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INTERNATIONAL JOURNAL OF ARCHITECTURE AND URBANISM
DEPARTMENT OF ARCHITECTURE | FACULTY OF ENGINEERING | UNIVERSITAS SUMATERA UTARA

Design of Vertical Village in Pantai Burung Village Medan City (Ecology Architecture)

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Abstract. Illegal settlement becomes one of the factors that cause the order of an irregular city and tend to slum. Its location in the region of the River could potentially interfere with the conservation of the river. One of the ways to superintend those problems, it is needed to design and organize the settlement as well as for society, and it has to redesign for the core city to make it better. This design aims to rehabilitate the area from physical, environment, facilities and infrastructure and can support positive activities for the surrounding community. In this case, a vertical-village concept has chosen as an approach for this research because of the narrowest area and the progressing human's life every year. With this design, land use can be optimally, and the collaboration of architecture ecology approach which exploits the facility naturally that will be exposed human's need with should not have to spend expenditure too much. Residential unit use container materials to provide a flexible dwelling, easy to put on and work quickly. Then, to reduce the effect of radiation is acquired by container material that contained a metal using isolation and giving aperture maximally to create a thermal situation comfortably for people. The application of watering conservation is programmed by apply biofilter to distill the gray-water. In improving the economy, it will on organized by utilizing area gardening on floodplain a river that can be a part of the communal area as the waterfront.

Keyword: vertical housing, ecology, container

1. Introduction

As time goes by, the population is increasing. In one Southeast Asian country, Indonesia has the most population in 10 of ASEAN countries. The higher the number of residents it is undeniable the more demand for land used as residential areas and settled. In big cities in Indonesia especially Medan, Some low-income communities are forced to use the illegal land for settlements. This settlement made the city order irregular and became a slum village. Rearrangement of this settlement needed for setting back the slums by digging the potential there is. This design aims to improve conditions in the physical aspects, environment, facilities, and infrastructure, which can also support activities of the surrounding community.

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Journal Homepage: https://talenta.usu.ac.id/ijau

2. Literature Review

Vertical Village is a manifestation of the preservation of the existence of a people's village that is now increasingly eroded by the needs of modern times. Vertical villages can be an alternative to future population growth and the need for shelter. Especially if this residence can also serve as an economic buffer. Especially if this residence also can serve as a buffer of people's economy [3].

The theme applied to this Vertical Village is Architectural Ecology. Ecological Architecture is an ecological dimension in architecture that is attentive to the natural environment and limited natural resources [1]. The development of eco-architecture aims to improve the quality of architecture and the environment. The environment in question is a natural global environment that includes elements of earth, air, water, and energy that need to be preserved. This eco-architecture aim is implementing energy-saving architecture which is one of the architectural typology oriented global natural environment conservation.

According to Frick (1998) in ecology architecture, there are basics of thought that need to be known, among other things. The basic eco-architecture associated with the whole system, as a whole is more important than just a collection of parts (Holistic). Utilizing human experience, it is a tradition in building the experience of the natural environment against humans. Development as a process and not as a static specific reality. Cooperation between man and the natural surroundings for the sake of the safety of both parties.

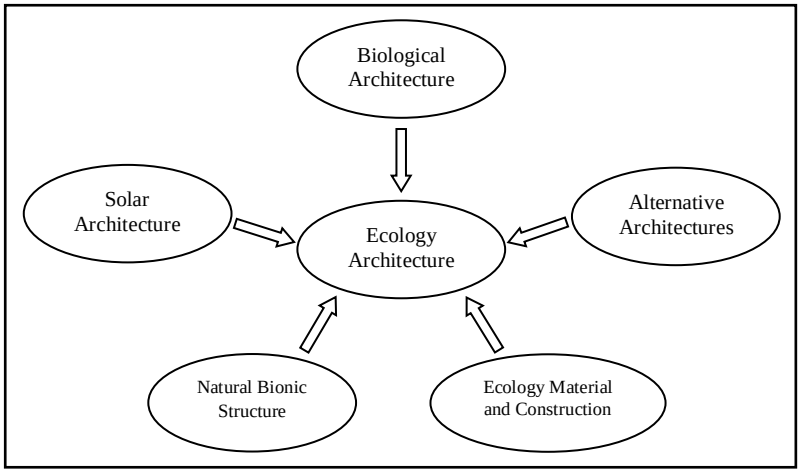


Figure 1. Basic Eco-Architecture
(Source: Frick,1998)

It is seen that the architecture is concerned with all aspects of Solar Architecture, Biological architecture, architectural Alternatives, Material and Ecological Construction, and Bionic structure of nature (Figure 1).

