

SUSTAINABLE FLAT IN MEDAN DELI WITH A FOCUS ON BIOCLIMATIC ARCHITECTURE

Devin Defriza Harisdani¹, Iren Fitriana Sitindaon²

Architecture Department, Faculty of Engineering, Universitas Sumatera Utara, Medan, 20155, Indonesia

*Corresponding Author: devin.defriza@usu.ac.id¹, irentindaon@gmail.com²

Abstract

Medan City has taken measures to tackle the issue of inadequate housing by offering basic rental flats (RUSUNAWA) for low-income communities (MBR). This initiative is a response to the pressing issue of escalating land density in Medan and the emergence of slum settlements among disadvantaged residents who are unable to purchase or rent homes. Particularly in swiftly developing industrial zones, the demand for housing is on the rise. This situation is influenced not only by the local residents of Medan but also by migrant workers who come to the city to work in its industrial sectors. Nevertheless, this growth is not in harmony with Medan's climate equilibrium due to the absence of bioclimatic concepts in construction practices. To tackle this challenge, bioclimatic-concept flats emerge as a promising solution for low-income communities. These flats are crafted to offer cost-effective, eco-friendly housing, uphold energy efficiency, and provide comfort for industrial workers. Consequently, this approach also upholds the principles of synergy between structures and the environment, striving to attain an equilibrium between urban expansion and environmental sustainability in Medan.

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Key Words

apartments, bioclimatic, low-income neighborhoods, sustainability.

1. Introduction

The industrial development sector in Medan City has experienced an increase that is in line with the city's growth. One example is in Medan Deli District, North Sumatra. This area is the area with the highest population in Medan City due to the presence of a large industrial area [1]. This attracts the interest of residents of North Sumatra and around the city of Medan who want to work and earn a living in the area. Thus, the high population requires balance through the provision of adequate facilities and means for appropriate, efficient, and practical housing, especially for factory workers. On the other hand, the growth in the construction of various buildings in Medan City has had an impact on its climate balance. This is because these buildings do not apply the bioclimatic concept in their design. It has been explained in UU No 28 Tahun 2002 tentang Bangunan Gedung that the building layout must be harmonious with its environment; this regulation aims to maintain the balance of nature and climate in the environment around the building. Considering the things mentioned above, it is necessary to have a residence for low-income communities, namely flats that apply the bioclimatic concept as buildings responsive to the surrounding climate with functions that are suitable for low-income communities [2].

1.1. Overview of Flats

Flats are multi-story buildings designed with structurally functional sections divided horizontally and vertically. Each unit can be individually owned and utilized, has rental status, and is built using the Regional Revenue and Expenditure Budget (APBD) primarily allocated for residential purposes [3]. Flat housing is a flat that is intended for low-income people [4]. A simple flat is a multi-story building that accommodates the most basic living activities, with a minimum area of each unit of 18 m² and a maximum of 36 m². A simple 5-story flat is a flat where the ground floor is used as a facility for economic or cultural activities, while the other floors mainly function as residences and social activities[5].

1.2. Overview of Bioclimatic Architecture

Bioclimatic architecture is an architectural concept that aims to protect the environment and natural resources through adaptation to the climatic conditions of the environment [6]. The essential element of

bioclimatic architecture is integrating passive systems by utilizing the existing natural resources for the natural conditioning of buildings. The result of bioclimatic is the creation of a climate in a building that provides thermal comfort for its occupants with the lowest possible energy consumption [7]. Bioclimatic design involves designing buildings based on local climate data and natural resources. This approach utilizes sunlight, wind, air, vegetation, and soil components to minimize energy consumption and create a comfortable living environment. Understanding local climate characteristics and data forms the foundation of bioclimatic design (Matolcsy et al., 2015).

