Final Architecture Design Studio

BUILDING PERFORMANCE & TECHNOLOGY LABORATORY

*Design of*

# Conservation House for Turtle

## in Goa Cemara, Sanden, Bantul

*with Ecological Approach*

Mode Jutta Dewi Haryono | 17512127

*Supervisor:*
Dr. Yulianto Purwono Prihatmaji, IPM., IAI.

DEPARTMENT of ARCHITECTURE

International Undergraduate Program in Architecture

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Final Architecture Design Studio 2022

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# Validation Page

Final Architectural Design Studio Entitled:

**Design of Conservation House for Turtle in Goa Cemara Beach, Sanden, Bantul with Ecological Approach**

Student's Full Name : Mode Jutta Dewi Haryono

Student's Number : 17512127

Has been evaluated and agreed on : Yogyakarta, 23 November 2022

| Supervisor | Jury 1 | Jury 2 |
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| Dr. Yulianto P. Prihatmaji, S.T., M.T., IPM., IAI. | Prof. Ar. Noor Cholis Idham, S.T., M.Arch., Ph.D., IAI | Dr. Ing. Putu Ayu P. Agustiananda, S.T., MA. |

Head of Undergraduate Program in Architecture

Ir. Hanif Budiman, M.T., Ph.D

# Supervisor's Notes

Final Architectural Design Studio Entitled:

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Design Report Quality of FADS : ~~Average~~ / Good / ~~Excellent~~ *) circle one

With ~~the result~~ of that, this product is

**Recommended** / ~~**Not Recommended**~~ *) circle one

To be a reference for Final Architectural Design Studio

Yogyakarta, 1 December 2022

**Supervisor,**

Dr. Yulianto P. Prihatmaji, S.T., M.T., IPM., IAI.

# Statement of Authenticity

The undersigned below:

| | |
|---|---|
| Student's Name | : Mode Jutta Dewi Haryono |
| Student's Number | : 17512127 |
| Faculty | : Civil Engineering and Planning |
| Final Architectural Design Studio entitled | : Design of Conservation House for Turtle in Goa Cemara, Sanden, Bantul with Ecological Approach |

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Mode Jutta Dewi Haryono

# Foreword

Praise and gratitude I pray for the presence of Allah SWT, author was able to complete the Final Architectural Design Studio Project entitled "Design of Conservation House for Turtle in Goa Cemara, Sanden, Bantul with Ecological Approach" up to this stage.

The process of preparing this thesis certainly cannot be separated from the help and support from various parties. Therefore, on this occasion the I would like to express his gratitude to:

1. Allah SWT, for the gracious mercy and tremendous blessing that enable me to accomplish this study.
2. My beloved parents who always provide love, constant support, prayers, and motivation. I owe them biggest gratitude, a thousand thank you are not even close to enough.
3. My supervisor, Dr. Yulianto P. Prihatmaji, S.T., M.T., IPM., IAI., I would like to give my gratitude and respects for the great patient, provided a lot of helps, inputs, and supports to complete this FADS project. Many thanks for your times and willingness to guide me for these several months.
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6. Mr. Fajar and fellow staff of Mino Raharjo Conservation Group in Goa Cemara, Sanden, Bantul, who gave me permission to do research and survey.
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10. My group friends during FADS project: Imara Dzakia, Shafira Satya, Panji Sultan, 'Aisy Sumardhiya, Aris Ryant, Eno Rahadi, Ilia Raiskha, Dwi Karina, and Namira Nadhindra. Thank you for surviving this far, helping, comforting and encouraging each other.
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12. All parties that cannot be mentioned one by one who genuinely help and support me.

Author,

Mode Jutta Dewi Haryono

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## Design *Premise*

The turtle conservation center at Goa Cemara Beach in Sanden, Bantul is one of the efforts of the local community to protect and conserve turtles. Because the turtle population is increasingly threatened, mainly due to human activities, it is necessary to increase awareness of the importance of protecting turtles and its environment. With the development of ecotourism on the coast of Bantul to protect the coastal area, the construction of a new conservation center by increasing conservation facilities as a medium to provide recreational education is needed. Thus, this project will accommodates activities related to turtles from hatchery to captivity which includes conservation, education and tourism facilities. The conservation facilities that provided include hatchery, captive ponds, and management offices. Meanwhile the education facilities are a conservation center with gathering space for active education and gallery/interactive visual media for passive education. Another supporting facilities for tourism will be added, such as toilet, musholla, food court and souvenir corner.  This conservation center uses an ecological architectural design approach that responds to environmental conditions and the activities carried out in it. The ecological aspect will be focused on building design that consider the tropical coastal climate, energy efficiency, and the use of sustainable local materials. This approach was chosen as an effort to create a harmonious relationship between the building and the site in order to preserve nature and the comfort of living creatures in the area.

*chapter 1*

# INTRODUCTION

## 1.1 Background

### 1.1.1 Endangered Turtle

Turtles is very important for coastal and marine ecosystems. However, as time goes by, the existence of turtles is increasingly threatened with extinction. In government regulation number 7 of 1999 concerning the Preservation of Plant and Animal Species in the attachment to the List of Protected Animals, it is stated that all types of turtles that exist in Indonesia have legal status protected by law. In addition, the red data book of the International Union for Conservation of Nature (IUCN) and the Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES), all types of wildlife turtles have been categorized in the list of appendix I or the status of the existence of life in the world has been at the level of the threat of extinction.

Many things threaten the existence of turtles, such as predators and exploitation by humans. In Indonesia, humans are one of the one of the main factor that contribute to the decreasing number of turtle population due to illegal hunt and trade. For example, nowadays, sale of turtle eggs can still be found. This is an effect of the public myth of the efficacy of turtle eggs consumption. Besides that, humans also play a  huge role in coastal damage and sea pollution. The development of coastal tourism that increased lately, makes turtles lose their ideal area for laying eggs (nesting). Tutle tend to choose a nesting area that is wide and sloping, quiet with no light. Unfortunately, most of developer doesn't pay attention to turtle's characteristic that sensitive to light and sound. Besides that, sea pollution often causes habitat destruction, which causing sea turtles to get sick or even die. In this case, human awareness of the importance of maintaining coastal biodiversity, especially turtles, needs to be increased so that natural ecosystems are maintained.

Figure 1. Sale of turtle shell jewelry
Source: https://www.turtle-foundation.org/pt-pt/programa-indonesia/ (accessed on 18 June 2022)

Figure 2. Sale of turtle eggs on a market stand
Source: https://www.turtle-foundation.org/pt-pt/programa-indonesia/ (accessed on 18 June 2022)

Figure 3. Turtle Conservation House in Goa Cemara Beach
Source: Author, 2022

Figure 4. Existing hatchling ponds
Source: Author, 2022

## 1.1.2 Turtle Conservation Center in Goa Cemara Beach

Goa Cemara Beach in Sanden, Bantul, Yogyakarta is one of area that become a favorite place for turtle to laying their eggs. It is because this beach is wide and sloping with a lot of cemara udang/pine trees (Casuarina equisetifolia). Due to concerns about the decreasing population of turtles, the local community of Goa Cemara Beach, created a Conservation Group named Mino Raharjo. This group built a conservation center in 2010 cooperate with Department of Fisheries and Marine of Yogyakarta and Natural Resources Conservation Center (BKSDA). For 12 years, this conservation house has succeeded in caring for and releasing thousands of turtles into their habitat. Within a year, more than 1,000 turtles have been released by them into the sea. During 2009 to 2015 it was recorded that 8,000 turtles were saved by Mino Raharjo.

**Conservation Center That Is Not Optimal**

According to author's interview with Mr. Fajar, the secretary of Mino Raharjo Group (2022), current conservation house does not appear to be optimal. The turtle hatchery pond is still temporary ponds with manual seawater filling system. In fact, the seawater filling system is better to use a pump so that the water can be replaced more easily and continues to flow.


## 1.1.3 Goa Cemara Beach and Ecotourism Potency

Referring to the Decree of the Bantul Regent No. 284 of 2014 concerning Reserves for Coastal Park Conservation Areas in Bantul Regency, the coastal area of Bantul Regency has the potential for natural resources in the form of turtles and mangrove vegetation, which has the attractiveness of living natural resources, geological formations, and/or natural phenomena that can be developed for the benefit of utilizing the development of science, research, education and awareness raising of natural resources, biological, marine tourism, and recreation.

Goa Cemara Beach area is one of the tourist destinations in Bantul that has potential for ecotourism. As its name, this beach offers a beach area with many *cemara udang*/pine trees (Casuarina equisetifolia) and sea turtles as the icon of this beach. This beach has been a place for the preservation of pine trees and sea turtles. For a long time, local community groups have collaborated with the government to preserve the local flora and fauna.

**Not Optimal for Tourism Support**

However, turtle conservation in Goa Cemara still has not maximized its potential as part of ecotourism. This can be seen from the closing of the conservation center outside the turtle migration period. In fact, education to the community does not have to be practiced only during the migration period. Education can still be done by adding attractive tourist support facilities, passive education such as galleries or interactive visual media that convey information about turtles. Besides that, Mr. Fajar also said that they don't have an adequate gathering space for presentations when there are large group of visitors. In addition, many people do not know about turtle conservation in Goa Cemara. Meanwhile, with tourists visiting the Goa Cemara area every day, there is bigger chance for the turtle conservation house to be a medium to increase public awareness to protect the environment and turtles, also it can increase the economic of surounding community.

Figure 5. Icon of Goa Cemara Beach
Source: https://raskita.com/pantai-goa-cemara-bantul/ (accessed on April 2022)

Figure 6. Pine Trees in Goa Cemara Beach
Source: https://pantaiha.web.app/pantai-goa-cemara-bantul.html (accessed on April 2022)

### 1.1.4 Sustainable Building for Conservation

"This beach is our asset, an asset for the local government, as well as the community. We hope that we will take care of this asset to realize an environmentally friendly Bantul, friendly in the tourism sector," said Deputy Regent of Bantul Joko Purnomo (2021).

The coastal area is one of the important tourism sectors in Yogyakarta. However, with the increasing growth of coastal tourism, of course the threat of damage to the coastal environment is increasing. The building that will be build in Goa Cemara Beach area, which has been a place for conserving pine trees and turtles also developing ecotourism, should pay attention to the surrounding environment. Because architecture is very close-related to the surrounding environment, we must consider designs that minimize the negative impact on our surroundings. In this case, green architecture is one of the right options so that we can create buildings that are environmentally friendly and in accordance with the concept of conservation.

## 1.2 Problem Statement

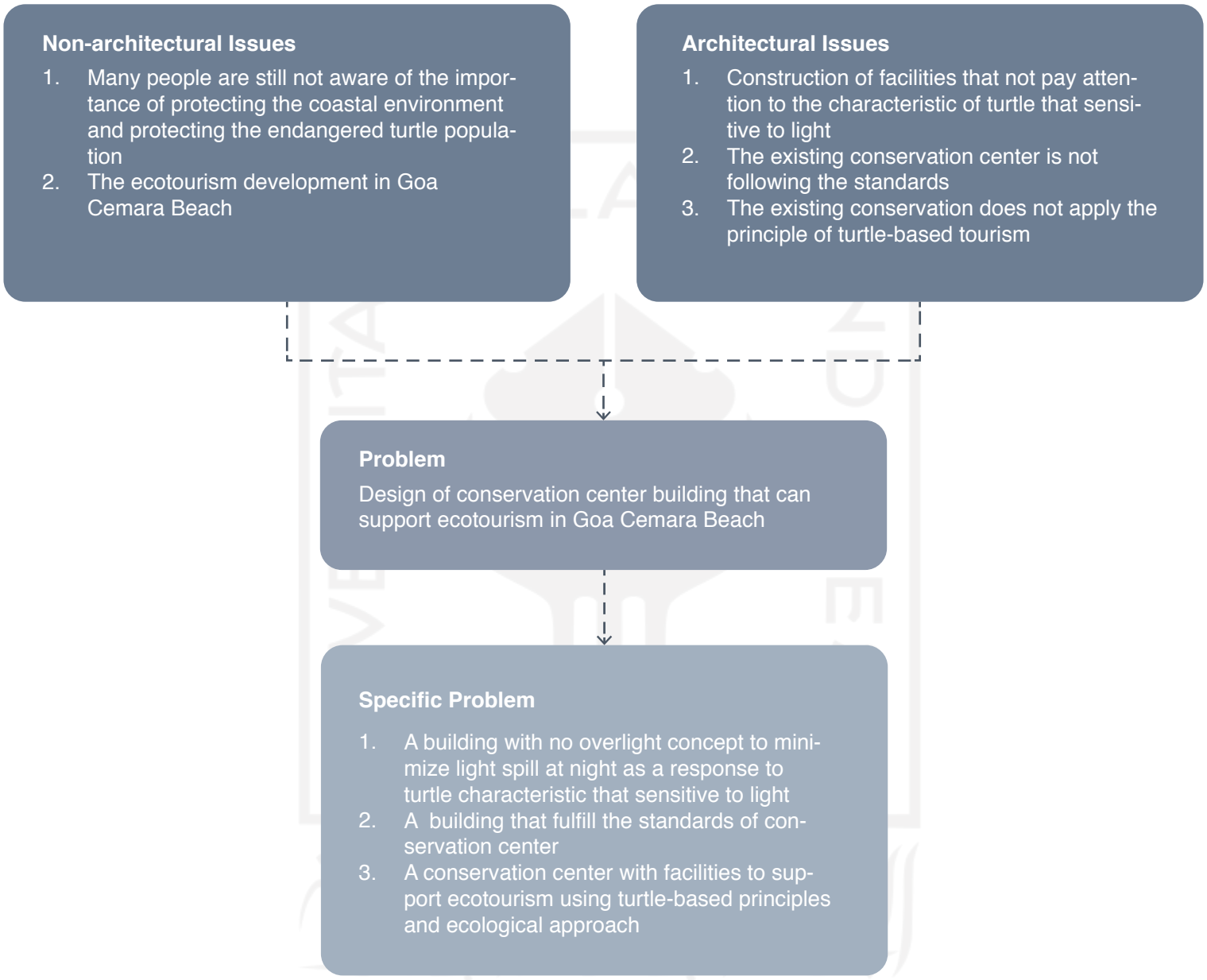



Figure 7. Diagram of Problem Mapping
Source: Author, 2022

## 1.3 Objectives and Limitation

**Design Aims**

To design a conservation center building that can support turtle-based ecotourism in Goa Cemara Beach

**Design Objectives**

1. Design a building near turtle nesting area that lay attention to turtle characteristic that sensitve to light
2. Design of building that fulfill the standards of conservation center
3. Design of conservation center with facilities to support ecotourism using turtle-based principles and ecological approach

**Architect**

1. Designing a conservation center that also support the ecotourism in Goa Cemara Beach, Sanden, Bantul
2. Design including mass planning, spatial planning, building envelope, landscape, and structures
3. The building is designed based on turtle-based tourism and ecological approach that consider site context

**Client**

Mino Raharjo Turtle Conservation Group of Goa Cemara, Sanden, Bantul

**User**

The user of this conservation center is conservation worker of Mino Raharjo, researcher, and visitors of Goa Cemara Beach

## 1.4 Design Methods

**1. Background and Issues**

Background issues are obtained by looking for a problem that occurs in an area, then deepening it by using data that can support the problem so that the cause can be found.

**2. Analysis**

After define the problems, we try to find out which problem-solving methods are most relevant to solve the problems. The problem solving method is analyzed according to the context behind the problems that occur, so that it will be studied first to obtain an approach to the design so that the design can function as a problem solver that occurs in the building. In this design process, besides context studies, we try to learn about turtle life cycle first. From there, we can implement turtle-based design for our building.

**3. Design Problem**

At this stage, the previously tried approach will be derived into variables and parameters that detail the problem-solving actions of each approach. This action is then matched to relevant design elements, such as building mass arrangement, building facades, landscape, and spatial layout.

**4. Design Concept**

The concept will be very closely related to the schematic design that will be carried out. This will be done based on the strategic design and ideas that have been obtained previously

**5. Evaluation**

At the design test stage, we do a design test for lighting using velux and/or AGI32 Light Simulation Software

## 1.4 Framework of Thinking

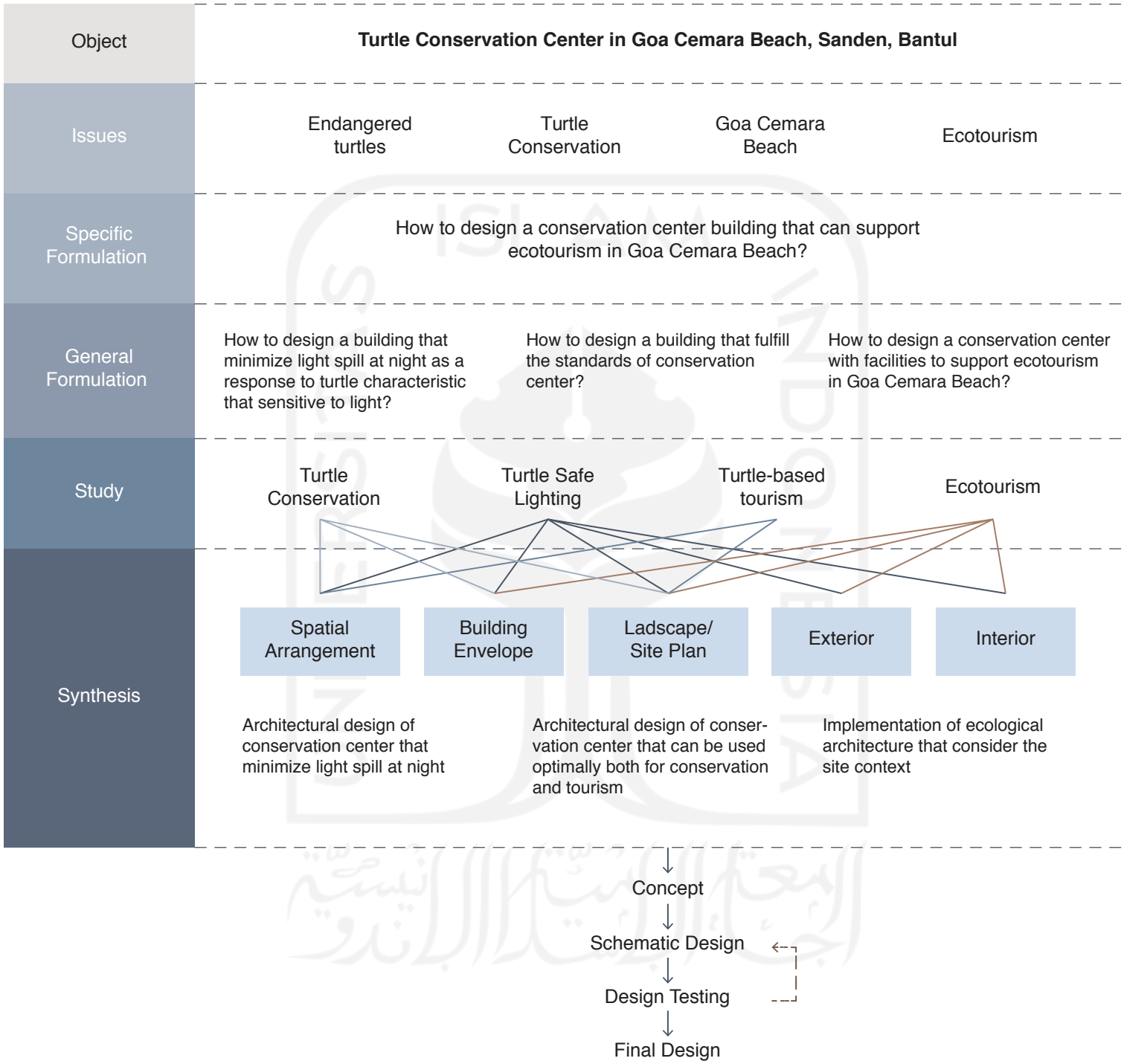



Figure 8. Diagram of Framework of Thinking
Source: Author, 2022

## 1.6 Originality and Novelty

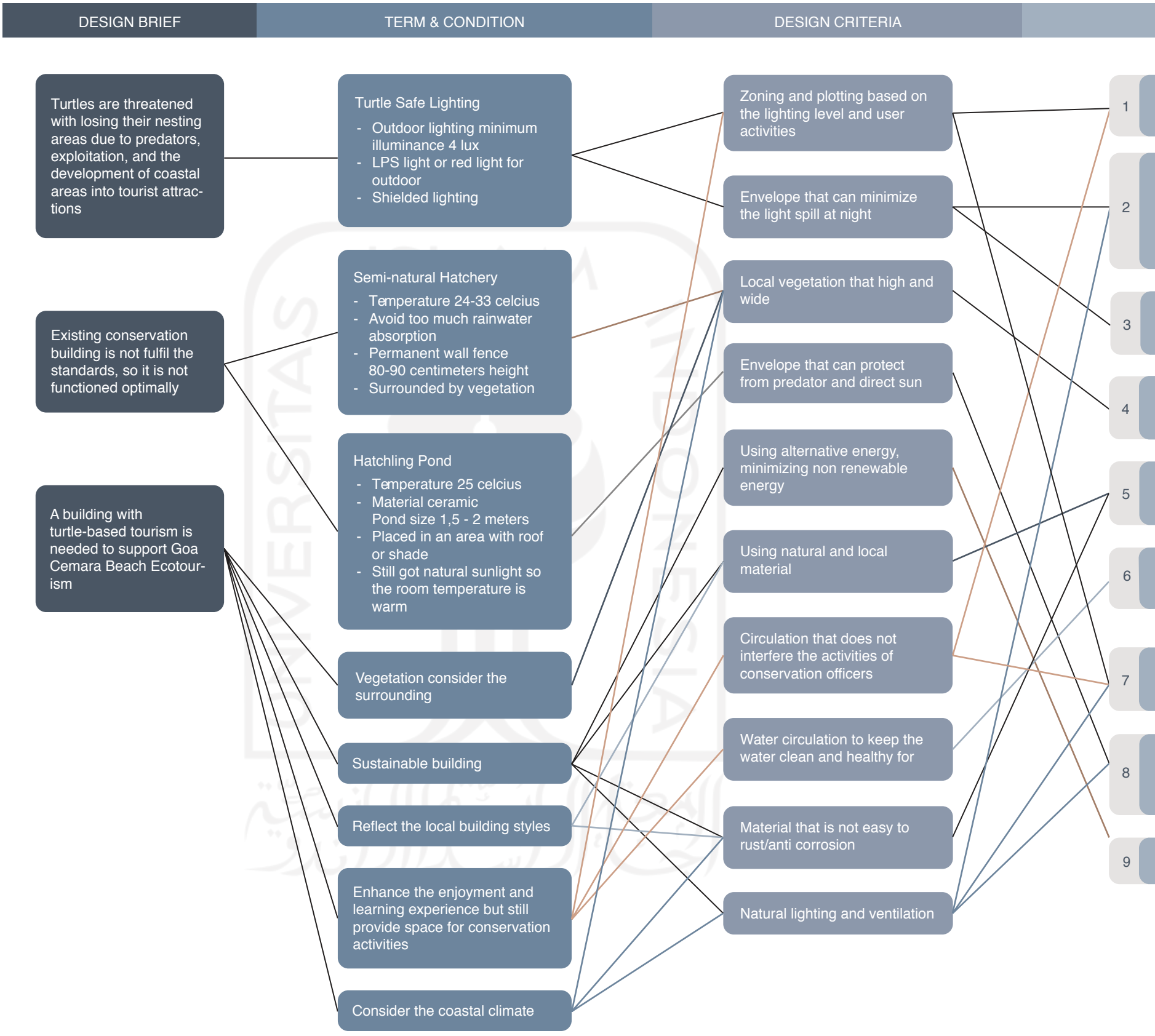
Table 1. Originality and Novelty

| Title | Author | About | Difference |
|---|---|---|---|
| Design of Kili-Kili Turtle Conservation Area in Trenggalek with Community Based Design Approach | Kabib Rosadi, 2018 | Discuss about the design process of turtle conservation in Kili-Kili with Community Based Design, as media for education, conservation and tourism for the community | Design approach and methods |
| Design of Belitung Cultural Center with Ecological Approach | Nurul Rizki Ananda, 2021 | Discuss about creating cultural center using ecological approach | Building typology and design goals |
| Design of a Science Center in BSD City, South Tangerang with an Ecological Architecture Approach | Muhammad Nauval Abdurrahman, 2020 | Discuss about Science Center as an educational tour based on science and technology, with an ecological approach | Building typology and design goals |

Source: Author, 2022

*chapter 2*

# DESIGN PROBLEM STUDY


DESIGN BRIEF
TERM & CONDITION
DESIGN CRITERIA
Turtles are threatened with losing their nesting areas due to predators, exploitation, and the development of coastal areas into tourist attrac-tions
Existing conservation building is not fulfil the standards, so it is not functioned optimally
A building with turtle-based tourism is needed to support Goa Cemara Beach Ecotour-ism
Turtle Safe Lighting
- Outdoor lighting minimum illuminance 4 lux
- LPS light or red light for outdoor
- Shielded lighting
Semi-natural Hatchery
- Temperature 24-33 celcius
- Avoid too much rainwater absorption
- Permanent wall fence 80-90 centimeters height
- Surrounded by vegetation
Hatchling Pond
- Temperature 25 celcius
- Material ceramic Pond size 1,5 - 2 meters
- Placed in an area with roof or shade
- Still got natural sunlight so the room temperature is warm
Vegetation consider the surrounding
Sustainable building
Reflect the local building styles
Enhance the enjoyment and learning experience but still provide space for conservation activities
Consider the coastal climate
Zoning and plotting based on the lighting level and user activities
Envelope that can minimize the light spill at night
Local vegetation that high and wide
Envelope that can protect from predator and direct sun
Using alternative energy, minimizing non renewable energy
Using natural and local material
Circulation that does not interfere the activities of conservation officers
Water circulation to keep the water clean and healthy for
Material that is not easy to rust/anti corrosion
Natural lighting and ventilation
1
2
3
4
5
6
7
8
9

| DESIGN GUIDELINES | CONCEPT | SCHEMATIC | DRAWING |
|---|---|---|---|

Separate the visitor area and conservation area based on lighting level and activities

Opening that can maximize natural light and air circulation to enter the building during the day but can be completely closed at night (especially that face the beach)

Door for entrance-exit does not face the beach

Type of local vegetation that high and wide

Ecological materials: wooden, stainless steel, bricks, and concrete for the materi-

Sea water pump istallment for easier clean sea water circulation for turtle

Building mass arrangement and orienta-tion consider the climate and site condition

Sun intensity to hatchery and hatchling pond area so that the hatching and growth of turtles is not disturbed

Solar panel as renewable energy

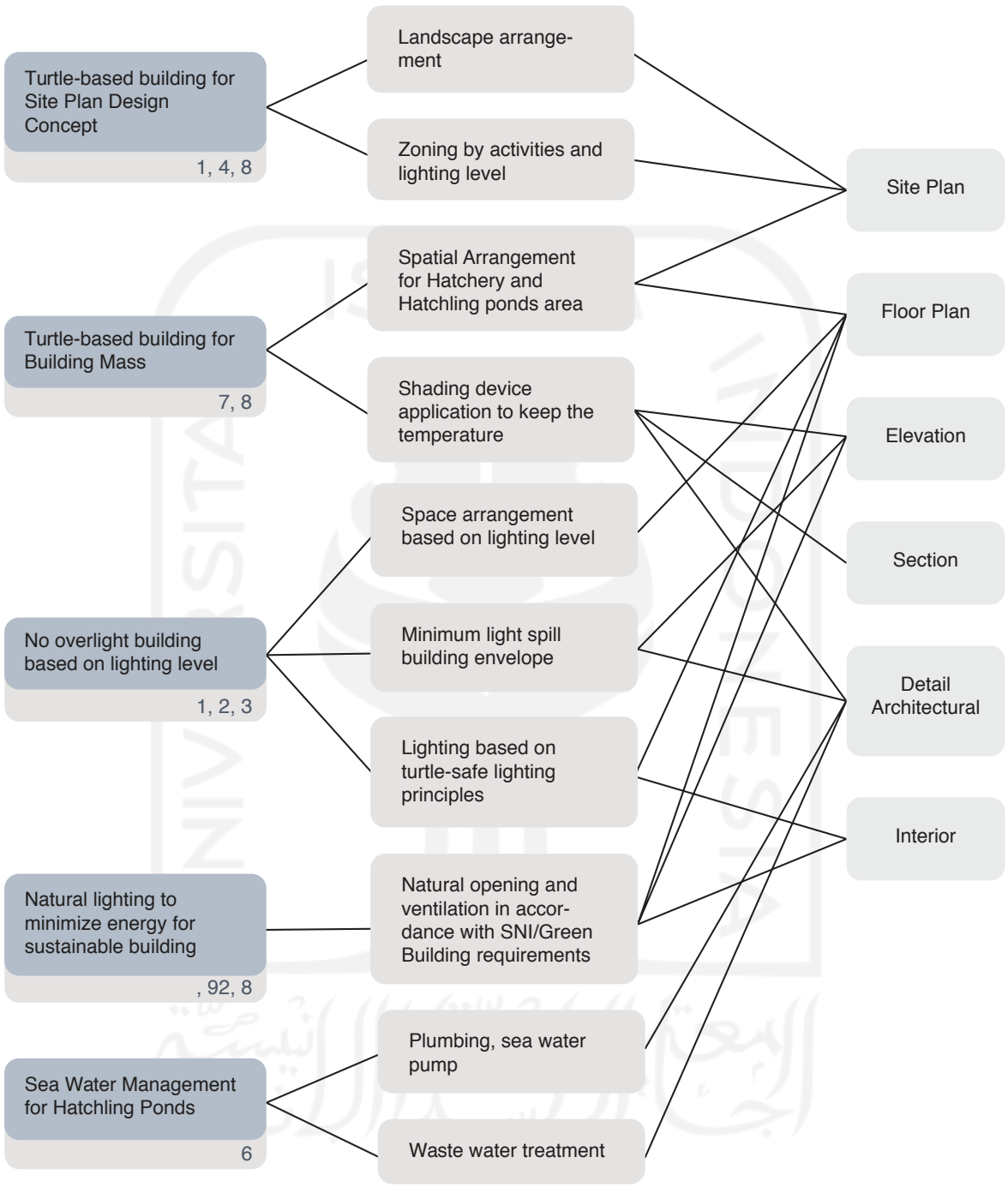



Figure 9. Diagram of
Source: Author, 2022

## 2.1 Site Context Study

Yogyakarta, Indonesia

Bantul Regency

Gadingsari Village,
Sanden District


## 2.1.1 Goa Cemara Beach

Goa Cemara Beach is located in Gadingsari Village, Sanden District, Bantul Regency, Special Region of Yogyakarta. It is one of tourist destinations on southern coast of Bantul. It is named Goa Cemara because this beach has a lot of *cemara udang*/pine trees that are line up neatly and look like a cave. Those pine trees are to protect seawater abrasion and hold the sand dunes, so there is no displacement occurs due to the wind. This beach has soft black sand and strong winds in accordance with the character of the south coast.

## 2.1.2 Turtle Conservation in Goa Cemara

The turtle conservation house in Goa Cemara is located in Rajiman street in Goa Cemara Beach Tourism Area, Sanden, Bantul Regency. It is about 150 meters from the beach area for turtle nesting. The site area is 3000 square meters, surrounded by plantation of local residents. Goa Cemara Beach Area offers a beach area with many pine trees (Casuarina equisetifolia var. Incana) and sea turtles as the icon of this beach. This beach has been a place for the preservation of pine trees and sea turtles. For a long time, local community groups have collaborated with the government to preserve the local flora and fauna.

Figure 10. Macro-micro map of Goa Cemara, Sanden, Bantul
Source: Digitized by author, 2022

## 2.2 Site Analysis


Figure 11. Proposed Site Location
Source: Digitized by author (from Google Earth), 2022

Figure 12. Goa Cemara Parking Area I
Source: Google maps (accessed June, 2022)

Figure 13. Goa Cemara Parking Area II
Source: Google maps (accessed June, 2022)

Figure 14. Access to the site (Rajiman Street)
Source: Author, 2022

## 2.2.1 Site Location

The proposed site location is the existing area of the Goa Cemara turtle conservation house with an additional area in front of it, so it will directly connected to the beach area where turtles usually lay eggs. Based on the information from the secretary of Mino Raharjo Group, this site is owned by the Sultan Ground which was granted to the community group to manage turtle conservation.

## 2.2.2 Surrounding

The conditions surrounding the site are dominated by plantations owned by local residents. Most of the plantations are vegetable plantations and Cemara Udang/Pine Tree seedlings. The site is approximately 100 meters from the Goa Cemara Parking Area II. In the tourist area of Goa Cemara itself, there are also food stalls, restaurants, stage shows, open joglos, and the secretariat office for the Goa Cemara tourist area.

## 2.2.3 Accessibility

The main access for motorized vehicles to the site is via Jalan Lintas Selatan/Southern Cross Road, then enters the main gate of the Goa Cemara Beach Area. For visitors who use buses, they will park in parking area I (approximately 200 meters from the site). Meanwhile, visitors who use motorbikes and cars can park their vehicles in parking area II (approximately 100 meters from the site). Then, from these parking areas, visitors can continue to walk to the site which is also an existing turtle conservation house. Access to the site (Jl. Rajiman) is a small street that can only be passed by one car. Usually, Jalan Rajiman is only passed by local motorcycles and cars cars transporting crops.

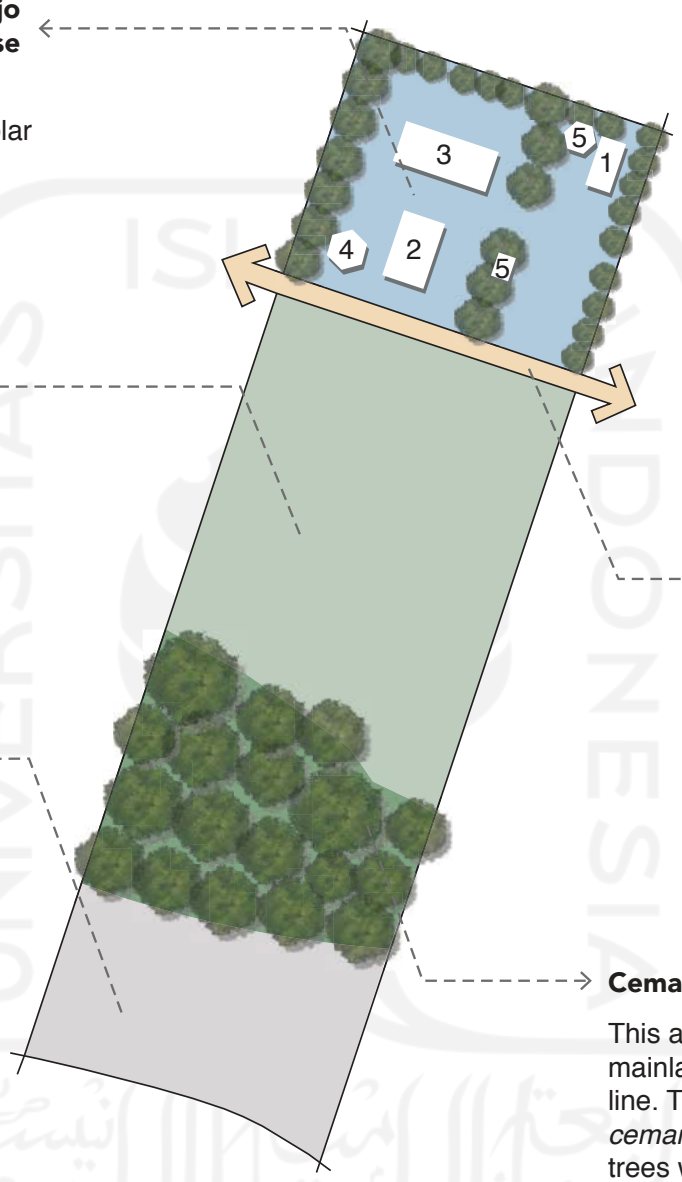
## 2.2.4 Existing Condition

**Mino Raharjo Conservation House**

1. Hatchery
2. Office and Solar Battery
3. Solar Panel
4. Storage
5. Gazebo

**Fields**

The existing function of this area is for farming




**Main Access**

The main street access is Rajiman Street that connecting the site with Goa Cemara Beach Area. It is a 3 meters wide street without asphalt nor paving block.

**Beach**

This area is part of turtle nesting area. It is wide, sloping, has a lot of trees and quiet. Whis is suitable as a place for turtle to lay egg

**Cemara Udang**

This area separates the mainland from the shoreline. There are many *cemara udang*/pine trees trees which also function as abrasion prevention.