3. Methodology

3.1 Methodology Design

The selection of the location determined based on RTRW* the city of Medan, and potential for existing problems to be developed. The location of the selected design is Aur, district Medan Maimun, Medan City. The location becomes an area with "Very Poor" slum level, based on the Determination of Housing and Environmental Location at Slums of Medan City 2015 (Table 1).

Table 1: The determination of the location of the residential neighborhood a seedy Neighborhood in the city of Medan the year 2015

NO	The Village	District	Level of Slum	Wide of Area (Ha)	Number of Households
10	Aur	Medan Maimun	Very Bad	3,49	307

(Source: RTRW Medan City, 2015)

3.2 The method of the approach to solving problems and Designing Stages

By studying the application of concepts and themes that are the same who have been there and took some important points to be applied again. It is concerned in the arrangement of tread, zoning space/circulars, as well as the utility and application of the structure. Field Survey by plunging directly to the site, observing the activities and needs to be needed, and interacting with the local community. The survey was conducted by mapping the quality of the site, building, and all the natural and artificial aspects that exist in the location. The literature study is conducted by studying the theoretical and conceptual basis for the design approach so that problems that occur in the location can be solved with a design. Also, there is also a review of the regulations applicable to the design area.

The design location is located on the line 3°32'17.96 "- 3°56'49" North Latitude, 98°40'54.19 "- 98°41'30.98" East Longitude. Aur Village is part of Medan Maimun subdistrict which is divided into ten environments with various village names in every neighborhood. The design is located in environment two that is Pantai Burung Village. The total area of the Village Pantai Burung environment 2 Kelurahan Aur are 1.8 Ha.

* RTRW : Rencana Tata Ruang Wilayah (Spatial Plans)

Figure 2. Design Area

Pantai Burung Village, located in the center of the city and surrounded by government, commercial and office centers. The regulation of urban space determines, the design area does not cover the entire area of 2 Aur Village because this area is right on the edge of the road Katamso, which consists of enough quality buildings. Thus, the design area is a rear area with an area of 1.3 Ha (Figure 2).

4. Result and Discussion

Based on the potential problems and design needs. Selected the theme of ecology. This theme is expected to support all existing activities, but also apply the concept of water conservation support activities and planning, i.e., gardening. This activity aims to add value to the economy of the Village of Pantai Burung.

Water conservation and gardening are applied to the utilization of contaminated wastewater, and by utilizing contours as a gardening area, liquid waste to be discharged first through the filtration process of each contour. This causes water that has passed through the filtration can be directly discharged into the river in a clean state. Also, the river area becomes a waterfront that changes the river is no longer a back area. Thus, the quality of slum and river villages increased, making it a good part of the city.

4.1 The Concept of Circulation

Based on infrastructure, the circulation is sufficient. However, due to the very limited size of the road many obstacles experienced by vehicles to enter the village. The entrance of this site is divided into two types of service lines/vehicles and pedestrian paths (Figure 3).