2. Methodology

The Medan Flats concept employs a descriptive-qualitative approach combined with a typological study of housing theories, floor arrangements, and case studies of various residences in Medan. Data is collected based on flat building categories, and several case studies are compared. This allows for concluding the appropriate types and forms for designing flats, ensuring that design ideas effectively address the identified issues [8]. Data collection methods (primary and secondary) in this research used observation methods, collecting old photographs, area maps, satellite maps, recording frontal images of area conditions, two-dimensional depictions of existing facades, and in-depth interviews with several sources. The research location is in Bangun City, Medan Deli District, Medan City.

3. Result and Discussion

3.1. Project Description

The flat, named Rusunawa Arga, is located on Platina 1 Street in Titi Papan Village, Medan Deli District, Medan City, covering an area of 15,000 m². The site falls within the R-1 Zone, which includes housing, commerce, and plantations. Situated in the heart of a residential area, it is accessible via a secondary road, 6 meters wide, that connects the site to the Medan Industrial Area. Most Medan Deli District residents are migrants, with the native population predominantly from the Deli Malay Tribe, making up only about 30%. Urbanization in this area is accelerating due to the presence of the Medan Industrial Area (KIM), managed by the State-Owned Enterprise PT. Kawasan Industri Medan, which spans around 514 hectares. KIM offers numerous job opportunities, leading to rapid growth and an increasing demand for flats close to workplaces (Figure 1).



Figure 1. Site of The Project
Source: *earth.google.com* [9].

3.2. Zoning Site

The flat is divided into multiple zones: a private zone, a public zone, and a semi-public zone. The private zone is a residential area where the flat consists of three towers (tower A, tower B, and Tower C). The public zone is the area in front of the flat, namely the mini terminal and food and court. The semi-public zone is the zone around the flat tower, which has entered the border of the security guard post. The service area is the zone for the technician only. This area consists of mechanical, electrical, and plumbing machines that function to support activities in the flat so that the flat can be lived in well and comfortably (Figure 2).

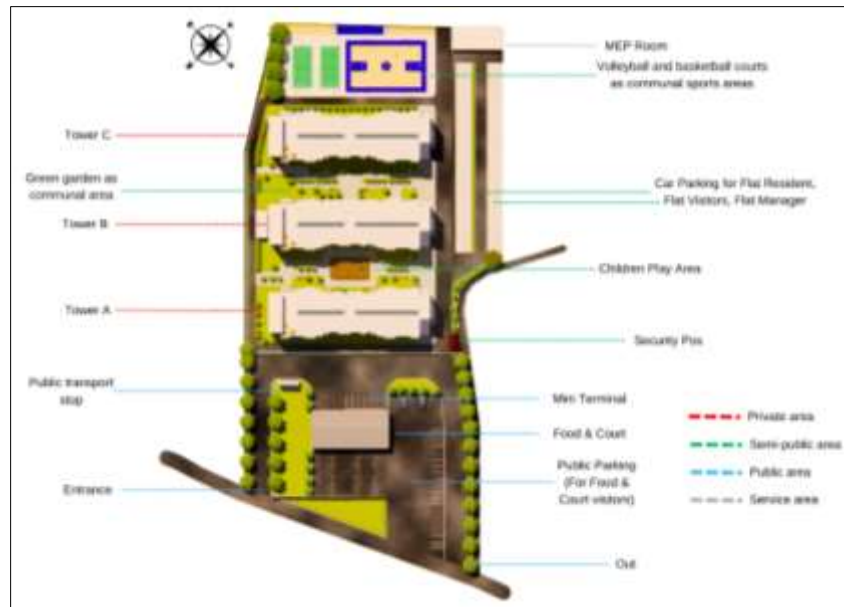


Figure 2. Layout Masterplan

3.3. Facilities

According to SNI 03-7013-2004, flats must have several facilities consisting of Commercial amenities, educational facilities, healthcare services, places of worship, public services, and open spaces. So Rusunawa Arga contains all these facilities in its flat. For commercial facilities, this flat provides a food and court building as a commercial facility for flat residents who want to sell food. For educational facilities, this flat has a small library that provides books for flat residents of all ages. For health facilities, this flat has a community clinic. For public service facilities, this rusunawa has an RT room for the head of the rusunawa RT and a cooperative. For worship facilities, this flat has a prayer room. This flat has a green garden, a children's play area, and a field as an open communal space [10] (Figure 3).

