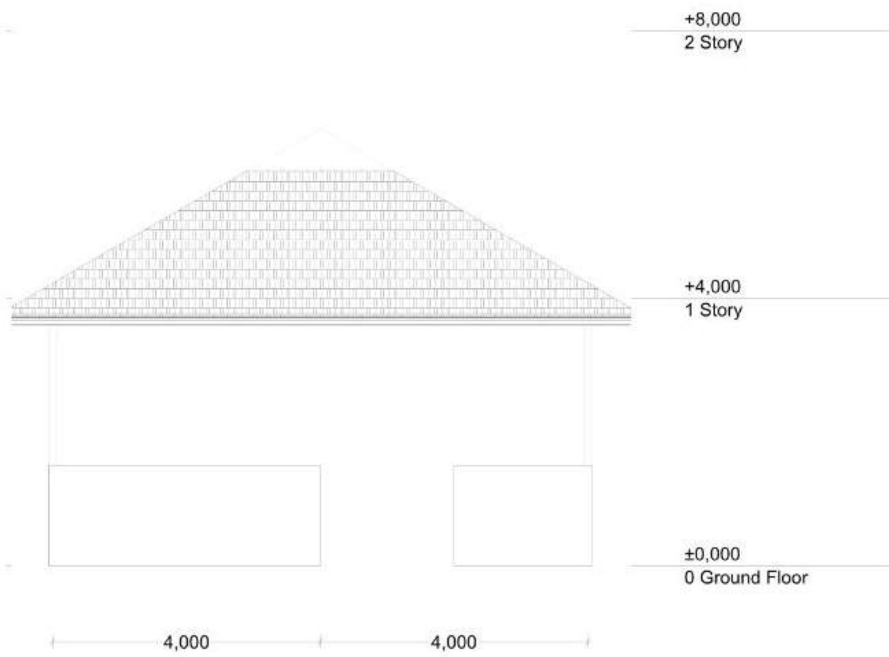




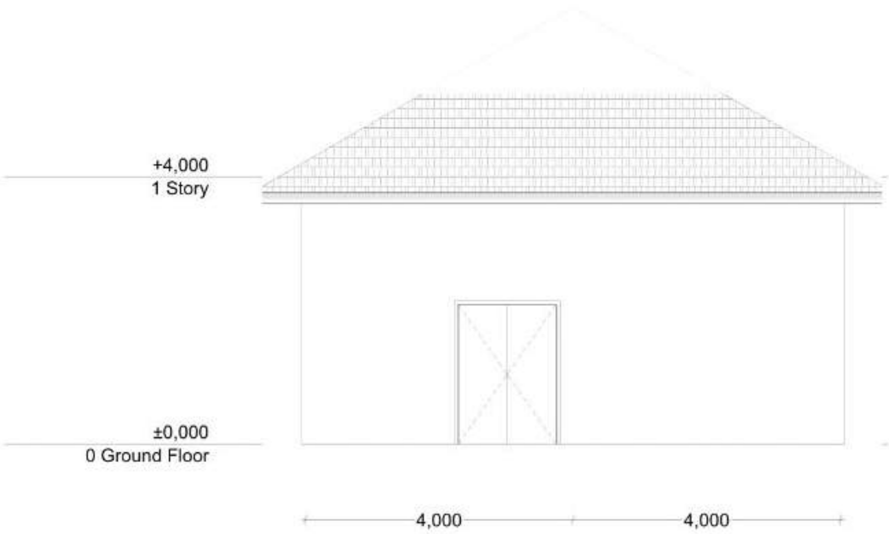




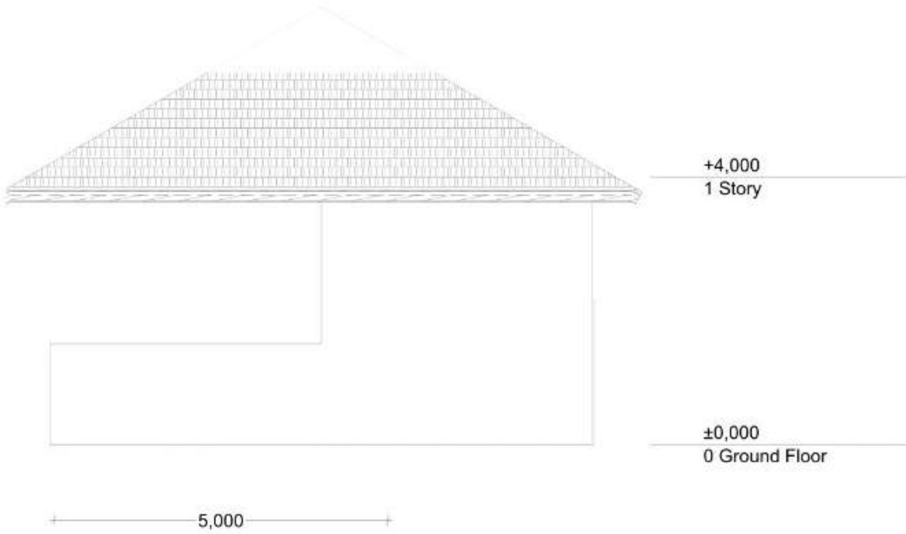
NORTH ELEVATION
SCALE 1:100



EAST ELEVATION
SCALE 1:100

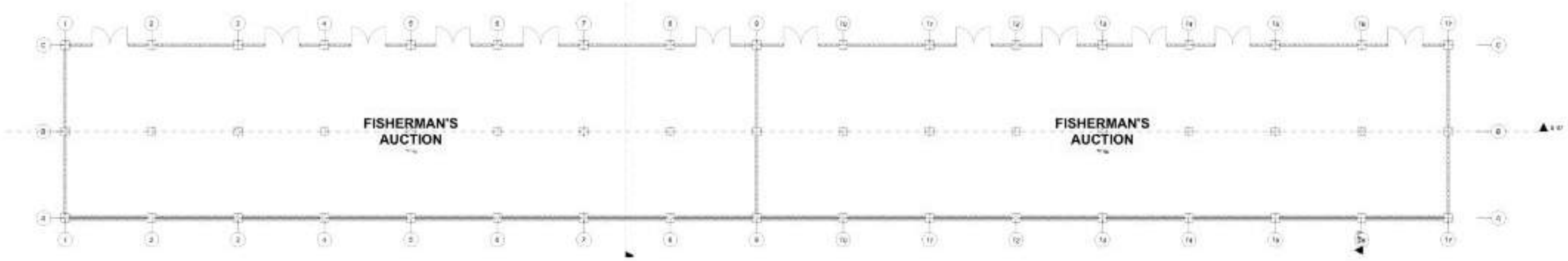


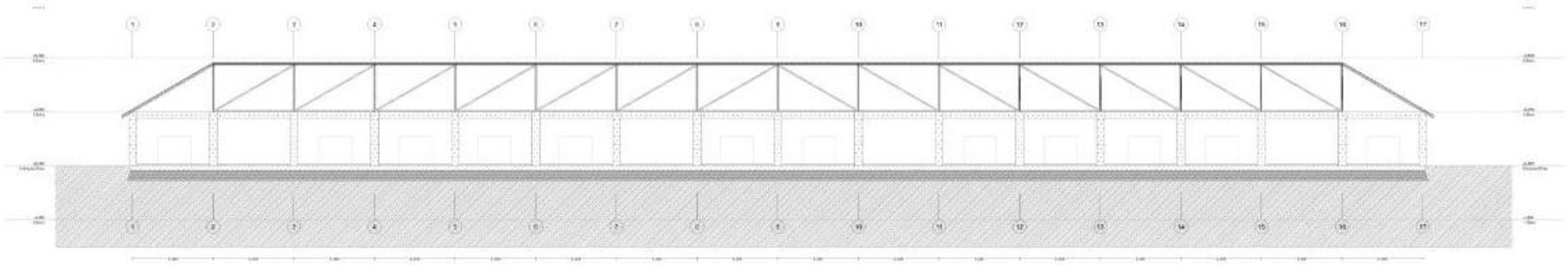
SOUTH ELEVATION
SCALE 1:100

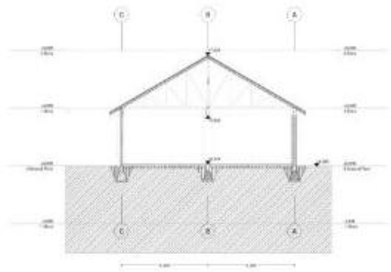


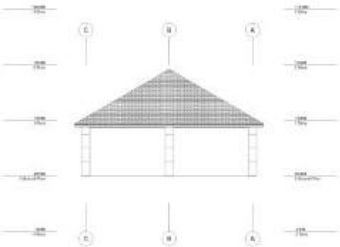
WEST ELEVATION
SCALE 1:100

4.0.7 FISH AUCTION'S PLAN, SECTIONS, ELEVATIONS

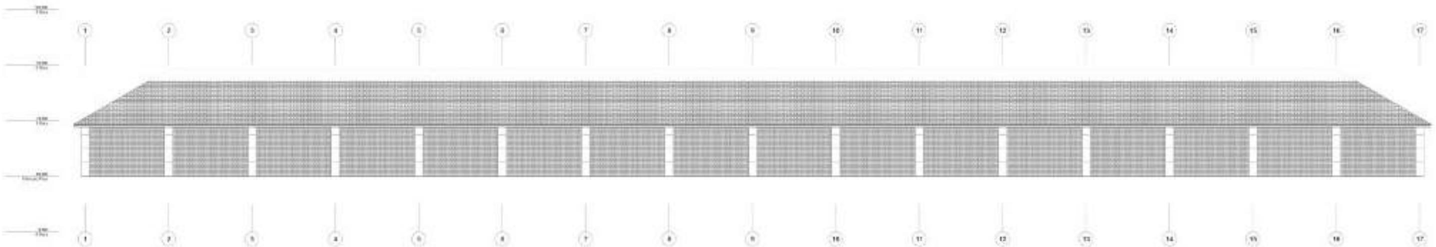








EAST ELEVATION
SCALE 1:500



NORTH ELEVATION
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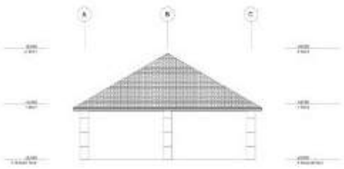
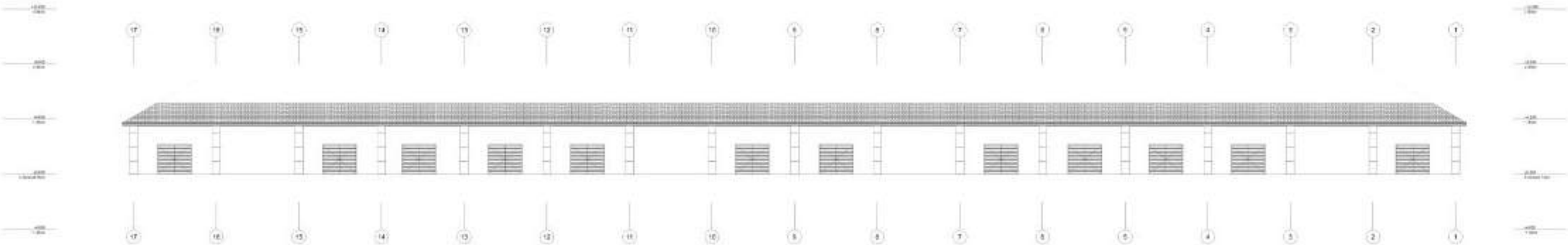
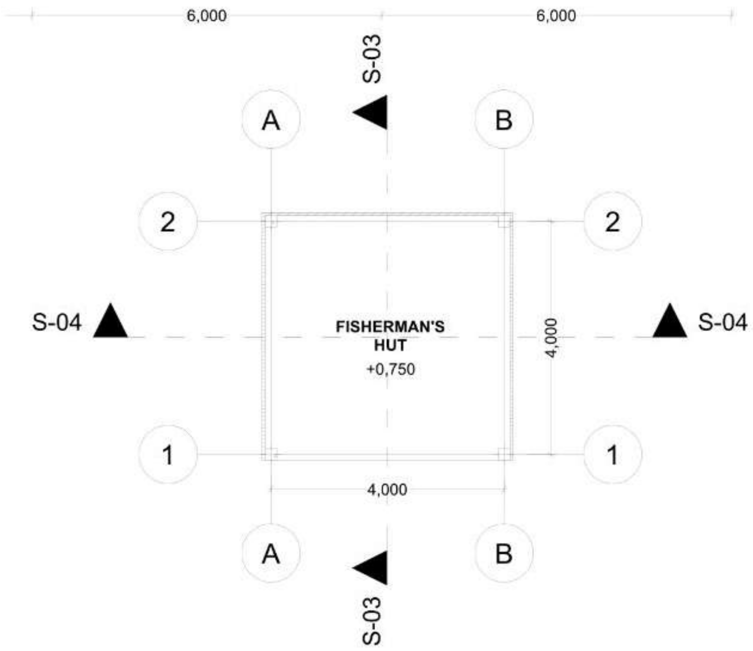