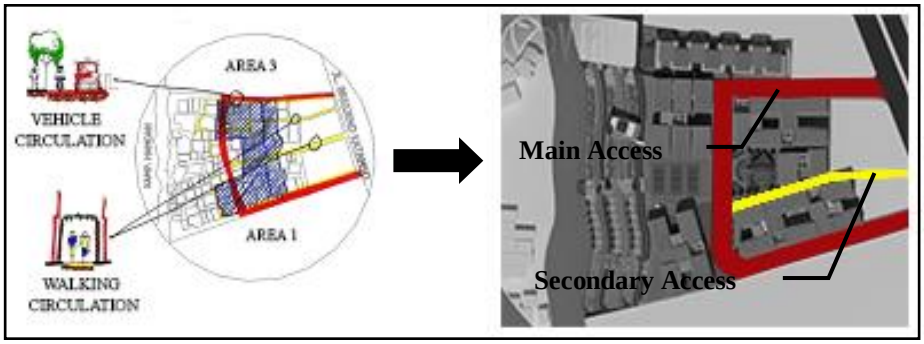


Figure 3. The Concept of Circulation Design

All existing site entrances are maintained. But it will be widened for easy access. Both roads on the edge of the tread (red) are designed for the vehicle, especially for service vehicles, and then the width of the ways will be added. So the vehicle can reach and pass through the entire area of the site. While the two entrances (yellow) located in the middle of the tread is only for pedestrian circulation, so there is no meeting between pedestrians and motorists.

4.2 Zoning Site Concept

The piece makes U form on residential buildings, that became open space given special circulation of a residential area that allows for the villagers can meet each other (A). On the ground floor on mass of residential buildings lies the entire public area such as Shop, Open Space, Mosque, etc. Vehicle parking spaces are placed adjacent to the highway to facilitate mobility (B) (Figure 4).

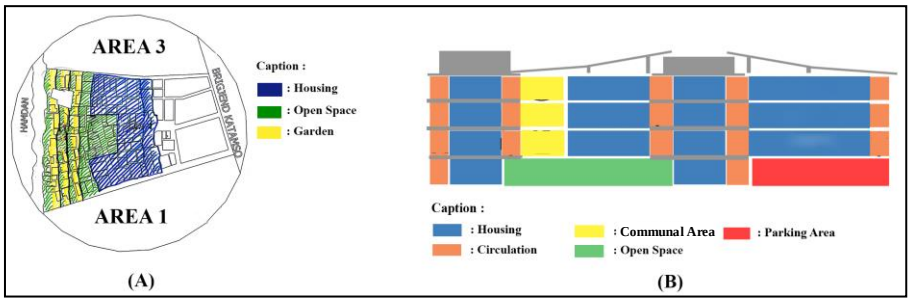


Figure 4. Zoning Concepts Site (A) and Mass of Building (B)

4.3 Utility Concept (water)

The gray water used will take it to the ground floor to undergo the filtration process following the designed contour. Each contour has been prepared various types of filtration. The first stages, the liquid waste will pass through the marsh plants then stages two past the fish pond. After the water is clean enough, then it will be used for vegetable crops until finally, the liquid waste that has been filtration is free of dirt and ready to be thrown into the river in a clean condition. Gray water is only intended for gardening activities to save water usage (Figure 5).

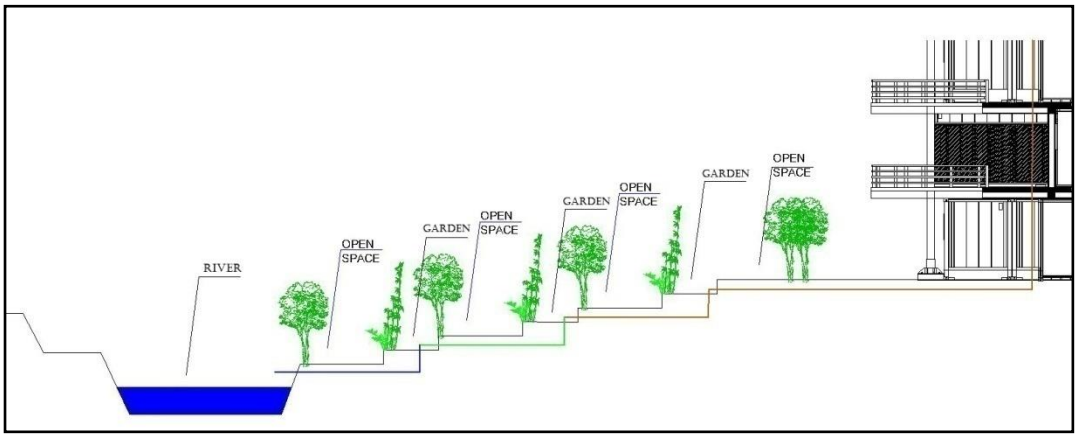


Figure 5. Greywater Scheme

4.4 Rain Harvesting

For daily use such as drinking, bathing, etc. So it takes rain water conservation that comes from nature. The rainwater that is accommodated in the roof will be flowed to the ground tank to experience various kinds of the filtration process. And then it will be collected for the water storage and at the pump to the water tower until it is ready to be distributed to every dwelling (Figure 6).