Figure 15. Existing Site Condition
Source: Author, 2022

**1. Mino Raharjo Conservation House**

**2. Fields/Plantations**

**3. Cemara Udang**

**4. Main Access**

**5. Beach/Nesting Area**

Figure 16-20. Existing Site Condition
Source: Author, 2022

## 2.2.5 Climate Analysis

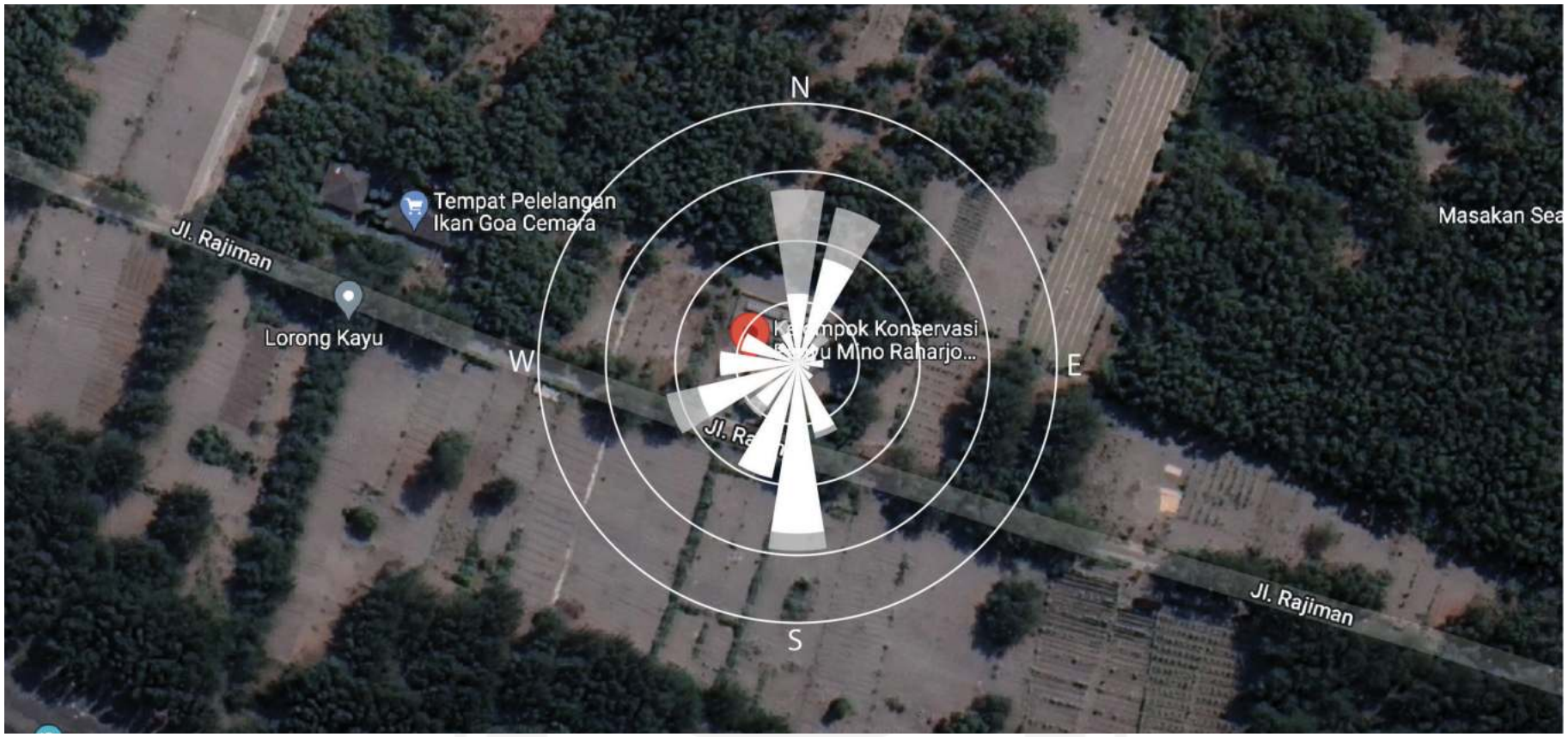



Figure 21. Wind Rose
Source: meteoblue.com & google maps (accessed on 15 May 2022)

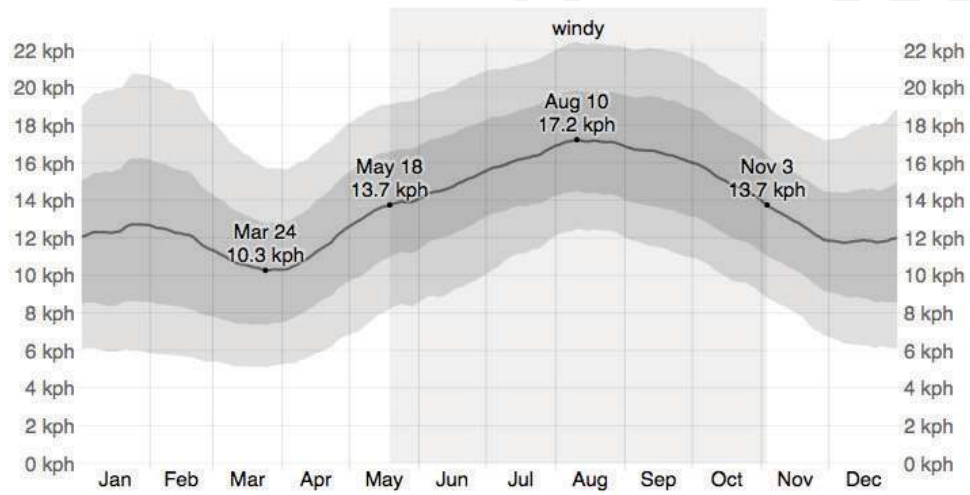



Figure 22. Wind Data
Source: weatherspark.com (accessed on 15 May 2022)

**Wind**

The wind mostly come from the south and the north. This wind data will be used as the consideration of the openings and facade to achieve the comfort of the building user. Wind became one of the most important aspect to create passive cooling to the building. The wind can give thermal comfort to the user. Cross ventilation created to achieve the temperature standard based on the SNI. Openings and the mass arrangement in the southern and northern part became crucial since most of the wind came from the south and the north.

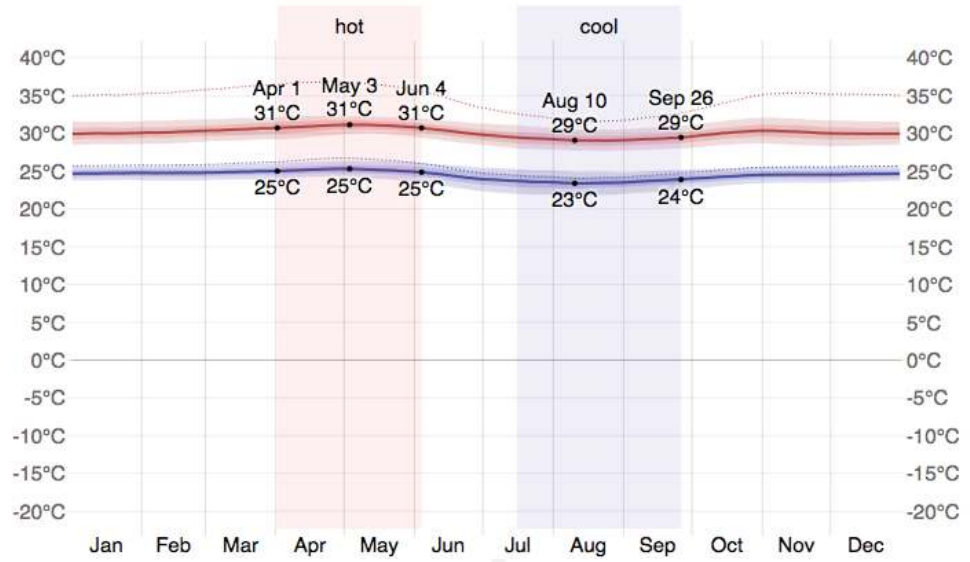



Figure 23. Temperature Data
Source: weatherspark.com (accessed on 15 May 2022)

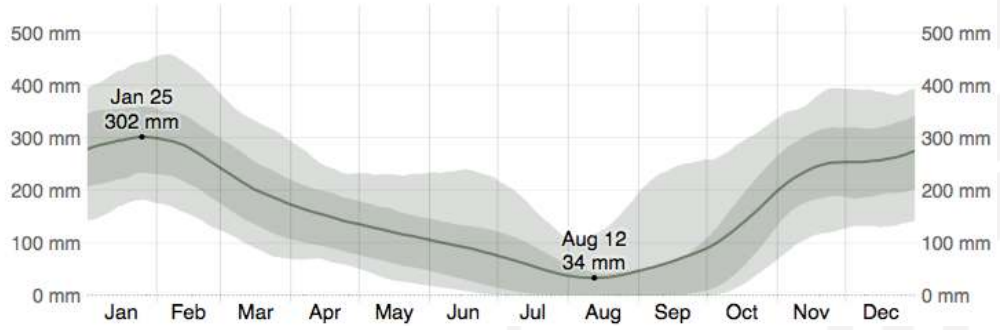



Figure 24. Rainfall Data
Source: weatherspark.com (accessed on 15 May 2022)


Figure 25. Precipitation Data
Source: weatherspark.com (accessed on 15 May 2022)

**Temperature**

The hottest month of the year in Sanden is May, with an average high of 31°C and low of 25°C. The coldest month of the year in Sanden is August, with an average low of 23°C and high of 29°C.

**Rainfall**

The month with the most rain in Sanden is January, with an average rainfall of 295 millimeters and the month with the least rain is August, with an average rainfall of 34 millimeters.

**Precipitation**

Based on this categorization, the most common form of precipitation throughout the year is rain, with a peak probability of 70% on 1st February.

Figure 26. Green Turtle
Source: profauna.net, Tentang Penyu Indonesia
(accessed May 2022)

Figure 27. Olive Ridley Turtle
Source: news.unair.ac.id, 2021
(accessed May 2022)

## 2.3 Design Theme Study

### 2.3.1 Turtle Characteristic and Criteria

Turtle is one of reptile's type that lives under the sea and it is able to migrate over long distances. They usually migrate along the Indian Ocean, Pacific Ocean, and Southeast Asia. Among seven types of turtles in the world, six species are live in Indonesia sea, there are green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricata*), olive ridley turtle (*Lepidochelys olivacea*), flatback turtle (*Natator depressus*), leatherback turtle (*Dermochelys coriacea*), andoggerhead turtle (*Caretta caretta*). In marine life, turtles contribute a lot to maintaining the continuity of marine ecosystems, so the existence of turtles is very important to be maintained. Unfortunately, turtle population is currently threatened with extinction. Shift of land use that cause damage to coastal habitats, inadequate management of conservation techniques, climate changes, turtle disease, threats of predators, and exploitation of turtles and their eggs are the main factors that cause the populations of turtle has decreased. In addition, turtles have long life cycle characteristics, especially green turtles, hawksbill turtles, and loggerhead turtles. It takes about 30-40 years to reach stable conditions or constant population abundance.

#### 2.3.1.1 Morphology of Turtle

We have to know the parts of turtle's body and their function to indentify properly. Turtle body part consist of:
important to be maintained.

1. Carapace, which is the part of body that is on the back and srves as a protector
2. Plastron, which covers the chest and abdomen
3. Infra Marginal, which is a connecting piece between the edge of the carapace and the plastron. This section can be used as an identification tool.
4. Forelimbs, is the forelegs that function as paddles to swim
5.. Hind limbs, is the hind legs (pore fliffer) which function to dig the sand

Goa Cemara Beach is home for green turtle and olive ridley turtle (Femi, 2020). Thus, in this paper, we are more focused in those two types of turtles.

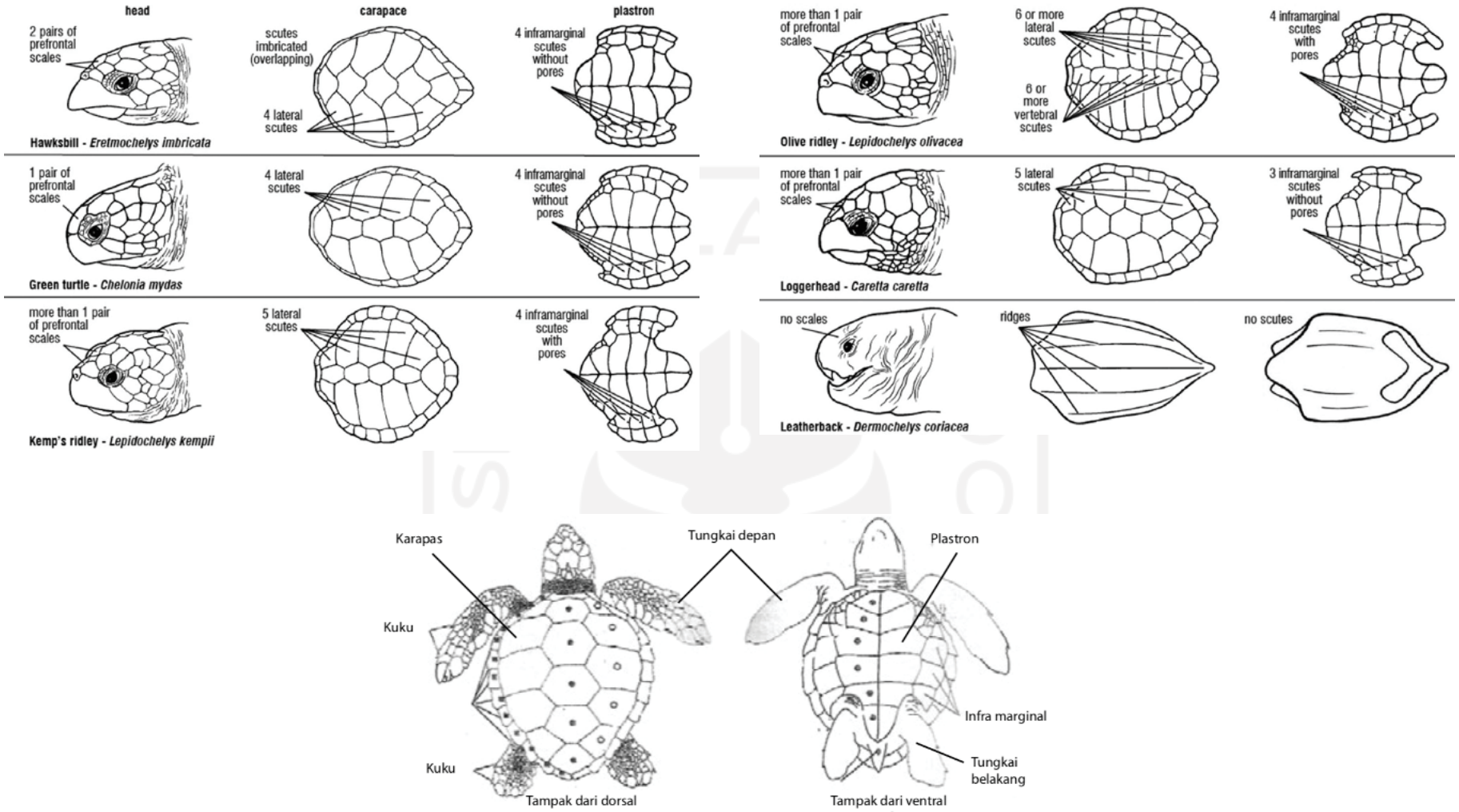



Figure 28. Turtles Morphology
Source: Pedoman Teknis Konservasi Penyu, 2009

**Hatchlings/Baby Turtles**

Table 2. Morphology of green turtle and olive ridley turtle hatclings

| Hatchling | Morphology |
|---|---|
| Green turtle | The carapace is wide and black |
| Olive ridley turtle | The carapce is similar with the green turtle but longer |

Source: Pedoman Teknis Konservasi Penyu, 2009

Figure 29. Green Trutle Hatchling
Source: Tony Karumba at Liputan6.com, 2021

Figure 30. Olive Ridley Hatchling
Source: https://news.unair.ac.id/2021/04/30/menilik-jenis-ke-lamin-tukik-penyu-lekang-berdasarkan-histologi-gonad/?lang=id

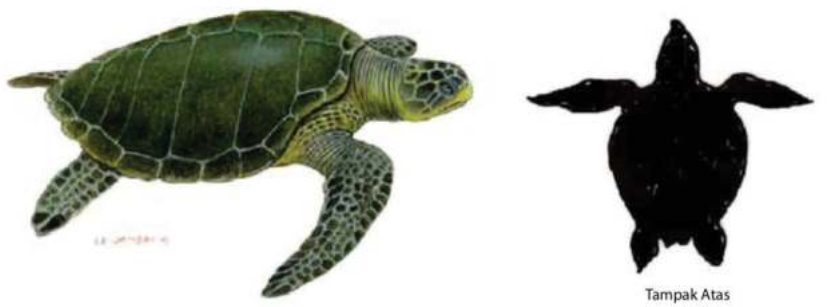
**Turtles (Adult)**

Table 3. Morphology of green turtle and olive ridley turtle adult

| Turtle | Morphology |
|---|---|
| Green turtle | The shape of carapace is ellipse, not tapered on the back, the color is yelow ten to grey, and the head is rounded. |
| Olive ridley turtle | The shape of carapace is look like a tall dome, consist of 5 pairs of “coastal scutes”, which each side consist of 6-9 parts. The edge of carapace is smooth, the color is dark olive green, dan the plas-tron’s color is yellow. The head is quite big. |

Source: Pedoman Teknis Konservasi Penyu, 2009


Green Turtle (*Chelonia mydas*)




Olive Ridley Turtle (*Lepidochelys olivacea*)

Figure 31. Turtle morphology
Source: Pedoman Teknis Konservasi Penyu, 2009

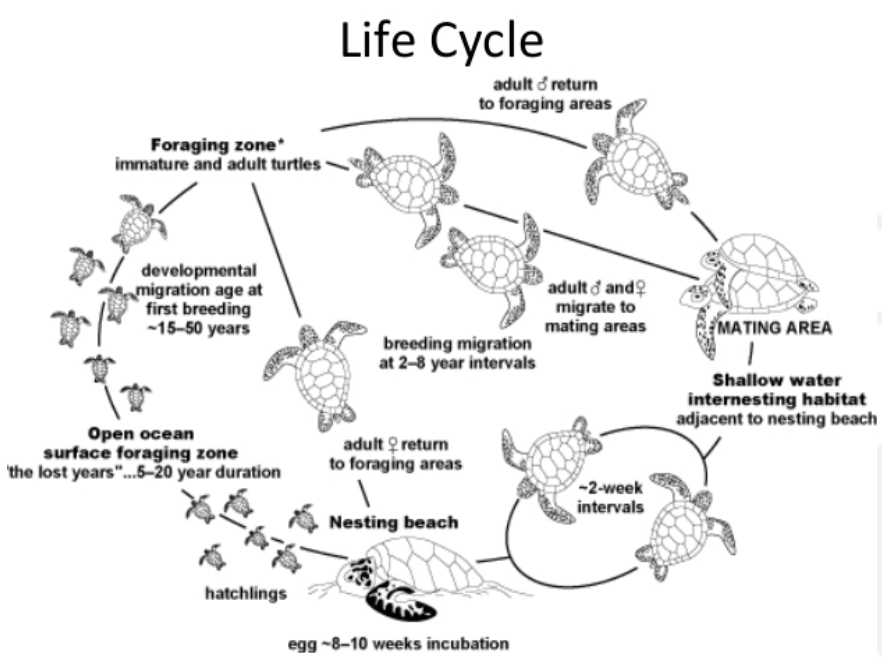



Figure 32. Turtle Life Cycle
Source: Pedoman Teknis Konservasi Penyu, 2009

Figure 33. Turtle nest/sand pit
Source: Pedoman Teknis Konservasi Penyu, 2009

### 2.3.1.2 Turtle Life Cycle

**Turtle Mating and Nesting**

All turtle species have the same life cycle. Turtles have very slow growth and take decades to reach reproductive age. Adult sea turtles live for many years in one place before migrating to mate by traveling long distances (up to 3000 km) from the feed to the nesting coast. At an unknown age (around 20-50 years) male and female turtles migrate to nesting areas around their birth areas. Adult turtle mating occurs off the coast a month or two before the first spawn of the season. Both male and female turtles have several mating partners. The female turtle stores the sperm of the male turtle in her body to fertilize three to seven eggs (later to become 3-7 nests) which will be laid in that season.

Male turtles usually return to their feeding routes after the female has completed her fortnightly egg-laying activity on the beach. The female turtle will come out of the sea when it is ready to lay eggs, using her front flippers to drag her body to the spawning beach. The female turtle makes a body pit with her front limbs and then digs a hole for the nest 30-60 cm deep with the hind limbs. If the sand is too dry and unsuitable for laying eggs, the turtle will move to another location.

**Turtle Migration**

Turtles have a strong return to home ("Strong homing instinct") (Clark, 1967, McConnaughey, 1974; Mortimer and Carr, 1987; Nuitja, 1991), namely migration between feeding grounds and nesting sites (breeding ground). This migration can change due to various reasons, such as climate change, scarcity of food in nature, the number of predators including human disturbance, and the occurrence of severe natural disasters in spawning areas, such as tsunamis.

Turtle conservation efforts will never be enough if only done at nesting sites, because turtles are migratory animals. Turtles that have reached adulthood in a foraging ground will migrate to breeding and nesting migration sites. After releasing all the eggs, the female turtle will again migrate to their respective feeding areas (post-nesting migration). The same is true for male turtles, which will migrate back to their feeding grounds after mating.

Knowledge of turtle migration paths is obtained by applying tracking techniques using satellite telemetry. In Indonesia, this study was conducted intensively on green, gray and leatherback turtles. The study with a small sample size shows that the movement of Hawksbill turtles in these two nesting areas is only local, meaning that they are not too far from their nesting locations.

**Turtle Hatching**

The embryo in the egg will grow into hatchlings similar to the parent, the incubation period is approximately 2 months. Stages of the hatching process until the hatchlings come out of the nest according to the Alam Lestari Foundation (2000) are:

1. Eggs inside the nest/sand pit
2. Hatchlings break egg shells using the caruncle at the tip of the upper jaw.
3. Hatchlings begin to be active and try to get out of the nest after the embryonic membrane is released
4. The hatchlings together with their siblings try to climb the sand to reach the surface

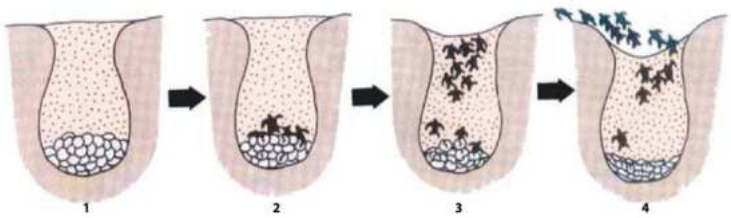



Figure 34. Hatching Process
Source: Alam Lestari Foundation, 2000

**Hatchlings Walk Towards the sea**

Hatchlings hatch after about 7-12 weeks. Groups of hatchlings take two or more days to reach the surface of the sand, usually at night. To find the direction to the sea, the hatchlings are based on the brightest direction and use the topography of the surrounding horizon line. Once they reach the sea, hatchlings use various combinations of clues (wave direction, current and magnetic field) to orient themselves to deeper offshore areas. The activity of the hatchlings crossing the beach and swimming away is an attempt to record the clues needed to find their way home when they are about to mate. This process is called the imprinting process

Figure 35. Hatchlings go to the sea after hatching
Source: ãSeaPics.com

**2.3.1.2 Trail, Size of Nesting, and Laying Eggs Habits**

Each type of turtle has different habit while laying their eggs. The width of green turtle's trail is approximately 1 meter. The symmetrical patterned diagonal markings and track are made by the forelegs. While the width of the olive ridley trail is approximately 80 centimeters, the shape of the track is shallow, and the diagonal markings made by the forelegs are not symmetrical.

The depth of green turtle's nest/sand pit is between 55-60 centimeters and the diameter is betwen 23-25 centimeters. Meanwhile, the depth of olive ridley's nest/sand pit is between 37-38 centimeters and the diameter is between 20-21 centimeters. Olive ridley able to laying their eggs every time (night or noon) and it can be find simultaneously within several "arribada" days. Arribada is female olive ridley's unique habit which nesting/laying their eggs at the same time in certain time. This turtle is laying their eggs in an area that have a lot of tropical trees.

Figure 36. Turtle's Trail
Source: Pedoman Teknis Konservasi Penyu, 2009

**2.3.1.3 Characteristic of Nesting Habitat**

All types of turtles, including those that live in Indonesian waters, will choose a unique nesting area. The results of research in various regions of the world from 1968 to 2009 concluded that:

1. Green Turtle
   There are Hibiscus tiliacus, Terminalia catappa, and Pandanus tectorius along the beach. The type of sand consist of quartz minerals.

2. Olive Ridley Turtle
   The nesting area consist of black sand and contain of mineral more than 70% "opac".

#### 2.3.1.4 Requirements of Nesting Area

1. **Supra-tidal Area**
   Turtle will choose a wide and sloping beach area for laying their eggs.

2. **Temperature between 24-33 degree celcius**
   More than that, the embryo will die. The higher the temperature of the sand, the faster the eggs will hatch. Research on green turtle eggs placed at different sand temperatures showed that eggs at 32 C hatched within 50 days, while eggs at 24 C hatched in more than 80 days.

3. **The sand must be humid**
   Egg diameter is strongly influenced by the water content in the sand. The more water absorption by the egg from the sand causes the growth of the embryo to be greater which results in the diameter of the egg becoming larger. On the other hand, dry sand will absorb water from the eggs because the salt content in the sand is higher. As a result, the embryo in the egg will not develop and die.

4. **Absorption of oxygen should't be blocked**
   Oxygen is needed for embryo growth. Rainwater that absorbs into the nest turns out to be able to block the absorption of oxygen by the eggs, as a result the embryo will die.

## 2.3.2 Turtle Safe Lighting

Nesting turtles once had no trouble finding a quiet, dark beach on which to nest, but now they must compete with tourists, businesses and coastal residents for use of sandy beaches. Both the nesting and hatching process greatly influence sea turtle populations and are both affected by nesting beach conditions. One of the biggest threats to this process is the presence of lighting shining onto beaches used for nesting (Barshel, 2014).

1. **Keep it off**
   Keep light off the beach and lights off when not needed.
2. **Keep it low**
   Mount the fixture as low as possible to minimise light trespass, and use the lowest amount of light needed for the task.
3. **Keep it shielded**
   Fully shield the light so bulbs and/or glowing lenses are not visible and avoid light escaping upwards and outwards. requirement is that no lamp lumens go above a 90-degree angle with no more than 10% of the lamp lumens exceeding 80-degrees
4. angle.
   **Keep it long**
   Use long wavelength light sources (ambers and reds) in the appropriate lighting fixtures.

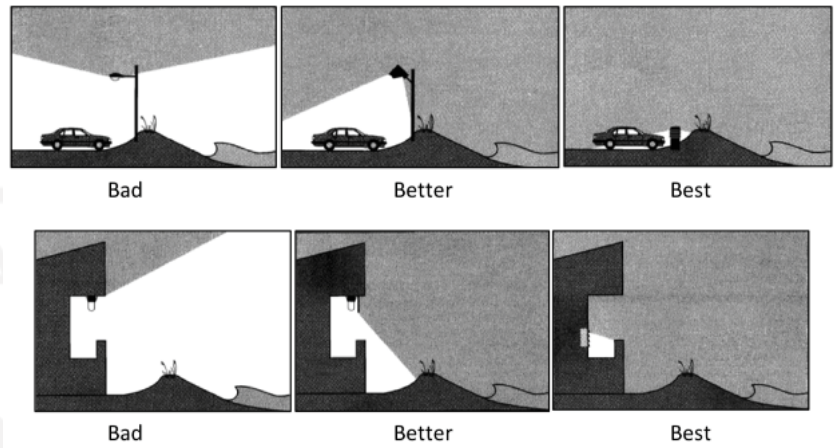



Figure 37. Keeping Light Low Illustration
Source: Witherington & Martin, 2000

Lights that are appropriate for the coastal environment meet the following criteria:

1. The source of light (i.e. light bulb) is not directly visible from the beach.
2. The source of light does not directly or indirectly illuminate the beach. (maximum illuminate 4 lux)
3. Using Low pressure Sodium (LPS) 18w 35w, Red, orange, or Amber LED (true red, orange or Amber diode, not filters

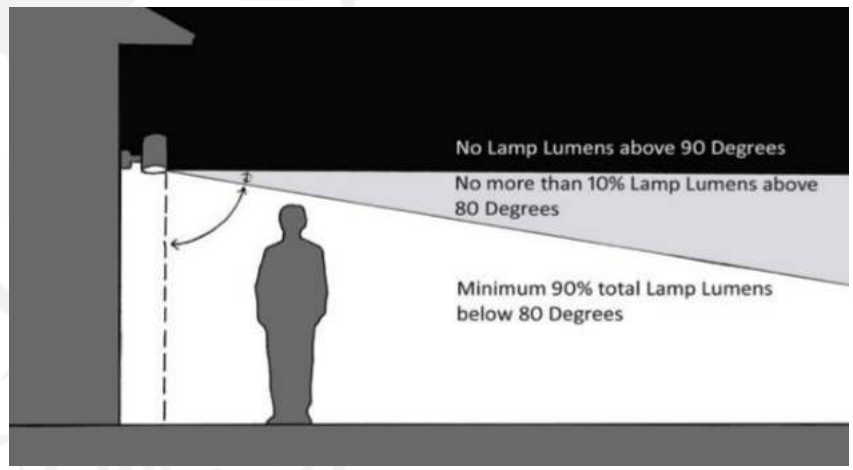



Figure 38. Keeping Light Shielded Illustration
Source: Witherington & Martin, 2000

## 2.3.2 Ecotourism

'Ecological tourism' or 'ecotourism', today, has international currency as a concept grounded in preservation-conservation and sustainable development ideals. Hetzer (1965), responsible ecotourism is measured against four standards: minimum environmental impact, minimum impact on-and maximum respect for cultures, maximum economic benefits to host country's grassroots, and maximum recreational satisfaction to participating tourists.

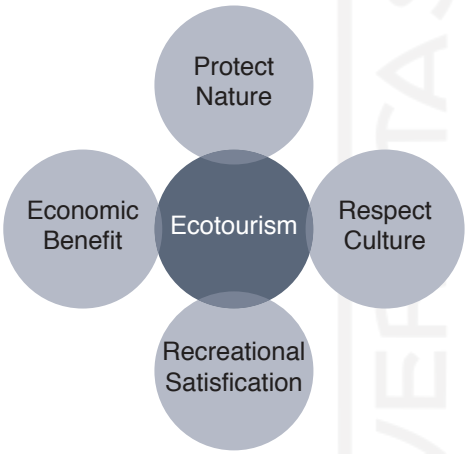



Figure 39. Standards of Ecotourism
Source: Hetzer, 1965

According to The International Ecotourism Society (TIES), ecotourism is responsible travel to natural areas that conserves the environment and sustains the well being of local people.
The principles of ecotourism are:

1. A focus on enjoying nature (animals, water, landscapes, sky-
2. scapes, etc)
3. Tourists' money funding nature conservation
4. Sustainable and low-impact facilities / accommodation
5. Respect of local and indigenous cultures
6. Tourists' money going directly to local people
   A focus on learning about the destination's ecology and culture

In term of architecture, the key principles is 'Sustainable and low-impact facilities / accommodation'. Clearly this alone isn't enough to make an ecotourism experience, but it is an important point. Also, good design can help to fulfil some of the other points too: being culturally sensitive by respecting local architectural styles, and benefiting the host community economically by hiring local people. When planning a new facility it is important that the size of the facility must not exceed the ability of the environment to sustain it. They should reflect the local building styles and materials without creating a negative impact on the local building materials resources or increasing the costs to the local community for the same building materials. The facilities also have the opportunity to enhance the enjoyment and learning experience for the visitor.

## 2.3.3 Ecological Architecture

Ecological architecture is a design that considers humans and their environment. With ecological architecture, the design of the building minimizes environmental damage as much as possible. Heinz Frick (1998) stated that ecological architecture is a design that unites the relationship between humans with the natural environment. It is also contains dimension of time, nature, socio-cultural, space, and building technique. Therefore, ecological architecture is holistic and contains all fields. Principles of ecological architecture are:

1. Adaptation to the local natural environment,
2. Save non-renewable natural energy sources and save energy use,
3. Protecting environmental resources (air, soil, water),
4. Maintain and improve natural circulation,
5. Reducing dependence on central energy systems (electricity, water) and waste (wastewater and garbage),
6. Possibility of residents to produce their own daily needs,
7. Utilizing natural resources around the planning area for building systems, both related to building materials and for building utilities (energy sources, water supply).

## 2.4 Building Function Study

### 2.4.1 Turtle Conservation

According to Peraturan Pemerintah Republik Indonesia No. 7 Tahun 1999, conservation has the main function of breeding and or saving plants and animals while maintaining the purity of their species. In addition, the conservation institution also functions as a place for education, demonstration and research as well as the development of science. Turtle conservation is carried out as one of the important efforts to save the endangered turtle population. The existence of conservation can help to provide education to the public so that they are aware of protecting turtle populations and their habitats. Based on the Technical Guidelines for the Management of Turtle Conservation by the Directorate of Marine National Park and Conservation (2009), the technical management and conservation of turtles are:

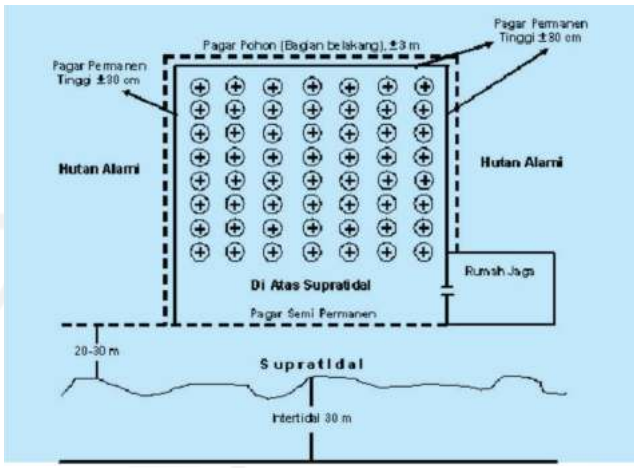



Figure 40. Design of Semi-natural Hatchery
Source: Pedoman Teknis Konservasi Penyu, 2009

**a. Semi-natural Hatchery**

After the turtles leave their eggs on beach, the eggs will be moved to the hatchery, so they are not eaten by predators or exploited by irresponsible humans. The eggs will be placed in a sand pit inside a natural hatchery surrounded by fences and vegetation. Hatching time is usually around 45-60 days.

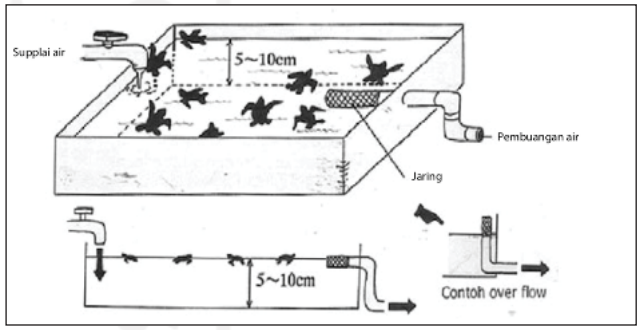



Figure 41. Design of Hatchling Pond
Source: Pedoman Teknis Konservasi Penyu, 2009

**b. Hatchling Pond**

After hatching, the baby turtles will be placed in a breeding pond before being released into the sea. The pond is usually in circular or square shape with fiber or ceramic materials. The water is usually sea water which must be changed 2 times a day feeding the turtles. The water temperature that suitable for baby turtles is around 25 degrees Celsius and the depth ranges from 5 – 10 cm.

Figure 42. Turtle Release at Goa Cemara Beach
Source: documentation by Mino Raharjo Conservation Group

**c. Turtle Release**

Once the baby turtles are strong enough, they will be brought to the beach to be released back to their natural habitat. The purpose of the release is to multiply the turtles in the sea.

### 2.4.2 Turtle-based Tourism

Based on Technical Guidelines for the Management of Turtle Conservation, 2009 Guidelines for Turtle-based Tourism are:

1. Create or design the spatial layout of spaces that must be in place (minimum):
   Management office and information center, nesting sites, semi-natural hatchery sites, hatchling rearing locations, and hatchling release locations.
2. Vegetation that is suitable for the turtle habitat
3. Building materials are made from natural materials while paying attention to the strength of the building
4. Pay attention to the conditions and comfort for turtles to lay eggs, considering the nature of turtles which are very sensitive to disturbances of light and sound

The steps that are considered important in implementing turtle conservation education include:

1. Provide educational campaigns for all levels of society from households onwards, including kindergarten to university.
2. Creating Leaflets: Leaflets are made in an attractive and easy-to-understand format, aiming for enlightenment to society. Government Regulation of the Republic of Indonesia No. 7 and
3. No. 8 of 1999 concerning preservation of plant and animal types to maintain the diversity of plant and animal species and their ecosystems both inside and outside their habitats from extinction.

