Green architecture concept in Chinese region at Clan Jetties area, Penang Malaysia

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Abstract. Penang is part of Malaysia’s territory where there is an area recognized by UNESCO as the world heritage, George Town. As a center of the conservation area, it is a port that became the center of commerce during the colonial period. It makes the city inhabited by multi ethnic from different parts of the world, such as Malay ethnic, Chinese ethnic, and Indian ethnic. This multi ethnic settlement becomes the main attraction to be made as the research material. This study aims to find the concept of green architecture of clan jetties area, describe the use of natural materials in its buildings and residences and explain the utility system on the region. This research uses qualitative method with analysis approach using general-specific method. Based on the research we conducted with the method of observation and direct observation of the research object, it can be concluded that clan jetties is a special settlement for Chinese ethnic who are migrants. The residential location is along the coastline adjacent to the Weld Quay harbor. The settlement is divided into 7 areas based on family or clan; Ong Jetty, Lim Jetty, Chew Jetty, Tan Jetty, Lee Jetty, New Jetty and Yeoh Jetty. Each clan has a similar pattern of settlement that extends to the sea with one main road and the side of the road is occupied by the houses of the citizens. The utility system of the area is broadly divided according to the utility of clean water for sewage and fire, lighting, and fire-fighting utilities. Each clan is already equipped with the utility. The main material used for building houses is wood. The placement of vegetation for greening using a flower pot is either placed at the bottom or hung on top.

1. Introduction
George Town is one of the historic areas in Penang, Malaysia. This conservation area is protected by UNESCO since 2008. More than 500 years ago this city was the center of trade and port so that now the region has many cultures, a blend of eastern and western cultures. This can be seen from the image of the buildings that dominate the region is a blend of European, Malay and Chinese ethnic styles.

Weld Quay and Clan Jetties are a coastal area of George Town which is located on the beach so this area becomes a port and residential area. Communities that live in the ports commonly have a livelihood as fishermen and workers. This area is protected as a historic conservation area with various ethnic groups including Malay, Chinese, Indian and Turkish. Each of these tribes occupies different areas so as to create a settlement area according to the tribe.

In ancient times, the main mode of transport for shipments of goods was sea vessels that made the port area became the attraction of the community as a place of livelihood. Therefore, there are many
trading companies and warehouses here. In George Town area, there is a residential area of clan Jetties which is mainly inhabited by Chinese ethnicities who originally worked as fishermen or port workers. Inside it, there are several clans which are distinguished by family ties, such as Ong Jetty, Lim Jetty, Chew Jetty, Tan Jetty, Lee Jetty, New Jetty and Yeoh Jetty.

According to [1], Green Architecture is a minimal architecture consuming resources: natural resources, including energy, water and materials, and minimal negative impact on the environment. Meanwhile, according to [2] formulates the definition of Sustainable Development (sustainable development) as development that can meet the needs of today's people without sacrificing the potential of future generations.

Green Architecture is a concept of planning a building that is friendly to the environment. This is an attempt to solve the problem of earth global warming. The implementation of Green Architecture is not only in Indonesia but other countries also begin to organize environmentally friendly buildings [3].

The World Green Building Council defines the rating system in Green Building as Greenship as a rating system divided into six aspects consisting of:

- Appropriate Site Development (ASD)
- Energy Efficiency & Refrigerant (EER)
- Water Conservation (WAC)
- Material Resources & Cycle (MRC)
- Indoor Air Health & Comfort (IHC)
- Building Environment Management (BEM)

2. Methodology
This research used descriptive qualitative method. The research object was located in the clan Jetties area of George Town Penang Malaysia with an area of 259.42 hectares (figure 1). Data collection techniques were conducted in several ways: literature review, field observation, and interviews with local residents.

Data collected from the survey in Penang, Malaysia were then selected and classified into some categories. Those that were not suitable with the result were eliminated. The data analysis was done from of sketches and documentation of observation result.

![Figure 1. Research area.](image)

3. Result and discussion
Clan Jetty consists of 7 (seven) clans residing in the port area [4]. The clan division is based on lineage or family. However, this research only focused on Lim Jetty and Chew Jetty [5].
3.1. Lim Jetty
Lim Jetty was previously a much larger settlement with 42 buildings before World War II. Unfortunately, it was burned and destroyed during the Japanese bombing in December 1941. The reconstruction began slowly after the war and new temples appeared to meet the spiritual needs of the people. The houses with zinc roofs are divided into two separate main areas with one row of wooden shacks lined along one path facing the sea and the other cottage facing each other on the other side (figure 2).