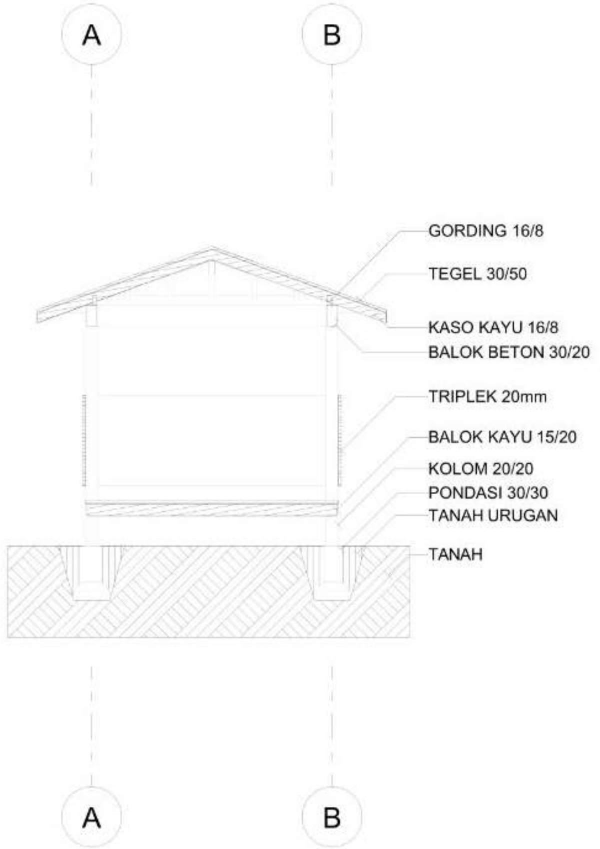
WEST ELEVATION
SCALE 1:500



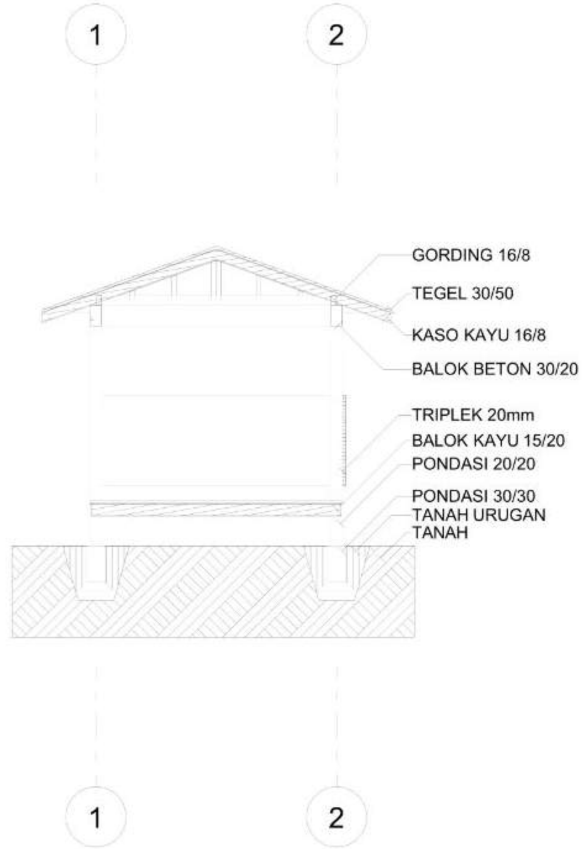
SOUTH ELEVATION
SCALE 1:500

4.0.8 GAZEBO’S PLAN, SECTIONS, ELEVATIONS

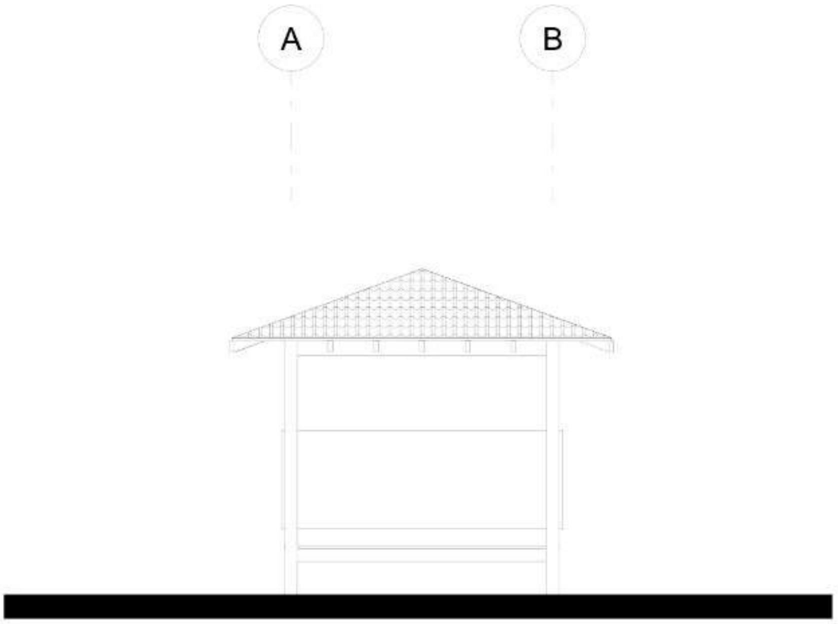




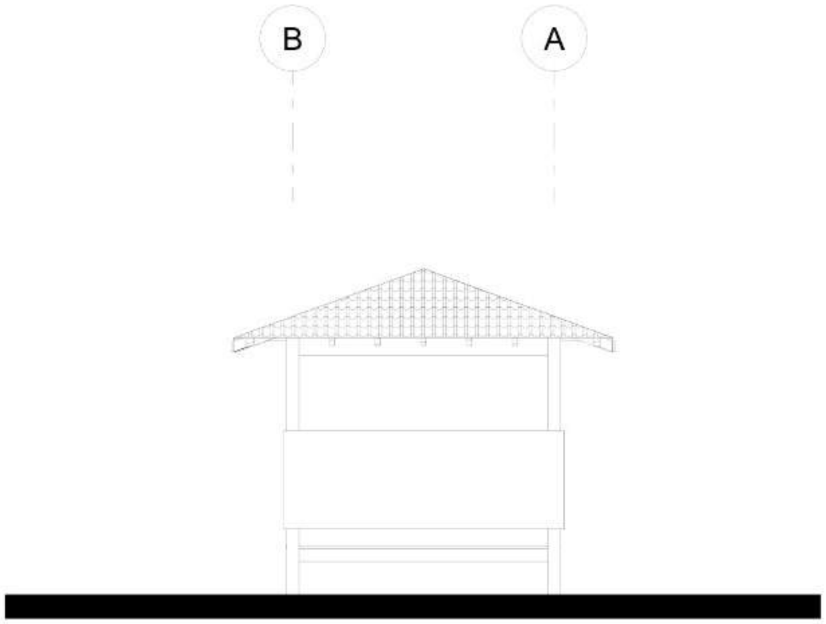
SECTION B-B'
SCALE 1:50



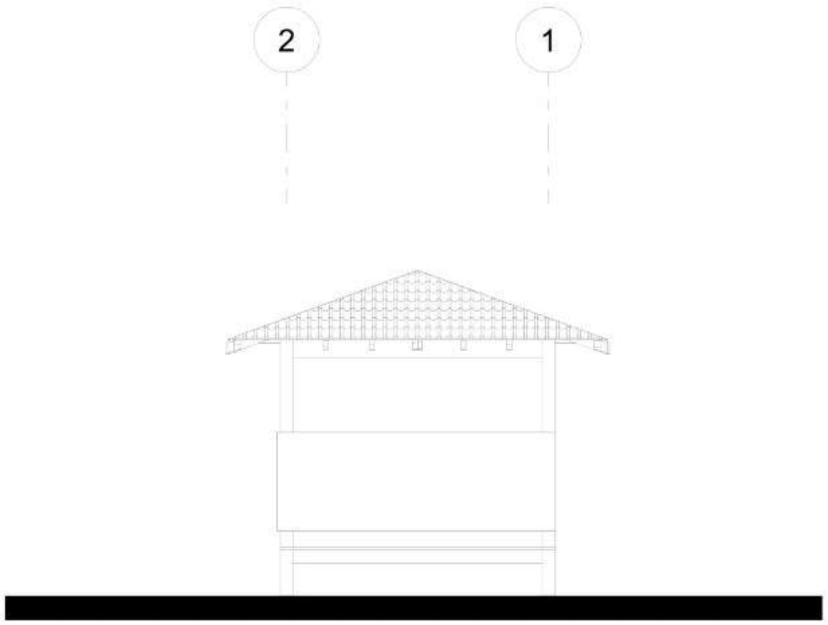
SECTION A-A'
SCALE 1:50



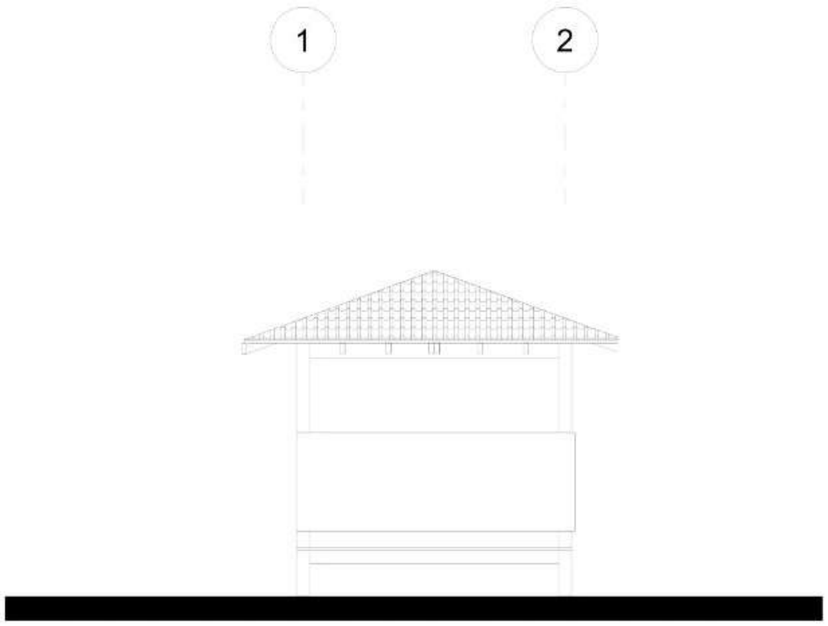