## 2.5 Building Regulation

**Building Type**

The Turtle Conservation Center in Goa Cemara is a special type of animal conservation center. According to Regulation of the Minister of Environment and Forestry P.22/MENLHK/SETJEN/KUM.1/5/2019, conservation is the management of plants and/or wildlife in a wise manner to meet the needs of current and future generations. Special Animal Conservation Center is a place to save certain types of animals while maintaining the purity of the species, controlled breeding, breeding sources, and genetic reserves to support in-situ populations.

**Boundary Line**

According to Peraturan Daerah Kabupaten Bantul, the boundary line from the beach is determined to be at least 100 (one hundred) meters from the highest tide and the boundary line from local street and neighbor is determined to be at least 2 meters

**KDB**

KDB is the percentage of the basic building area to the land area, which is how many percent of the land area that can be built. KDB in Bantul is 40%

**KLB**

KLB is is a determining factor for how many square meters the total building is allowed to be built, it also determines how many floors the building can be made. KLB in Bantul is 0,8.

## 2.6 Precedent Study

### 2.6.1 Mon Repos Turtle Center, Australia

This building provides a contemporary ecotourism experience that allows visitors to fully immerse themselves in marine turtle research and conservation. The design of the centre was carefully considered to ensure the building is ecologically sustainable, long-lasting and had minimal impact on the surrounding environment.

Figure 43. Mon Repos Turtle Center
Source: Archdaily (accessed on April 2022)

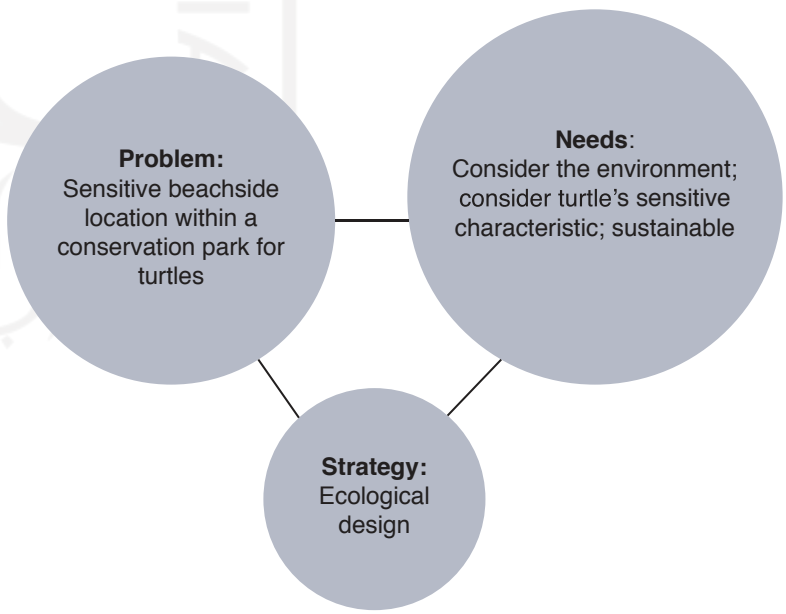



Figure 44. Precedent analysis diagram
Source: Author, 2022

**Naturally Ventilated Building with Zero Light Spill**

Since turtles are sensitive to light when choosing a place to lay their eggs, the building should minimize the impact of light output at night but still maximizing natural ventilation. Instead of making a building with glass openings, this building chose to make wooden doors that can be opened during the day and closed at night so that the light from inside the room does not come out. The building also has a "black-box" on the roof that can serve as a source of natural ventilation and even a source of natural light during the day.

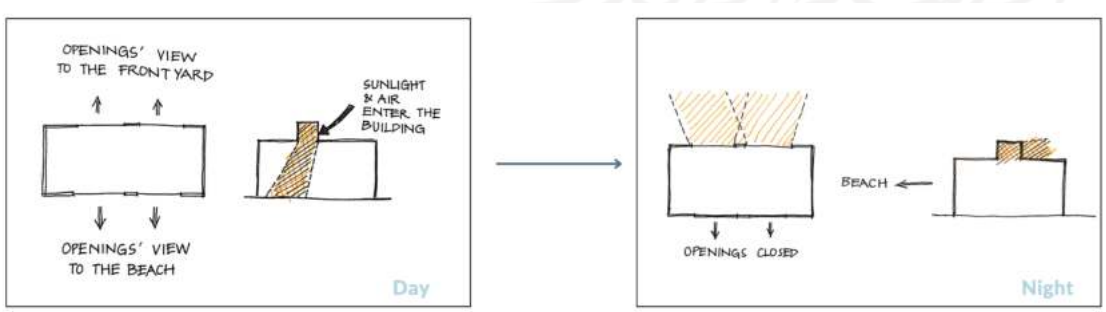
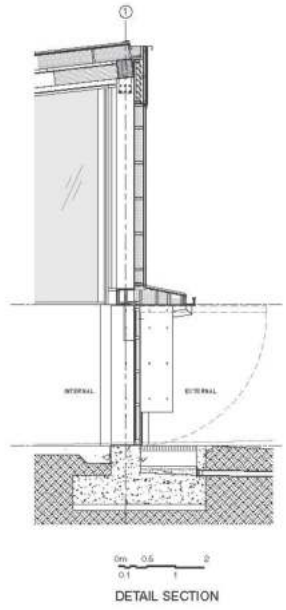



Figure 45. Mon Repos Turtle Centre during day and night
Source: Designboom (accessed on April 2022)

Figure 46. Analysis of opening and light spill
Source: Author, 2022


**The Orientation of the Building was Carefully Considered to Maximize Air Movement**

Naturally ventilated and daylighting strategies. Permanent fixed and operable louvers achieve adequate natural ventilation while the courtyard space is totally naturally ventilated and has some overhead fans and triangular skylights. The floor surface is a honed mass concrete that also contributes to the thermal mass of the center helping modulate the internal temperatures.

**Natural Sustainable Material and Construction Based on Site Condition**

Using local materials and the structure is designed according to the character of the surroundings, to withstand the corrosive sea air and seasonal cyclones. Using local, sustainable wood materials, glulam wood.

Figure 47. Inside Mon Repos Turtle Center
Source: Archdaily (accessed on April 2022)

Figure 48. Structure of Mon Repos Turtle Center
Source: Archdaily (accessed on April 2022)


Figure 49. Entrance of Taman Kili-Kili
Source: tribunnews.com (accessed on April 2022)

Figure 50. Hatchling pond area in Taman Kili-Kili
Source: tribunnews.com (accessed on April 2022)

## 2.6.2 Taman Kili-Kili, Trenggalek

Taman Kili-Kili is one of a conservation center of turtles in Trenggalek, Eastern Java, Indonesia. Because this place is located in beach tourism area, the Taman Kili-Kili become a conservation with education and tourism concept. ventilation and even a source of natural light during the day.

Application in design:
1. Maintain existing vegetation
2. Maximize the facilities for conservation and tourism

Table 4. Function and space in Taman Kili-Kili

| | |
|---|---|
| Conservation Function | - Hatchery<br>- Hatchling pond<br>- Turtle captive |
| Passive Education Function | - Workshop facility<br>- Library<br>- Gallery |
| Tourism Function | - Food Court<br>- Garden |
| Other | - Office<br>- Musholla<br>- Toilet |

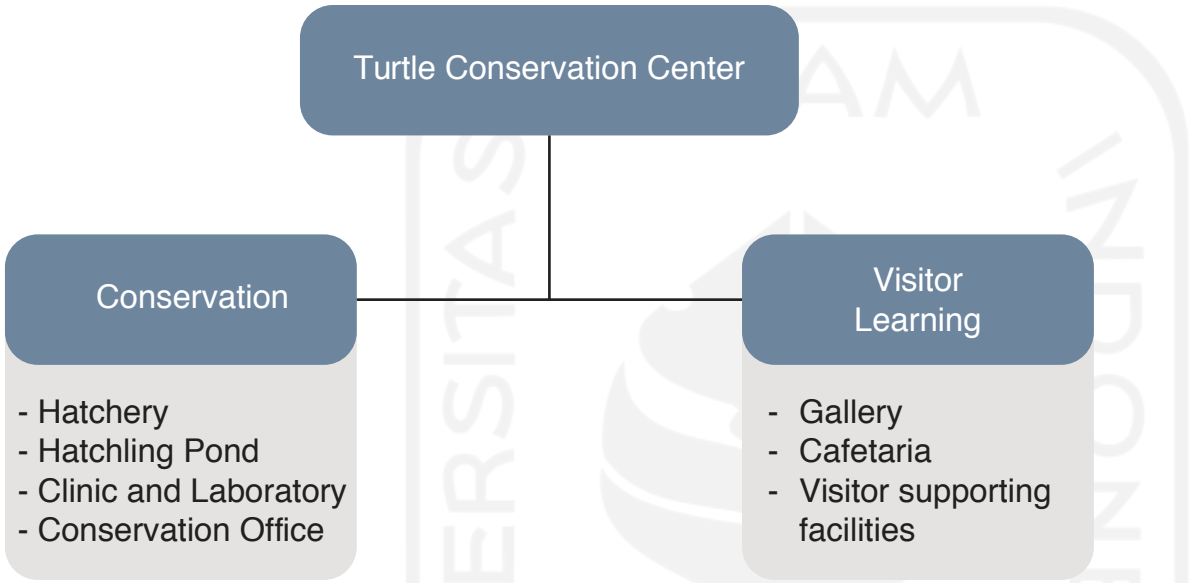
Source: Kabib Rosadi, 2018

*chapter 3*

# DESIGN RESULT & PROOF

## 3.1 Analysis Building Function

### 3.1.1 Analysis Function of Conservation Center




Mino Raharjo Turtle Conservation Center in Goa Cemara is a special animal conservation center. Because turtles are one of the endangered animals due to the decreasing population because of habitat destruction, predators, and exploitation. Humans are one of the factors that contribute to the decreasing population of turtles. Thus, conservation center is needed to increase awareness and also preserve turtles and their habitats. However, the existing conservation center is not fulfill the standard, such as facilities that are not in accordance with conservation needs. Where this causes the conservation function is not maximized and the lack of comfort for visitors. Therefore, the new design will fixes this problem by building a conservation center with the following facilities:

1. Maintenance and care facilities in the form of hatcheries, hatchling ponds (quarantine ponds) with shade, and food storage
2. Healthy recreational facilities
3. Health facilities in the form of clinics
4. Researchers facilities (laboratory)
5. Visitor facilities, in the form of information rooms, toilets, musholla, trash cans, and directions
6. Management office facilities

Figure 51. Analysis Function of Conservation Center
Source: Author, 2022

### 3.1.2 Analysis Function of Ecotourism

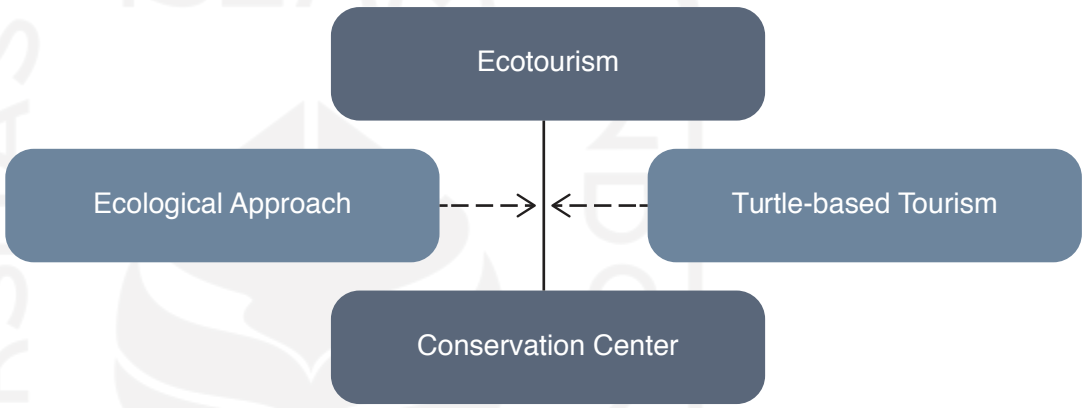



Figure 52. Analysis Function of Ecotourism
Source: Author, 2022

Bantul is one of the regencies in Yogyakarta that offers the coastal natural tourism sector as a major tourist attraction. Goa Cemara Beach in Sanden Bantul itself offers the beauty of Pine Trees and turtles as the main attractions. Over time the development of tourism in coastal areas also causes problems such as abrasion and environmental pollution because development often does not pay attention to the natural surroundings and is the irresponsible act of its users. The Goa Cemara Tourism Area, including the existing Conservation House itself, has implemented ecotourism or ecological tourism in order to grow healthy recreational facilities.

The design of the new conservation center will be built using an ecological approach in order to support ecotourism, with regard to:

1. Characteristics of turtles that are sensitive to sound and light
2. User convenience
3. Natural conditions of the coastal
4. Sustainable and low impact facilities
5. Enhance the enjoyment and learning experience
6. Reflect the local building
7. Focus on enjoying nature

## 3.1.3 Turtle Life Cycle and Treatment

Table 5. Analysis of turtle life cycle and treatment

| | Spawn | Egg | Hatchlings | Turtle Release |
|---|---|---|---|---|
| Natural | On the beach | Natural sand pit on the beach | Beach | Beach |
| Artificial | No artificial | Hatchery | Hatchlings Pond | Beach |
| Time | Time: 9 PM - 2 AM on May - September<br>Duration: 1-3 hours | Duration: 45-60 days | Duration: 15-30 days | Time: Afternoon or Night<br>Duration: 1-2 hours |
| Process | **Female turtles lay eggs looking for a dark and quiet place.** If it doesn't match, they'll find another place. Once that's done, they'll bury the eggs and return to the sea. | **Artificial:**<br>Eggs are moved/kept away from predators and tides. Semi-natural hatcheries are becoming a common choice. **It is maintaining the original condition, also ensures protection from predators.** | **Natural:**<br>After the egg hatched, hatchlings/turtle baby will go directly to the sea<br>**Artificial:**<br>Hatchlings will be cared for until they are strong enough to be released into the sea. | **Artificial:**<br>Hatchlings will be released on the beach and allowed to walk into the sea on their own but still under the supervision of officers. If it is done at night, **it must be ensured that the atmosphere is not too bright so that the hatchlings don't get disoriented and wander to places they shouldn't.** |
| Place | • Wide and sloping beach<br>• Dark, quiet, and lots of trees | • Supratidal area, humid<br>• Temperature: 24 C - 33 C | • Pond with sea water<br>• Temperature: 25 C | • Wide and sloping beach<br>• Dark, quiet, and lots of trees |
| Treatment | Building surround the nesting/spawn area should minimize the lighting | Semi-natural hatchery surrounded with fences for protection from predators | Captive pond in conservation house | Building surround the nesting/spawn area should minimize the lighting |
| Terms & Conditions | • Use low-pressure sodium-vapor lighting (LPS) instead of normal lights;<br>• Use Turtle Safe Lighting | • Permanent low fence with vegetation that suits the surroundings<br>• Sand pit: 20 cm width and 40-60 cm depth<br>• Humid but minimizes the absorption of excess rainwater into the nest | • Captive pond size 1,5 - 2 meters, material ceramic or fiber<br>• The captive ponds placed in an area with roof or shade,<br>• Still got natural sunlight so the room temperature is warm | • Use low-pressure sodium-vapor lighting (LPS) instead of normal lights;<br>• Use Turtle Safe Lighting |

Source: Author, 2022

A turtle life cycle analysis was done, so the architect knew what can be applied to the design to help the natural and artificial processes of turtles from laying eggs, hatching, and returning to the beach. Then we can get the treatment and terms & conditions for each stage based on literature study. So we can determine the room needs along with the guidelines to design it.

### 3.1.4 User Activities and Spatial Needs

Table 6. Analysis of user and spatial needs

| User | Activities | Criteria | Spatial Needs |
|---|---|---|---|
| Conservation Officer | Arrival | Easy and clear circulation | Gate/access entrance |
| | Go to the conservation office | Easy and clear circulation | Corridor/access to the conservation office |
| | Store personal items | Locker room that safe and in accordance with the standard | Office |
| | Taking care the turtles (feeding, cleaning, regular checking) | Storage that close to the hatchling area and hatchery | Hatchery, hatchling pond, storage for food and equipments |
| | Patrolling along beach of the conservation area | Easy and clear circulation from conservation center to the beach | Pathway/access to the beach |
| | Bring eggs to the hatchery | Have separate access, without passing through the visitor area | Pathway/access on the side of the site |
| | Bring turtle that ready to release to the beach | | |
| | Break out time | A comfortable pantry and gathering area | Pantry and gathering area |
| | Sanitation | Sufficient lighting, comfortable and the smell doesn't spread | Toilet |
| | Praying | Comfortable and clean | Musholla |
| | Go home | Easy and clear circulation | Gate/access exit |
| Researcher | Arrival | Easy and clear circulation | Gate/access entrance |
| | Go to the conservation office | Easy and clear circulation | Corridor/access to the conservation office |
| | Store personal items | Locker room that safe and in accordance with the standard | Office |
| | Research activity (Tagging), Treatment of sick/disabled animals | Comfortable, enough light, direct access from hatchling pond | Clinic and laboratory |
| | Making data, writing, etc. | Comfortable, enough light, working desk | Researcher working area |
| | Stay overnight | Comfortable for sleep, separate between male and female | Bedroom |
| | Break out time | A comfortable pantry and gathering area | Pantry and gathering area |
| | Sanitation | Sufficient lighting, comfortable and the smell doesn't spread | Toilet |
| | Bath | Comfortable and clean, separate between male and female, become one with bedroom | Bathroom |
| | Praying | Comfortable and clean | Musholla |
| | Go home | Easy and clear circulation | Gate/access exit |

| User | Activities | Criteria | Spatial Needs |
|---|---|---|---|
| Visitor Learning (Large group) | Arrival | Easy and clear circulation | Gate/access entrance |
| | Go to the hall | Easy and clear circulation | Corridor/access to the hall |
| | Gathering for lecturer/presentation | Space that can accommodate up to 150 people | Hall |
| | Go to hatchery | Easy and clear circulation from the hall | Corridor/access to the hatchery |
| | Go to the hatchling pond | Easy and clear circulation from the hatchery | Corridor/access to the hatchling pond |
| | Go to the beach for turtle release and clean the beach | Easy and clear circulation from the hatchling pond | Pathway/access to the beach |
| | Break out time | Space that can accommodate up to 150 people, to eat and leisure | Hall |
| | Souvenir shopping | Comfortable, close to the exit | Souvenir shop |
| | Sanitation | Sufficient lighting, comfortable and the smell doesn't spread | Toilet |
| | Praying | Comfortable and clean | Musholla |
| | Go home | Easy and clear circulation | Gate/access exit |
| Visitor Tourism (Small group) | Arrival | Easy and clear circulation | Gate/access entrance |
| | Go to the reseptionist | Easy and clear circulation | Corridor/access to the conservation office |
| | Learn about turtles and their habitat | Space to exhibit and give indirect information about turtle and coastal environment conservation, good lighting | Gallery |
| | Go to hatchery | Easy and clear circulation from the gallery | Corridor/access to the hatchery |
| | Go to the hatchling pond | Easy and clear circulation from the hatchery | Corridor/access to the hatchling pond |
| | Go to the beach for turtle release and clean the beach | Easy and clear circulation from the hatchling pond | Pathway/access to the beach |
| | Break out time | Place to eat and leisure | Cafetaria |
| | Souvenir shopping | Comfortable, close to the exit | Souvenir shop |
| | Sanitation | Sufficient lighting, comfortable and the smell doesn't spread | Toilet |
| | Praying | Comfortable and clean | Musholla |
| | Go home | Easy and clear circulation | Gate/access exit |

| User | Activities | Criteria | Spatial Needs |
|---|---|---|---|
| Employees | Arrival | Easy and clear circulation | Gate/access entrance |
| | Go to the conservation office | Easy and clear circulation | Corridor/access to the conservation office |
| | Store personal items | Locker room that safe and in accordance with the standard | Office |
| | Reseptionist staff's front desk | Comfortable, natural lighting, accommodate 2 people | Reseptionist |
| | Souvenir shop cashier | Comfortable, natural lighting, accommodate 1 people | Souvenir shop |
| | Cafetaria cashier | Comfortable, natural lighting, accommodate 1 people | Cafetaria |
| | Cafetaria kitchen staff | Accommodate 4-5 people, enough storage, enough cooking equipment, natural lighting, good air circulation | Kitchen |
| | Janitor staff | Cleaning equipment storage | Storage |
| | Break out time | A comfortable pantry and gathering area | Pantry and gathering area |
| | Sanitation | Sufficient lighting, comfortable and the smell doesn't spread | Toilet |
| | Praying | Comfortable and clean | Musholla |
| | Go home | Easy and clear circulation | Gate/access exit |

Source: Author, 2022

Analysis of user activities was done, so the architect can find out what rooms are needed along with the criteria for the space. User types are divided into 4: conservation officers, researchers, visitors (learning and tourism), and employees. The learning visitor is large group visitor, usually students or group from certain institution for education and practice. Meanwhile the tourism visitor is small group (1-6 people), who visit for educational and recreational purpose.

## 3.2 Design Concept

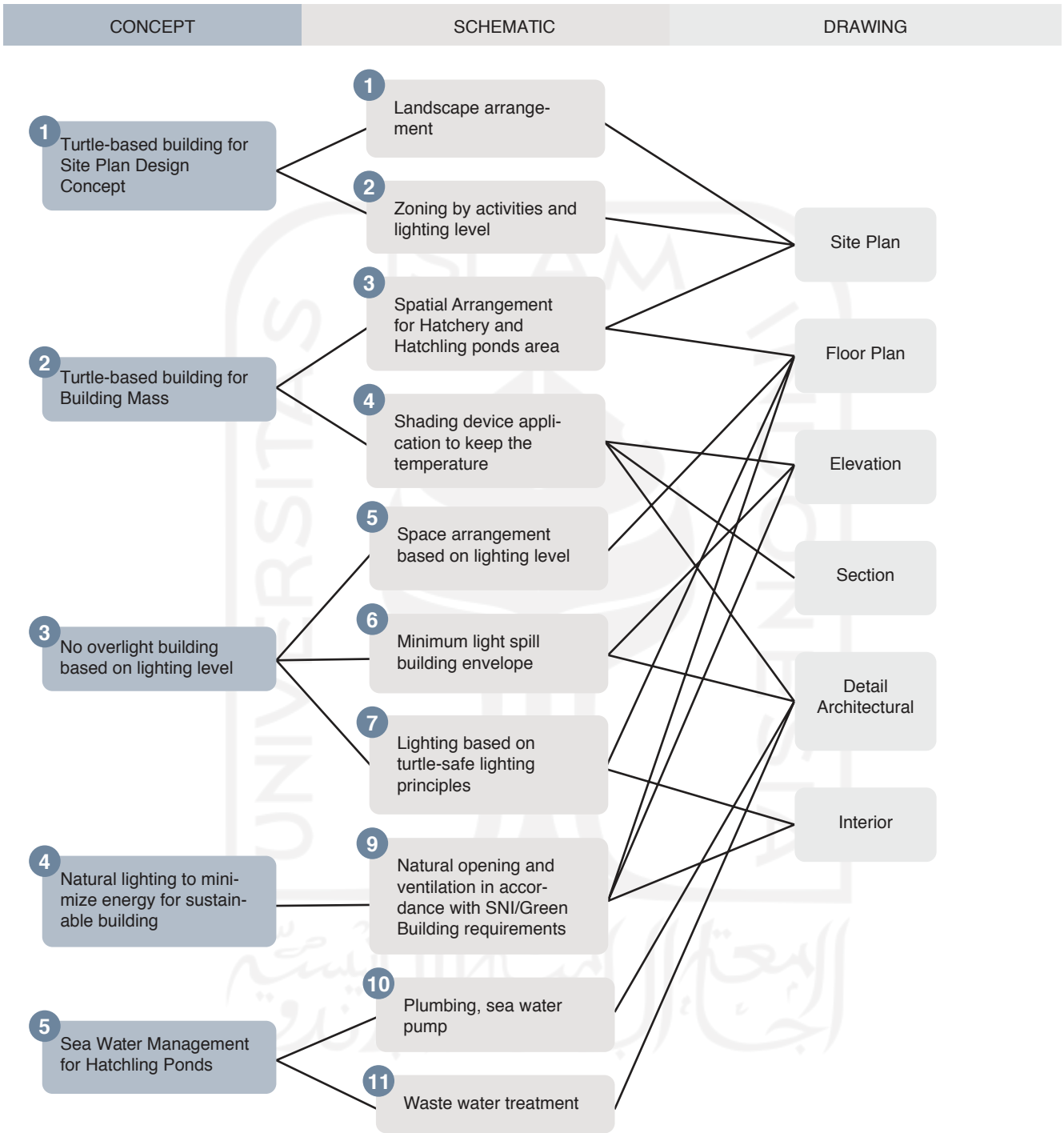



Figure 53. Diagram of Design Concept
Source: Author, 2022

## 3.2.1 Turtle Based Building for Site Plan Design Concept

### 3.2.1.1 Exisiting Condition on Site Location

The site is located in Rajiman Street, Sanden, Bantul. It has an area of 12.500 sqm. It is part of Goa Cemara Beach area. The site is surrounded by plantation that owned by locals. Existing conservation house was included in the site to and it's owned by Mino Raharjo Conservation Group that cooperate with Department of Fisheries and Marine of Yogyakarta and Natural Resources Conservation Center (BKSDA).

The site was choosen because the distance from Goa Cemara Beach area isn't too close nor too far, it is approximately 100 meters from Goa Cemara parking area. The existing conservation house was included, so we don't need to open a new site which has possibility to damage the natural environment. The soil is suitable for turtle nesting and hatching.

Table 7. Design Criteria of Turtle Nesting

| Design Criteria | Problem Solving |
|---|---|
| • Turtle's nesting area must be quiet and dark | • Planting more trees in the beach area<br>• Existing trees are maintained<br>• Conservation building shouldn't be too close to the beach |

Source: Author, 2022

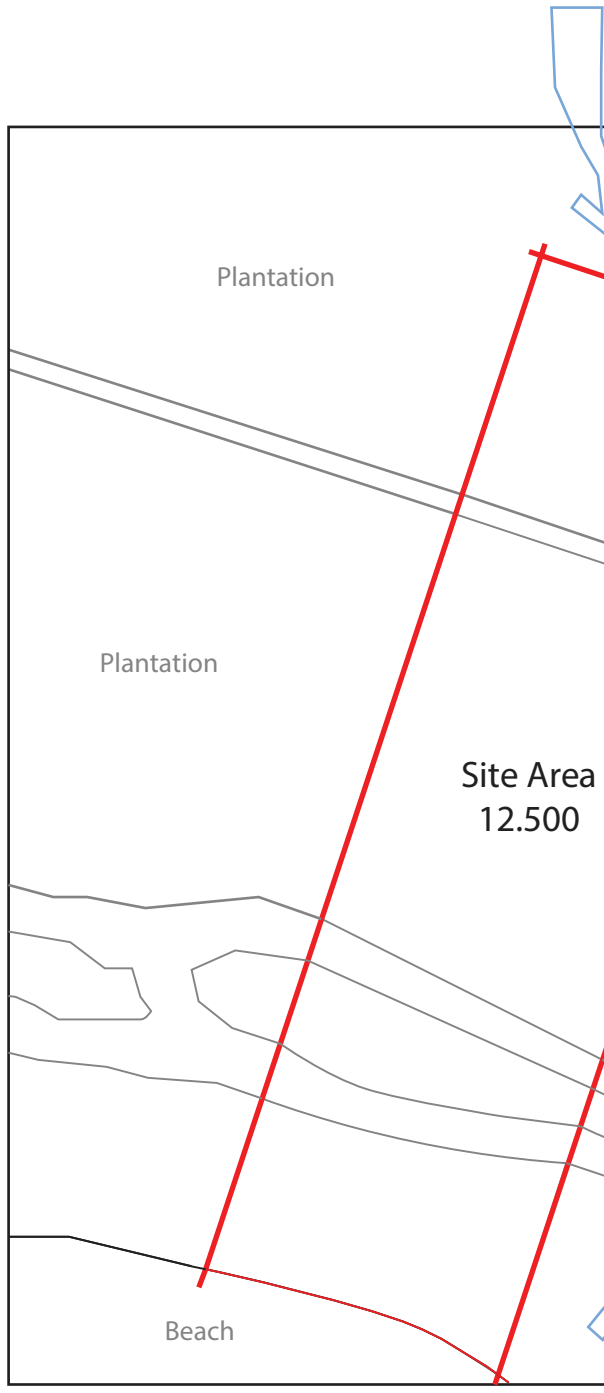
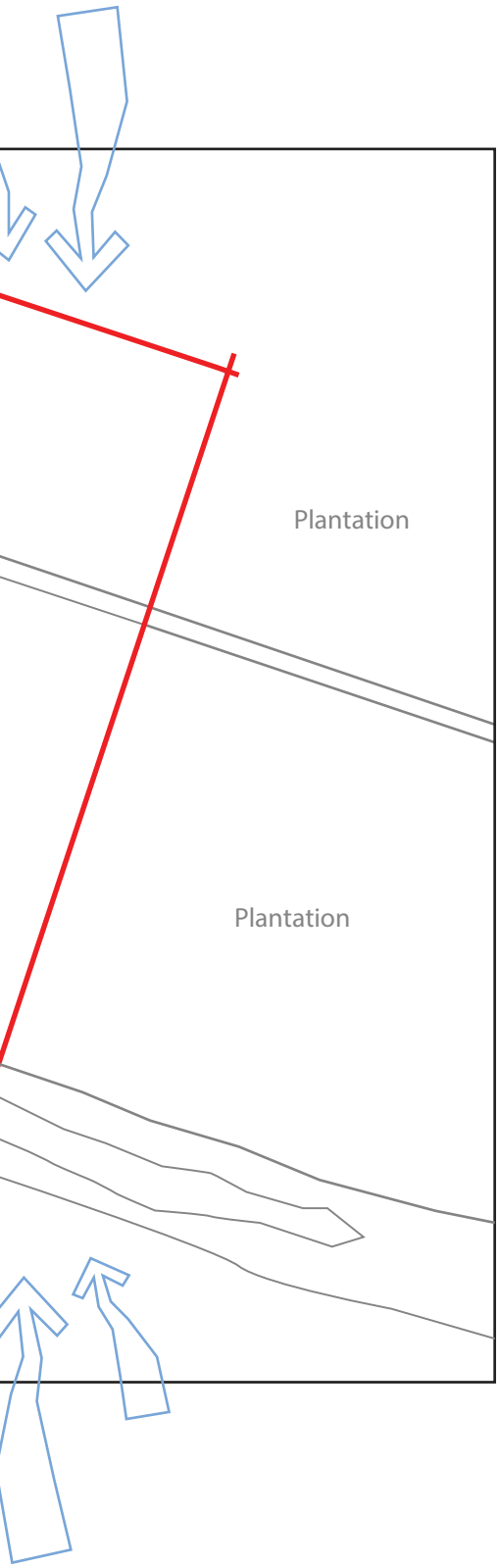



Figure 54. Site Location
Source: Author, 2022




**Wind**

Coastal winds tend to be strong compared to the land. Therefore, if not responded well, it will disrupt indoor activities. In addition, coastal winds can also corrode building materials which make buildings less durable. Thus, the wind is an important consideration in determining the orientation of buildings, materials and structures. Wind sources come from north and south. Wind from south is quite strong. The trees near the beach can break the wind from the south. The existing site also has some trees in the north, so it's enough to be used as wind breaker.

**Contour**

The contour line on the site is tend to be flat. There are only a few small mounds typical of the beach area, and near the beach there are sand dunes with pine trees.

**View**

Due to the existing condition of site that surrounded by plantation and not too much building, the view can be directed to every direction. There is a house located beside the site (south east). However, it doesn't affect the view of the site much.

## 3.2.1.2 Zonning Analysis based on Activities and Lighting Level

**Activities**

Turtle conservation is divided into two activities, there are conservation activities as main activities and visitor activities as supporting activities. The conservation activities consist of hatchery, hatchling ponds, laboratory, and conservation office. Meanwhile, visitor activities is focused on introduction of turtles and raising awareness about turtle protection.

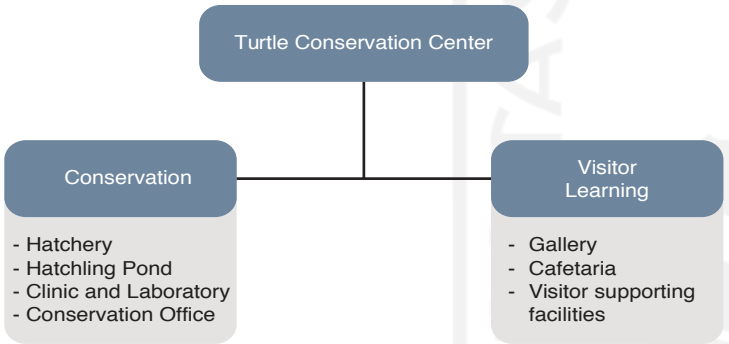



Figure 55. Turtle Conservation Activities
Source: Author, 2022

**Lighting Level**

Because turtle is highly sensitive to light, we must consider about the lighting, so it doesn't affect or seen from the beach.
If the beach is too bright and noisy, the turtles will be looking for other places to lay their eggs. In addition, light also affects how turtles return to the sea. They walked back to the sea based on the brightest direction and use the topography of the surrounding horizon line. If there is light from the mainland, the turtle will get lost. Thus, if there is light that comes out from buildings at night, it must be directed in the opposite direction to the beach.

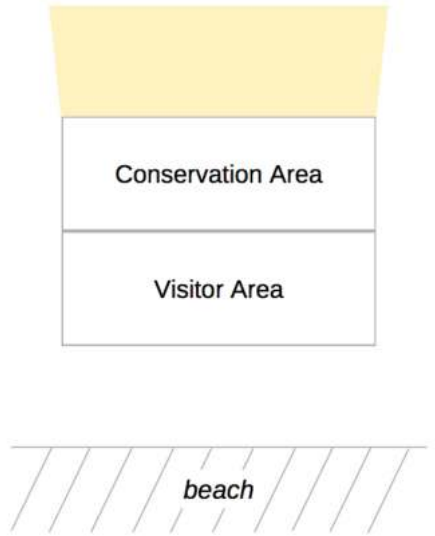
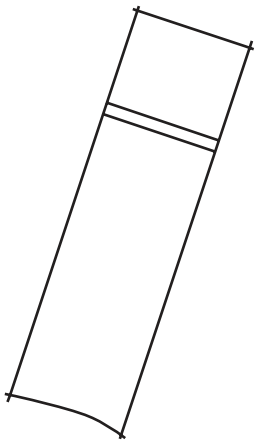



Figure 56. Mass Arrangement basen on Lighting Level
Source: Author, 2022

The closer to the beach, the better the lighting intensity should decrease. So the turtles will choose the beach as a place to lay their eggs because it is quite dark and egg laying activities will not be disturbed.

Based on author analysis before, conservation center is active almost 24 hours per day. Meanwhile, the visitors area is active only during the day. Thus, the conservation area is placed far from the beach and visitor area can be closer so it can block the lighting from conservation area. There must be space between beach and the building. This space is intended as a place to plant trees to avoid abrasion and make it possible to make the beach area darker.