![Figure 2. Lim Jetty area (a) main gate; (b) settlement.](image)

3.2. Chew Jetty
Chew Jetty is the largest and the most visited water village among the other clans. The closed-tied Chew community played an important role in the settlement of Chew clan immigrants from the same hometown in the old days and has largely been spared the war damage for years. The area offers a public shuttle to reach the ships parked in the center of the sea lane and it is a favorite spot for shutterbugs and setting of movies with its friendly villagers, along with small shops, hair salons, beverage outlets and souvenir stores lined the narrow alleys (figure 3).

![Figure 3. Chew Jetty area (a) front area; (b) central area (souvenir area).](image)

The annual prayer ceremony of Thi Kong She held to commemorate the Emperor's birthday on the 9th day of the Lunar New Year. It is especially celebrated on a grand scale here and remains as one of the highlights on the Penang calendar for the festival. They will prepare food like roast pork, pastries and fruits and put them on a 50-meter-long altar with main road sides. The side of the table is tied with sugarcane, a symbol of gratitude to God and favorable pieces of red paper hung from sugarcane stems.
and pasted on food offerings. The altar is surrounded by huge tusces of colorful giant incense and midnight fireworks that turn the road into a magical landscape.

3.3. Green architecture
Green Architecture in clan Jetty area covers various aspects such as natural lighting and the use of natural materials in residential buildings and supporting infrastructure of the area.

3.3.1. Natural lighting. Lim Jetty is an area close to the Quay weld harbor, where the area is mostly a dock for ships - docked. Ventilation in this settlement is using air vents located above the door of the building where the open ventilation is wide enough to circulate the air (figure 4(a)). Natural lighting in this settlement is using windows of a house like a house in general. The types of windows are various - naco glass windows and ordinary glass window.

Chew Jetty is a souvenir central area in clan Jetty. The area is mostly stalls merged with the home residents. Like other clan Jetty settlements, houses in Chew Jetty area are also made of wood, so for home air circulation they use ventilation and windows as the main air circulation (figure 4(b)). The main lighting in the settlement is obtained from the windows and doors of the house where the windows are blown with glass and woodwork so that the lighting and air conditioner can be maximized.

![Figure 4. Natural lighting (a) Lim Jetty; (b) Chew Jetty.](image)

3.3.2. Building materials. Clan Jetty in Penang area is a settlement established on the sea, where its wall and main roads of the settlement are made of natural material, wood (figure 5).

![Figure 5. Wood and concrete foundations (a) Chew Jetty; (b) Lee Jetty.](image)
3.4. Vegetation
Reforestation in clan Jetty area utilizes the media in the form of pots and hanging plants. This is influenced by the location of a relatively large area located over the sea, so harnessing pot for planting area is very profitable and become solution of greening problem. The plant plots are in various positions such as on the roadside and in the home garden area so that the treatment of the plants is done by each house (figure 6).

![Figure 6. vegetation plots in the area of citizen, rear (a) and along the road (b).](image)

4. Conclusion
Based on the research, it can be concluded that clan Jetty is an area that belongs to a heritage protected by UNESCO. This area is included in the scope of George Town area of Penang Island Malaysia. It is a residential area inhabited by Chinese migrants ethnic where the area is located near to the harbor of the weld base. At first, the migrants from China came to Penang Island to trade when George Town was a well-known port city at the time. Now, the migrants occupy the coastal areas and work on average at the base of the ship in various professions.

Clan Jetty is a residential area of Chinese ethnic based on clan so that each region is a collection of clan's descendants. The clan in the area consists of 7 districts and 6 clans and one area which is a mixed area of the entire clan. Clans which are as follows: clan Ong Jetty, clan Lim Jetty, clan Chew Jetty, clan Tan Jetty, clan Lim Jetty, clan New Jetty and clan Yeoh Jetty. From the seven clans, the clan and new Jetty are clans of various clans.

The layout of each clan has the same characteristics that are both located above sea level and jutting toward the sea except Ong Jetty and Yeoh Jetty areas which are on the land. The pattern of settlement is linear in which the road as its center and the settlement is on the left and right of the road, except Chew Jetty residential area where its settlement pattern is forked and divided into a residential area.

Lighting and carriage in every house of the area uses natural stimulation and is assisted with artificial lighting during the night. Air circulation in the residents is using windows and ventilation, and assisted with the use of air conditioner.

The utilization of vegetation for greening in this area is using plants in pots and placed in the area of the road and yard of the house.

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