FRONT ELEVATION
SCALE 1:50



BACK ELEVATION
SCALE 1:50



RIGHT ELEVATION
SCALE 1:50

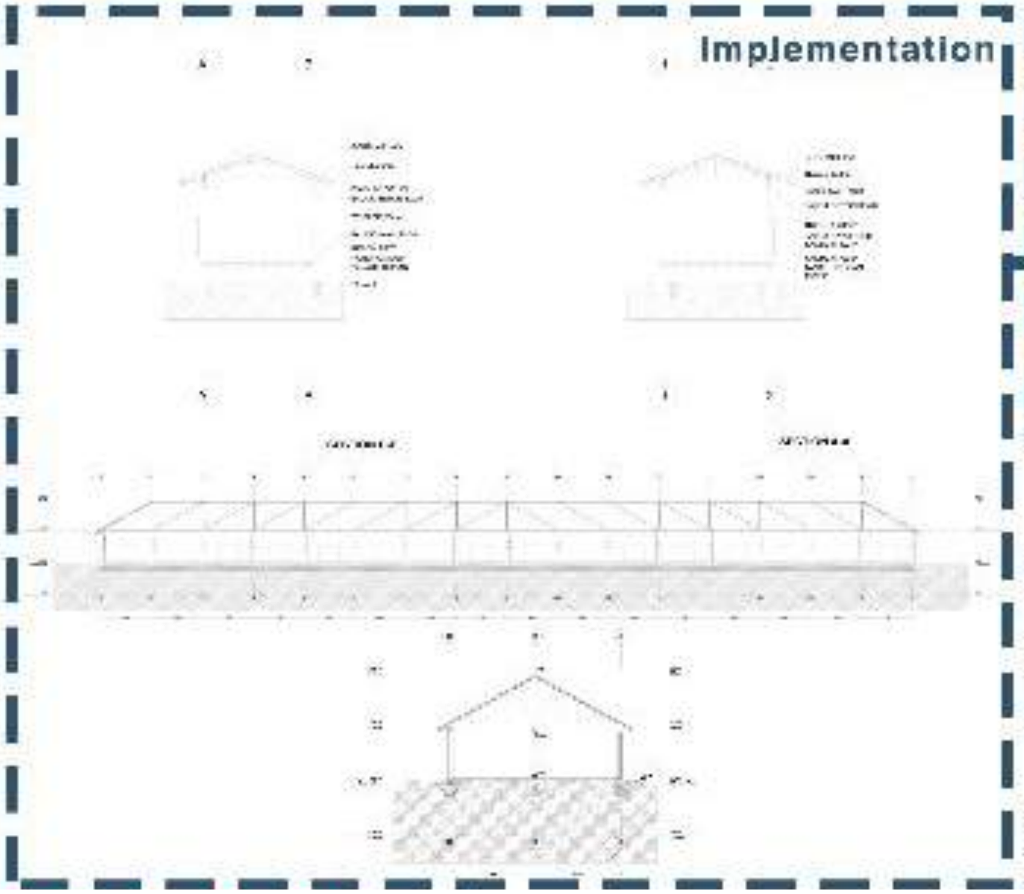


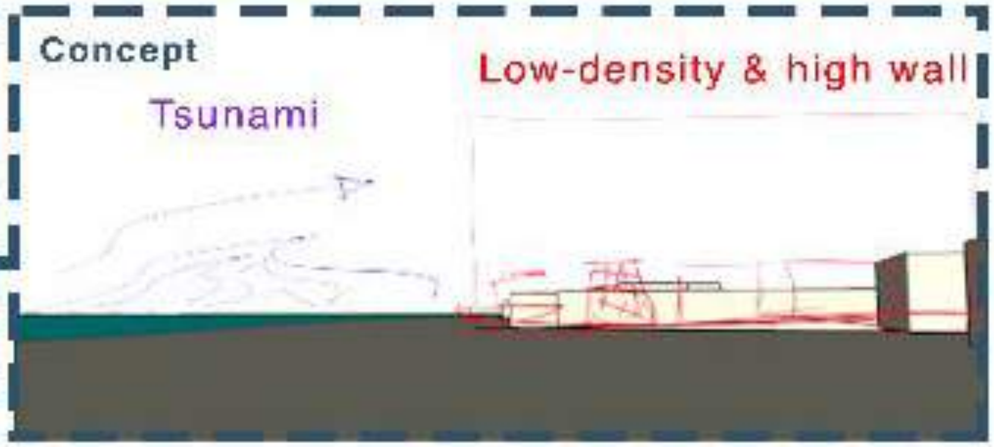
LEFT ELEVATION
SCALE 1:50

4.1 MASSING AREA SAFETY FOR TSUNAMI

These are the zonings, each zone has different ways to provide safetiness. The different zones will have different ways of both earthquake and tsunami mitigation.