## 3.2.1.3 Building Regulation



The total area of site is 12.740 sqm. Minus the street area, it becomes 12.600 sqm

Koefisien Dasar Bangunan/KDB is at least 40%

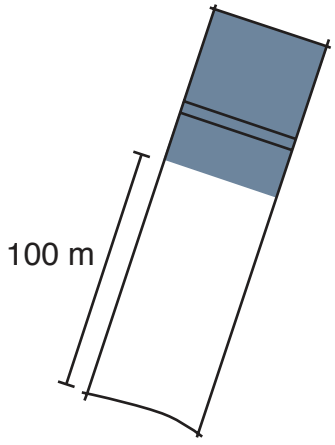
= Site Area Total x KDB
= 12.500 sqm x 40%
= 5.000 sqm

Koefisien Luas Bangunan/KLB is at least 0,8

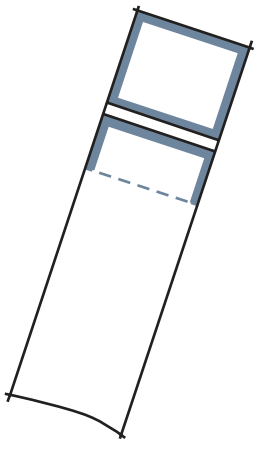
= Site Area Total x KDB
= 12.500 sqm x 0,8
= 10.000 sqm

Number of floors

= KLB / KDB
= 10.000 / 5.000
= 2 floors (maximum)

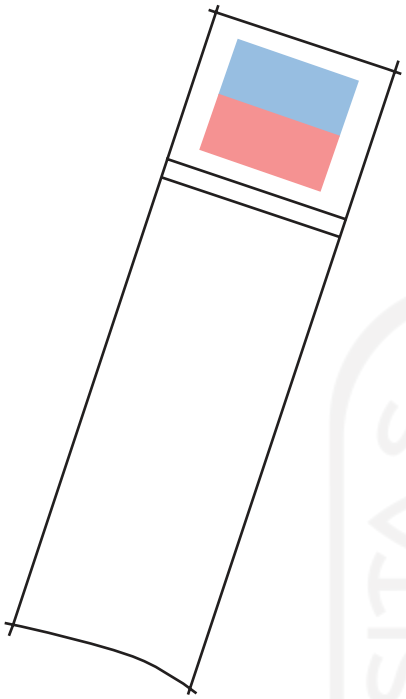



The boundary line from the beach is determined to be at least 100 (one hundred) meters from the highest tide



The boundary line from local street and neighbor is determined to be at least 2 meters

## Alternative Site Plan



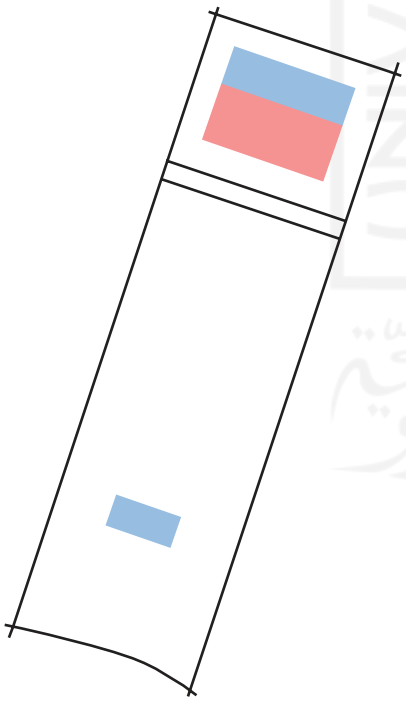


Figure 57. Alternative Site Plan Analysis
Source: Author, 2022

### Alternative 1

In this altenative, the conservation and visitor area is placed in the north, far from the beach. The visitor area is placed in front of the beach because this area tends to be inactive at night so that there is no light spilling onto the beach. The conservation area is located farthest from the beach so that if there is light that comes out at night, it can be covered by the visitor area.

Pros and Cons:

(+) The building won't too close to the beach, so it can minimize the impact of tidal water and abrasion due to damage to the shoreline area due to construction
(+) Easier to monitor hatchery and hatchling pond
(+) Closer distance to laboratories and food storage

(-) The distance from the beach to the building is too far

### Alternative 2

In this altenative, the conservation area is divided into two. The hatchery is placen near the beach and the rest is in the north side.

Pros and Cons:

(+) The hatchlings can go to the sea right after hatching
Visitor area close to the main area of Goa Cemara Beach

(-) Difficult to monitor the hatchery
(-) Hatchery is far from the laboratory area
(-) Prone to being preyed on by predators. In conservation principles, it is better to put the hatchlings to a pond first before release them to the sea. So hatchling growth can be monitored until they are strong enough to be released into the wild
It is too close to the beach, so it's not safe to be hit by tidal waves

Based on analysis of alternative site plan, it can be decided that alternative 1 is the best zoning. Laying the building into an area far from the beach makes it easier to monitor turtle hatching and hatchling growth. In addition, providing sufficient distance from the beach can also reduce the danger of abrasion, tidal waves, and light spills from buildings which will interfere with turtle nesting activities on the beach.

## Development of Selected Alternative

**Conservation Center Area**

The main building of the conservation center is located on the north side of the site. This is to avoid light spills at night and night activities will not disturb the turtles when they lay their eggs. This area is also supratidal which is an area far from the waves, so it is still safe during high tide.

**Transitional Area**

It is a transitional area from a natural spawning area to a conservation center area. In this area the landscape is designed to make direct access that easy and clear to the beach area. Also to plant local vegetation as an effort to preserve local plants and environment (help to avoid abrasion)

In this area, which is a sand dune with pine trees and a sloping beach, natural conditions will be maintained so that the natural nesting area is maintained without light and remains the lush greenery, so turtles are attracted to lay eggs in this area. Thes pine trees also help to prevent abrasion.

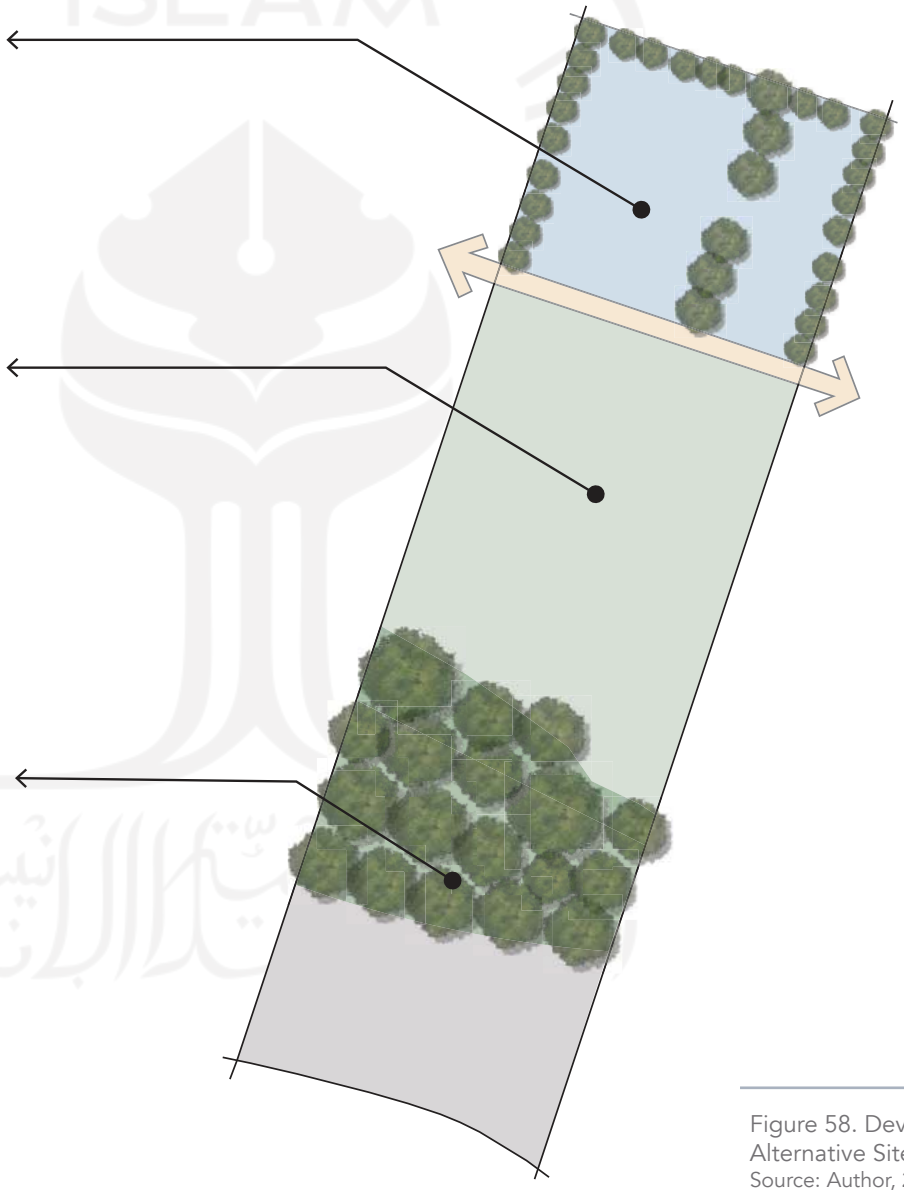


Figure 58. Development of Selected Alternative Site Plan
Source: Author, 2022

## 3.2.2 Turtle Based Building for Building Mass Concept

Table 8. Design Criteria of Hatchery and Hatchling Pond

| Design Criteria | Design Guidelins |
|---|---|
| • The temperature of the hatchery and hatchling pond should be warm or normal, around 25-30 degrees Celsius | • Placed hatchery and hatchling pond area in the east because morning sunlight is suitable (not too hot)<br>• The use of transparent material or sufficient openings for the wall to avoid predator but sufficient sunlight can enter and keep the room temperature warm |
| • The hatchery should neither be too dry nor too wet. So the humidity should be kept with sun intensity around 40-60% | • Placed in an area with roof or shading device to avoid too much solar heat and maintain humidity. This can also avoid predators. |

Source: Author, 2022


Figure 59. Sunpath
Source: sunearthtools.com (accessed May 15, 2022)

**Sun Analysis**

According to data from *sunearthtools.com* (accessed on May 15, 2022), the movement of the sun is directly above the site, but slightly from the north. The important thing to consider is the sunlight from the west and north which affects the thermal quality in the room as well as natural lighting. The orientation of the sun is an important consideration in determining the shape of the mass, openings and handling the facade on the building envelope.


Figure 60. Wind Rose
Source: meteoblue.com & google maps (accessed on 15 May 2022)

**Wind Analysis**

Wind is an important aspect in creating passive cooling and natural ventilation in buildings so that building users can feel comfortable in their activities. Coastal winds tend to be strong compared to the land. Therefore, if not responded well, it will disrupt indoor activities. In addition, coastal winds can also corrode building materials which make buildings less durable. Thus, the wind is an important consideration in determining the orientation of buildings, materials and structures.

## Shading Device

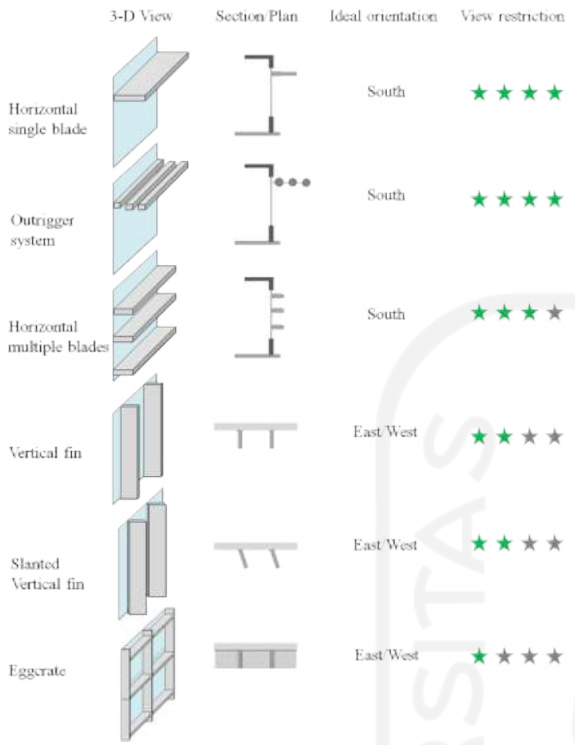



Figure 61. Type of shading device and effectiveness level
Source: (accessed May 15, 2022)

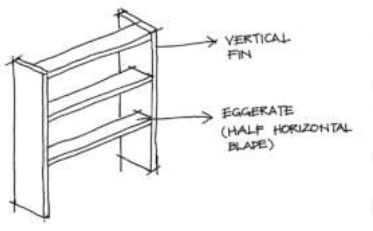



Figure 62. Selected Shading Device
Source: (accessed May 15, 2022)

To maximize natural light entering the building, sufficient openings are made. To reduce direct exposure of sunlight and radiation, vertical and horizontal shading is added, as well as planting vegetation with tall and lush trees.Based on the effectiveness level, the most effective shading device for east and west is vertical fin and eggerate (combine fin and blade). Thus, based on author's analysis and simulation, for site in Goa Cemara beach, we can apply eggerate shading device with slanted vertical fin or regular vertical fin. Because the hatchling pond area need more lighting to keep the temperature warm, half horizontal blade is better so that the light during the day can enter the building.

## Alternative Shading Device

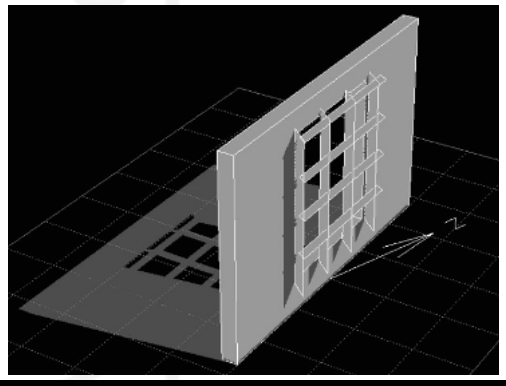
**Alternative 1**

In this altenative, the building is facing the north east (70% orientation). It has both vertical and horizontal shading. The vertical shading is a bit tilted to prevent to much solar radiation into the building. Meanwhile, the horizontal shading is slightly advanced so there is still a little light coming in during the day.

Pros and Cons:

(+) If there is light coming out from the inside, it is not too visible from the beach

(-) Too many fins are used which increases the material cost



**Tabulated Daily Solar Data**

Latitude: -7.0°
Longitude: 110.0°
Timezone: 120.0° [+8.0hrs]
Orientation: 120.0°

Date: 1st May
Julian Date: 121
Sunrise: 06:44
Sunset: 18:29

Local Correction: -37.0 mins
Equation of Time: 3.0 mins
Declination: 14.7°

| Local | (Solar) | Azimuth | Altitude | HSA | VSA | Shading |
|---|---|---|---|---|---|---|
| 07:00 | (06:22) | 74.6° | 3.7° | -45.4° | 5.3° | 30% |
| 07:30 | (06:52) | 73.5° | 10.9° | -46.5° | 15.6° | 33% |
| 08:00 | (07:22) | 72.0° | 18.0° | -48.0° | 25.9° | 35% |
| 08:30 | (07:52) | 70.1° | 25.0° | -49.9° | 35.9° | 41% |
| 09:00 | (08:22) | 67.7° | 32.0° | -52.3° | 45.6° | 51% |
| 09:30 | (08:52) | 64.7° | 38.8° | -55.3° | 54.7° | 58% |
| 10:00 | (09:22) | 60.7° | 45.4° | -59.3° | 63.3° | 64% |
| 10:30 | (09:52) | 55.3° | 51.7° | -64.7° | 71.4° | 75% |
| 11:00 | (10:22) | 47.8° | 57.6° | -72.2° | 79.0° | 74% |
| 11:30 | (10:52) | 37.4° | 62.6° | -82.6° | 86.2° | 62% |
| 12:00 | (11:22) | 22.9° | 66.4° | -97.1° | 93.1° | [Behind] |
| 12:30 | (11:52) | 4.6° | 68.2° | -115.4° | 99.7° | [Behind] |
| 13:00 | (12:22) | -14.7° | 67.5° | -134.7° | 106.2° | [Behind] |
| 13:30 | (12:52) | -31.1° | 64.6° | -151.1° | 112.6° | [Behind] |
| 14:00 | (13:22) | -43.4° | 60.1° | -163.4° | 118.9° | [Behind] |
| 14:30 | (13:52) | -52.1° | 54.6° | -172.1° | 125.2° | [Behind] |
| 15:00 | (14:22) | -58.4° | 48.4° | -178.4° | 131.6° | [Behind] |
| 15:30 | (14:52) | -62.9° | 41.9° | 177.1° | 138.0° | [Behind] |
| 16:00 | (15:22) | -66.4° | 35.2° | 173.6° | 144.6° | [Behind] |
| 16:30 | (15:52) | -69.1° | 28.3° | 170.9° | 151.4° | [Behind] |
| 17:00 | (16:22) | -71.2° | 21.3° | 168.8° | 158.3° | [Behind] |
| 17:30 | (16:52) | -72.8° | 14.2° | 167.2° | 165.4° | [Behind] |
| 18:00 | (17:22) | -74.1° | 7.1° | 165.9° | 172.7° | [Behind] |

Figure 63 & 64. Design Simulation of Alternative 1
Source: Author, 2022 (with VELUX)

## Alternative 2

In this altenative, the building is facing the east (120% orientation). It has both vertical and horizontal shading. The vertical shading is not tilted to prevent to much solar radiation into the building. Meanwhile, the horizontal shading is slightly advanced so there is still a little light coming in during the day.

Pros and Cons:

(+) Fins are used less so they don't add material cost

(-) If there is light that comes out at night, it will be seen from the beach, so a way is needed to cover the area



**Tabulated Daily Solar Data**

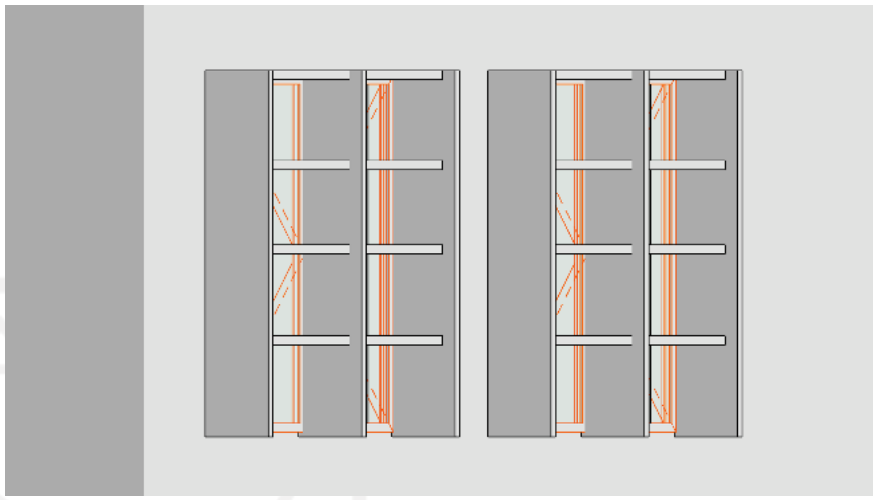
Latitude: -7.0°
Longitude: 110.0°
Timezone: 120.0° [+8.0hrs]
Orientation: 70.0°

Date: 1st May
Julian Date: 121
Sunrise: 06:44
Sunset: 18:29

Local Correction: -37.0 mins
Equation of Time: 3.0 mins
Declination: 14.7°

| Local | (Solar) | Azimuth | Altitude | HSA | VSA | Shading |
|---|---|---|---|---|---|---|
| 07:00 | (06:22) | 74.6° | 3.7° | 4.6° | 3.7° | 41% |
| 07:30 | (06:52) | 73.5° | 10.9° | 3.5° | 10.9° | 40% |
| 08:00 | (07:22) | 72.0° | 18.0° | 2.0° | 18.0° | 41% |
| 08:30 | (07:52) | 70.1° | 25.0° | 0.1° | 25.0° | 47% |
| 09:00 | (08:22) | 67.7° | 32.0° | -2.3° | 32.0° | 47% |
| 09:30 | (08:52) | 64.7° | 38.8° | -5.3° | 38.9° | 49% |
| 10:00 | (09:22) | 60.7° | 45.4° | -9.3° | 45.8° | 57% |
| 10:30 | (09:52) | 55.3° | 51.7° | -14.7° | 52.7° | 60% |
| 11:00 | (10:22) | 47.8° | 57.6° | -22.2° | 59.5° | 60% |
| 11:30 | (10:52) | 37.4° | 62.6° | -32.6° | 66.5° | 68% |
| 12:00 | (11:22) | 22.9° | 66.4° | -47.1° | 73.4° | 78% |
| 12:30 | (11:52) | 4.6° | 68.2° | -65.4° | 80.5° | 74% |
| 13:00 | (12:22) | -14.7° | 67.5° | -84.7° | 87.8° | 69% |
| 13:30 | (12:52) | -31.1° | 64.6° | -101.1° | 95.2° | [Behind] |
| 14:00 | (13:22) | -43.4° | 60.1° | -113.4° | 102.9° | [Behind] |
| 14:30 | (13:52) | -52.1° | 54.6° | -122.1° | 110.7° | [Behind] |
| 15:00 | (14:22) | -58.4° | 48.4° | -128.4° | 118.8° | [Behind] |
| 15:30 | (14:52) | -62.9° | 41.9° | -132.9° | 127.2° | [Behind] |
| 16:00 | (15:22) | -66.4° | 35.2° | -136.4° | 135.7° | [Behind] |
| 16:30 | (15:52) | -69.1° | 28.3° | -139.1° | 144.5° | [Behind] |
| 17:00 | (16:22) | -71.2° | 21.3° | -141.2° | 153.4° | [Behind] |
| 17:30 | (16:52) | -72.8° | 14.2° | -142.8° | 162.3° | [Behind] |
| 18:00 | (17:22) | -74.1° | 7.1° | -144.1° | 171.3° | [Behind] |

Figure 65 & 66. Design Simulation of Alternative 2
Source: Author, 2022 (with Suntool)



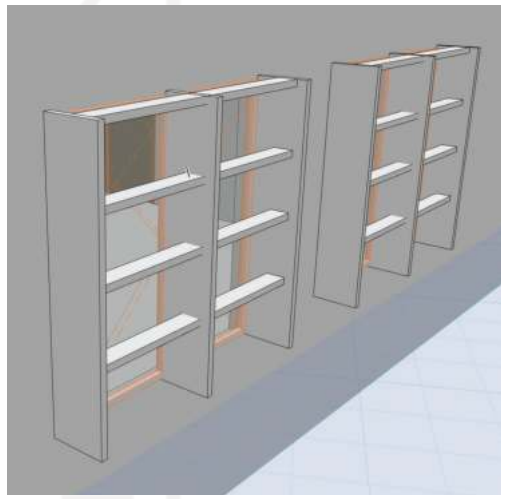


Figure 67 & 68. Design Result
Source: Author, 2022

Based on the alternative design simulation, the shading device that more suitable for hatchling pond area is the alternative 2. It has more sunlight intensity than the alternative 1, even though both has good result in design simulation.

## 3.2.3 No Overlight Building based on Lighting Level Concept

### 3.2.3.1 No Overlight Building

Nesting turtles once had no trouble finding a quiet, dark beach on which to nest, but now they must compete with tourists, busi- nesses and coastal residents for use of sandy beaches. Therefore, the construction of new buildings in coastal areas near turtle nesting sites should minimize the light that comes out of the building.

The concept of no overlight building is to reduce the amount of artificial light that is visible from nesting beaches, by:

1. Room programming based on lighting level of each area at night.
2. Create opening that can maximize natural light and air circulation to enter the building during the day, but can be completely
3. closed at night (especially that face the beach).
   Minimize the use of glass for opening that face the beach or make a secondary skin and opening's cover so that it can block
4. light from inside.
   Create a door area that does not face the beach. Or design the door area to pass through a short passage/transition area first, so the light from inside doesn't spill out right away.

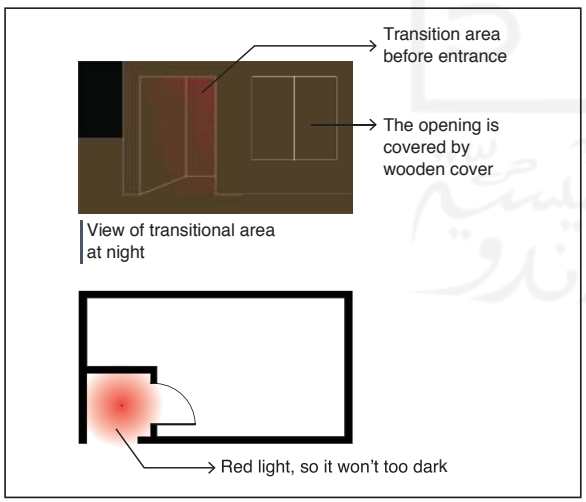



Figure 69. Transitional area before enter the building
Source: Author, 2022

### 3.2.3.2 Turtle-Safe Lighting

Coastal communities around the world have passed ordinances that require residents turn off beachfront lights during turtle nesting season. Unfortunately, these ordinances are not always enforced. Thus, it is very important to apply turtle safe lighting principles, especially to the landscape and exterior lighting of building in coastal.

1. **Keep it off**
   Keep light off the beach and lights off when not needed.
2. **Keep it low**
   Mount the fixture as low as possible to minimise light trespass, and use the lowest amount of light needed for the task.
3. **Keep it shielded**
   Fully shield the light so bulbs and/or glowing lenses are not visible and avoid light escaping upwards and outwards. Re- quirement is that no lamp lumens go above a 90-degree angle with no more than 10% of the lamp lumens exceeding 80-de- grees angle.
4. **Keep it long**
   Use long wavelength light sources (ambers and reds) in the appropriate lighting fixtures.

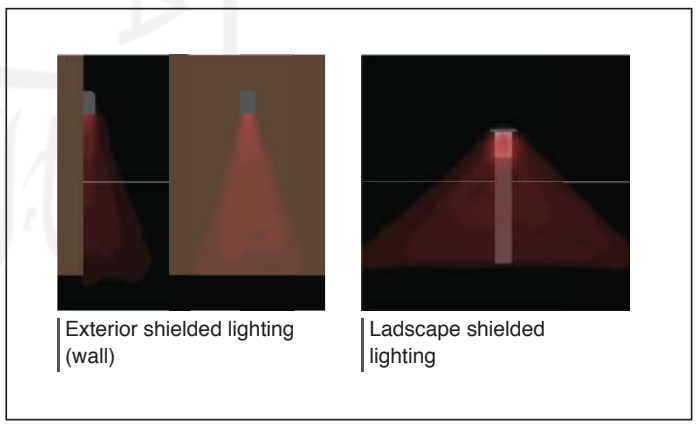



Figure 70. Shielded lighting
Source: Author, 2022

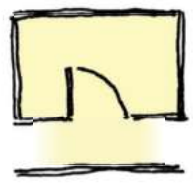
Table 9. Design Criteria of Area based on Light Intensity

| Design Criteria | Design Guidelines |
|---|---|
| • Light intensity < 50% (visitor area) | • This area placed in the front to blocked the conservation area from the beach<br>• All openings that face the beach should be covered with window cover to avoid light spill |
| • Light intensity 40-60% (entrance, lobby, outdoor hatchery and hatchling pond area) | • Using shielded lighting<br>• Make a transition area before enter the building and equipped with red light |
| • Light intensity 100% (laboratory, management building) | • This area placed in the back, far from the beach |

Source: Author, 2022

**Alternative of Transitional Area**

1

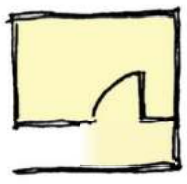


Pros and Cons:

(+) Circulation feels more flexible and wide

(-) There is still the possibility of light spilling at night

2

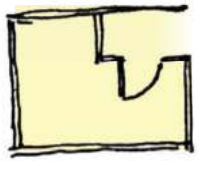


Pros and Cons:

(+) Lighting won't spill at night because the door can be placed close to the wall that blocks the light

(-) Circulation feels narrow

3

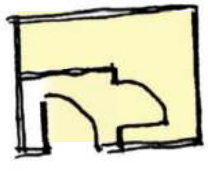


Pros and Cons:

(+) Maximum use of space

(-) There is still the possibility of light spillage because the transition area is relatively short

4



Pros and Cons:

(+) Maximum lighting blocking

(-) Access feels narrow, costs increase

Figure 71. Alternative of Transitional Area
Source: Author, 2022

**Alternative of Window Cover**

1

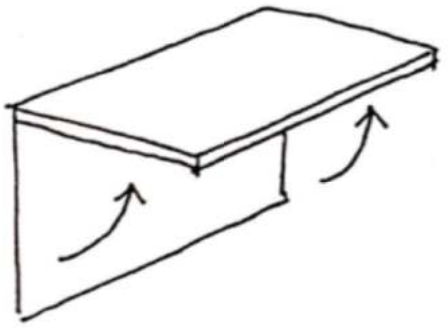


Figure 72. Alternative of Window Cover
Source: Author, 2022

Pros and Cons:

(+) Can block lighting at night

(+) It can be use for shading and avoid rainwater enter the building

(-) It can be use for window with glass

(-) Need wide area to open the cover

2

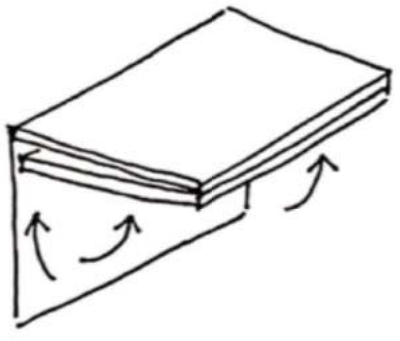


Figure 73. Alternative of Window Cover
Source: Author, 2022

Pros and Cons:

(+) Can block lighting at night

(+) It can be use for shading and avoid rainwater enter the building

(+) It can be use to avoid strong wind because it can be adjust following the situation

(+) It can be use for window with glass

Need wide area to open the cover

3

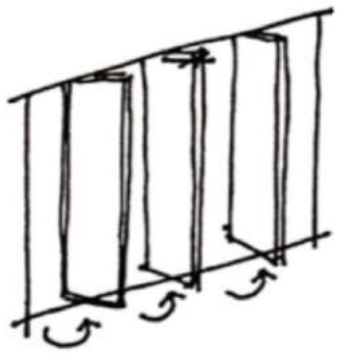


Figure 74. Alternative of Window Cover
Source: Author, 2022

Pros and Cons:

(+) Can block lighting at night
(+) It can be use for shading device
(-) Can't be use for window with glass
(-) Can't avoid rain water, so we need to apply cantilever

4

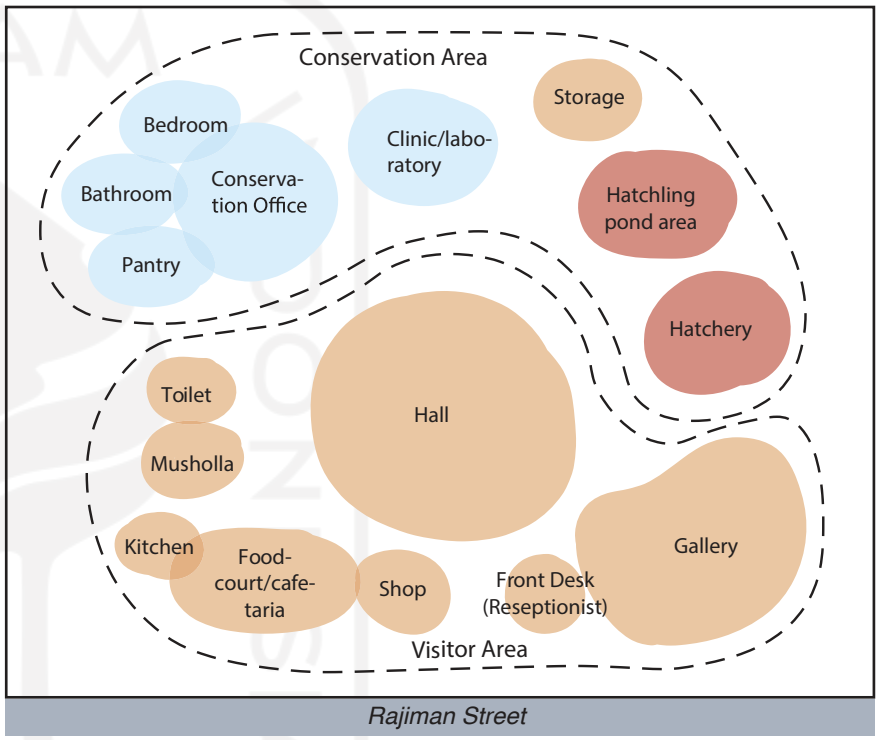
Figure 75. Alternative of Window Cover
Source: Author, 2022

Pros and Cons:

(+) Can block lighting at night
(+) It can be use for window with glass
(-) Can't be use for shading (north and south) so we need to apply horizontal shading device
(-) Can't avoid rain water so we need to apply cantilever

## Building Space Arrangement based on lighting level

The spatial arrangement is formulated by make a room programming based on activities and time/duration. Then divided into two zones to maximize the conservation center and turtle-based tourism. The lighting level of each room is also measured to determine its placement to help minimize light coming out of the building at night.