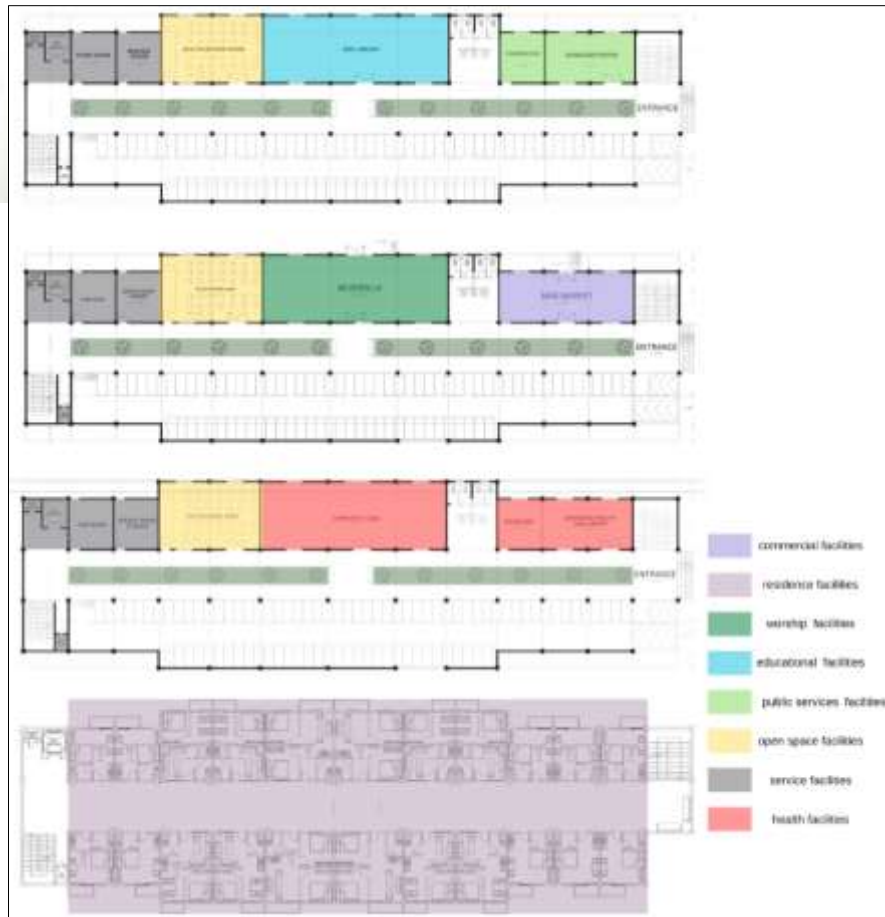


Figure 3. Floor Layout and Zoning Area

3.4. Concept

The Rusunawa Arga building is designed to maximize the existing space to balance the function and theme of the building [11]. The design of this Rusunawa building also involves existing government regulations in its application. For further information, below is a picture of the concept of the building mass in the Rusunawa Arga design process (Figure 4).

