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# Fish Landing Base in Pantai Cermin with Ecological Architecture Approach

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**Abstract.** Indonesia is a maritime country that has a sea area of 5.8 million km², with enormous potential for marine products. The fisheries sector is one of the things that supports the third largest Indonesian economy with a GDP (Gross Domestic Product) of Rp 1.900 billion. There are many fishery ports in Indonesia commonly referred to as Fish Landing Base. In North Sumatra itself, there are 23 Fish Landing Base, and one of the areas that include it in the RTRW (Regional Spatial Plan) is Serdang Bedagai Regency, especially in Cermin Beach sub-district. However, the fact that the fisheries sector is not the main attraction of the Pantai Cermin area indicates no fishery center. This Fish Landing Base uses problem-solving to solve existing problems, starting from the formulation stage, location surveys, data collection, literature studies, and comparative studies. To respond these issues, ecological architecture becomes the answer to the problem of design conditions, such as responding according to local conditions both from society and nature. Fish Landing Base in Pantai Cermin expect to respond to users comfortably, creates interaction between users and the environment, and can also form a public space so that it can encourage economic generators based on sources of life in coastal areas, and so become one of the new tourist destinations to enjoy the marine products of Indonesia, especially in Serdang Bedagai, North Sumatera.

**Keywords:** ecological architecture, fish landing base, Pantai Cermin

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## 1 Introduction

Indonesia is a maritime country with a 5,8 million km² sea area, so it has great potential for marine products. Based on the 2018 Central Statistics Agency, one of the sectors that supports the third largest Indonesian economy is the fisheries sector, with a GDP (Gross Domestic Product) of IDR 1,900 trillion [1]. In that way, many fishing ports are found in Indonesia, commonly knowns as Fish Landing Base. It is a place for mooring fishing boats to land fish, a center for production activities, marketing processing products, and fostering fishing communities [2]. Based on the Directorate of Capture Fisheries Infrastructure in 2004, it is

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stated that the development and construction of fishing ports/fish landing bases can promote the economy in an area while at the same time increasing state revenue and local revenue [3].

The Central Statistics Agency in 2016 recorded that there were around 23 Fish Landing Base units in North Sumatra. As for one of the regions that proclaimed the development of the Fish Landing Base in the Regional Spatial Plan regulation in the Serdang Bedagai Regency Regional Regulation Number 12 of 2013, Article 48 paragraph 5 which reads: " In paragraph (4) letter b in Serdang Bedagai Regency includes Fish Landing Base Pantai Cermin, Fish Landing Base Tanjung Beringin, Fish Landing Base Sialang Buah, Fish Landing Base Bandar Khalipah" [4]. Serdang Bedagai Regency is included in the east coast region of North Sumatra, with a historical footprint in the fisheries sector that is rarely discussed. Based on the book History of Indonesian Fisheries, the Pantai Cermin area, which is included in the East Coast of North Sumatra, is a fishery production area that a Dutch company occupied during the Dutch colonial period named "The Big Five" [5]. With this statement, the positive side can be taken from the existence of the Pantai Cermin fishery sector, which previously played an essential role for the region to be able to support the value of the existence of this area as one of the fisheries sectors in North Sumatra and support the level of the settlement by communities around so it can better through the facilities provided.

To respond these issues, ecological architecture is the appropriate implementation. These are several principles of ecological design, including solution grows from the place (understanding the local community, especially in the socio-cultural aspect), design with nature (the design is planned to be able to maintain the ecosystem on the site), minimize energy and material use, cultural relations with nature, maintaining environmental aspects such as water, vegetation, and many more [6]. Based on the Greenship for Sustainable Neighborhoods regulation, the things that need to be done in the design to fulfil an ecologically sustainable area are as follows: improving the ecological value of the land, knowing the performance inside and outside the area, managing water conservation and management, using materials and setting a strategy to support the welfare of the local community [7].

Therefore, the primary purpose of this design is to find ideas for designing the Fish Landing Base area by considering a sustainable site under the principles of ecological architecture. The final result of the design is expected to be able to find effective ideas at the Fish Landing Base in Pantai Cermin that responds to users comfortably, creates interaction between users and the environment, and can also form a public space so that it can encourage economic generators based on sources of life in coastal areas, and become one of the new tourist destinations to enjoy the marine products of Indonesia, especially in North Sumatera.