Lighting Level (at night)

100% = active at night, so it needs normal light
50% = active at day, doesn't need much light
25% = in outdoor, it needs turtle safe light

Figure 76. Zoning on main building of conservation center based on activities and lighting level
Source: Author, 2022

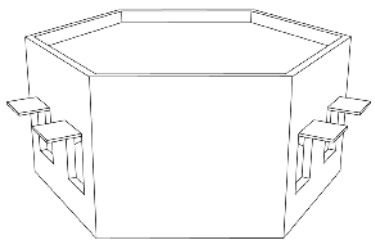
## 3.2.4 Natural lighting to minimize energy for sustainable building

Table 10. Design Criteria of natural lighting

| Design Criteria | Problem Solving |
|---|---|
| • Minimum of 30% of the floor area used for work gets a natural light intensity of at least 300 lux | • The building mass tends to extend from east to west to maximize natural lighting but avoid excessive radiation<br>• Minimize the opening that face the south (beach) toavoid lightspill at night |

Source: Author, 2022

**Alternative 1**



In this altenative, the building shape is hexagon
Pros and Cons:

(+) View to every direction
(+) Unique form to add the aesthetics
(-) Natural lighting can't reach building center

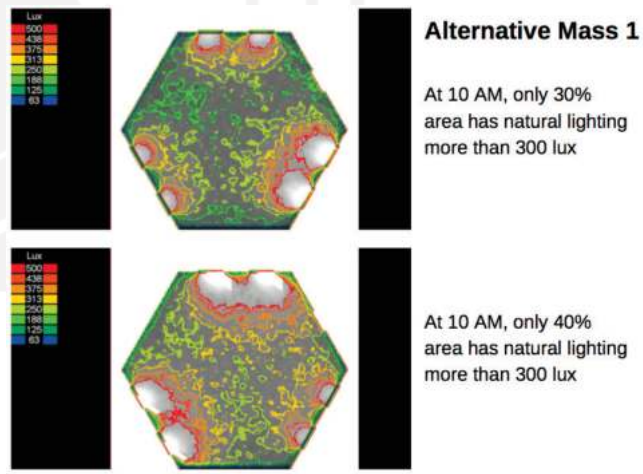
**Alternative 2**

Figure 77 & 78. Mass exploration
Source: Author, 2022

In this altenative, the building shape is rectangular
Pros and Cons:

(+) Natural lighting can reach the building center, even though based on the simulation, opening should be added. So it will be more maximized
(-) View only two direction
(-) Form a bit monotone

**Alternative Simulation**



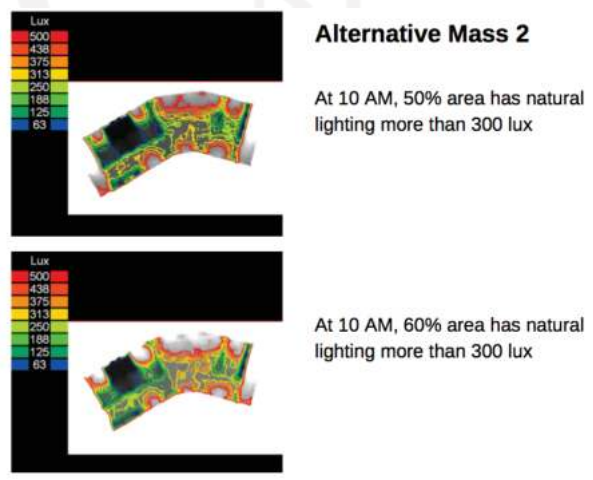



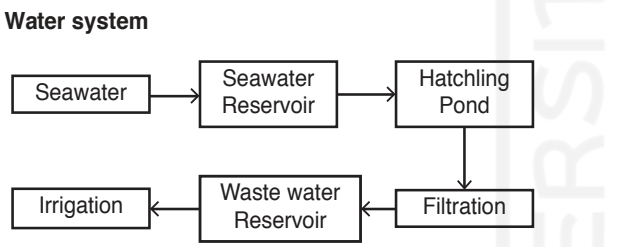

Figure 79 & 80. Alternative Simulation
Source: Author, 2022 (with VELUX)

## 3.2.5 Sea water management for hatchling ponds

Table 11. Design Criteria of hatchling pond

| | |
|---|---|
| seawater and replaced 2x a day after feeding the turtles | • Making temporary seawater re<br>• Creating a wastewater treatme so the use of water can be ma |

Source: Author, 2022



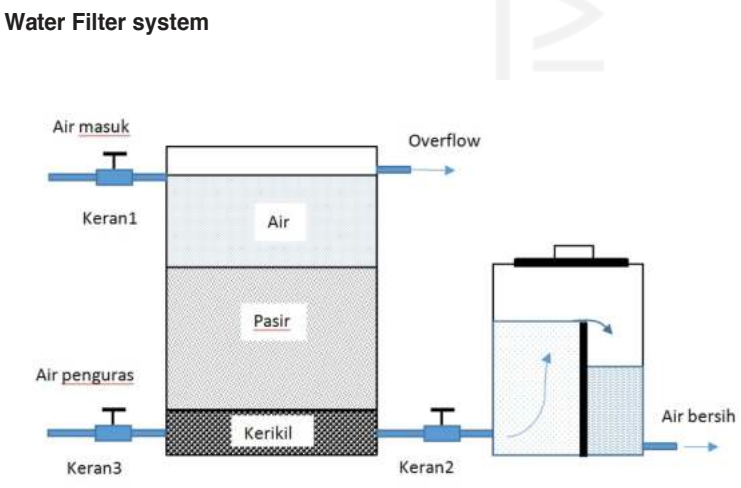
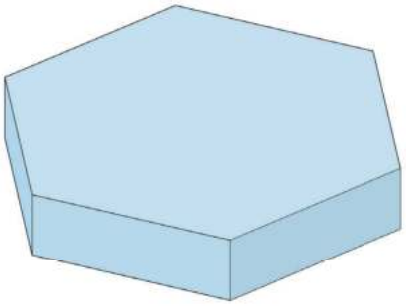
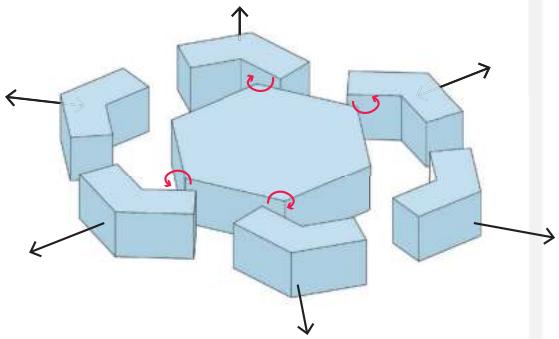




Figure 81. Water system scheme
Source: Author, 2022
Figure 82. Sea water filtration schemet
Source: Author, 2022

## Building Mass Arrangement

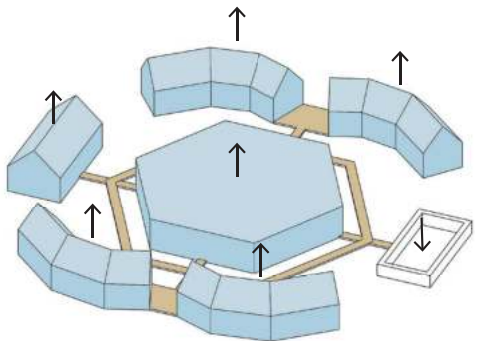


Required architecture building volume.
Hexagon shape to r epresent the turtle s hell



Divide the space containing each function:

| | |
|---|---|
| 1. Office | 5. Cafetaria |
| 2. Laboratory | 6. Souvenir Shop |
| 3. Hatchery | 7. Support Facilities |
| 4. Gallery | 8. Hall |

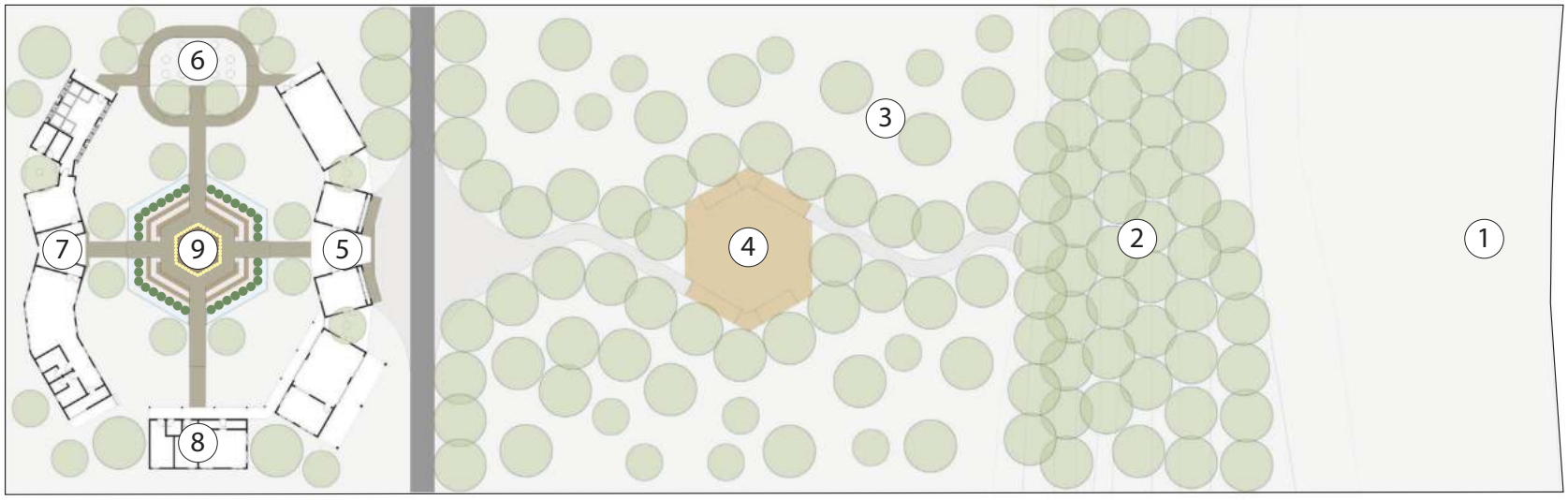


Add pathway t hat connecting each b uilding. Adds a building level to contrast with the ground and p reventing sand f rom entering when t he wind blows. Tilted roof to response the climate, so t he r oom i s not hot and water run off can directly fall to the ground

Figure 83. Mass transformation
Source: Author, 2022

## 3.3 Schematic Design

### 3.3.1 Landscape Arrangement



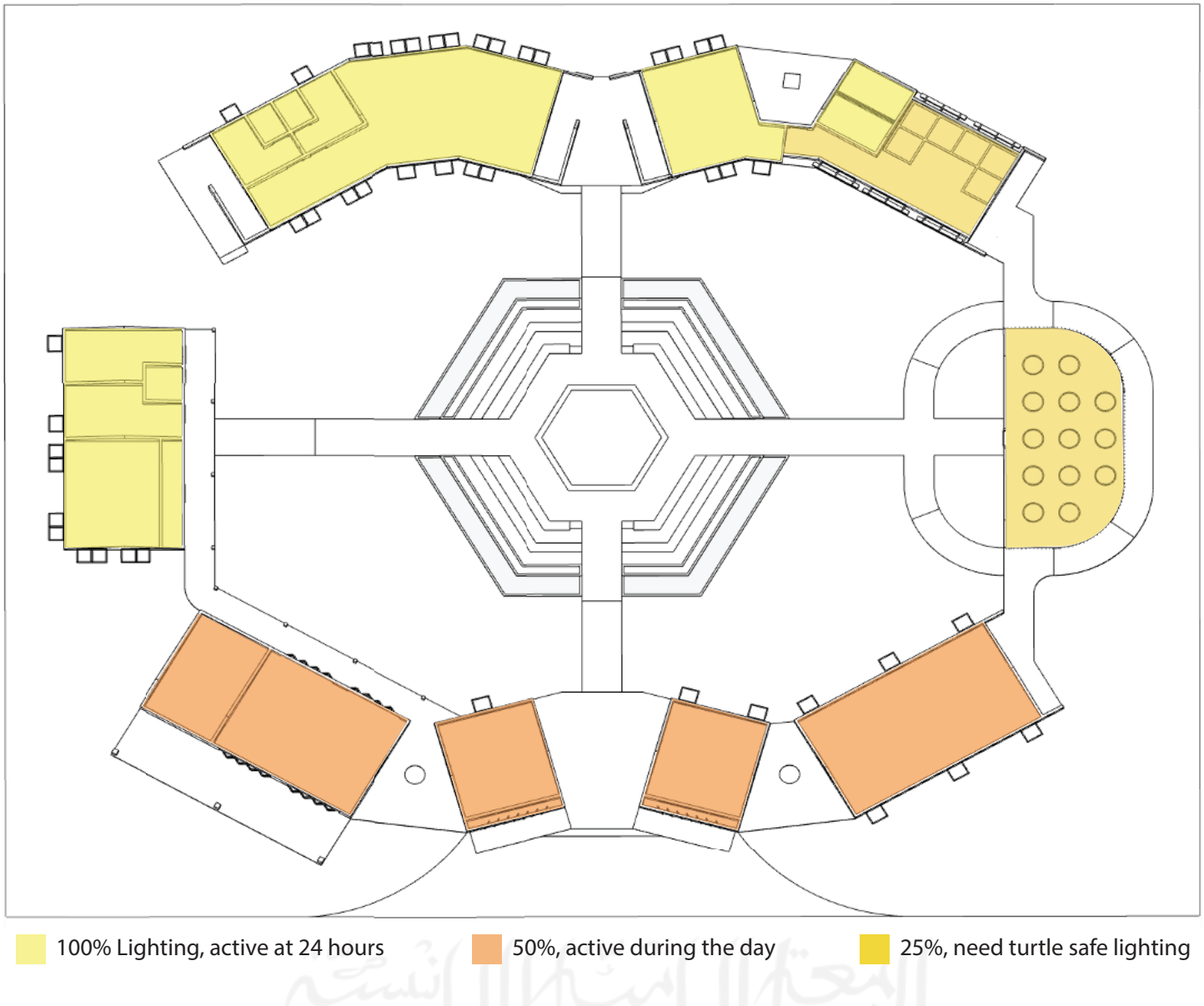

1. Beach
2. Sand Dune
3. Pine Trees Plantation
4. Plaza
5. Visitor Building
6. Hatchery
7. Conservation Building
8. Support Facilities Building
9. Amphitheater
- Pine Trees
- Decoration Plant
- Decoration Plant

Figure 84. Site Plan Scheme
Source: Author, 2022

The concept of site plan, adjust the ecological aspect. In designing the site plan, the turtle characteristic and site condition are considered. Turtle tend to sensitive toward lighting. When turtles want to go back to the sea, they are following the horizon light. Thus, buildings near turtle nesting area shouldn't spill too much light to avoid distraction (turtle will get lost because confused following the light. Turtle also sensitive to noise, the will frightened out and looking for another nesting site if the beach is too noisy. Hence, to adjust this turtle characteristic, the existing trees are maintained and the building placed a bit far from the beach. The placement of building also consider the local regulation about border line.

The sand dunes near the beach also maintained to avoid abrasion. In the middle area (3) pine trees are planted as shade. This was done because the area was previously a plantation without tall trees and tended to be hot. A stage or level is added so that visitors who want to look around can stop (4). The sites are separated by small unpaved roads with a width of approximately 3 meters. To avoid accidents, pay attention to the road boundaries. In addition, a fairly large area is made on the side of the road, so that if a user wants to cross and there is a vehicle, they can wait first. On the building site area, existing trees are maintained so that the area remains shady and cool.

### 3.3.2 Zoning by Activities and Lighting Level




The visitor building placed in the front because it is only active during the day. At night, this building doesn't need any lighting. This placement also can help to blocked the light spill from the building behind. For the Outdoor area including hatchery, the turtle dafe lighting such as shielded red light is needed to avoid light glare.

Figure 85. Zoning by Lighting Level
Source: Author, 2022

### 3.3.3 Spatial Arrangement for Hatchery and Hatchling Ponds

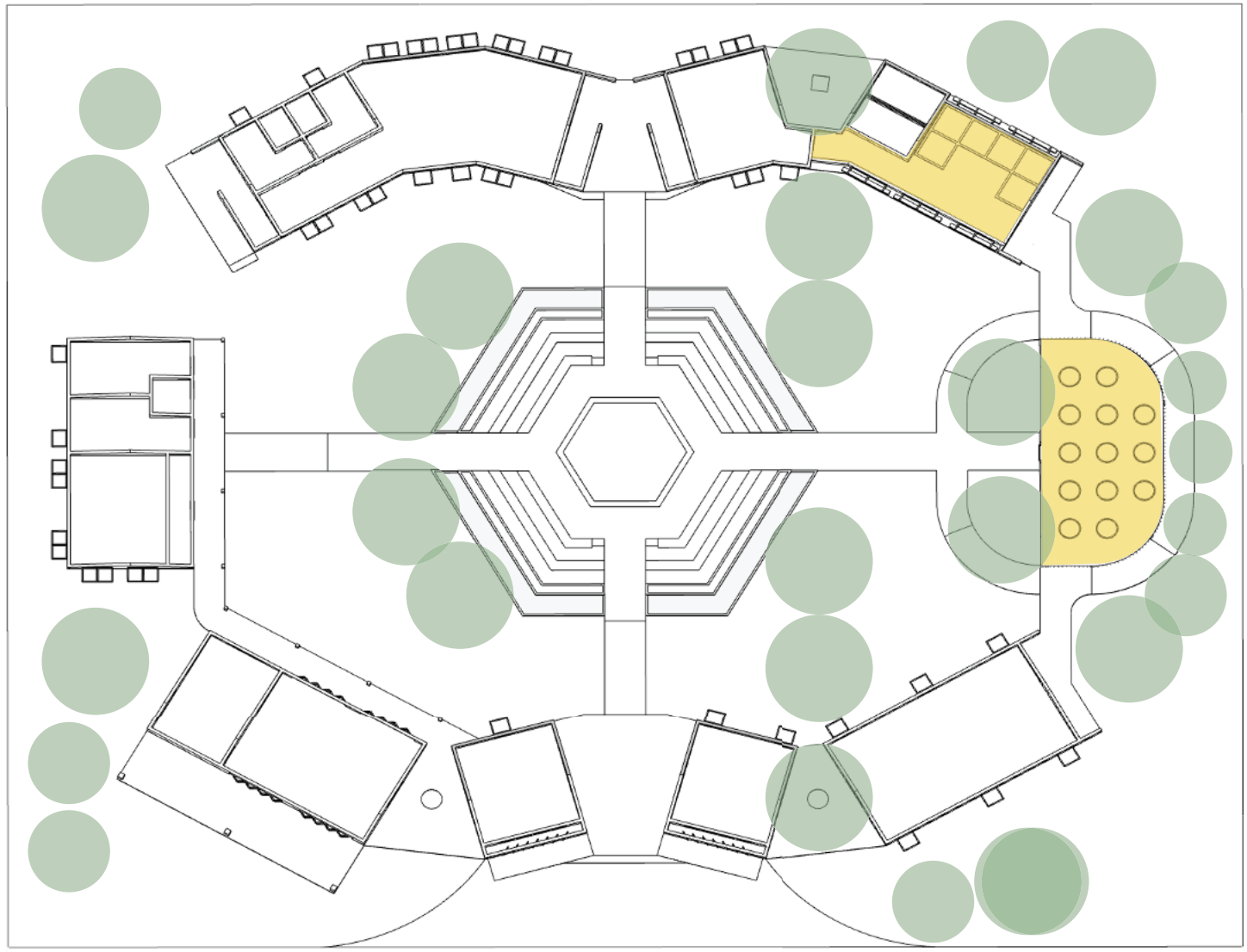


Figure 86. Spatial arrangement
Source: Author, 2022

The hatchery and hatchling pond area are placed in the east side of the site to get maximum natural lighting in the morning. It is also surrounded by trees as natural shading to avoid too much solar heat that can cause the death of turtle embryos and hatchlings.

### 3.3.4 Shading Device Application to keep the Temperature

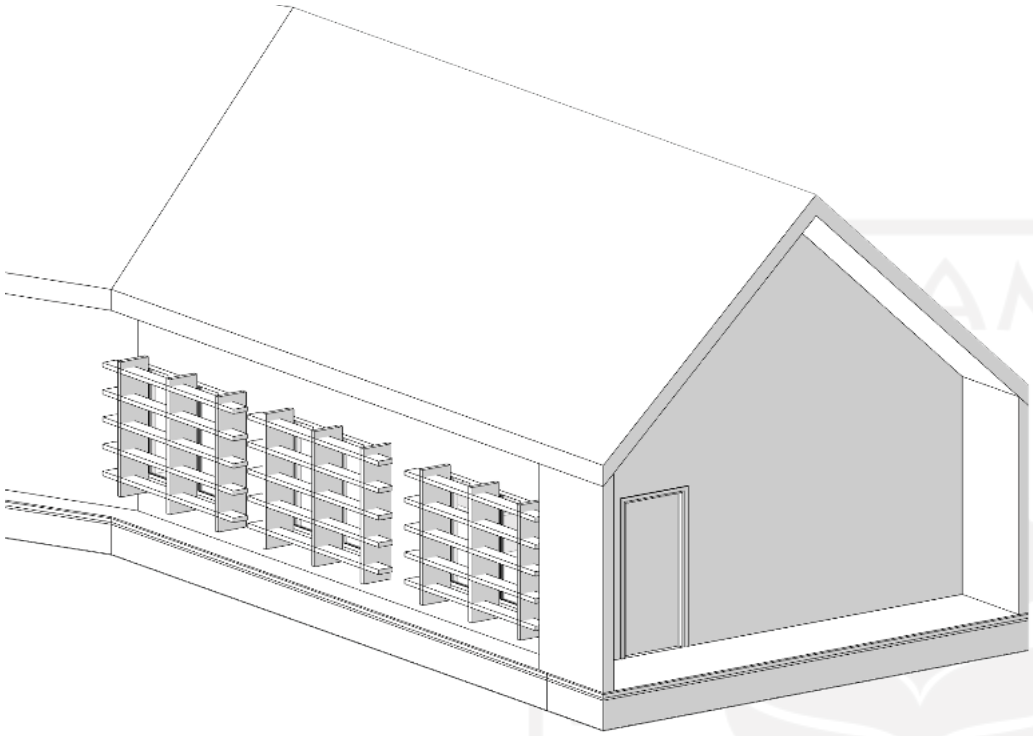


Figure 87 Schematic of Shading Device
Source: Author, 2022

Based on the alternative design simulation, the shading device that more suitable for hatchling pond area that face the east, is shading that combine both horizontal and vertical. It has more sunlight intensity but still in the normal standard (not too hot nor cold) than the regular one.

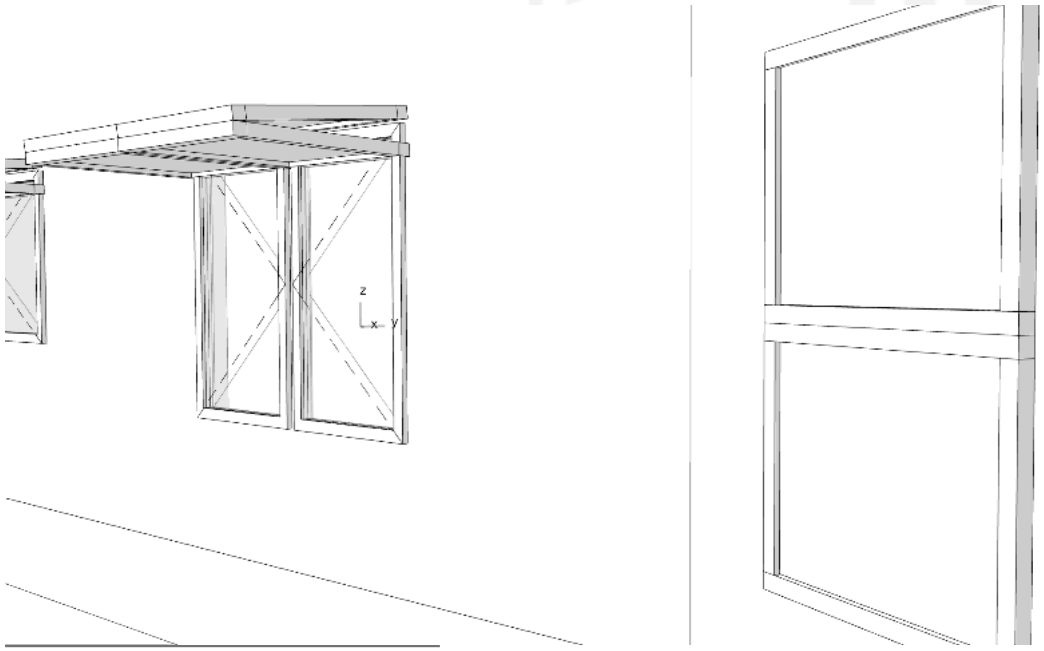



Figure 88. Schematic of Window Cover
Source: Author, 2022

For the window, folded window cover from wood was chosen because of it's multifunction. During the day, this device can be a shading. But at the night, it can help to block the light from inside the building

## 3.3.5 Minimum Light Spill Building Envelope

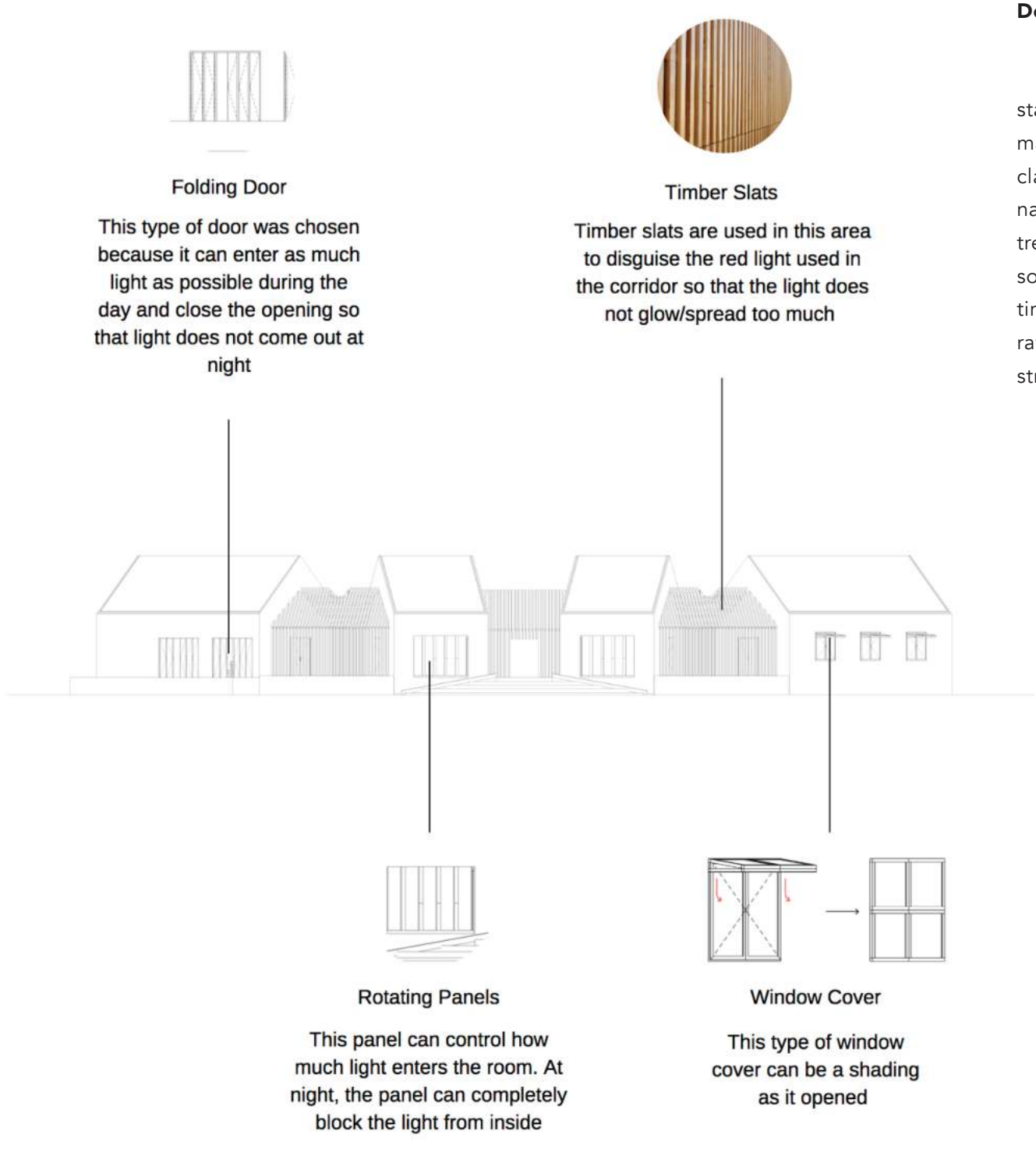



Figure 89. Schematic of Facade
Source: Author, 2022

**Detailed Facade**

To reduce the risk of corrosion, stainless steel and wood are the main materials for the structure with timber cladding on the facade. Timber has a natural resilience to high winds and extreme climates. Beside that, unlike masonry or other rigid cladding materials, timber has a higher strength to weight ratio allowing it to withstand far greater stresses and movement.

### 3.3.6 Lighting Based on Turtle Safe Lighting

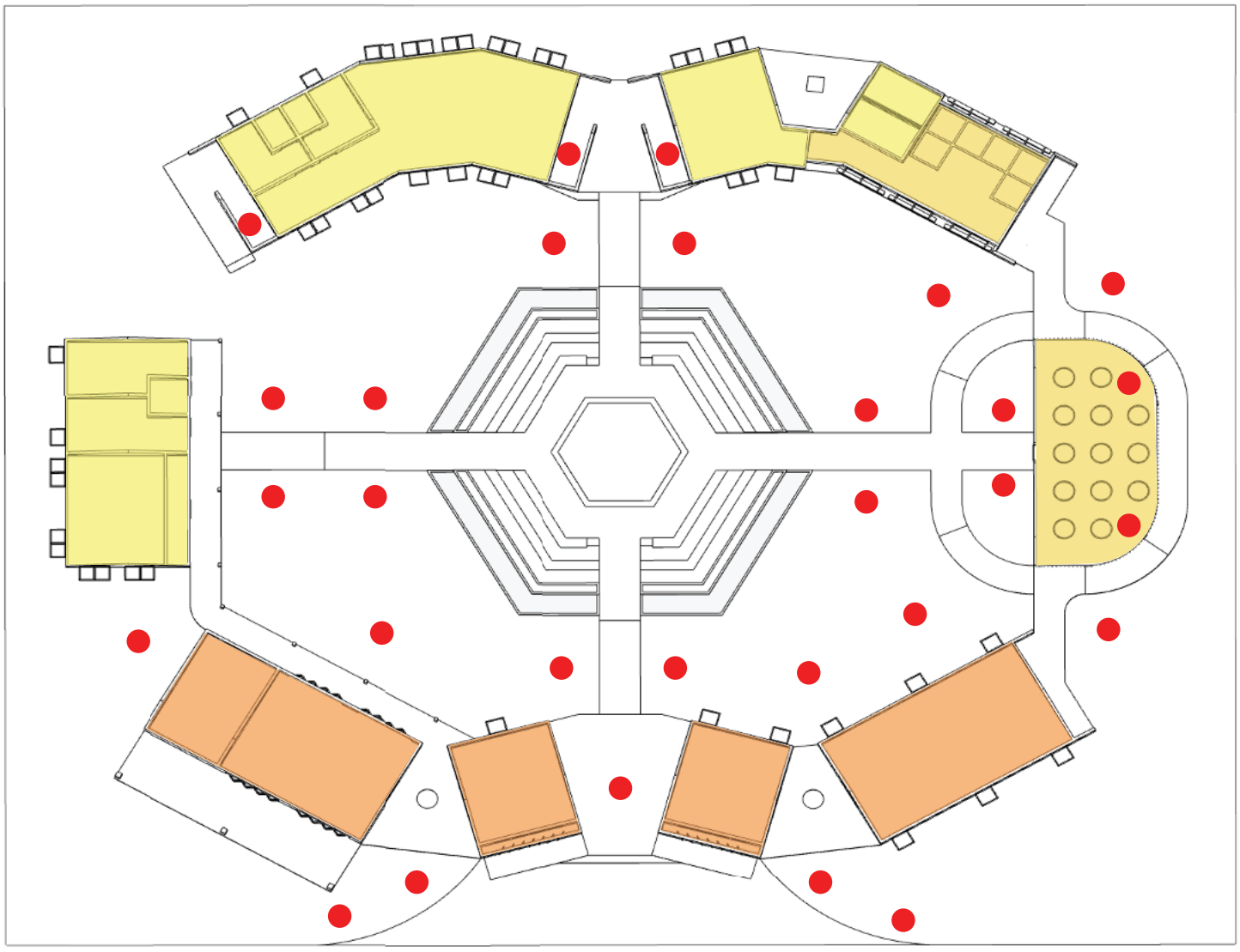
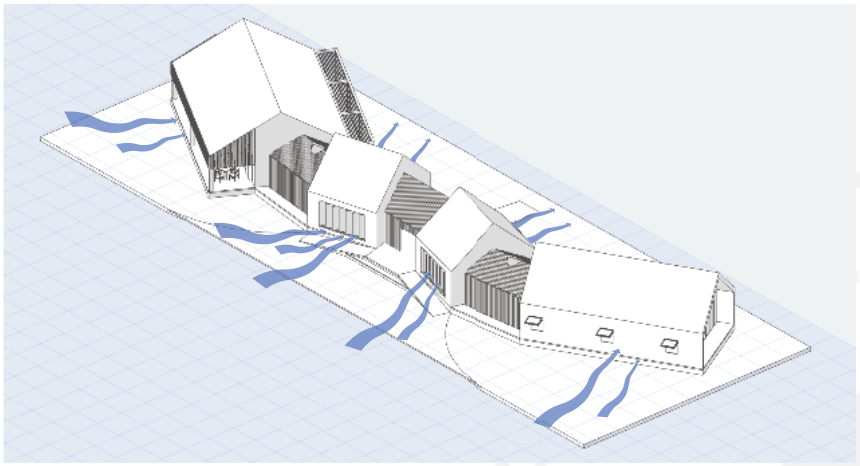



Figure 90. Schematic of Lighting
Source: Author, 2022

## 3.3.Natural Opening nad Ventilation



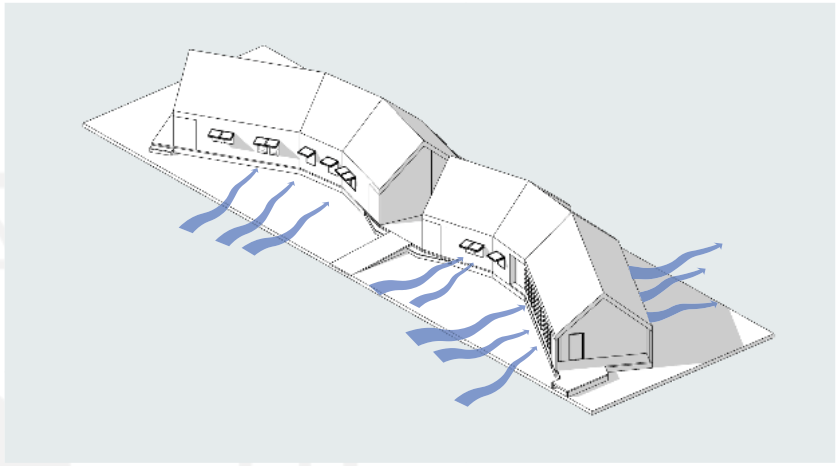
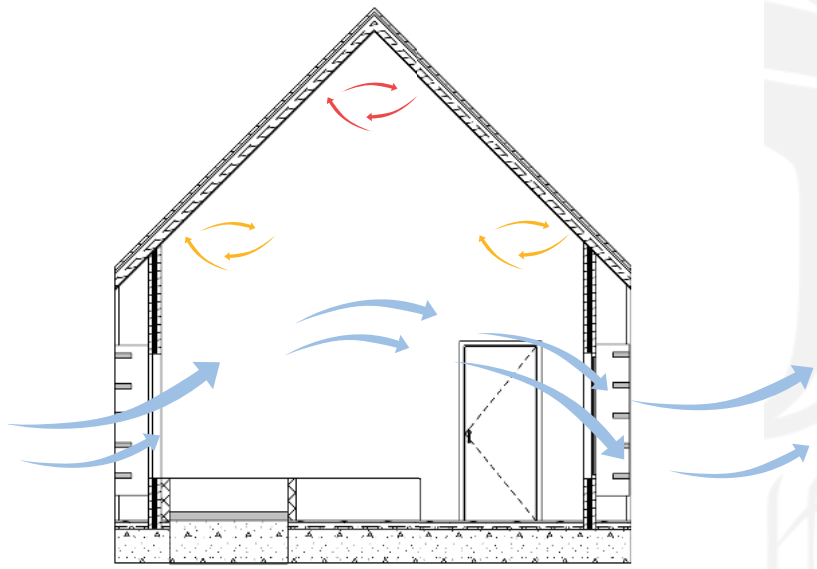


Figure 91. Natural Opening
Source: Author, 2022



SCHEMATIC VENTILATION AND THERMAL

This building minimize the use of glass to let natural lighting and air circulation enter the building. This building using cross ventilation principle, so the air that flows in the room remain fresh. Besides that, this building has quite high ceiling to avoid thermal heat.