4.2 SEAFRONT AREA SAFETY FOR TSUNAMI

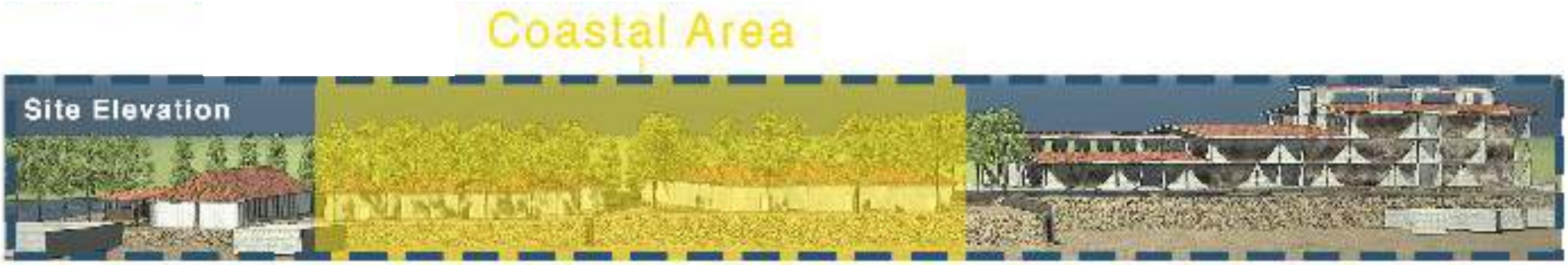


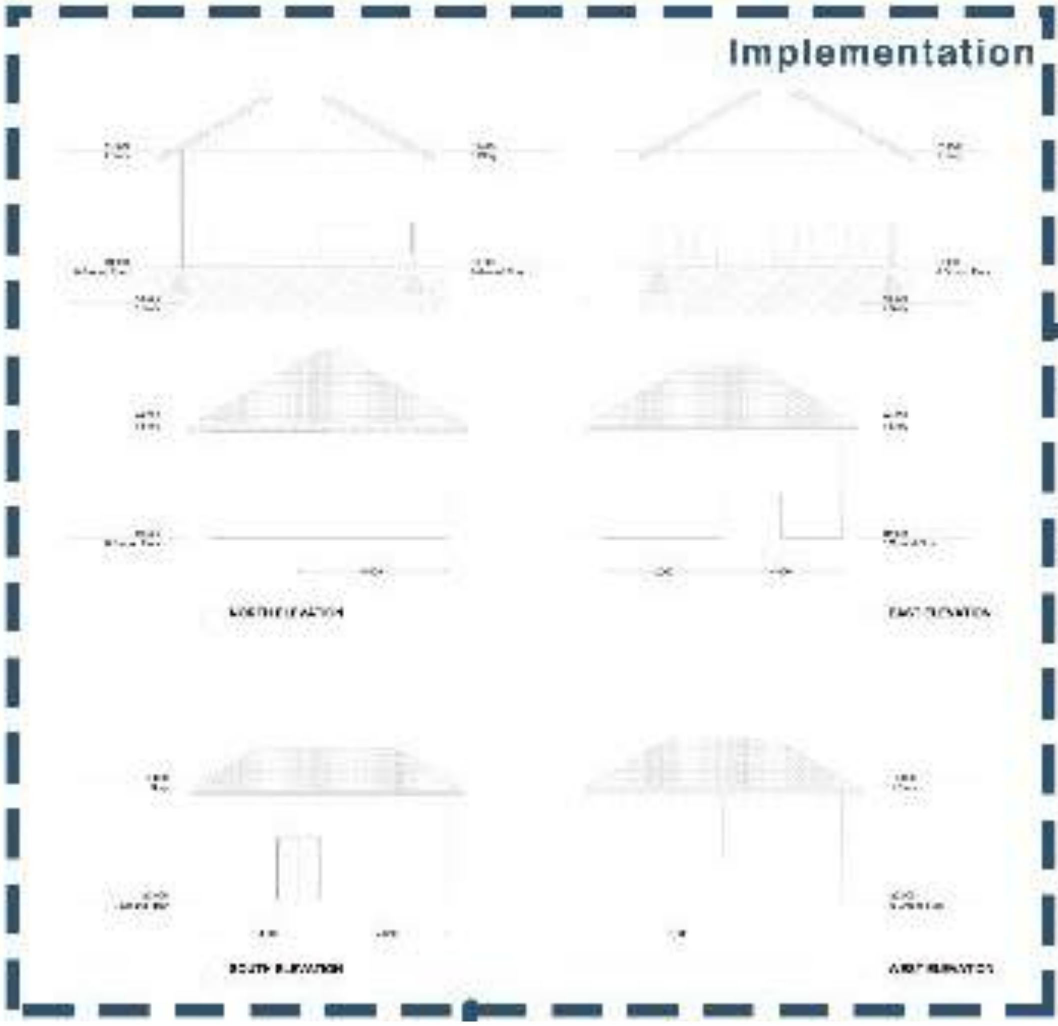


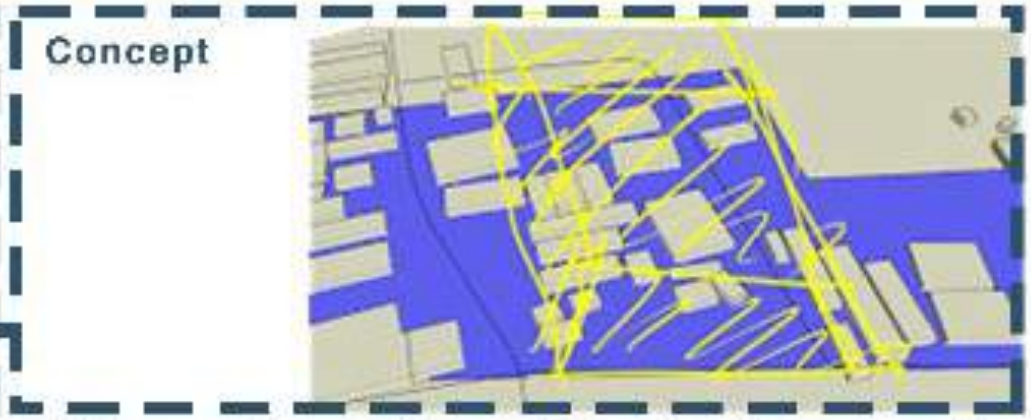
The seafront area will became the first one that face tsunami, therefore the area made for less activity. The low density building designed to prevent significant damage from the tsunami.

On seafront area, the foundation for the building, instead of using pile foundation, it will be using pad foundation, because its good to hold tsunami force.

4.3 COASTAL AREA SAFETY FOR TSUNAMI



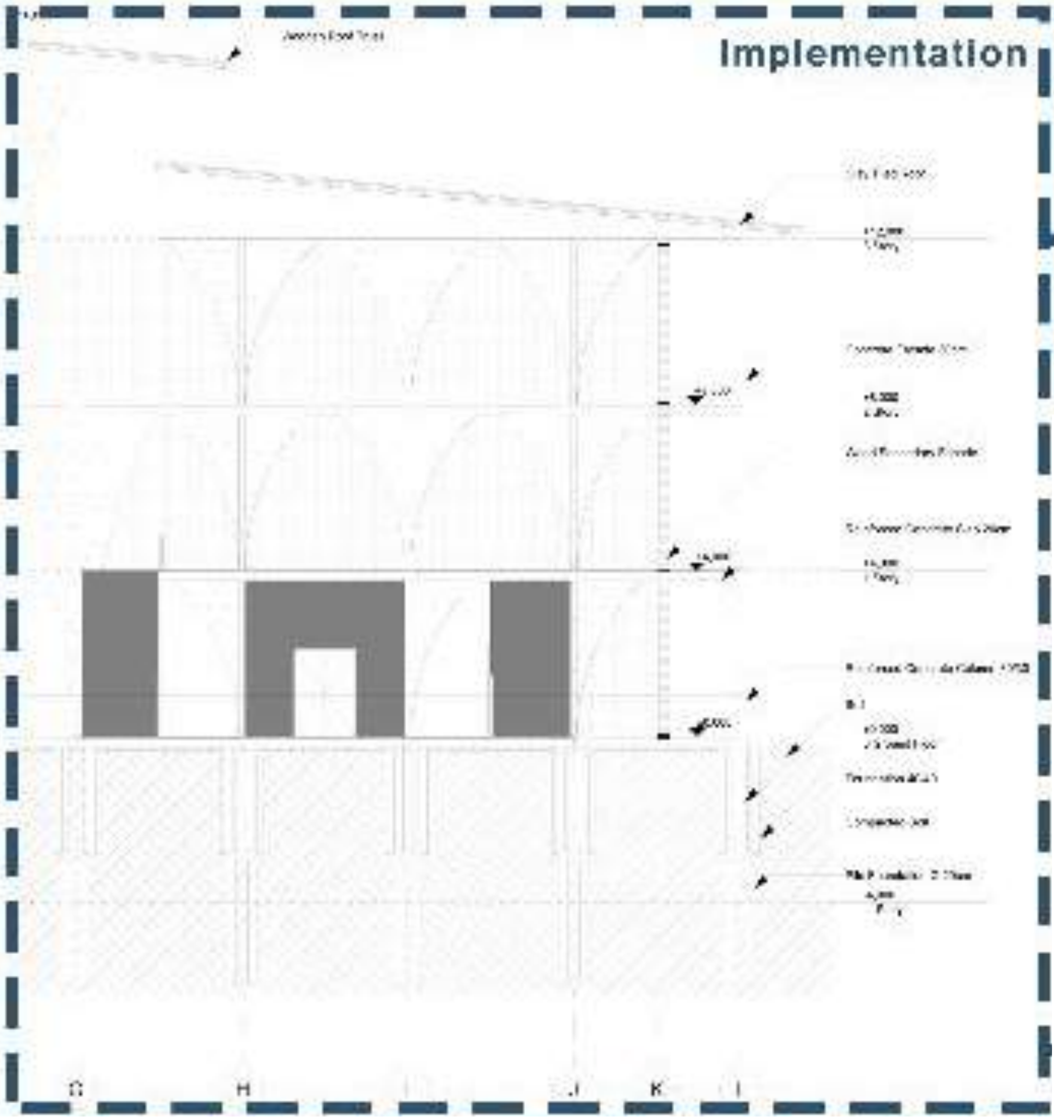


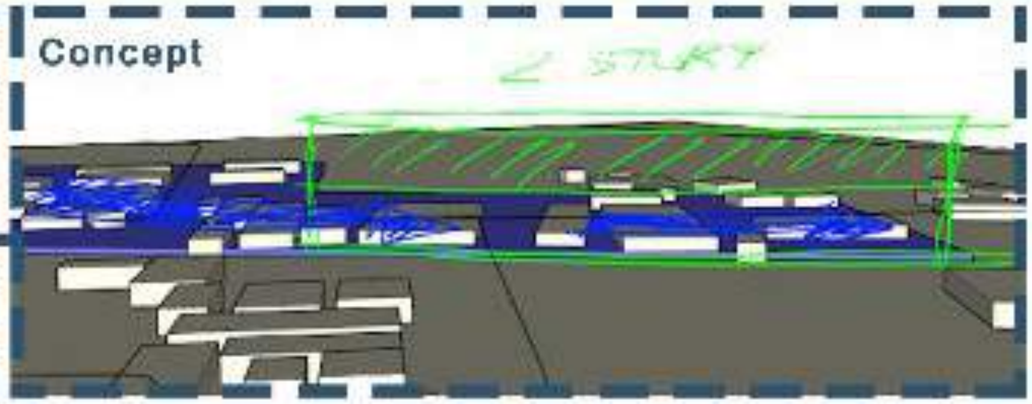