## 2 Literature Review

### 2.1 Fish Landing Base

*Fish Landing Base* is one of the economic infrastructures that was built to support the fishery sector development [8] as a function of public services, the main functions of the Fish Landing Base are as follows [9]: infrastructure to facilitate the production of fishing vessels, processing, and marketing of fishery products and services for logistics purpose, the focal point for developing fishing communities is the provision of guidance and counselling, and centre for local fishery economic development through the development of the fishery sector.

### 2.2 Ecological Architecture

*Ecological architecture* is an architectural concept that prioritizes the development of the built environment as a necessity for human life in a reciprocal relationship with the natural environment. The integration is divided into three levels, as the first level is physical integration with local ecological characteristics (soil condition, vegetation, topography, climate, etc.), for the second level is system integration with natural processes including water use, sewage treatment, building heat release systems, and for the third level is the sustainable use of resources [10].

Based on the purpose of this design, the ecological concept is exact and efficient because it is one of activity that utilizes natural resources in the site that can be a way to educate, research, and conservation the environment and aims to improve the economy of society in the coastal area and even in a state [11].

## 3 Methodology

In this study, the most important thing to do is to choose a location so that the design of the building follows the environmental context. The Pantai Cermin Fish Landing Base location serves as a public facility and supports the regional fisheries sector; therefore, the location should be in an easily accessible place, close to residential areas and the beach. Regarding the selection of the project location, it was carried out through a literature study and a review of the city structure through the RTRW (Regional Spatial Plan) of Serdang Bedagai Regency [12] to ensure that the area selected for planning could be built and make sure the concrete data about the location, both architectural and non-architectural. Next, all data were collected in the analysis to solve the design problem, and the results of the analysis produced a design concept.

## 4 Result and Discussion

### 4.1 Design Location

Pantai Cermin District is one of the sub-districts in Serdang Bedagai Regency, North Sumatera. The existing condition of the design site is vacant land located in Pantai Cermin District with a

total area of 2.2 Ha based on calculation from satellite maps with contours that tend to be flat in most locations and decrease by 2ft (60.95 cm) in the coastal area (Figure 1). The land is government ownership and acccording to RTRW (Regional Spatial Plan), this area is designated for developing the Fish Landing Base. This area is planned as a Minopolitan area with efficient and integrated fisheries sector development activities [13].

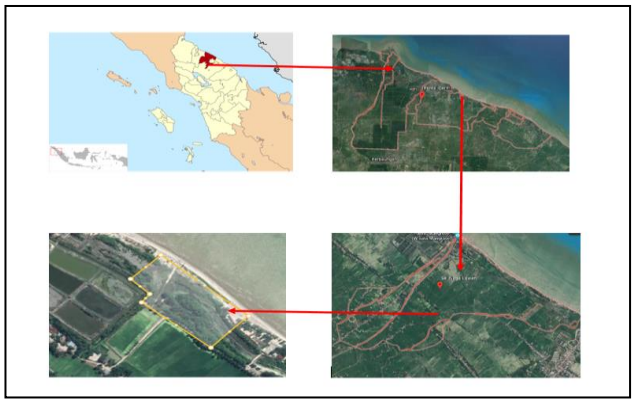

**Figure 1** Site Location

### 4.2 Zoning Concept

The zoning establishment on the site is divided into four zones: the central zone (auctions, fish sellers, and other primary functions), the supporting zone (public open space), the green zone (vegetation), and the docking zone (Figure 2).