*chapter 4*

# DESIGN DESCRIPTION

## 4.1 Situation

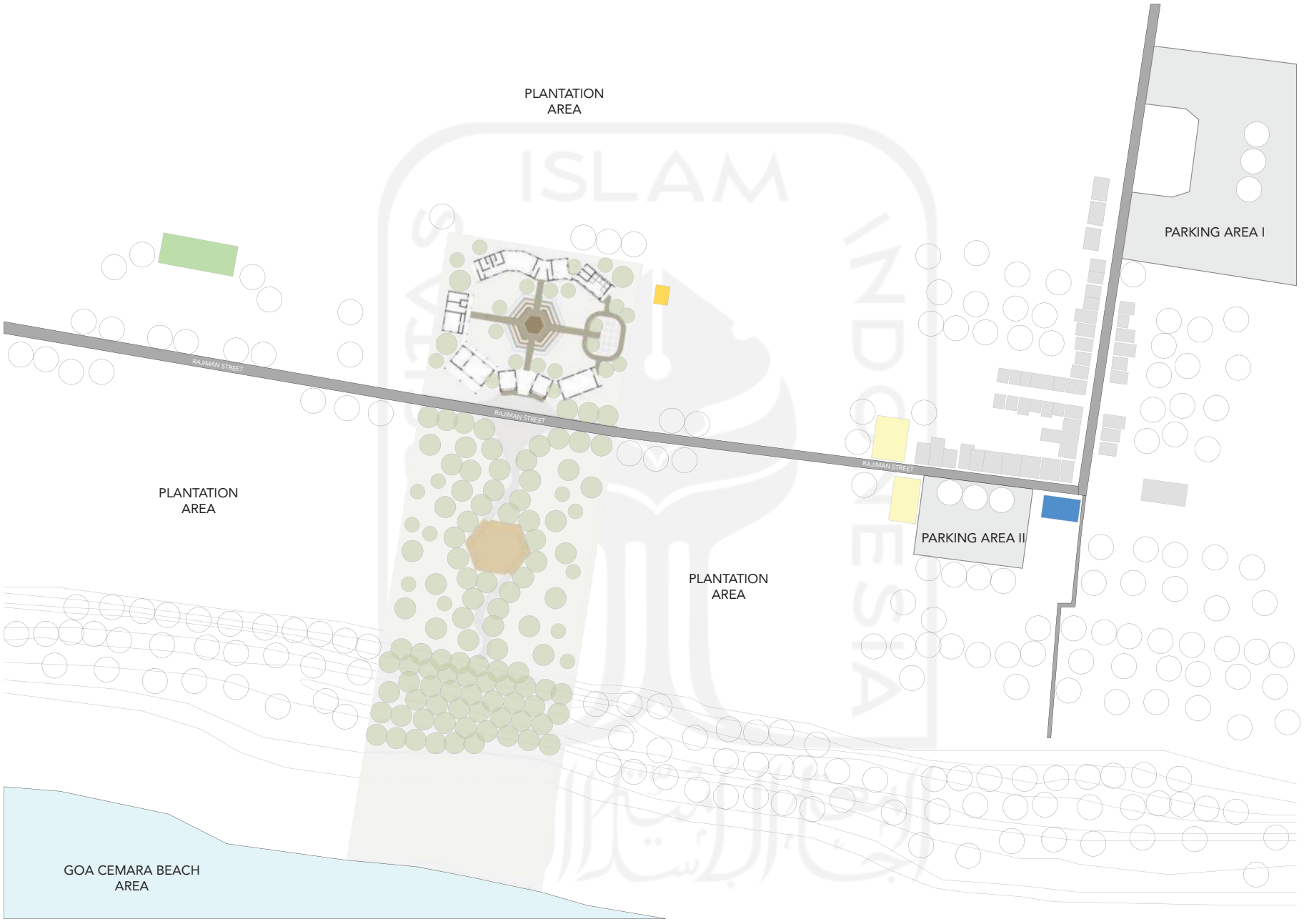
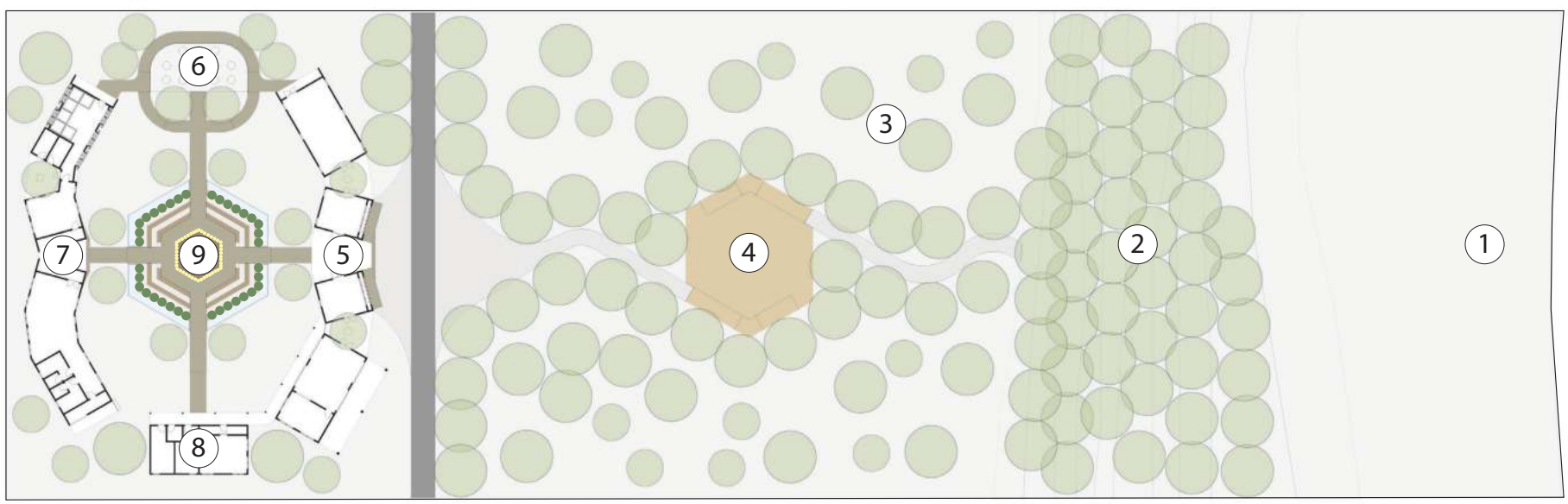



Figure 92. Situation
Source: Author, 2022

## 4.2 Site Plan




1. Beach
2. Sand Dune
3. Pine Trees Plantation
4. Plaza
5. Visitor Building
6. Hatchery
7. Conservation Building
8. Support Facilities Building
9. Amphitheater
- Pine Trees
- Decoration Plant
- Decoration Plant

Figure 93. Site Plan
Source: Author, 2022

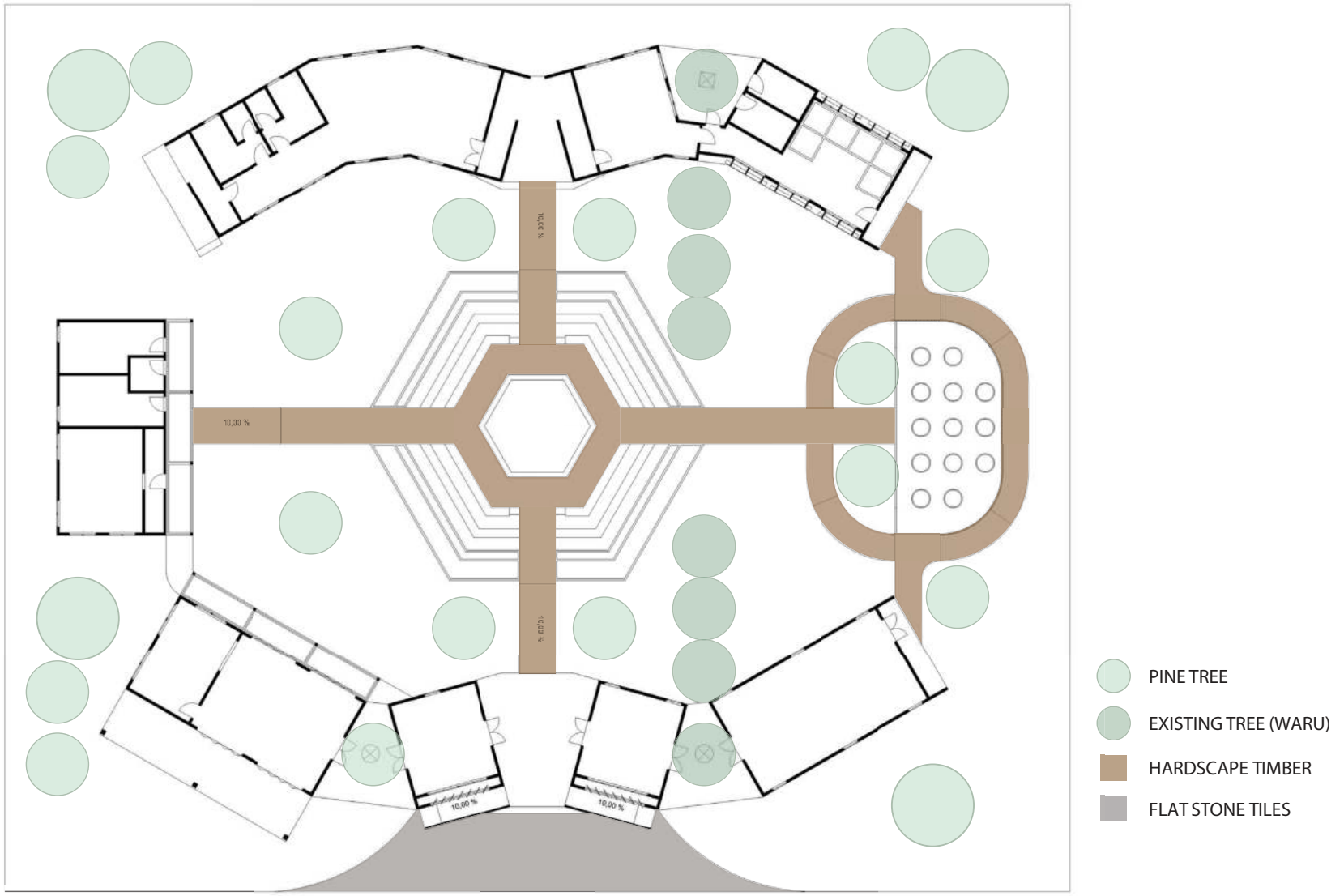
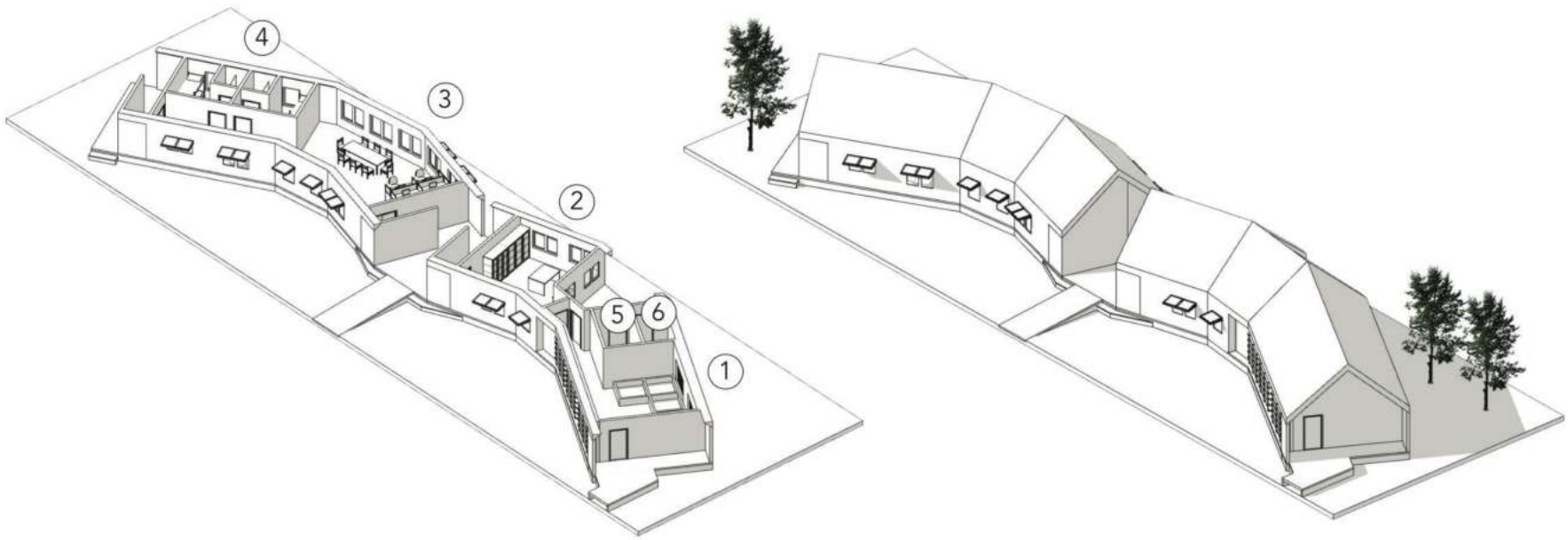



Figure 94. Site Plan (Conservation House)
Source: Author, 2022

The result of the siteplan is to make the building mass spread out and adjust to the existing trees on the existing site. The amphitheater is the center of this conservation center. Pathway and deck were added to make circulation clearer and accsessible for all people include disabilities people.

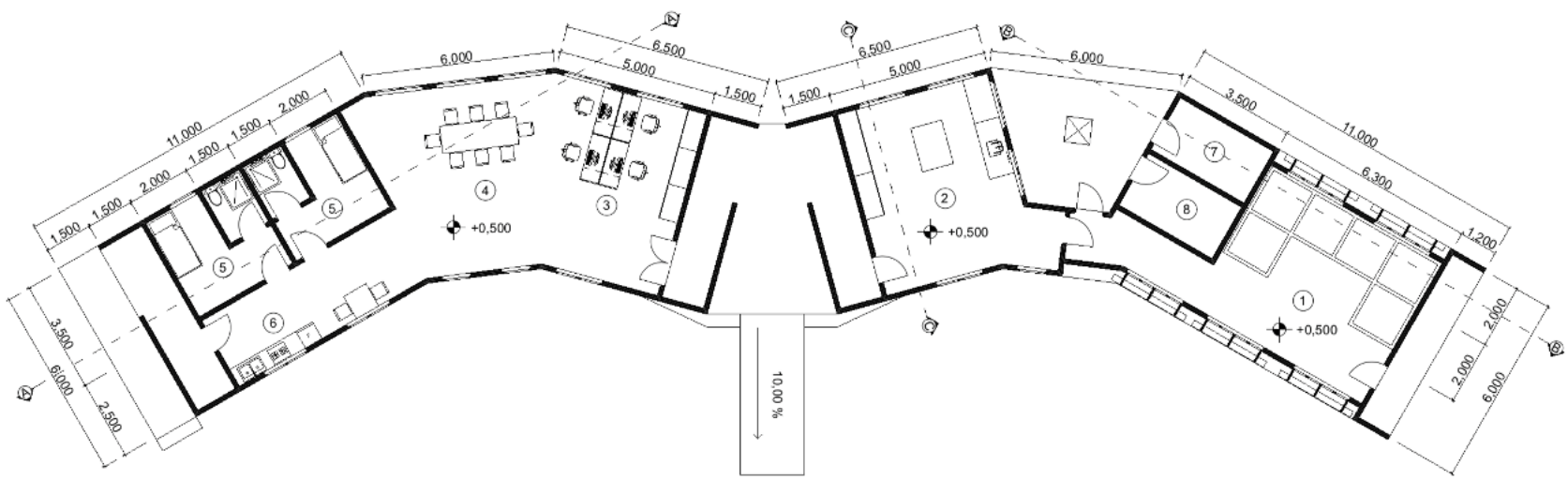
## 4.3 Conservation Building




1. Hatchling Pond
2. Laboratory/Clinic
3. Management Office
4. Bedrooms and Pantry
5. Food Storage
6. MEE

The conservation area is divided into 3 parts, there are office area, laboratory, and conservation area (which consists of hatchling pond and hatchery). The office area is made without many partitions with a large table as a gathering place. This is because the administrators of this conservation house are local residents, where they gather more often, unlike a formal office working behind a desk. The working desk is only used by the researcher.

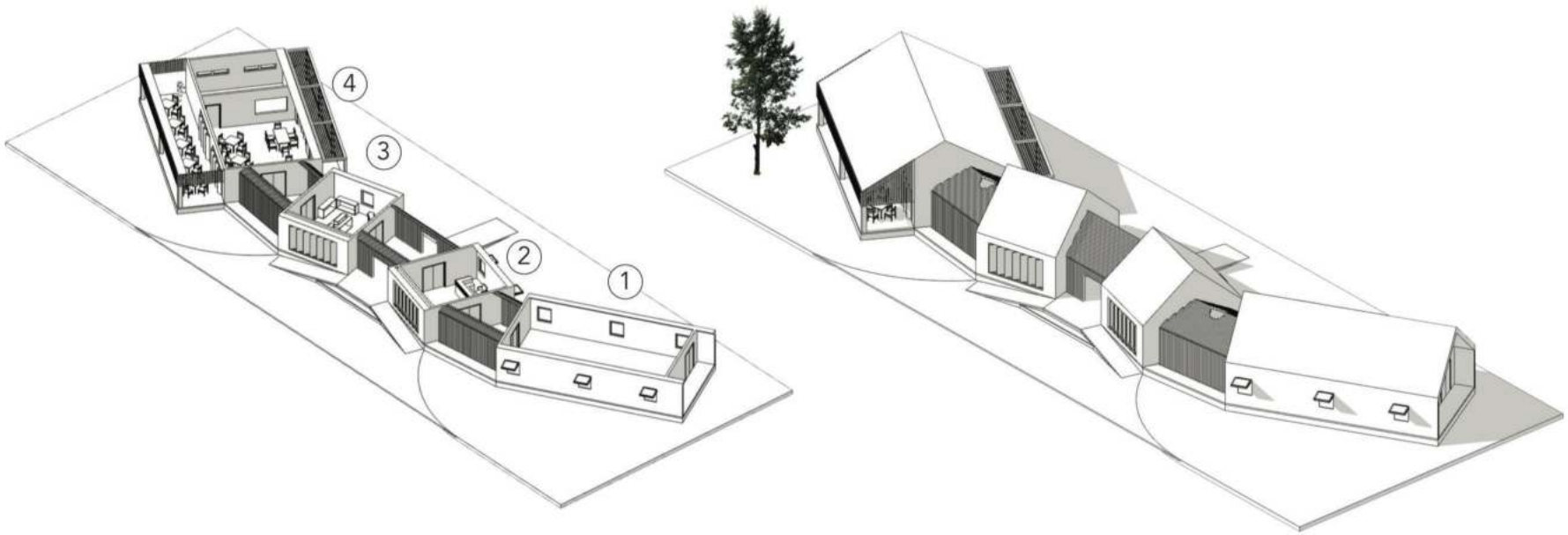
Figure 95. Axonometry of Conservation Building
Source: Author, 2022




1. Hatchling Pond Area
2. Laboratory and Clinic
3. Researcher Desk
4. Gathering Area
5. Bedroom
6. Pantry
7. MEE
8. Food Storage

Figure 96. Floor Plan of Conservation Building
Source: Author, 2022

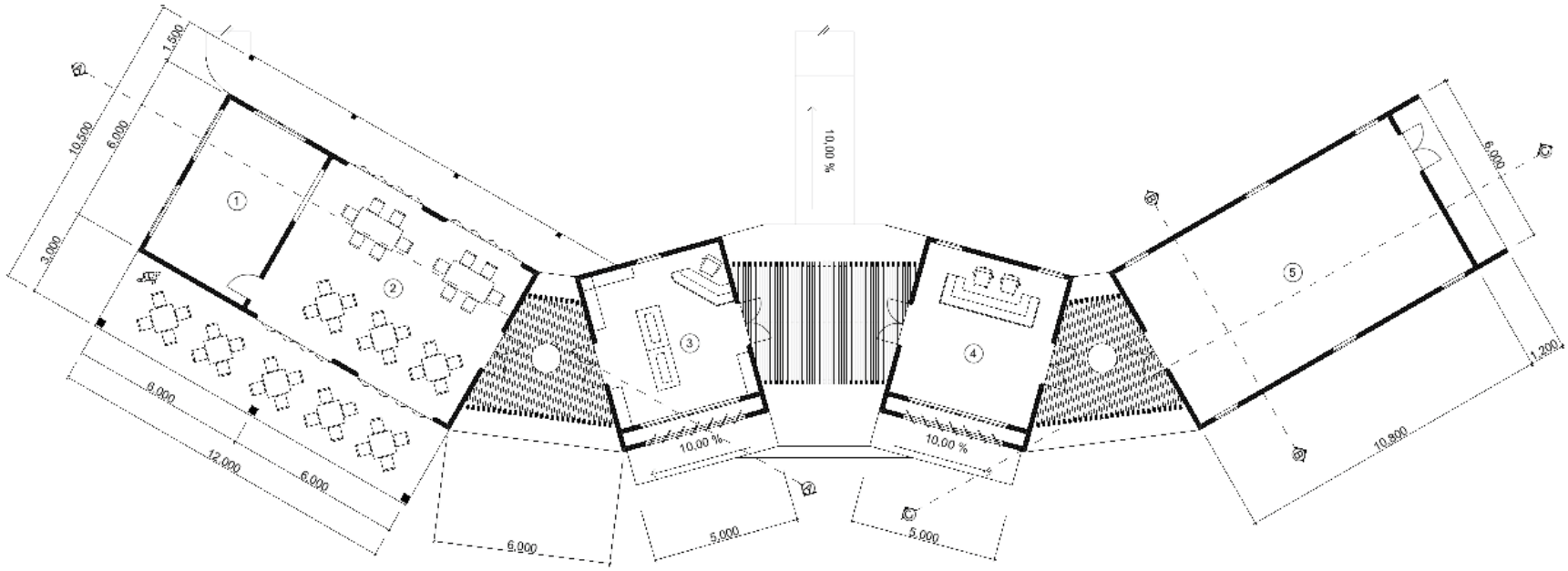
## 4.4 Visitor Building




1. Gallery
2. Lobby
3. Souvenir Shop
4. Kitchen and Cafe

The visitor area consist of front desk, gallery, souvenir shop, and cafetaria. The main entrance of this building is a corridor with wooden grating. This corridor also can help to avoid overlight at night.

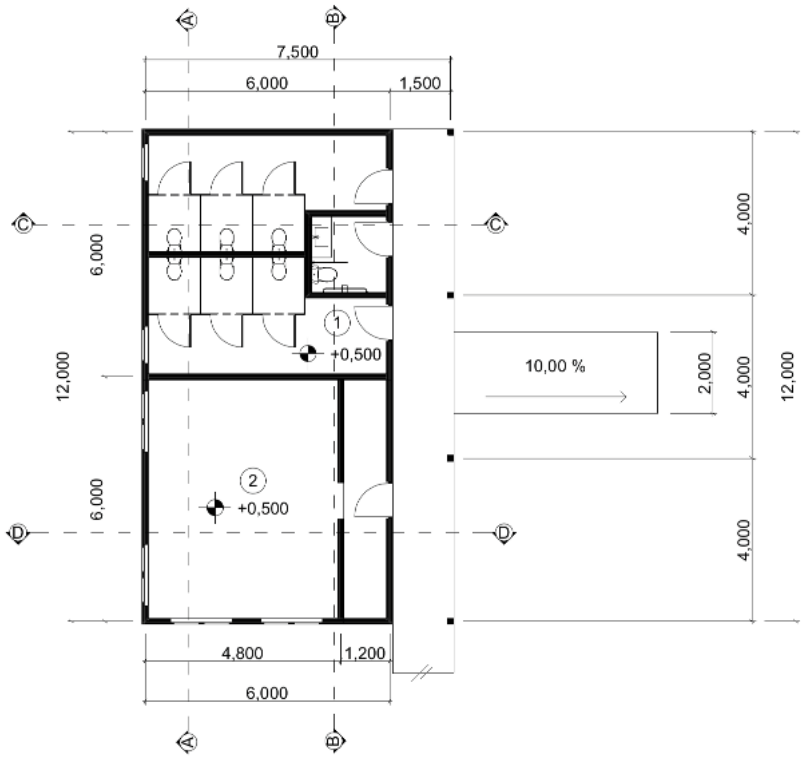
Figure 97. Axonometry of Visitor Building
Source: Author, 2022




1. Kitchen
2. Cafe
3. Souvenir Shop
4. Lobby
5. Gallery

Figure 98. Floor Plan of Visitor Building
Source: Author, 2022

## 4.5 Support Facilities Building




1. Toilet
2. Musholla

Figure 99. Floor Plan of Support Facilities Building
Source: Author, 2022

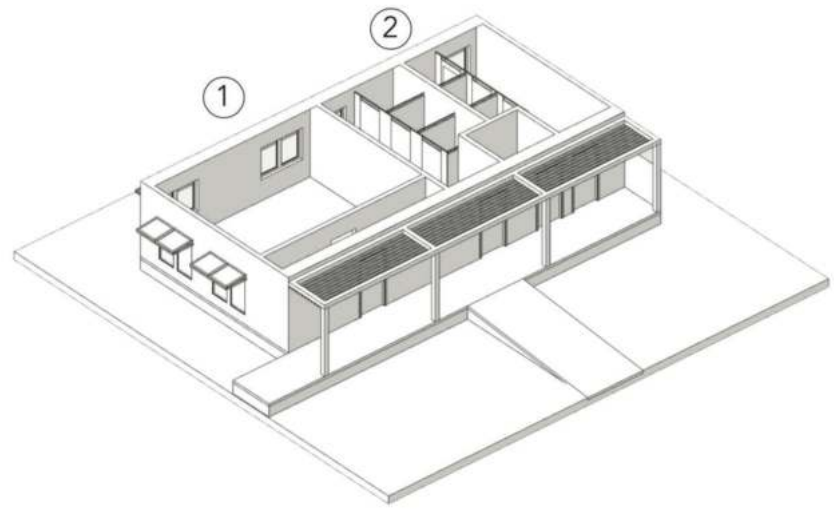



Figure 100. Axonometry of Support Facilities Building
Source: Author, 2022

The supporting facilities building consist of toilet and musholla. It is located between conservation building and visitor building. The toilet is equipped with toilet for disability people.

## 4.6 Hatchery and Amphitheater

**1. Hatchery**

This is the area where turtle eggs are stored until they hatch. Eggs will be immediately transferred from the coast to this area to avoid predators and as a conservation measure so that the growth of hatchlings can be monitored properly. The hatchery is designed semi-naturally, where the eggs are still laid in the sand pit, but are given additional protection in the form of concrete buis to protect the hole and the fence that surrounds the hatchery area. In addition to the fence, there is also a pathway with a higher level as access for visitors who want to see the hatchery. Its function, so that the pit area is not crowded by visitors.

**Sand Pit Fence**

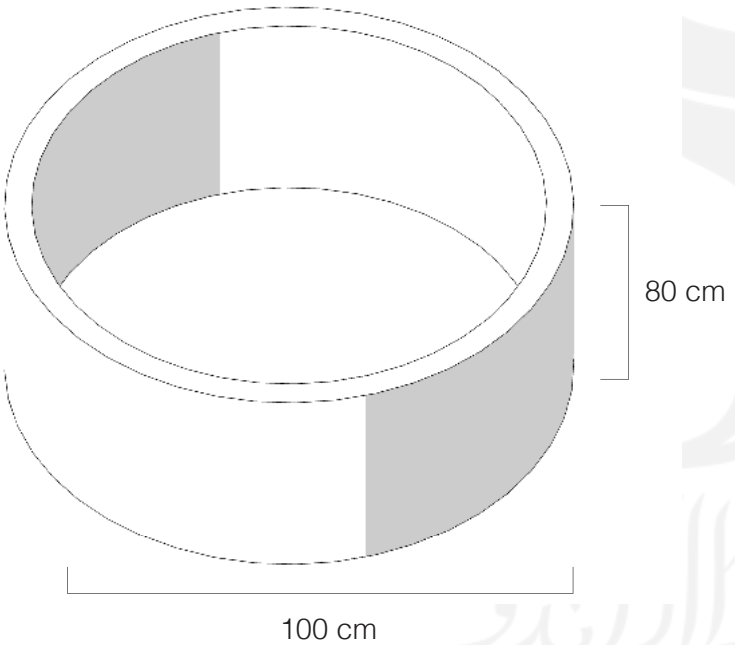
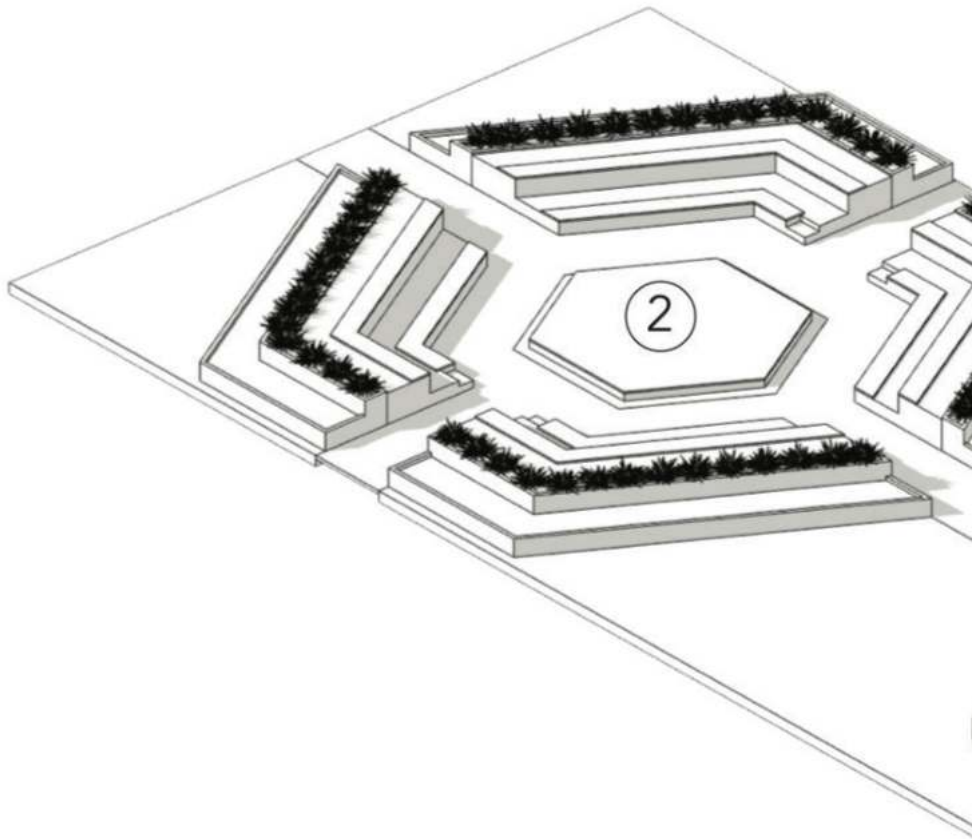



Figure 101. Sand Pit Fence
Source: Author, 2022



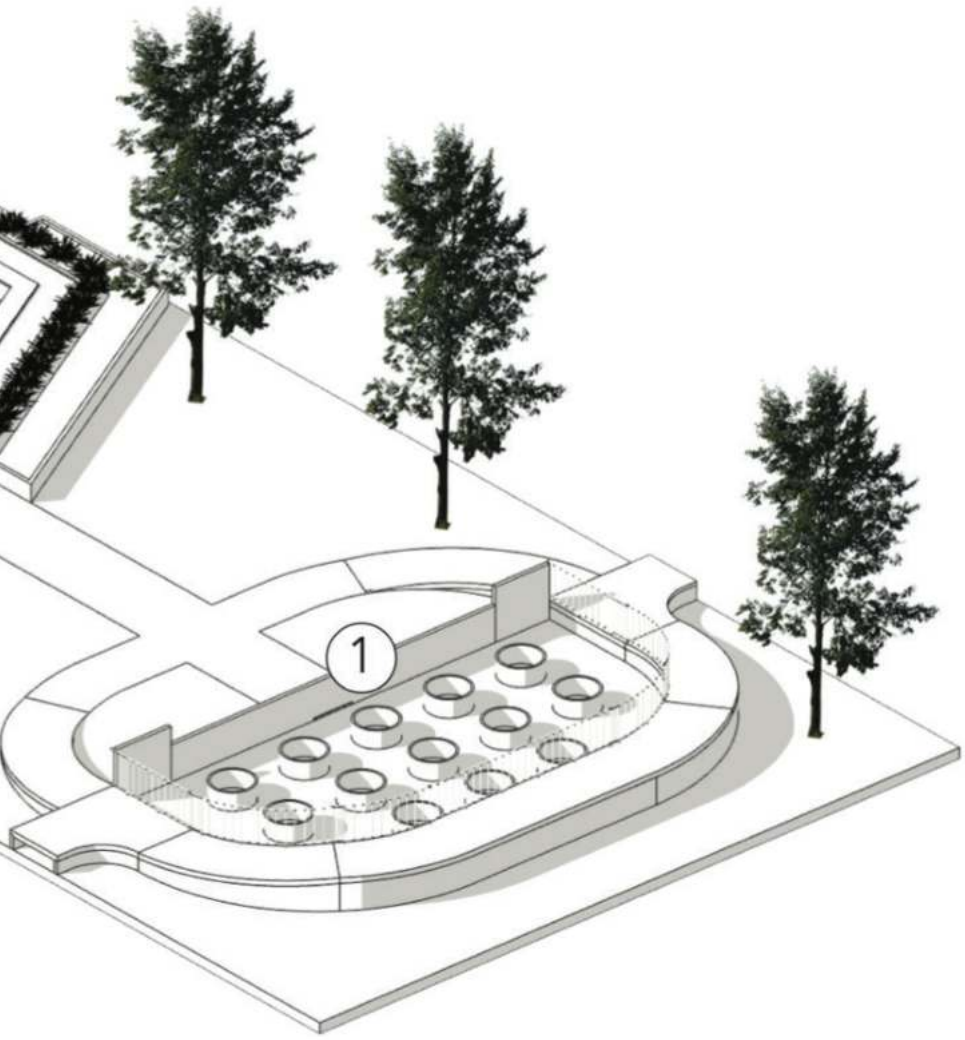



Figure 102. Axonometry of Amphitheater and Hatchery
Source: Author, 2022

**2. Amphiteater**

This is an area where large groups of visitors (around 100 persons) will be gathered to get presentation materials of turtles. The amphitheater is surrounded by plants and a reservoir that functions as a reservoir for seawater for hatchlings and wastewater for irrigation.

**Water Reservoir**

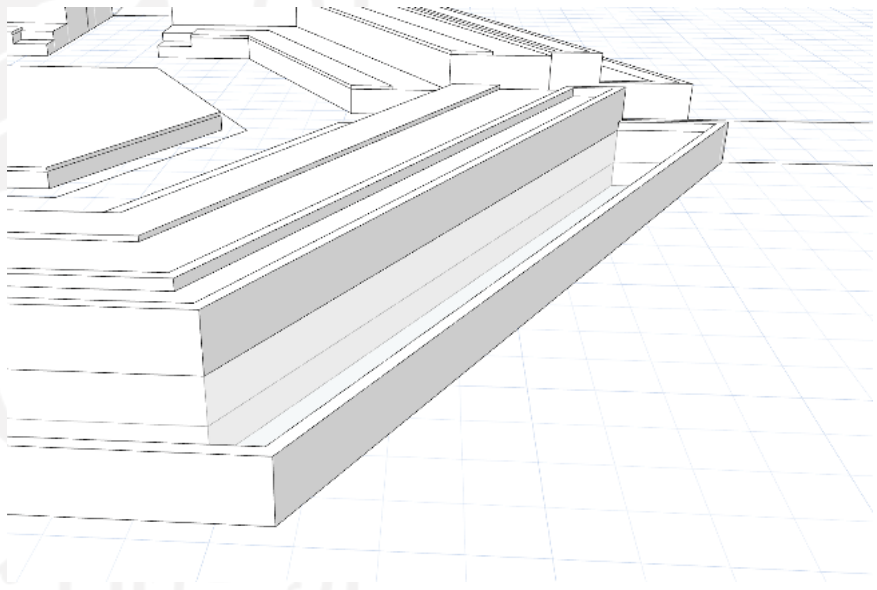


Figure 103. Water Reservoir
Source: Author, 2022

# 4.7 Detail Architectural

## 4.7.1 Zero Light Spill

- Transitional Space

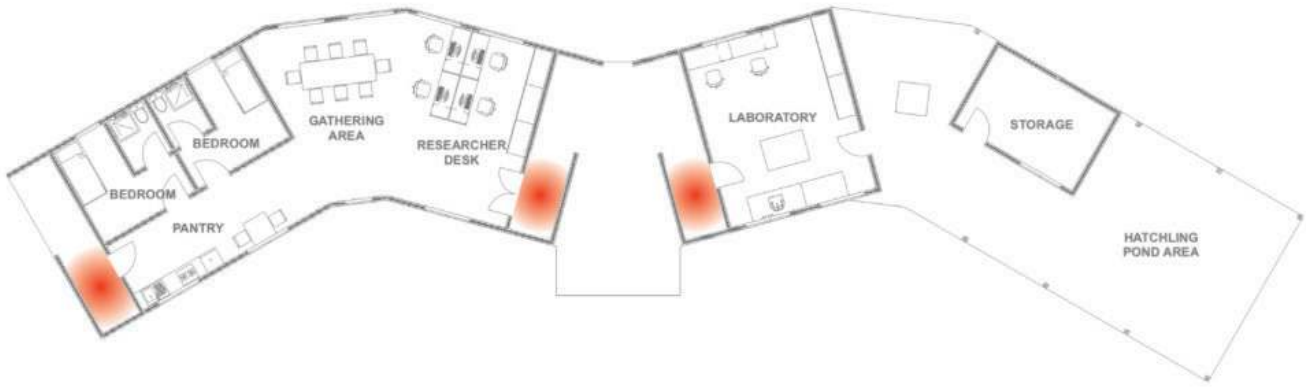



Figure 104. Transitional Space
Source: Author, 2022

**Exterior Lighting Device**

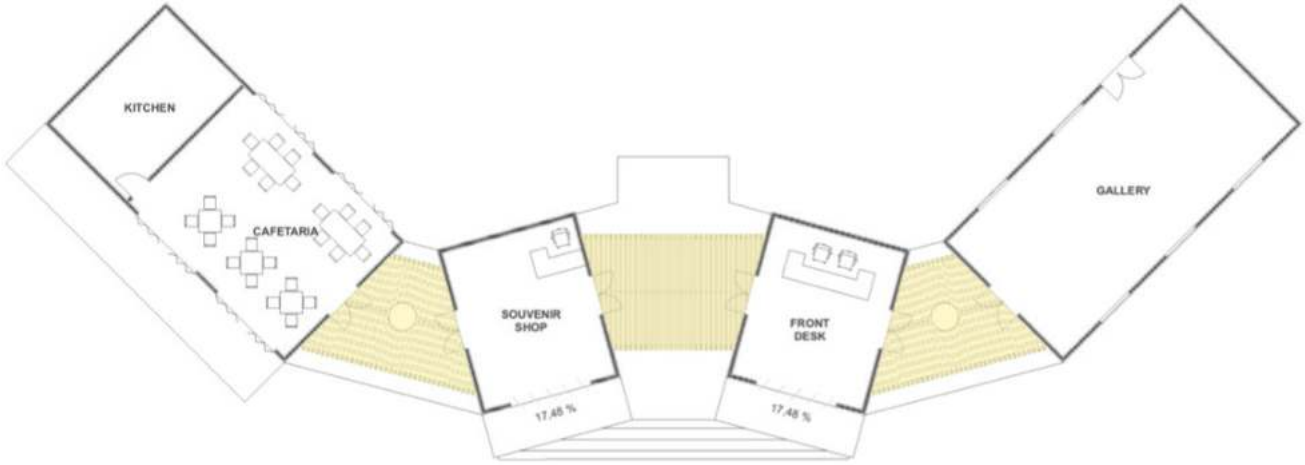
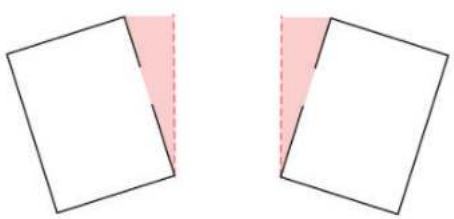



Figure 105. Corridor Lighting Area
Source: Author, 2022



The mass is rotated, So the door will tend to face opposite from the beach. In addition, the mass can also help find light from within when opening the door, so that it is not visible from the beach

## 4.7.2 Facade

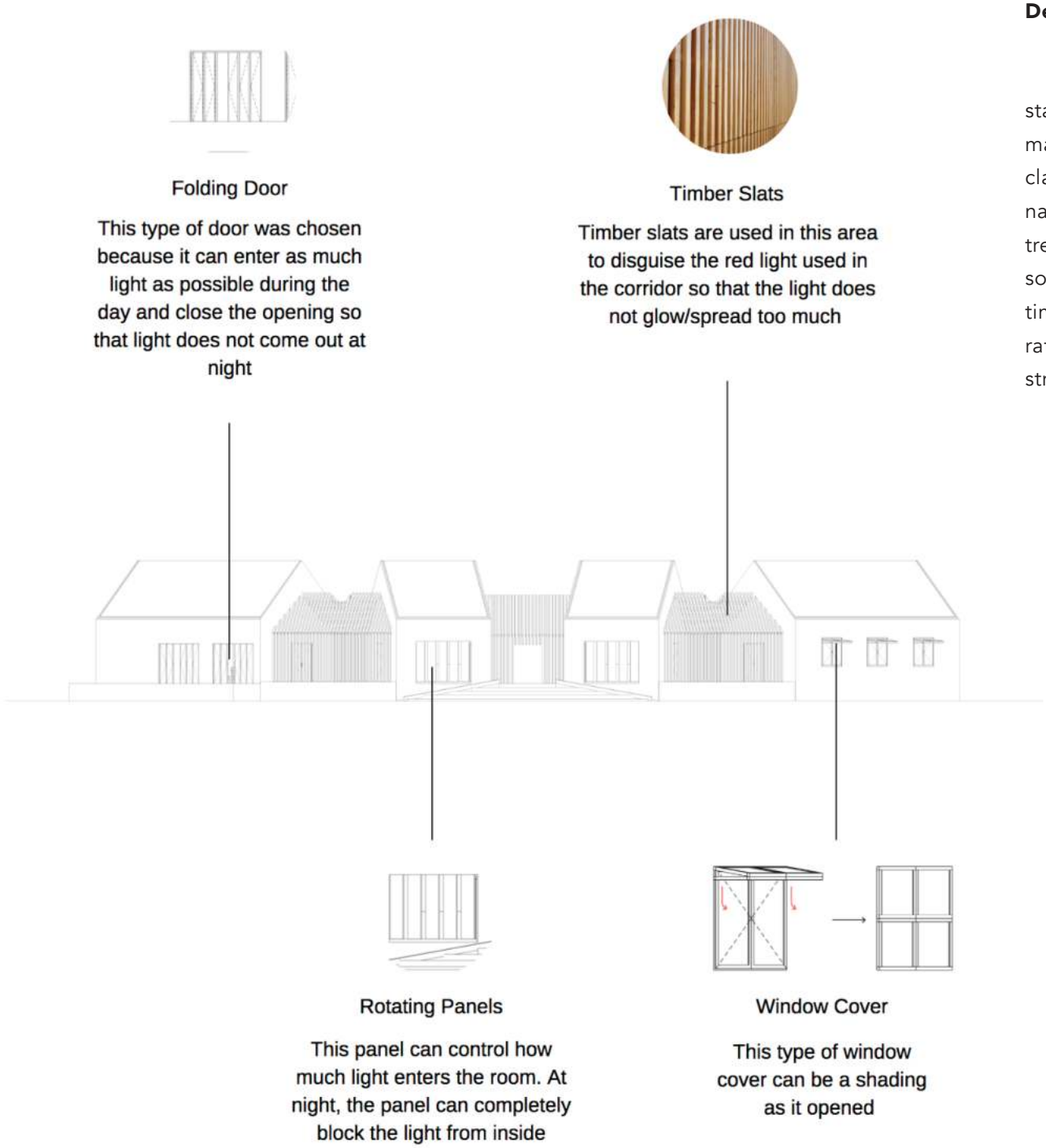



Figure 106. Schematic of Facade
Source: Author, 2022

**Detailed Facade**

To reduce the risk of corrosion, stainless steel and wood are the main materials for the structure with timber cladding on the facade. Timber has a natural resilience to high winds and extreme climates. Beside that, unlike masonry or other rigid cladding materials, timber has a higher strength to weight ratio allowing it to withstand far greater stresses and movement.