The configuration of the building on the coastal area will be more dense. Clustered building on this area will be as prevention on tsunami to slowing it down into inland area.

The strip foundation will be used in this coastal area, this foundation also good to held tsunami forces, also this makes the wave of tsunami dispersed and slowing down.

4.4 INLAND AREA SAFETY FOR TSUNAMI

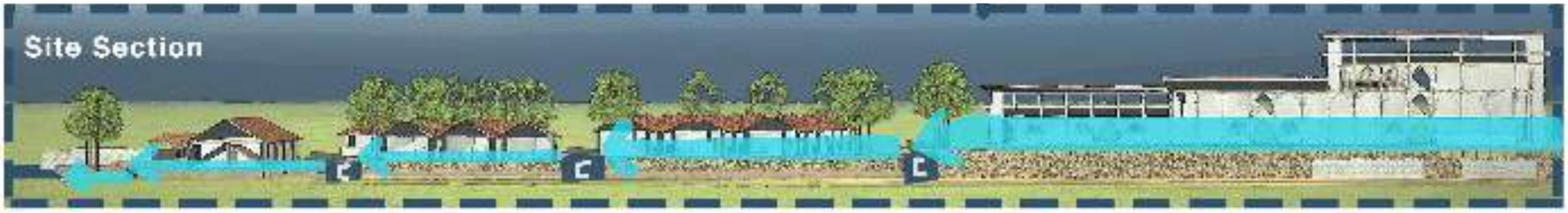




The inland area was provide to be a final place as shelter, so after several process of protection from tsunami, this area was elevated in order to let the remaining wave get through the building.