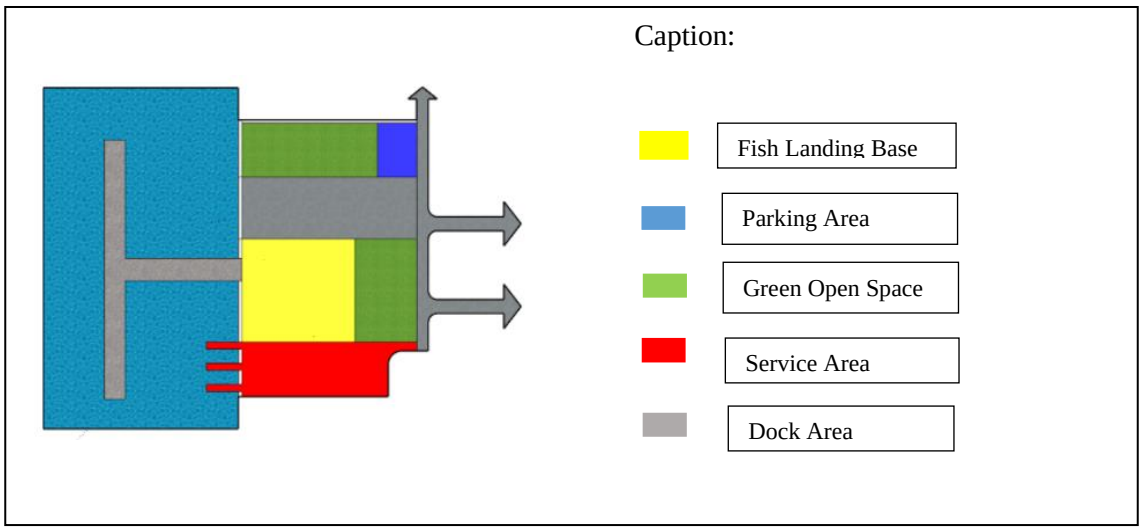


**Figure 2** Zoning

### 4.3 Circulation Concept

This design circulation consists of three types such as general circulation, service circulation, and ship circulation. For circulation, fishing boats come and dock at the loading and unloading dock, then pass through the supply dock. To protect the waterfront due to the impact of the ship when the ship docked, the wharf must be equipped with fenders. To prevent ships from drifting

and moving places due to current waves, it is necessary to provide facilities for mooring ships, such as mooring poles, mooring buoys, and others (Figure 3).

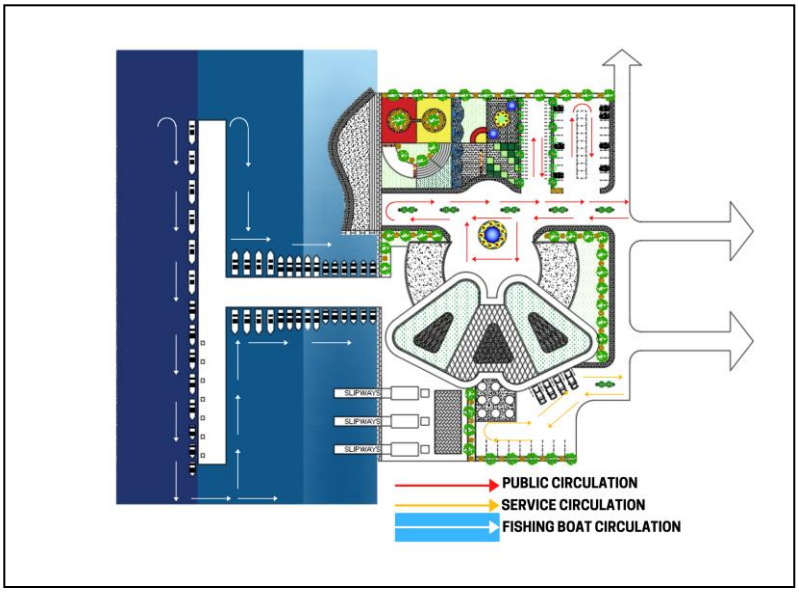


**Figure 3** Circulation concept

Service circulation is close to the building service area, such as the goods dock. In contrast, by the public circulation, it passes through the front area of the building, which is the separator between the building and public open space. Furthermore, for the circulation of the catch that has been unloaded, sorted, separated, and placed into a basket and then launched from the ship to the dock apron using a sliding way. After being weighed, the catch is placed on the auction floor. After the auction, the catch is transferred to the packing area, lifted, and transported to the market destination.

### 4.4 Building Mass Concept

The concept of mass and appearance of the Fish Landing Base is taken from the shape of the site itself, adaptive plus subtractive processes are carried out, and zoning division is based on proximity of space and attractiveness between spaces (Figure 4). They are taking into account the orientation of the façade towards North-South to avoid overheating. The mass of the building is formed dynamically as a response to the accommodated because this function is required to have a continuous circulation of each activity.

As for the landing site should be located at a convenient distance from the auction site, for the berth location must be safe for fishing boats in all weather and tidal conditions, and the last consideration is the location of each activity is placed in an area that provides easy access from the docking area and auction/market outlets.

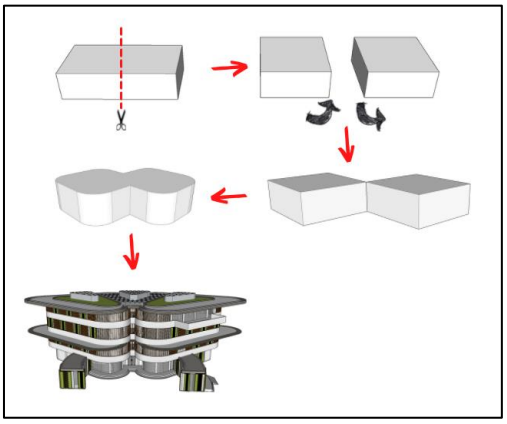

**Figure 4** Building mass concept

### 4.5 Respect for Site

To respond to the ecological architecture, the landscape consists of 40% of the 2.2 Ha area provided as green and public open spaces or about 8.800 m². The area consists of a public space devoted to a recreational area as one of the functions of a tourist attraction. Still, it pays attention to existing ones, such as providing a waterfront in the public space area (Figure 5).