## 4.7.2 Structure

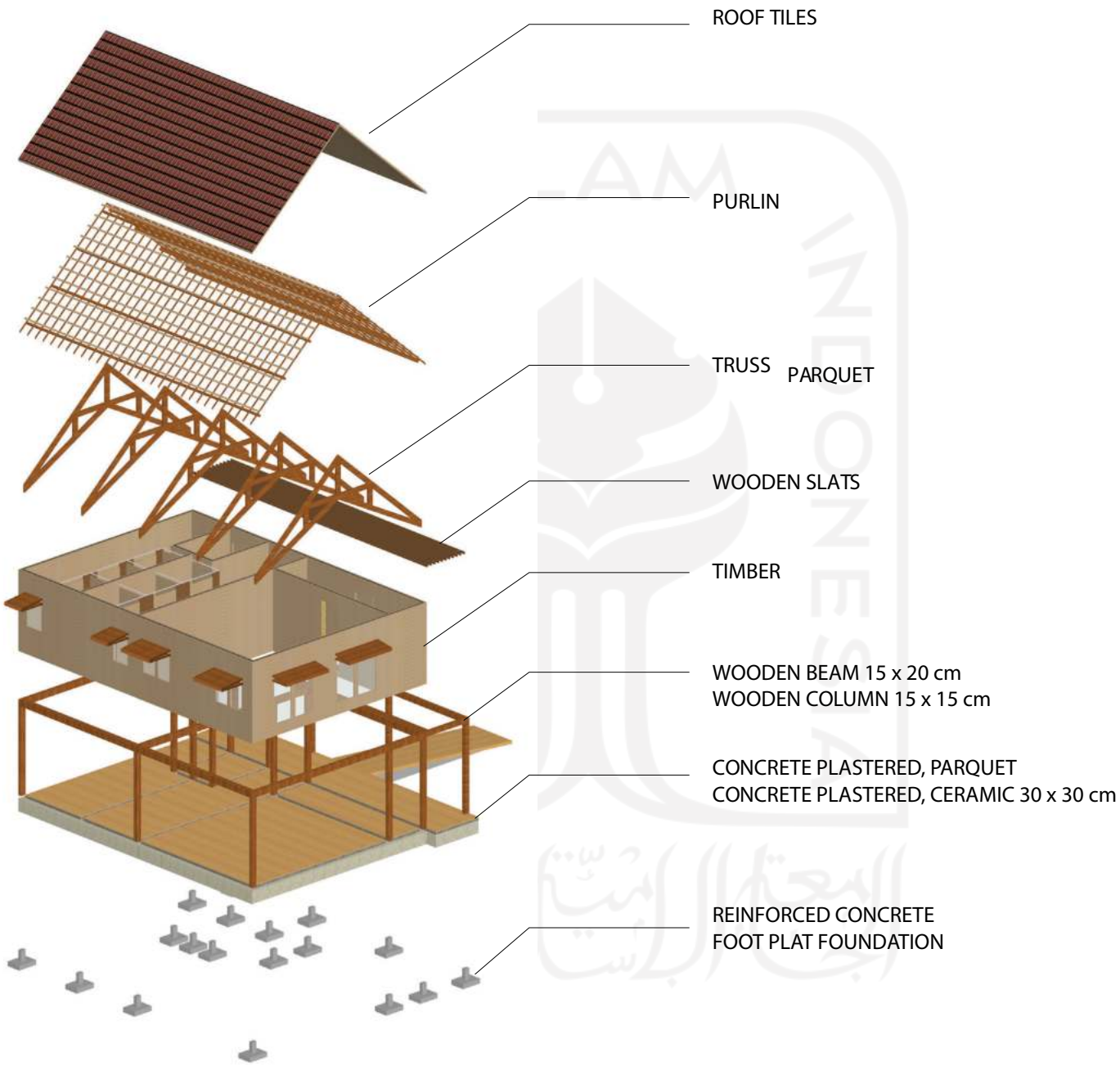
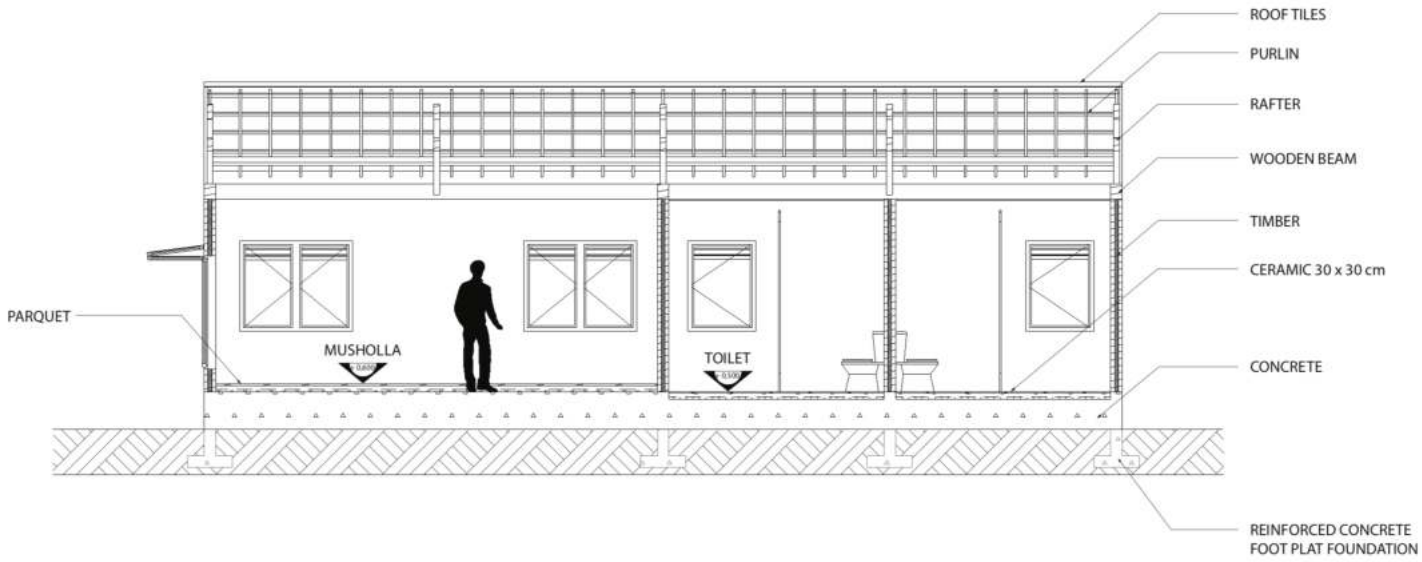



Figure 107. Axonometry of Structure
Source: Author, 2022



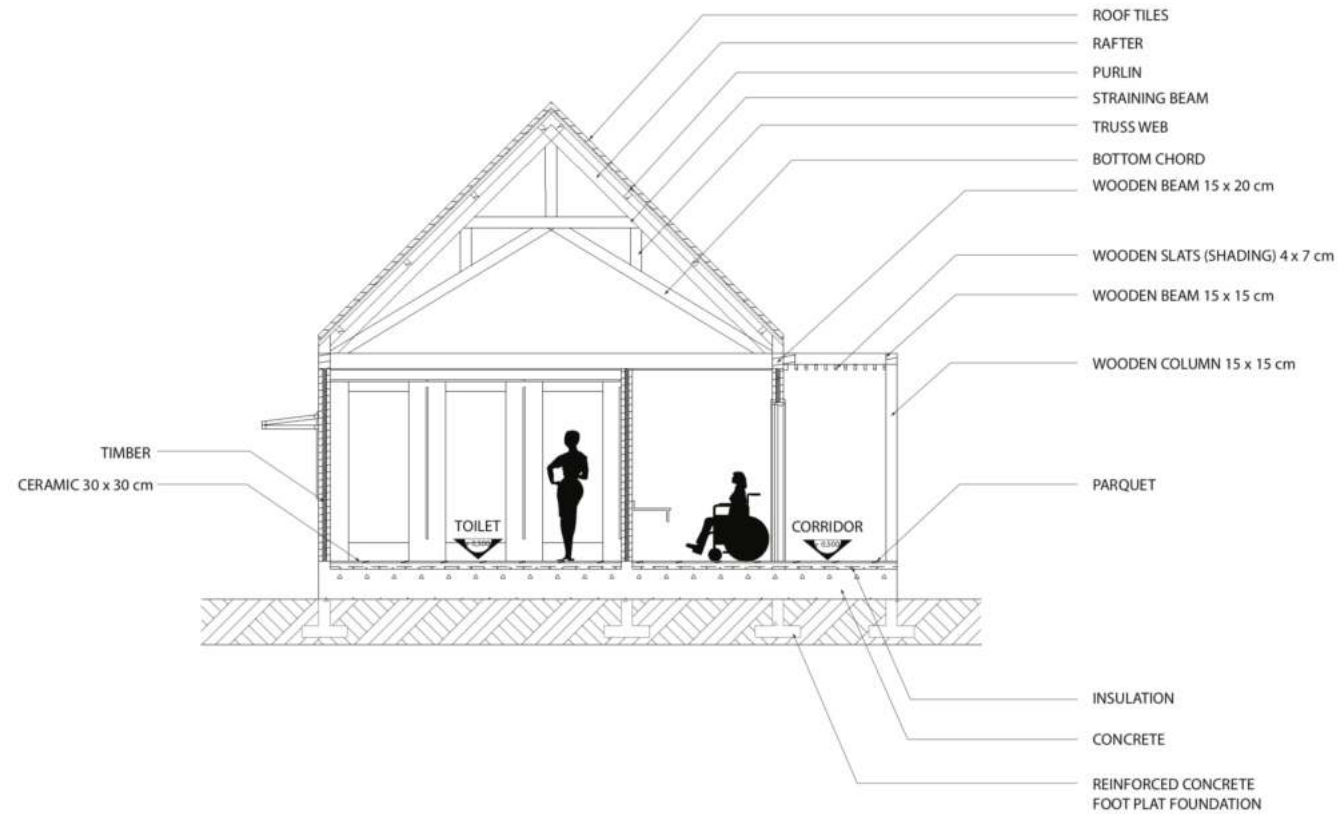
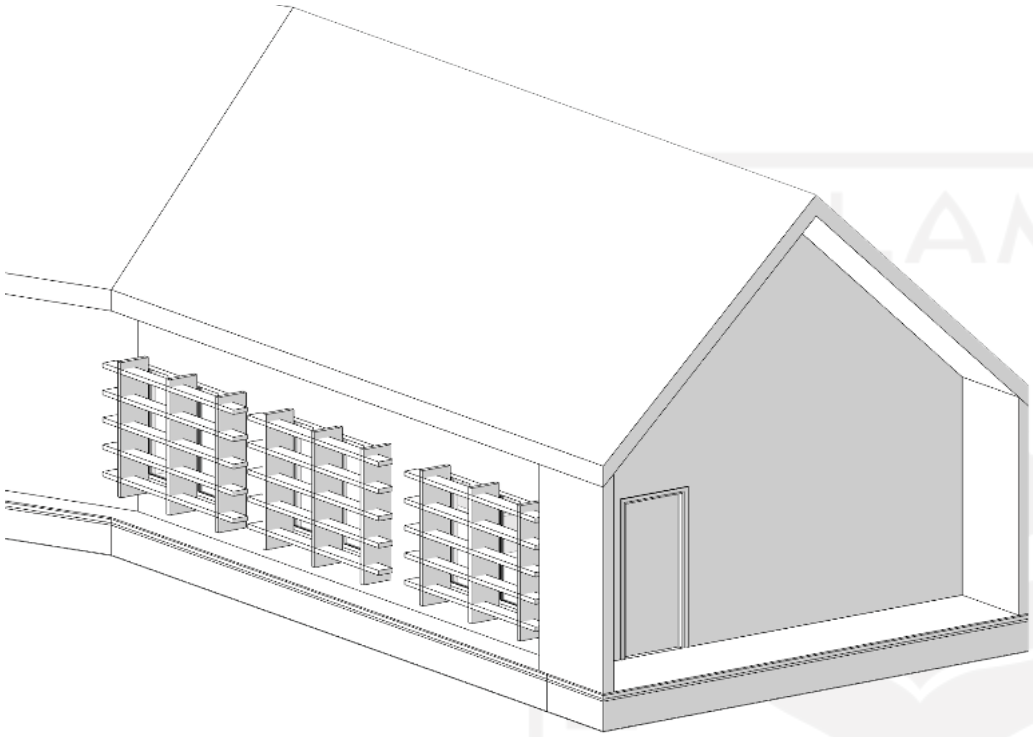
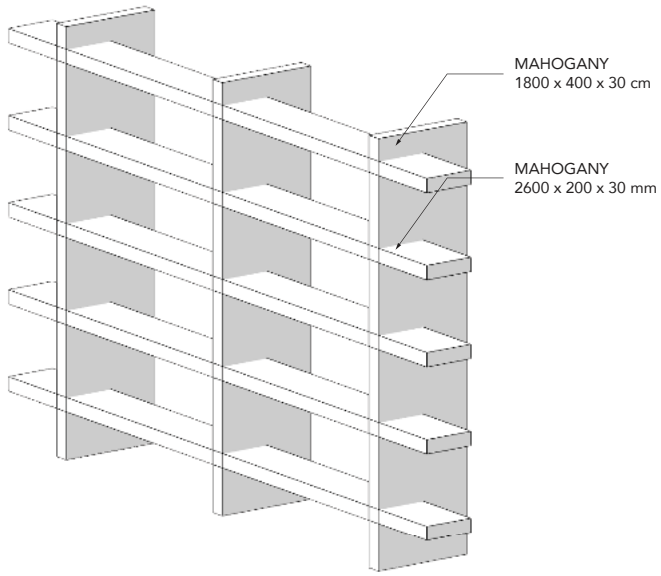




Figure 108. Structure Detail
Source: Author, 2022

## 4.7.3 Shading Device in Hatchling Pond Area






**Detailed Facade - Shading Device**

Shading device was added to maintain the ideal room temperature. The temperature for hatchlings that too hot or too cold will cause the hatchling die. The temperature that too cold also can affect the hatchling growing. Thus, the ideal temperature is around 25 degrees celcius. This shading device can help to reduce the solar radiation that enter the building. Based on the design simulation test, it is better to use combination ofvertical and horizontal shading

Figure 109. Shading Device for Hatchlign Pond Area
Source: Author, 2022

Figure 110. Shading Device Detail
Source: Author, 2022

## 4.8 Schematic of Barrier Free Design

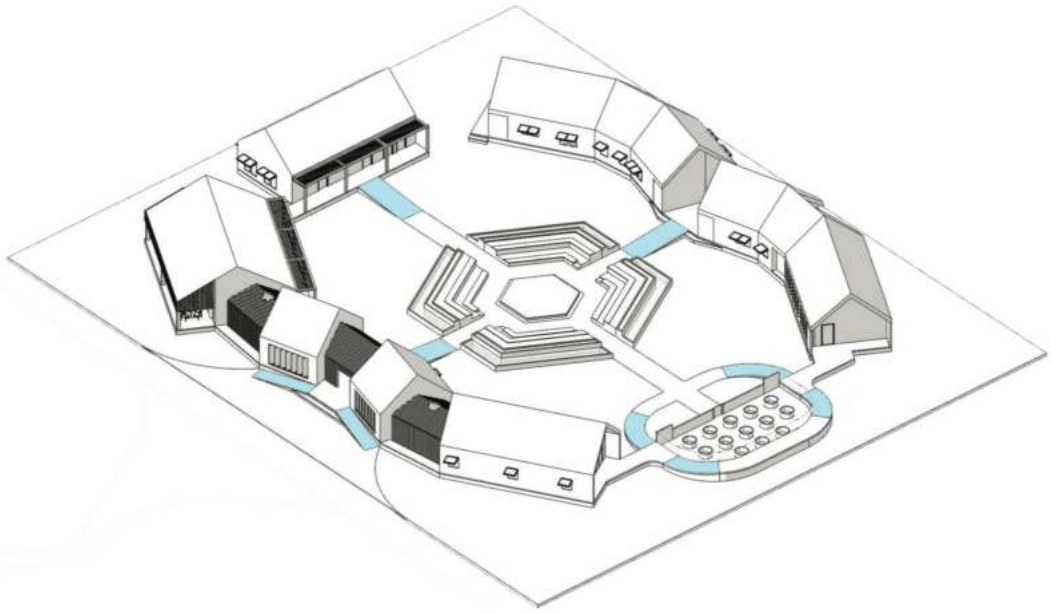


Figure 111. Ramp
Source: Author, 2022

The site is located in an area with black beach sand. To provide access for everyone, including people who use wheelchairs, the building is designed with pathways and ramps to facilitate the circulation of visitors. There is also toilet for disabled people as the supporting facilitites.

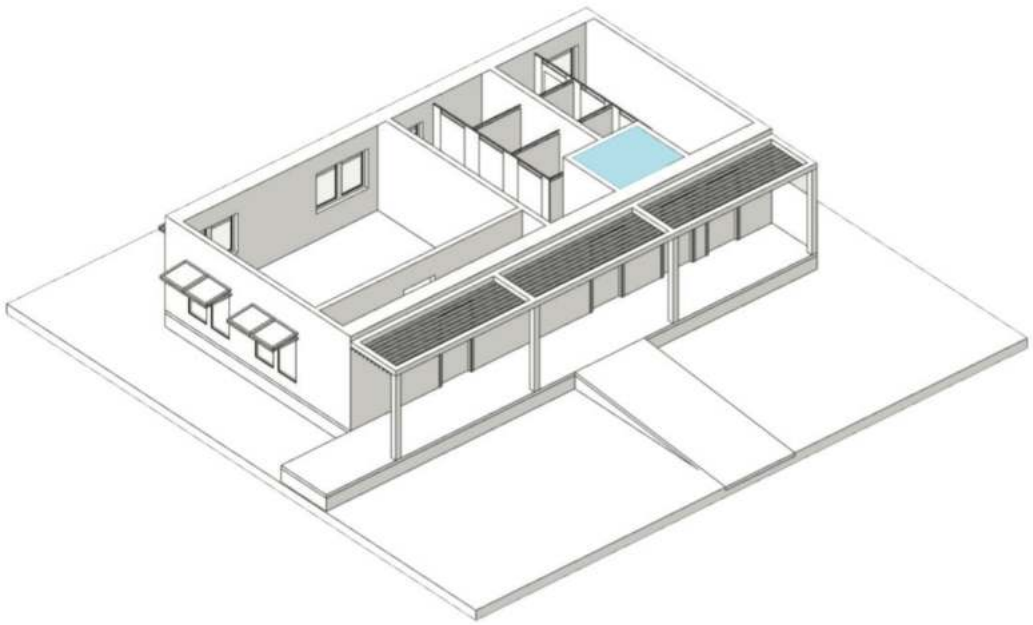


Figure 112. Toilet for Disabled People
Source: Author, 2022

## 4.9 Schematic of Fire Safety

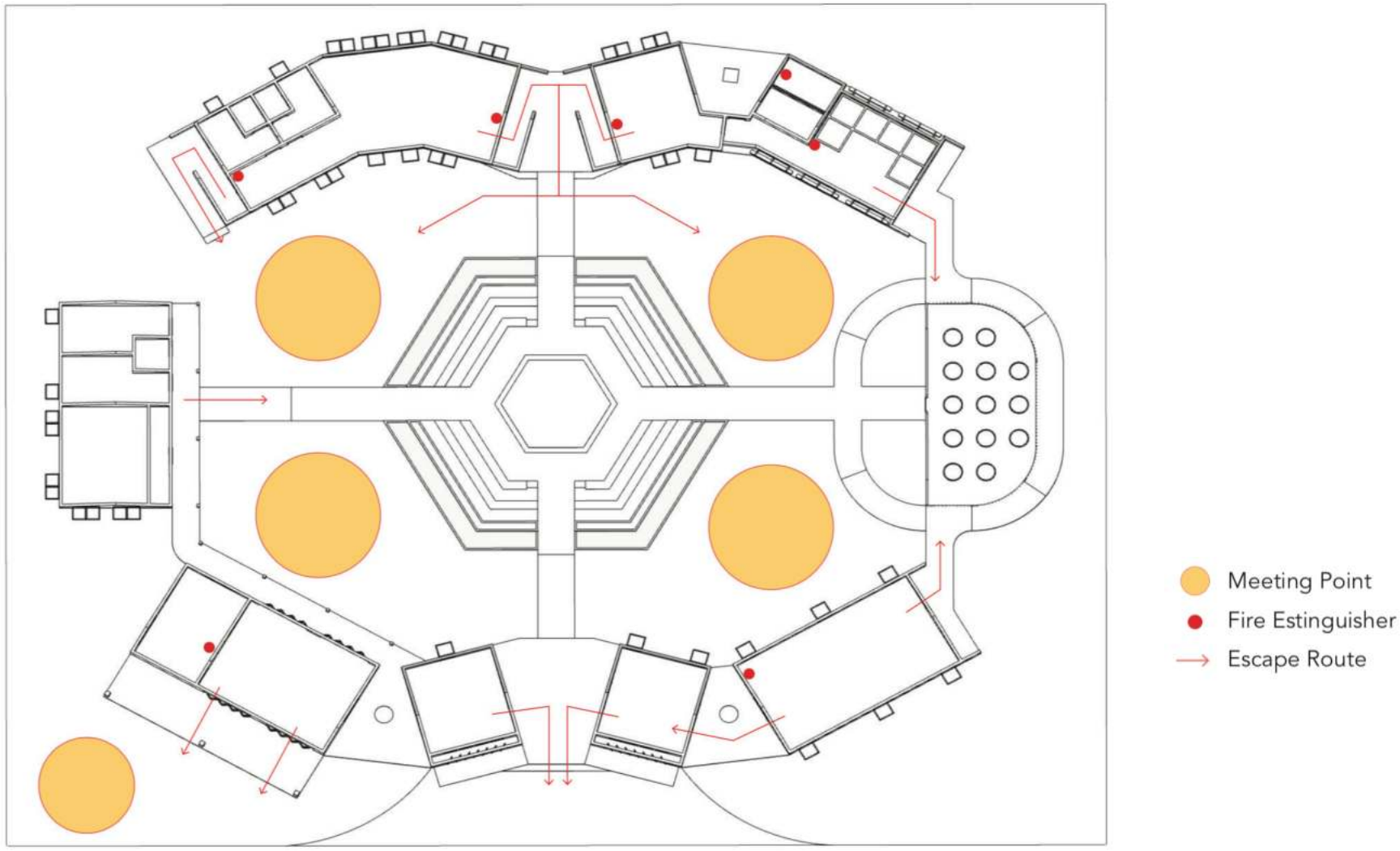
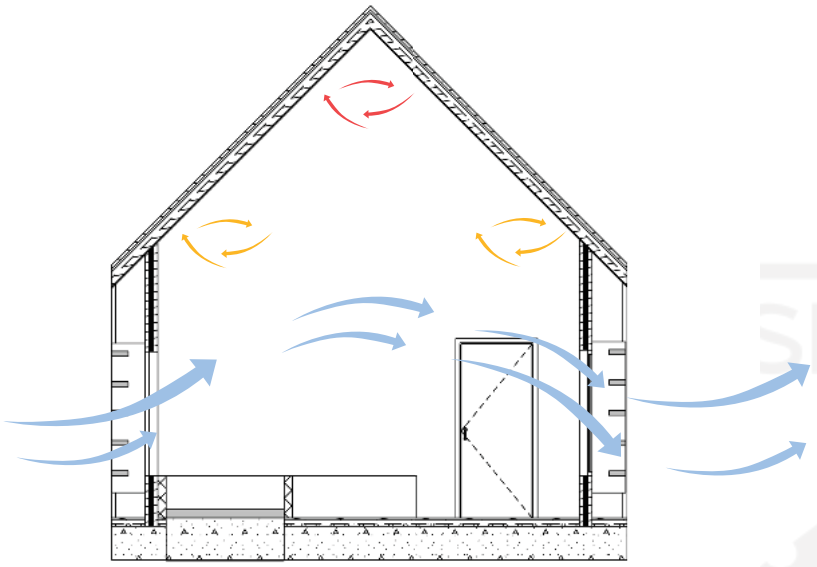


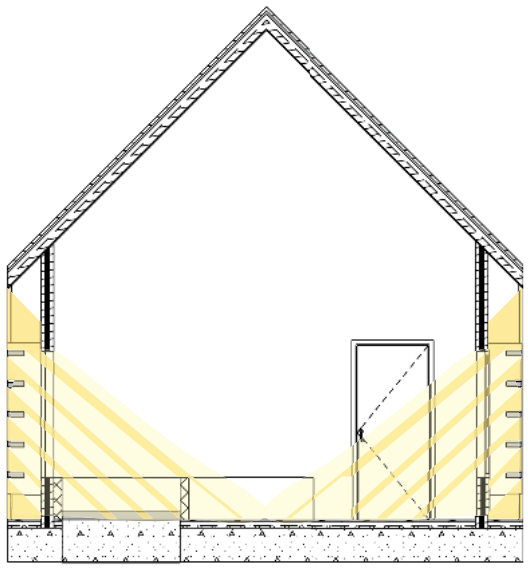

Figure 113. Fire Safety Plan
Source: Author, 2022

## 4.10 Schematic of Thermal, Ventilation, and Natural Lighting



SCHEMATIC VENTILATION AND THERMAL

Maximize natural ventilation from the south-north and southwest-northeast. Cross ventilation is applied for good air circulation. Winds that coming from the south and north will be minimized by planting vegetation as natural windbreaks.



SCHEMATIC NATURAL LIGHTING

Shading device applied in the building to avoid too much solar radiation that can cause death of hatchlings due to the hot temperature.

## 4.11 Schematic of Day Lighting

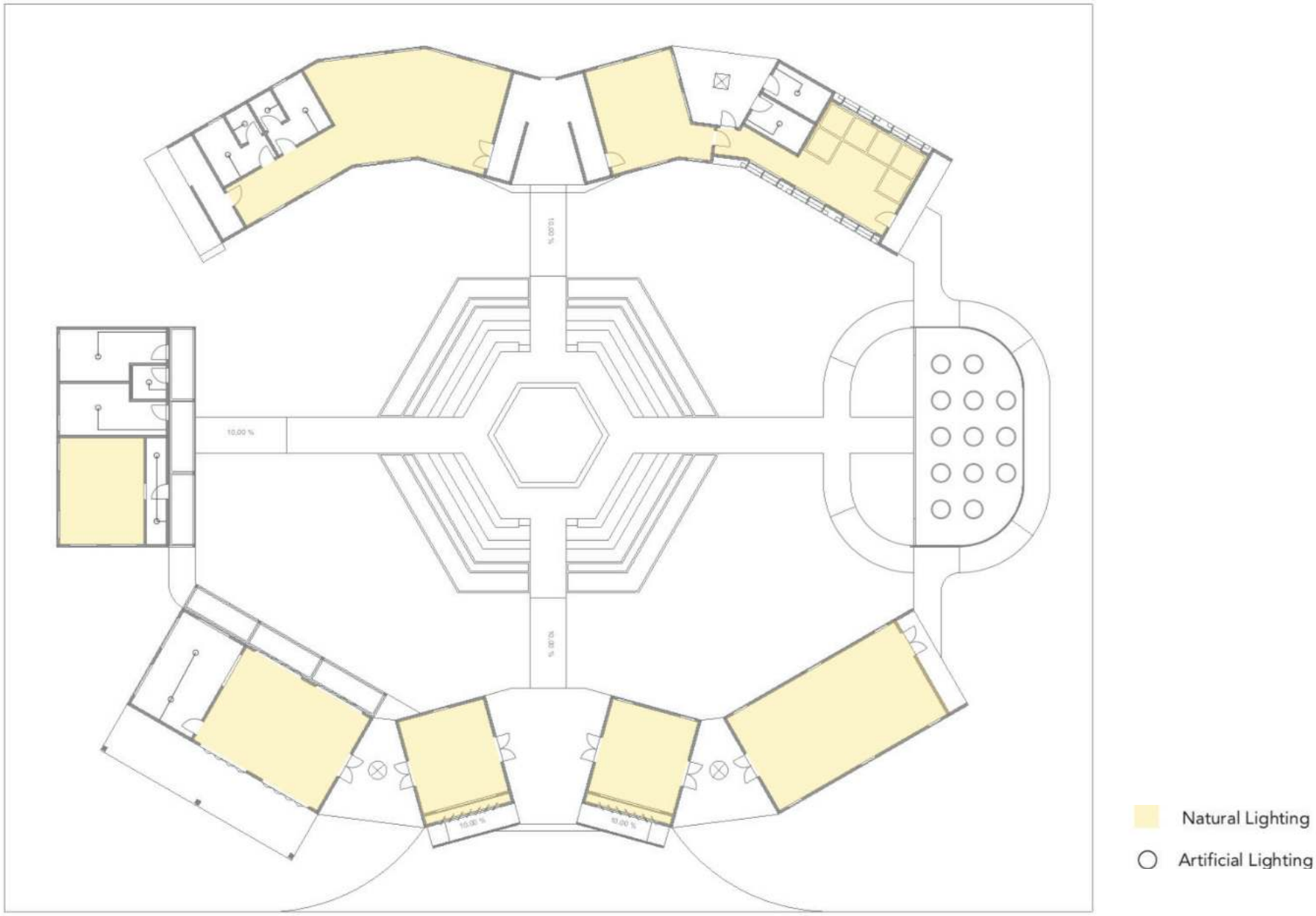


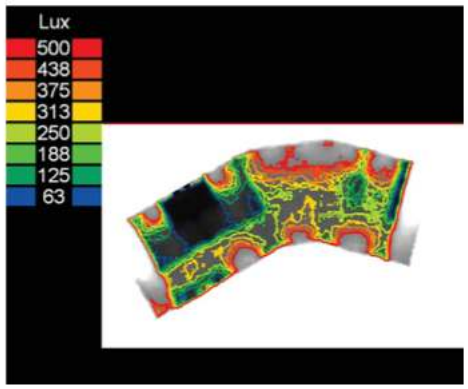

Figure 116. Lighting Area
Source: Author, 2022

*chapter 5*

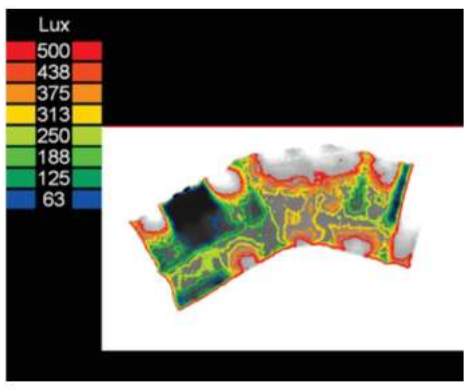
# DESIGN SIMULATION

## 5.1 Natural Lighting

| Design Criteria | Problem Solving |
| --- | --- |
| • Minimum of 30% of the floor area used for work gets a natural light intensity of at least 300 lux | • The building mass tends to extend from east to west to maximize natural lighting but avoid excessive radiation<br>• Minimize the opening that face the south (beach) toavoid lightspill at night |




At 10 AM, 50% area has natural lighting more than 300 lux

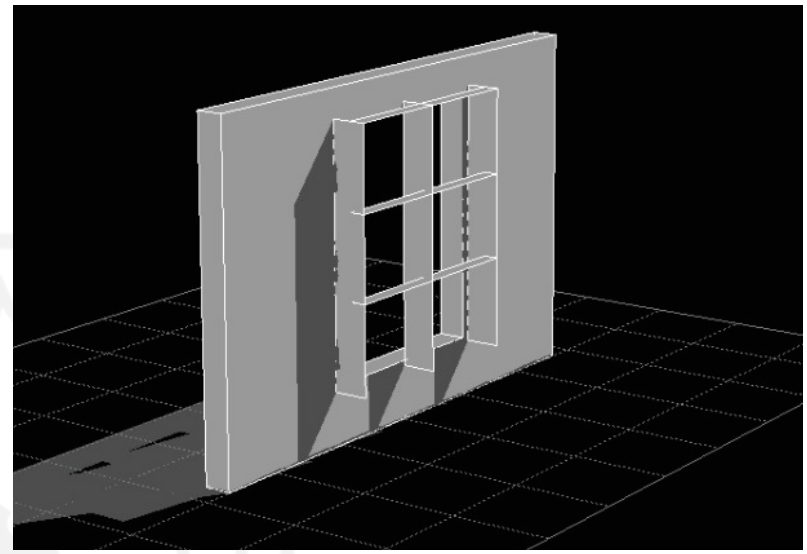



At 10 AM, 60% area has natural lighting more than 300 lux

In this design, sufficient openings were made to let natural sunlight enter the building. Based on the design test, the area of the room that active during the day in this building that can get natural lighting is about 50% - 60% area. It means, the design is in accordance with the standard of natural lighting.