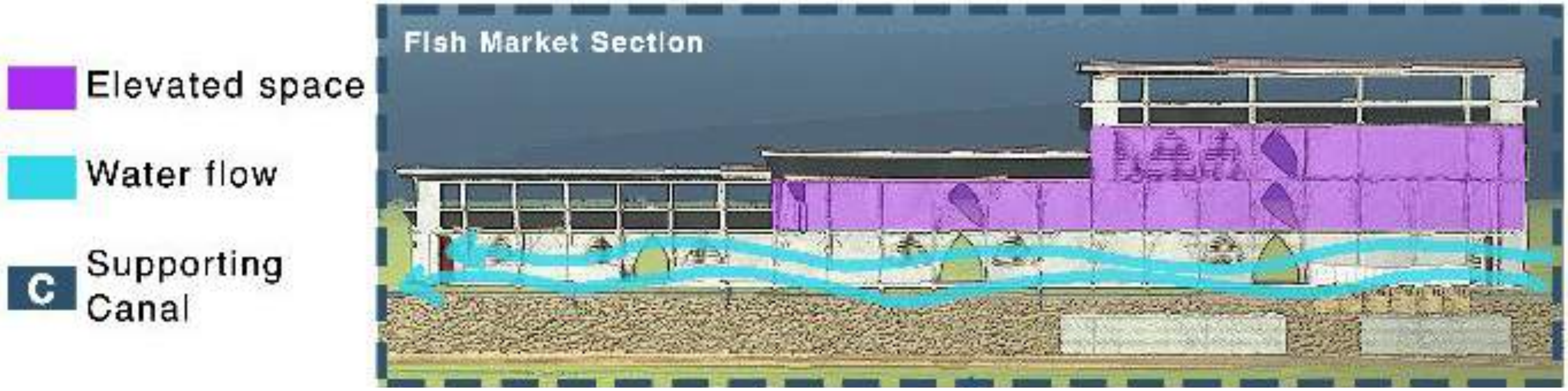
The pile foundation used in order to elevate the building. This elevated building will makes the wave let through the building, and makes the upper level of the building safe from the wave.

4.5 FISH MARKET TSUNAMI BUILDING SYSTEM



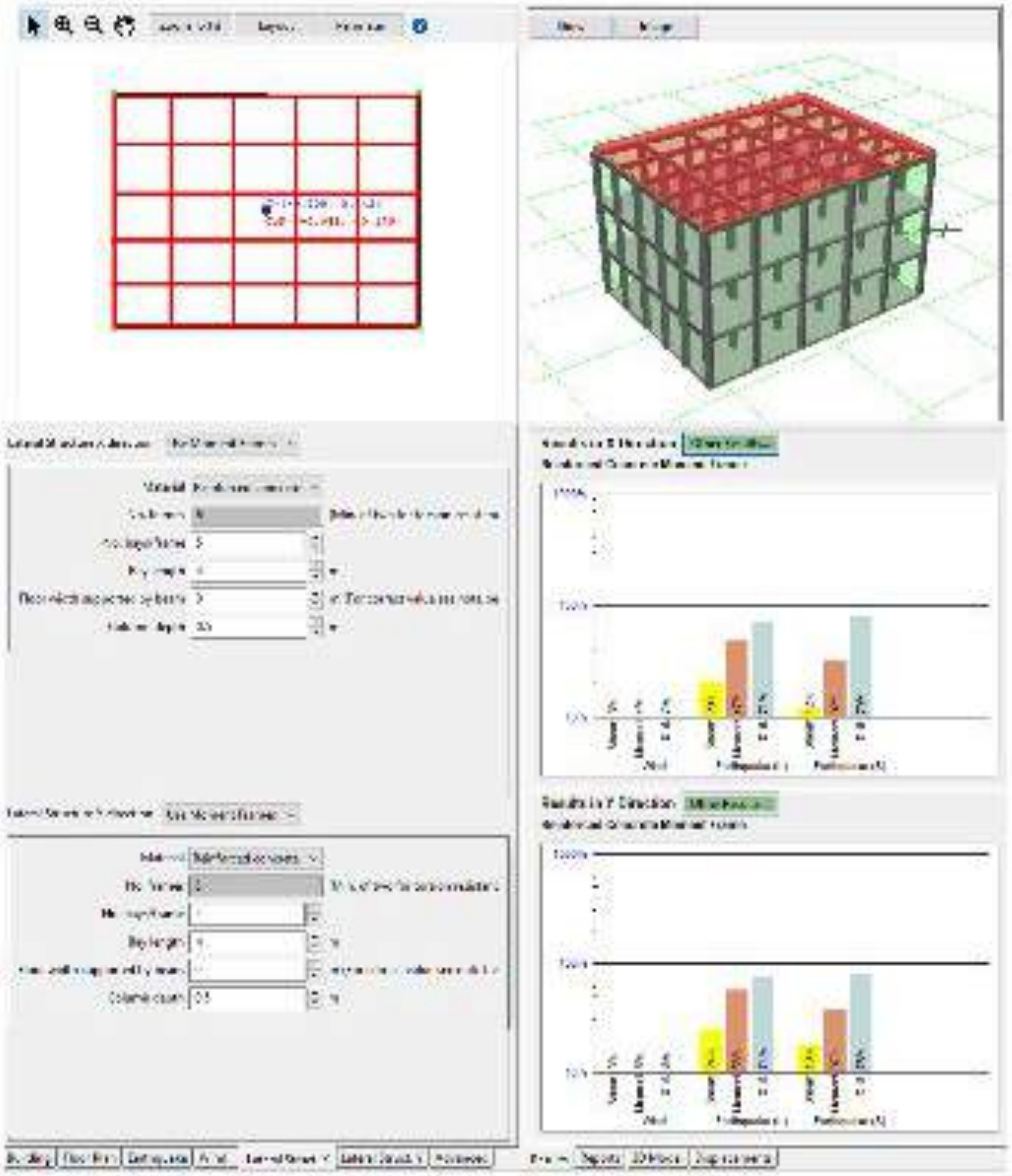
The fish market building have 3 story in total which each story having different function. Ground floor will act as emergency water way for Tsunami cases, while the upper floors wil act as a Shelter or a Safe Haven.

This elevated approach will also maximize the site's different height, as the water from fish market will flow naturally to lower zoning until it hit the sea.

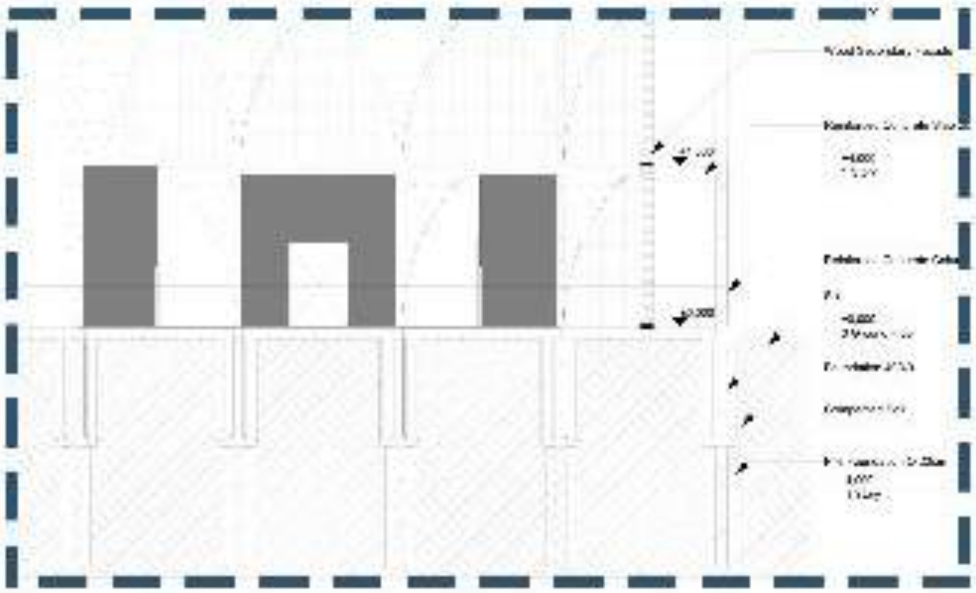


4.6 FISH MARKET EARTHQUAKE STRUCTURE SYSTEM

RESIST Analysis:



Implementation:

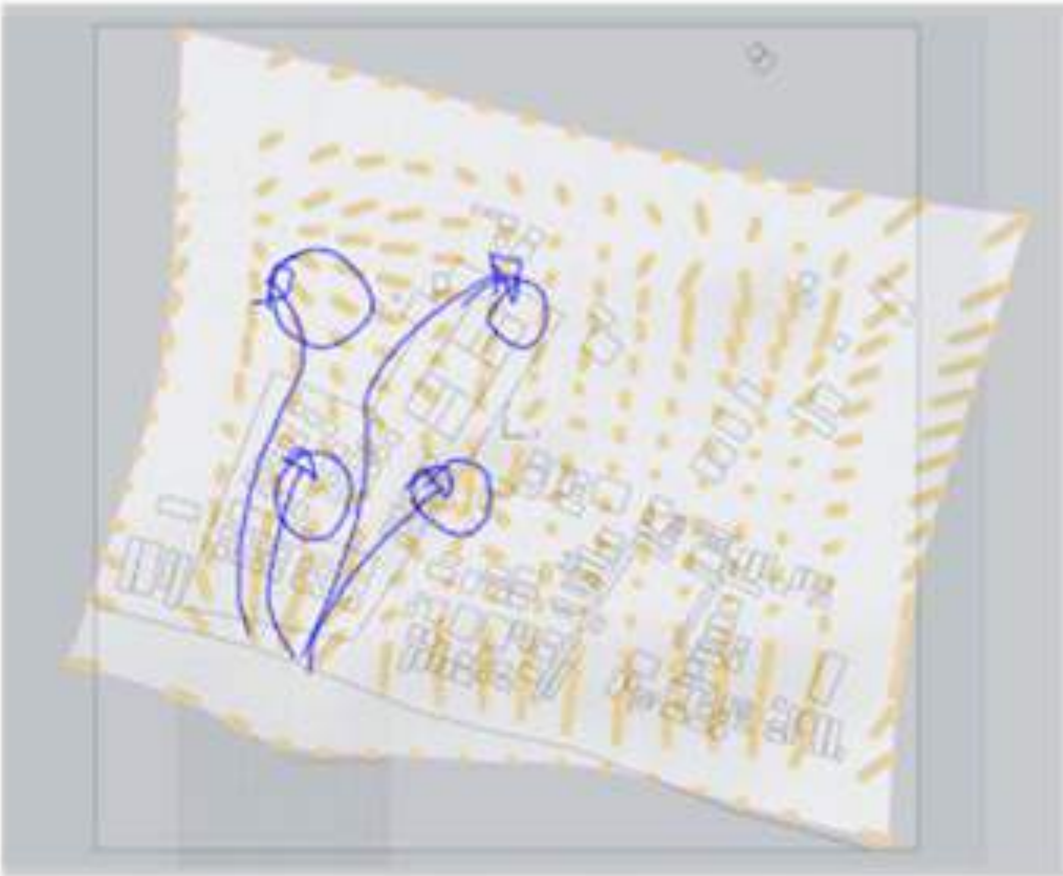


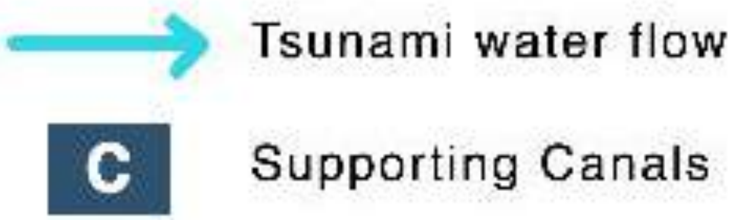
Building column design have a function as bracing of the building. And every 4 meters grid repetition to create strong bracing against earthquake forces, then this elevated column system was made for prevention from tsunami. This design was expected to make the building and occupants avoid the flow of water from tsunami on the ground.

4.7 CIRCULATION EVACUATION

The circulation from Seafront and Coastal area are directly connected to Fish Market which act as a Safe Haven before being evacuated.

4.8 SITE WATER FLOW





Analysis

The water flow test based on grasshopper and rhino program, the blue area has the most drowned area.

Responds

By using sloped design, tsunami water and rainwater in general will naturally goes to the sea.

There are also supporting canals between zoning to help channel water to surrounding of the site.

Chapter 5. DESIGN EVALUATION

Contents

5.1 DESIGN BRIEF EVALUATION

Jury	Comments	Response	Detail in Page
Dr. Yulianto P. Prihatmaji, S.T., M.T., IAI, IPM	What's a design challenges of market and safety building?	Location in seashore has both Tsunami and Earthquake natural challenges.	9, 24
	2. What's design parameter of fish market and seafood culinary? What's a differences?	The parameter is formed as conclusion of literature study. Fish market is a place to sell fresh caught fish, while Seafood culinary is restaurant which local people can sell their unique culinary seafood dishes.	35, 43-45
	3. Is there any specific TOR from the owner the project ?	The TOR in this case is a subject to responsiveness of Author to the problems.	8
Dr. Ing. Putu Ayu P. Agustiananda S.T., M.A.	Please explain the results of the literature studies you have conducted regarding earthquake-resistant building and waterfront facilities in an 'architectural way'.	There is a design guideline made that act as a conclusion to the literature studies.	35
	How did you explore and select the site, particularly pertaining to natural environmental safety aspects of Parangtritis Beach, as well as social cultural aspects of the local people. Support your arguments with site-survey or photographic documentation.	By first hand survey, asking local people, and through secondary medium such as literature, studies, even books that talk about Parangtritis Beach in general and how it performed when Tsunami and Earthquake happened in the past.	12-20, 26-29
	Please clarify the lessons you learnt from precedent studies regarding architectural typology, design methods, and design theme.	The site should have 3 distinct area typing with all of them have implemented canal system, while also having distinct structure system.	21-39

Table 5.1: Design Brief Evalution
Source: Author

5.2 COMPREHENSIVE EVALUATION

Jury	Comments	Response	Detail in Page
Dr. Yulianto P. Prihatmaji, S.T., M.T., IAI, IPM	Wrap up comments from Design Brief and update on your progress in a coherent, concise, and logical way.	Challenge, parameter, owner	4-9, 13, 17
	What's the Design Criteria and Design Guideline for the concepts? And what's the Concepts to solve the Problems	Guideline from SNI, Analysis from thematic review as guidelines.	35, 47-65
	What's Design Evaluation do you need to confirm your Design Aims?	Program Evaluation by building performance program. (Rhino, Grasshoper, Resist, Blender, etc.)	29, 64-65
	The site location better not directly hit by the wave of tsunami when it occured	Find some alternative site location, for now there are 2 alternative site location.	42-43
	Show the details of technical drawings and building function	Added some detail in main building technical drawing.	78-79
	Learn the characteristic of the tsunami and the earthquake	Need more research on the ministry of marine affairs and fisheries.	24, 39
Dr. Ing. Putu Ayu P. Agustiananda S.T., M.A.	What was the most critical issue you have managed to deal with?	To achieve the aims based on the guidelines, there are also several external factor (environmental)	62-65
	Explain how you applied the lesson learned from precedent studies (architectural typology, design methods, design theme) to develop your design concepts.	Explanation on 3d model	47-65
	Clarify how you explored facade and building forms based on aesthethics principles or art composition.	The form exploration cme from the environmental	47-56