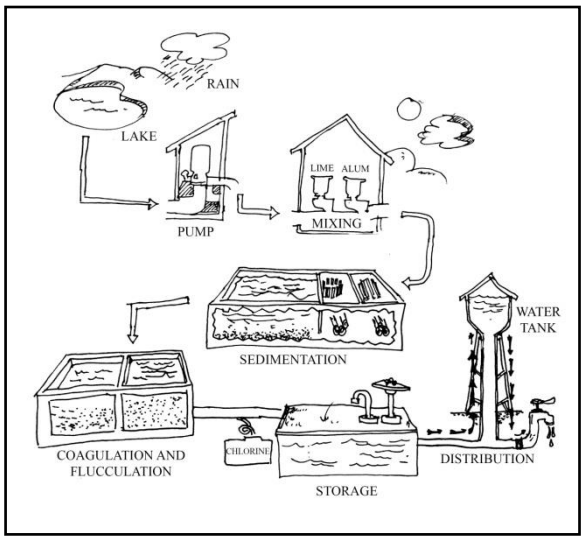


Figure 6. Filtration

4.5 Residential Concept

Residential units to be designed should be cheap and by expectations of needs. This time to create a residential then the material used is the material container. Container containers that have the same modules and precision are easy to assemble; large quantities and low prices can be an innovation as a human shelter with the right treatments and the correct application of thermal comfort in the building. Its abundant presence and easy disassembly make it a sustainable and energy-efficient material as a recycled material. By size, the container is divided into containers of 20 feet, 40 feet, 40 HC feet and 45 ft. Whereas based on the type of cargo load is known as dry, reefer, and a special container.

But at this time the type of container used is a container that has a module of 20 ft. The 20ft container will be arranged in such a way as to form an efficient space. It is also attempted to facilitate the installation of containers for easy compilation.

Figure 7. Residential Unit 1 and 2 (A) and Residential Unit 3 (B)

Housing unit (A) using four containers 20 feet is the largest residential units in both types of occupancy above. The unit type (B) is a combination of both containers and 2 feet modules resulting in an area of 4x6 m2. This dwelling is designed almost similar to the form of occupancy apartment by maximizing the existing rooms (Figure 7).

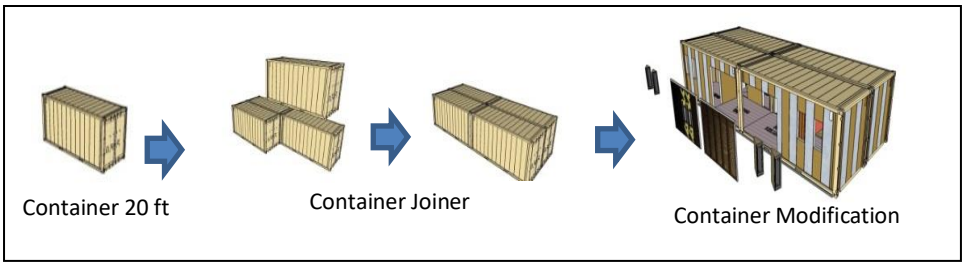
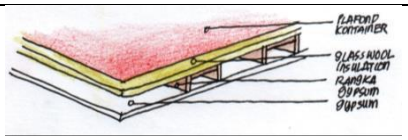
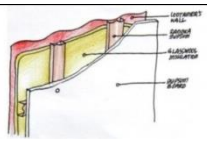
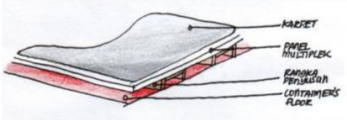


Figure 8. Container Modification

Each type of residence uses a foldable partition wall so that the area of each dwelling can be flexible by combining the area within the dwelling and outside area (Figure 8). This can save on existing space by building and adding vertically. To reduce the effect of radiation on the container then applies the insulation of space.