**Figure 5** Respect for site in design

### 4.6 Respect for User

To respond to the needs of users, fishers, managers, and visitors who need a place to sell the marine product by providing ship dock, auction, retail, and office with easy access (Figure 6).

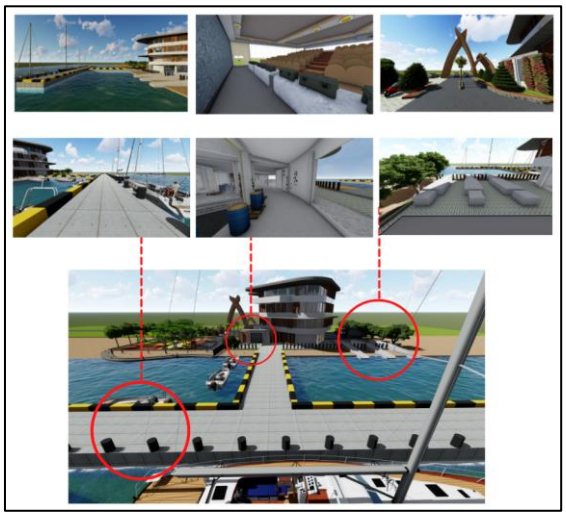

**Figure 6** Respect for user in design

### 4.7 Working with Climate

Following the ecological concept in harmony with the climate, place the orientation of the building's façade to North-South direction to avoid overheating, wall materials in the form of tempered glass and double façade as well as the application of green roofs as an effort to reduce the temperature in the building (Figure 7).

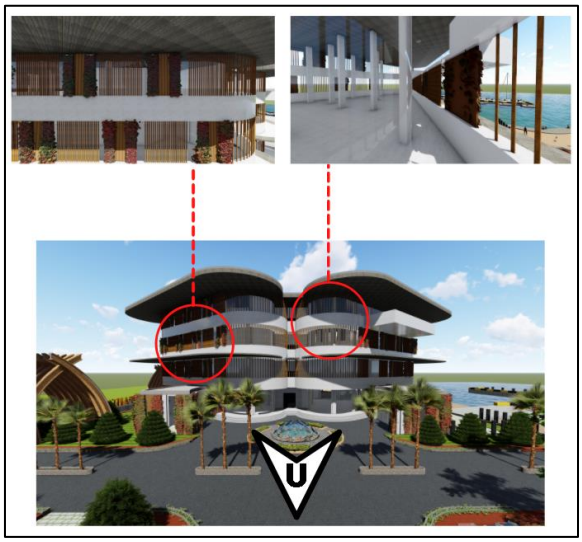

**Figure 7** Working with climate in design

### 4.8 Conserving Energy

This design uses solar energy conversion through BiPVT (Building Integrated Photovoltaic) [14] as renewable electricity backs up energy. Building-integrated photovoltaics materials are used to replace conventional building materials in parts of the building envelope, in this case are used for the roof (Figure 8).


**Figure 8** Conserving energy in design: BiPVT

Building Integrated roof layers in this design consist of photovoltaic layer, insulation layer for reducing heating, airflow insulation layer, PCM (Phase Change Material layer 1, PCM airflow, and PCM layer 2 (Figure 9).