Table 5.2: Comprehensive Evalution
Source: Author

5.3 FINAL DEFENSE EVALUATION

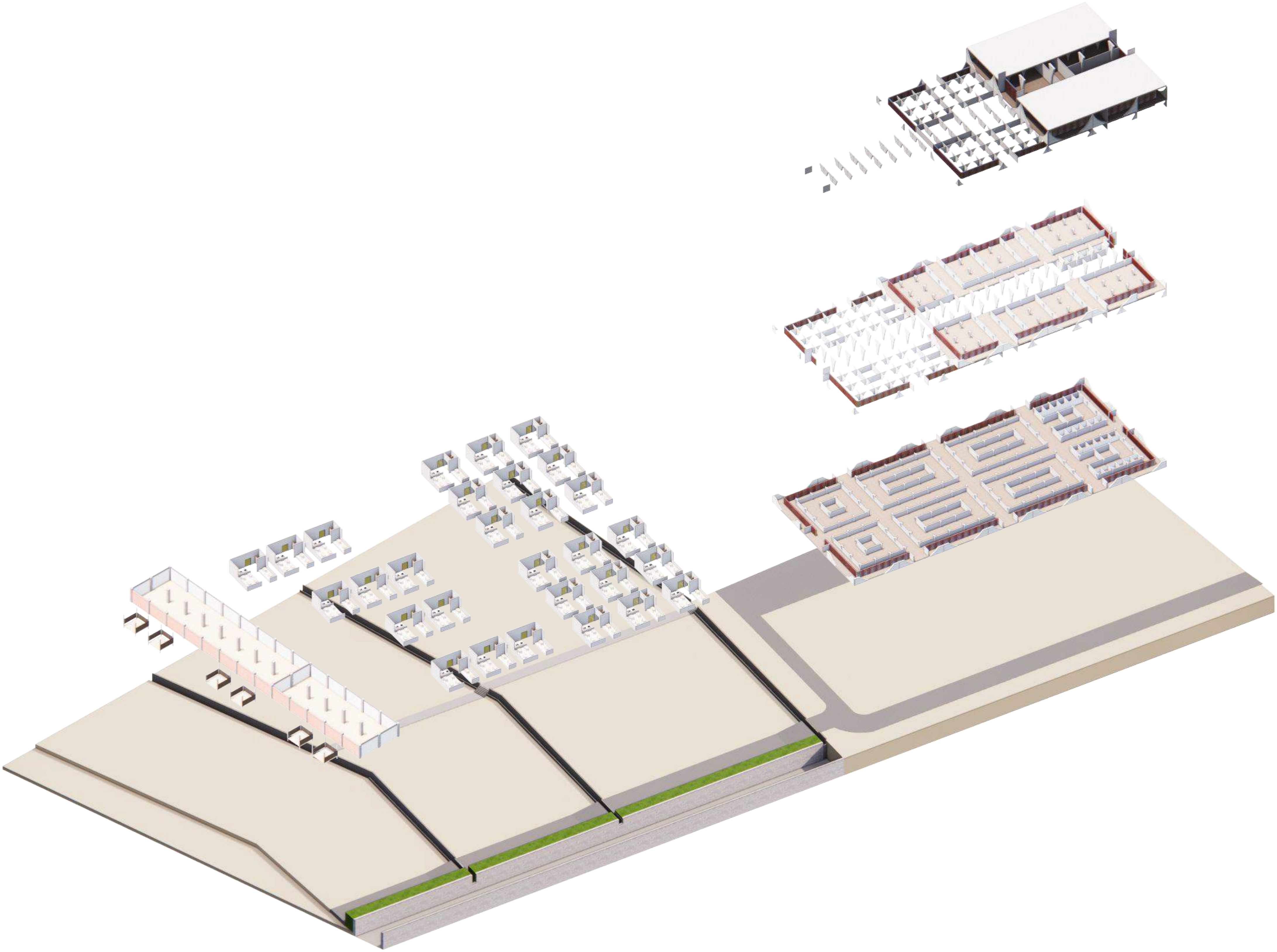
Jury	Comments	Response	Detail in Page
Dr. Yulianto P. Prihatmaji, S.T., M.T., IAI, IPM	As a prolog for your seminar, start with all responses againts all notes of design brief and comprehensive seminar. Show in your designs or documents as needed.	Technical drawings of all buildings and also masterplan with explanation is made.	68-85
	What's stategies to maximize functions of fish market based on spatial organization? Shows by your design using design criterias and adequate drawing	Implementation of each concept has been thoroughly explained.	86-93
	Shows your design criterias of an integrated fish market and seafood culinary in a meso area scale, and how to evuate that your design alteratives was the best way?	Implementation of the concept is explained with detailed drawing.	68-85
	How to enduser characters effects in the fish market and seafood culinary based on earthquake and tsunami disasters? Shows your design criterias, adequate study and your design.	Integrated system of the site and also how the buildings work with drawings to explain the implementation can be seen.	86-93
Dr. Ing. Putu Ayu P. Agustiananda S.T., M.A.	Explain how you applied the lesson learned from precedent studies (architectural typology, design methods, design theme) to develop your design concepts.	Through thorough and distinct typing of areas in the site a proper, detailed, and performative solution is achieved.	86-93
	Clarify how you explored facade and building forms based on aesthethics principles or art composition.	Facade and building forms are adjusted to the need of the concept, whilst also still maintaining some aesthethics.	87-89

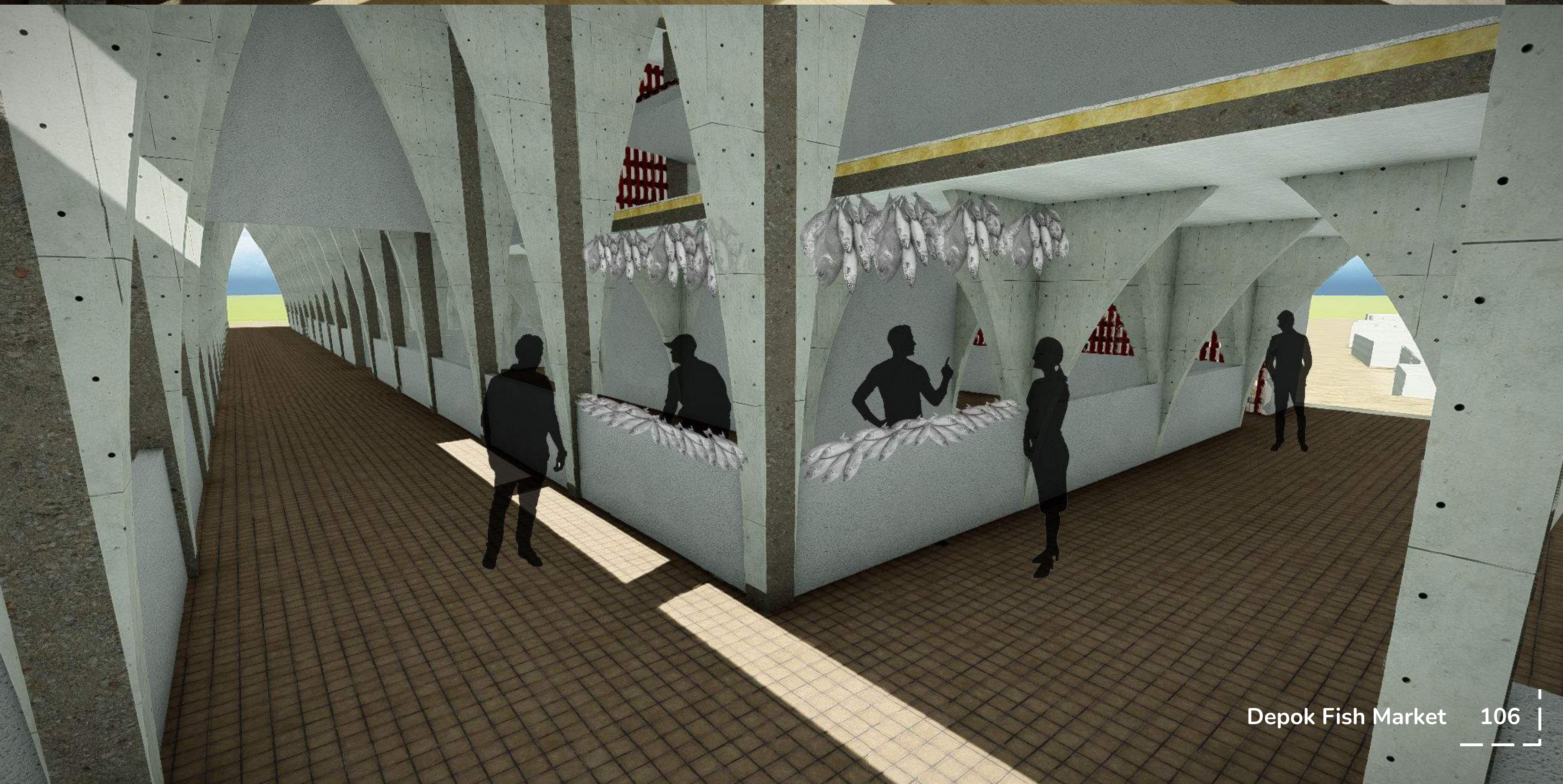
Table 5.3: Final Defense Evalution
Source: Author

5.4 CONCLUSION

1. The site will be contoured as way to break tsunami and also way to move the water back to the sea.
2. There will be canal in the east side of the site.
3. The building of fish auction will have taller wall as also a way to break tsunami.
4. The building structure module is using steel material with dimension simulated in RESIST.

5.5 VISUALIZATIONS





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