Table 2. Details of the Container Layer

Parts	Insulation
Plafond	
Wall	
Floor	

The use of polyurethane insulation aims to keep the room temperature maintained and comfortable (Table 2). The application of polyurethane insulation is one of the most widely used layer elements in some container buildings (judging from typology data), so polyurethane can be called one of the most perceived heat absorption. Wall and ceiling using paint a wall like in General. With a bright white color display clean and compact impression. With the bright white color to reflection the heat maximally. The following is an overview of the results based on the analysis of the temperature on the occupancy of the container.

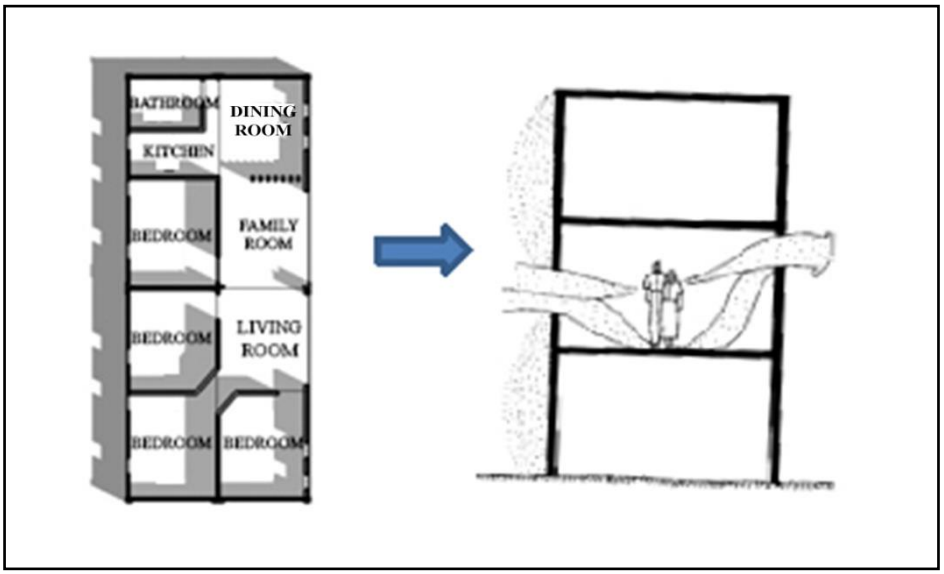


Figure 9. Housing Plan and Air Flow Scheme

Shows the shape of the floor plan and some opening points that exist in the dwelling. Aperture is used as a place of airflow. The openings of the air flowing out of the gap, allowing the air can penetrate the passing of each residential unit headed for open space (Figure 9).

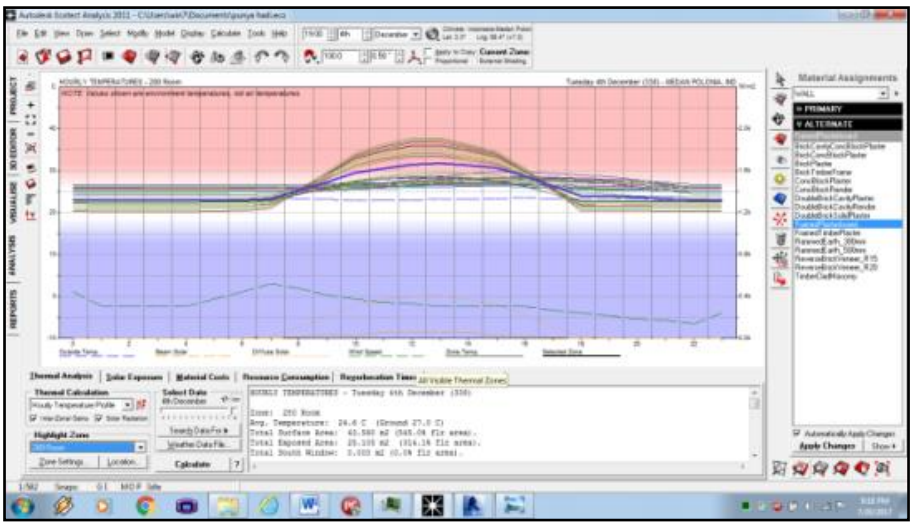


Figure 10. The Development of Every Room Temperature

From shows an increase in temperature in some residential rooms at 10.00-16.00. However, based on the analysis of occupant activity, these hours are the zones that people spend outside the room. Thus, residents are not likely to occupy space at these hours. Regardless of the peak temperature rise at any given time, the temperature will return to normal based on the required comfort (Figure 10).