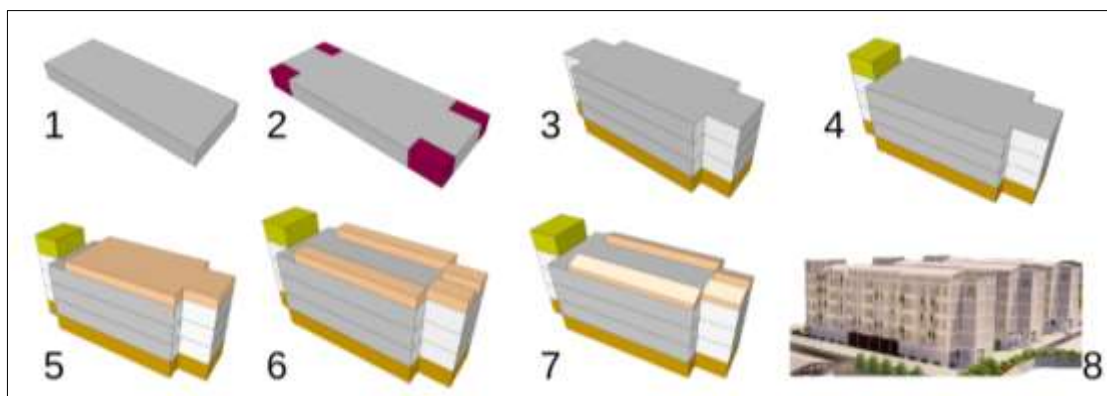


Figure 4. Mass Transformation

Rusunawa Agra adheres to the concept of bioclimatic architecture. Therefore, apart from applying appropriate building orientation, natural lighting, and energy-saving and sustainable materials, this flat building also applies rainwater harvesting [12] (Figure 5) and there is vertical farming on the rooftop (Figure 6).

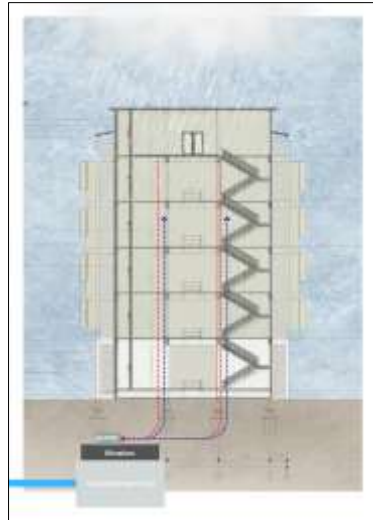


Figure 5. The application of rainwater harvesting in buildings



Figure 6. Vertical farming on the rooftop

Interior

This flat consists of three types of units, namely unit types 18, 27, and 36, which comply with government regulations regarding flats for low-income people. Unit type 18 (Figure 7) does not have a particular room for sleeping but only a room that is combined with space for sleeping, sitting, and cooking. Meanwhile, unit type 27 (Figure 8) has one bedroom, living room, and kitchen connected to the dining room. Unit type 36 (Figure 9) has two bedrooms, a living room, and a kitchen connected to the dining room.



Figure 7. Detail of unit type 18



Figure 8. Detail of unit type 27



Figure 9. Detail of unit type 36

Building Facades

The facade of the Rusunawa Agra building is an implementation of bioclimatic architecture, namely environmentally friendly materials [13]. Where the materials used are simple materials that are easy to obtain and environmentally friendly [14] (Figure 10).



Figure 10. Material of building facades

Overall, the Rusunawa Agra building is by the concept of function and architectural style. Its function as housing for low-income people has fulfilled existing government regulations. For its architectural concept, Rusunawa Agra has fulfilled quite a lot of concepts of bioclimatic architectural characteristics. By implementing these two functions in this flat building, the residents of Rusunawa Agra can obtain comfort and prosperity [15].

4. Conclusion

This study aimed to determine how the bioclimatic architectural approach correlates positively with flats located in industrial areas so that it can create safe and comfortable housing to help residents, the majority of whom are industrial workers [16]. They need to have housing that is livable and close to where they work so that the quality of their work is better. Rusunawa Arga is located at Platina 1 Street, Titi Papan Village, Medan Deli District, Medan City, with an area of 15,000 m². The bioclimatic architectural approach can provide sustainability and save energy, making it suitable for low-income communities.

5. Acknowledgment

This research centers on sustainable flats utilizing a bioclimatic architectural approach to offer housing for low-income individuals in industrial regions. The author extends gratitude to the Department of Architecture, Faculty of Engineering, University of North Sumatra, and everyone who contributed to the study and creation of Rusunawa Agra in Medan Deli.

6. Conflict of Interest

The author explicitly declares that this manuscript is free from conflicts of interest or external financial support. This assurance ensures the writing's independence and integrity, with the manuscript's content being founded entirely on objective research and analysis.

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