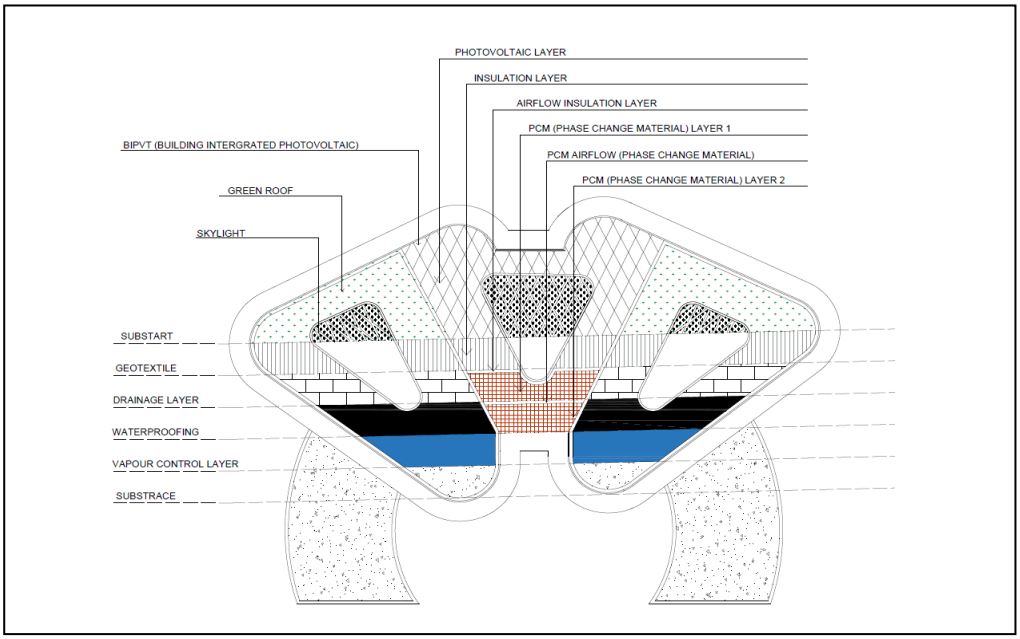


**Figure 9** Conserving energy in design: BiPVT layers

### 4.9 Minimizing New Resources

To support the concept of ecology in buildings, minimizing new resources by applying the technology of processing saltwater into freshwater with a reverse osmosis system (Figure 10) by using pressure greater than osmosis pressure of saltwater. The brine pressed to pass through a semi-permeable membrane will filter out the molecules having a diameter more extensive than the water [15].

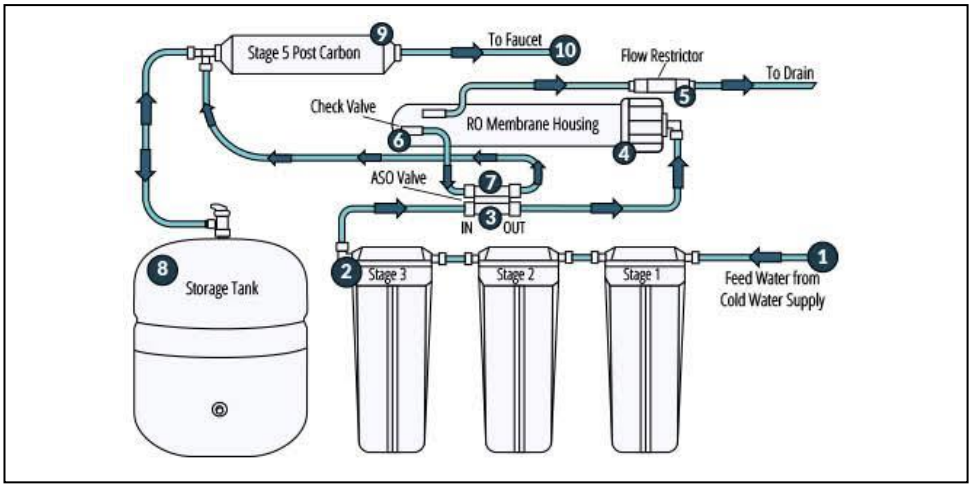


**Figure 10** Minimizing new resources in design: reverse osmosis diagram

*Source: Olympia Water System*

## 5 Conclusion

To create buildings by the principles of ecological architecture by applying building designs to suit tropical climate conditions and to respond to ecological aspects, such as providing 40% of the site area as green open space and public open space, responding to the needs of users so they can have access. The next is adapting to the tropical climate typical of the coast by placing the orientation of the building façade to the North-South direction to avoid overheating and then converting solar energy through Building Integrated photovoltaics (BiPVT) technology as renewable energy at this design. The last is the application of processing saltwater into freshwater with reverse osmosis to create a Fish Landing Base design that can solve local community problems and has an attractive design. Hence, the local and broader communities are interested in visiting and using the facilities, especially in the fisheries sector.

## Acknowledgment

This research is made as a suggestion for the government to overcome Fish Landing Base with an ecological architecture approach so the stigma about fishing port in the mind of the community can change into something good, a perfect place to visit so it can help to develop the economic aspect in the area. The author would also like to thank the Department of Architecture, Faculty of Engineering, University of North Sumatra, and all parties who have assited in this research and design of Fish Landing Base in Pantai Cermin with Ecological Architecture Approach.

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