4.6 Structure Concept

The structure used in this vertical village is to use composite structures and steel columns (Figure 11). The grid used follows the arrangement of container modules arranged into a dwelling. The steel construction system using steel rods as columns and beams, while for the Foundation to use the Trail Foundation. In the steel column, the column portion is screwed to the top of the foundation base as a connection.

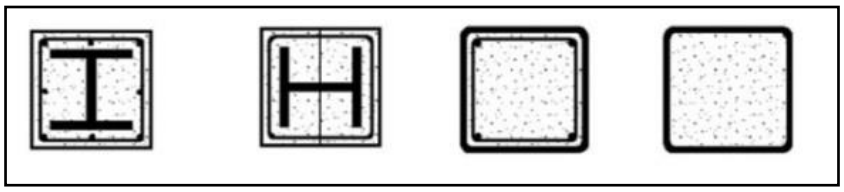


Figure 11. Composite Steel Column
(Source: [2] Hindarto, 2012*)*

Connection system between columns, beams, and floor buffer trash. Above as galvalume sheet can be placed as the bottom floor construction, later on, it can be closed with wood, etc. Between container and column, there is a difference of a residential structure (Figure 12).

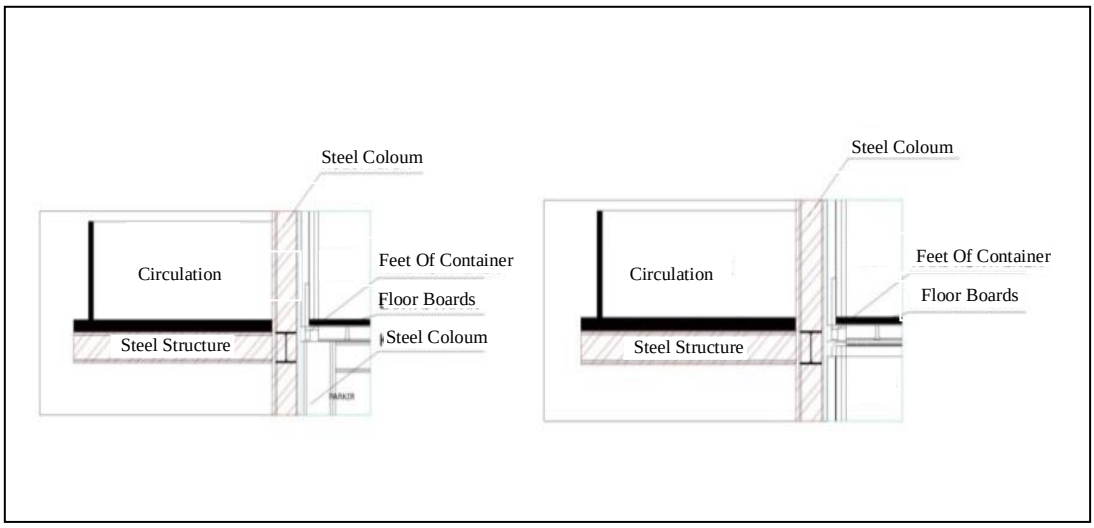


Figure 12. Separation of structure steel and Containers

Due to the nature of the container which already has its structure, then**,** in this case**,** steel or composite structures both columns and beams are only used for circulating support floor 2 to floor 4.

5. Conclusion

Vertical Village became one alternative completion in organizing slums to set him again a city design as well as settlements in the narrow land. By applying the concept of ecology will reduce excessive energy consumption, and more emphasis on the utilization of the resource again. Each residential unit made of container will make residential unit is flexible.

And the use of insulation polyurethane will keep indoor temperature stability maximum occupancy. Make room on each floor as the communal areas of socialization and interaction of our fellow neighbors to create unity and harmony.

Acknowledgment

This journal is made as a requirement to get a degree from the Department of Architecture Engineering, Faculty of Engineering, Universitas Sumatera Utara, Indonesia.

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