## 5.1 Sunlight Intensity

| Design Criteria | Design Guidelins |
|---|---|
| • The temperature of the hatchery and hatchling pond should be warm or normal, around 25-30 degrees Celsius | • Placed hatchery and hatchling pond area in the east because morning sunlight is suitable (not too hot)<br>• The use of transparent material or sufficient openings for the wall to avoid predator but sufficient sunlight can enter and keep the room temperature warm |
| • The hatchery should neither be too dry nor too wet. So the humidity should be kept with sun intensity around 40-60% | • Placed in an area with roof or shading device to avoid too much solar heat and maintain humidity. This can also avoid predators. |



**Tabulated Daily Solar Data**

Latitude: -7.0°
Longitude: 110.0°
Timezone: 120.0° [+8.0hrs]
Orientation: 70.0°

Date: 1st May
Julian Date: 121
Sunrise: 06:44
Sunset: 18:29

Local Correction: -37.0 mins
Equation of Time: 3.0 mins
Declination: 14.7°

| Local | (Solar) | Aziumuth | Altitude | HSA | VSA | Shading |
|---|---|---|---|---|---|---|
| 07:00 | (06:22) | 74.6° | 3.7° | 4.6° | 3.7° | 41% |
| 07:30 | (06:52) | 73.5° | 10.9° | 3.5° | 10.9° | 40% |
| 08:00 | (07:22) | 72.0° | 18.0° | 2.0° | 18.0° | 41% |
| 08:30 | (07:52) | 70.1° | 25.0° | 0.1° | 25.0° | 47% |
| 09:00 | (08:22) | 67.7° | 32.0° | -2.3° | 32.0° | 47% |
| 09:30 | (08:52) | 64.7° | 38.8° | -5.3° | 38.9° | 49% |
| 10:00 | (09:22) | 60.7° | 45.4° | -9.3° | 45.8° | 57% |
| 10:30 | (09:52) | 55.3° | 51.7° | -14.7° | 52.7° | 60% |
| 11:00 | (10:22) | 47.8° | 57.6° | -22.2° | 59.5° | 60% |
| 11:30 | (10:52) | 37.4° | 62.6° | -32.6° | 66.5° | 68% |
| 12:00 | (11:22) | 22.9° | 66.4° | -47.1° | 73.4° | 78% |
| 12:30 | (11:52) | 4.6° | 68.2° | -65.4° | 80.5° | 74% |
| 13:00 | (12:22) | -14.7° | 67.5° | -84.7° | 87.8° | 69% |
| 13:30 | (12:52) | -31.1° | 64.6° | -101.1° | 95.2° | [Behind] |
| 14:00 | (13:22) | -43.4° | 60.1° | -113.4° | 102.9° | [Behind] |
| 14:30 | (13:52) | -52.1° | 54.6° | -122.1° | 110.7° | [Behind] |
| 15:00 | (14:22) | -58.4° | 48.4° | -128.4° | 118.8° | [Behind] |
| 15:30 | (14:52) | -62.9° | 41.9° | -132.9° | 127.2° | [Behind] |
| 16:00 | (15:22) | -66.4° | 35.2° | -136.4° | 135.7° | [Behind] |
| 16:30 | (15:52) | -69.1° | 28.3° | -139.1° | 144.5° | [Behind] |
| 17:00 | (16:22) | -71.2° | 21.3° | -141.2° | 153.4° | [Behind] |
| 17:30 | (16:52) | -72.8° | 14.2° | -142.8° | 162.3° | [Behind] |
| 18:00 | (17:22) | -74.1° | 7.1° | -144.1° | 171.3° | [Behind] |

In this design, shading device were used to avoid room temperature that too hot nor too wet. Based on the design simulation, the shading device that more suitable for hatchling pond area is the combination of horizontal and vertical shading. It is in accordance with the standard of sun intensity

*chapter 6*

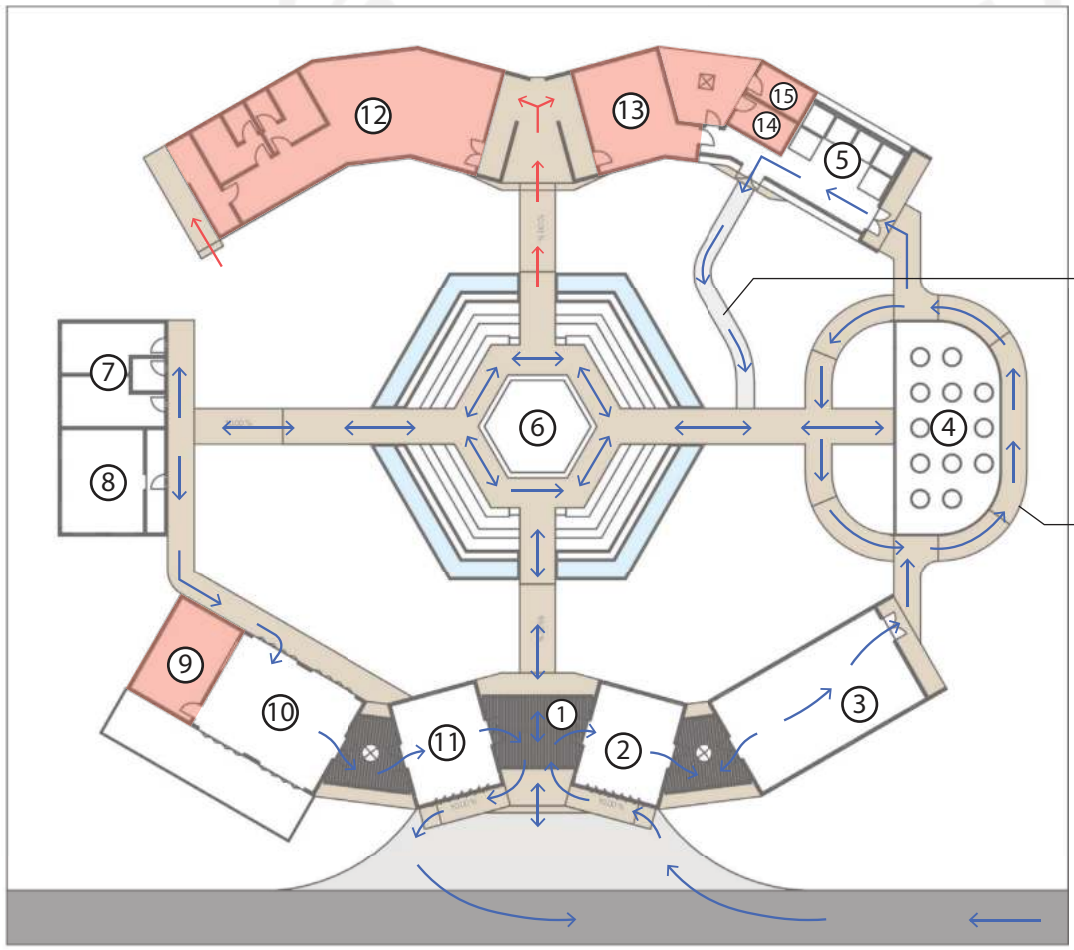
# DESIGN EVALUATION

Based on the evaluation results, there are some parts responded by examiner (Prof. Noor Cholis Idham, Ph.D., IAI. and Dr. Ing. Putu Ayu P. Agustiananda, S.T., M.A.) and supervisor. This improvement is expected to be a better design reference for readers.

## 6.1 Public and Private Circulation

This conservation house is not only used for private conservation activities, but also allowed public visit to learn and get to know more about turtles. Thus, the circulation for public and private must be clear for the convenience of all users.

In the previous design, there's just one access for entrance and exit in Hatchling Pond area. To avoid circulation crowds, another door and pathway were added for exit access from this area.





Stone Pathway


Boardwalk

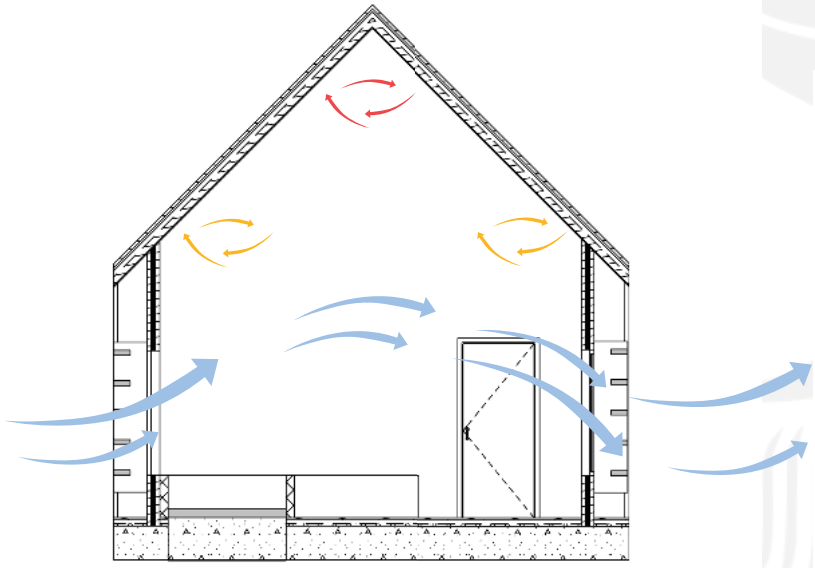
1 Entrance/Exit
2 Lobby
3 Gallery
4 Hatchery
5 Hatchling Pond
6 Gathering Area
7 Toilet
8 Musholla
9 Kitchen
10 Restaurant
11 Souvenir Shop
12 Management Office
13 Laboratory
14 Food Storage
15 MEE

→ Public Access
→ Private Access
Private Area

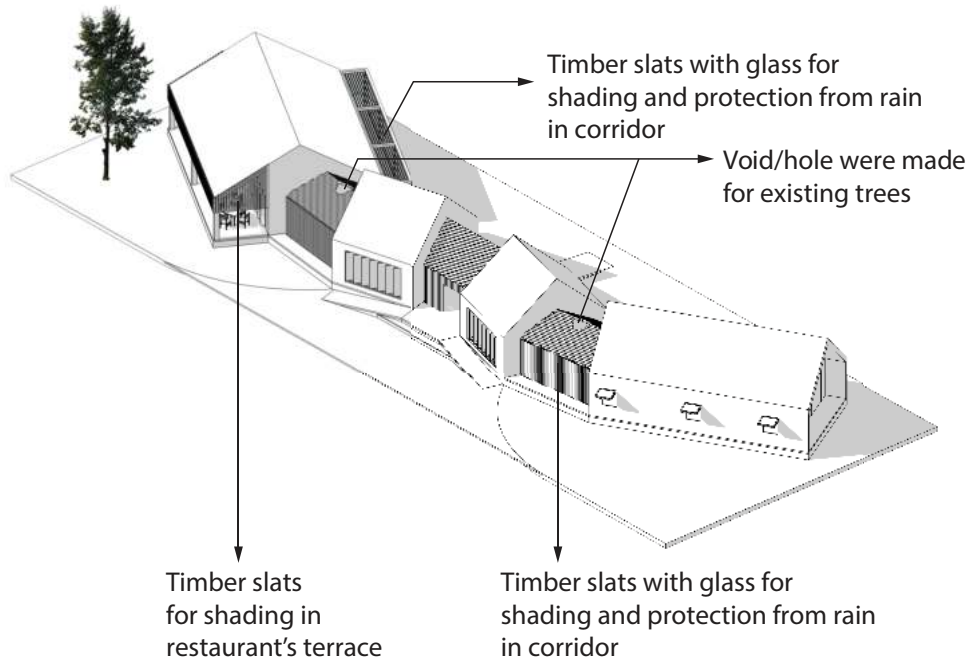
## 6.2 Ecological Aspect Regarding the Climate

This conservation house is located in tropical area near the beach. The climate condition is tend to hot during the day in summer/ dry season, but humid in rainy season. Almost everyday the winds blow strongly (**climate analysis in page 20**). The nesting season is between May until September. Those month is where the wind blows quite hard between 13-17 kph. In May, temperatures tend to heat up to 31° Celsius. However, near September, the temperature tends to decrease, although the decrease is not significant. In May to September, the rain intensity also tends to be low (average under 100 mm). In addition, these months also enter the dry season.

To overcome these climatic conditions, the design adjusts based on site conditions. The shape of the roof is made in such a way with clay material to reduce heat. In addition, cross ventilation is applied so that air circulation flows better and the room does not feel hot. Slab concrete with parquet finishing is used to modulate internal thermal (**detailed structure, page 80**). Timber slats for corridor is made as shading. Several pine trees were maintained and added in the ladscape to help reduce the direct sunlight to the site/natural shade (**landscape site plan, page 70**).



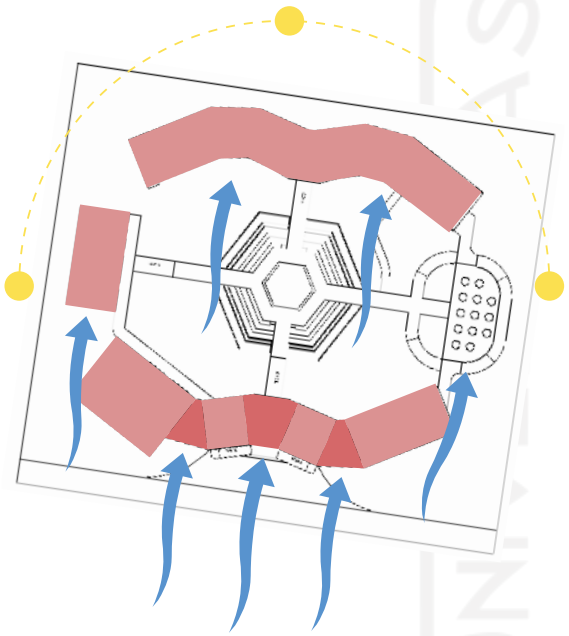
SCHEMATIC VENTILATION AND THERMAL



## 6.3 Argumentation in the Form Making

**Mass Orientation**

The formation of the mass of the building is adjusted to the site conditions. The building is made elongated from east to west so that it is not exposed to too much solar radiation. In addition, the shape of this building also allows for good air circulation and avoids hot temperatures because most of the wind blows from the south and north

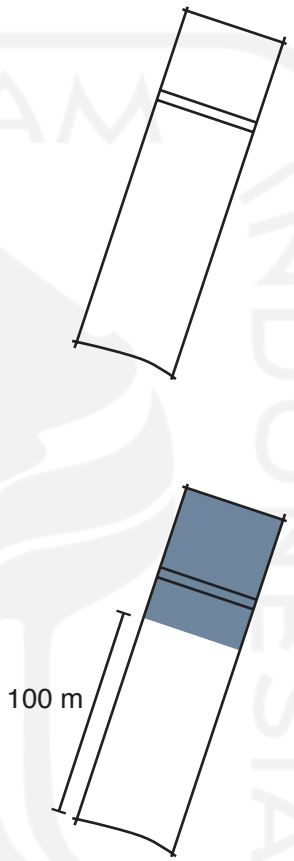


**Spatial Arrangement**

The design of the building mass is also adjusted to the needs of space, activity and light level (**page 56, page 62**). The conservation area is placed on the easternmost side to get maximum sunlight in the morning so that the temperature of the hatchery and hatchling pond remains warm

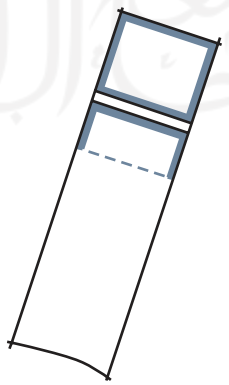
## 6.4 Argumentation in Building Placement

The placement of building consider the local regulation and also the previous conservation house.



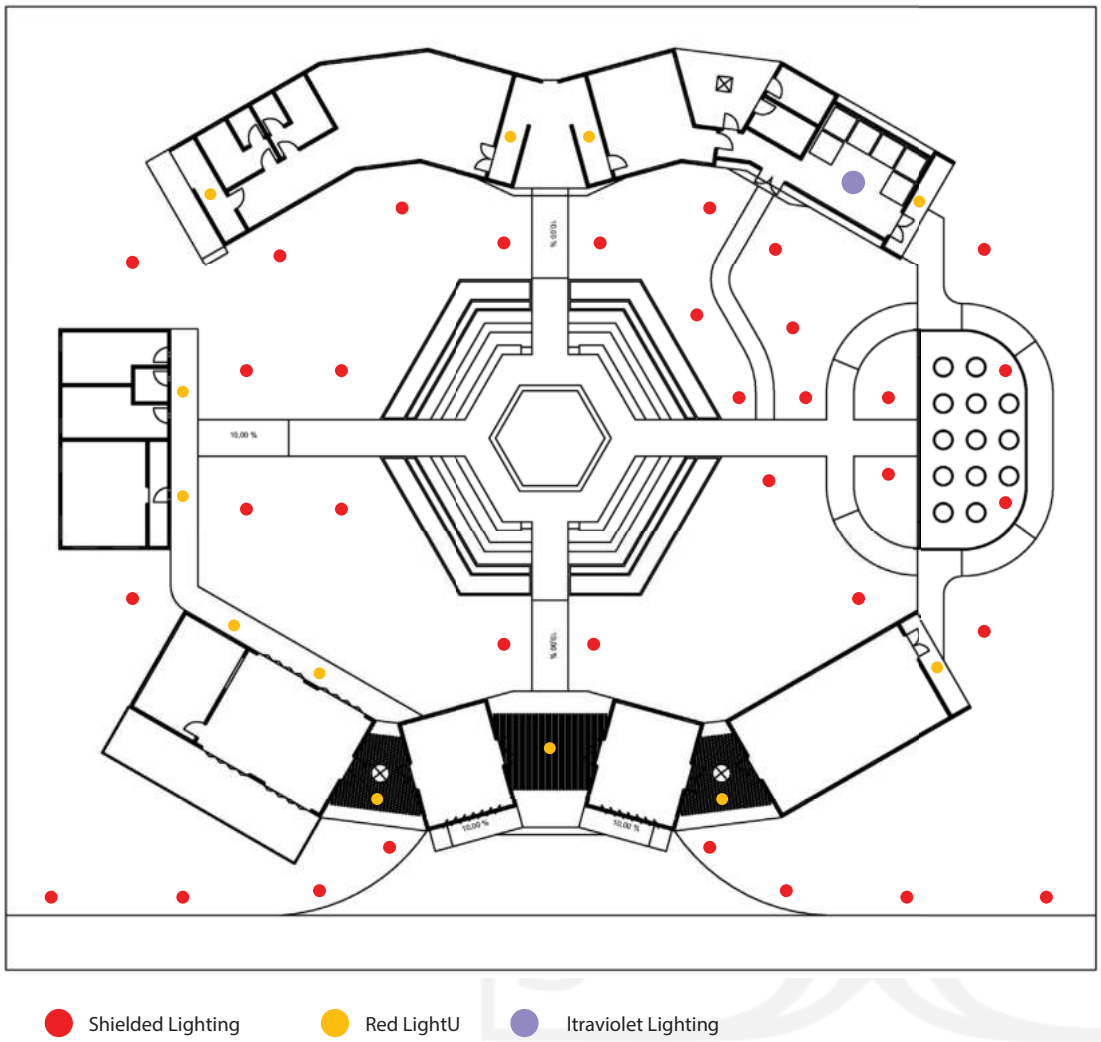

The total area of site is 12.740 sqm. Minus the street area, it becomes 12.600 sqm

The boundary line from the beach is determined to be at least 100 (one hundred) meters from the highest tide



The boundary line from local street and neighbor is determined to be at least 2 meters

## 6.5 Turtle-based Lighting




Buildings on the beach where turtles nest, are highly recommended to avoid spilling light towards the beach (**page 55**). In this design, in outdoor or semi-outdoor areas, shielded lighting and red light are used. For the hatchling pond area, an ultraviolet lamp is used to maintain a warm temperature.

*chapter 7*

# Attachment

Plagiarism Check
Architecture Presentation Board
Design Drawing

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**SURAT KETERANGAN HASIL CEK PLAGIASI**

Nomor: 1931093855/Perpus./10/Dir.Perpus/X/2022

*Bismillaahirrahmaanirrahiim*

*Assalamualaikum Wr. Wb.*

Dengan ini, menerangkan Bahwa:

| | |
|---|---|
| Nama | : Mode Jutta Dewi Haryono |
| Nomor Mahasiswa | : 17512127 |
| Pembimbing | : Dr. Yulianto P. Prihatmaji, IPM., IAI. |
| Fakultas / Prodi | : Teknik Sipil dan Perencanaan/ Arsitektur |
| Judul Karya Ilmiah | : Design of Turtle Conservation Center in Goa Cemara, Sanden, Bantul with Ecological Approach |

Karya ilmiah yang bersangkutan di atas telah melalui proses cek plagiasi menggunakan **Turnitin** dengan hasil kemiripan (*similarity*) sebesar **10 (Sepuluh) %.**

Demikian Surat Keterangan ini dibuat untuk dapat dipergunakan sebagaimana mestinya.

*Wassalamualaikum Wr. Wb.*

Yogyakarta, 10/21/2022
Direktur

Muhammad Jamil, SIP.

BUILDING PERFORMANCE & TECHNOLOGY LABORATORY

# GOA CEMARA

## *CONSERVATION HOUSE FOR TURTLE*

The turtle conservation at Goa Cemara Beach in Sanden, Bantul is one of the efforts of the local community to protect and conserve turtles. Because the turtle population is increasingly threatened, mainly due to human activities, it is necessary to increase awareness of the importance of protecting turtles and its environment. With the development of ecotourism on the coast of Bantul to protect the coastal area, the construction of a new conservation center by increasing conservation facilities as a medium to provide recreational education is needed. Thus, this project will accommodates activities related to turtles from hatchery to captivity which includes conservation and visitor facilities. The conservation facilities that provided include hatchery, captive ponds, and man- agement offices. Meanwhile the visitor facilities are a conservation center with gathering space and gallery/interactive visual media. Another supporting facilities for tourism will be added, such as toilet, musholla, cafe and souvenir corner. This conservation center uses an ecological architectural design approach that responds to environmental conditions and the activities carried out in it. The ecological aspect will be focused on building design that consider the tropical coastal climate, turtle characteristic, and the use of sustainable local materials. This approach was chosen as an effort to create a harmonious relationship between the building and the site in order to preserve nature and the comfort of living creatures in the area.

## Backgorund

**Endangered Turtles**

Turtles is very important for coastal and marine ecosystems. However, the existence of turtles is increasingly threatened with extinction. In government regulation number 7 of 1999 concerning the Preservation of Plant and Animal Species in the attachment to the List of Protected Animals, it is stated that all types of turtles that exist in Indonesia have legal status protected by law.

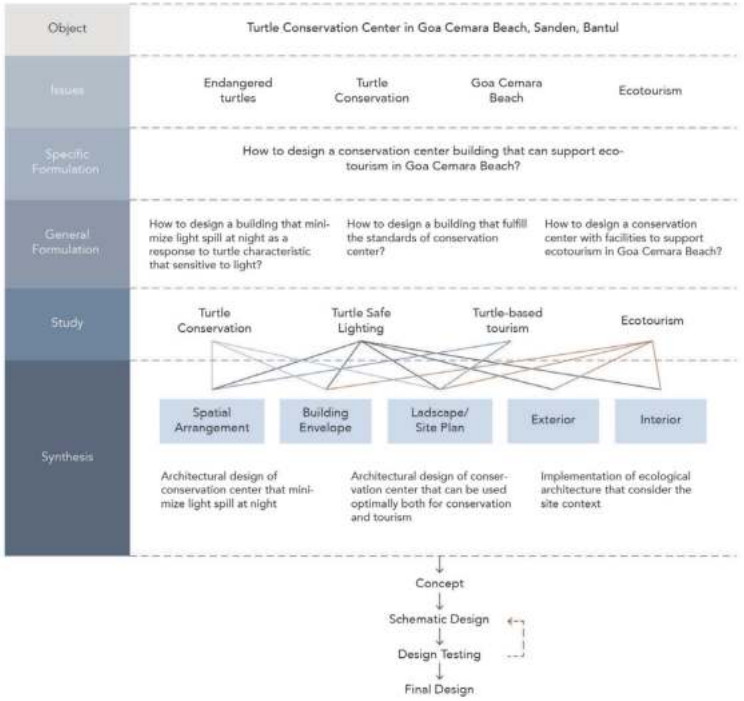
**Conservation House**

Goa Cemara Beach is one of area that become a favorite place for turtle to laying their eggs. However, current conservation house does not appear to be optimal. The turtle hatchery pond is still temporary ponds with manual seawater filling system. In fact, the seawater filling sys- tem is better to use a pump so that the water can be replaced more easily and continues to flow.

**Ecotourism**

Referring to the Decree of the Bantul Regent No. 284 of 2014, the coastal area of Bantul has the potential for natural resources (turtles and mangrove), which has the attractiveness of living natural resources, geological formations, and/or natural phenomena that can be developed for the benefit of utilizing the development of science, research, education and awareness raising of natural resources, biological, marine tourism, and recreation.

## Framework of Thinking



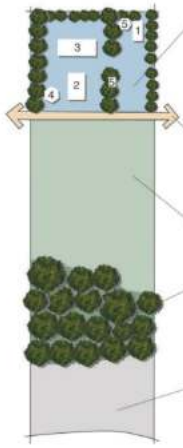

## Site Analysis

### SITE CONDITION


**Location** : Rajiman Street, Goa Cemara, Sanden, Bantul, Yogyakarta
**Total Area** : 12.500 sqm
**Regulation** :
KDB: 40%
KLB: 0,8
Boundary Line from the beach: 100 meters
Boundary Line from the street: 2 meters

Goa Cemara Beach is located in Gadingsari Village, Sanden District, Bantul Regency, Special Region of Yogyakarta. It is one of tourist destinations on southern coast of Bantul. It is named Goa Cemara because this beach has a lot of cemara udang/pine trees that are line up neatly and look like a cave. Those pine trees are to protect seawater abrasion and hold the sand dunes, so there is no displacement occurs due to the wind. This beach has soft black sand and strong winds in accordance with the character of the south coast. The turtle conservation house in Goa Cemara is lo- cated in Rajiman street in Goa Cemara Beach Tourism Area. It is about 150 meters from the beach area for turtle nesting. The site area is 3000 square meters, surrounded by plantation of local residents. For a long time, local community groups have collaborated with the government to preserve the local flora and fauna.

**Contour**
The contour line on the site is tend to be flat. There are only a few small mounds typical of the beach area, and near the beach there are sand dunes with pine trees.




**Mino Raharjo Conservation House**
1. Hatchery
2. Office and Solar Battery
3. Solar Panel
4. Storage
5. Gazebo

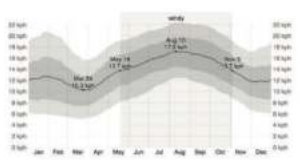
**Main Access**
The main street access is Rajiman Street that connecting the site with Goa Cemara Beach Area. It is a 3 meters wide street without asphalt nor paving block.

**Fields**
The existing function of this area is for farming

**Cemara Udang**
This area separates the mainland from the shoreline. There are many cemara udang/pine trees trees which also function as abrasion prevention.

**Beach**
This area is part of turtle nesting area. It is wide, sloping, has a lot of trees and quiet. Whis is suitable as a place for turtle to lay egg

**Sun**
According to data from sun earth tools (accessed on May 15, 2022), the movement of the sun is directly above the site, but slightly from the north.



**Wind**
The wind mostly come from the south and the north. This wind data will be used as the consideration of the openings and facade to achieve the comfort of the building user.

**Temperature**
The hottest month of the year in Sanden is May, with an average high of 31°C and low of 25°C. The coldest month of the year in Sanden is August, with an average low of 23°C and high of 29°C.

**Precipitation**
Based on this categorization, the most common form of precipitation throughout the year is rain, with a peak probability of 70% on 1st February.

DEPARTMENT of ARCHITECTURE

FINAL ARCHITECTURE DESIGN STUDIO

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Examiner:
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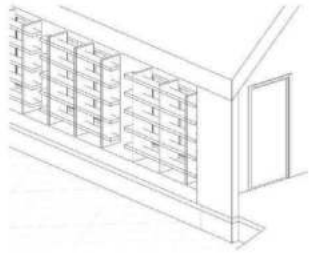
# Design Result

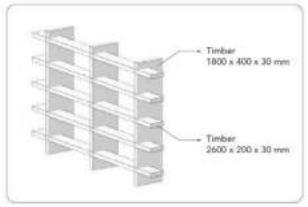
## 1. Turtle-based Building for Building Mass

| Design Criteria | Design Guidelines |
|---|---|
| The **temperature** of the hatchery and hatchling pond should be warm or normal, around **25-30 degrees celcius**. | - Placed **hatchery and hatchling pond area in the east** because morning sunlight is suitable (not too hot).<br>- The use of transparent material or sufficient openings for the wall to avoid predator but sufficient sunlight can enter and keep the room temperature warm. |
| The hatchery should neither be to dry nor too wet. So the humidity should be kept with **sun intensity areund 40-60%**. | - Placed in an area **with roof or shading device** to avoid too much solar heat and maintain humidity. This can also avoid predators. |

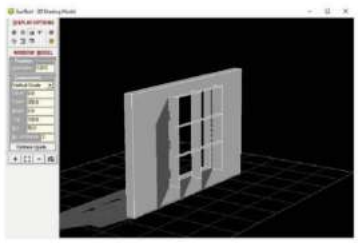
### Shading Device

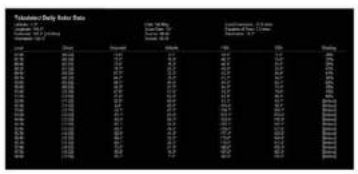
Based on the effectiveness level, the most effective shading device for east and west is vertical fin and eggerate (combine fin and blade). Thus, based on author's analysis and simulation, for site in Goa Cemara beach, we can apply eggerate shading device with slanted vertical fin or regular vertical fin. Because the hatchling pond area need more lighting to keep the temperature warm, half horizontal blade is better so that the light during the day can enter the building.






### Design Test Simulation





## 2. No Overlight Building based on Lighting Level

| Design Criteria | Design Guidelines |
|---|---|
| Light intensity less than 50% (visitor area) | - Visitor area placed in the front to blocked the conservation area from the beach.<br>- All openings that face the beach should be covered with window cover to avoid light spill at night. |
| Light intensity 40-60% (entrance, lobby, hatchery and hatchling pond area) | - Using shielded lighting<br>- Make a transition area before enter the building and equipped with red light. |
| Light intensity 100% (laboratory and management office) | - This area placed in the back, far from the beach |

### Window Cover

In this design, folding window cover from wood was chosen as the main opening cover. This type of cover can be use as shading during the day and it can block the light at night. Meanwhile, rotating panel also chosen for the lobby because it can cover the window in lobby that bigger than the other opening. Wooden slats also used to cover outdoor lighting in corridor.


Since the lobby and shop has bigger opening which makes too much sunlight enter the building, it needs a cover that can be used as shading device during the day. Vertical fin is preferred for an opening that facing the south.

### Shielded Lighting

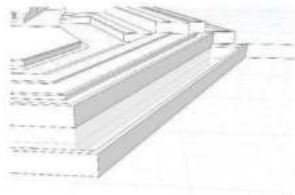
1. **Keep it low**
   Mount the fixture as low as possible to minimise light trespass, and use the lowest amount of light needed for the task.
2. **Keep it shielded**
   Fully shield the light so bulbs and/or glowing lenses are not visible and avoid light escaping upwards and outwards.
3. **Keep it long**
   Use long wavelength light sources (ambers and reds)

### Transitional Area

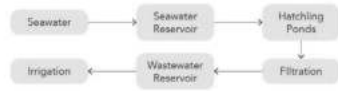
## 3. Seawater and Wastewater Management System

| Design Criteria | Design Guidelines |
|---|---|
| The water for hatchling pond must be seawater and it should be change 2 times a day | - Using seawater pump system<br>- Making temporary water reservoir to save the energy<br>- Creating a wastewater treatment system, so the water usage can be maximized |

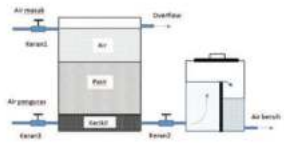
Water reservoir was added to keep the seawater, so it's easier to change the water and saving the electricity. Waste water reservoir also added because the waste water is quite a lot and we can reuse it for irrigation. The reservoir placed near amphitheater in the center of the site.



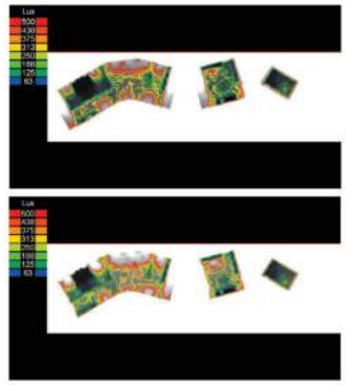
### Water System




### Water Filtration System



### Design Test Simulation



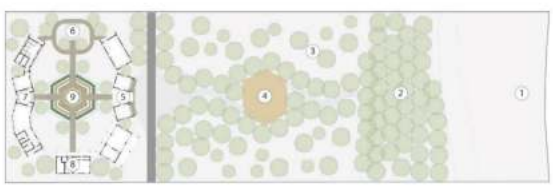

## 4. Natural Lighting to Minimize Energy for Sustainable Building

| Design Criteria | Design Guidelines |
|---|---|
| At least 30% of floor area gets natural lighting intensity more than 300 lux. | - Building mass tends to extend from east to west to maximize natural lighting but avoid excessive radiation<br>- Minimize the opening that face the south (beach) to avoid light spill at night |

## 5. Turtle-based Building for Site Plan

| Design Criteria | Design Guidelines |
|---|---|
| Turtle nesting area must be quiet and dark | - Planting more trees on the beach area Existing trees are maintained<br>- Conservation building shouldn't be too close to the beach. At least 100 meters from the beach (based on regulation in Bantul Regency) |

Placed the hatchery into one area with the office makes it easier to monitor turtle hatching and hatchling growth. In addition, providing sufficient distance from the beach can also reduce the danger of abrasion, tidal waves, and light spills from buildings which will interfere with turtle nesting activities on the beach.

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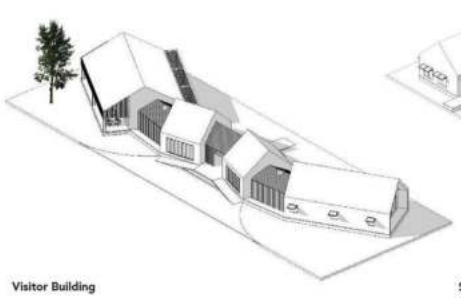
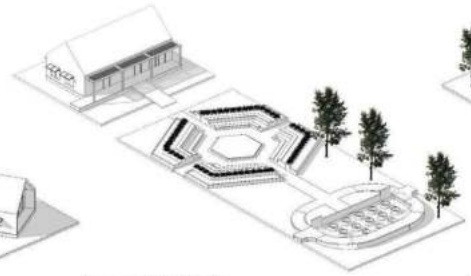
## Design Result

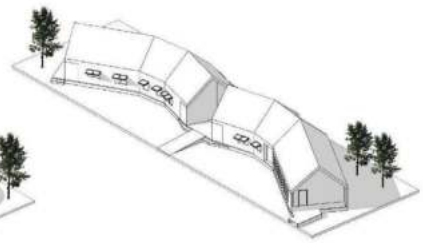
### Building Axonometry



Visitor Building

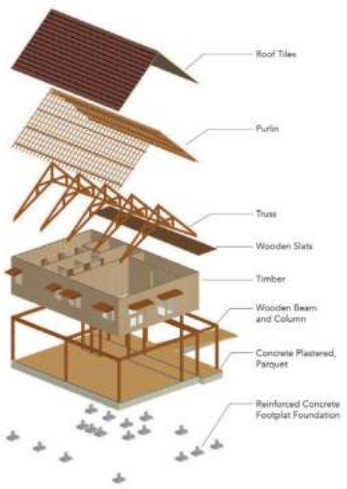


Support Facilities Building, Amphitheater and Hatchery

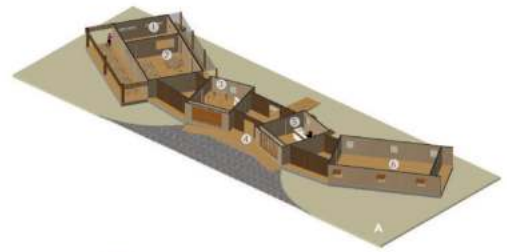


Conservation Building

### Structure Axonometry




### Interior Axonometry






**A. Visitor Building**
1. Kitchen
2. Restaurant
3. Souvenir Shop
4. Entrance
5. Lobby
6. Gallery

**B. Conservation Building**
1. Pantry
2. Bedrooms and bathrooms
3. Gathering room
4. Researcher desk
5. Laboratory/clinic
6. Food Storage
7. MEE
8. Hatchling Pond Area

**C. Support Facilities Building**
1. Musholla
2. Toilets
3. Toilet for Disable People

## Interior and Exterior


Front Perspective


Hatchery


Pathway to Hatchery


Hatchling Ponds


Amphitheater


Pathway to Amphitheater


Exterior of restaurant and support facilities building


Entrance


Souvenir Shop


Lobby


Office


Gallery

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## Architecture Presentation

## Design Drawing

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